UPLAND AND RIVER OPERABLE UNITS REMEDIAL INVESTIGATION REPORT

Bradford Island
Cascade Locks, Oregon

June 2012

Prepared for:

U.S. Army Corps of Engineers
Portland District
333 S.W. First Avenue
Portland, Oregon 97208-2946

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850
25697026

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ACRONYMS

%	percent
AOPC	area of potential concern
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
ATL	Acceptable Tissue Level
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	ambient water quality criteria
B2EHP	bis(2-ethyl hexyl)phthalate
BAF	bioaccumulation factor
BHHRA	baseline human health risk assessment
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BSAF	biota-sediment accumulation factor
C	concentration
CB-1	catch basin #1
CB-2	catch basin #2
CEC	contaminant of ecological concern
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEM	conceptual exposure model
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIC	community involvement committee
C_{ij}	concentration of contaminant *i* in medium *j*
COC	chemicals of concern
COI	contaminant of interest
COPC	contaminant of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPEC	contaminant of potential ecological concern
CRITFC	Columbia River Inter-Tribal Fish Commission
CSM	conceptual site model
CTL	Critical Tissue Level
cy	cubic yards
DART	Data Access in Real Time
DEQ	(Oregon) Department of Environmental Quality
DCA	dichloroethane
DCE	dichloroethene
DHS	(Oregon) Department of Human Services
DNOP	di-n-octyl phthalate
DoD	Department of Defense
DQO	data quality objective
DRO	diesel range organics
DSR	data sufficiency report
DTSC	Department of Toxic Substances Control
Ecology	Washington State Department of Ecology

EcoSSLs	Ecological Soil Screening Levels
ECSI	Environmental Cleanup Site Information
EDQW	Environmental Data Quality Workgroup
EE/CA	engineering evaluation/cost analysis
ELCR	excess lifetime cancer risk
EMPC	estimated maximum potential concentration
EPC	exposure point concentration
ERA	ecological risk assessment
ESA	Endangered Species Act
ESU	evolutionarily significant unit
ºF	degree(s) Fahrenheit
FS	feasibility study
GRO	gasoline range organics
HAI	Huang and Associates, Inc
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HMSA	hazardous material storage area
HPAH	high molecular weight polycyclic aromatic hydrocarbon
HQ	hazard quotient
HTRW	hazardous, toxic, and radiological waste
IRIS	Integrated Risk Information System
ITR	independent technical review
kg	kilogram(s)
km	kilometer
K-M	Kaplan–Meier
L	liter(s)
LCFRB	Lower Columbia Fish Recovery Board
log K_{ow}	octanol-water partition coefficient
LOQ	Limit of Quantitation
LPAH	low molecular weight polycyclic aromatic hydrocarbon
LWG	Lower Willamette Group
µg	microgram(s)
µm	micrometer
MCL	Maximum Contaminant Levels
MDD	minimum detectable differences
MDL	method detection limit
mg	milligram(s)
mm	millimeter
MP	Management Plan
MRL	method reporting limit
msl	mean sea level
NCP	National Contingency Plan
ND	not detected
NFA	No Further Action
NHPA	National Historic Preservation Act

N_{ij}	total number of i contaminants in medium j for which an SLV is available
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
OAR	Oregon Administrative Rules
ODFW	Oregon Department of Fish and Wildlife
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PDT	project delivery team
pg	picogram(s)
PM	project manager
PRG	Preliminary Remediation Goal
Q	receptor designator
QAPP	Quality Assurance Project Plan
RAO	remedial action objective
R_{BAC}	bioaccumulation index for chemical
RBC	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
RDL	reported detection limit
RI	remedial investigation
RI/FS	remedial investigation/ feasibility study
RM	river mile
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RRO	residual range organics
RSL	Regional Screening Levels
RTC	Response to Comments
SI	site inspection
SLV	screening level value
SLV_{ij}	screening level value for contaminant i in medium j
SPLP	Synthetic Precipitation Leaching Procedure
SPMD	Semi permeable membrane device
SSI	supplemental site inspection
SVOC	semivolatile organic compound
SWDIV	Southwest Division
TAG	technical advisory group
TBD	to be determined
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure

TDS	total dissolved solids
TEQ	toxicity equivalence quotient
T_{ij}	toxicity ratio for contaminant i in medium j
T_j	summation of toxicity ratios for i contaminants in medium j
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
TRW	Technical Review Workgroup
UCL	upper confidence limit
UPL	upper prediction limit
URS	URS Corporation
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCP	Voluntary Cleanup Program
VOC	volatile organic compound
WDF	Washington Department of Fisheries
WDOH	Washington Department of Health
WQC	Water Quality Criteria

Bradford Island is part of the Bonneville Dam complex, located on the Columbia River at river mile (RM) 146.1, approximately 40 miles east of Portland, Oregon. The site is a multipurpose facility that consists of the First and Second Powerhouses, the old and new navigation locks, and a spillway. Numerous investigations have been performed by the United States Army Corps of Engineers (USACE) and their contractors since 1997, focusing on two operable units (OUs), the Upland OU and the River OU. The Upland OU includes four areas of potential concern (AOPCs): the Landfill AOPC, Sandblast Area AOPC, Pistol Range AOPC, and Bulb Slope AOPC.

This Remedial Investigation (RI) Report documents the investigation activities that have taken place over the past ten years, and uses the data to identify source areas at Bradford Island, defines the nature and extent of the environmental contamination, and identifies the contaminants of potential concern (COPCs) for human health and contaminants of potential ecological concern (CPECs) in the media from the Upland and River OUs.

Landfill AOPC Summary of Contamination The Landfill AOPC is a former waste disposal site at the tip of Bradford Island that was used from the early 1940s until the early 1980s. Waste disposed of in the Landfill included: household waste, project-related wastes (grease, light bulbs, sandblast grit), electrical debris, up to 50 ballasts, broken glass, rubber tires, metal debris, wood debris, metal cables, asbestos containing building materials, burned debris, ceramic insulators, and mercury vapor lamps. Pesticide/herbicide mixing and rinsing of pesticide/herbicide application equipment also occurred near the Landfill. By 1982, the surface of the Landfill AOPC had been capped with soil, and another layer of soil was added in 1989.

Disposal and handling practices at the Landfill AOPC have impacted soil and/or groundwater with low levels of polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), metals, polychlorinated biphenyls (PCBs), pesticides, and herbicides.

Groundwater seeps discharge to the river along the northern boundary of the AOPC. The majority of the Landfill AOPC is flat and well vegetated, with no evidence of runoff or erosion. While there is no visual evidence of current sloughing along the northern perimeter of the Landfill AOPC, however, if mass wasting were to occur on the steep slopes, the soils may reach the river.

Sandblast Area AOPC Summary of Contamination The Sandblast Area AOPC includes the area surrounding the former sandblast building on the eastern end of the site and consists of the following subareas:

- Former disposal area for spent sandblast blast grit
- Former transformer maintenance area east of the former sandblast building
- Former Hazardous Material Storage Area (HMSA) located east of the equipment building
- An inferred release of tetrachloroethylene (PCE) from an aboveground storage tank (AST) historically located in the vicinity of the current HMSA
- Laydown area used for current storage of industrial equipment and materials located along the north and south sides of the landfill access road

Spent sandblast grit was disposed of onsite in the area immediately east of the former sandblast building for an unknown period prior to 1994, and has resulted in the release of metals and butyltins into the soil. In November 1995, PCB-containing transformers were disassembled by the USACE at the paved parking area on the east side of the former sandblast building and approximately 1 quart of PCB-containing oil was inadvertently released. Prior to 1993/1994, hazardous waste generated at the Bonneville Dam complex was stored at the former HMSA, which did not have a secondary containment system or berms. Historical waste handling in this area resulted in the release of metals, pesticides, TPH, and PAHs to nearby soils. The current HMSA does not appear to be a source of contamination, but prior to its construction, an approximately 300-gallon AST was formerly located in the vicinity. Several volatile organic compounds (VOCs) have been detected in soil, groundwater, and soil gas in the area. From these results, it has been inferred that there was a historical release from the AST formerly located in the vicinity of the current HMSA. The USACE stores industrial equipment and materials in the laydown area along the northern and southern portions of the Landfill access road. Soils in this area have become contaminated with metals, pesticides, PCBs, PAHs, TPH, and potentially other contaminants.

Stormwater runoff from impervious surfaces in the Sandblast Area AOPC drains to four catch basins that discharge to the Columbia River through two outfalls. It appears, however, that the majority of the runoff from asphalt immediately southeast of the former sandblast building flows northeast and discharges onto a short, steep, forested hill slope, where it causes rills to develop on the hill slope. This runoff travels down the slope to the equipment laydown area and adjacent Landfill access road, and onto a vegetated area between the Landfill road and the river. Evidence of surface runoff or erosion is absent in this vegetated area, suggesting that runoff flowing onto this area infiltrates before reaching the river

<u>Pistol Range AOPC Summary of Contamination</u> The Pistol Range AOPC is located on the south side of Bradford Island and was used for small arms target practice from approximately 1950 through 1970. Surface soils became contaminated with low concentrations of lead and zinc. The topography of the area consists of a sequence of vegetated slopes and flat areas. Erosion and transport of soil from the Pistol Range AOPC to the river is currently unlikely. However, when the Pistol Range AOPC was in use as a firing range, the ground surface may have been less vegetated and there may have been historical runoff to the Columbia River.

<u>Bulb Slope AOPC Summary of Contamination</u> The Bulb Slope AOPC consists of a fan-shaped accumulation of glass and electrical light bulb debris that extends across approximately 1,900 square feet of a steep slope between the Columbia River and the Landfill access road. A thin layer of soil, up to 1 foot thick, overlies bedrock and became contaminated with low concentrations of PCBs, mercury, and lead. The well-vegetated slope exhibits no evidence of surface runoff, and mass wasting appears to be the only potential mechanism for transport of contaminated soil into the river.

<u>River OU Summary of Contamination</u> The River OU was identified in 2000, when numerous pieces of electrical equipment and other solid waste were discovered in the Columbia River along the north shore of Bradford Island. The removal of equipment and debris took place in December 2000 and in February and March 2002. Following delineation of the extent of sediment contamination, impacted sediments along the north shore of Bradford Island were dredged in October 2007. Residual contamination (including PCBs, PAHs, and possibly metals) in the sediment, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination. Transport of contaminants from the Upland OU, discussed above, may also be a current and/or historical source of contamination to the River OU.

Downstream sediment sampling appears to confirm that contaminated sediments are limited to the Bonneville Dam Forebay. Site-specific reference area soils and sediments were analyzed to determine naturally-occurring concentrations of inorganic constituents. Sediment and tissue samples from an upstream River Reference Area were analyzed to help distinguish site-related from non-site-related contributions of both inorganic and organic chemicals. The only significant limitation identified for the available data set is the fact that the Forebay smallmouth bass samples were collected in 2006, prior to the sediment removal action, and are therefore not representative of current Forebay conditions. Similarly, the lifespan of crayfish and sculpin is also long enough that the concentrations measured in these samples probably also incorporate exposure to pre-sediment removal conditions

Receptors and Exposure Pathways Potential on-site human receptors include outdoor workers who may be exposed to contaminated surface soils at the Upland AOPCs. Construction workers and excavation workers may be exposed to contaminated subsurface soils if they were to engage in soil-intrusive activities. Exposure routes related to soil include incidental ingestion, dermal contact, and outdoor inhalation of dusts and vapors. In the unlikely event that new wells are installed and untreated and unfiltered groundwater in the vicinity of either the Landfill AOPC or Sandblast Area AOPC is used for potable uses, the on-site workers may be exposed to contaminated groundwater by ingestion, dermal contact, and inhalation of vapors. At the Sandblast Area AOPC, the potential exists for intrusion of vapors from the subsurface (from soil gas and groundwater) into indoor environments, if enclosed structures were to be constructed here in the future. Upland OU contamination may be transported to the River OU via erosion, mass wasting, or groundwater discharge.

In the River OU, the primary human receptors are subsistence fishers, recreational fishers, and hypothetical consumers of unfiltered, untreated river water. The area where human receptors may potentially come in direct contact with contaminated sediments is near the mouth of Eagle Creek. Bioaccumulative chemicals in the River OU water and sediments may enter the food web when taken up into the tissues of edible species such as the crayfish and smallmouth bass. Recreational and subsistence anglers (adults and children) may then consume these edible species. Incidental ingestion of, or dermal contact with, river water is also considered.

Potential Upland OU ecological receptors include terrestrial plants, soil invertebrates, birds, and mammals. Exposure pathways include root uptake from, direct contact with, or ingestion of surface or subsurface soils. In the River OU, potential ecological receptors include benthic organisms, fish, and aquatic-dependent birds and mammals. Exposure pathways include ingestion of and dermal contact with surface water or sediments and the consumption of contaminated prey items.

Upland OU Risk Assessments Human health risk assessments (HHRAs) were completed through the problem formulation phase and ecological risk assessments (ERAs) were completed through Levels I and II (screening level) for each of the Upland AOPCs

At the Landfill AOPC, COPCs for human receptors in soil and groundwater included several metals, semivolatile organic compounds (SVOCs) including carcinogenic PAHs (cPAHs), chlorinated VOCs and TPH. Arsenic, cPAHs and chlorinated VOCs emerged as the primary carcinogenic COPCs. Only soil was identified as a medium of concern for ecological receptors at the Landfill AOPC. CPECs for terrestrial ecological receptors included antimony, chromium, lead, mercury, nickel, and high molecular weight PAHs (HPAHs). The areas with the highest concentrations of these COPCs and CPECs included the mercury vapor-lamp test pit, lead hot-spot test pits #1 and #2, gully test pit, and pesticide/herbicide wash area.

At the Sandblast Area AOPC, the COPCs in soil were primarily a few metals, chlorinated VOCs, and cPAHs. The COPCs in groundwater were metals, VOCs, cPAHs, and some TPH fractions. The COPCs in soil gas were primarily chlorinated compounds. Lead may be a minor contributor to non-cancer hazards at the Sandblast Area AOPC. Arsenic, chlorinated VOCs, and cPAHs were the primary carcinogenic COPCs. CPECs in soil at the Sandblast Area AOPC included antimony, cadmium, chromium, lead, mercury, nickel, bis(2-ethyl hexyl) phthalate (B2EHP), and HPAHs. Areas with soil concentrations exceeding human health and ecological screening values occurred throughout the Sandblast Area AOPC, including the spent sandblast grit disposal area, around CB-1, the equipment laydown area, south of the current HMSA, and within the area where soils were identified as erodible in 2009.

The HHRA concluded that neither the Pistol Range AOPC nor the Bulb Slope AOPCs pose a threat to human health. For ecological receptors at the Pistol Range AOPC, lead in soil was the only CPEC. Areas with soil lead concentrations exceeding ecological screening values at the Pistol Range AOPC occurred behind the backstop and at the eastern corner of the former firing shed. CPECs at the Bulb Slope AOPC were limited to lead and mercury in soil.

In addition to the COPCs and CPECs identified in the screening evaluation and listed above, additional COPCs and CPECs were identified during the uncertainty evaluation (Appendix O), for reasons including, but not limited to, retention of degradation products, lack of SLVs, lack of SLVs that take into account bioaccumulation, and potential overland transport to the River (e.g., mass wasting/erosion).

River OU Risk Assessments Similar to the Upland OU, the HHRA and ERA for the River OU were completed through the problem formulation phase and through Levels I and II, respectively.

PCBs were identified as the primary COPCs in the River OU. In addition, a few metals, cPAHs and phthalates were retained as COPCs for sediment, crayfish tissue, and/or smallmouth bass tissue, although their contribution to risk is likely to be minor. They may contribute to human health risk through the pathway of crayfish and smallmouth bass consumption for both subsistence and recreational fish consumers. Although concentrations of metals in sediment were found to be less than Reference Area sediment, arsenic (in crayfish tissue) and mercury (in bass tissue) were identified in Forebay tissue that may be of concern for human health. PCBs were present in sediments, crayfish and smallmouth bass tissues at concentrations that may be of concern for human health. Five cPAH compounds were present in smallmouth bass tissues at concentrations that may be of concern to human health. PCBs, PAHs (both carcinogenic and non-carcinogenic), SVOCs, and TPH were detected in sediments at the mouth of Eagle Creek. Although direct contact with shallow sediments may occur in the vicinity of Eagle Creek, the human health risks at the River OU are associated primarily with consumption of smallmouth bass tissue, and secondarily crayfish tissue, although the observed concentrations are likely the result of historical body burden.

PCBs and a few metals were the only CPECs identified for ecological receptors in the River OU. PCBs in sediment were present at concentrations that may pose a risk to the benthic community exposed through direct contact. Cadmium, lead, mercury, and PCBs in sediment and sculpin tissue; cadmium in clam tissue; and mercury and PCBs in bass tissue were present at concentrations that may pose a risk to upper trophic level fish and shellfish. Mercury and PCBs in sediment and sculpin and bass tissue, and PCBs in crayfish tissue were present at concentrations that may pose a risk to aquatic-dependent birds. Mercury and PCBs in sediment and tissue (sculpin and bass) were present at concentrations that may pose a risk to aquatic-dependent mammals. Although PCBs were present in crayfish tissue at concentrations identified as potentially a risk to aquatic-dependent birds, crayfish are not a driver species for birds due to the much higher concentrations of PCBs detected in sculpin and bass tissue (likely the result of historical body burden). PCBs in sediment were identified as an ecological concern at only three locations: stations P4 on the north shore of Bradford Island, P09 on the south side of the island (for birds only), and P43 at the mouth of Eagle Creek.

Given the low risk levels estimated for targeted Goose Island sediments samples relative to the risk levels estimated for the random Forebay for PCBs, and the absence of elevated PCB concentrations in Goose Island tissues, PCB concentrations in the targeted Goose Island samples are likely to have contributed minimally to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay. Concentrations of PCBs in Goose Island sediment may be of concern to human receptors although crayfish tissues did not show similar elevated risk levels. Although the Aroclor data for Goose Island demonstrated elevated ecological risk estimates for sediment, the available congener data, which are expected to provide a more accurate measure of total PCB concentrations, demonstrate acceptable risk levels for ecological receptors. Overall, although COPC and CPEC concentrations in media collected from the targeted Goose Island samples indicate low or acceptable risk levels, Goose Island will be maintained as part of the Forebay evaluation in the forthcoming FS in response to DEQ’s request.

<u>Recommendations</u> Based on the screening level risk assessments at the Landfill and Sandblast Area AOPCs, implementation of one of two options is recommended for each of these AOPCs:

1. Perform a Feasibility Study (FS) to identify targeted soil removal or other remedial actions which will decrease residual concentrations to acceptable risk levels or
2. Perform a site-specific baseline human health risk assessment (BHHRA) and Level III baseline ecological risk assessment (BERA) to determine if risks to human and ecological receptors are unacceptable. If this option is selected, site-specific factors would be considered (i.e., absence of special-status species, AOPC size, contribution of background levels of inorganics, etc.).

No additional evaluation of potential human health risk is recommended for either the Pistol Range or Bulb Slope AOPCs. However, further action addressing potential ecological risk is recommended at both AOPCs - either in the form of a Level III BERA or remediation of the soils with elevated CPEC concentrations. If a Level III BERA is performed, site-specific factors would be considered (i.e., absence of special-status species, AOPC size, contribution of background levels of inorganics, etc.).

Neither a Level III BERA nor a BHHRA is recommended for the River OU. Instead, progression to a FS is recommended. Although a few other COPCs and CPECs were also identified, PCBs (through the consumption pathway) were identified as the primary risk drivers for both humans and wildlife. However, the PCB concentrations remaining in Forebay sediment (after the 2002 and 2007 removal actions) are inconsistent with PCB concentrations measured in Forebay tissue (most notably in smallmouth bass which were collected prior to the sediment removal action).

Monitoring of PCB concentrations in Forebay tissue may be recommended, to confirm that tissue concentrations are decreasing with time and that residual sediment concentrations are at acceptable levels.

Post-RI Activities As part of the pre-FS work for the River OU, additional bass, clam, and sediment samples were collected from the Forebay in September and October 2011, while additional bass were collected from the Reference Area in August 2011. In the Forebay, the bass were collected from areas north of Bradford Island, north of Goose Island, and south of Cascade Island. Bass were successfully collected at twenty-three locations in each of the areas; however, only nineteen samples from the Reference Area and twenty samples from the Forebay were analyzed based on project needs and goals. The co-located sediment and clam samples were collected at seven locations along the north-shore of Bradford Island in the areas suggested by DEQ as most likely to be influenced by Upland sources. Sediment and clam samples were successfully collected at all seven proposed sample locations; however, only six of the locations yielded enough clam tissue for the planned analysis. Sediment and tissue samples were analyzed for PCBs (Aroclors and 209 congeners), metals, PAHs, pesticides, butyltins, and SVOCs. This data will be presented in a subsequent document and will be used to verify the COPCs identified in the RI/RA for the River OU, as well as the COPCs originating from erosion or mass wasting evaluation of soils from the Upland OU. If the results indicate a potential source of contamination was overlooked, the list of sediment and tissue COPCs may be modified to reflect the new information. A more thorough evaluation of the potential for erosion and mass wasting of Upland soils will be conducted during the FS phase to support conclusions made regarding the likelihood and magnitude of the overland transport pathway.

1.0 INTRODUCTION

The Portland District of the United States Army Corps of Engineers (USACE) has conducted a multi-year effort to characterize and evaluate the contamination arising from historical USACE activities at Bradford Island in Oregon. Bradford Island is part of the Bonneville Dam complex, which is located on the Columbia River at river mile (RM) 146.1, approximately 40 miles east of Portland, Oregon.

The investigation around Bradford Island began as part of the evaluation of the former Bradford Island Landfill (the Landfill), which was used from the early 1940s to the early 1980s. In the course of numerous investigations that USACE and its contractors performed on Bradford Island and offshore since 1997, it became apparent that past upland and shoreline disposal activities had resulted in contamination of the site soil and groundwater, as well as the sediments of the adjacent river. Since 1996, USACE has been working with the Oregon Department of Environmental Quality (DEQ) to address the state's concerns regarding the site investigations and any associated cleanup activities.

In 2000 and 2001, discarded electrical equipment and debris were discovered in the river immediately north of Bradford Island. Three piles of debris were identified, which were removed in 2000 and 2002 (Appendix E of URS Corporation [URS] 2002a, URS 2002b). Following the equipment removal, sediments along the north shore of the island were characterized and the most highly impacted sediments were removed in October 2007 (Huang and Associates, Inc [HAI] 2007).

In 2007, the USACE submitted a Remedial Investigation/Feasibility Study (RI/FS) Management Plan (MP) (URS 2007a), which defined the objectives of the remedial investigation (RI) and described the work to be performed to meet the project objectives. Using the Data Quality Objectives (DQO) approach (United States Environmental Protection Agency [USEPA] 2006), the RI/FS MP identified data gaps and described plans for extensive data collection to fill the identified data gaps for the site soils and groundwater (Upland operable unit [OU]) and for the offshore sediments, surface water, and tissues of various aquatic species (River OU). The RI/FS MP also described how the collected data would be used to delineate the nature and extent of contamination, evaluate the potential risks to human and ecological receptors, and support decision-making needs. The USACE and the external stakeholders for the project, which are collectively referred to as the Technical Advisory Group (TAG) and include the DEQ, conducted extensive internal and external review of the RI/FS MP, and the document was finalized in September 2007.

The collection of additional data was completed by April 2009 in accordance with the requirements of the Upland OU Quality Assurance Project Plan (QAPP; URS 2008a), Upland QAPP Addendum (URS 2009a), River OU QAPP (URS 2007b), Revised Sculpin Analysis Strategy Technical Memorandum (URS 2009b), and In Water QAPP Addendum (URS 2009c). The suite of media sampled included upland soils, groundwater, soil gas, sediments, surface water, and tissue samples from multiple species, including clams (co-located with sediment samples), sculpin, smallmouth bass, and crayfish.

Two interim deliverables, the River OU Data Sufficiency Report (DSR) and the Upland OU DSR, were completed in November 2009 (URS 2009d,e). The DSRs evaluated the quality and quantity of the data available. The DSRs determined that the data gaps and data needs identified in the RI/FS MP (URS 2007a) were filled and that the data to be sufficient and usable to complete the RI and associated human health risk assessment (HHRA) and ecological risk assessment (ERA).

This RI Report documents the investigation activities that have taken place over the past ten years, and uses the data to identify source areas at Bradford Island, defines the nature and extent of the environmental contamination, and identifies the contaminants of potential concern (COPCs) for human health and contaminants of potential ecological concern (CPECs) in the media from the River OU and Upland OU.

1.1 Report Objectives and Organization

The objectives of this RI report include:

- Identify source areas
- Identify current on-site upland source contribution to river sediment contamination
- Identify nature and extent of contamination in the upland and river areas
- Evaluate fate and transport of contaminants
- Perform a screening level (Problem Formulation) HHRA to identify COPCs which pose potentially unacceptable risk to human health.
- Perform a screening level (Phase I and II) ERA to identify CPECs which pose potentially unacceptable risk to ecological receptors.
- Determine which COPCs/CPECs in which portions of the site require additional risk assessment via a Baseline HHRA (BHHRA) and/or Level III Baseline ERA (BERA) to determine whether or not they need to be addressed in the subsequent feasibility study (FS).
- Determine which COPCs/CPECs in which portions of the site require no additional risk assessment and will be carried forward to the FS.

This report will provide the basis for the FS studies to be reported under separate cover, the objective of which will include:

- Evaluate whether source controls are necessary to address upland sources to sediment contamination
- Evaluate potential cleanup alternatives, both in the uplands and for sediment
- Determine Remedial Action Objectives (RAOs)
- Evaluate cleanup alternatives
- Recommend proposed cleanup remedies

This RI report is organized as follows:

Executive Summary

Section 1 – Introduction

Section 2 – Reviews Project Organization and Responsibilities

Section 3 – Reviews Site Background and Physical Characteristics

Section 4 – Presents Conceptual Site Model

Section 5 – Reviews the Historical Site Operations, Environmental Investigations, and Remedial Actions

Section 6 – Reviews Recent Site Investigations

Section 7 – Evaluates the Quality of the Data

Section 8 – Compares Site data to Reference Areas

Section 9 – Discusses Nature and Extent of Contamination

Section 10 – Discusses the Fate and Transport of Contaminants of Further Interest

Section 11 – Presents the Human Health Risk Assessment

Section 12 – Presents the Ecological Risk Assessment

Section 13 – Summary and Conclusions

Section 13 – References

Appendix A contains the project analytical database, Appendix B contains the field boring logs, Appendix C contains a photographic summary of the site, and Appendix D contains groundwater elevations (table and plots). Appendix E contains the analytical laboratory reports and Appendix F contains the data validation reports. Appendix G contains the historical data not included in the RI. Appendix H provides the individual polychlorinated biphenyl (PCB) congener data, and describes the calculation of total PCBs (as Arcolors and as congeners) and total polycyclic aromatic hydrocarbons (PAHs). Appendix I provides data summaries and statistics for each of the OUs and areas of potential concern (AOPCs). The screening level values (SLVs) are provided in Appendix J. Appendix K analyzes data sensitivity relative to the SLVs and Appendix L compare site data to reference area data. M and N present the HHRA and ERA screening tables, respectively. Appendix O presents the uncertainties in the HHRA and ERA. Appendix P provides the Responses to DEQ Comments on the Draft RI Report.

1.2 Site Description

Bradford Island is part of the Bonneville Dam complex, located on the Columbia River at RM 146.1, approximately 40 miles east of Portland, Oregon (Figure 1-1). The site is a multipurpose facility that consists of the First and Second Powerhouses, the old and new navigation locks, and a spillway with a capacity of 1.6 million cubic feet per second (cfs) (USACE 2000). Features of the Bonneville Dam complex are shown on Figure 1-2.

1.2.1 Site Overview

Site investigations on Bradford Island began with evaluation of the Landfill. The Landfill was used from the early 1940s until the early 1980s. The USACE informed the USEPA and the DEQ of the presence of the Landfill in 1996. The Landfill was added to the DEQ Environmental Cleanup Site Information (ECSI) database in April 1997, and the Bonneville Dam Project Manager (PM) signed a DEQ Voluntary Cleanup Agreement letter for the Landfill in February 18, 1998 under the DEQ Voluntary Cleanup Program (VCP). In 2004, USACE elected to continue the Bradford Island project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The USACE is currently working with the DEQ to address the state's concerns regarding this investigation and any associated cleanup activities.

Numerous investigations have been performed by the USACE and their contractors since 1997, focusing on two OUs, the Upland OU and the River OU (Figure 1-3). A review of site records for the Upland OU, including employee interviews, site environmental audits, and environmental investigations resulted in the identification of four AOPCs: the Landfill AOPC, Sandblast Area AOPC, Pistol Range AOPC and Bulb Slope AOPC (Figure 1-4). Contaminant source areas within the AOPCs are discussed in Section 4.0. The primary contaminants of interest (COIs) that have been identified in soil and/or groundwater in the four AOPCs include selected metals; PCBs; semivolatile organic compounds (SVOCs), including PAHs; butyltins; volatile organic compounds (VOCs); and a few pesticides/herbicides. A detailed description of the historical and recent soil and groundwater investigations and remedial activities is included in Sections 5.0 and 6.0, respectively. The COIs identified in offshore sediments include selected metals, PCBs, and PAHs.

Numerous dredge evaluations and other sediment studies/investigations were conducted in the Bonneville Dam Forebay since 1991. During the investigation of the Landfill, hydrographic and underwater dive surveys were conducted in October and November 2000 along the north shore of Bradford Island and numerous pieces of electrical equipment and other solid waste were discovered in the Columbia River adjacent to the Landfill. The removal of equipment and debris from the Columbia River along the north shore of Bradford Island took place in December 2000 and in February and March 2002 (Appendix E of URS 2002a, 2002b). Approximately 32 tons of solid waste was removed and disposed of off-site. Following delineation of the extent of sediment contamination, impacted sediment along the north shore of Bradford Island were dredged in October 2007 (HAI 2007). A description of the historical studies/investigations and dredging/removal actions is included in Section 5.0. In areas where historical data is representative of current conditions (i.e., in upland soils) it is used in this RI. In areas where historical data no longer represents currents conditions (i.e., river sediments) it is not used in this RI. Post-removal sampling that has filled upland data gaps and characterized conditions in the River OU after the sediment removal is discussed in Section 6.0. With the exception of few samples collected from areas that were subsequently dredged, all of this recent data is included in the RI data set.

1.3 Regulatory Initiative

Through Executive Order 12580, authorities under the CERCLA (42 United States Code [USC] 9601 et seq.) have been delegated from the President of the United States down to the Director of Civil Works of the Army. These authorities include the authority provided in CERCLA Section 104 to conduct removal and remedial actions in response to releases or threatened releases of a CERCLA hazardous substance or pollutant or contaminant, the authority provided in CERCLA Section 121 to select remedial actions to respond to such releases, and the authority to carry out response actions on federal facilities under CERCLA Section 120 as the lead federal agency. This authority to select and carry out response actions as the lead federal agency in accordance with CERCLA has been delegated to the Commander of the USACE Northwestern Division with respect to releases or threatened releases at Bradford Island. This includes the authority to sign decision documents or records of decision (RODs) for removal or remedial actions in accordance with CERCLA and the National Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] Part 300) at Bradford Island.

The USACE is conducting the RI/FS at the Bonneville Lock and Dam Project, and therefore the authority the USACE has to fund the project is through its operations and maintenance funds for the Project.

The DEQ and CERCLA have the same objectives regarding protection of human health and the environment, and it is the goal of the USACE and the project delivery team (PDT) to meet these broad objectives. The PDT is working directly with DEQ to ensure that appropriate Oregon cleanup regulations and DEQ guidance documents are being followed. However, in attempting to follow both DEQ and CERCLA, specific methodologies and guidance may not completely concur. The PDT, in conjunction with the independent technical review (ITR) team, will use the most current, scientifically defensible methods as required by USACE guidance (Department of Defense [DoD] Environmental Data Quality Workgroup [EDQW] 2009) throughout this project to develop investigation and cleanup strategies. These methods will meet all Federal requirements, and to the extent possible also conform to DEQ guidance.

USEPA has elected not to be directly involved with this project; however, the PDT will keep USEPA informed of project progress as needed.

1.4 Project Schedule

The following table presents the current and potential future project milestones with expected completion dates. Depending upon the evaluation of FS data needs, further investigations may be necessary, which would affect the estimated completion dates for subsequent project milestones.

Project Milestones	Estimated Date
RI Report, incl. Level I and II ERA and HHRA Reports	November 2010
Level III BERA and BHHRA Report for Selected Upland AOPCs	2011
FS Data Needs – QAPP and Data Collection	2011 & 2012
FS Report	TBD
Proposed Plan	TBD
ROD	TBD

Notes:
TBD – To Be Determined

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section describes key USACE roles on this project, as well the roles of other federal agencies, state agencies, Indian Tribes, and contractors.

2.1 USACE Project Manager

The USACE PM, Joseph M. Dasso, will have project management authority throughout the life of the project and is responsible for overall management and execution of the project, including project quality, cost, and schedule. Specific tasks include:

- Manage overall project and project funding.
- Communicate and coordinate with Tribal governments, agencies, and stakeholders, including the TAG, public, DEQ, USEPA, United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), Columbia River Inter-Tribal Fish Commission (CRITFC), Oregon Department of Human Services (DHS), Oregon Department of Fish and Wildlife (ODFW), Washington State Department of Ecology (Ecology), and Washington Department of Health (WDOH).
- Document all communication with stakeholders and tribal governments.
- Initiate and participate in TAG, public, community involvement committee (CIC), and stakeholder meetings.
- Communicate with media, including reporters.
- Lead communication and coordination with Division and Headquarters.
- Convene and coordinate with hazardous, toxic, and radiological waste (HTRW) committee as necessary.
- Make decisions affecting project after consulting with PDT.
- Participate in weekly PDT coordination meetings.
- Ensure that actions satisfy and conform to regulatory requirements.

2.2 USACE Technical Lead

The USACE Technical Lead, Mike Gross, will assist the PM as needed throughout the life of the project. Specific tasks include the following:

- Manage the PDT.
- Act as a main point of contact for contractors, and initiate and manage contractor task orders.
- Initiate and participate, as necessary, in weekly team coordination meetings, as well as in technical, TAG, and other meetings.
- Assist the PM as necessary.
- Act as the PM as needed.

2.3 USACE Technical Team

The USACE Technical Team is composed of technical experts from both the Portland and Seattle Districts. In addition to the USACE PM and USACE Technical Lead, the Technical Team includes John Wakeman, Catherine Martin, and Kenneth Duncan. Disciplines include risk assessment, biology, hydrogeology, chemistry, and environmental engineering. The USACE Technical Team is led by designated task leaders who are assigned on a task-by-task basis. The task leaders direct the PDT. The USACE Technical Team are supplemented with additional USACE resources as needed.

The Technical Team will work closely with all contractors. The task leads will coordinate with the PDT, the PM, and/or the Assistant PM to help resolve all technical issues.

2.4 USACE Independent Technical Review

ITR is the process that confirms the proper selection and application of established criteria, regulations, laws, codes, principles, and professional procedures to ensure a quality product. Technical review confirms the effectiveness of the product and the use of clearly justified and valid assumptions and methodologies. Technical review also includes a comprehensive interdisciplinary review consistent with the established review budget. For this project, the ITR shall consist of discipline-specific review and interdisciplinary coordination review by senior staff or appropriate peer review by those who were not primary designers. All documents produced for this project will undergo ITR.

The ITR team consists of senior technical staff at the Portland District, the Seattle District, and Environmental and Munitions Center of Expertise in Omaha, Nebraska. Specific reviewers include Terry Walker, Sam Bass, Thomas Georgian, Chung –Rei Mao, and Sandy Fry. Other reviewers may be assigned on a task-by-task basis by the task leads.

2.5 Contractors

The prime contractor performing this work is URS. Mike Powell, of the Portland, Oregon office, is the URS PM. He is assisted by specialists from multiple disciplines, including risk assessment, biology, geology, hydrogeology, chemistry, and engineering. The URS team is led by designated task leaders who are assigned on a task-by-task basis. The task leaders report to the URS PM who works closely with the USACE Technical Team. The URS PM will coordinate with the PDT, the USACE PM, and/or the Assistant USACE PM to help resolve all technical issues.

2.6 Technical Advisory Group

Natural resource trustees are federal, state, or Tribal officials who may act on behalf of the public as trustees for natural resources. Natural resources are land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources controlled by the United States, any state or local government, or any Indian Tribe (40 CFR 300.5 and CERCLA §107[f][1]). The federal trustees actively participating in this project include the USACE, USFWS, and NOAA. The state trustees include DEQ, ODFW, DHS, and Ecology. The federal and state trustees are invited to participate in regularly scheduled TAG meetings and given the opportunity to review and provide detailed comments on all technical work completed for this project. Comments provided by the federal and state trustees will be evaluated and addressed by the PDT.

Several Indian Tribes have interests in the Columbia River and the Bradford Island site, including the Yakama Nation, the Warm Springs Tribe, the Cowlitz Tribe, the Chinook Nation, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Reservation. Tribal interests include potential sites with cultural significance (National Historic Preservation Act [NHPA] Section 106) as well as treaty fishing rights in "usual and accustomed" areas. These areas may extend beyond a Tribe's reservation land and apply to landless Tribes.

The federal trust responsibility involves recognizing trust obligations and trust resources. In order to exercise trust responsibility it is important to obtain Indian Tribal views of trust and treaty responsibilities related to USACE actions. These responsibilities are exercised in accordance with provisions of treaties, laws, executive orders, and the Constitution of the United States when the USACE implements or takes an action that may affect a Tribal interest. In order to effectively develop a relationship with the Tribes, the PDT will consult with each Tribe as a sovereign nation on matters related to trust and treaty responsibilities. The Tribes are invited to participate in regularly scheduled TAG meetings and given the opportunity to review and provide detailed comments on all technical work completed for this project. Comments provided by the Tribes will be evaluated and addressed by the PDT. Specifically, the USACE will:

- Operate within a government-to-government relationship with federally recognized Indian Tribes
- Consult, to the greatest extent practicable and permitted by law, with Indian Tribal governments before taking actions that affect federally recognized Indian Tribes
- Assess the impact of agency activities on Tribal trust resources and assure that Tribal interests are considered before the activities are undertaken
- Remove procedural impediments to working directly with Tribal governments on activities that affect trust property or governmental rights of the Tribes
- Work cooperatively with other agencies to accomplish these goals

Consultation efforts will be coordinated through the USACE Portland District Tribal Liaison.

3.0 SITE BACKGROUND AND PHYSICAL CHARACTERISTICS

The Portland District of the USACE has conducted a multi-year effort to characterize and evaluate the potential environmental contamination arising from historical USACE activities at Bradford Island in Oregon. Bradford Island is part of the Bonneville Dam complex, which is located on the Columbia River RM 146.1, approximately 40 miles east of Portland, Oregon. This section describes the Bonneville Dam complex, its general location, history, facility operations, and regulatory status, as well as a brief description of the each of the OUs and AOPCs which are the subject of this RI.

3.1 General Location and Description

The Bonneville Dam and Lock Project (the Project) is the most downstream dam within the Columbia-Snake River navigation system that consists of eight locks and dams (Figure 3-1). The Bonneville Dam is at the upper limit of tidal influence from the Pacific Ocean, about 145 miles upstream from the mouth of the Columbia River and 40 miles east of Portland-Vancouver.

The dam is located at 45° 38’ 27’’ N - 121° 56’ 31’’ W. Bonneville Lock and Dam create a 48-mile-long reservoir from the Bonneville Dam upstream to the Dalles Dam, called the Bonneville Pool. The Columbia River at the Bonneville Dam is divided into three channels by two islands: Bradford Island and Cascade Island. The tailrace for the First Powerhouse forms one channel, the spillway forms the middle channel, and the tailrace channel for the Second Powerhouse forms the third channel (Figure 1-2). The spillway, consisting of 18 gates, each 50 feet wide, is located between Bradford and Cascade Islands, spanning the middle channel. The spill gates are raised to allow excess river flow to pass under them at a depth of about 50 feet below the upstream water surface.

The major features of the Project include the spillway, two powerhouses, two navigation locks (one lock is no longer in use), and a fish hatchery (Figure 1-2). The fish hatchery, main office, and navigation lock visitor center are located on the Oregon shore of the Columbia River. A warehouse and automotive garage facility, and navigation lock support facilities are located on Robins Island, located between the Oregon shore and Bradford Island. The major features on Bradford Island are the Bradford Island visitor center, fish ladders, the service center building, and the equipment building. Although the sandblast building is shown in Figure 1-2, it was structurally damaged in a storm a couple years ago and was demolished within the last year. Another fish ladder is located on Cascade Island, and a third visitor center is located on the north shore of the Columbia River in Washington State.

The old navigation lock is adjacent to the First Powerhouse and is no longer in use. The upstream side of the old navigation lock consists of an end sill (where the lock doors are located) that extends from the riverbed to an elevation of 40 feet above mean sea level (msl). The current navigation lock (Figure 1-2) is located immediately south of the old navigation lock and has an end sill that extends to an elevation of 51 feet above msl.

An authorized federal navigation channel in this reach of the river is 300 feet wide and 27 feet deep, although the depth is currently maintained at 17 feet (USACE 1991). Limited dredging is necessary to keep the channel to the maintained depth near the dam. Bathymetric surveys conducted by USACE indicate that the pool near the Bonneville Dam (within the spillway forebay) is up to 100 feet deep.

3.1.1 Regional Geology

The Project is located in the Columbia River Gorge, a 50-mile canyon that cuts through the Cascade Range physiographic province (Orr and Orr 1999). The canyon has formed through time as the Columbia River incised through various geologic formations, including the Western Cascade Group, the Columbia River Basalt Group, and the High Cascade Group, in response to the uplift of the Cascades over the last 2 million years (Beeson and Tolan 1987).

Three bedrock formations are present near Bonneville project: the Ohanapecosh Formation (also referred to as the Weigle Formation), the Eagle Creek Formation, and the Columbia River Basalt Group (Holdredge 1937; Wise 1970). The Ohanapecosh Formation consists of late Oligocene-aged volcaniclastic siltstones and sandstones with minor conglomerates. As much as two-thirds of the clasts in this formation consist of glass fragments. The fragments have subsequently altered to a dominantly clay mineral assemblage, greatly weakening the formation.

Folding and faulting have significantly disturbed the Ohanapecosh Formation. Bedding generally strikes northeast and north, with a dip of 5 to 20 degrees to the east and southeast. Two predominant fault/shear zone orientations have been identified in association with the development and construction of Bonneville Dam. They include northwest-striking features dipping moderately to steeply to the northeast and northeast-striking features dipping gently to moderately to the northwest. These features do not continue into the overlying Eagle Creek Formation, indicating that fault movement ceased before the Eagle Creek sediments were deposited. No outcrops of the Ohanapecosh formation are found at the site.

The Eagle Creek Formation overlies the Ohanapecosh Formation, and is differentiated primarily by larger clast size and lack of alteration. The Eagle Creek Formation consists primarily of sandstones and conglomerates, with individual units of sedimentary tuffs. Bedding in the unit is near horizontal. The Eagle Creek Formation crops out near river level near the site.

The Columbia River Basalt Group disconformably overlies the Eagle Creek Formation. Flood basalts of this group are Miocene in age and originated from a series of fissures in eastern Washington, Oregon, and Idaho. In the vicinity of Bonneville Dam, the basalts have been uplifted several hundred feet above the current river level.

Two landslides have significantly modified the topography in the vicinity of the site (Sager 1989). Those slides are believed to have been at least partly the result of catastrophic floods during the late Pleistocene that scoured away the talus slopes from the Columbia Gorge. That action over steepened the walls of the Gorge and effectively removed the buttressing effect of the talus slopes. Scouring also exposed the clay-rich Ohanapecosh Formation, which may have contributed to the landslides. The Tooth Rock Landslide is a large rotational block failure that originated on the Oregon side of the Gorge, south of Bradford Island. The slide is reported to have incurred only rotational movement, without lateral expansion. Large slide blocks of the Eagle Creek Formation contributed to the formation of Bradford Island. Because of the slide’s rotational nature, the blocks are relatively undisturbed and form a local, but variable, bedrock surface beneath the Bradford Island. Portions of the Tooth Rock slide block extend into the Columbia River and are submerged. Therefore, the river bottom in the immediate vicinity of Bradford Island consists of Eagle Creek Formation overlain by a thin layer of sands and silts that have been deposited in lower velocity areas.

A second large-scale landslide in the area is known as the Bonneville (Cascade) slide. The slide originated on the Washington side of the Gorge between 400 and 800 years ago. The toe of the landslide forms the northern abutment of the Second Powerhouse. Debris from the slide have been observed to overlie the Tooth Rock slide on portions of Bradford Island.

The Tooth Rock slide blocks at the site are also overlain by up to 30 feet of alluvium associated with Holocene to recent flooding of the Columbia River. The alluvium consists of silty sands and gravels that contain increasing amounts of Eagle Creek Formation clasts with depth.

3.1.2 Climate

A meteorological observation station has been in operation at the Project since July 1, 1948. During a 57-year period of meteorological records (1948 through 2005), the station recorded average summer daytime maximum temperatures of 65.8 degrees Fahrenheit (°F) and average winter daytime maximum temperatures of 35.4°F (Western Regional Climate Center 2002). Temperature extremes at the Bonneville Dam have varied from a low of (-5°F) on January 31, 1950, to a high of (107°F) on August 18, 1977.

The average annual precipitation at the Project for the period of record is 77.05 inches. December and January are the months with the highest precipitation rates, and July is the month with the lowest (Western Regional Climate Center 2002). Recorded daily maximum precipitation rates have exceeded 1 inch for every month, with the maximum daily rate of 5.05 inches recorded on November 25, 1999. Average annual snowfall at the dam is 17.7 inches, normally occurring from November through March.

3.1.3 Groundwater/Hydrogeology

Occurrences of shallow groundwater have been evaluated as part of the previous environmental investigations near the former Landfill and the former sandblast building (eastern tip of Bradford Island). Additional groundwater information was generated as part of this RI. Based on these investigations, two shallow stratigraphic units exist on the eastern tip of Bradford Island:

1. **Fill/alluvium.** This unit consists of silty to clayey sands and ranges from 15 to 30 feet in thickness. At depth, there are increasing bedrock clasts. This unit occurs beneath the upland portion of the site and pinches out near the northern shore of Bradford Island.

2. **Bedrock.** The bedrock unit consists of a slide block emplaced from the Oregon side of the river. The block is composed of the Eagle Creek Formation, which consists primarily of sandstones and conglomerates. The uppermost 2 to 5 feet of this unit is fractured.

Groundwater on the eastern tip of Bradford Island appears to be perched in the alluvium above the less-permeable Eagle Creek slide block. Where the fractured bedrock crops out on the north shore of the island, seeps form in the winter months. The slide block forms the base of the river near the island, with no to little sediment thickness found on top of the slideblock.

Appendix D summarizes hydrologic information collected from the on-site monitoring wells. Based on the horizontal hydraulic gradient measured in the fill/alluvium, the direction of groundwater flow beneath the Landfill AOPC is to the north (Appendix D, Figures D-1 through D-4). Horizontal hydraulic gradients between MW-2 and MW-5 in the Landfill AOPC range from 0.10 to 0.13 foot per foot (Appendix D, Table D-2). Measured hydraulic conductivities in the fill/alluvium beneath the Landfill AOPC based on slug tests range from 14 to 320 feet per day (URS 2004b). Based on a water balance calculated for the former Landfill, approximately 61 percent (%) of the precipitation that falls on the Landfill AOPC footprint percolates to groundwater and discharges either along the north shore of Bradford Island as seeps or offshore of Bradford Island (URS 2004b). One of the monitoring wells (MW-8) is completed in the bedrock beneath the Landfill AOPC and groundwater elevations measured in this well in April 2008 and May 2002 are lower that the adjacent pool elevation (Appendix D, Table D-1). This suggests that in Spring, the direction of groundwater flow in the bedrock aquifer is downward (although it is upward at other times of year).

At the Sandblast Area AOPC, groundwater flow is to the north and northwest (Appendix D, Figure D-5 through D-8). Horizontal hydraulic gradients between MW-11 and MW-115 (to the north) range from 0.10 to 0.11 foot per foot and between MW-11 and MW-14 (to the northwest) range from 0.07 to 0.08 foot per foot (Appendix D, Table D-2). Measured hydraulic conductivities beneath the Sandblast Area AOPC based on slug tests range from 0.02 to 285 feet per day, indicating significant heterogeneity in this area.

3.1.3.1 Drinking Water - Bonneville Lock and Dam Project

No active drinking water wells are located on Bradford Island. Water supply well DW2, which is located on the eastern side of Bradford Island (Figure 3-2), was used for drinking water until 2000 (Perletti, pers. comm. 2010). The USACE decommissioned well DW2 in 2008.

Hatchery Wells H1, H2a, H3, H4, H5, H6 and H7 are located on the eastern end of Robins Island (Figure 3-2). The hatchery wells were installed between 1986 and 1991 to replace wells that were abandoned during the construction of the new navigation lock. The groundwater is extracted from a former alluvial unit that was buried by the Tooth Rock landslide. The alluvium overlies the Ohanapecosh Formation in this location and is up to 100 feet thick (Scofield 1998). These wells provide water to the hatchery and, either individually or combined, also provide drinking water to the Project (Perletti, pers. comm. 2010).

Water supply wells DW1 (also referred to as PW1 and WW-1794) and DW5 (also referred to as PW2 and WW-1800) are located on the eastern end of Robins Island (Figure 3-2). Both DW1 and DW5 historically provided drinking water to the Project (McCavitt, pers. comm. 2001). The USACE stopped using wells DW1 and DW5 several years ago for drinking water use as the wells were going dry; however, the USACE has not yet decommissioned the wells (Perletti, pers. comm. 2010).

Water supply wells DW3 and DW4, which are located on Cascade Island and the Washington shore, respectively, are currently supplying drinking water to the Project (Perletti, pers. comm. 2010). Potential releases to groundwater from Bradford Island should not pose a threat to these populations due to the lack of hydraulic connection to the perched water-bearing unit beneath the island.

3.1.3.2 Drinking Water – Project Vicinity

The population within a 4-mile radius relies on municipal water supplies taken from groundwater supply wells (Leland, pers. comm. 2001). The Columbia River hydraulically separates these populations from Bradford, Cascade, and Robins Islands. Potential releases to groundwater from Bradford Island should not pose a threat to these populations due to the lack of hydraulic connection to the perched water-bearing unit beneath the island.

3.1.4 River Hydrology

Flow within the Columbia River is modified by the operations of several federal and non-federal dams. Bonneville Dam at RM 146.1 is the dam farthest downstream on the Columbia River. Hydrologic conditions immediately upstream and downstream of the dam are the primary focus of this section; however, regional hydrology is addressed given its influence on local hydrologic processes and the Columbia River's evolution.

3.1.4.1 Regional Hydrology

The Columbia River drains an area of 259,000 square miles and is ranked seventh in length and fourth in stream flow among United States rivers. It flows 1,243 miles from its headwaters in the Canadian Rockies of British Columbia, across Washington State, and along the border of Washington and Oregon to the Pacific Ocean (Figure 3-1). There are 11 dams on the Columbia River's mainstem in the United States and 162 dams that form reservoirs with capacities greater than 5,000 acre-feet in the United States and Canadian parts of the basin (United States Geological Survey [USGS] 1996).

Climate in the Columbia River Basin varies considerably, but river hydrology is dominated by snowmelt from high-elevation areas, with the majority of annual flow occurring between April and July. High flows also occur between November and March, caused by heavy winter precipitation (Northwest Power and Conservation Council [NPCC] 2004).

All of the major dams and reservoirs within the basin operate in coordination with each other to manage floods, control fish migration, and produce power. The general operating year for the dams and reservoirs within the basin is divided into three periods:

- September through December – A fixed reservoir drawdown occurs, since a forecasted volume of runoff that will occur in the spring is not yet available. Flows are managed to enhance the spawning of chum salmon below Bonneville Dam.
- January through mid-March to April – A variable drawdown occurs to meet the forecasted volume of the spring runoff based on snow pack measurements. Water must be present in April for juvenile fish migration.
- April through August – Refill season; the reservoirs are managed in an effort to fill the reservoirs and allow fish migration.

3.1.4.2 Local Hydrology

Most technical publications concerning the Columbia River focus on the basin and subbasins, specifically as they relate to water quality and specific habitats. Publications addressing details of individual hydrologic inputs in the immediate vicinity of Bonneville Dam do not appear to be readily available. The position of the Columbia River as a border between Oregon and Washington may contribute to the disjunction of available information. A series of subbasin plans and water quality reports were reviewed to obtain general information about the Columbia River Basin within the area of interest, which runs approximately from RM 142 (Pierce and Ives Islands) to RM 148 (Bridge of the Gods).

Bonneville Dam is considered a run-of-river project. Run-of-river projects, by definition, have limited storage and were developed primarily for navigation and hydropower. These types of projects pass water at the dam at nearly the same rate it enters the reservoir, with an average variance of water level behind the dam of 3 to 5 feet.

The tailwater elevation below Bonneville Dam varies in direct relationship to the river discharges, and ranges from about 7.0 feet above msl at a river flow of 70,000 cfs to 36.3 feet above msl at a river flow of 660,000 cfs (USACE 1998). From Bonneville Dam to the ocean, the slope of the Columbia River is very flat and subject to tidal action. The daily tidal influence on water level during low water periods ranges from 1 to 2 feet at the dam (Washington Department of Fisheries [WDF] et al. 1990).

Within the Columbia River Basin are numerous subbasins formed by tributaries of the mainstem river. Although the layouts of the subbasins in their entirety extend beyond the area of interest, they each contain tributaries of the Columbia, as identified below, within the area of interest.

Hydrologic inputs immediately upstream of the dam include Ruckel and Eagle Creeks on the Oregon side. Washington maps do not indicate any named creeks immediately above the dam, although drainage features are presumed to exist. Hydrologic inputs immediately downstream of the dam include Tanner and Moffett Creeks on the Oregon side with Greenleaf and Hamilton Creeks contributing on the Washington side.

Streams draining the Oregon side of the Columbia River Basin (within the area of interest) originate and flow through the Hatfield Wilderness, a 39,000-acre portion of land managed by the United States Forest Service (USFS). Although streams discharging to the Columbia originate and primarily flow through the protected wilderness, they also pass through the privately held and often developed properties located along the waterfront. Development such as roadways and railroads with riprap bisect the lower reaches of the tributaries and are presumed to have the greatest influence on the flow rate and water quality at the point where the tributaries join the Columbia.

Urbanization of the land along the Columbia on the Washington side has substantially altered original drainage and subsequent hydrologic inputs. A major highway, railroad, and associated riprap also bisect tributaries along the riverfront on the Washington side.

Forestry is a major industry upstream and downstream of the dam, especially in Washington. Timber practices are typically clear-cut and slash-and-burn, subject to Forest Practices Act regulations of both states (WDF et al. 1990). The significance of this industry, and to a lesser degree agriculture, is its effect on runoff and subsequent water quality. A damaged or destroyed riparian buffer, due to deforestation and agriculture, can substantially alter the morphology of streambeds and, in some cases, whole drainage basins. An example would be increased flow rates, which can result in aggressive streambed scour, increased turbidity, elevated concentrations of dissolved minerals, and habitat destruction. Not only is the tributary being affected but also subsequent discharge can potentially influence water quality, habitat, and flow in the mainstem.

3.1.5 Site Ecology

This section describes the habitats present at Bradford Island and identifies Endangered Species Act (ESA)-listed species and other important non-listed fish that may occur or have the potential to occur in the area.

3.1.5.1 Habitats

A description of the habitat at each Upland OU AOPC and a description of the aquatic habitat of the River OU are provided below. Appendix C contains a photographic summary of each Upland OU AOPC and the River OU.

Landfill AOPC – Upland meadow and shrub/forest fringe communities occupy the Landfill AOPC. This area once served as a temporary nursery for landscape plants used at Bonneville Dam and adjacent facilities. Not all of these ornamental plants were removed and some have survived. Adjacent to the Landfill AOPC is a larger area of conifer-dominated forest. The upland meadow habitat that occupies the surface of the Landfill AOPC has been disturbed by various field investigative activities (i.e., test pits, drilling operations) but has since been recolonized by the invasion of surrounding herbaceous vegetation.

The shrub and forest fringe area is characterized by rocky outcrops at the edges of the island and at the margin of the flat meadow area adjacent to the forested habitat. The substrate consists of a mixture of soils, rock that may have been placed in some areas, and what appear to be natural rock outcrops. The Landfill AOPC terrain is flat at the top and slopes steeply to the north and east into the Columbia River. The slopes are more densely vegetated with shrubs and trees than the flatter areas adjacent to the meadow.

The upland conifer forest in the Upland OU Reference Area appears to be the least disturbed habitat on the island, as it is composed of mostly native species. This forest is apparently relatively young; USACE photographs from the 1930s show much smaller trees. It is likely that this forest was naturally seeded rather than planted. No stumps are present, indicating that past logging either did not occur, or was followed by recontouring the land that included removal of stumps. The larger trees are up to 1.5 feet in diameter at 4.5 feet above the ground, and form a closed canopy. The substrate in the forest area consists of relatively thin topsoil and rocky outcrops. Dead and downed woody material is common.

At the eastern tip of the island, a small (less than 0.25 acre) opening is located at the top of the cliffs that form the shoreline. A thin veneer of soil covers bedrock in this area. A smattering of the shrubs similar to the forest habitat described above are present, but the area is mostly open.

Sandblast Area AOPC – The Sandblast Area AOPC generally consists of a north facing slope with numerous topographic/habitat complexities. Upslope of the former sandblast building is a relatively undisturbed and densely herbaceously vegetated hill slope. Below the upper hill slope is a relatively flat and paved area around the former sandblast building. Downslope (to the north-northeast) of the former sandblast building and the adjacent paved area is a short, steep hill with a shrub/forest community leading to the flat, unvegetated equipment laydown area and the paved road leading east to the Landfill AOPC. Downslope (to the northwest) of the former sandblast building is a relatively flat, herbaceously vegetated area, followed by a recently disturbed slope, then a paved road. Excavation and filling activities on the northwest slope in 2009 removed vegetation and exposed bare, erodible soils at the ground surface. During the following year, the disturbed area has naturally revegetated and is currently vegetated with a dense scrub/shrub community (see the photos in Appendix C).

Pistol Range AOPC – Once the Pistol Range AOPC ceased being used for small arms practice in the late 1960s or early 1970s, the firing range was recolonized by the invasion of surrounding herbaceous vegetation. The topography of the area consists of a series of cuts and fills, resulting in a sequence of slopes and flat areas. Currently, the ground surface is vegetated with a mix of scrub-shrub and herbaceous vegetation. An upland meadow community, similar to the Landfill AOPC meadow community, covers the firing range. The hillside behind the backstop is moderately steep (15 to 30 degree slopes) and is densely vegetated with herbaceous vegetation and shrub/forest fringe communities. Along the southern portion of the firing range and south of the access road, a densely vegetated scrub/shrub community is present.

Bulb Slope AOPC - The Bulb Slope AOPC consists of a steeply sloped area between the Landfill access road and the Columbia River on the north side of Bradford Island. The substrate consists of a mixture of soils, rock that may have been placed in some areas, and what appear to be natural rock outcrops, all of which is underlain by underlain by siltstone bedrock. The majority of the Bulb Slope AOPC is herbaceously vegetated and/or covered with organic debris.

Aquatic Habitat – Bradford Island (Upland OU) does not contain any wetlands, lakes, or ponds that would have the potential to be considered sensitive environments. However, aquatic habitats include a portion of the Columbia River adjacent to Bradford Island, consisting of the pooled area behind the Bonneville Dam complex, known as the Bonneville Dam Forebay (River OU). The area of this portion of the River is approximately 230 acres.

Water depth behind Bonneville Dam is variable. The area between Bradford Island and Cascade Island extends to a depth of approximately 100 feet. Based on historic photographs and USACE hydroacoustic sounding data, a submerged shelf appears to be adjacent to the north side of Bradford Island at a depth of about 30 feet below pool level. This shelf appears to be about 50 feet wide, parallel to the north shore of the island. The shelf could be critical habitat for ESA-listed salmonids. Shallow water (20 feet deep or less) also occupies a band approximately 50 feet wide along the south shoreline of Bradford Island.

Hydraulic modeling of the waters near Bradford Island was conducted by the USACE (Langsley 1999). This modeling indicates that a large eddy forms behind the dam and creates a reverse current flow next to Bradford Island. This reverse flow appears to attract adult salmonids exiting the fish ladder on their way upstream and may result in the fish being swept back over the dam (Langsley 1999). Introduced fish species may be present in the Forebay for prolonged periods throughout the year and are popular recreational species with a recognized societal value.

3.1.5.2 ESA-Listed Species & Other Important Fish

The list of sensitive species with potential to occur at the Bonneville Dam Forebay is provided in Table 3-1. The table is an updated summary of the more detailed information presented in the Biological Characterization (Appendix F) of the Draft Supplemental Site Inspection (SSI) (URS 2000). The list of species was originally derived from Oregon Natural Heritage Program (1999) data for species recorded within 5 miles of the Landfill, correspondence from USFWS (1999) and National Marine Fisheries Service (NMFS; 2000), information from USACE personnel, reference books, and reports of studies focused on protected species in the Bonneville Dam vicinity. The status of the species in the list was updated based on the Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon (USFWS 2009) and the Oregon Natural Heritage Program Rare, Threatened and Endangered Species of Oregon list (Oregon Natural Heritage Program 2007).

The special-status (federally and state-listed threatened) fish and wildlife species that are known to occur or could potentially occur at the site are described below. In addition, this section also presents a brief discussion of non-listed important fish species that may occur in the Forebay.

3.1.5.3 Fish Species

The Lower Columbia River is characterized by warmer, slower waters than the upper reaches, and this region consequently supports a larger diversity of native resident fish species such as the following non-listed fish: white sturgeon (*Acipescer transmontanus*), longnose suckers (*Catostomus catostomus*), and minnows (i.e., chiselmouth [*Acrocheilus alutaceus*]). Other native species that are found throughout the Columbia River include special-status trout (i.e., steelhead [*Oncorhynchus* spp.] and bull trout [*Salvelinus confluentus*]), non-listed trout (i.e., cutthroat trout [*Oncorhynchus clarki clarki*]), non-listed whitefish (i.e., mountain whitefish [*Prosopium williamsoni*]), and a variety of non-listed sculpins (*Cottidae*) (Troffe 1999; USACE 2001).

Special-status anadromous fish species that have the potential to be present in the Bonneville Forebay are listed Table 3-2. Ten of the 12 evolutionarily significant units (ESUs) shown in Table 3-2 have the potential to be present near Bradford Island as juveniles, adults or both. The Columbia River near Bradford Island is used by these species primarily as a migratory route between upstream spawning areas and the Pacific Ocean. The listed ESUs fall into two juvenile life-history strategies: "ocean-type" that rear in freshwater for only a few weeks to a few months before migrating to the estuary/ocean during their first year of life, and "stream-type" that spend at least a year rearing in freshwater prior to their downstream migration to the ocean. The Biological Assessment for Anadromous Fish Species and Steller Sea Lion Essential Fish Habitat (USACE 2007) provides additional information as well as a general overview of the life history and status of each ESU and describes when adults and juveniles would be expected to occur near Bradford Island.

Adult salmon typically nearly cease feeding once leaving the Columbia River estuary on their upstream migration. Adult steelhead migrating upstream feed to a limited extent. Juvenile salmon and steelhead feed on their downstream migration. Juveniles feed on aquatic invertebrates and small fish. As noted above, several listed and candidate anadromous fish pass through the lower Columbia River on their journeys between spawning areas and the ocean. The residence time for anadromous fish near Bradford Island is expected to be minimal, but native and introduced resident species may forage at the Bonneville Dam Forebay and many of these fish are popular recreational species.

Popular recreational fish species such as largemouth (*Micropterus salmoides*) and smallmouth (*M. dolomieui*) bass are common to the lower Columbia River and could reside in the Bradford Island vicinity. Other introduced fish species such as catfish (*Ameiurus* spp.), yellow perch (*Perca flavescens),* and walleye (*Stizostedion vitreum*) are also important sport fish that may be present near the landfill for prolonged periods throughout the year.

3.1.5.4 Wildlife Species

The following wildlife species that are indigenous to this area of the Columbia River Gorge are federally (USFWS) and/or state (ODFW) listed as endangered or threatened (USFWS 2009):

- Northern spotted owl *(Strix occidentalis caurina)* – Federally and state-listed threatened
- Bald eagle *(Haliaeetus leucocephalus)* – State-listed threatened

- Columbia white-tailed deer *(Odocoileus virginianus leucurus)* – Federally listed endangered

The northern spotted owl lives in old-growth forests of the nearby Mount Hood and Gifford Pinchot National Forests. No old-growth forest exists on Bradford or Cascade Islands, and it is unlikely that adult spotted owls occur there due to lack of suitable nesting habitat. However, juvenile spotted owls might pass through the area.

The bald eagle is the only special-status piscivorous species that has the potential to occur in the upland habitats of Bradford Island. Bald eagles occur as nesting and wintering residents of the Columbia River Gorge/Bonneville Dam area. Eagles primarily feed on fish, waterfowl, and waterbirds that occupy the Bonneville Dam Forebay. Several bald eagles were observed during Landfill investigations by USACE and URS personnel during 2001.

Columbia white-tailed deer are very unlikely to occur on Bradford or Cascade Islands. Habitat for this species most frequently consists of riparian zones and bottomland hardwood forests and agricultural areas, including islands within the Columbia River downstream of Portland, Oregon (between RM 32 and RM 50), approximately 100 miles downriver from Bonneville Dam.

3.1.6 Land Use and Population

3.1.6.1 Land Use

3.1.6.1.1 Project-Related Land Use

The Bonneville Project is a multiuse project, managed for hydropower, navigation, recreation, and natural resource and wildlife preservation. The Bonneville Master Plan (USACE 1997a) describes the land use details for the Project. Specific Project uses are described below.

Areas of Bradford Island are specifically managed for wildlife use. Thirteen acres of wooded and open areas on the eastern tip of Bradford Island are for multiple resource wildlife management, primarily goose nesting and pasture areas. The open area immediately south of the service building is managed for goose pasture. Geese also use lawn areas associated with the visitor’s facilities for feeding. The downstream western end of the island has 34 acres used for low-density recreational fishing. Eighteen acres on Bradford Island are used for visitor facilities, and the remaining acreage is used for project operations, including office, storage, and equipment maintenance facilities.

Approximately half of Cascade Island (34 acres) is managed for goose pasture, with small areas set aside for goose nesting. The remainder of Cascade Island is used for project operations, including equipment storage and powerhouse management.

All of Goose Island is set aside for goose nesting or pasture. A portion of the north bank of the Columbia River (Washington State) between the Second Powerhouse and an upstream Tribal treaty fishing site is also goose pasture.

Hamilton Island is located two river miles downstream of the Bonneville Project and is a 221-acre multiple resource management area providing habitat for resident wildlife species. Three acres are managed specifically for goose foraging, and 27 acres are managed for low-density recreation, primarily fishing from the bank and a boat launch.

Lawn areas of Robins Island and the fish hatchery are used for goose foraging. The fish hatchery on the Oregon shore is a 22-acre cooperative use site with ODFW. The hatchery is mitigation for resource damage caused by the dam construction. Portions of Hamilton Island also are managed for goose pasture. Fort Cascade is a 56-acre cultural resource area on the downstream Washington shore preserved because of Native American and early European American settlement. Approximately 46 acres of the north shore of the river within the Project are used for low-density recreation, and 2 acres are specifically for goose foraging.

Other visitor facilities include the Navigation Lock visitor area (6 acres) and the north shore visitor complex (22 acres). Other areas for recreation on the project include Robins Island (21 acres), the south shore area near the fish hatchery (24 acres), and the Pacific Crest Trailhead (4 acres). The remaining Project areas (more than 100 acres) are used for Project operations. There is no public access to the portion of Bradford Island involved in this RI.

There are no plans to change the above land uses at the Project, therefore these appear to be the likely future land uses.

3.1.6.1.1 Surrounding Area Land Use

The Bonneville Dam complex lands set aside specifically for project operations include 97 acres of land that is owned and operated by USACE, and occupied by the main facilities at the Project.

The dam complex is located within the Columbia River Gorge National Scenic Area. The Mount Hood National Forest is located south of the dam and south of Interstate 84. Gifford Pinchot National Forest is located on the Washington side of the river, approximately 6.5 miles north of the dam. Beacon Rock State Park is located approximately 2.5 miles to the west, on the Washington side of the river. All of these areas are used for various forms of recreational activities including fishing, boating, hiking, biking, and camping.

The vast majority of land near Bonneville Dam is dedicated to forestry activities, with agriculture a distant second. Timber resources in the region support large, integrated timber processing industries in the major population centers (WDF et al. 1990).

Pierce and Ives Islands are located downstream of the dam at RM 142. Pierce Island is a 200-acre nature conservancy preserve dedicated to protecting native riverine flora and fauna. Ives Island is part of the Gifford Pinchot National Forest and is managed by the Columbia River Gorge National Scenic Area.

Population densities along subbasin tributaries are low, and uses of the streams are not as significant as those along the Columbia River. Habitat alteration and loss due to logging or agriculture are more common threats on these small streams (WDF et al. 1990).

3.1.6.2 Population Profiles

The three distinct human populations in the general site area are the site staff, site visitors, and the nearby residents.

3.1.6.1.2 Site Staff

The USACE currently employs approximately 154 full-time-equivalent positions at the Bonneville Dam complex. Staff duties include a wide range of occupations, including maintenance, construction, office staff, visitor services, and natural resource management.

Approximately 10 additional staff from the Portland District headquarters are stationed at the dam. Approximately 300 fisheries-related personnel (contractors/researchers from state and federal agencies) work at the dam from April through September. The number of construction and service contractors at the project varies depending on workloads but can number approximately 175 people (McCavitt, pers. comm. 2006).

3.1.6.1.3 Site Visitors

A road from Interstate 84 provides access to the Bonneville Dam complex. The access road is gated, and visitors are allowed to access several dam facilities (visitor centers, fish ladders, etc.). The site and general vicinity on Bradford Island is gated and off limits to the public. Only USACE personnel and authorized visitors are allowed into these areas.

3.1.6.1.4 Nearby Residents

No permanent residential dwellings are located on the Project. The primary population center in proximity to the dam is the town of North Bonneville, situated on the Columbia River just west of the dam on the Washington side of the river. The current population is estimated at approximately 950 persons.

Major population centers to the west include Portland, Astoria, and St. Helens in Oregon, and Vancouver, Longview-Kelso, and Camas-Washougal in Washington. The cities of Cascade Locks, Hood River, and The Dalles in Oregon and Stevenson, Carson, and White Salmon in Washington lie upstream of the dam. Municipal and industrial pollution from these urban areas are expected to have affected the water quality of the mainstem Columbia River. Population growth is anticipated to result in the conversion of forest, rural residential and agricultural land uses to high-density residential uses, with potential impacts to habitat conditions (Lower Columbia Fish Recovery Board [LCFRB] 2004).

3.1.6.3 Beneficial Uses

According to DEQ guidance for determining beneficial water uses (DEQ 1998a), groundwater may be classified as unlikely to be suitable for potable water uses if it meets the criteria of greater than 10,000 milligrams per liter (mg/L) of total dissolved solids (TDS) and yield less than 0.5 gallons per minute (720 gallons per day). Neither the shallow perched groundwater nor the deeper groundwater at Bradford Island appears to meet the yield criterion. A water supply well originally drilled at Bradford Island to supply potable water to on-site workers was left inactive due to inadequate yield (McCavitt, pers. comm. 2001). The well was formally abandoned in 2008. Therefore, potable water supply use is a highly unlikely potential beneficial use for groundwater.

Designated beneficial uses for surface water in the mainstem of the Columbia River are described in Oregon Administrative Rules (OAR) 340-41-0101 (DEQ 2009a). They include a variety of high-quality uses such as public and private domestic water supply, fishing, water contact recreation and protection of fish and aquatic life (Table 3-3). Beneficial use designations for fish uses include salmon and steelhead migration corridors as well as shad and sturgeon spawning and rearing (Table 3-4).

3.2 Site History

Construction of the First Powerhouse and navigation lock, spillway, fish passage facilities, fish hatchery, and office and maintenance buildings began in 1933. Operations at the Bonneville Dam complex began in 1938. During World War II, in addition to enlarging the first powerhouse and installing additional generators, the military installed anti-aircraft batteries and a rifle/pistol range near the present day location of the service center (USACE 2005).

Between 1974 and 1981, the Second Powerhouse was constructed adjacent to the Washington State shore, to aid in supplying the electrical power needs of the Northwest. The construction of the Second Powerhouse required the relocation of the former town site of North Bonneville, which was relocated approximately 1.5 miles downstream, 4 miles of Washington Highway 14, and 3 miles of Burlington Northern railroad track. During the roadway/railway construction activities, a significant archeological site was excavated. First noted in the Lewis and Clark journals, the site is the only known relatively undisturbed archeological site along the lower Columbia River and provided evidence of 500 years of occupation from the time of Native American occupation to the time of historic settlement in the mid-1800s. This site is on the National Register of Historic Places. Retrieval of cultural material necessary for site interpretation began when it was realized that construction activities would affect the archeological site. Retrieval of cultural material was completed in the summer of 1979 (USACE 2005).

A second navigation lock was constructed at the Bonneville Power Complex on the Oregon side between 1989 and 1993. Associated with construction of the new lock, the southeastern edge of Bradford Island was excavated to improve the approach channel. Soils from that excavation were placed to create Goose Island, 0.5 mile upstream near the Oregon shore.

3.3 Current Facility Operations

The USACE operates and maintains Bonneville Lock and Dam for hydropower, fish and wildlife protection, recreation, and navigation. The major features of the dam complex include a spillway, two powerhouses, two navigation locks, and a fish hatchery. The fish hatchery, main office, and navigation lock visitor center are located on the Oregon shore of the Columbia River. A warehouse and garage facility and navigation lock support facilities are located on Robins Island. The major features on Bradford Island include the Bradford Island visitor center, fish ladders, the service center building, the equipment building, and the former sandblast building. A fish ladder is located on Cascade Island, and the Washington Shore visitor center is located on the north shore of the Columbia River.

3.4 Bonneville Project Regulatory History

The Bonneville Lock and Dam was initially placed on the Federal Facilities Compliance Docket after the 1986 explosive failure of a bushing on an oil circuit breaker in the switchyard on the roof of the First Powerhouse. The bushing failure released approximately one pound of PCBs in tar from the core of the bushing. The bulk of the tar fell on the powerhouse roof, but an unknown quantity reached the river. A second bushing failed in 1991 with similar results. Both spills were cleaned up in accordance with the Toxic Substances Control Act (TSCA) and documented in a preliminary assessment (PA) in 1992. In 1994, the USEPA declared No Further Action (NFA) was necessary with respect to these accidental releases. All PCB-containing bushings and circuit breakers on the powerhouse roof were replaced in the 1995 rehabilitation of the powerhouse.

In 1987, Hamilton Island, a former construction landfill on project lands 1.5 miles downstream from the Second Powerhouse in Washington State, was placed on the Federal Facilities Compliance Docket. The site was investigated for wastes from the construction of the Second Powerhouse at Bonneville Dam, possible PCB waste from the Bonneville project, and wastes from the demolition of the town of North Bonneville. In 1991 the site was placed on the National

Priorities List (NPL) under CERCLA. USACE completed a RI/FS in 1994 and the site was delisted by USEPA in 1995 after a NFA ROD.

USACE maintains a point source discharge permit for discharges from the facility's wastewater treatment plant. The plant services all sanitary waste facilities on the project. The ODFW-managed fish hatchery discharges are not treated by this facility but have a separate discharge in Tanner Creek.

The investigation around Bradford Island began as part of the evaluation of the former Bradford Island Landfill. The Landfill is a former waste disposal site at the Bonneville Lock and Dam Project on the Oregon side of the river. The Landfill was used from the early 1940s until the early 1980s. On June 13, 1996, the USACE submitted a letter to USEPA Region 10 and DEQ, informing them of the presence of the Bradford Island Landfill. In response to the letter, the USEPA requested that sediment samples be collected in the Columbia River around the Landfill perimeter, and that groundwater seep samples be collected if seeps were identified. These issues were considered during the first investigation (the 1998 SI) at the site.

The Bradford Island Landfill was added to the DEQ ECSI database on April 1, 1997. On April 24, 1997, the Bonneville Lock and Dam Project signed a Letter of Intent to participate in DEQ's VCP for the investigation and remediation of the Landfill site. On February 18, 1998, the Portland District Engineer signed a DEQ Voluntary Cleanup Agreement letter for the Landfill site. In 2004, USACE elected to continue the Bradford Island project under the CERCLA.

The USACE will complete the RI/FS in accordance with CERCLA principles, with DEQ requirements as applicable, or with relevant and appropriate requirements (ARARs). Both USEPA and Ecology have been provided the opportunity to comment and participate in the USACE investigations. Neither of these two agencies have committed resources to the project, but support the USACE efforts and have informally deferred to DEQ. The USACE is currently working with the DEQ to address the state's concerns regarding this investigation and any associated cleanup activities.

3.5 Investigation Operable Units

The investigations on Bradford Island began as part of the evaluation of the Landfill, which was used from the early 1940s to the early 1980s. In the course of numerous investigations, it became apparent that past upland and in-water disposal, as well as other operational activities, had resulted in contamination of the site soil and groundwater, as well as the sediments of the adjacent river.

The areas requiring additional evaluation and possible response actions were divided into the Upland OU and the River OU (Figure 1-3). The Upland OU includes four separate AOPCs (Figure 1-4):

- Landfill AOPC
- Sandblast Area AOPC
- Pistol Range AOPC
- Bulb Slope AOPC

Sections 5.0 and 6.0 detail the historical and recent investigations that have been conducted at the Upland and River OUs. The following presents a brief description of the each of the Upland OU AOPCs and of the River OU.

3.5.1 Upland OU

3.5.1.1 Landfill AOPC

Historical investigations at the Landfill AOPC began in 1998. In general, the investigations found that for approximately 40 years, the USACE managed, stored and disposed of waste materials at the landfill in excavated pits or existing depressions on the eastern end of Bradford Island (Figure 1-4). Some additional wastes were disposed of over the northern and eastern edges of the island. Pesticide/herbicide mixing and rinsing of pesticide/herbicide application equipment also occurred near the Landfill, Figure 3-3. The Landfill AOPC boundary shown on this Figure was defined based on known historical use at the site, physical parameters (e.g., the river), and site observations and investigations, including geophysical surveys of the Landfill.

Landfill Waste Characterization and Extent

On February 24, 1997, the Portland District USACE performed a review of available historical aerial photographs of the Landfill AOPC between the years 1936 and 1982. Information derived from the aerial photograph review indicated that use of the Landfill began around 1942, and by 1952, the Landfill appeared to be in its heaviest use. The photographs indicated that deposition of trash occurred intermittently until the early 1980s, and materials and equipment stored in the Landfill AOPC included drums, aboveground storage tanks, vehicles, lumber, and scrap metal. By 1982, the surface of the Landfill AOPC had been capped with soil cover. Neither the overall geographic extent, the estimated depth of landfilled materials, nor the volume of materials disposed within the Landfill could be determined from the review of the aerial photographs (URS 2000).

Based on information from site investigations including electrical resistivity data, seismic refraction data, and boring logs, the volume of landfilled material was estimated to be between 7,500 cubic yards (cy) and 9,900 cy, with a maximum depth of 15-feet below ground surface (bgs). The waste was buried in separate pits, rather than one continuous pit. Waste either observed onsite or known to have been disposed of in the Landfill includes: household waste, project-related wastes (grease, light bulbs, sandblast grit), electrical debris, up to 50 ballasts, broken glass, rubber tires, metal debris, wood debris, metal cables, asbestos containing building materials, burned debris, ceramic insulators, and mercury vapor lamps. Some exposed wastes have been observed on the northern edge and the surface of the Landfill itself, including concrete rubble, steel cables, a few empty buckets and drums, plastic planter buckets, empty cans and paint solids, and metallic slag and partially-burned construction debris, and miscellaneous trash items (Tetra Tech 1998, URS 2004a). PCB-containing light ballasts were discovered in the river north of the Landfill AOPC in March 2000 and March 2001 (see Section 3.5.2).

Landfill Management and Assessment

The Bradford Island Landfill and the equipment storage area in the vicinity of the Landfill AOPC are no longer in use by the Bonneville Dam operation. In 1989, approximately 8-inches of additional soil cover was placed on the Landfill site by the USACE (Hibbs, personnel comm. 2001). Although this portion of Bradford Island is managed as wildlife for geese according to the

Bonneville Master Plan (USACE, 1997a), active management (periodic mowing) of the habitat ceased in the middle to late 1990s to prevent geese from laying eggs in areas that are under investigation (Hibbs, personnel comm. 2001).

The Bradford Island Landfill was added to the DEQ ECSI database on April 1, 1997. On April 24, 1997, the Bonneville Lock and Dam Project signed a Letter of Intent to participate in DEQ's VCP for the investigation and remediation of the landfill site. On November 6, 1997, the Bonneville Lock and Dam PM signed a DEQ Voluntary Cleanup Agreement letter for the landfill site. The USACE started an engineering evaluation/cost analysis (EE/CA) in 2005 to assess the value of conducting a non-time critical removal action at the Landfill AOPC. The Landfill EE/CA work was suspended pending completion of this RI/FS.

Overall, disposal and handling practices in the vicinity of the Landfill AOPC have impacted soil and groundwater with low levels of petroleum products, metals, PCBs, pesticides, and herbicides. Disposal of materials in the Columbia River have impacted near shore sediments with petroleum products, metals, and PCBs (addressed in the River OU). Debris disposed of in the river have been removed.

No evidence of runoff or erosion was observed or predicted through modeling for the Landfill surface (URS 2009f). Minor runoff was observed on the Landfill access road. The source of the Landfill road runoff was a groundwater seep at the base of the steep slope along the southern margin of the Landfill. The water flows west along the road and then infiltrates along the northern margin of the road to the west of the Landfill. The runoff water was clear at the time of the field survey, indicating that the flow of seep water along the road is not causing soil erosion. Runoff from the road appeared to infiltrate and evidence of direct discharge of road runoff to the river was not observed (URS 2009f).

While there is no visual evidence of current sloughing along the northern perimeter of the Landfill AOPC, undercutting was observed along the waterline at the north slope indicating that historical mass wasting likely occurred. Although the potential for bedrock failure is low, if mass wasting were to occur on the steep slopes, the soils may reach the river.

3.5.1.2 Sandblast Area AOPC

The Sandblast Area AOPC includes the area surrounding the former sandblast building on the eastern end of the site (Figure 1-4). The Sandblast Area AOPC consists of the following subareas that are associated with different sources of contamination (Figure 3-4):

- Former disposal area for spent sandblast blast grit
- Former transformer maintenance area east of the former sandblast building
- Former Hazardous Material Storage Area (HMSA) located east of the equipment building
- An inferred release of tetrachloroethylene (PCE) from an aboveground storage tank (AST) historically located in the vicinity of the current HMSA
- Laydown area used for current storage of industrial equipment and materials located along the north and south sides of the landfill access road

The Sandblast Area AOPC boundary, shown on Figure 3-4, was defined based on known historical use at the site, physical parameters, and site observations and investigations.

Within the Sandblast Area AOPC, a portion of the stormwater runoff from impervious surfaces (asphalt) drains to four catch basins (designated #1, #2, #3, and #4 in this report) that discharge to the Columbia River through two outfalls. In October 2001, the USACE cleaned the sediment from the stormwater system, and replaced the filter fabric socks that line each catch basin (URS 2002e). USACE Bonneville Dam project employees replace the socks on a periodic basis.

It appears, however, that the majority of the runoff from asphalt immediately southeast of the former sandblast building flows northeast and discharges onto a short, steep, forested hill slope, where it causes rills to develop on the hill slope. Eroded soil from the rills combined with sandblast grit from further upslope has been observed accumulated at the base of the slope and behind one of two concrete curbs that run along the base of the slope at the equipment laydown area (URS 2009f).

In 2009, evidence of runoff was observed along the Landfill access road and the adjacent equipment laydown area. These areas are flat and evidence of erosion is generally lacking. Runoff from the road appears to flow north onto a vegetated area between the road and the river. Evidence of surface runoff or erosion is absent in this vegetated area, suggesting that runoff flowing onto this area infiltrates before reaching the river (URS 2009f). Within the remainder of the Sandblast Area AOPC, in particular vegetated areas, no evidence of surface runoff, soil erosion, or sediment deposition was observed.

Former Sandblast Building and Sandblast Grit Disposal Area

A variety of equipment associated with the Bonneville Dam complex has historically been painted with materials that contained metallic (including lead and zinc chromate systems) and organometallic compounds. This equipment was periodically stripped with blast material and repainted in the former sandblast building. The former sandblast building was used for sandblasting operations and painting from approximately 1958 to 1988. After 1988, the sandblasting and painting operations moved to the service center building. No records of disposal activities for sandblast grit were kept from 1958 to 1994. Application of lead-based paints has reportedly not occurred at the dam complex since the early 1980s. A record of disposal from 1994 shows 215,680 pounds of sandblast grit were disposed of as Resource Conservation and Recovery Act (RCRA) hazardous waste, and after 1997 waste disposal records indicate that on average, approximately 70 tons of spent blast media were generated per year from sandblasting operations (URS 2006a).

Based on the presence of sandblast grit adjacent to the former sandblast building (Figure 3-4), spent sandblast grit was historically spread onsite for an unknown period prior to 1994. Previous investigations concluded that the primary source of soil contamination in the Sandblast Area is from the open disposal of sandblast grit (URS 2006a). The disposal of spent sandblast grit in the area immediately east of the former sandblast building has resulted in the release of metallic and organometallic constituents, which were used in historical painting operations, into the surface and subsurface soil. This material has subsequently been transported across the site by surface water runoff into the stormwater drainage features (Figure 3-4).

Former Sandblast Building Septic System

A septic system formerly serviced a bathroom located in the painting (western) portion of the former sandblast building. Floor drains in the former sandblast building may have also discharged into the septic system. The system reportedly includes a tank and drain field. The septic tank and the drain field are located near the north-central side of the former sandblast building (Figure 3-4). The system is not currently in use (the sandblast building recently demolished). Because a septic tank located on Robbins Island had been backfilled with sandblast grit, the former sandblast building septic tank was investigated to determine if it had been similarly backfilled with sandblast grit. Investigation of the septic tank determined that it had not been backfilled with sandblast grit and was not a source of contamination at the Sandblast Area AOPC (URS 2006a).

The remnants of a small (estimated at less than 100 square feet) burn pit was located at the eastern end of the sandblast disposal area (URS 2006a). The former burn pit is bermed with wood timbers and earthen materials, and the pit contains approximately 2 cy of solid waste consisting of charred wood (mostly), electrical wire, scrap metal, small electrical components, and broken glass. The burn pit is no longer used and the last date of use is not known. Based on analytical data, the burn pit itself does not appear to be a source of contamination. Instead, the sandblast grit located across the sandblast disposal area, including the burn pit, appears to be the source of contamination.

Transformer Disassembly Area

In 1995, PCB-containing transformers were disassembled by the USACE at the paved parking area on the east side of the former sandblast building. On November 22, 1995, approximately 1 quart of PCB-containing oil was released. The release was spread northward by stormwater runoff and into the stormwater drainage system (previously described), which has two outfalls to the river. At the time of the release, a sheen of oil was observed on the Columbia River below the outfall. The release was contained using booms and absorbent pads placed on the upland areas of the release and below the storm drain outfall in the river. At the time of the release, samples were not collected from the stormwater system. Figure 3-4 depicts the transformer disassembly area and the storm drain system.

Former Hazardous Material Storage Area

Prior to 1993/1994, hazardous waste generated at the Bonneville Dam complex was stored at the former HMSA (Figure 3-4). The former HMSA was located approximately 200 feet to the south of the former sandblast building and is sometimes also referred to as the ‘former drum storage area.’ The former HMSA pad was constructed of wood and metal and did not have a secondary containment system or berms (URS 2002c). Based on investigations in the vicinity of the former HMSA, there have been limited releases of contaminants.

AST Release in the Vicinity of the Current HMSA

Since approximately 1993 or 1994, hazardous waste is stored at the current HMSA, located 50 feet southeast of the former sandblast building (Figure 3-4). The current HMSA was constructed in 1993 or 1994 and consists of a 2,300 square feet (51.5 feet long by 45 feet wide) concrete pad with berms that is partially covered with a steel-framed canopy. A 75 to 100 square foot enclosed flammable materials storage shed is located on the western edge of the storage pad. The excavation for the concrete pad foundation was approximately 2 feet deep (over an area of 51.5 feet long by 45 feet wide), meaning 150 to 200 cy were excavated for the construction. The excavated material was transported to the Bradford Island Landfill for disposal. No record of the type of material (e.g., percent of sandblast grit) that was excavated is available (URS 2006a). The current HMSA does not appear to be a source of contamination.

Prior to the construction of the current HMSA, an approximately 300-gallon AST was formerly located the vicinity. Waste paints were temporarily stored in this AST until the late 1990s at which time the tank was removed. The tank and the waste within it were appropriately disposed of offsite. During an investigation, a solvent odor was noted in a soil sample collected adjacent to the current HMSA (URS 2002c). Analytical chemistry results for the soil sample identified the presence of several VOCs. From these results, it has been inferred that there was a historical release from the AST formerly located in the vicinity of the current HMSA.

Equipment Laydown Area

The USACE stores industrial equipment and materials along the northern and southern portions of the Landfill access road (Figure 3-4). Periodic grading of the laydown area has been performed to expand storage capacity. Soils may have become contaminated with oil, metallic debris, or other contaminants due to this equipment storage.

3.5.1.3 Pistol Range AOPC

The Pistol Range AOPC is located on the south side of Bradford Island (Figure 1-4). The pistol range was used for small arms target practice from sometime between the early 1940s and the late 1950s to the late 1960s or early 1970s. No other land use associated with the pistol range is known. The pistol range consisted of an approximately 20-foot by 20-foot firing shed and a 30-foot long, 7-foot tall heavy timber backstop constructed of treated lumber. The firing shed, located 80 feet southwest of the backstop, fell into disrepair and was knocked down in the 1990s by the USACE. The building materials from wood-framed and wood-sided structure were not removed following demolition. Due to the historical land use of the Pistol Range AOPC, the soils immediately adjacent to the firing shed, backstop, and areas down gradient of the shed and backstop have been impacted with metals associated with firing range activities.

The overall slope of the Pistol Range AOPC is to the southeast toward the Columbia River. The topography of the area consists of a series of cuts and fills, resulting in a sequence of slopes and flat areas. Currently, the ground surface is vegetated with a mix of scrub-shrub and herbaceous vegetation and does not show evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable. Erosion and transport of soil from the Pistol Range AOPC to the river is currently unlikely. When the Pistol Range AOPC was in use as a firing range the ground surface may have been less vegetated and there may have been historical runoff to the Columbia River.

3.5.1.4 Bulb Slope AOPC

The Bulb Slope AOPC was identified during the removal of equipment offshore of Bradford Island in February and March of 2002. The Bulb Slope AOPC is a fan-shaped accumulation of glass and electrical light bulb debris that extends across approximately 1,900 square feet of a steep slope between the Columbia River and the Landfill access road (Figure 1-4). The vegetated disposal area slopes steeply from the Landfill access road (approximate elevation of 95 to 100 feet above msl) down to the Columbia River (approximate elevation of 75 feet msl; University of Washington 2003). The slope angle is near vertical at the base of the slope for a height of approximately 4 feet above the river level. The normal operating range for the Bonneville pool is between 71.5 feet msl elevation and 76.6 feet msl as measured at the dam (USACE 1998). Based on this information, the base of the bulb slope may be partially submerged during some periods.

The debris is concentrated in the center of the slope and the types of glass observed included internal/external light bulbs, fluorescent light bulbs, automobile light bulbs, 1- to 1.5-inch-diameter glass tubes, clear window pane glass, white-colored molded glass (possibly lamppost light covers), and miscellaneous glass beverage containers. Based on the analytical results of soil sampling collected in 2002, surface soils at the Bulb Slope AOPC are impacted with metals (lead and mercury), PCBs, and total petroleum hydrocarbons (TPH).

The majority of the Bulb Slope AOPC is well vegetated, covered with organic debris, and exhibits no evidence of surface runoff or overland flow to the river. At the base of the slope, however, wave erosion has resulted in mass wasting (small slope failures) of material into the river. Mass wasting appears to be the only potential mechanism for transport of debris and/or contaminated soil into the river.

3.5.2 River OU

Historically, electrical equipment debris was disposed of directly in the River on the north side of the Landfill AOPC. Figure 3-5 depicts the in-water historical source locations, identified as Former Debris Piles (#1 through #3). The electrical equipment debris included light ballasts, electrical insulators, lightning arresters, electrical switches, rocker switches, a breaker box, and electrical capacitors. The electrical debris contaminated the surrounding sediment with PCBs, PAHs, and metals. The electrical equipment debris were removed in 2000 and 2002 (Appendix E of URS 2002a,b) and the majority of the associated PCB-contaminated sediment was removed in 2007 (HAI 2007). Residual contamination in the sediment includes PCBs, PAHs, and selected metals.

4.0 CONCEPTUAL SITE MODEL

The purpose of this conceptual site model (CSM) is to identify the physical setting and potential sources of contamination, including their transport media and release pathways. The CSM was developed with information gathered from historical investigations and recent investigations (see Sections 5.0 and 6.0). Because the CSM is 'conceptual', it is not dependent on the quantification of the chemical nature and extent and fate and transport.

The site consists of two OUs: the Upland OU and River OU (Figure 1-3). The potential sources of contamination for each of these units are discussed in the following sections. The conceptual exposure models (CEMs), included in Sections 11.0 and 12.0, determine which receptor exposure pathways are complete, potentially complete and incomplete.

4.1 Upland Operable Unit

The physical setting and potential or known sources of contamination in the Upland OU (Figure 1-4) are summarized in this section. Appendix C includes photographs showing each of these AOPCs. Sections 5.0 and 6.0 provide the historical and recent investigation information from which Site sources were identified.

4.1.1 Physical Setting

Physical characteristics of Bradford Island, which are relevant to the discussion of site transport mechanisms, are summarized below.

- There are two areas of higher elevation in the center of the island that range from 170 feet to 195 feet above msl. For reference, the Landfill AOPC is at elevation 120, the Sandblast Area AOPC is at elevation 98, and the Pistol Range AOPC is at elevation 94 feet above msl.
- River stage elevation upstream of the dam at the island averages approximately 74 feet above msl.
- North of the Landfill AOPC, the land surface drops steeply by approximately 30 to 35 feet to the Columbia River. The topography east of the Landfill AOPC also drops steeply to the Columbia River. West of the Landfill AOPC, the topography slopes gently to the west. Topography in the Sandblast Area AOPC slopes to the north with areas of varying steepness. The riverbank is a rip-rapped north of the Sandblast Area AOPC. The Bulb Slope AOPC is situated entirely on the steeply sloping north edge of the island. The land rises moderately south of the Landfill, Sandblast Area, and Bulb Slope AOPCs, and southwest of the Landfill AOPC. The Pistol Range AOPC consists of a pair of vegetated topographic benches stepping down toward the Columbia River to the South. The shoreline is very gently sloped into the adjacent lagoon.
- Bedrock outcrops of conglomerate, sandstone, and limited siltstone are exposed along the north slope of the island. The potential for bedrock failure is low.
- Surface water drainage generally follows sloping topography as sheet flow, before infiltrating into the porous soils, particularly in vegetated areas.
- Precipitation that infiltrates the soil at the island may percolate to groundwater. Under both wet season and dry season conditions, shallow groundwater at the island likely flows to the

north on the north half of the island and to the south on the south half of the island. Groundwater discharge to surface water occurs as diffuse flow in the high permeability materials in the steep slopes on the northern edge of the island as well as in seeps located in vertical fractures in the underlying low-permeability materials. Groundwater may enter the river through bottom sediments or above-water surface seeps.

4.1.2 Landfill AOPC

The primary sources of COIs released at the Landfill AOPC are trash pits, Landfill mixed-waste disposal areas, and the pesticide mixing area. Based on information from previous site investigations including electrical resistivity data, seismic refraction data, and boring logs, the Landfill volume is estimated to be between 7,500 cy and 9,900 cy, with a maximum depth of 15-feet bgs (Tetra Tech 1998, URS 2004a). The waste was buried in separate pits within the Landfill, rather than one large pit. Pesticide/herbicide mixing and rinsing activities historically occurred just south of the Landfill. Stained soils have been observed in the center of the Landfill AOPC (potentially indicating a historical burn area).

COIs have been released from these primary sources into the soil and groundwater (secondary sources). During wet portions of the year, the groundwater elevation can potential rise high enough to encounter waste materials in a small portion of the Landfill AOPC. Analytical data demonstrate that soils and/or groundwater are impacted by metals, herbicides, pesticides, PCBs, VOCs, SVOCs (including PAHs), and/or TPH. While there is no visual evidence of current sloughing along the northern perimeter of the Landfill AOPC, undercutting was observed along the waterline at the north slope indicating that historical mass wasting likely occurred. Although the potential for bedrock failure is low, if mass wasting were to occur on the steep slopes, the soils may reach the river.

4.1.3 Sandblast Area AOPC

The Sandblast Area AOPC includes the area surrounding the former sandblast building on the eastern end of the site (Figure 3-4). The Sandblast Area AOPC consists of the following subareas that are associated with different sources of contamination:

- The former disposal area for spent sandblast blast grit, which resulted in the release of metals and potentially butyltins into the soil (secondary source) and to the river via the stormwater drainage system.
- The former HMSA located east of the equipment building, which has potentially resulted in limited soil contamination of metals, pesticides, and PAHs.
- The paved former transformer maintenance area east of the former sandblast building, at which approximately 1 quart of PCB-containing oil was released on November 22, 1995, and which may have been transported to adjacent soils (secondary source) and possibly the river via the stormwater drainage system.
- An inferred release from an AST historically located in the vicinity of the current HMSA, which resulted in the contamination of soil, and subsequently groundwater, with VOCs.
- The equipment laydown area used for historical and current storage of industrial equipment and materials located along the north and south sides of the Landfill access road, which appears to have resulted in the contamination of soil with metals, pesticides, PCBs, and SVOCs (including PAHs).

Contaminants have been released from these primary sources (i.e., sandblast grit, PCB-containing oil, hazardous material storage, and equipment storage) to soil and/or groundwater (secondary sources). In addition, during a site visit in 2009 an area northeast of the former sandblast building was observed to have been recently disturbed and was identified as erodible, whereby contaminated surface soil is transported to the river via stormwater drainage and surface water runoff (URS 2009f). During the past year, this area has become revegetated (see the photo in Appendix C) and the soils are no longer considered erodible.

4.1.4 Pistol Range AOPC

The Pistol Range AOPC is located approximately 75 feet southeast of the equipment building and north of the Columbia River (Figure 1-4). The pistol range was used for small arms target practice from sometime between the early 1940s and the late 1950s to the late 1960s or early 1970s. No other land use associated with the Pistol Range AOPC is known. As a result of the historical land use of the Pistol Range AOPC, the soils immediately adjacent to the firing shed, backstop, and areas down gradient of the shed and backstop are impacted with selected metals associated with firing range activities.

Currently, the ground surface is vegetated with a mix of scrub-shrub and herbaceous vegetation and does not show evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable. Erosion and transport of soil from the Pistol Range AOPC to the river is currently unlikely. When the Pistol Range AOPC was in use as a firing range the ground surface may have been less vegetated and there may have been historical runoff to the Columbia River (e.g., the adjacent lagoon).

4.1.5 Bulb Slope AOPC

The Bulb Slope AOPC is a fan-shaped accumulation of glass and electrical light bulb debris that extends across approximately 1,900 square feet of a steep slope between the Columbia River and the Landfill access road (Figure 1-2). The Bulb Slope AOPC surface soil is impacted with metals (lead and mercury), PCBs, and TPH from the discarded light bulbs.

The majority of the Bulb Slope AOPC is well vegetated, covered with organic debris, and exhibits no evidence of surface runoff or overland flow to the river. At the base of the slope, however, wave erosion has resulted in mass wasting (small slope failures) of material into the river. Mass wasting appears to be the only potential mechanism for transport of debris and/or contaminated soil into the river.

4.2 River Operable Unit

The physical setting and potential or known sources of contamination in the River OU are summarized in this section. Sections 5.0 and 6.0 provide the historical and recent investigation information from which Site sources were identified. Sources of contamination from both in-water placement of debris and overland transport from the Upland OU have likely impacted sediments and surface water in the River OU.

4.2.1 Physical Setting

Physical characteristics of the River OU, which are relevant to the discussion of site transport and exposure mechanisms, are summarized below.

- The average annual variation of water level within the River OU is 3 to 5 ft. River stage elevation of the River OU at the island averages approximately 74 feet above msl.
- Based on historic photographs and USACE hydroacoustic sounding data, a submerged shelf appears to be adjacent to the north side of Bradford Island at a depth of about 30 ft below pool level. This shelf appears to be about 50 ft wide, parallel to the north shore of the island. Shallow water (20 ft deep or less) also occupies a band approximately 50 ft wide along the south shoreline of Bradford Island.
- Hydraulic modeling of the waters near Bradford Island was conducted by the USACE (Langsley 1999). This modeling indicates that a large eddy forms behind the dam and creates a reverse current flow next to Bradford Island. This reverse flow appears to attract adult slamonoids exiting the fish ladder on their way upstream and results in the fish being swept back over the dam (Langsley 1999). Introduced fish species may be present in the River OU for prolonged periods through the year and are popular recreational species with a recognized societal value.

4.2.2 Sources of Contamination

Historically, electrical equipment debris was disposed of directly in the River on the north side of the Landfill AOPC. Figure 3-5 depicts the in-water historical source locations, identified as Former Debris Piles (#1 through #3). The electrical equipment debris included light ballasts, electrical insulators, lightning arresters, electrical switches, rocker switches, a breaker box, and electrical capacitors. The electrical debris contaminated the surrounding sediment with PCBs, PAHs, and metals. The electrical equipment debris were removed in 2000 and 2002 (Appendix E of URS 2002a,b) and the majority of the associated PCB-contaminated sediment was removed in 2007 (HAI 2007). Residual contaminated sediment, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination.

In addition, the Upland OU sources identified in Section 4.1 may also be sources of contamination for the River OU through overland transport (Figure 4-1) or groundwater discharge to the river.

4.3 Release Mechanisms and Transport Media

Given the physical characteristics of the site and the current potential sources described above, the following mechanisms may transport site contaminants from one or more of the AOPCs to others areas within the Upland OU and/or to the River OU:

1. Volatilization of contaminants in soil to air, or dust generation and release of contaminants in particulate form to air.
2. Leaching and infiltration of contaminants from buried debris and/or contaminated soil to groundwater.
3. Discharge of contaminants in the perched groundwater zone to surface water (via seeps).
4. Overland transport of spent sandblast grit and surface water runoff of contaminants in soil directly to River surface water or via the stormwater drainage system outfalls.
5. Transport of contaminants via soil erosion and/or mass wasting to surface water.

In addition, the following mechanisms may redistribute site contaminants within the River OU:

6. Sorption/dissolution of surface water contaminants to/from sediments.
7. Contaminated sediment transport within the river.
8. Potential surface water communication to the deeper groundwater zone.

The CSM (Figure 4-2) depicts these current release mechanisms and transport media. Due to the potential surface water communication with the deeper groundwater zone, contaminants in the River OU may be transported into the deeper groundwater zone. However, there are no receptors that would be exposed to this deeper groundwater and, therefore, this pathway is not investigated or evaluated further.

5.0 HISTORICAL SITE INVESTIGATIONS

This section summarizes investigations that occurred prior to the September 2007 RI/FS MP (URS 2007a). The results of investigations that were conducted following the RI/FS MP are summarized in Section 6.0

Except where data quality does not meet the standards outlined in the RI/FS MP (URS 2007a), analytical results from investigations in the Upland OU from 1999 to 2009 are included in the RI data set and were evaluated in the risk assessments (exceptions are noted). The relatively static physical environment of the Upland OU means that environmental data collected over the past decade can be considered representative of current conditions. Therefore, all historical Upland OU investigations are summarized, in chronological order, based on the date in which the investigations were conducted. Data are provided in Tables in this Chapter. Historical Upland OU data not utilized in the RI due to poor data quality are provided in Appendix G.

In contrast to the Upland OU, the physical environment of the River OU is much more dynamic. As discussed previously, the electrical equipment and debris and the majority of the contaminated sediment have been removed from the river. Water movement and human activities have redistributed sediment within the Forebay. Additionally, the sampling methods used to collect the historical data in the River OU are not comparable to the recent sampling which was conducted in accordance with the procedures outlined in the River OU QAPP (URS 2007b), Revised Sculpin Analysis Strategy Technical Memorandum (URS 2009b), and In Water QAPP Addendum (URS 2009c).

In order to focus on the current river conditions, only analytical results from investigations in the River OU after 2007, with the exception of smallmouth bass collected in 2006, are included in the RI data set and used in the risk assessments. Therefore, only a brief review of the historical investigations are presented in this report. A detailed summary of the historical investigations for the River OU is presented in the RI/FS MP (URS 2007a). Appendix G provides the historical River OU data not utilized in the RI.

5.1 Data Processing

The analytical data presented in this Section, as well as in the following Section (Section 6.0), was processed for use in this RI Report in a manner similar to the Upland and River DSRs (URS 2009d,e). Both processed and unprocessed data are provided in Appendix A. The following sections summarize the processing treatments for the Upland OU and River OU data necessary for utilization. A complete enumeration of the processing treatments for the data is provided in the metadata file in Appendix A. Appendix E provides the laboratory reports and Appendix F provides the data validation reports. Appendix H presents the results of the individual congener analyses, along with the methodology used for summing total PCBs as congeners, total PCBs as Aroclors, and total PAH, and tables with the sums for each sample.

- **Method Detection Limits (MDLs) and Method Reporting Limits (MRLs) –** There are both MDLs and MRLs associated with the majority of data. For some historical data, only MRLs were available, in which cases the MRLs were used in lieu of MDLs. MDLs and MRLs are presented in Appendix A. For simplicity, only the MDLs are shown in the data tables presented in this section (Tables 5-1 through 5-7) and in the tables presented in Section 6.0 (Tables 6-2 through 6-14).

- **Field Duplicates –** Results from field duplicates were averaged with corresponding primary sample values to create a single value, as long as the analytes was detected in both the primary and field duplicate samples. When averaging, the lower of the MDLs and the higher of the MRLs were assigned to the average. If the analyte was detected in only one of the pair, the detection result was used and the MDL/MRL associated with this detection was considered as the MDL/MRL of the result. If the analyte was undetected in both samples, the lowest MDL/MRL of the pair was used. This procedure follows DEQ's guidance for the treatment of data for primary samples and duplicates (DEQ 2009b).
- **Analyses –** Data from Synthetic Precipitation Leaching Procedure (SPLP), Toxicity Characteristic Leaching Procedure (TCLP), and NWTPH-HCID analyses were not included in this RI data set. The SPLP and TCLP analyses measures COI concentrations in simulated leachate from a soils sample, and are used to evaluate waste handling and disposal requirements. The NWTPH-HCID analysis is a screening analysis documenting the presence of hydrocarbons which is typically followed by quantitative analysis of specific COIs. Neither of these types of data are relevant to the RI, although all results are retained in the project database.
- **Summing PCB Congeners –** Total PCBs as Congeners were summed for each River OU media in which it was analyzed. Data qualified as "U" are undetected results at the laboratory-provided reported detection limit (RDL). Neither MDLs nor MRLs were provided by the laboratory. Data qualified as "EMPC" represent the estimated maximum potential concentration of analytes that were not definitively identified. Total PCBs as Congeners were summed using the Kaplan-Meir (K-M) method with Efron's bias correction, capped at the simple sum (see Appendix H, Tables H-7 through H-12). Undetected results were censored at the RDL; EMPC-qualified data were censored at the full reported value.
- **Summing PCB Aroclors –** Total PCBs as Aroclors were summed for each media. Since no more than two Aroclors were detected in a given medium, the K-M method could not be used to sum total PCBs as Aroclors. Instead, for summing total PCBs as Aroclors, the replacement value for individual Aroclors depended on whether or not that particular Aroclor had been detected in any of the other samples from the same media. If the analyte was undetected in all samples, a value of zero was used. If the Aroclor was detected in at least one sample in the media, the total was summed twice, once using the full MDL and once using the full MRL for censoring undetected values (see Appendix H, Tables H-4 through H-6 and Tables H-13 through H-17).
- **Summing PAHs –** In soil samples, total high molecular weight PAHs (HPAHs) and total low molecular weight PAHs (LPAHs) were summed for use in the ERAs. Total HPAHs, Total LPAHs, and Total PAHs were summed in sediment samples, for use in the ERA. HPAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene. LPAHs include 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorine, naphthalene, and phenanthrene. Total HPAHs, Total LPAHs, and Total PAHs were summed using the K-M method with Efron's bias correction, capped at the simple sum (see Appendix H, Tables H-1 through H-3 and Tables H-18 through H-22). Total LPAHs, HPAHs, and

PAHs were summed twice, once using the full MDLs and once using the full MRLs for censoring undetected values.

5.1.1 Treatment of Data from Excavations in the Upland OU

Analytical data from composite samples of excavated soils that were replaced in test pits in the Upland OU were treated as follows:

- **Sandblast AOPC Data –** Soil samples from locations “TRA-04” and “TRA-02” (sampled in 2001) were in an area where vegetation was removed by USACE in 2004. Only vegetation and soils clinging to roots were removed from site (other soils were graded and remained on site, less than 6” of soil was disturbed). Since the soils that these samples represent were not definitively removed, these analytical results were utilized in the RI Report.
- **Landfill AOPC Test Pit Data –** In 2001, six composite soil samples, initially identified as “IDW,” were collected and analyzed from the soil removed from the gully test pit (BIL01TPG, BIL02TPG, BIL03TPG, and BIL05TPG) and the mercury vapor-lamp test pit (BIL28TPM and BIL29TPM). The stockpiled soils were then used to backfill their respective excavation pits. The soil may have been placed anywhere within the 0-10 feet bgs depth of the test pits. This represents an element of uncertainty when using this data, since the risk assessment process considers three potential exposure intervals (0-1 foot bgs, 0-3 feet bgs, and 0-10 feet bgs). This uncertainty was recognized in the RI/FS MP (URS 2007a) and eight additional surface and shallow soil samples were collected from the gully test pit area in 2009 as part of the Landfill data gap sampling and analyzed for select analytes. Data from these recent samples supersedes the historical data for the 0-1 and 0-3 feet exposure intervals for this area. However, the data from the test pit soil samples were used for analytes that were not analyzed for in 2009. Specifically:
    - The data from the four gully test pit samples are included in the assessment of potential risk to ecological or human receptors exposed to surface and shallow soil intervals (0-1 and 0-3 feet bgs) except for o-xylene, toluene, PCE, and PAHs.
    - All the data from the four gully test pit samples are included in the 0-10 feet bgs interval, which is only applicable to human receptors.
    - The data from the two mercury vapor-lamp test pit samples were used in this RI Report and will be used in the RAs to assess risk to ecological and human receptors exposed to surface, shallow, and deeper soil intervals (0-1, 0-3, and 0-10 feet bgs) since there is no way to assign a depth at which the results for these samples occur.

5.2 Upland Operable Unit

Multiple investigations have been conducted by the USACE and its contractors to evaluate the environmental conditions in the Upland OU. As discussed above, the Upland OU includes four AOPCs (Figure 1-4):

- Landfill AOPC
- Sandblast Area AOPC

- Pistol Range AOPC
- Bulb Slope AOPC

Historical investigations of each are discussed below.

5.2.1 Landfill AOPC

5.2.1.1 Landfill Site Inspection – August/September 1998

The purpose of the initial Landfill Site Investigation (SI) was to assess the potential for historical disposal practices to have adversely impacted the environment and to assess whether additional investigation or remediation was necessary (Tetra Tech 1998). Specific areas of concern that were addressed during the SI included the Landfill, a pesticide/herbicide mixing area located just south of the Landfill, and the shorelines proximate to Bradford Island Landfill. The SI included:

- Summary of the USACE historical aerial photograph review of the Landfill site between 1936 to 1982.
- Summary of the findings of the USACE employee interviews, documenting historical waste disposal practices.
- Collection and analysis of four surface soil samples (three from background locations and one from downgradient of the pesticides mixing area)
- Collection and analysis of 10 subsurface samples from eight test pits (TP1 through TP8) and one soil boring (SB3) located within the Landfill footprint
- Collection and analysis of three samples of building materials (found within the Landfill test pits) for the presence of asbestos
- Installation and sampling of four groundwater monitoring wells (MW1, MW2, MW3, MW4)
- Completion of a visual survey of groundwater seeps along the north, east and south shores of Bradford Island, and the attempted collection of Columbia River sediment samples from the nearshore areas of Bradford Island

The SI report concluded that past disposal practices have impacted soil and groundwater in the Landfill with petroleum hydrocarbons, organochlorine pesticides, PCB Aroclor 1260, PCE, SVOCs, arsenic, and lead. Landfill debris encountered in the test pit excavations included mercury vapor lamps, electrical equipment, and asbestos-containing materials. None of the materials encountered in the excavations were removed. Additionally, no groundwater seeps were identified during a visual survey of the sloped banks of Bradford Island in the vicinity of the landfill during September 1998. Supplementary investigation of the Landfill was deemed necessary in order to evaluate potential remedial alternatives. The analytical results are included in Appendix A; however, the analytical results were not utilized in this RI Report for multiple reasons (i.e., sample reporting limits do not meet established data quality objectives, depth of soil samples incompatible with target depths needed for risk evaluations, etc).

5.2.1.2 Landfill Supplemental Site Inspection – 1999/2000

URS conducted an SSI of the Landfill for the USACE during 1999 and 2000. The purpose of the SSI was to augment information presented in the 1998 SI report, fill data gaps, conduct a risk evaluation, and provide a list of alternatives for the long-term management of the Landfill. The SSI (URS 2000) included:

- Collection and analysis of 10 primary surface soil samples from Landfill AOPC (BIL01SSI, etc.)
- Installation of groundwater monitoring well (MW-5) in September 1999
- Collection and analysis of groundwater samples from the four wells (MW-1 through MW-4) in July 1999 and from five wells (MW-1 through MW-5) in November 1999, and January 2000
- Additional visual assessment for groundwater seeps, and the collection of seep soil and water samples
- Erosion potential evaluation
- A site survey to facilitate completion of a biological characterization
- A screening level human health and ERA

Analytical results from this investigation are included Table 5-1 and sample locations are shown in Figure 5-1. Results from this, and all subsequent investigations at the Landfill AOPC (discussed below) were included in this RI. The Draft SSI report (URS 2000) concluded that surface and subsurface soils contained relatively low concentrations of VOCs, SVOCs, metals, chlorinated herbicides, organochlorine pesticides, and PCBs. Groundwater contained relatively low concentrations of VOCs, SVOCs, petroleum hydrocarbons, and metals. One seep was found and results indicated that low concentrations of metals were detected in the seep water.

The SSI report (URS 2000) also included a preliminary risk screening for human health and ecological receptors based on landfill contamination. The report identified maintenance workers and on-site construction/excavation workers as human receptors that could be affected by inhalation of, incidental ingestion of, or dermal contact with surface and subsurface soil. Since groundwater is not used at the site as drinking water, it was not included in the preliminary human health screening.

The report identified three preliminary potential exposure pathways for aquatic and terrestrial ecological receptors: incidental ingestion of groundwater discharged to the Columbia River, dermal contact with groundwater discharged to the Columbia River, and incidental ingestion of on-site surface soil. Ecological and human health risk screening was conducted and concluded that soil and groundwater posed no risk to human receptors. The report also concluded that there were localized exceedances of risk-based screening levels for ecological receptors.

Based on DEQ’s comments on the conclusions made in the Draft SSI report, USACE elected not to finalize the report. The DEQ and USACE agreed that additional investigation and analysis were necessary to address DEQ comments on the SSI report.

5.2.1.3 Slope Stability Assessment – 2001

The discovery of PCB-containing light ballasts along the shoreline during the SSI prompted additional investigations into the nature and extent of the debris, and into the potential for environmental impacts from these materials on ecological receptors in the Columbia River. The light ballasts found along the shoreline were thought at that time to have eroded from the

Landfill. URS conducted a slope stability assessment of the steep shoreline along the landfill in May 2001 to determine whether there were potential for landfill wastes to be transported from the landfill into the Columbia River by slope failures (URS 2001). The stability assessment findings included:

- The shoreline along the north slope of the landfill ranges from vertical to over-vertical, to a steep incline.
- Bedrock outcrops of conglomerate, sandstone, and limited siltstone (part of the slide block) are exposed along the north slope. The potential for bedrock failure is low.
- The contact between the slide block and overlying soils along the slope varies from less than 5 feet to 20 feet bgs.
- Where over-steepened, soils along the north slope are marginally stable, and have failed in the past, in one area.
- USACE personnel familiar with this area have not observed significant slope retreat over the past few years.
- There is no evidence that significant and/or multiple rock slope failures have occurred along the north slope of the island. Consequently, the possibility that slope failure transported waste from the landfill into the river is low.

In conjunction with the stability assessment, underwater surveys to locate and map the extent of all waste materials in the river were conducted in October and November of 2000, and in May 2001. All wastes identified were removed in December 2000 and March 2002 (URS 2001; URS 2002a,b,d). These activities are discussed in more detail in Section 6.2.2.

5.2.1.4 Draft Level I Ecological Scoping Assessment and Human Health Problem Formulation – 2002

A Draft Level I Ecological Scoping Assessment and Human Health Problem Formulation report was completed in 2002 for the Bradford Island Landfill (URS 2002d). This report discussed (qualitatively) potentially complete exposure pathways and identified COIs for human and ecological receptors. In conclusion, the report recommended that a Level II Ecological Screening Assessment be performed to provide a more thorough evaluation of the potentially complete and significant exposure pathways for ecological receptors based on soil, sediment, groundwater, surface water, and food-web contamination. The report also recommended that a BHHRA be performed.

5.2.1.5 Phase II Supplemental Landfill Site Investigation – 2001/2002

The objective of the additional site characterization investigation was to collect site information to assist in the characterization of known or suspected potential environmental concerns at the Landfill (Site Characterization Report, Bradford Island Landfill; URS 2004a). The additional site characterization field activities included:

- Collecting and analyzing 10 primary soil samples from a test pit in the gully area (BIL13 through BIL22)

- Removing mercury vapor lamps from a known area of disposal at the Landfill, and collection and analysis of seven primary soil samples from the mercury vapor-lamp excavation area (BIL05 through BIL11)
- Completing a geophysical evaluation of the Landfill using electrical resistivity and seismic refraction methods to estimate the extent of the Landfill
- Installing and developing four monitoring wells (MW-6, MW-7, MW-8, MW-9)
- Collecting and analyzing nine primary groundwater samples (one each) from MW-1 through MW-9
- Collecting and analyzing six primary soil samples at the Landfill (BIL24, BIL26, BIL27, BIL30, BIL31, BIL32)
- Collecting and analyzing six composite soil samples excavated from the gully test pit (BIL01TPG, BIL02TPG, BIL03TPG, BIL05TPG) and the mercury vapor-lamp test pit(BIL28TPM, BIL29TPM), which were then backfilled at their respective test pits at the Landfill

Additional tasks used to refine the CSM included:

- Developing a water budget for the Landfill area
- Determining the thickness of Landfill material and the thickness of unconsolidated material above the slide block
- Determining aquifer characteristics

The site characterization report (URS 2004a) concluded that wastes disposed of within the Landfill include household waste and project-related wastes such as grease, light bulbs, sandblast grit, and miscellaneous metal. The Landfill is located within a 0.63-acre area. Landfill materials and visually impacted soils did not appear to extend beyond 15 feet in depth. The estimated volume of the Landfill ranged from 9,900 to 7,500 cy, whereas the estimate for the actual debris may be as low as 3,758 cy plus any sandblast grit.

A minimal quantity of electrical debris were observed in the Landfill when compared to the amounts removed from within the river or on the shore of the island. There was no evidence that significant and/or multiple past slope failures have occurred along the north slope of the island. Consequently, the possibility that slope failures have transported electrical debris to the river was considered low to negligible.

The Landfill wastes were considered to have impacted soils primarily, with petroleum hydrocarbons, and select VOCs, SVOCs, metals, and PCBs. This resulted in groundwater being impacted with low levels of VOCs, SVOCs and metals. Groundwater was expected to discharge from the site into the river predominantly through diffuse flow or through fractures on the north side of the island.

Analytical results for this investigation are included Table 5-2 and the sample locations are shown in Figure 5-1.

5.2.1.6 Level II Screening Ecological Risk Assessment and Baseline Human Health Risk Assessment – 2004

A Level II Screening ERA and BHHRA report (URS 2004b) was completed for the Bradford Island Landfill. The Level II report concluded (with caveats) that risks to human health at the site were considered acceptable under current land use conditions and that risk reduction measures were not necessary to protect human health. The primary concerns identified for ecological receptors were the potential for direct exposure toxicity to birds and mammals from contact with Landfill soils. Based on some exceedances of ambient water quality criteria (AWQC) by site groundwater concentrations, additional evaluation of the potential for groundwater to impact surface water quality of the river was recommended.

The Level II report deferred a quantitative evaluation of risks posed by the aquatic habitat to after the sediment removal. Consequently, an EE/CA (URS 2005) for in-water sediment removal work was prepared in 2005 and provides an evaluation of human health and ecological risks related to the aquatic environment (primarily from contaminated sediment).

5.2.1.7 Upland Source Evaluation – January to August 2007

In 2007, an Upland Source Evaluation for the Landfill was conducted, which qualitatively evaluated the need for upland source control measures (URS 2007c,d). The focus of the evaluation was on direct transport of impacted soil to surface water, either through erosion and transport by storm water or by mass wasting. In April 2007, a limited soil sampling investigation between the Landfill and the river was conducted.

Six surface soil samples from the north slope of Bradford Island between monitoring well MW-6 and the Columbia River (BIL01USE, BIL02USE, BIL03USE, BIL07USE, BIL08USE, and BIL09USE). Three additional samples were taken on the eastern tip of the island where debris was removed in 2002, just upslope of former inwater pile #1 (BIL04USE, BIL05USE, and BIL06USE). Sample locations are shown in Figure 5-2 and analytical results are tabulated in Table 5-3. These nine samples, included in this RI report, were inadvertently omitted from the Upland DSR.

Undercutting was observed along the waterline at the north slope suggesting that historical mass wasting likely occurred. The Upland Source Evaluation for the Landfill concluded that since both slopes are covered with surface vegetation, there appears to currently be a low potential for soil migration via overland transport but that a quantitative erodibility study would be needed to further assess the potential for soil loss (URS 2007d).

5.2.2 Sandblast Area AOPC

The “Sandblast Area” is an informal name that has been used during past investigations to describe the former sandblast building and the area around the building where spent blast media (sandblast grit) has been placed on the ground surface or where other potential contamination sources may be present. Figure 3-4 depicts the Sandblast Area AOPC. As discussed in Section 3.5.1 and 4.1, potential contamination sources include:

- Former disposal area for spent sandblast blast grit
- Former HMSA located east of the equipment building
- Former transformer maintenance area east of the former sandblast building

- An inferred release of VOCs (i.e., PCE) from an AST historically located in the vicinity of the current HMSA
- Laydown area used for current storage of industrial equipment and materials located along the north and south sides of the landfill access road

5.2.2.1 Stormwater System Sampling and Cleaning–2001 to 2002

Solid materials from the catch basins and near the stormwater system outfalls on the northern perimeter of the Sandblast Area AOPC were sampled in May 2001. Based on the results of the catch basin and stormwater system outfall sampling, the stormwater system was identified as a potential pathway for conveying contaminants form the Sandblast Area AOPC to the river. In October 2001, the USACE cleaned the sediment from the stormwater system, replaced the filter fabric socks that line each catch basin, and characterized and disposed of the waste generated during the cleaning process.

Since the stormwater system was identified as a potential pathway for conveying contaminants form the Sandblast Area to the river, the USACE developed and implemented a regular inspection and maintenance program to prevent the discharge of sediment into the storm drain system (e.g., replacement of the filter socks on a periodic basis). Additional details regarding the stormwater system sampling and cleaning activities can be found in the In Water Investigation Report (URS 2002a) and the Storm Water Drain Cleaning Summary Technical Memorandum (URS 2002e). Since the stormwater system solids that were tested have been removed and disposed of, this data is not used in this RI Report.

5.2.2.2 Preliminary Assessment/Site Inspection Sandblast Area, Transformer Release Area, and Former Drum Storage Area – 2001/2002

The PA/SI of the Sandblast Area was conducted in 2001 to aid in the characterization of environmental concerns associated with the transformer maintenance area, and the former HMSA (also referred to as the former drum storage area) (URS 2002c). The SI included:

- Twenty-seven sandblast grit/soil samples collected from northeast, east, and south east of the former sandblast building (DSA01 through DSA12, SBB01, SBB03 through SBB07, SBB10 to SBB12, SBB13, SBB14, SBB17, SBB18, SBB23, and SBB24). Some of these samples were labeled as “sandblast” based on field observations to indicate samples containing higher quantities of sandblast; however, samples labeled as both “sandblast” and “soil” were treated as soil in this RI.
- Fourteen soil samples were collected near catch basin #1 (CB-1) and along the shoulders of the access road northeast of the former sandblast building (TRA01 through TRA07, TRA09, TRA11, TRA12, SBB09, SBB13, SBB15, and SBB16).

Sample locations are shown in Figure 5-2 and the associated analytical results are shown in Table 5-4. The burn pit located southeast of the former sandblast building and a septic tank northwest of the building was identified at that time as additional potential sources of contamination within the Sandblast Area AOPC. In addition, evidence of localized solvent-impacted soil was discovered south of the current HMSA. A soil sample (SBB18) collected below the grit-soil interface at approximately 2.5 feet bgs at this location exhibited a strong VOC odor and detections of VOCs and SVOCs.

The PA/SI report estimated that an area of approximately 20,000 square feet and 1 to 3 feet deep (1,500 to 2,000 cy) might be regulated as hazardous waste if excavated based on lead and chromium concentrations (URS 2002c). The total volume of sandblast grit present was estimated at between 1,410 and 2,025 cy. Figure 3-4 shows the approximate extent of the primary sandblast grit disposal area; however, evidence of sandblast grit was also observed in surface soils further to the north.

5.2.2.3 Soil Sampling – 2004

In April and May 2004, the USACE cleared the vegetation and graded an area of approximately 1,600 square feet near CB-1 (Figure 3-4). This work was performed to provide space for the storage of dam gates on several concrete piers. Less than 6 inches of topsoil were excavated by the USACE during vegetation removal. The vegetation and some soil connected to the roots were temporarily stockpiled in a roll-off dumpster.

After grading the area, USACE personnel collected 18 surface soil samples from the area that had been cleared and six soil samples from the dumpster. These samples were submitted for leachable lead and chromium analysis by TCLP. Analytical results are available in Appendix B of the SSI, Sandblast Area (URS 2006a). Based on the results, the soil in the dumpster was disposed of as hazardous waste at the chemical waste landfill in Arlington, Oregon. The TCLP results were not used in this RI Report because the TCLP analysis uses a simulated leachate sample to evaluate leachable COI concentrations for waste handling and disposal requirements.

5.2.2.4 Supplemental Site Inspection – 2004 to 2006

The SSI of the Sandblast Area was conducted in November 2004 to assist in the characterization of known or suspected potential environmental concerns at the Sandblast Area. The investigation method details and analytical results were summarized in the SSI, Sandblast Area (URS 2006a). The investigation included (Figure 5-2):

- Twenty four soil samples collected using hand augers and direct push borings near the current HMSA, adjacent to the river, outside of the sub basin captured by the former sandblast building stormwater system, from within the catch basins, around the septic tank, and beneath the former burn pit (DP1 though DP12 and HA1 through HA12).
- Twelve groundwater samples were collected from direct-push borings: four borings were drilled along the Landfill access road (DP1 through DP4), five borings were drilled in the drain field for the former sandblast building septic system (DP5 through DP9), and three were drilled in the presumed downgradient direction adjacent to the HMSA (DP10 through DP12).

The SSI concluded that in addition to the metals and butyltins, detected during the previous investigations, several other COIs were detected in the Sandblast Area AOPC. These included PCBs, SVOCs, and VOCs. The sandblast grit is not believed to be the source of contamination for these COIs. The report concluded that the four potential sources of PCB, SVOC, and VOC contamination were (URS 2006a):

- Incidental spills of hazardous materials at the southwest corner of the hazardous materials storage area.

- Storage of dam-related equipment along the Landfill access road. Oil-stained soil, metal painted with lead-based paint, and potentially PCB-containing equipment and insulators were observed in this area in 1996.
- Disposal and incineration of wastes in a former burn pit at the east end of the Sandblast Area.
- Transformer maintenance documented in the PA/SI (URS 2002c). A small release of PCB-contaminated oil occurred in 1995 at the paved area east of the former sandblast building during a transformer rehabilitation project.

Additionally, low levels of petroleum hydrocarbons, VOCs, SVOCs, butyltins, and pesticides were detected in several groundwater samples in the Sandblast Area AOPC.

During a previous investigation, air compressor blow-down water was identified as a potential source for lead and bis(2-ethyl hexyl) phthalate (B2EHP) identified in river sediments proximate to a drainage outfall north of the former sandblast building (URS 2002c). As part of the SSI, one sample of blow down water was collected from a pipe that conveys compressor blow-down water from the current sandblasting area in the service center building to the drainage ditch near the former sandblast building. The blow-down water appeared clear, did not have a sheen, and had no unusual odors. Neither B2EHP nor lead were detected in the blow-down water sample, but low levels of three SVOCs, four VOCs, and chromium were detected (URS 2006a).

5.2.3 Pistol Range AOPC

During the PA/SI for the Pistol Range, conducted in 2002, 73 soil samples were collected from 42 sample locations (in some locations samples were collected at different depths). The area investigated was approximately 200 feet long and between 20 to 30 feet wide (approximately 4,550 square feet). Figure 5-3 depicts the location of the Pistol Range and former firing shed in relationship to the sample locations. Table 5-6 tabulates the analytical results. The investigation method details were summarized in the PA/SI Report for the Former Pistol Range (URS 2003a).

Groundwater data were not collected during the PA/SI. In the preliminary screening of the data, the maximum soil analytical concentrations indicated that lead was the only metal elevated above relevant screening criteria at the time (USEPA Region 9 Preliminary Remediation Goals [PRGs]), and it was found primarily near the former firing shed and around the backstop (URS 2003a). These areas appeared to be relatively small (600 square feet around the firing shed, and 1,400 square feet of soil around the backstop) and shallow (impacts likely extend up to 2 feet bgs). The report also concluded that concentrations of both lead and zinc exceeded sediment screening values protective values for the benthic community and could cause a potential concern if the upland soils were transported to the river (URS 2003a).

5.2.4 Bulb Slope AOPC

A reconnaissance investigation of the Bulb Slope area was conducted in November 2002. The investigation and findings are described in the Draft Bulb Slope Reconnaissance Investigation and Evaluation of Potential Remedial Options (URS 2003b). The investigation included soil samples collected from eight locations. The sample locations are shown in Figure 5-4 and analytical results and provided in Table 5-7.

The investigation report concluded that PCBs as Aroclor 1260, lead, and mercury are present in soils within the area of visually observed glass debris at the Bulb Slope. The report estimated that approximately 95 to 125 cy of debris and impacted soil is present at the Bulb Slope on top of a bedrock base (URS 2003b).

5.3 River Operable Unit

The historical River OU data (samples collected prior to 2007) are not used in the risk assessments are therefore not discussed in detail in this report. The one exception is the Forebay smallmouth bass collected in 2006, are discussed in Section 6.0. The data for samples collected from the River OU from December 2000 forward are available in the project database (Appendix A) and tabulated historical data are included in Appendix G.

The USACE completed sediment evaluations associated with dredging and construction work related to the Bonneville Project in 1991 (USACE 1991), 1997 (USACE 1997b), 2001 (unpublished USACE study), and 2002 (URS 2002f).

In October and November 2000, underwater dive surveys were conducted due to the discovery of light ballasts on-shore on the north side of the island adjacent to the Landfill. The surveys identified waste-related items submerged in the Columbia River in three distinct piles, just offshore of the Landfill. As described in Appendix E of the In Water Investigation Report approximately 60 electrical items were removed from Debris Pile #1 and four sediment samples were collected during the recovery activities in December 2000 (URS 2002a).

A preliminary in-water investigation was conducted in May 2001 to evaluate sediment, clams and crayfish near the waste items in order to plan for a removal of the items (URS 2002a). Waste-related items were removed in February and March 2002 (URS 2002b). Additional investigations were completed in 2002 and 2003 to assess the extent of sediment related impacts from the waste-related items (URS 2003c and URS 2004c). Based on the results of the sediment investigations within the Forebay the EE/CA for sediment removal was completed in 2005 (URS 2005). The conclusion of the EE/CA was to perform dredging near the former debris pile areas along the tip and the northern shoreline of Bradford Island.

In April 2006, additional high volume surface water and sediment data were collected to support the EE/CA following the Surface Water and Sediment Sampling for Non-Time-Critical Sediment Removal Action QAPP (USACE and URS 2006). Analytical results were presented in the Removal Design Data Gaps Surface Water and Sediment Sampling Technical Memorandum (URS 2006b). A detailed summary of the historical investigations conducted in the River OU is presented in the RI/FS MP (URS 2007a).

5.4 Summary

This section summarized the investigations that occurred prior to the September 2007 RI/FS MP (URS 2007a). The relatively static physical environment of the Upland OU means that environmental data collected over the past decade can be considered representative of current conditions. Except where data quality does not meet the standards outlined in the RI/FS MP (URS 2007a), analytical results from investigations in the Upland OU from 1999 to 2009 were included in the RI data set and were evaluated in the risk assessments (exceptions are noted above). The results of Upland OU investigations that were conducted following the RI/FS MP are summarized in the next section (Section 6.0).

The physical environment of the River OU is much more dynamic. As discussed previously, the electrical equipment and debris and the majority of the contaminated sediment were removed from the river between 2001 and 2007, and water movement and human activities have redistributed sediment within the Forebay. Additionally, the sampling methods used to collect the historical data in the River OU are not comparable to the recent sampling which was conducted in accordance with the procedures outlined in the River OU QAPP (URS 2007b), Revised Sculpin Analysis Strategy Technical Memorandum (URS 2009b), and In Water QAPP Addendum (URS 2009c). In order to focus on the current river conditions, only analytical results from investigations in the River OU after 2007, with the exception of smallmouth bass collected in 2006, were included in the RI data set and were used in the risk assessments. The results of River OU investigations that were conducted following the RI/FS MP, as well as the Forebay smallmouth bass collected in 2006, are summarized in the next section (Section 6.0).

6.0 RECENT SITE INVESTIGATIONS

Recent site investigations are defined in this report as investigations occurring after the completion of the September 2007 RI/FS MP (URS 2007a), which described the overall site investigation management plan. The goal of the RI/FS MP was to provide a foundation for subsequent investigations to support the preparation of this RI report, the HHRAs and ERAs, and to permit evaluation of engineering alternatives to address site contamination. Section 8.0 of the RI/FS MP describes the data gaps for the Upland and River OUs. Data gaps were identified under three categories: gaps with respect to understanding nature of contamination, gaps with respect to understanding the extent of contamination, and gaps with the respect to the ability to perform risk evaluations.

Data gap sampling for the Upland and River OUs was completed in 2007 through 2009, following the guidance of the Upland OU QAPP (URS 2008a), Upland QAPP Addendum (URS 2009a), River OU QAPP (URS 2007b), Revised Sculpin Analysis Strategy Technical Memorandum (URS 2009b), and In Water QAPP Addendum (URS 2009c). Upon completion of the data gap sampling, two reports were prepared evaluating whether the objectives of the RI/FS MP were met. The Upland OU DSR (URS 2009e) and the River OU DSR (URS 2009d) concluded that the data met project objectives outlined in the RI/FS MP and the data were sufficient and usable for the completion of this RI and the risk assessments. The following sections briefly summarize the data gap sampling investigations conducted in the Upland and River OUs. The data presented in this section are used in the risk evaluations (unless otherwise noted).

The comprehensive data set used for the RI includes historical samples that meet data quality objectives (Upland OU only) and recent samples (Upland and River OUs). Appendix G provides the historical data not utilized in the RI due to poor data quality or because historical samples are no longer representative of current conditions. The historical investigations are discussed in Section 5.0, and recent investigations are described in this Section. The total number of samples included in this RI for each sample matrix are presented in Table 6-1.

Section 5.1 summarizes the processing treatments for the Upland OU and River OU data necessary for use in the RI Report. Processed and unprocessed data are provided in Appendix A, along with a complete enumeration of the processing treatments. Appendix E provides the laboratory reports and Appendix F provides the data validation reports. Appendix H presents the results of the individual congener analyses, along with the methodology used for summing total PCBs as congeners, total PCBs as Aroclors, and total PAH, and tables with the sums for each sample.

6.1 Upland OU

This section briefly summarizes the investigations and sampling that occurred after the September 2007 RI/FS MP (URS 2007a). Analytical data from these investigations is incorporated in this RI Report and used in the risk evaluations.

6.1.1 Landfill AOPC

The recent fieldwork completed in the Landfill AOPC included the sampling of four quarters of groundwater data and the collection of additional surface and near-surface soil samples from the gully area (URS 2008a).

The field activities included:

- Collection/analysis of four quarters (March 2008, July 2008, October 2008, and January 2009) of groundwater samples from the nine monitoring wells located in the Landfill AOPC
- Survey for groundwater seeps during each quarterly groundwater event. Collection/analysis of samples from each observed seep along with the surface water immediately adjacent to the seep.
- Collection/analysis of soil samples from depth intervals of 0-1 foot bgs and 1-3 feet bgs from four test pits (L1 though L4) in the gully area.

Details of the well installation of the Sandblast Area AOPC groundwater wells are included in the Groundwater Monitoring Well Installation Report (URS 2008b). The results for the groundwater sampling were reported quarterly, with each successive quarterly report incorporating data from the previous reports, therefore the fourth quarter report will be referenced here (URS 2009g). Finally, the results for the soil samples collected from the gully area were included in the Upland OU Data Gap Sampling Report (URS 2009f). Sample locations are shown in Figure 5-1 and the analytical results are tabulated in Table 6-2.

6.1.2 Sandblast Area AOPC

The data gaps identified for the Sandblast Area AOPC in the RI/FS MP (URS 2007a) included the need for additional groundwater, soil, and soil gas samples. Following the publication of the RI/FS MP, routine maintenance activities occurred in July 2008 that included scraping and stockpiling surface soils to extend the eastern portion of the laydown area. The actively exposed soils appeared to have tar-like residue (URS 2009a). The USACE elected to performed additional site investigations on the newly exposed soils, which are included in the discussion below.

The recent field activities in the Sandblast Area AOPC included:

- Installation of five groundwater monitoring wells in the Sandblast Area AOPC (MW-11 through MW-15).
- Collection/analysis of four quarters (March 2008, July 2008, October 2008 and January 2009) of groundwater samples from the five monitoring wells located in the Sandblast Area AOPC.
- Collection of surface and near surface soil samples from eight sampling stations (SB1 through SB8) within known areas of sandblast grit disposal to be sieved into two size fractions and analyzed for lead only.
- Collection/analysis of five soil gas samples (SB10 through SB14).

- Collection/analysis of five soil samples from five test pits in the newly exposed laydown area (LD1 through LD5).
- Collection/analysis of six surface soils from stockpiled soils in the laydown area (LD6 through LD11).

Details of the well installation of the Reference Area groundwater well are included in the Groundwater Monitoring Well Installation Report (URS 2008b). The results for the groundwater sampling were reported quarterly, with each successive quarterly report incorporating data from the previous reports, therefore the fourth quarter report will be referenced here (URS 2009g). The sampling activities and results are included in the Upland OU Data Gap Sampling Report (URS 2009f). Sample locations are shown in Figure 5-2 and analytical results are tabulated in Table 6-3.

6.1.3 Pistol Range AOPC

The recent fieldwork completed in the Pistol Range AOPC included the collection and analysis of grab groundwater samples and lagoon sediment samples.

The field activities included:

- Collection/analysis of two grab groundwater samples (PR1 and PR2D)
- Collection/analysis of five sediment samples from the Pistol Range Lagoon (PR4 through PR8).

The sampling techniques and results are included in the Upland OU Data Gap Sampling Report (URS 2009f). Sample locations are shown in Figure 5-3 and analytical results are tabulated in Table 6-4.

6.1.4 Bulb Slope AOPC

No data gaps were identified for the Bulb Slope AOPC in the RI/FS MP (URS 2007a); therefore, additional sampling was not performed at this AOPC.

6.1.5 Reference Area

The objective of the Reference Area was to provide site-specific background concentrations of inorganic COIs in soil and groundwater (URS 2008a). The samples were also analyzed for selected organic analytes to evaluate the potential contribution, if any, of non-site-specific sources to organic COI to site risk.

The field activities for the Reference Area included:

- Installation of the Reference Area groundwater monitoring well (MW-10)
- Collection/analysis of four quarters (March 2008, July 2008, October 2008 and January 2009) of groundwater samples from the Reference Area monitoring well.
- Collection/analysis of fourteen surface soil samples (R1 through R14)

Details of the well installation of the Reference Area groundwater well are included in the Groundwater Monitoring Well Installation Report (URS 2008b). The results for the groundwater sampling were reported quarterly, with each successive quarterly report incorporating data from the previous reports, therefore the fourth quarter report will be referenced here (URS 2009g). The sampling techniques and results are included in the Upland OU Data Gap Sampling Report (URS 2009f). Sample locations are shown in Figure 6-1 and analytical results are tabulated in Table 6-5.

6.1.6 Upland OU Erodibility Studies

As described in the RI/FS MP (URS 2007a), the identification of erodible soils was identified as a data gap for the Upland OU. Erodibility surveys were carried out in 2009 for each of the three primary AOPCs, including the Landfill, Sandblast Area, and Pistol Range AOPCs. A visual survey was performed for the Bulb Slope AOPC because this AOPC is a steep, rocky, vegetated slope on the north shore of Bradford Island, which was not suitable for the model used in the Erodibility surveys of the other AOPCs.

The objective of these surveys was to estimate the volume of sediment, and associated mass of COIs, potentially transported from each of the AOPCs to the Columbia River. Field surveys of the site were conducted on January 26 and February 5, 2009 (URS 2009f). The erodibility study identified only a limited portion of the Sandblast Area AOPC, where soils had been temporarily exposed during construction activities, as having a potentially complete pathway associated with stormwater runoff to the river. No currently-erodible soils were identified in the Landfill, Bulb Slope, or Pistol Range AOPCs. In a follow-up sampling event in March, 2009, surface soil samples were collected from the potentially erodible soils at the Sandblast Area AOPC. This included:

- Collection/analysis of two composite soil samples from the sloped area north of the former sandblast building, near catch basin #2 (CB-2), in the Sandblast Area AOPC. Eight subsamples were composited into sample SB-EUA and sixteen subsamples were composited into sample SB-EUB. VOC analyses were conducted on eight discrete subsamples (SB-EUA-02, SB-EUA-04, SB-EUA-06, SB-EUA-08, SB-EUB-02, SB-EUB-03, SB-EUB-12, and SB-EUB-15).

For further details, see the Erodibility Study presented in Attachment E of the Upland OU Data Gap Sampling Report (URS 2009f). Sample locations are shown in Figure 5-2 and analytical results are tabulated in Table 6-3. As discussed above, since March 2009, this portion of the Sandblast Area AOPC has become revegetated and no longer contains erodible soils.

6.2 River OU

This section briefly summarizes the recent sampling activities, including:

- Sampling of smallmouth bass, sediment, and clam samples in 2006 and 2007 prior to the sediment removal,
- Monitoring during the removal action,
- Post-removal statistically-based sampling in the Forebay and Reference area,
- Sampling of downstream sediment, and
- Targeted sampling in the Forebay (Eagle Creek and Goose Island Slough).

Analytical data from these investigations were used in this RI and the risk evaluations, unless otherwise noted.

6.2.1 Pre-Removal Sampling

In June and August 2006, the USACE collected smallmouth bass (and one sucker composite sample) from the Forebay. The findings were presented in the Forebay and Reference Area Smallmouth Bass Collected June 2006 through May 2008 Summary Report (URS 2008c). Sample locations are shown in Figure 6-2 and the analytical results are included in Table 6-6. These smallmouth bass samples were archived pending collection of the Reference Area smallmouth bass (Section 6.2.3). Data from the Forebay smallmouth bass samples are included quantitatively in the risk assessments. The data from the single sucker sample are considered qualitatively in the risk assessments.

In September 2007, pre-removal sediment and clam samples, from the vicinity of the three former debris piles, were collected following the River OU QAPP (URS 2007b). The pre-removal samples were collected from within the footprint of the planned sediment removal area. Five sediment samples and four co-located clam samples were collected. Clam tissue was scarce at one of the five sediment locations (sample station 4) and therefore could not be collected. The objective of collecting these co-located clam and sediment samples was to enable the estimation of biota-sediment accumulation factors (BSAFs) and to estimate concentrations of PCBs that might be present in the removal area. Analytical results are reported in the Pre-Removal Action Sediment and Clam Sampling Analysis (URS 2008d). Sample locations are shown in Figure 6-3 and the analytical results are included in Table 6-7. These data are not representative of post-removal conditions, but, at the request of TAG members, the data are considered qualitatively in the risk assessments.

6.2.2 Sediment Removal and Monitoring

The preferred option selected during the EE/CA for sediment removal was dredging near the former debris pile areas along the tip and the northern shoreline of Bradford Island (URS 2005). Sediments were removed between October 2 and October 30, 2007 using used diver-assisted hydraulic dredging starting on. The total area dredged was approximately one acre as detailed in the Project Closure Report (HAI 2007) and shown in Figure 6-3. Sediments were dewatered onsite. The process produced dredge effluent water that was treated by gravity separation, particulate filtration and carbon filtration prior to being discharged back to the Columbia River. The sediment was contained on a barge and disposed of offsite.

To assess the potential for impacts to the Columbia River from the dredging operation and the discharge of the treated water (i.e. effluent), a water quality monitoring program was developed and implemented (URS 2007e). The program consisted of sampling the dredge effluent at the point of discharge on a weekly basis during dredging, deploying semi-permeable membrane devices (SPMDs) prior to dredging (e.g. to establish baseline conditions) and during dredging, collecting grab water samples in conjunction with the SPMD deployments, and measuring turbidity during dredging.

Turbidity monitoring results are presented in the Project Closure Report (HAI 2007). Analytical data from dredge effluent, SPMD, and surface water samples collected between August 20, 2007 and November 2, 2007 are summarized in the Water Quality Monitoring Report In-Water

Removal Action (URS 2008e) and are included in the projected database (Appendix A). The dredge effluent samples showed no detectable PCBs in either the particulate or dissolved phase in the dredging return water. The SPMD results showed the dissolved fraction of PCBs in the water column both before and during dredging the activity were at very low levels, on average approximately 30 picograms per liter (pg/L) (URS 2008e). Comparison of the SPMD results between the removal action area and the downstream station indicate that the dredging activity did not have any appreciable effect on the concentration of PCBs in the dissolved fraction of the water column. Since the analytical data collected to monitor the dredging they are not used in the risk assessment and are not discussed further.

6.2.3 Forebay and Reference Area Post-Removal Sampling

While extensive sediment data had previously been collected in the River OU, sampling was focused near the former debris piles and tissue sampling was primarily focused on lower trophic level media. Additionally, these historical samples do not represent current (port-removal) conditions in the Forebay. The RI/FS MP (URS 2007a) identified the following data needs:

- A statistically-based program of collection/analysis of sediment and tissue data from the Forebay to assess the migration of biomagnifying COIs through the food web.
- A statistically-based program of collection/analysis of sediment and tissue data from an upstream Reference Area to establish site-specific background concentrations of inorganic COIs and evaluate the contribution of ambient concentrations of organic COIs to the site-wide risk estimate.
- Collection/analysis of surface water from the Forebay and Reference Area to evaluate surface water impacts in the Forebay
- Collection/analysis of targeted sediment data from the mouth of Eagle Creek, hereafter referred to as the "Eagle Creek" samples, to assess exposure to sediments for human anglers.

In addition, after the preparation of the RI/FS MP, one additional data need was identified:

- Collection/analysis of targeted sediment and tissue (clams, crayfish, and sculpin) data from the slough on the southern side of Goose Island, hereafter referred to as the “Goose Island” samples, to further investigate the presence of PCBs detected in smallmouth bass random Forebay samples.

6.2.3.1 Statistical Sampling of Sediment, Clam, Crayfish, Sculpin and Smallmouth Bass

As described in the QAPP a minimum of 14 samples were required for each media in order to meet the sample size needed for statistical comparison. The target sample size for each media was therefore between 14 and 21 randomly selected sampling stations for sediment, clam, crayfish and sculpin in both the Forebay and Reference Area (URS 2007b).

Sediment and clam tissue were successfully collected in February/ March 2008 from 17 and 19 of the randomly selected stations in the Forebay and Reference Area, respectively (URS 2008f). Crayfish and sculpin trapping at the random stations did not result in sufficient sample mass to generate the minimum number of samples (i.e., 14 each in the Forebay and Reference Area). Therefore, the traps were set in nearby areas outside the original randomly selected sampling stations which posed more suitable habitat. This strategy was successful for crayfish, but insufficient sculpin were obtained in during the February and March 2008 field activities (URS 2008g).

Additional sculpin collection in both the Forebay and Reference Area was carried out by the USGS between July and October 2008 and resulted in sufficient sculpin mass for analysis. A geographical-based sculpin compositing scheme was proposed by the USACE (URS 2009h). Based on comments received from the TAG during the January 28, 2009 TAG meeting, the final compositing scheme was selected as described in the Revised Sculpin Analysis Strategy Technical Memorandum (URS 2009b).

As described in Section 6.2.1, smallmouth bass were collected in the Forebay in June and August 2006, prior to sediment remediation and archived pending collection of the Reference Area smallmouth bass. Smallmouth bass were collected from the Reference Area in October and November 2007 and May 2008 (URS 2008c). Due to the relatively large home range of the smallmouth bass, sample locations were not restricted to the 21 randomly selected sampling stations. Additionally, due to a lack of suitable habitat, insufficient smallmouth bass were caught within the geographical boundary of the Reference Area, so the data set includes bass caught further upstream (Figure 6-2).

Multiple data deliverables were submitted (URS 2008c,f,g; URS 2009i,j). The number of samples in both the Forebay and Reference Area met the statistically-required minimum sample size for sediment, clams, crayfish, scuplin, and smallmouth bass (Table 6-1). Analytical results for sediment and tissue media collected in Forebay and Reference Area are presented in Tables 6-6, 6-8 through 6-11 and are included in the project database, Appendix A. Sample locations for sediment and tissue media collected in the Forebay and Reference Area are presented in Figures 6-2, 6-3, and 6-4.

Analytical data for the randomly sampled Forebay media (sediment, clam, crayfish, sculpin and smallmouth bass) are used in the risk assessments. Targeted Forebay sample stations (Eagle Creek and Goose Island) are also shown on Figure 6-3. These data are also considered in the risk assessments. Reference Area data are considered in the risk assessments when evaluating the site-related contribution to risk in the Forebay.

6.2.3.2 Surface Water

Five high volume surface water samples were collected in the Forebay and Reference Area between February and March 2008 (URS 2008f and URS 2009f). Sample locations are presented in Figures 6-3 and 6-4. Analytical results are presented in Table 6-12, and are used in the risk assessments.

6.2.3.3 Targeted Sediment Sampling at Eagle Creek

Two sediment samples were collected from the mouth of Eagle Creek in February 2008 (URS 2008f and URS 2009j). Sample locations are shown in Figure 6-3. Analytical results are presented in Table 6-13. These data are used for evaluation of the direct contact pathway in the HHRA.

6.2.4 Downstream Sediment

USACE had not collected sediment samples from depositional areas downstream of the dam prior to 2008. The objective of the 2008 downstream sediment investigation was to assess the potential for sediment impacts related to releases from the site downstream of the dam. Six downstream sediment locations were chosen from likely depositional areas based on hydrodynamic modeling (URS 2007a,b) and are shown on Figure 6-5. Sediment samples were collected in March 2008 from these sample stations (URS 2008f and URS 2009i). Analytical data are presented in Table 6-14.

6.2.5 Goose Island Slough

During the January 28, 2009 TAG meeting, the Goose Island Slough (slough) was identified as a potential data gap by Oregon DEQ and USFWS, due to the fact that many of the Forebay smallmouth bass were collected from the slough, while the other Forebay media were collected from the main channel of the Columbia River. It was suggested by Oregon DEQ and USFWS during the January TAG meeting that additional samples from the slough would aid in filling this potential data gap.

Based on these comments, an Addendum to the River OU QAPP (URS 2009c), detailing the additional slough sampling, was submitted to and reviewed by the TAG. The Goose Island Slough samples were collected in April/May 2009. The sampling locations are shown on Figure 6-3 and the analytical results are presented in Table 6-13. A report summarizing the historical and recent (2009) analytical data from samples located in the slough and in the immediate vicinity of Goose Island was submitted to the TAG (URS 2009k). This report concluded that it is highly probable the elevated PCB concentrations observed in the smallmouth bass collected from the slough were the result of historical body burden associated with the contaminated equipment and sediments that have since been removed from the northern side of Bradford Island. These data are considered in the risk assessments.

7.0 DATA QUALITY ANALYSIS

The tables included in Chapters 5 and 6 represent the comprehensive set of data used in this RI for the evaluation of nature and extent of contamination, as well as the human health and ecological RAs. This chapter discusses the quality of this comprehensive data set and its suitability for the completion of these tasks. The data quality evaluation covers the following topics:

- Sample sizes
- J-flagged Data
- Variable MDLs and MRLs
- MDLs of undetected data greater than SLVs
- MRLs of undetected and J-flagged data greater than SLVs

To assist the reader, the following definitions are provided from the DoD Quality Systems Manual for Environmental Laboratories Version 4.1 (DoD EDQW 2009) provides the following definitions for these parameters:

> **Method Detection Limit**
>
> The MDL is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and it is determined from analysis of a sample in a given matrix containing the analyte.
>
> **Method Reporting Limit**
>
> The MRL [referred to as the Limit of Quantitation (LOQ) in DoD EDQW 2009] is the minimum concentration of a substance that can be reported with a specified degree of confidence. It is the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the MRL (or LOQ) is set at or above the concentration of the lowest initial calibration standard.
>
> **U-flagged Data**
>
> A “U” flag, or qualifier, indicates that the analyte was not detected (ND) and is reported as less than the limit of detection defined by the client. The limit of detection has been adjusted for any dilution or concentration of the sample.
>
> **J-flagged Data**
>
> A “J” flag, or qualifier, indicates that the reported result for an analyte is an estimated value. More specifically, matrix interference was observed or the analyte was detected at a concentration outside the range of values in a laboratory instrument calibration curve between the MRL and the highest successfully analyzed initial calibration standard for that instrument.

For purposes of this project, the limit of detection is defined as the MDL. Therefore, *all references to “detections” indicate that a particular analyte within a given medium was measured at a concentration greater than the MDL. Similarly, all references to “non-detect”, or U-flagged, results indicate that an analyte was not detected above the MDL*, unless otherwise noted.

As described in the definition, above, data may be qualified with a J flag for multiple reasons. Although certain data for this project are J-flagged due to matrix interferences and other reasons related to data quality (e.g., holding times exceeded, surrogate failure, and peak identification), this section specifically evaluates data that are J-flagged *because the estimated result is reported between the MDL and MRL*. Evaluation of J-flagged data is important because these results were treated as detected concentrations, and this assumption introduces uncertainties in the RI and RAs, as discussed in Section 7.4.

Section 7.1 presents the data summaries, for each COI and each medium, for each of the Upland AOPCs and the River OU. This section identifies data sets with limited sample size and discusses the use of J-flagged data. Section 7.2 presents the statistics for data sets with at least two detected results and discusses the effect of censoring undetected data at the MDLs versus the MRLs on the resulting statistical parameters (i.e., upper confidence limits [UCLs]). Section 7.3 presents a brief discussion on the relevant SLVs used to screen data for the risk assessments. Section 7.4 presents the data sensitivity analysis, in which the MDLs and MRLs are compared to the SLVs to identify specific COIs and matrices for which the literature-based SLVs may be lower than the sensitivity of current analytical methods.

Since this data quality evaluation was conducted in support of the HHRA and ERA, the evaluation includes not just each of the individual AOPCs, but also the combination of the four AOPCs. This is because certain receptors have the potential to be exposed to all four Upland AOPCs. The combined data set is used for evaluating potential risk to these wide-ranging receptors. The analysis does not consider whether or not the soils in the four AOPCs have different characteristics. The combined data set characterizes the combined potential exposure.

7.1 Data Summary

In this section, the data summary tables for the Upland and River OUs presented in Appendix I are described.

In regards to sample size, any analyte/matrix with a total sample size (detections and non-detects) of fewer than eight is considered to be a limited sample size for which statistical upper-bound estimates of the mean, such as the UCL, cannot be reliably estimated (Singh et al. 2010). In these cases, the maximum detected concentration was used as the exposure point concentration (EPC) for human receptors and all mobile ecological receptors in the risk assessments.

For the population-to-population statistical comparisons to identify COIs that are above Reference concentrations (Section 8.0), a minimum number of 14 samples were required to achieve the desired level of confidence in the results. For data sets with fewer than 14, but more than eight samples, the population-to-population statistical comparisons were conducted, but the level of confidence associated with the results is lower. For these data sets with even fewer samples, the range in concentrations of the site data was compared to the range of concentrations observed in the Reference Area, and box-and-wisker plots were used to determine whether or not site data was higher than Reference Area data. More information is provided in Section 8.0.

7.1.1 Upland OU

Tables I-1, I-2, I-3, and I-4 in Appendix I present the data summaries for the Landfill, Sandblast Area, Pistol Range, and Bulb Slope AOPCs, respectively. The data summary for all four AOPCs combined is presented in Table I-5, and the Reference Area data summary is presented in Table I-6 in Appendix I. The tables summarize the data by AOPC, medium, analyte group, preparation fraction, analyte, and depth category. The data summary tables provide the number of samples, number of detections, range of detections, and detection rate. All tables also note which data sets are considered limited because they contain fewer than eight samples (a summary of analytes with limited data sets is provided in Table 7-1). They also include the range of MDLs for non-detects, range of MRLs for non-detects and detects below the MRL (i.e., J-flagged), number of non-detects, number of detects between the MDL and MRL (J-flagged), and number of detects above the MRL.

The following text provides a brief description of the data summaries for the four AOPCs.

Landfill AOPC - Among the soil data sets available for the Landfill AOPC (0 to 1, 0 to 3, and 0 to 10 feet bgs), more than eight samples (between 9 and 44 samples) are available for most of the analytes, with the exception of butyltins, a few herbicides and pesticides, and one SVOC (Table I-1). With the exception of aluminum, cobalt, and vanadium for the 0 to 1 and 0 to 3 foot depth intervals, the minimum number of 14 samples was achieved for metals and PAHs for population-to-population statistical comparisons. For the butyltins, limited data sets (fewer than eight samples) only occur with soil from 0 to 1 foot bgs; more than eight samples are available for the other two depth intervals. For the herbicides and pesticides and the one SVOC (total benzofluoranthenes), limited data sets are associated with soil from the 0 to 1 and 0 to 3 feet bgs; and more than eight samples are available for the 0 to 10 foot depth interval. It should be noted that more than 14 samples are available for all soil data sets for both benzo(b)fluoranthene and benzofluoranthene, measured as separate analytes.

For the subset of the samples that comprise the data set for mass wasting soils (0 to 1 foot bgs), more than eight samples are available for most metals, pesticides, PCBs, SVOCs, and PAHs, but not for all herbicides, three TPH mixtures, one SVOC (aniline), and all VOCs.

For groundwater, more than 8 samples are available for all analytes (inorganics and organics) measured as total concentrations in this medium. All groundwater samples from the Landfill were collected from monitoring wells. Dissolved data are available for the 20 metals analyzed for in groundwater, and more than eight dissolved results are available for nine of these metals. Limited data sets are available for seep and surface water data associated with the Landfill for all analytes.

Sandblast Area AOPC – Among the soil data sets available for the Sandblast Area AOPC (0 to 1, 0 to 3, 0 to 10 feet bgs), more than eight samples (between eight and 81 samples) are available for all analytes, including sieved samples analyzed for lead (Table I-2). The minimum number of 14 samples was achieved for all metals and PAHs in soil from these 3 depth intervals, allowing for population-to-population statistical comparison, with the exception of benzo(b)fluoranthene and benzofluoranthene in the 0 to 1 foot bgs data set. Between five and six samples are available for soils collected deeper than 10 feet bgs. In addition, five soil gas samples were collected from the Sandblast Area.

For the subset of the samples that comprise the data set for mass wasting soils (0 to 1 foot bgs), more than eight samples are available for all VOCs, but not for the remaining analytes.

Two types of groundwater data have been collected at the Sandblast Area AOPC: monitoring well samples and direct push grab samples. For groundwater collected from monitoring wells, more than eight samples are available for arsenic, iron, and vanadium measured as total and dissolved concentrations, and limited data sets are associated with the remaining inorganics (all essential nutrients) that were only measured as dissolved concentrations. More than eight samples are also available for monobutyltin, three TPH mixtures, and the three PAHs analyzed for in groundwater. Fewer than eight samples are available for five of the 65 VOCs analyzed for in groundwater. All monitoring well data for organics were measured as total concentrations.

For direct push groundwater, more than eight samples are available for all metals, which were measured as both total and dissolved concentrations, and for all VOCs (measured as total concentrations). Fewer than eight samples are available for butyltins, pesticides, PCBs, three TPH mixtures, which were measured as total concentrations. SVOCs and PAHs were measured as both total and dissolved concentrations in direct push samples, and fewer than eight samples are available for four of the 68 total samples and 16 of the 67 dissolved samples (none of these are PAHs).

Pistol Range AOPC - More than eight samples (between 10 and 63 samples) are available for the metals analyzed for in soil (0 to 1 foot bgs) of the Pistol Range (Table I-3), with lead having the highest number of samples. Limited data sets are associated with antimony and arsenic. With the exception of antimony, arsenic, molybdenum, and zinc, the minimum number of 14 samples was achieved for metals for the population-to-population statistical comparison.

Fewer than eight samples are available for the four metals (copper, lead, nickel, and zinc) analyzed in lagoon sediment and direct push groundwater samples (measured as both total and dissolved concentrations).

Bulb Slope AOPC - More than eight samples (between 8 and 12 samples) are available for all of the analytes measured in soil (0 to 1 foot bgs) of the Bulb Slope (Table I-4): lead, mercury, PCB Aroclors, and TPH. Population-to-population statistical comparisons were performed comparing metals concentrations in the Bulb Slope AOPC to the Reference Area; however, the level of confidence in the results was lower than desired.

All Four AOPCs Combined - Excluding the soil samples collected from deeper than 10 feet bgs, which are not included in the combined AOPC data set, more than eight samples (between 13 and 199 samples) are available for all of the analytes measured in soil (0 to 1, 0 to 3, and 0 to 10 feet bgs) (Table I-5). The minimum number of 14 samples was achieved for all metals in soil from all three depth intervals for the population-to-population statistical comparisons.

For groundwater collected from monitoring wells, more than eight samples are available for all analytes (inorganics and organics) measured as total concentrations in this medium. Dissolved data are available for the 20 metals analyzed for in groundwater from the Landfill, and fewer than eight dissolved results are available for nine of these metals. Limited data sets are available for seep and surface water data associated with the Landfill AOPC for all analytes.

For direct push groundwater, fewer than eight samples are available for butyltins, pesticides, PCBs, three TPH mixtures, which were measured as total concentrations. Fewer than eight samples are available for four of the 68 total samples and 16 of the 67 dissolved samples analyzed as SVOCs and PAHs (none of these are PAHs).

Upland Reference Area - Fourteen samples are available for the two classes of analytes measured in Reference Area soils (0 to 1 foot bgs) (Table I-6), which is sufficient for statistical comparison to site soils. Fewer than eight background groundwater samples are available for all analytes since there is only a single monitoring well located in the Reference Area. Groundwater collected from the Reference Area was not intended for statistical comparisons, but rather a semi-quantitative comparison to groundwater from the three AOPCs with groundwater data.

Summary - The minimum number of 14 samples are available for most metals and PAHs in soil, which allows for a population-to-population statistical comparison with Reference Area data at the desired level of confidence. In addition, the minimum number of eight samples required to calculate a 95% UCL (i.e., the EPC used for human receptors and all mobile ecological receptors) was achieved for most analytes measured in media of the Upland OU. For those data sets that were intended for statistical comparisons, the EPC for analytes with fewer than eight samples will be based on the maximum concentration because a UCL cannot be estimated reliably (e.g., tributyltin in the 0 to 1 foot interval for Landfill soils, Table I-12). This is consistent with conventional risk assessment guidance (USEPA 1989). The potential for over prediction or under prediction of risk related to use of the maximum concentration is difficult to assess but does represent the most conservative use of the available data. Some of the data sets identified above with limited sample size were generally not intended for statistical calculations but rather for assessing nature and extent and for gaining a better understanding of fate and transport mechanisms (e.g., Upland to River migration patterns). This minimizes the uncertainty associated with the small data sets.

7.1.2 River OU

Tables I-7, I-8, I-9, I-10, and I-11 in Appendix I present the data summaries for the Pre-Sediment Removal Forebay, Random Forebay, Targeted Forebay, Downstream, and Reference Area, respectively. Data summaries for PCB congeners, when available for a given area, are shown separately from the other analyte groups. The tables summarize the data by area, medium, analyte group, preparation fraction, and analyte. The summary tables provide the number of samples, number of detections, range of detections, and detection rate. All tables also note which data sets are considered limited because they contain fewer than eight samples (a summary of analytes with limited data sets is provided in Table 7-2). For all analytes except PCB congeners, the tables also include the range of MDLs for non-detects, range of MRLs for non-detects and detects below the MRL (J-flagged), number of non-detects, number of detects between the MDL and MRL (J-flagged), and number of detects above the MRL.

The PCB congener tables instead include the range of RDLs for non-detects, number of non-detects below the RDL, range of reported values for EMPC-qualified data, and number of EMPC-qualified results. For PCB congeners, the limit of detection is defined as the RDL or the EMPC (both handled in the same manner), such that *all references to “detections” indicate that a particular congener within a given medium was measured at a concentration greater than the RDL or EMPC*, unless otherwise noted. Similarly, *all references to “non-detect” results indicate that a congener was not detected above the RDL or EMPC*, unless otherwise noted.

Between 15 and 19 sediment, clam, sculpin, crayfish, and smallmouth bass samples are available for the Random Forebay and Reference Area data sets, with the exception of certain chemicals (Tables I-8 and I-11). For example, several metals and all SVOCs could not be analyzed for in sculpin samples due to inadequate tissue mass. With these few exceptions, the minimum number of 14 samples to perform a population-to-population statistical comparison was achieved. In addition, the minimum number of eight samples to calculate a 95% UCL (i.e., the EPC used for human receptors and all mobile ecological receptors) was achieved.

Fewer than eight Pre-Sediment Removal Forebay samples (Table I-7), large-scale sucker samples from the Forebay (Table I-8), Targeted Forebay samples (Table I-9), Downstream samples (Table I-10), and surface water samples (Tables I-8 and I-11) were collected. This was intentional. These samples were not collected for statistical purposes, minimizing the uncertainty associated with the small sample size available. As discussed in Section 6.2, many of these samples were collected to assess presence or absence of certain chemicals in specific media for purposes of nature and extent delineation or were used qualitatively in the risk assessments.

In summary, the number of samples to perform statistical calculations with the desired level of confidence (e.g., population to population comparisons or development a 95% UCL) is available for most analytes and media in the Random Forebay and Reference Area data sets. For the analytes with limited sample sizes, the maximum detected concentrations will be used as the EPC and is subject to some potential for either under prediction or over prediction of risk. Data sets with limited sample size not intended for statistical calculations are also sufficient for assessing nature and extent or for specific qualitative evaluations in the risk assessments.

7.2 Data Statistics

The summary statistics developed for the detected analytes are described in this section.

7.2.1 Upland OU

Tables I-12, I-13, I-14, I-15, and I-16 in Appendix I present the data statistics for the Landfill AOPC, Sandblast Area AOPC, Pistol Range AOPC, Bulb Slope AOPC, and All Four AOPCs Combined, respectively. The tables provide the following statistics for data with at least two detected results: number of samples, number of detections, mean of detections, median of detections, maximum detected value, and 95% UCLs censored at both the MDL and MRL for non-detects.

Table I-17 in Appendix I presents the data statistics for the Reference Area. The table provides the following statistics for data with at least two detected results: number of samples, number of detections, mean of detections, median of detections, maximum detected value, and 95% UCL (if there are at least eight samples).

The objective of this evaluation was to determine how much the 95% UCLs differed depending on what value (the MDL or the MRL) is used to censor the undetected results. Both methods use the J-flagged data at face value. The only difference is whether the undetected data are censored at the MDL, in which case the rank-ordering of the data set puts them below the J-flagged data, or are censored at the MRL, in which case the rank ordering puts them higher than the J-flagged data. In general, censoring using the MDL is the preferred statistical method since it preserves the rank order of the data. However, censoring using the MRL is a more conservative approach.

In the Upland OU, the majority of calculated 95% UCLs are identical or differ by less than 10% for both data censored at the MDLs and those censored at the MRLs, with the following exceptions:

Landfill AOPC

- Soil
    - PCBs – MDL-censored 95% UCLs are **greater** than MRL-censored 95% UCLs by about 18% for Total PCBs as Aroclors (0-1 and 0-3 ft bgs).

  - SVOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 13 to 18% for benzoic acid and butyl benzyl phthalate (0-10 ft bgs).

- Groundwater
  - Butyltins – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 22% for monobutyltin.
  - TPH – MDL-censored 95% UCL is **less** than the MRL-censored 95% UCL by about 21% for gasoline range organics (GRO).
  - SVOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 14% for 2-Methylnaphthalene.
  - VOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 21 to 26% for chloroform and vinyl chloride.

Sandblast Area AOPC

- Soil
  - Metals – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 16 to 25% for beryllium (0-1, 0-3, and 0-10 ft bgs), selenium (0-1, 0-3, and 0-10 ft bgs), and thallium (0-1 ft bgs).
  - Pesticides – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 55% for 4,4'-DDD, 4,4'-DDE, BHC (delta), dieldrin, endosulfan II, endosulfan sulfate, and heptachlor (0-1, 0-3, and 0-10 ft bgs).
  - PCBs – MDL-censored 95% UCLs are **greater** than MRL-censored 95% UCLs by about 23% for Total PCBs as Aroclors (0-1, 0-3, and 0-10 ft bgs).
  - TPH – MDL-censored 95% UCL is **less** than the MRL-censored 95% UCL by about 19% for GRO (0-1 ft bgs).
  - SVOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 11 to 47% for butyl benzyl phthalate (0-1, 0-3, and 0-10 ft bgs), di-n-octyl phthalate (DNOP) (0-1, 0-3, and 0-10 ft bgs), and phenol (0-1 ft bgs). The MDL-censored 95% UCL is **greater** than MRL-censored 95% UCL by 432% for phenol (0-3 ft bgs).
  - VOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 10 to 77% for fourteen VOCs (various depth intervals).
- Potentially Erodible Soil
  - TPH – MDL-censored 95% UCL is **less** than the MRL-censored 95% UCL by about 18% for GRO.
  - VOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 14 to 41% for seven VOCs.
- Groundwater
  - Butyltin and TPH – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by about 29 and 33% for monobutyltin and GRO, respectively.

- DP Groundwater
  - Metals – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 11 to 41% for five metals.
  - SVOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 38% for seven SVOCs.
  - VOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 16 to 44% for eight VOCs.

All Four AOPCs Combined

- Soil
  - Metals – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 17% for beryllium (0-1, 0-3, and 0-10 ft bgs), selenium (0-1, 0-3, and 0-10 ft bgs), and thallium (0-1 ft bgs).
  - Pesticides – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 38% for 4,4'-DDE, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, and heptachlor (various depth intervals). The MDL-censored 95% UCL is **greater** than MRL-censored 95% UCL by 12% for chlordane (technical) (0-10 ft bgs).
  - PCBs – The MDL-censored 95% UCL is **greater** than MRL-censored 95% UCL by about 19% for Total PCBs as Aroclors (0-3 ft bgs).
  - SVOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 10 to 44% for seven SVOCs (various depth intervals).
  - VOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 10 to 44% for seven VOCs (various depth intervals).
- Groundwater
  - Butyltins, TPH, and SVOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by about 27, 23, and 14% for monobutyltin, GRO, and 2-methylnaphthalene respectively.
  - VOCs - MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by about 18 to 34% for chloroform, toluene, and vinyl chloride.
- DP Groundwater
  - Metals – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 11 to 43% for five metals.
  - SVOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 38% for seven SVOCs.
  - VOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 16 to 44% for eight VOCs. The MDL-censored 95% UCL is **greater** than MRL-censored 95% UCL by about 25% for 1,1-dichloroethane.

These results are consistent with the expectation that, in most cases, the 95% UCL calculation is relatively insensitive to the choice of censoring level. Differences generally only occur when there is a large percentage of undetected data. In these cases, the MDL-censored 95% UCLs are generally somewhat lower than the MRL-censored 95% UCLs, but not always. Based on this review, the more statistically-robust calculation (the MDL-censored 95% UCLs) are used in the risk assessment.

7.2.2 River OU

Tables I-18 and I-19 in Appendix I present the data statistics for the Random Forebay and Downstream, respectively. For all analytes except PCB congeners, the tables are identical to those for the Upland OU, and provide the following statistics for data with at least two detected results: number of samples, number of detections, mean of detections, median of detections, maximum detected value, and 95% UCLs (if there are at least eight samples) censored at both the MDL and MRL for non-detects.

For PCB congeners, the tables provide the following statistics for data with at least two detections: number of samples, number of detections (not non-detect or EMPC-qualified), mean of detections, median of detections, maximum detected value, and 95% UCLs censoring non-detects at the RDL and EMPC-qualified data at the reported value. Since MDLs and MRLs are not available for the congener data, there is only on 95% UCL calculation.

In the River OU, the majority of calculated 95% UCLs (for non-congener data sets) are identical or differ by less than 10% for both data censored at the MDLs and those censored at the MRLs, with the following exceptions:

Random Forebay

- Sediment
    - PCBs – The MDL-censored 95% UCL is **greater** than MRL-censored 95% UCL by about 76% for Total PCBs as Aroclors.
    - SVOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 10 to 74% nine SVOCs and Total HPAHs, LPAHs, and PAHs.
- Clam
    - Metals – The MDL-censored 95% UCL is **less** than the MRL-censored 95% UCL by 42% for antimony.
    - SVOCs – MDL-censored 95% UCLs are **less** than the MRL-censored 95% UCLs by 10 to 34% for seven SVOCs.
- Crayfish
    - SVOCs – MDL-censored 95% UCLs are **less** than the MDL-censored 95% UCLs by 10 to 48% for ten SVOCs.
- Smallmouth Bass
    - Metals – The MDL-censored 95% UCL is **less** than the MRL-censored 95% UCL by about 19% for beryllium.

As for the Upland OU data sets, the 95% UCL calculation is relatively insensitive to the choice of censoring level. Based on this review, the more statistically-robust calculation (the MDL-censored 95% UCLs) are used in the risk assessments.

Table I-20 in Appendix I presents the data statistics for the Reference Area. The table provides the following statistics for data with at least two detections: number of samples, number of detections, mean of detections, median of detections, maximum detected value, and 95% upper prediction limit (UPL). These 95% UPL values are used in developing the medium-specific SLVs, as discussed in the next section.

7.3 Screening Level Values and Bioaccumulative Compounds

7.3.1 Screening Level Values

For each medium, SLVs were selected for human and ecological receptors, based on a hierarchy of sources (Appendix J, Tables J-1 through J-3). Site-specific reference concentrations were used to establish SLVs for inorganic analytes in soil and sediment, only. The SLV selection hierarchy was developed based on discussions with the USACE and DEQ during the meetings held from December to February, 2010, as documented in DSR Meeting Minutes Memorandum (URS 2010a) and River OU and Upland OU DSR Response to Comments (RTC) (URS 2010b,c). Appendix J presents the agreed-upon hierarchy of Human Health and Ecological SLVs. Tables J-4 and J-5 present the SLVs for specific human health and ecological receptors, respectively, used to identify COPCs in the HHRA (Appendix M) and CPECs in the ERA (Appendix N). Appendix also presents the SLVs (generally the more conservative of the human health and ecological SLVs, unless only one is applicable) used for identifying preliminary COPCs for discussion of nature and extent of contamination (Section 9.0).

7.3.2 Identification of Bioaccumulative Compounds

In addition to selecting appropriate SLVs, bioaccumulative compounds were also identified. Bioaccumulation is a phenomenon in which concentrations of chemicals accumulate in biological tissues through exposure to environmental concentrations, which results from processes of preferential uptake and retention in adipose and organ tissues. Bioaccumulation occurs as living organisms retain and concentrate chemicals both directly from their surrounding environment (i.e., from soil or water) and indirectly from media that transfer chemicals into dietary components, such as plant or animal tissues. Biomagnification is a form of bioaccumulation in which the concentration of a chemical in a higher trophic level organism (e.g., bird, mammal, reptile, or human) is greater than the concentration in the food that this organism consumes.

Bioaccumulation and biomagnification are of primary interest in RAs because of the potential for chemical transfer through the food web, as people and top-level predatory species consume food that may have high tissue residues of bioaccumulative chemicals. Thus, even though the people or predatory biota are not directly exposed to chemicals in soil or water, they may still be adversely affected because of their indirect exposure to these chemicals through consumption of fish, shellfish, or other food items.

Hunting is prohibited on Bradford Island. Therefore, in the Upland OU only ecological receptors may be potentially exposed to bioaccumulative compounds via the consumption of prey items that may have accumulated site COIs in their tissues. In contrast, fishing is not only allowed by commonly takes place in the River OU. Therefore, both human and ecological receptors may be potentially exposed to bioaccumulative compounds via the consumption of aquatic food items.

In support of the RAs, bioaccumulative compounds were identified for both the Upland and River OUs by examining multiple lines of evidence, as follows:

- The bioaccumulation potential of nonpolar organic compounds is generally related to their hydrophobicity or lipophilicity and is approximately estimated by their octanol-water partition coefficient (log K_{ow}). Bioaccumulative chemicals were defined as those with a log K_{ow} exceeding 3.5 (with an optimum range between 3.5 and 5.5; Suter 1993). This applies equally to organic compounds in the Upland and River OUs.
- In the River OU, inorganic compounds were identified as bioaccumulative if they had a Bioconcentration (BCF) > 300 (Suter 1993).
- In the Upland OU, inorganic compounds were identified based on bioaccumulation factors (BAFs) which are separately for earthworms, plants, or vertebrates. The Hazardous Waste Identification Rule (USEPA 1999a) recognizes compounds as having a high bioaccumulation potential if the BAF is greater than 1.0, and a medium bioaccumulation potential if the BAF is between 0.1 and 1.0. For this project, all compounds with a receptor-specific BAF > 0.1 were identified as bioaccumulative.

Compounds identified as bioaccumulative are listed in Table J-6 (Upland OU) and Table J-7 (River OU).

7.4 Data Sensitivity Analysis

In data sensitivity analysis, the goal is to evaluate the level of confidence in the low end of the reported range of concentrations with respect to its usability for the purposes of the RI. Less uncertainty is associated with the upper end of the range of reported concentrations that are well above the MDL and the MRL, i.e., well above the lowest initial calibration standard of the laboratory instrument.

Within a data set, individual data points may fall into one of three categories as they range from high to low concentrations: unqualified detections, J-flagged detections or U-flagged non-detects (Figure 7-1).

For unqualified detections, there is a high degree of confidence associated with both the identity of the analyte and its reported concentration. There is less confidence in J-flagged detections because, although the analyte has been positively identified, the reported J value is an estimated value and the true concentration may actually be as low as the MDL or as high as the MRL. The U-flagged non-detect value is understood to represent a reliable concentration limit, above which an analyte is not present.

J-flagged values represent an intermediate category of data with some associated uncertainty, in contrast to the higher level of confidence placed in unqualified detections and in U-flagged non-detects. Many analytes in the project have J-flagged data. Therefore, a data sensitivity analysis (Appendix K) was performed for analytes with a detection frequency of less than 100% (i.e., those with at least one non-detect result) and for analytes with detections below the MRL (i.e., J-flagged). The data sensitivity analysis compares the MDLs and MRLs associated with each non-detect observation (i.e., reported below the MDL), and MRLs associated with detections below the MRL (i.e., J-flagged), with the lowest analyte-specific human health and ecological SLVs (Appendix J).

There are two objectives of this analysis:

1. The first objective is to determine whether analytes that were reported as undetected in 100% of the samples could be eliminated from any further consideration as COIs.
2. The second objective is to determine the level of confidence in the EPCs used for risk assessment (i.e., maximum concentrations or 95% UCLs) for analytes in a given medium that were not detected in all samples but were detected in at least one sample (i.e., less than 100% detection frequency, and typically greater than a 5% detection frequency).

Understanding the level of confidence in meeting these two objectives is important primarily in terms of whether the uncertainties in the data quality are likely to lead to overestimation or underestimation of risk when the data are used for risk assessment purposes. By comparing the SLVs to the MDLs and MRLs, the impact of the uncertainty regarding the J-flagged data and undetected results on the use of the data for risk assessment purposes (i.e., elimination of a COI and development of an EPC) can be evaluated.

There are three potential cases, depending on where the SLV for a given analyte falls relative to the MDL and MRL

Case 1

If the SLV is higher than both the MDL and MRL for an individual non-detect observation (Figure 7-1), then there is a high level of confidence that the analyte is not present in that sample at concentrations of potential concern. If the SLV is higher than both the MDL and MRL and 100% of the samples are non-detect for that analyte, then that analyte can be eliminated as a COI with a high level of confidence. The use of J-flagged data does not limit the ability to determine whether or not an analyte is present at a level of potential concern, because the J-flagged result is constrained to be lower than the MRL, which in turn is lower than the SLV.

Case 2

If the SLV falls between the MDL and the MRL and an individual observation is reported as a J-flagged value (Figure 7-1), some uncertainty is introduced. Pertaining to the first data use objective, if a COI is eliminated as a COPC due to comparison between a J-flagged value and the SLV, this could result in an under prediction of risk. This is because the true value of that sample may be higher than the reported J-value, up to the limit of the MRL. Under this scenario, if the J-value is actually an underestimation of the true concentration, which is higher than the SLV, the COI should really be retained as a COPC.

For the second objective, if J-flagged values are included in the estimation of the EPC, this may result in an EPC that is either an underestimate or an overestimate of the true value. This uncertainty is limited by the fact that the true value of the J-flagged data in constrained to between the MDL and the MRL. The closer the reported J-flagged value is to the MDL, the greater the potential for underestimation of risk. The closer the J-flagged value is to the MRL, the greater the potential for overestimation of risk. Retaining the J-flagged values as detected concentrations follows accepted risk assessment protocols (USEPA 1989 et seq.) and minimizes the potential for underestimation of risk that would result from considering J-values as non-detects.

Case 3

If the SLV is lower than both the MDL and the MRL (Figure 7-1), then there is a limited ability to meet the first data use objective. U-flagged data are commonly interpreted as signifying the absence of an analyte at the MDL. If the MDL is higher than the SLV, then it is more difficult to assume that the analyte is not present at a concentration of concern and the level of confidence in eliminating the analyte is lower. Since the MDL is primarily influenced by the analytical and methodological technology, this type of uncertainty is not easily remedied unless more sensitive analytical methods are available and feasible for use.

Relative to the second objective, if J-flagged values are included in the estimation of the EPC, the same uncertainty in the calculated EPC exists as was discussed in Case 2. However, the potential exists for a greater underestimation of potential risk. This is because the upper and lower bounds of the true value of the J-flagged data remain the same (i.e., MRL and MDL), but the difference between the even lower SLV and the J-flagged value increases.

In this case (when an SLV is lower than both the MDL and MRL), the underestimation of risk related to elimination of a COI or estimation of the EPC is noted in the risk assessment and qualitatively discussed in the uncertainty section.

All three of these cases occur in the RI data set, as discussed in the sections below. The evaluation process is intentionally conservative because the lowest human health and ecological SLVs are used to evaluate data quality. In reality, multiple pathways and receptors are evaluated in the HRHA and ERA, some of which may have higher SLVs. Therefore, exceedance of the lowest SLV by the MDL or MRL does not mean that the non-detect values have the potential to overestimate or underestimate risks for all receptors and pathways, only the receptor-pathway combination with the lowest SLV. Therefore, for a given AOPC/OU, analyte, and media, if the MDL and/or MRL exceeds the lowest SLV, then the nature of the analyte and the magnitude of exceedance are further reviewed in the risk assessments to evaluate the significance of the exceedance and the possible impact on interpretation of results.

For each analyte in the entire data set, Tables K-1 to K-16 provide detailed analyses of the number of samples, lowest human health or ecological SLV, number of non-detects below the MDL (i.e., U-flagged values) and the number of detections between the MDL and the MRL (i.e., J-flagged values). The minimum and maximum MDLs and MRLs for the non-detect observations are listed, as well as the number of these MDLs and MRLs that are greater than the associated SLVs. Analytes for which a large proportion of the MDLs and MRLs for the non-detect observations exceed the SLV are associated with a higher level of uncertainty when the data are used for risk assessment purposes, as discussed above. The purpose of the tables is to allow for identification of every analyte for which some potential for underestimation or overestimation of risk may exist.

The information from Tables K-1 to K-16 is summarized in Tables 7-1 to 7-6. Data sets which have a larger degree of uncertainty, as a result of limited sample size or a high proportion of estimated data (i.e., the majority of the data is J-flagged) are summarized in Tables 7-1 and 7-2. These tables provide a summary of the detected analytes for which more than 50% of the detected concentrations consists of J-flagged results, and further highlight those analytes in the Upland and River OU data sets for which the MRL exceeded the lowest human health or ecological SLV. The inclusion of these analytes and their associated J-flagged values in the RI process indicates that there is a potential for overestimation of risk if the true value is higher than the SLV and a potential for underestimation of risk if the true value is lower than the SLV.

Table 7-3 summarizes the analytes that were never detected (100% non-detect) or sometimes detected (<100% non-detect) whose MDLs exceeded the lowest human health or ecological SLV. The elimination of the 100% non-detect analytes with elevated MDLs as COPCs is subject to an unavoidable potential for underestimation of risk since they cannot be conclusively shown to be absent at concentrations of concern. However, there is less potential for underestimation of risk related to the analytes that were sometimes detected because the estimation of the EPC for these analytes by the Kaplan-Meyer method takes the absolute value of the MDL into consideration by including these MDLs in the concentration ranking for that analyte when the UCL uses the MDL as the censoring limit.

Table 7-4 summarizes the analytes that were never detected (100% non-detect) or sometimes detected (<100% non-detect) in the Upland and River OU data sets for which either human health or ecological SLVs were not available. This represents a different type of uncertainty that is not related to analytical data quality but is relevant to the risk assessment process. The lack of SLVs indicates an absence of reliable toxicological information for the evaluation of the chemicals. Analytes that were never detected are eliminated as COPCs even if no SLVs are available and this may result in a potential for underestimation of risk. However, all analytes without SLVs (detected and non-detected) are discussed qualitatively in the Uncertainty Assessment sections of the risk assessments.

Tables 7-5 and 7-6 provide the same information as Tables 7-3 and 7-4, but for the River OU dataset.

7.4.1 Upland OU AOPCs

The following datasets were considered in the Upland OU data sensitivity analysis:

- Landfill: soil, groundwater, and seep water, and surface water
- Sandblast Area: soil, groundwater, and soil gas (human health only)
- Pistol Range: soil and groundwater (lagoon sediments were not evaluated because all of the analyzed COIs were 100% detected).
- Bulb Slope: soil

7.4.1.1 Human Health Sensitivity Analysis

Analytes with J-flagged Data with SLVs

Tables K-1, K-2, K-3, and K-4 in Attachment K present the results of the human health sensitivity analysis for the Landfill, Sandblast Area, Pistol Range, and Bulb Slope AOPCs, respectively. As summarized in Table 7-1, more than 50% of the detected results were J-flagged for a few metals and several VOCs, SVOCs, and pesticides for the soil and water media. However, few of these analytes had MRLs that exceeded the lowest human health SLV. Thus the potential for underestimation or overestimation of risks (within the bounds of the MDL and the MRL) is limited to a few analytes (e.g., thallium and dibenz(a,h)anthracene in soil) and this uncertainty is mitigated to the extent possible by including the J-flagged data in estimating the EPCs.

Analytes with U-flagged Data with SLVs

As summarized in Table 7-3, the analytes that were never detected in upland media and also had MDLs that were higher than the lowest human health SLV included primarily several VOCs in soils, and VOCs, SVOCs and pesticides in water media. The larger number of analytes listed for groundwater is mainly due to the very low SLVs for water. Elimination of these chemicals as COPCs may have the potential to underestimate risk. Among the analytes that were sometimes detected, there are far fewer analytes whose MDLs exceed the SLVs, although again there are more exceeded analytes for water media. Use of the MDL to censor the undetected data in the EPC estimation method minimizes the potential for underestimation of risk to the extent possible.

Analytes without SLVs

As summarized in Table 7-4, analytes that were never detected in a given medium in the Upland OU and also do not have human health SLVs are primarily several VOCs in soil and water media. Elimination of these analytes as COPCs may underestimate risk, as discussed further in the Uncertainty Assessment of the HHRA. The list of analytes that were sometimes detected and do not have human health SLVs is much smaller and includes two SVOCs (n-butylbenzene and sec-butylbenzene) in soil and ethanol in soil gas. These analytes were also retained as COPCs and discussed qualitatively in the Uncertainty Assessment, as well as analytes that were detected but do not have SLVs (Section 11.0).

7.4.1.2 Ecological Sensitivity Analysis

Analytes with J-flagged Data with SLVs

Tables K-5, K-6, K-7, and K-8 in Attachment K present the results of the ecological sensitivity analysis for the Landfill, Sandblast Area, Pistol Range, and Bulb Slope AOPCs, respectively. As discussed in Section 7.4.1.1, more than 50% of the detected results were J-flagged for a few metals and several VOCs, SVOCs and pesticides for the soil and water media (Table 7-1). However, far fewer of these analytes had MRLs that exceed the lowest ecological SLV. Thus, the potential for underestimation or overestimation of risks (within the bounds of the MDL and the MRL) is limited to these analytes and the uncertainty is mitigated to the extent possible by including the J-flagged data in estimating the EPCs.

Analytes with U-flagged Data with SLVs

As summarized in Table 7-3, the analytes that were never detected in Upland soil and also had MDLs that were higher than the lowest ecological SLV primarily included one metal (antimony) several pesticides, herbicides, and VOCs, and a few SVOCs. For water, these analytes included a few dissolved metals, and several pesticides, herbicides, VOCs, and SVOCs (including PAHs). The larger number of analytes listed for groundwater is mainly due to the very low SLVs for water. Many of these non-detect analytes with MDLs above the ecological SLVs are associated with the Landfill, due to the higher total number of samples and total number of analytes that originate from historical sampling events (older analytical methods). Elimination of these chemicals as CPECs may have the potential to underestimate risk.

Among the analytes that were sometimes detected, there are far fewer analytes whose MDLs exceed the SLV, with the exception of soils (0 to 1 and 0 to 3 feet bgs) from the Sandblast Area AOPC. Use of the MDL in the EPC estimation method minimizes the potential for underestimation of risk to the extent possible.

Analytes without SLVs

As summarized in Table 7-4, analytes that were never detected in a given medium in the Upland OU and also do not have ecological SLVs include several herbicides, VOCs, and SVOCs in soil and water media. Elimination of these analytes as CPECs may underestimate risk and is discussed further in the Uncertainty Assessment of the ERA. The list of analytes that were sometimes detected and do not have ecological SLVs is much smaller and includes TPH mixtures and one SVOC (n-butylbenzene). These analytes were retained as CPECs and discussed qualitatively in the Uncertainty Assessment of the ERA, as well as analytes that were detected but do not have SLVs (Section 12.0).

7.4.2 River OU

The following data sets were considered in the River OU data sensitivity analysis:

- Pre-Sediment Removal Forebay: sediment and clam (ecological only)
- Random Forebay: sediment, clam (ecological only), crayfish, sculpin (ecological only), large-scale sucker, and smallmouth bass
- Targeted Forebay: Eagle Creek sediment & Goose Island sediment, clam (ecological only), and crayfish
- Downstream: sediment

The major findings of the sensitivity analysis are discussed below.

7.4.2.1 Human Health Sensitivity Analysis

Analytes with J-flagged Data with SLVs

Tables K-9, K-10, K-11, and K-12 in Attachment K present the results of the human health sensitivity analysis for the Pre-Sediment Removal Forebay, Random Forebay, Targeted Forebay, and Downstream, respectively. The results are also summarized in Table 7-2. Similar to the Upland data, analytes with more than 50% J-flagged data are primarily SVOCs, TPH, a few Aroclors and a very few metals. Only a very few of these analytes, however, had SLVs that were lower than the MRLs (e.g., none in clam, Aroclor 1254 in sediment).

Analytes with U-Flagged Data with SLVs

As summarized in Table 7-5, the analytes that were never detected in River OU media and also had MDLs that were higher than the lowest human health SLV are primarily Aroclors in sediment, crayfish, large-scale sucker and smallmouth bass and a few metals in water. Although these analytes are eliminated as COPCs, PCBs are further evaluated using the more sensitive congener-based data for both COPC selection and EPC estimation. Therefore, the potential for underestimation risk related to Aroclors is minimized. The same is true for analytes that were sometimes detected with MDLs greater than the SLVs since these are also limited primarily to Aroclors and B2EHP.

Analytes without SLVs

As summarized in Table 7-6, analytes that were never or sometimes detected in a given medium in the River OU and also do not have human health SLVs are primarily a few SVOCs such as phthalate compounds, carbazole and p-cresol. Elimination of these analytes as COPCs may underestimate risk and is discussed further in the Uncertainty Assessment of the HHRA, as well as analytes that were detected but do not have SLVs (presented in the HHRA screening tables in Section 11.0).

7.4.2.2 Ecological Sensitivity Analysis

Analytes with J-flagged Data with SLVs

Tables K-13, K-14, K-15, and K-16 in Attachment K present the results of the ecological sensitivity analysis for the Pre-Sediment Removal Forebay, Random Forebay, Targeted Forebay, and Downstream, respectively. The results are also summarized in Table 7-2. As discussed in Section 7.4.2.1, more than 50% of the detected results were J-flagged for several SVOCs, two TPH mixtures, two Aroclors (1242 and 1254) and a very few metals. Only a few of these analytes, however, had MRLs that were higher than the ecological SLVs, including a couple of PAHs and Aroclor 1254 in sediment, B2EHP in bass tissue, and dissolved cadmium in surface water.

Analytes with U-Flagged Data with SLVs

As summarized in Table 7-5, the analytes that were never detected in River OU media and also had MDLs that were higher than the lowest ecological SLVs are limited to Aroclors in sediment, clams, sculpin, and smallmouth bass. Although these analytes are eliminated as CPECs, PCBs are further evaluated using the more sensitive congener-based data for the CPEC selection process. Therefore, the potential for underestimation risk related to PCBs is minimized.

Analytes that were sometimes detected and have MDLs higher than the ecological SLV include Aroclors in sediment, clams, sculpin, and smallmouth bass (and B2EHP in bass), and dissolved cadmium and total aluminum in water. Use of the MDL in the EPC estimation method for these analytes minimizes the potential for underestimation of risk to the extent possible.

Analytes without SLVs

As summarized in Table 7-6, analytes that were never or sometimes detected in a given medium in the River OU and also do not have ecological SLVs include a few metals (antimony, beryllium, and chromium) and a couple of SVOCs (carbazole and p-cresol) in tissue, and TPH in sediment and water. Elimination of these analytes as CPECs may underestimate risk and is discussed further in the Uncertainty Assessment of the ERA, as well as analytes that were detected but do not have SLVs (Section 12.0).

7.4.3 Data Sensitivity Analysis Summary

In summary, the data quality analysis evaluated the quality of analytical data for RI use with respect to three attributes for each analyte: sample size, J-flagged data, MDLs and MRLs with respect to SLVs, and analytes without SLVs. Overall, sample sizes for each analyte are considered to be sufficient for their intended uses since they meet the minimum required sample size for statistical evaluation or are clearly designated as targeted samples collected for non-statistical use. Eight samples is the minimum necessary to calculate a 95% UCL as the EPC, and 14 samples is the minimum desired for the population-to-population statistical comparison to identify COIs that are above Reference concentrations with the desired level of confidence. Limited sample sizes were noted for some analytes in samples intended for these statistical analyses. The maximum detected concentration was used to represent the EPC for analytes with fewer than eight samples and represents the best effort to avoid underestimation of risk. Analytes for which at least 14 samples are not available were not included in the statistical comparison, and a qualitative comparison to Reference concentrations was performed.

The use of J-flagged data and the fact that some SLVs are lower than analytical MDLs and MRLs both result in some potential for under prediction of risk but, but this uncertainty is mitigated to the extent possible by the risk assessment methodology. The treatment of analytes without SLVs may also have the potential to under predict risk, but these analytes and media are evaluated qualitatively in the risk assessments.

8.0 COMPARISON OF SITE DATA TO REFERENCE AREA DATA

This chapter, along with Appendix L, compares site data to reference area data for both the Upland and River OUs. Both organic and inorganic analytes are included. The objective is to determine which analytes measured in site media have concentrations that are elevated relative to the reference areas, and, thus, potentially attributable to the site, and which have concentrations that are indistinguishable from more widespread conditions, which are likely due to other sources not related to the site. With the exception of inorganic constituents, these results are not used for developing screening levels, or performing the screening level risk assessments.

8.1 Statistical Comparison Methods

The statistical evaluations involved the comparison of two independent data sets. In each case, statistical methods were used to compare each investigation data set to the corresponding reference data set, to determine if an analyte’s concentrations were present in the site at a level significantly greater than that of the appropriate reference area. This approach is commonly known as a population-to-population comparison, and the results of this evaluation process determine whether the mean site values were statistically greater than the mean reference area values.

For this study, the hypothesis testing methods described in the USEPA guidance document *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (USEPA 2002a) and the Navy guidance document titled *Procedural Guidance for Statistically Analyzing Environmental Background Data* (Southwest Division [SWDIV] and EFA WEST 1998) were used.

Hypothesis testing refers to a category of statistical analysis methods that are used to choose between two competing statements or hypotheses. One is called the null hypothesis, denoted by H_0, and the other is called the alternative hypothesis, denoted by H_A. The null hypothesis is the baseline condition that is assumed to be true in the absence of any data. If the data provide sufficiently strong evidence contrary to the null hypothesis, the null hypothesis is rejected and the alternative hypothesis accepted. If the data do not provide sufficiently strong evidence, the null hypothesis is not rejected. However, this lack of strong evidence does not necessarily mean that the null hypothesis is true; it only means that the available data are not sufficient to prove the alternative hypothesis. If the null hypothesis is not rejected, it is important to check the power of the test, which is defined as the probability that the test would be able to detect a specified minimum true difference from the condition defined by the null hypothesis. If the power of the test is sufficiently large, and the null hypothesis is not rejected, one could say with a high degree of confidence that no change has occurred in the condition defined by the null hypothesis.

For the comparison between the site data and the reference area data, the hypothesis testing was set up as follows:

Null hypothesis, H_0: The mean concentration in the site data set was less than or equal to the mean concentration in the reference area data set.

Alternative hypothesis, H_A: The mean concentration in the site data set was greater than the mean concentration in the reference area data set.

The appropriate statistical test was selected based on the percentage of non-detects within a given pair of data sets and the distribution of the data in the data sets. If all values in both data sets for a given analyte were detects, the Shapiro-Wilk W test at a 5% significance level was used to evaluate the distributions of values in each data set (i.e., to determine if raw values or log-transformed values were normally distributed). If the data sets were neither (both) normal nor (both) lognormal, then a non-parametric Wilcoxon Rank Sum test was performed. If both data sets fitted a normal or lognormal distribution, then the Student's *t*-test was used for the evaluation. Depending on the calculated variances of the data sets for each analyte, either the form for equal variances or unequal variances was used to compare the two data sets.

If detectable values were present in at least one of the data sets, but not all concentrations were detectable, the Wilcoxon Rank Sum test was used to compute non-parametric estimates for the comparison with all non-detects censored at the median MDL/MRL (i.e., the median value of various different MDLs/MRLs for the combination of the site and reference area data sets). The effect of this censoring was to establish a minimum "cut-off" value or a common "bottom line," such that below which no data (detected or undetected) could fall, and thus a statistical comparison is plausible given the various data sets might have different censoring levels. In reviewing the population-to-population comparisons, it is important to remember that all detected data (in either the site or the reference area) which were below the cut-off value were "reset" to that cut-off value. In cases where a large percentage of detected data were reset to a higher cut-off value, the population-to-population comparison had limited power to reject the null hypothesis (i.e., to conclude the site data had a higher mean concentration than the reference area data). In these cases, other numerical or graphical tools, such as box-and-whisker plots, were used for additional evaluation.

All statistical comparisons were performed twice, once using the median MDL (of both populations combined) as the lower cut-off value for the population-to-population comparisons and once using the median MRL (of both populations combined) as the lower cut-off value. The results are presented in Appendix L. In each table, the selected test is listed under the column "Appropriate Statistical Test." A significance level (α) of 5% was used for all statistical tests, and the comparison result was presented in the form of a "Yes" or "No" answer to the question, "Is the mean Site concentration significantly higher than the mean Reference Area concentration?" If more than 90% non-detects were present in one or both data sets, the Contingency Table Analysis method was used in the evaluation, which is a comparison to determine significant differences between the detection frequencies in the site and the reference area data sets.

If the null hypothesis was not rejected (i.e., the answer was "No" to the question, "Is the mean site concentration significantly higher than the mean reference area concentration?"), a further assessment was made to evaluate the minimum detectable differences (MDDs) for which the statistical comparison could be achieved. In other words, the MDD was the minimum required "separation" between the true means of the site and reference area data for the statistical test to be able to conclude that a significant difference existed at a 95% confidence level (or false rejection rate, α=0.05) and 80% power of detection (or false acceptance rate, β=0.2).

If the null hypothesis was rejected (i.e., the answer was "Yes" to the question, "Is the mean site concentration significantly higher than the mean reference area concentration?"), there was no need to evaluate the power of the statistical comparison, because the sample data had provided evidence at the specified level of confidence that the mean site concentration was significantly higher than the mean reference area concentration. The power analysis was not performed for data sets in which all samples were non-detects or for comparisons using the Contingency Table Analysis method.

The MDD depended on the pooled standard deviation of the reference area and AOPC data, and this pooled standard deviation. The calculation of the MDD for non-parametric tests is generally complicated. For simplicity, the calculation of the MDD was based on normal distribution theory, as an approximation, for all analytes in this evaluation. The calculated MDD was then expressed as a percentage of the mean of the reference area data. For example, if this percentage was 20%, one would interpret it as follows: if the true AOPC mean were 20% higher than the true reference area mean, the statistical test would be able to conclude that the AOPC concentrations were significantly higher, given the designed confidence level and power of detection.

The goal established in the RI/FS MP for statistical power associated with the background comparison power was achieved (i.e., to detect “one-standard-deviation-away”). However, for some Upland soils, this one-standard-deviation is high due to the high data variability, which could not be controlled because of the inherent heterogeneity of the Upland soils. As an artifact of this high data variability, MDDs greater than 100% of the reference mean were calculated for several metals in soil of the Landfill, Sandblast Area, and the four combined AOPCs (Table L-1 in Appendix L). Although the null hypothesis was not rejected, the statistical power to detect substantial differences between the site and Reference Area datasets for metals with MDDs greater than 100% of the reference mean might be limited. These metals are identified in Section 8.2.1, and the measures taken to address the uncertainty introduced in the background comparison for these metals are also described. Data variability for all metals in other datasets subjected to the statistical background comparison, i.e., sediment and tissue samples from the River, were low and the MDDs were generally well within acceptable range. The exception to this statement is lead in crayfish and chromium in bass, which are discussed in Section 8.3.1.

To address the limitation of the statistical methodology for data sets with large numbers of non-detects, all comparisons also included an examination of the data distributions using box-and-whisker plots. These plots are also included in Appendix L. For each population, the box-and-whisker plots used boxes to show the 25th percentile, median, and 75th percentile, along with whiskers extending to the outermost data point that falls within the distances computed as: (a) 25th percentile minus 1.5 times of interquartile range, and (b) 75th percentile plus 1.5 times of interquartile range. The actual data points were superimposed but jittered, with different symbols for detected and un-detected data. Examination of the box-and-whisker plots allowed for the identification of data sets in which the analyte concentrations in the site data were clearly higher than the reference area concentrations, even when the population-to-population comparisons were inconclusive.

8.2 Upland OU

The following data were collected from the Upland OU Reference Area:

- Metals and PAHs in soil (14 samples)
- Metals in groundwater (4 quarters of samples from one monitoring well)
- Organics in groundwater (1 sample from one monitoring well)

8.2.1 Soil

Reference Area soil samples were collected from the 0-1 ft bgs depth interval. The very rocky nature of the undeveloped areas of Bradford Island precluded the collection of deeper samples. However, the geologic setting and (geologically) recent formation of the island are consistent with a uniform composition of reference area soils. The population of Reference Area soil data was compared independently to soil data from each of the three depth intervals (0-1 ft bgs, 0-3 ft bgs, and 0-10 ft bgs) of each AOPC to be used in the RAs. It was recognized that the combined false positive rate for all three depth intervals was likely to be greater than 5%. However, since the decision rule was based on individual exposure area (e.g., whether a specific depth interval within a given AOPC was above or below background), a more conservative approach of using 95% confidence level (5% significance level) was used in the hypothesis testing.

Reference Area soils were analyzed for metals and PAHs (Table 6-5). There were sufficient reference soil data to perform a statistical evaluation to assess whether the mean COI concentrations in soil within each AOPC, as well as the mean soil COI concentrations for all four AOPCs combined, were significantly higher than the mean Reference Area concentrations.

Tables L-1 and L-2 (in Appendix L) present the statistical population-to-population comparison between the Reference Area data and the data from each of the Upland AOPCs, as well as the combined data set which included soil data from all four AOPCs. Figures L-1a through L-1u present the corresponding box-and-whisker plots for each of the comparisons.

For some of the metals (particularly antimony, mercury, and silver), a portion of historic Site data had elevated detection limits (both MDLs and MRLs), relative to the Reference Area data which were collected more recently. Because the median MDL or MRL was the cut-off value for both detected and undetected data, these elevated MDLs/MRLs limited the power of the statistical tests to reject the null hypothesis (i.e., to conclude the Site AOPC data had a higher mean concentration than the Reference Area data). In these cases, the box-and-whisker plots were examined and a conservative determination was made to retain some of these metals as having higher concentrations in the Site data. These metals were marked and footnoted in Table 8-1, which summarizes those analytes for which site soil concentrations were significantly higher than the Reference Area soil concentrations. This table lists analytes for which the statistical evaluations using the MDL, MRL, or both indicated significantly higher Site concentrations.

As discussed in Section 8.1, MDDs greater than 100% of the reference mean were assessed for several metals in soil of the Landfill, Sandblast Area, and the four combined AOPCs (Table L-1 in Appendix L). Although the results of the statistical background comparison indicated that concentrations of these metals were present below or equal to that of the Reference Area levels, and therefore these metals were not carried to the SLV comparison step, the high MDDs (greater than 100% of the reference mean) present an uncertainty with this finding. These metals include the following:

Landfill

- 0 to 1 foot bgs – arsenic, chromium, copper, and nickel
- 0 to 3 feet bgs – chromium, copper, magnesium, and nickel
- 0 to 10 feet bgs – arsenic, chromium, copper, magnesium

Sandblast Area

- 0 to 1 foot bgs, 0 to 3 feet bgs, and 0 to 10 feet bgs – copper, magnesium, and mercury

Four Combined AOPCs

- 0 to 1 foot bgs, 0 to 3 feet bgs, and 0 to 10 feet bgs – copper, and magnesium

To address the uncertainty with the results of the statistical background comparison, these metals were subjected to a risk-based screening evaluation in Appendix O. The purpose of this evaluation is to explore whether or not these metals should be included as COPCs, and ultimately advanced to the next level of risk assessment or directly to the FS. A weight-of-evidence approach similar to the one implemented in Sections 11 and 12 (screening level risk assessments) was used to evaluate these metals, as described in Appendix O.

With the exception of a single PAH (acenaphthylene) in the 0-1 ft bgs interval in the Landfill AOPC, the statistical comparisons concluded that all PAHs were detected at higher concentrations in Upland OU site soils than in Reference Area soils (Tables L-1 and L-2). Further examination of the single exception revealed that acenaphthylene was only detected in a single sample in the Reference Area, and thus, the Contingency Table Analysis was used in the statistical comparison. This method is less powerful to detect differences, especially when the MDLs and MRLs were quite different for the two data sets. Examination of the box-and-whisker plots for this analyte confirmed that there was not sufficient data to conclude that the concentrations were not statistically higher in the site data. No other organic compounds were analyzed for in the Reference Area soils.

8.2.2 Groundwater and Seep Water

There were insufficient groundwater data to perform statistical comparisons between the Site and Reference Area data. Therefore the groundwater data were evaluated by comparing the range of analyte concentrations observed in groundwater samples from monitoring wells in the Landfill and Sandblast Area AOPCs with the range of concentrations observed in the Reference Area monitoring well (MW-10).

Table L-3 shows the results of this comparison. The table also lists the range of concentrations observed in the seep samples collected along the perimeter of the Landfill AOPC, and compares those with concentrations observed in the Reference Area monitoring well. Not all analytes were measured in the Reference Area monitoring well. For those analytes that were measured, groundwater concentrations at the AOPCs, appeared to exceed Reference Area groundwater concentrations for most COIs. The results are summarized in Table 8-2.

At the Landfill AOPC, COI concentrations in seep water were generally lower than concentrations observed in groundwater, and fewer analytes exceeded the corresponding Reference Area groundwater concentrations. Arsenic, barium, copper, iron, lead, mercury, selenium, diesel range organics (DRO), residual range organics (RRO), chloroform and PCE were the only analytes for which seep water concentrations exceeded Reference Area concentrations (Table 8-2).

8.3 River OU

The following data were collected from the River OU Reference Area:

- Metals and organics in sediment (18 samples)
- Metals and organics in clams (18 samples)
- Metals and organics in crayfish (19 samples, except SVOCs which only have 18 samples)
- Selected metals and PCBs in sculpin (18 samples)
- Metals and organics in smallmouth bass (19 samples)
- Metals and organics in surface water (5 samples)

These data were compared to the random Forebay data sets, the targeted Forebay samples, and the Downstream sediment samples. In addition, soils potentially subject to mass wasting or erosion from the Upland OU (in the Landfill, Sandblast Area, and Bulb Slope AOPCs) may be transported to the River OU. Therefore, these soils were compared to both Upland Reference Area soil data and River Reference Area sediment data to evaluate the potential for these Upland OU soils to impact the River OU should they be transported into the river.

8.3.1 Forebay Random Samples

By design, sufficient sediment, clam, crayfish, sculpin, and smallmouth bass samples were collected from the upstream Reference Area to allow for a robust statistical comparison to the Forebay random data sets. The Reference Area samples were analyzed for the same suite of analytes as the Forebay samples.

Tables L-4 and L-5 (in Appendix L) present the statistical population-to-population comparisons between the Forebay random data set and the Reference Area data set for the sediment and tissue non-congener data. As with the Upland OU data, the statistical comparisons were performed twice, once censoring non-detect data at the median MDL and once censoring the non-detect data at the median MRL. Table L-6 presents the statistical population-to-population comparisons for the congener data. Since MDLs and MRLs are not available for the congener data, the statistical comparisons were performed only once, with non-detect data censored at the RDL and the EMPC-qualified data censored at the full reported value. Figures L-2 through L-6 present box-and-whisker plots for each of the statistical comparisons, for sediment, clams, crayfish, sculpin, and smallmouth bass, respectively.

The population-to-population comparisons were not conducted for every congener. Instead, the comparisons were carried out for the twelve dioxin-like congeners, and for the sum of 209 congeners. If concentrations of any of the dioxin-like congeners were found to be significantly higher in the Forebay, then concentrations of any of the other individual congeners which were not evaluated could be considered potentially higher in the Forebay. The statistical comparison of total PCBs (as sum of 209 congeners) was conducted separately, and the calculation of the sum of 209 congeners was based on the K-M method.

Table 8-3 summarizes those analytes for which Forebay sediment and tissue concentrations were significantly higher than the Reference Area concentrations. Censoring non-detect data at the MRLs (rather than the lower MDLs) generally reduced the ability of the statistical test to differentiate between the Forebay and the Reference Area data sets, and rendered it more likely that the test would conclude that concentrations in the Forebay were not significantly higher than that in the Reference Area. Therefore, the conservative approach was taken, and analytes were listed in Table 8-3 even if only the MDL-censored data set led to the conclusion that the Forebay concentrations were significantly higher.

As discussed in Section 8.1, MDDs greater than 100% of the reference mean were assessed for lead in crayfish and chromium in bass (Table L-4 in Appendix L). Although the results of the statistical background comparison indicated that concentrations of these metals were present below or equal to that of the Reference Area levels, and therefore these metals were not carried to SLV comparison step, the high MDDs (greater than 100% of the reference mean) present an uncertainty with this finding. To address this uncertainty, lead in crayfish and chromium in bass were subjected to a risk-based screening evaluation in Appendix O. The purpose of this evaluation is to explore whether or not these metals should be included as COPCs, and ultimately advanced to the next level of risk assessment or directly to the FS. A weight-of-evidence approach similar to the one implemented in Sections 11 and 12 (screening level risk assessments) was used to evaluate these metals, as described in Appendix O.

There were insufficient surface water samples to perform statistical comparisons between the Forebay and Reference Area data. Therefore box-and-whisker plots were used to compare the surface water total concentrations (unfiltered grab samples and the sum of filter plus column for XAD samples) from the Forebay with those observed in the Reference Area. These results are presented in Figures L-7a through L-7f. Table 8-4 summarizes those analytes for which Forebay total surface water concentrations appeared to be higher than Reference Area total surface water concentrations, based on the available data set.

Each of the Forebay media are discussed individually, below.

Sediment

Population-to-population statistical comparisons showed that for all metals, concentrations observed in the 19 random Forebay sediment samples were not significantly higher than the concentrations observed in the 18 random Reference Area samples (Table 8-3). Similarly, none of the PAHs had sediment concentrations which were significantly higher in the Forebay than in the Reference Area. Neither DRO, nor Aroclor 1254 (the only Aroclor detected) concentrations were significantly higher in the Forebay than in the Reference Area. The only compounds which were shown to be higher in the Forebay, with a statistically significant level of confidence were RRO and several of the dioxin-like congeners. Interestingly, the concentration of total PCBs (as congeners) was not significantly higher in the Forebay than in the Reference Area (Table 8-3 and Figures L-2a through L-2g). These conclusions were identical, whether the non-detect data were censored at the MDLs (Table L-4) or the MRLs (Table L-5).

Clams

The results of population-to-population statistical comparisons between the random Forebay and Reference Area clam data are summarized in Table 8-3. In clams, beryllium and cadmium were the only inorganic analytes for which random Forebay concentrations were significantly higher than Reference Area concentrations. Among the organics, concentrations of acenaphthene, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, pyrene, and selected dioxin-like congeners were also significantly higher in the Forebay. Concentration of total PCBs (as congeners) in clam tissue was not significantly higher in the Forebay than in the Reference Area (Table 8-3). The only difference in the conclusions when the population-to-population comparisons censored non-detect data at the MRLs, versus the MDLs, was that beryllium was no longer significantly higher in the Forebay clam when the MRLs were used for censoring (compare Tables L-4 and L-5 and Figures L-3a through L-3g).

Crayfish

In crayfish, antimony, arsenic, chromium, mercury, methyl mercury, and nickel concentrations were significantly higher in the random Forebay samples than the River Reference Area samples, whether the undetected results were censored at the MDLs or the MRLs (Tables L-4 and L-5). Among PAHs, acenaphthene, benzo(a)anthracene, benzo(g,h,i)perylene, fluoranthene, phenanthrene, and pyrene were found to be significantly higher in the Forebay when the MDLs were used to censor the non-detect data. When MRL-censoring was used, the ability of the statistical test to differentiate between the Forebay and Reference Area populations was significantly reduced (compare Tables L-4 and L-5 and Figures L-4a through L-4g). Concentrations of individual dioxin-like congeners, as well as total PCBs (as congeners) were significantly higher in the Forebay crayfish than in the Reference Area crayfish. These results are summarized on Table 8-3.

Sculpin

Due to insufficient sample volumes, the sculpin were only analyzed for four metals and PCBs. Among those metals analyzed, cadmium, lead, and mercury concentrations were significantly higher in the Forebay sculpin than in the Reference Area sculpin (Table 8-2 and Figure L-5a). Aroclor 1254 (the only Aroclor detected) concentrations were no higher in the Forebay than in the Reference Area, but the power of this conclusion was limited by the fact that Aroclors were detected in only a few samples (Tables L-4 and L-5 and Figures L-5b). In contrast, when the more sensitive PCB congener analysis was used and the detection rate increased, the population-to-population statistical tests had sufficient power to conclude that concentrations of individual dioxin-like congeners, as well as total PCBs (as congeners) were significantly higher in the Forebay than in the Reference Area (Table L-6, and Figure L-5c). These conclusions were identical, whether the non-detect data were censored at the MDLs (Table L-4) or the MRLs (Table L-5).

Smallmouth Bass

The results of population-to-population statistical comparisons between the random Forebay and River Reference Area smallmouth bass data are also summarized in Table 8-3; the box-and-whisker plots are provided in Figures L-6a through L-6g. For smallmouth bass, aluminum, barium, copper, mercury, and zinc concentrations were significantly higher in the random Forebay than the Reference Area. Anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene were found to be significantly higher in the Forebay when the MDLs were used to censor the non-detect data. Aroclors 1242 and 1254 were detected, but the limited number of detections resulted in the conclusion that the Forebay concentrations were no higher than the Reference Area concentrations (Tables L-4 and L-5). An examination of the box-and-whisker plots (Figures L-6e) revealed that Aroclor concentrations were higher in the Forebay smallmouth bass. This was confirmed with the more robust data set afforded by the congener analysis. Concentrations of all of the dioxin-like congeners, as well as total PCBs (as congeners), were significantly higher in the Forebay than the Reference Area (Table L-6 and Figure L-6f). Additionally, B2EHP was found to have statistically higher concentrations in Forebay smallmouth bass than in Reference Area smallmouth bass – although there was no statistical difference found for this analyte in any of the other media (Table 8-3). These conclusions were identical, whether the non-detect data is censored at the MDLs (Table L-4) or the MRLs (Table L-5).

Surface Water

The sample size (five each in the Forebay and Reference Area) was too small for statistical comparison, so the surface water was evaluated semi-quantitatively using box-and-whisker plots (Figures L-8a through L-8g). This analysis was performed using the total surface water concentrations (as opposed to dissolved). The results are summarized in Table 8-4.

Among the metals, the range of concentrations detected in Forebay surface water were less than the range detected in Reference Area surface water, with the exception of aluminum and barium (Figure L-7a). For each of these COIs, the detected concentration in one Forebay sample was higher than the maximum concentration detected in the Reference Area. Among the organic analytes, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, phenanthrene, a few of the dioxin-like PCB congeners, and total PCBs (and congeners) also had maximum detected Forebay concentrations which exceed the maximum Reference Area concentrations. In all cases, the magnitude of these exceedances were small, making it hard to conclusively state that concentrations of these analytes are higher in the Forebay. However, to be conservative, all are listed on Table 8-4.

8.3.2 Forebay Targeted Samples

Since the sample size for the targeted areas of the Forebay (Eagle Creek and Goose Island) were too small to allow for statistical comparisons to Reference Area samples, the concentrations observed in these targeted samples were compared to Reference Area concentrations by evaluating whether or not the concentrations observed in the targeted samples were within the range of concentrations observed in the same media in the Reference Area, and whether they fell below the 95% UPL of the reference area data. The results are presented in Table L-7, and discussed below.

Eagle Creek

The mouth of Eagle Creek was represented by only two sediment samples. Concentrations of all metals, TPHs, and phthalates were less than the range of concentrations observed in Reference area sediments. Aroclor 1248 was detected in one sample (which exceeded the undetected results from the Reference Area); congeners were not analyzed. In addition, the concentration of carbazole, anthracene, phenanthrene, chrysene, and total LPAHs exceeded the Reference Area concentrations, but only in the sample that contained Aroclor 1248 (Table L-7).

Goose Island

The Goose Island targeted samples include two sediment samples and one sample each of clam, crayfish, and sculpin. Among the metals, concentrations of antimony, cadmium, thallium, and zinc were higher in the Goose Island sediments than in Reference Area sediments. However, this was not true for the tissues. The clam sample only had one metal (beryllium) with a concentration higher than Reference Area concentrations; the crayfish sample had a higher concentration of mercury than Reference Area concentrations, and no metals were higher in the sculpin. This does not suggest a local source of metals, but instead may be indicative of natural variability.

Regarding organic analytes, concentrations of DRO, RRO, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, Aroclor 1260, selected dioxin-like PCB congeners, and total PCBs exceeded Reference Area concentrations in one or both of the sediment samples. However, in tissue, only a few PAHs were higher in the Goose Island samples than in the Reference Area. Most significantly, none of the individual PCB Aroclors or dioxin-like congeners, and none of the total PCBs (calculated as either Aroclors or congeners) had concentrations exceeding Reference Area concentrations in any of the tissues (clams, crayfish, or sculpin) (Table L-7). Again, this does not suggest a local contamination source, but may instead reflect natural variability.

8.3.3 Downstream Sediments

The objective of the downstream sampling was to determine whether or not contaminated sediments from the Forebay may have migrated and accumulated in the Downstream area and whether further sampling might be needed to assess the potential contamination.

Unlike the Forebay and Reference areas, a non-statistical sampling approach was implemented Downstream, whereby areas of the river most conducive to sedimentation were targeted for sampling (depositional areas identified by lower river velocities) in an attempt to collect from locations most likely to be impacted by Forebay sediment transport. During the post-removal in-water sampling that occurred in March 2008, sediment was collected from six Downstream locations. These samples were collected from 1,200 feet below the dam to approximately 26,500 feet (5.0 miles) downstream of the dam.

All Downstream sediment samples were analyzed for the same chemicals that were analyzed in the Forebay and Reference areas: SVOCs (including PAHs), metals, PCBs as Aroclors, TPH, and sediment quality parameters (i.e., total organic compounds [TOC] and grain size).

COI concentrations in the downstream sediment samples were compared to concentrations in Reference Area sediments to determine whether or not site-related contamination may be present downstream of the Forebay. The sample size (six samples) is too small for statistical comparison, so the population of downstream samples were compared to the reference area population using box-and-whisker plots. The results are presented in Figures L-8a through L-8g (Appendix L).

For all analyte groups, the downstream sediments concentrations appeared to be essentially indistinguishable from the Reference Area concentrations. There were a few cases where a single concentration measurement in a downstream sample might be higher than the maximum concentration measured in the Reference Area, but the overall distributions appeared to be comparable.

See Section 9.6.1, which provides an evaluation of the Downstream sediment.

8.3.4 Upland OU Soils that may be Transported to the River OU

As described in Section 4.3, the soils on the steep slopes of the Landfill and Bulb Slope AOPCs may be subject to mass wasting in which the soils would be transported to the River OU. In addition, the surface soils in a small portion of the Sandblast Area AOPC were temporarily erodible, as a result of construction activities at the AOPC in 2009. Therefore the concentrations in these erodible/mass wasting soils were compared to sediment concentrations in the River OU

Reference Area to determine whether or not the soil concentrations are significantly higher than the Reference Area sediment concentrations. This was accomplished by comparing the maximum concentration observed in the erodible soil samples to the maximum and 95% UPL of the Reference Area sediment samples (Table L-8). In general, analyte concentrations were higher in these soils than in the Reference Area sediments. The only exceptions were aluminum, antimony, barium, beryllium, and vanadium.

These erodible/mass wasting soils were also compared to Reference Area soils from the Upland OU, again by comparing the maximum concentration observed in the erodible soil samples to the maximum and 95% UPL (Table L-9). Again, the analyte concentrations were generally higher in these soils than in the Reference Area sediments. The only exceptions were aluminum, beryllium, and manganese.

9.0 NATURE AND EXTENT OF CONTAMINATION

This section describes the nature and extent of contamination associated with releases at the Bradford Island Upland and River OUs. The AOPC boundaries for each of the Upland AOPCs were developed based on historical knowledge of usage, physical parameters (e.g., the river), and site observations and investigations, including geophysical surveys of the Landfill AOPC. This section focuses on the preliminary COPCs that were identified within each AOPC or the River OU (see Section 9.1), which are potentially associated with an unacceptable risk to human and/or ecological receptors. The following essential nutrients were excluded as potential COPCs or CPECs in soil and sediment: calcium, iron, magnesium, potassium, and sodium. However, these essential nutrients were evaluated for groundwater, seep water, and surface water.

Constituents that were undetected in all samples of a given media were not evaluated in this section of the report. Instead, these undetected constituents are addressed in the data sensitivity analysis (see Section 7.4 and Appendix K). COIs that lacked SLVs are not discussed herein, but are addressed in the uncertainty sections of the HHRA and ERA.

This section includes a number of figures showing the spatial distribution of preliminary COPCs in various media. The station symbols and preliminary COPC concentrations shown in the associated text boxes have been colored to indicate whether the concentration is above the most conservative SLV (red), less than the SLV (green), undetected (black), or not analyzed (grey). Surface (0-1 foot bgs) and shallow soil (0-3 feet bgs) data were plotted together because both of these depth intervals were screened against the lower of the ecological and human health SLVs. Deeper soil (> 3 feet bgs) data were plotted on separate figures because they were only screened against human health SLVs (this soil interval is not ecologically relevant for assessment; (URS 2007a). However, during the HHRA, data from the entire depth interval (0-10 feet bgs) was evaluated for risk to human receptors.

Throughout this section, please note that PAHs are discussed separately from other SVOCs.

9.1 Identification of Preliminary COPCs

Consistent with DEQ and USEPA guidance, COIs are chemicals that are known to be present or may be present at a site (DEQ 2000; USEPA 1989, 1997a,b, and 1998). The COIs identified in environmental media in the Upland and River OUs were subjected to a multi-step screening process to identify those chemicals potentially associated with an unacceptable risk to human and/or ecological receptors, hereafter termed “preliminary COPCs.”

The multi-step screening process included an evaluation of detection frequency, comparison to background levels for inorganics, and a preliminary screening in which COI concentrations were compared against the lowest potentially-applicable SLV for human and/or ecological receptors. The nature and extent of contamination and the fate and transport of these preliminary COPCs are discussed herein and in Section 10. The final selection of COPCs and CPECs, including an evaluation of receptor specific toxicity and multiple COI toxicity, is completed in the HHRA (see Section 11 and Appendix M) and ERA (see Section 12 and Appendix N).

Relevant media, depth intervals, and EPCs for specific human and ecological receptors are discussed in the Upland and River DSRs (URS 2009d,e), DSR Meeting Minutes Memorandum (URS 2010a), River OU and Upland OU DSR RTC (URS 2010b,c), and the Area-Weighted Average Memorandum (URS 2010d). Additional information regarding relevant media and depth intervals for specific human health and ecological receptors is included in the HHRA (see Section 10 and Appendix I) and ERA (see Sections 11 and Appendix J). Please note that the preliminary COI screening utilizes the maximum detected concentration for the EPC, which is compared to the lowest of the human health and ecological SLVs, since the most conservative screening approach was desired at this point in the process.

The preliminary COI screening methodology utilized to identify the preliminary COPCs is similar to the methodology presented in the RI/FS MP (URS 2007a) and screening conducted in the Upland and OU DSRs (URS 2009d,e). However, this RI screening supersedes the DSR screenings because the data set is different (additional data are included in this RI report) and the SLVs have since been revised. The preliminary COI screening process steps vary depending on the OU, media, and contaminant group, as discussed below.

Section 8.0 compared inorganic soil, sediment, and tissue data from the Upland and River Reference Areas with site concentrations to differentiate site-related concentrations of inorganic COIs from are naturally occurring concentrations. A population-to-population statistical comparison for the Upland OU organic data was also performed by comparing the soil PAH concentrations within each AOPC and for all four AOPC combined to the Reference Area PAH concentrations. Similarly, a population-to-population statistical comparisons for organic data between the Forebay and Reference Areas of the River OU was performed. However, the results of these organic statistical comparisons were not used for the preliminary COPC identification or the identification of COPCs and CPECs in the risk assessments and are not discussed in this nature and extent of contamination section or the fate and transport section (Section 9.0). The results of the organic statistical comparisons are discussed in Section 8.0 and Appendix L.

9.1.1 Upland OU

The Upland OU data set evaluated in this section includes the historical and recent soil, lagoon sediment, groundwater, seep water and adjacent surface water, and/or soil gas from within each AOPC (see Tables 5-1 through 5-7 and Tables 6-2 through 6-4). For the Pistol Range and Bulb Slope AOPCs soil evaluations, only surface soil was evaluated (0 to 1.5 feet bgs and 0 to 1 foot bgs, respectively). As noted in the RI/FS MP, a review of historical activities and the source of contamination at the Pistol Range AOPC (bullets and casings from firing practice) are consistent only with surface impacts; therefore, deeper samples do not need to be evaluated for this AOPC. Since the Bulb Slope AOPC only has a thin layer of soil underlain by a bedrock base, there are no soils deeper than 1 feet bgs in this area and the existing surface soil data are sufficient to evaluate risk.

Each media was screened against the media-specific SLVs described above. In addition, selected soil samples were also screened against sediment SLVs as follows:

- While there is no visual evidence of current sloughing or erosion at the Landfill AOPC and minimal visual evidence of potential sloughing at the Bulb Slope AOPC, sloughing of soils from the steep slopes on the northern side of Bradford Island is possible. Therefore, all soil results in the Bulb Slope AOPC and those surface soil samples collected from the steep slope on the northern edge of the Landfill AOPC (BIL01USE through BIL09USE, BIL13SSI, and L-01 through L-04) were also screened against sediment SLVs.

- The erodibility assessment (Appendix E of URS 2009f) determined that there was the potential for soil to be eroded from a portion of the Sandblast Area AOPC and transported to the river that had been disturbed during construction activities. The subset of soil samples within the erodible area (SB-EUA, SB-EUB, SB-EUA-02, SB-EUA-04, SB-EUA-06, SB-EUA-08, SB-EUB-02, SB-EUB-03, SB-EUB-12, SB-EUB-15, and SB-04) was screened against sediment SLVs. Please note that this area has become revegetated during the past year and is no longer considered to be erodible (see Section 4.1.3).

Soil

1. *Frequency* – Within each AOPC and for all four AOPCs combined, COIs were not retained as preliminary COPCs if detected at a frequency of 5% or less with a sample size of 20 or more (Appendix I, Tables I-1 through I-5).

   Statistical Comparison Between the Reference Area and AOPCs for Inorganics Only – In Chapter 8, a statistical comparison of two independent data sets was performed between the Reference Area surface soil data set (Appendix I, Table I-6) and each of the Upland AOPC soil data sets (for each of the depth intervals; 0-1, 0-3, and/or 0-10 feet bgs). In addition, the comparison to Reference Area soils was performed for the combined data sets (including all four Upland AOPCs) for each depth interval.

   Inorganic COIs were not retained as preliminary COPCs within a given AOPC or for all four AOPCs combined if the statistical comparison indicated that the AOPC data were not significantly greater than the Reference Area data (Table 8-1 and Appendix L, Tables L-2 and L-3).

2. *SLV Screening* – COIs within each AOPC and for all four AOPCs combined were not retained as preliminary COPCs if they were detected at concentrations below the soil SLVs (Tables 9-1 through 9-5).

Potentially Erodible or Mass Wasting Soils

1. *Comparison to Reference Area Sediments for Inorganics Only* – Since the erodible soils (from 2009) and soils potentially susceptible to mass wasting may impact river media if the soils are transported to the river, the inorganic data were compared to Reference Area sediment data from the River OU. The objective of this comparison was to determine if the inorganic COI concentrations were elevated above the naturally occurring concentrations in the river (i.e., the Reference Area sediment concentrations) (Appendix L, Table L-8).
2. *SLV Screening* – COIs detected in the potentially erodible or mass wasting soil within the were not retained as preliminary COPCs for the erodibility and mass wasting pathway if they were detected at concentrations below the sediment SLVs (Table 9-6).

Lagoon Sediment

1. *Comparison to Reference Area Sediments for Inorganics Only* – The inorganic data from the Pistol Range AOPC lagoon sediments were compared to Reference Area sediment data from the River OU to determine if the concentrations were elevated above the naturally occurring concentrations in the river.

2. *SLV Screening* – COIs detected in the Pistol Range AOPC lagoon sediment were not retained as preliminary COPCs if they were detected at concentrations below the sediment SLVs (Table 9-3).

Groundwater, Seeps, and/or Surface Water

1. *Frequency* – Within each AOPC and for all four AOPCs combined, COIs were not retained if detected at a frequency of 5% or less with a sample size of 20 or more (Appendix I, Tables I-1 through I-5).
2. *Reference Area Groundwater Comparison for Inorganics Only* - For groundwater, the inorganic groundwater data for COIs within each AOPC and all four AOPCs combined were compared to the Reference Area groundwater data. The objective of this comparison was to determine if Upland OU inorganic COI concentrations were elevated above the site-specific naturally occurring levels (i.e., the Reference Area groundwater concentrations) (Table 8-2 and Appendix L, Table L-3). Inorganic COIs within each AOPC and within all four AOPCs combined were not retained as preliminary COPCs if they were detected at concentrations at or below the Reference Area groundwater data.
3. *SLV Screening* – Those COIs that were retained after step 2 (i.e., COIs with > 5% detections and concentrations > reference area concentrations) were then compared to the water SLVs. COIs within each AOPC and within all four AOPCs combined were not retained as preliminary COPCs if they were detected at concentrations below the water SLVs (Tables 9-1 through 9-5).

Soil Gas

1. *SLV Screening* – VOCs within the Sandblast AOPC were not retained as preliminary human health COPCs if they were detected at concentrations below the SLVs (Table 9-2).

Summary

Those Upland COIs not eliminated during the preliminary COI screening process were retained as preliminary COPCs and are summarized in Table 9-7. The nature and extent of preliminary COPC contamination at each AOPC within the Upland OU are presented in Sections 9.2 through 9.5. In addition, all potentially bioaccumulative COIs, which have a BAF > 0.1 or log K_{ow} > 3.5, detected in the Upland OU were further evaluated in the ERA. The Upland OU detected bioaccumulative COIs are listed in Appendix J, Table J-6.

9.1.2 River OU

Forebay Random Samples

The Forebay data set of samples from the randomly selected locations evaluated in this section includes the post-removal surface water, sediment, and tissue, as well as the pre-removal 2006 smallmouth bass. This data set does not include the Eagle Creek, Goose Island, Downstream, or pre-removal sediment and clam data sets, which were evaluated separately. The following summarizes the preliminary COI screening process for the random Forebay data set:

1. *Frequency* – COIs were not retained as preliminary COPCs if detected at a frequency of 5% or less with a sample size of 20 or more (Appendix I, Tables I-8a and I-8b).

   Statistical Comparison to Reference Area for Inorganics Only – Similar to the Upland OU, Chapter 8 included a statistical (population-to-population) comparison of two independent data sets for each media was performed between the Reference Area sediment and tissues (clam, crayfish, smallmouth bass, and sculpin) and the random Forebay sediment and tissues. Inorganic COIs were not retained as preliminary COPCs within the Forebay if the statistical comparison indicated that the Forebay data were not significantly greater than the Reference Area data (Tables 8-3 and 8-4; Appendix L, Tables L-4 through L-6).

2. *SLV Screening* – COIs were not retained as preliminary COPCs within the Forebay if they were detected at concentrations below their media-specific (i.e., water, sediment, and tissue) SLVs (Table 9-8).

Forebay Targeted Samples - Goose Island and Eagle Creek

1. *Comparison to Reference Area for Inorganics Only* – For the targeted Forebay sampling locations at Goose Island and Eagle Creek, which do not have enough samples to perform a statistical (population-to-population) comparison, the maximum detected inorganic concentrations in sediment and tissue (clam and crayfish) were compared to the inorganic in the Reference Area data (Appendix L, Table L-7). COIs were not retained as preliminary COPCs if detected at concentrations less than the Reference Area.
2. *SLV Screening* –COIs were not retained as preliminary COPCs at Goose Island or Eagle Creek if they were detected at concentrations below their media-specific (i.e., water, sediment, and tissue) SLVs (Tables 9-9 and 9-10, respectively).

Summary

Those River COIs not eliminated during the preliminary COI screening process were retained as preliminary COPCs and are summarized in Table 9-11. The nature and extent of preliminary COPC contamination within the River OU are presented in Section 9.6. In addition, all potentially bioaccumulative COIs, which have a BCF > 300 or log $K_{ow} > 3.5$, detected in the River OU were further evaluated in the HHRA and ERA. The River OU detected bioaccumulative COIs are listed in Appendix J, Table J-7.

9.2 Landfill AOPC Nature and Extent of Contamination

As previously described, the Landfill AOPC was used by the USACE to manage, store, and dispose of waste materials from approximately 1942 to 1982, with its heaviest use in 1952. The Landfill AOPC encompasses approximately 28,000 square feet on the northeast corner of Bradford Island (Figure 3-3). Based on a review of aerial photographs, the Landfill AOPC was capped by 1982. In 1989, an additional soil cover (approximately 8 inches thick) was placed on the Landfill site by the USACE and the site was managed as a wildlife habitat for geese (Hibbs, personnel comm. 2001). Although this portion of Bradford Island is managed as wildlife for geese (USACE 1997a), active management (periodic mowing) of the habitat ceased in the middle to late 1990s to prevent geese from laying eggs in areas that are under investigation (Hibbs, personnel comm. 2001).

The surface of the actual Landfill (excluding the steep slopes around the perimeter of the AOPC) slopes gently to the northwest, north, and northeast, toward the Columbia River. The Landfill road runs along the southern margin of the Landfill. The Landfill surface is densely vegetated with forest, scrub-shrub, and herbaceous vegetation. The road is more sparsely vegetated with herbaceous vegetation. No evidence of runoff or erosion was observed or predicted through modeling for the Landfill surface (URS 2009f). Minor runoff has been observed on the Landfill road. The source of the Landfill road runoff is a groundwater seep at the base of the steep slope along the southern margin of the Landfill. The water flows west along the road and then infiltrates along the northern margin of the Landfill road to the west of the Landfill. The runoff water was clear at the time of the field survey, indicating that the flow of seep water along the road is not causing soil erosion. Runoff from the road appeared to infiltrate and evidence of direct discharge of road runoff to the river was not observed (URS 2009f).

While there is no visual evidence of current sloughing along the northern perimeter of the Landfill AOPC, undercutting was observed along the waterline at the north slope indicating that historical mass wasting may have occurred. Although the potential for bedrock failure is low, if mass wasting were to occur on the steep slopes, the soils may reach the river.

Shallow groundwater flows to the north and enters the river through bottom sediments or above-water surface seeps. During the wet season, groundwater may rise shallow enough to encounter waste materials in a small portion of Landfill AOPC.

9.2.1 Soil

There have been extensive investigations of the surface/shallow soil across the Landfill AOPC, including the collection of 37 surface and shallow samples. Deeper soil samples are limited to 18 locations within two areas: the gully test pit and the mercury vapor-lamp test pit (see Figure 5-2). Soil analytical results are present on Tables 5-1a through 5-1c, 5-2a through 5-2d, 5-3a and 5-3b, and 6-2a. Appendix I, Table I-1 presents the summary statistics and detection frequency for the Landfill AOPC data.

Metals

Metals were detected in surface, shallow, and deeper soil throughout the Landfill AOPC. Concentrations of several metals (antimony, arsenic, cadmium, lead, mercury, and/or zinc) exceeded soil SLVs at most surface/shallow soil locations (Figure 9-1a). Concentrations of these metals in deeper soil are comparable to concentrations in surface/shallow soils (Figure 9-1b). However, there are only a few locations at which any of these metals (arsenic and/or lead) exceeded the less conservative human health soil SLVs that are applicable to the deeper interval.

It is also important to note that the concentrations of arsenic observed in Landfill soils are no higher (based on statistical population-to-population tests) than site-specific reference area soils (see Table 8-1 and discussion in Section 8.1). Therefore, although soil arsenic concentrations may exceed conservative SLVs, the source of the arsenic is naturally-occurring and unrelated to site activities.

Butyltins

Butyltin analyses were conducted at 22 surface, shallow, or deep sample locations, and detected in one surface, one shallow, and two deep locations. None of the butyltin concentrations exceeded their soil SLVs in surface, shallow, or deeper soil (see Table 9-1).

Herbicides & Pesticides

Herbicides were detected in a few surface and shallow sample locations across the Landfill AOPC but not in deeper soil. Pesticides were detected in several surface and shallow sample locations and a few deeper locations. Concentrations of several herbicides and pesticides (2,4,5-T, dichloroprop, MCPP, and 4,4'-DDT) only exceeded soil SLVs at a few surface/shallow soil locations, scattered across the Landfill AOPC (Figure 9-1c). In deeper soil, pesticide concentrations were lower than both less conservative deeper soil SLVs and the more conservative surface and shallow soil SLVs (see Table 9-1 and Appendix I, Table I-1).

PCBs

PCBs were detected in the majority of the surface, shallow, and deeper sample locations throughout the Landfill AOPC. However, concentrations of total PCBs (as Aroclors) exceeded soil SLVs at only three surface/shallow soil locations, all in the western portion of the Landfill AOPC (Figure 9-1d). In deeper soil, the only location where the total PCB (as Aroclors) concentration exceeded the less conservative human health soil SLV, applicable to the deeper interval, was at the gully test pit sample location BIL01TPG (which is treated as both a surface/shallow sample and deeper sample because it is unknown where it occurs in the 0-10 feet interval) (Figure 9-1e).

PAHs

PAHs were detected in all surface, shallow, and deeper sample locations except shallow location BIL13SSI. Total HPAH concentrations exceeded the soil SLV at most surface/shallow soil locations (Figure 9-1f). There is no soil SLV applicable to total HPAHs in the deeper soils. However, concentrations of most of the individual HPAHs exceeded their less conservative human health soil SLVs at most deeper locations (see Table 9-1). Total LPAH concentrations only exceeded soil SLVs at one shallow location at the gully test pit (BIL18) (Figure 9-1f). There is no soil SLV applicable to total LPAHs in the deeper soils. None of the individual LPAHs exceeded their less conservative human health soil SLVS applicable to the deeper interval (see Table 9-1).

TPH

TPHs were detected in the majority of the surface, shallow, and deeper soil samples throughout the Landfill AOPC. Concentrations of GRO exceeded the soil SLV at only a single surface/shallow soil location, within the mercury vapor-lamp test pit (BIL29TPM) (Figure 9-1g). Concentrations of DRO and RRO did not exceed their soil SLVs at any of the surface/shallow soil locations. In deeper soil, with the exception of BIL29TPM (which is treated as both a surface/shallow sample and deeper sample because it is unknown where it occurs in the 0-10 feet interval), no deeper soil locations with DRO, GRO, or RRO concentrations exceeded their soil SLVs (Figure 9-1h).

SVOCs

In addition to PAHs, other SVOCs were detected in the majority of the surface, shallow, and deeper soil samples throughout the Landfill AOPC. Concentrations of dibenzofuran exceeded its soil SLV at approximately half the surface/shallow soil locations (everywhere it was detected) (Figure 9-1g). Concentrations of a few other SVOCs (B2EHP, carbazole, and di-n-butyl phthalate) exceeded their soil SLVs at only one or two surface/shallow soil locations (different locations for each SVOC) (see Table 9-1). In deeper soil, none of the SVOCs had concentrations that exceeded the less conservative human health soil SLVs applicable to the deeper interval (Figure 9-1h and Table 9-1).

VOCs

VOCs were detected in the majority of the surface, shallow, and deeper soil samples throughout the Landfill AOPC. Concentrations of only two VOCs (ethylbenzene and PCE) exceeded their soil SLVs (see Table 9-1), both of which were in the same sample (BIL04TPG) within the gully test pit. Ethylbenzene exceeded the more conservative ecologically based surface/shallow SLV. PCE, which was only evaluated for the deeper interval in the gully test pit samples since more recent surface/shallow samples were analyzed for PCE, exceeded the human health-based SLV for the deeper interval.

9.2.1.1 Mass Wasting Soil

Soils potentially susceptible to mass wasting along the perimeter of the Landfill AOPC are represented by fourteen surface soil locations (BIL01USE through BIL09USE, BIL13SSI, and L-01 through L-04), which were evaluated for potential impacts to the river by screening the surface soil concentrations against sediment SLVs (see Table 9-6 and Figures 9-2a and 9-2b). L-01 through L-04 were only analyzed for selected PAHs.

Metals

Metals were detected at all of the perimeter soil sample locations. Many metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, thallium, and/or zinc) were present at concentrations that exceeded sediment SLVs.

Herbicides/Pesticides

Herbicides were not detected at the single perimeter soil sample location (BIL13SSI) where herbicides were analyzed. Concentrations of the pesticides 4,4’-DDT and dieldrin exceeded their sediment SLVs at every location where they were detected (seven of 10 locations and one of 10 locations, respectively).

PCBs

PCBs were detected at nine of the 10 sample locations where PCBs were analyzed. All of the detected concentrations of total PCBs (as Aroclors) exceeded the sediment SLV.

PAHs

HPAHs and LPAHs were detected at 13 of the 14 sample locations where PAHs were analyzed. All of the detected concentrations of total HPAHs and total LPAHs exceeded their sediment SLVs

TPH

DRO, GRO, and RRO were not detected at the single location (BIL13SSI) where TPH was analyzed.

SVOCs

Other SVOCs (in addition to PAHs) were detected at the 10 sample locations where SVOCs (other than PAHs) were analyzed. Of the six SVOCs detected in the perimeter surface soil locations, two (benzoic acid and benzyl alcohol) did not have sediment SLVs, two (B2EHP and dibenzofuran) had concentrations that did not exceed their sediment SLVs, and two (and di-n-butyl phthalate and carbazole) had concentrations that only exceed their sediment SLVs at one or two locations (different for each).

VOCs

VOCs were detected at the five sample locations where VOCs were analyzed. Only three VOCs (dichloromethane, PCE, and toluene) were analyzed at four of the five locations. None of the detected concentrations exceeded the sediment SLVs.

9.2.2 Groundwater, Seep Water, and Surface Water

Nine monitoring wells (MW-1 through MW-9) were installed at the Landfill AOPC between 1998 and 2002 to evaluate potential groundwater contamination. Landfill AOPC groundwater analytical results are presented on Tables 5-1d through 5-1f, 5-2e through 5-2g, and 6-2b. Seep water analytical results are presented on Tables 5-1d through 5-1f, and 6-2b.

Metals

A variety of metals have been detected in both total and dissolved groundwater at all monitoring wells. Several metals were detected in groundwater at the Landfill AOPC at concentrations exceeding the MW-10 Reference Area concentrations (Table 8-2). Metals detected in seep water at concentrations that exceeded both Reference Area concentrations and SLVs included total arsenic, iron, lead, and manganese; and dissolved barium, iron and manganese (Table 9-7).

Several total metals concentrations (arsenic, iron, manganese, lead, and thallium) exceeded the water SLVs at all monitoring well, seep water, and surface water sampling locations (Figure 9-3a). Several dissolved metals concentrations (arsenic, barium, calcium, iron, lead, manganese, sodium, and zinc) also exceeded their water SLVs at multiple monitoring well, seep water, and surface water sampling locations (see Table 9-1), but only total concentrations were plotted on the figures. Mercury vapor lamps were identified on the surface and in the subsurface at the Landfill AOPC. However, mercury was detected in groundwater only at MW-1 and MW-3, and at concentrations below the SLVs. Mercury was not detected in seep water.

Butyltins

Butyltins were detected in groundwater at all monitoring wells except MW-9. Dibutyltin concentrations exceeded its water SLV in the majority of monitoring wells (Figure 9-3d). Monobutyltin concentrations only exceeded the water SLV in a single monitoring well (MW-2) at the southern, upgradient portion of the Landfill AOPC. In most cases, wells in which earlier samples found butyltins have subsequently been found not to contain these analytes. Butyltins were not detected in seep water or surface water.

Herbicides & Pesticides

Herbicides were detected only at MW-5 (dichloroprop) and MW-8 (4-nitrophenol and pentachlorophenol). Pesticides were detected only at MW-3 (4,4'-DDE and dieldrin). Herbicides and pesticides were not detected in seep water. Herbicides and pesticides did not exceed their water SLVs at any of the monitoring wells (see Table 9-1 and Appendix I, Table I-1).

PCBs

PCBs were not detected in groundwater or seep water at the Landfill AOPC.

PAHs

Several PAHs were detected in groundwater at MW-1, MW-4, MW-5, MW-7, MW-8, and MW-9. PAHs were not detected in seep water in 2000. Phenanthrene is the only PAH that was analyzed for in seep water or surface water in 2008, and 2009 it was not detected. Naphthalene, which was only analyzed in the 1999-2002 sampling events, had a concentration that slightly exceeded the water SLV one time at only one monitoring well (MW-1) (Figure 9-3c). Phenanthrene concentrations exceeded the water SLV at MW-4, MW-5, and MW-8 in the center of the Landfill AOPC.

TPH

DRO and RRO were detected in groundwater from all monitoring wells. GRO was detected in all monitoring wells except MW-2, MW-4, and MW-9. DRO and RRO were also detected in seep water. Only DRO was detected in surface water. DRO, GRO, and/or RRO concentrations exceeded their water SLVs at all monitoring wells (Figure 9-3b). However, concentrations of all three fractions are lower than water SLVs at the seep water and surface water locations, except DRO, which exceeded the water SLV in one of two events at S4.

SVOCs

Several SVOCs (in addition to PAHs) were detected in groundwater, at all monitoring wells except MW-7. B2EHP and DNOP concentrations exceeded water SLVs at several monitoring wells (Figure 9-3c). A single SVOC, benzoic acid, was detected in seep water in 2000 at a concentration below its SLV. Only three SVOCs (1,4-dichlorobenzene, 4-nitrophenol, and phenol) were analyzed for in seep water or surface water in 2008 and 2009; they were not detected.

VOCs

VOCs were detected in all monitoring wells except MW-1 and MW-2. Chloroform and PCE were detected in seep water but not surface water. Concentrations of chloroform, PCE, and/or vinyl chloride exceeded their water SLVs at the majority of monitoring wells (Figure 9-3d). Chloroform and PCE concentrations exceeded their water SLVs in seep water.

9.2.3 Summary

In summary, use of the Landfill AOPC to manage, store, and dispose of waste materials has resulted in contamination of soil, groundwater, and seep water with chemicals associated with the wastes. The extent of the wastes is well defined based on topography, review of historical aerial photographs, a geophysical survey, excavation of test pits, observation of wastes on the ground surface, and the analysis of soil, groundwater, seep ,and surface water samples. The type and magnitude of contamination is variable, consistent with the variable waste management, storage, and disposal activities that occurred at the Landfill AOPC.

Soil

Metals, PAHs, and SVOCs were detected throughout the Landfill AOPC at concentrations exceeding the SLVs. Butyltins, herbicides, pesticides, PCBs, TPH, and VOCs had generally limited detections and/or few if any exceedances of SLVs (Figures 9-4a and 9-4b). The majority of the ground surface at the Landfill AOPC is relatively flat, well vegetated, and shows minimal evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable and there is minimal potential for off-site migration of contaminated soil.

Mass Wasting Soil

The north and east sides of the Landfill AOPC include steep slopes leading down to the Columbia River. Although the potential for mass wasting appears low, a subset of the surface soil sample data (from the steep slopes) was compared to sediment SLVs to assess soil that has the potential to migrate to the river via mass wasting. Metals, pesticides, PCBs, and PAHs were detected throughout the Landfill AOPC perimeter soil samples at concentrations exceeding the SLVs. Herbicides, TPH, SVOCs, and VOCs had generally limited detections and/or few if any exceedances of SLVs.

Groundwater, Seep Water, and Surface Water

Groundwater, seep water, and surface water analytical data were compared to applicable SLVs to assess the groundwater to surface water pathway at the Landfill AOPC. Elements of this pathway include leaching of soil contaminants to groundwater and discharge of groundwater to the river either at seeps or as base flow. The direction of groundwater flow beneath the Landfill AOPC is to the north (Appendix D, Figures D-1 through D-4). Horizontal hydraulic gradients between MW-2 and MW-5 in the Landfill AOPC range from 0.10 to 0.13 foot per foot (Appendix D, Table D-2). Metals, TPHs, and VOCs were detected in groundwater throughout the Landfill AOPC, as well as in seep water, at concentrations exceeding the SLVs. Metals and DRO were also detected in surface water at concentrations exceeding the SLVs. Butyltins, herbicides, pesticides, PCBs, PAHs, and SVOCs had generally limited detections in groundwater and/or few if any exceedances of SLVs. Butyltins, herbicides, pesticides, PCBs, and PAHs were not detected in seep water.

9.3 Sandblast Area AOPC Nature and Extent of Contamination

As previously described, contamination at the Sandblast Area AOPC resulted from a variety of historical and ongoing uses that include equipment storage and management, storage, and disposal of various hazardous materials and wastes. The Sandblast Area AOPC has been divided into subareas corresponding to the different uses and associated known or potential sources of contamination: the septic tank drain field area, the spent sandblast media disposal area, two HMSAs, a transformer disassembly area, an equipment laydown area, and a former burn pit (Figure 3-4). The two HMSAs include the former HMSA, also referred to as the drum storage area, and the current HMSA located immediately southeast of the former sandblast building. The former HMSA was investigated because various hazardous and non-hazardous materials were stored there from the early 1980s to the early 1990s and the former HMSA pad did not have secondary contaminant or protective berms. The current HMSA has secondary containment and no document releases have occurred in this area since its construction. Prior to construction of the current HMSA, a storage tank was reportedly present at this location that is inferred to have been the source of a historical release of VOCs to adjacent soils.

Several site investigations have occurred at the Sandblast Area AOPC since 2001 that focused on individual subareas within the Sandblast Area AOPC and/or the media associated with the individual subareas. Based on the results of these investigations, the three subareas that appear to be the primary sources of contamination are the sandblast grit disposal area, the equipment laydown area, and an inferred VOC release at the current HMSA (Figure 3-4).

There are only three sample locations (DP11, DP12, and HA12) that were sampled in deeper soil (3-10 feet bgs) at the Sandblast Area AOPC. Due to the limited number of samples within the 3-10 feet bgs interval, six very deep samples (DP5 through DP10 sampled at > 10 feet bgs) were also included in the evaluation of the deeper soil for nature and extent at the Sandblast Area AOPC. Note that DP10 (sampled at 9-12 feet bgs) was not included in the deeper soil interval (0-10 feet bgs) because most of the sampling interval was greater than 10 ft.

The topography of the Sandblast Area AOPC generally consists of a north facing slope with numerous topographic complexities. Upslope of the former sandblast building is a relatively undisturbed and densely vegetated hill slope. Below the upper hill slope is a relatively flat and paved area around the former sandblast building. Downslope (to the north-northeast) of the former sandblast building and the adjacent paved area is a short, steep forested hill slope leading to the flat equipment laydown area and the paved road leading east to the Landfill AOPC. Downslope (to the northwest) of the former sandblast building is a relatively flat, vegetated area, followed by a recently disturbed slope, then a paved road. Recent excavation and filling activities on the slope removed vegetation and exposed bare, erodible soils at the ground surface immediately upslope of CB-2.

Within the Sandblast Area AOPC, a portion of the stormwater runoff from impervious surfaces (asphalt) drains to four catch basins that discharge to the Columbia River through two outfalls. It appears, however, that the majority of the runoff from asphalt immediately southeast of the former sandblast building flows northeast and discharges onto a short, steep, forested hill slope, where it causes rills to develop on the hill slope. Eroded soil from the rills combined with sandblast grit from further upslope has been observed accumulated at the base of the slope and behind one of two concrete curbs that run along the base of the slope at the equipment laydown area (URS 2009f).

Evidence of runoff was observed along the Landfill access road and the adjacent equipment laydown area. These areas are flat and evidence of erosion is generally lacking. Runoff from the road appears to flow north onto a vegetated area between the Landfill road and the river. Evidence of surface runoff or erosion is absent in this vegetated area, suggesting that runoff flowing onto this area infiltrates before reaching the river (URS 2009f). Within the remainder of the Sandblast Area AOPC, in particular vegetated areas, no evidence of surface runoff, soil erosion, or sediment deposition was observed. In summary, the only complete pathway for direct discharge of surface water from the Sandblast Area AOPC to the river is via the four catch basins.

9.3.1 Soil

Extensive investigations of the surface/shallow soil have occurred throughout the Sandblast Area AOPC and its subareas, as well as along stormwater flow paths and adjacent to catch basins. One hundred and eighteen surface and shallow samples have been collected. Deeper and very deep soil samples are limited to nine locations within two subareas: the current HMSA and the septic tank drain field area (see Figure 9-5i). Soil analytical results are present on Tables 5-4a through 5-4e, 5-5a through 5-5c, and 6-3a through 6-3g. Appendix I, Table I-2 presents the summary statistics and detection frequency for the Sandblast Area AOPC data.

Metals

Metals were analyzed in surface and shallow soil samples throughout the Sandblast Area AOPC, including all subareas, as well as along the stormwater flowpath CB-1 and adjacent to CB-1. Metals were detected in surface and shallow soil throughout the Sandblast Area AOPC. Relatively elevated concentrations of metals were associated primarily with the spent sandblast media disposal subarea, the equipment laydown subarea, and to a lesser extent the former HMSA subarea, indicating these three subareas are the primary sources of metals in soil. Elevated concentrations of metals were also detected in soil samples collected at or near CB-1, indicating that transport of metals from potential source areas to the catch basin via the stormwater pathway has occurred. Concentrations of several metals (antimony, arsenic, cadmium, chromium, lead, nickel, selenium, and/or zinc) exceeded soil SLVs at most surface/shallow soil locations (Figures 9-5a through 9-5d).

Metals were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea and four borings at the current HMSA subarea. At the septic tank drain field subarea, concentrations in deeper soil and very deep soil (>10 feet bgs) for the eight metals listed above were generally lower than the surface and shallow concentration. The only exceptions were antimony, which had similar concentration, and arsenic, which had higher concentrations than in surface/shallow soils. At the current HMSA subarea all eight metals had lower concentrations than the corresponding surface and shallow soils (Figure 9-5e). Only arsenic and chromium concentrations exceeded the less conservative human health soil SLVs that are applicable to the deeper soil intervals.

Potential correlations among concentrations of the eight metals detected above their soil SLVs were examined. Concentrations of each metal were compared to each of the other metals (e.g., lead and chromium, lead and cadmium, chromium and cadmium, etc) by plotting the paired data for each location on scatter plots. Best-fit linear regression lines were calculated, along with the resulting r-squared values. Initially, the data set was divided into the following three data sets:

- Surface soil (0-1 foot bgs) in the southern portion of the Sandblast Area AOPC within/surrounding the former HMSA.
- Surface soil (0-1 foot bgs) in the remaining portion (northern portion) of the Sandblast Area AOPC.
- Subsurface soil (1-3 feet bgs) in the northern portion of the Sandblast Area AOPC.

Little evidence of correlation was found in any of these data sets. The surface soil (0-1 foot bgs) in the northern portion of the Sandblast Area AOPC was then divided into two subgroups based on samples that were noted for having higher soil or higher sandblast grit composition. The only correlation that was present was for chromium and nickel (r^2=0.93) in surface soil samples. This is consistent with the historical use of a chromium-nickel based coating system for some of the equipment which likely was sandblasted at the former sandblast building. No other correlations between metals concentrations were found.

Butyltins

Butyltins were analyzed in surface and shallow soil samples from the septic tank drain field, spent sandblast media disposal, current HMSA, transformer disassembly, and the equipment laydown subareas, as well as in one sample from the former HMSA, and several samples along the stormwater flow path to CB-1, and at CB-1. Butyltins were detected at the septic tank drain field, spent sandblast media disposal, current and former HMSA, and the equipment laydown subareas. Butyltins were also detected in samples along the stormwater flowpath to CB-1, but were not detected in soil samples at CB-1.

Butyltins were only analyzed in deeper soil at five borings located at the septic tank drain field subarea. Butyltins were detected at all five borings at depths ranging from 13 to 23 feet bgs (the samples depths corresponded to the depth where groundwater was first encountered in each boring).

Some butyltins were detected in less than 5% of samples (e.g., tetrabutyltin) and all butyltins had concentrations less than their soil SLVs in surface, shallow, deeper and very deep soil (see Table 9-2 and Appendix I, Table I-2).

Herbicides & Pesticides

Herbicides analyses were conducted on 12 surface soil samples at the former HMSA. No herbicides were detected (see Appendix I, Table I-2).

Pesticides were analyzed for and detected in surface and shallow soil samples at the septic tank drain field, spent sandblast media disposal, equipment laydown, and former HMSA subareas. Concentrations of several pesticides (4,4’-DDT, endrin, endrin aldehyde, and endrin ketone) exceeded soil SLVs within the surface soil at six locations at the east end of the equipment laydown subarea, and one location at the former HMSA subarea (Figure 9-5f). In one equipment laydown subarea sample, 4,4’-DDT also slightly exceeded the soil SLV in shallow soil. Pesticides analyses in deeper and very deep soil were limited to five borings located at the septic tank drain field subarea. Pesticides were not detected at these boring locations (see Table 9-2 and Appendix I, Table I-2).

PCBs

PBCs were analyzed in surface and shallow soil samples throughout the Sandblast Area AOPC, including all subareas, as well as along the stormwater flowpath to CB-1 and at CB-1. PCBs were detected in most or all of the samples from each subarea. PCBs were also detected in all samples along the stormwater flow path to CB-1 and in all samples at CB-1, indicating that transport of PCBs from potential source areas to the catch basin via the stormwater pathway has occurred. Concentrations of total PCBs (as Aroclors) exceeded soil SLVs at only six surface soil locations, limited to the northeastern portion of the east end of the equipment laydown subarea (Figure 9-5g). PCB concentrations were lower than the soil SLV in all shallow soil samples.

PCBs were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea; PCBs were not detected (see Table 9-2 and Appendix I, Table I-2).

PAHs

PAHs were analyzed in surface and shallow soil samples at the septic tank drain field, spent sandblast media disposal, current HMSA, former HMSA, and equipment laydown subareas. PAHs were detected at all sample locations. Total HPAH concentrations exceeded the soil SLV at over half of the surface/shallow soil locations, including every subarea (Figure 9-5h). Total LPAH concentrations are lower than soil SLVs at all surface/shallow locations (Figure 9-5h).

PAHs were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea and four borings at the current HMSA subarea. PAHs were detected in three of the five septic tank drain field subarea borings and one of the four current HMSA borings. There is no soil SLV applicable to total HPAHs in the deeper or very deep soils. Concentrations of several of the individual HPAHs exceeded the human health soil SLVs applicable to deeper soil but none of the individual HPAHs exceeded the human health soil SLVs in very deep soil (see Table 9-2). There is no soil SLV applicable to total LPAHs in the deeper or very deep soils. However, none of the individual LPAHs exceeded the applicable soil SLVs in surface, shallow, deeper, or very deep soil (see Table 9-2).

TPH

TPHs were analyzed in surface and shallow soil samples throughout the Sandblast Area AOPC, including all subareas, as well as along the stormwater flowpath to CB-1 and adjacent to CB-1. TPHs were detected in most or all of the samples from each subarea. TPHs were also detected in all samples along the stormwater flow path to CB-1 and in all samples at CB-1, indicating that transport of TPHs from potential source areas to the catch basin via the stormwater pathway has occurred. DRO and RRO were the most frequent detections; detections of GRO were infrequent. However, TPH concentrations were less than their soil SLVs in all surface and shallow soil samples (see Table 9-2).

TPHs were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea and four borings at the current HMSA. TPHs were not detected in deeper or very deep soils (see Appendix I, Table I-2).

SVOCs

In addition to PAHs, other SVOCs were analyzed in surface and shallow soil samples at the septic tank drain field, spent sandblast media disposal, current HMSA, and former HMSA, and equipment laydown subareas. SVOCs were detected in most or all of the samples from each of these subareas. Concentrations of B2EHP and dibenzofuran exceeded their soil SLVs at approximately 1/3 and 1/2 of the surface and shallow soil locations, respectively, with exceedances for one or both chemicals in all subareas sampled (Figure 9-5h).

SVOCs were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea and four borings at the current HMSA subarea. SVOCs were detected at every boring (see Appendix I, Table I-2) but all detected concentrations were less than the less conservative human health soil SLVs applicable to the deeper intervals (Figure 9-5i).

VOCs

VOCs were analyzed in surface and shallow soil samples at the septic tank drain field, spent sandblast media disposal, current HMSA, former HMSA, and equipment laydown subareas. A single VOC, PCE, was detected at only one of the 12 sample location at the former HMSA subarea. VOCs were detected at relatively low concentrations in all samples from the remaining subareas, with the exception of the current HMSA, where very high concentrations of PCE (420,000 micrograms/kilograms [µg/kg] at sample SBB18) and trichloroethene (TCE) (6,080 µg/kg at sample HA4) were found (Figure 9-5j). PCE and TCE exceeded their soil SLVs at both of these two sample locations. No other VOCs exceeded SLVs at SBB18 and HA4, and there were no other SLV exceedances elsewhere at the Sandblast Area AOPC.

VOCs were only analyzed in deeper and very deep soil at five borings located at the septic tank drain field subarea and four borings at the current HMSA subarea. VOCs were detected in every deeper and very deep soil sample (see Appendix I, Table I-2) but all detected concentrations were less than the SLVs (Figure 9-5k).

9.3.1.1 Erodible Soil

The erodible soils in the northwest portion of the Sandblast Area AOPC, identified in 2008 as a result of recent soil disturbance, are represented by two composite surface samples (SB-EUA and SB-EUB) that were analyzed for metals, PCBs, TPH, butyltins, pesticides, SVOCs, and PAHs, eight surface subsamples (SB-EUA-02, SB-EUA-04, SB-EUA-06, SB-EUA-08, SB-EUB-02, SB-EUB-03, SB-EUB-12, and SB-EUB-15) that were analyzed for VOCs, and an additional surface sample (SB-04) only analyzed for lead. Although this area has subsequently become naturally revegetated, these erodible soils were evaluated for potential impacts to the river by screening the surface soil concentrations against sediment SLVs (see Table 9-6 and Figure 9-6).

Metals

Twenty-three metals were detected in composite samples SB-EUA and SB-EUB. Lead was also detected in sample SB-04. Lead exceeded sediment SLVs at all three locations. Cadmium, chromium, copper, and nickel had concentrations that exceeded sediment SLVs in both of the two composite samples. Zinc exceeded the sediment SLV in only one of the two.

Organics

PCBs, TPH, butyltins, pesticides, SVOCs, and PAHs were detected in both composite samples. VOCs were detected in all eight subsamples. There are no sediment SLVs available for TPH, several pesticides, the majority of VOCs, and two of the three detected butyltins. Of the chemicals with available SLVs, concentrations of tributyltin, two pesticides (4,4’-DDT and 4,4’-DDE), total PCBs (as Aroclors), total HPAHs and total LPAHs, and one of two detected SVOCs (B2EHP) exceeded their sediment SLVs in both composite samples. The only VOC with a sediment SLV (naphthalene) was detected at concentrations less than the sediment SLV in all eight subsamples.

9.3.2 Groundwater

Groundwater investigations at the Sandblast Area AOPC focused on the current HMSA, spent sandblast media disposal, septic tank drain field, transformer disassembly, and equipment laydown subareas. Reconnaissance groundwater samples were collected in 2004 from 10 direct-push borings (DP1 through DP5, DP7, and DP9 through DP12; Tables 5-5d through 5-5g). Since these samples were collected from temporary borings, as opposed to properly developed monitoring wells, there is a potential for entrainment of soil particles in these groundwater samples, which can bias the results towards increased concentrations in groundwater. In 2008 and 2009 four quarterly groundwater sampling events were completed at five newly-installed monitoring wells (MW-11 through MW-15; Tables 6-3h and 6-3i). The groundwater data from monitoring wells are more representative of actual chemicals that are present and potentially mobile in groundwater, and are therefore the focus of the discussion below.

Groundwater elevations measured at MW-11 through MW-15 indicate that the direction of groundwater flow is north-northwest (Appendix D, Figure D-5 through D-8) at a gradient of 0.08 to 0.11 ft/feet (Appendix D, Table D-2). Based on this groundwater flow direction, the distribution of soil borings and monitoring wells relative to the gradient and direction of groundwater flow at the Sandblast Area AOPC are as follows:

- DP10 through DP12 and MW-11 are located at the upgradient edge.
- DP1 through DP4, MW-14, and MW-15 are located at the downgradient edge, just prior to groundwater discharge to the river.
- DP5, DP7, DP9, MW-12, and MW13 are at intermediate locations between the upgradient and downgradient edges.

Metals

Metals were detected in samples from all 10 borings and five monitoring wells. Total metals were detected at concentrations exceeding their water SLVs at all sampling locations except DP9 (Figure 9-7a). Arsenic, iron, and vanadium had concentrations that exceeded their water SLVs at the majority of the soil borings and at one or more monitoring wells. However, only arsenic concentrations consistently exceeded the water SLV in the monitoring wells. Cobalt and manganese had concentrations that exceeded their water SLVs at one or more of the borings, but were not analyzed in the monitoring well samples. Several dissolved metals (aluminum, arsenic, barium, iron, manganese, and vanadium) also had concentrations that exceeded their water SLVs at direct push sampling locations and monitoring wells (see Table 9-2), but only total concentrations were plotted on the figures. Note that essential nutrients (e.g., iron) were not evaluated in soil, but they were evaluated for groundwater. Based on these data, including exceedances of SLVs in downgradient borings and monitoring wells, it appears that metals in soil are leaching to groundwater and groundwater with concentrations of some metals exceeding applicable SLVs may be discharging to the river.

Butyltins

Groundwater samples were analyzed for butyltins at DP1 through DP4 and all five monitoring wells. Butyltins were detected at DP2 through DP4, MW-11, and MW-13. The detections at MW-11 and MW-13 indicate butyltins may be leaching to groundwater. The detections at DP2 through DP4 suggest butyltins in groundwater may be migrating downgradient. However, butyltins were not detected at the downgradient monitoring wells MW-14 and MW-15, or at downgradient boring DP1, suggesting that the detections at DP2 through DP4 may not be representative of actual butyltin concentrations in groundwater. None of the detected concentrations of butyltins exceeded the SLVs (see Table 9-2).

Herbicides & Pesticides

Since herbicides were not detected in soil at the former HMSA, and there are no records of herbicide use or management in other areas of the Sandblast Area AOPC, herbicides were not analyzed in groundwater.

Pesticides were analyzed in groundwater samples from DP5, DP7, and DP9, and detected at all three locations. The detected concentrations were lower than the SLVs and therefore pesticides were not analyzed in samples from the monitoring wells (see Table 9-2 and Appendix I, Table I-2).

PCBs

PCBs were analyzed in groundwater samples from DP1 through DP5, DP7, and DP9. PCBs were not detected in any of these samples, and therefore were not analyzed in samples from the monitoring wells (see Appendix I, Table I-2).

PAHs

PAHs were analyzed in groundwater samples from all monitoring wells and borings except boring DP12. The boring analyses included both unfiltered (total PAH) and filtered (dissolved PAH) samples to reduce the uncertainty associated with entrainment of soil particles in groundwater samples collected from soil borings. Groundwater analyses from the monitoring wells were limited to three PAHs (benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene). All boring groundwater samples had detections of total or dissolved PAHs, except DP9 where total PAHs were not detected. Total and/or dissolved concentrations of the HPAHs benzo(a)pyrene, total benzofluoranthenes, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded their SLVs at DP7. Two LPAHs (dissolved naphthalene and total phenanthrene) had concentrations that exceeded their water SLVs at DP2, DP4, DP7, and DP10. PAHs were not detected in samples from the monitoring wells with the exception of benzo(b)fluoranthene, which was detected during only one of the four sampling events at MW-12 and at a concentration above its SLV. Since it was detected at a frequency of only 5% it was not retained as a preliminary COPC.

The detection of dissolved concentrations of PAHs at every direct push boring, including all four downgradient borings, suggests PAHs may be leaching to groundwater and migrating toward the river. PAHs were not detected in the two downgradient monitoring wells MW-14 and MW-15, however only a subset of the PAHs detected in the samples from the direct-push borings were analyzed for in the monitoring wells. This lack of PAH data from the monitoring wells represents a potential data gap.

TPH

TPHs were analyzed in groundwater samples from all monitoring wells and borings except the downgradient borings DP1 through DP4. TPHs were detected at the upgradient locations DP10, DP11 and MW-11, and at the intermediate locations DP7, MW-12, and MW-13. TPHs were not detected at the upgradient location DP12, intermediate locations DP5 and DP9, and downgradient locations MW-14 and MW-15. None of the detected concentrations of TPHs exceeded their water SLVs (see Table 9-2). Although TPHs appear to be leaching to groundwater, they do not appear to be migrating toward the river.

SVOCs

SVOCs, excluding PAHs, were analyzed in groundwater from every boring except DP12, and detected at each of the sampled borings. Dissolved SVOCs were analyzed at every boring except DP11 and DP12 and detected at each of the sampled borings. All detected concentrations were less than their water SLVs (see Table 9-2) and therefore SVOCs were not analyzed for in monitoring wells. Although SVOCs appear to be leaching to groundwater, they do not appear to be migrating toward the river at concentrations of concern.

VOCs

VOCs were analyzed for, and detected, in groundwater from all 10 borings and all five monitoring wells. Concentrations of one or more VOCs exceeded their water SLVs at all borings, and at MW-12 through MW-15. Concentrations of PCE and/or TCE exceeded their water SLVs at all borings and MW-12 through MW-15. The concentration of 1,1-DCA exceeded the water SLV only at DP5 and MW-12. The concentrations of cis-1,2- dichloroethene (DCE) exceeded the water SLV only at MW-12. Vinyl chloride exceeded its water SLVs at DP11, DP5, and MW-12.

As shown on Figure 9-7b, the groundwater data from borings delineated a PCE plume in 2004 with concentrations greater than 10 times the SLV, starting at DP11 (next to the HMSA) and continuing downgradient toward the river. Similarly, the 2008/2009 monitoring well data delineated a PCE plume with concentrations greater than 10 times the SLV starting at MW-12 (north of the former sandblast building) and continuing downgradient toward the river.

As described above, prior to construction of the current HMSA, a storage tank was reportedly present at this location. Significantly elevated concentrations of VOCs are present in soil at the current HMSA subarea. The boring and monitoring well groundwater data confirm that VOCs, in particular PCE and TCE, have leached from and are likely continuing to leach from soil to groundwater from this source area and are migrating toward the river at concentrations of potential concern. However, as shown on Figure 9-7b, the extent of the plume with concentrations exceeding 10 times the SLV did not include the source area in 2008 (as it did in 2004), suggesting that the mass of VOCs available to leach to groundwater is decreasing over time. The breakdown products of PCE (1,1-dichloroethane [DCA] , cis-1,2-DCE, and vinyl chloride) were also present in groundwater but at generally lower concentrations and with fewer SLV exceedances.

9.3.3 Soil Gas

Soil gas samples were analyzed at five borings (SB-10 through SB-14). Three of the soil borings (SB-10 through SB-12) were installed at and downgradient of the VOC source area associated with the former storage tank at the current HMSA subarea. The other two soil borings (SB-13 and SB-14) were installed along the southwest edge of the Sandblast Area AOPC, adjacent to the Service Center and Equipment Buildings (the closest occupied structures).

VOCs were detected in soil gas from all five borings. However, exceedances of the soil gas SLVs were limited to TCE at soil boring SB-10 (located adjacent to the current HMSA), and PCE and TCE at SB-12 (located adjacent to the former sandblast building); both borings are within the footprint of the PCE groundwater plume (Figure 9-8). Other breakdown products of PCE (1,1-DCE, cis-1,2-DCE, trans-1,2,-DCE, and vinyl chloride) were not detected above their soil gas SLVs at these two locations). The sandblast building (recently demolished), current HMSA, and the adjacent outdoor areas are not occupied by site workers. There were no exceedances of the soil gas SLVs at soil borings SB-13 and SB-14, which are located adjacent to buildings that are occupied by site workers.

9.3.4 Summary

In summary, historical and ongoing uses of the Sandblast Area AOPC include equipment storage and management, storage, and disposal of various hazardous substances and wastes. These uses have resulted in contamination of soil, groundwater, and soil gas with chemicals associated with the equipment and wastes. The extent of the contaminated area is defined based on topography, location of former and existing site features and structures, knowledge of former and current site uses, visual observation of wastes (i.e. sandblast grit) and equipment on the ground surface, and the analysis of soil, groundwater, and soil gas samples. The type and magnitude of contamination is variable, consistent with the variable hazardous substance and waste management, storage, and disposal practices that occurred at the various subareas within the Sandblast Area AOPC. The sandblast grit disposal area, the equipment laydown area, and an inferred VOC release at the current HMSA appear to be the primary sources of contamination.

Soil

Metals, pesticides, PCBs, PAHs, SVOCs, and VOCs were detected at the Sandblast Area AOPC at concentrations exceeding the SLVs. Metals concentrations exceed soil SLVs throughout the Sandblast Area AOPC, including all subareas. Pesticide and PCB concentrations exceeded soil SLVs primarily at the east end of the equipment laydown subarea (Figure 9-9a). PAHs and other SVOCs exceeded SLVs throughout the Sandblast Area AOPC (Figures 9-9b and 9-9c). VOC concentrations exceeded SLVs only in soil immediately adjacent to the current HMSA.

TPHs and butyltins were detected in soil samples throughout the Sandblast Area AOPC, but at concentrations below the SLVs. Herbicides were not detected in soil.

Metals, butyltins, PCBs, and TPHs were detected in soil along the stormwater flow path to CB-1, and/or in soil immediately adjacent to CB-1, indicating that contaminant transport from potential source areas to the catch basin via the stormwater pathway has occurred. Since pesticides, PAHs, SVOCs, and VOCs were not analyzed in soil along the stormwater flow path or at CB-1, it is not known whether these chemicals are being transported via the stormwater pathway. However, since all other analyte groups that were detected elsewhere at the AOPC were also detected along the stormwater flow path or at CB-1, it is possible that pesticides, PAHs, SVOCs, and VOCs are also being transported along this pathway.

Erodible Soil

Potentially erodible soils were identified in March 2009, resulting from late 2008 excavation and filling activities were identified on a slope northwest of the former sandblast building. Metals, PCBs, TPH, butyltins, pesticides, SVOCs, PAHs, and VOCs were detected in samples of the erodible soil. Seven metals, tributyltin, two pesticides, total PCBs, total HPAHs, total LPAHs, and a single SVOC exceeded their sediment SLVs. As expected, the disturbed area has become naturally revegetated (see the photographs in Appendix C), and now resembles other vegetated slopes in the Sandblast Area AOPC that show no evidence of surface runoff, soil erosion, or sediment deposition.

Groundwater

Groundwater data were compared to applicable SLVs to assess the groundwater to surface water pathway at the Sandblast Area AOPC. Elements of this pathway include leaching of soil contaminants to groundwater and discharge of groundwater to the river as base flow. Seeps have not been observed along the riverbank at the northern margin of the Sandblast Area AOPC. Metals, butyltins, pesticides, PAHs, TPHs, SVOCs, and VOCs were detected in groundwater, indicating that these contaminants are leaching from source area soils to groundwater. PCBs were not detected. Concentrations of metals, PAHs, and VOCs in groundwater exceeded their surface water SLVs, including at locations immediately adjacent to the river, indicating that these contaminants may be migrating to the river at concentrations of potential concern. Butyltin, pesticide, TPH, and SVOC concentrations did not exceed SLVs.

Soil Gas

VOCs were detected in soil gas at locations corresponding to the footprint of the VOC plume originating at the current HMSA (Figure 9-10). PCE and TCE exceeded their soil gas SLVs only in areas where there are no structures that could be occupied by site workers.

9.4 Pistol Range AOPC Nature and Extent of Contamination

As described previously, contamination at the Pistol Range AOPC resulted from historical use of the area as a firing range. Located on the south side of Bradford Island, existing structures at the Pistol Range AOPC include a collapsed wooden firing shed, a secondary firing location, and a timber backstop. Based on the location of these structures as well as observation of the area on historical aerial photographs, the Pistol Range AOPC is approximately 200 feet long, 20 to 30 feet wide, and covers an area of approximately 4,550 square feet.

The overall slope of the Pistol Range AOPC is to the southeast toward the Columbia River. The topography of the area consists of a series of cuts and fills, resulting in a sequence of slopes and flat areas. Currently, the ground surface is vegetated with a mix of scrub-shrub and herbaceous vegetation and does not show evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable. Erosion and transport of soil from the Pistol Range AOPC to the river is currently unlikely. When the Pistol Range AOPC was in use as a firing range the ground surface may have been less vegetated and there may have been historical runoff to the Columbia River.

9.4.1 Soil

Surface (0-0.5 feet bgs) and near surface (1.0-1.5 feet bgs) soil samples were collected from within and adjacent to the Pistol Range AOPC and analyzed for lead. Subsets of the samples were analyzed for antimony, arsenic, copper, mercury, nickel, and zinc. Antimony, arsenic, and mercury were not detected. Copper and nickel were detected but at concentrations below their soil SLVs. With a few exceptions, lead and zinc concentrations in soil exceed their respective SLVs throughout the Pistol Range AOPC. The highest concentrations of lead were detected at and behind the backstop. The analytical data are summarized in Tables 5-6 and 9-3, as well as Appendix I, Table I-3. Sample locations and data for lead and zinc are shown on Figure 9-11.

9.4.2 Groundwater

Grab groundwater samples were collected from two temporary borings at the Pistol Range AOPC and analyzed for total and dissolved concentrations of copper, lead, nickel, and zinc. The analytical data are summarized in Table 6-4b; groundwater sample locations and data for lead and zinc are shown on Figure 9-11. Total concentrations of all four metals were detected in both samples, but no concentrations exceeded the water SLVs.

9.4.3 Lagoon Sediment

Five sediment samples were collected from a shallow lagoon in the Columbia River adjacent to the Pistol Range AOPC and analyzed for copper, lead, nickel, and zinc. The analytical data are summarized on Table 6-4a; sediment sample locations and data for lead and zinc are shown on Figure 9-11. All four metals were detected in all five samples. Copper, lead, and nickel did not exceed their sediment SLVs, but zinc exceeded its sediment SLV at all five sample locations. The zinc concentrations are all higher than the maximum concentration of zinc detected elsewhere in Forebay sediments (113 mg/kg), suggesting that the Pistol Range AOPC may be a historical source of zinc in the lagoon sediment.

9.4.4 Summary

In summary, use of the Pistol Range AOPC as a firing range has resulted in the contamination of surface soil with lead and zinc. Nearly all surface soil sample locations have lead and zinc present at concentrations that exceed soil SLVs. It is unlikely that significant concentrations of lead or zinc are leaching to groundwater since the groundwater SLVs are not exceeded. The Pistol Range AOPC may also be a historical source of zinc to the adjacent lagoon sediment. Currently, the area is currently well vegetated and does not show evidence of surface runoff, soil erosion, or sediment deposition.

Further investigation of the soil northeast of the backstop may be required to determine the full extent of contaminated soil in this area.

9.5 Bulb Slope AOPC Nature and Extent of Contamination

As previously described, contamination at the Bulb Slope AOPC resulted from placement of glass and electrical light bulb debris directly onto a steep slope between the Landfill access road and the Columbia River on the north side of Bradford Island. The debris include various types of light bulbs, glass tubes, clear window pane glass, white molded glass, and miscellaneous glass beverage containers that are variably intermixed with silt, sand, gravel, cobbles, and concrete rubble. The width of the deposit across the slope ranges from 30 to 65 feet, and the length of the deposit from the top of the slope to the river is about 40 feet. The deposit ranges in thickness from about 4 inches near the top of the slope to 5 feet at the base of the slope, and is underlain by siltstone bedrock. Concrete rubble and a small amount of glass debris have been observed in the Columbia River near the riverbank at the base of the Bulb Slope AOPC. The total area of the deposit is about 1,900 square feet (Figure 9-12).

The majority of the Bulb Slope AOPC is well vegetated, covered with organic debris, and exhibits no evidence of surface runoff or overland flow to the river. At the base of the slope, however, wave erosion has resulted in mass wasting (small slope failures) of material into the river. Mass wasting appears to be the only potential mechanism for transport of debris and/or contaminated soil into the river.

Twelve surface soil samples were collected from within the area visibly impacted by glass and light bulb debris and analyzed for lead, mercury, and PCBs (as Aroclors). Lead and mercury were detected in all 12 samples. PCBs were detected in eight of the 12 samples. TPH was analyzed for and detected in eight of the 12 samples. The analytical data are summarized in

Tables 5-7, 9-4, and 9-6, as well as Appendix I, Table I-4. Sample locations and data are shown on Figure 9-12.

Since mass wasting is a potential pathway for migration of contaminants to the river, the surface soil data were compared to soil SLVs as well as sediment SLVs. Eleven of the 12 detected concentrations of lead and 10 of the 12 detected concentrations of mercury exceeded soil SLVs. Sediment SLVs are not available for TPH. Eleven of the 12 detected concentrations of lead, six of the 12 detected concentrations of mercury, and all of the eight detected concentrations of PCBs exceeded the sediment SLVs (Figure 9-13).

In summary, placement of debris at the Bulb Slope AOPC has resulted in the contamination of soil with lead, mercury, PCBs, and TPH. All surface soil sample locations have one or more contaminants present at concentrations that exceed the applicable soil and/or sediment SLV. The lateral extent of contamination is well constrained by the visible presence of debris in the soil. The underlying siltstone bedrock defines the vertical extent of contamination.

9.6 River OU Nature and Extent of Contamination

As described in Section 3.5.2, electrical equipment debris was historically disposed of directly in the River on the north side of Bradford Island. Figure 3-5 depicts the in-water historical source locations, identified as Former Debris Piles (#1 through #3). The electrical equipment debris included light ballasts, electrical insulators, lightning arresters, electrical switches, rocker switches, a breaker box, and electrical capacitors. The electrical debris contaminated the surrounding sediment with PCBs and potentially other COIs. The electrical equipment debris were removed in 2000 and 2002 (URS 2002b) and the majority of the associated PCB-contaminated sediment was removed in 2007 (URS 2008f and URS 2009d). Residual contaminated sediment, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination.

The Columbia River is a dynamic environment in which sediment is constantly being redistributed through human and natural processes. As described in Section 6.0, this RI focuses on conditions in the River OU following the sediment removal effort. Immediately prior to the 2007 removal of contaminated sediments north of Bradford Island, samples of sediment and clams were collected from areas targeted for dredging. These Pre-removal data do not identify any additional preliminary COPCs (see Appendix O), and they are not representative of current Post-removal concentrations, they are not discussed further in the summary of nature and extent of COPCs in the River OU. The pre-removal data are considered further in the uncertainty sections of the HHRA and ERA (see Appendix O).

Historical sampling (discussed in Section 5.0), supported by hydrologic modeling, demonstrated that sediment from the Forebay is not transported upstream beyond Goose Island. Therefore, the upstream boundary of the River OU is the northern end of Goose Island (Figure 1-3). The other boundaries of the River OU include the Bonneville Dam and Spillway, the two powerhouses, and the riverbanks of the Columbia River. Evidence that site-related COIs have not been transported downstream of the dam is discussed in Section 9.6.1, followed by a discussion of nature and extent of COIs within the boundary of the River OU.

9.6.1 Downstream Sediments

As described in Section 8.2.3, six sediment samples were collected from likely depositional areas downstream of the dam, and analyzed to assess the potential for sediment impacts related to releases from the site. These sediment samples were analyzed for metals, TPH-Dx, PCBs, and PAHs. Table 9-12 compares the maximum COIs concentrations detected in the downstream sediments with the 95% UPLs for Reference Area sediment and the sediment SLVs. The only two COIs for which both the 95% UPL and the sediment SLV is exceeded are cadmium and vanadium. In both cases, only a single sample out of the six is higher, and only by a small amount (Table 9-12).

These data demonstrate that the contamination related to Bradford Island is restricted to the Forebay. No detectable contamination has migrated downstream. The extent of the contamination is therefore well constrained on the downstream end by the dam and spillways, and on the upstream end by the eastern end of Goose Island (the upstream limit to which numerical modeling suggests that sediment may be transported upstream).

9.6.2 Forebay – Random and Targeted Samples

The nature of the contamination in the Forebay has been characterized by both random and targeted sampling of surface water, sediment, and various tissues. Each of these media is discussed below.

9.6.2.1 Surface Water

A total of five surface water samples were collected to document conditions in the Forebay. Grab samples were analyzed for total and dissolved metals and TPH-Dx. XAD samples were analyzed for PCB Congeners and PAHs. Data are summarized in Tables 6-12 and 9-8. Since the surface water flows steadily through the Forebay, no spatial variation in surface water concentrations is expected or observed. All five samples are interpreted as representative snapshots of Forebay surface water conditions.

The only metals that exceeded SLVs were arsenic (total and dissolved) and barium (dissolved only); the only organic compounds exceeding SLVs were total PCBs as congeners (Table 9-8). No SLVs are available for total LPAHs or HPAHs; however concentrations of the individual PAH concentrations were all below the individual SLVs.

As discussed in Section 8.2.1, the range of concentrations of arsenic detected in the Forebay surface water were less than the range of concentrations detected in the River Reference Area (see Table 8-4). Therefore, although surface water concentrations of arsenic, barium, and total PCBs may pose a potential risk to ecological or human health, the arsenic does not appear to be related to site releases. These preliminary COPCs are evaluated further in the HHRA and ERA (Chapters 11 and 12).

9.6.2.2 Sediment

Sediment data from the 19 random Forebay locations are summarized in Tables 6-8a and 9-8. Sediment data from the targeted sample locations are summarized in Table 6-13b; Appendix I, Tables I-9a and I-9b; and Appendix L, Table L-7. Concentrations of selected metals and of total PCBs are plotted in Figures 9-14a through 9-14e.

Metals were detected in all of the random and targeted sediment samples. A few individual samples (random and targeted) had concentrations of cadmium (six samples, Figure 9-14b), mercury (five samples, Figure 9-14d), nickel (one sample), thallium (one sample) and zinc (one sample) above their SLVs. However, as discussed in Section 8.2.1, population-to-population statistical comparisons show that for all metals, concentrations observed in the Forebay sediment samples were not significantly higher than the concentrations observed in the Reference Area samples (Table 8-2). Therefore, although concentrations of selected metals in Forebay sediments exceeded conservative SLVs, they do not appear to be site related.

As presented in Section 8, the comparison of the targeted Eagle Creek and Goose Island sediment samples to the Reference Area data (Appendix L, Table L-7) shows that concentrations of all metals at Eagle Creek and all metals except antimony, cadmium, thallium, and zinc at Goose Island were less than the Reference Area concentrations.

None of the random or targeted sediment samples had SVOC concentrations exceeding SLVs (Tables 9-8, 9-9, and 9-10). TPH-Dx was retained as a preliminary COPC only because no SLV is available.

Concentrations of total PCBs (as congeners and as Aroclors, when detected) exceeded SLVs in all random and targeted Forebay sediment samples (Tables 9-8, 9-9, and 9-10). The highest concentrations were observed along the north shore of Bradford Island and at Eagle Creek (Figure 9-14e). The sample along the north shore (P4) of the island was adjacent to where the equipment and contaminated sediment were removed between 2000 and 2007, although the observed concentration of 28.9 µg/kg was much lower than historical samples collected in the remediated areas. There is no known PCB source near Eagle Creek, although the state–run Cascade Salmon Hatchery is in this location. In any case, the PCBs detected at station P43 reflect limited contamination in a small area since PCBs were undetected (MDL of 1.7 µg/kg) at the adjacent station (P44, Figure 9-14e). Throughout the remainder of the Forebay, PCB concentrations in sediment ranged from 0.061 to 1.69 µg/kg and no apparent spatial pattern (Figure 9-14e).

9.6.2.3 Tissue

Tissue data from the random Forebay locations are summarized in Tables 6-9a (clam), 6-10a (crayfish), 6-11a (sculpin), 6-6a (smallmouth bass) and Appendix I, Tables I-8a and I-8b. Tissue data from the single targeted goose island station are summarized in Tables 6-13a and Appendix I, Tables I-9a and I-9b.

For analytes in which one or more tissue sample(s) exceeded SLVs (Tables 9-8 and 9-9), concentrations were plotted spatially on Figures 9-14a through 9-14g and 9-15a through 9-15g. For comparison, sediment data are also plotted on these figures, even if all of the sediment data were below the applicable sediment SLV for the analyte shown.

Concentrations of arsenic in tissue exceeded the tissue SLV for all media (clam, crayfish, sculpin, and smallmouth bass) at all locations (Figures 9-14a and 9-15a). However, crayfish was the only media for which arsenic concentrations in the Forebay were significantly higher than arsenic concentrations in the Reference Area (Table 8-2). As discussed in Section 8.2, arsenic concentrations in Forebay sediments and in all other tissue types were not statistically higher than Reference Area concentrations (Table 8-2). Furthermore, arsenic concentrations in sediment were below the sediment SLV everywhere in the Forebay. The source of the arsenic is unknown, but does not appear to be site-related.

Although the Forebay sediment cadmium concentrations were not statistically higher than Reference Area concentrations (Table 8-2), cadmium concentrations in six individual sediment samples exceeded the SLV (Figure 9-14b). Cadmium concentrations in Forebay clams were statistically higher than in Reference Area clams (Table 8-2), and the concentrations exceeded the tissue SLV in all of the Forebay clam samples (Figure 9-14b). However, with the exception of two crayfish samples, the cadmium concentration was lower than the tissue SLV in all of the higher trophic-level samples (Figure 9-15b). Thus, although cadmium exceeded SLVs in the clam tissue, cadmium does not appear to be a concern in the sediment, nor does it appear to be a risk in higher trophic-level organisms.

Lead concentrations in all Forebay sediment samples were below the SLV and not statistically higher than the Reference Area concentrations. However, unlike the case for arsenic, lead concentrations were also below SLVs in all Forebay clam and smallmouth bass samples (Figures 9-14c and 9-15c). Selected Forebay samples of crayfish and sculpin did have lead concentrations which exceeded the SLV.

Mercury showed yet a different pattern. As with all metals, the Forebay mercury concentrations in sediment were not statistically higher than Reference Area concentrations (Table 8-2), although mercury concentrations slightly exceeded the SLV in five sediment samples (Figure 9-14d). Mercury concentrations in all of the Forebay clam and crayfish tissue samples were below the SLV (Figures 9-14d and 9-15d). In contrast, all of the sculpin and smallmouth bass samples had mercury concentrations exceeding the SLV (Figure 9-15d). The mercury concentrations in Forebay crayfish, sculpin, and smallmouth bass in the Forebay were all significantly higher than in the Reference Area (Table 8-2). The source of the mercury is unknown, but does not appear to be site-related.

B2EHP was detected in five of 23 sediment samples and all clam samples collected in the Forebay, but always at concentrations below the SLVs (Figure 9-14e), and at concentrations that were not significantly higher than in the Reference Area (Table 8-2). B2EHP concentrations above the SLV were measured in two crayfish samples and seven bass (Figure 9-15e). Bass was the only media for which concentrations of B2EHP were significantly higher in the Forebay than in the Reference Area. One other phthalate (butyl benzyl phthalate) was also detected above the SLV in one bass samples (Table 9-8). These observations may be consistent with B2EHP bioaccumulating in higher trophic-level organisms.

LPAHs did not exceed SLVs in any River media. However, five HPAHs were detected in one or more bass at concentrations exceeding the corresponding SLVs (Table 9-8). Benzo(a)pyrene was the only PAH detected above SLVs in crayfish (two samples only), and no PAHs exceeded SLVs in any of the other media (Table 9-8) (sculpin were not analyzed for SVOCs due to insufficient sample volumes). Since the eight bass in which benzo(a)pyrene concentrations exceeded the SLV included all bass in which any of the other HPAH concentrations exceeded the SLVs, this compound was plotted in Figures 9-14f and 9-15f to demonstrate the spatial pattern of HPAH SLV exceedances. As was the case for B2EHP, HPAH concentrations did not exceed SLVs for any sediment or clam samples (Figure 9-14f). One HPAH (benzo(a)pyrene) exceeded the SLV in two crayfish samples, and one or more HPAHs exceeded SLVs in eight bass samples (Figure 9-15f). The three bass with the highest benzo(a)pyrene concentrations were caught along the north shore and tip of Bradford Island. These observations may be consistent with HPAHs bioaccumulating in higher trophic-level organisms, even though concentrations of PAHs in Forebay sediment were not significantly higher than in the Reference Area (Table 8-2).

Concentrations of total PCBs (as congeners) exceeded SLVs for almost all tissue samples (Figures 9-14f and 9-15f). The highest observed total PCB (as congeners) concentration in clams (312 µg/kg) was from a sample collected at station P4 on the north shore of Bradford Island. Somewhat lower clam tissue concentrations (51.5 to 95.1 µg/kg) were measured at stations around the tip and southern shore of the island (Figure 9-14e). Throughout the remainder of the Forebay, clam total PCB concentrations were within a remarkably narrow range (21.4 to 34.0 µg/kg) – and within the range of concentrations (26.8 to 34.4 µg/kg) measured in the River Reference Area. This suggests that the clams (short-lived benthic organisms reflecting a very localized exposure area) were acquiring somewhat higher body burdens of PCBs from the small quantity of residual PCBs in sediments adjacent to the historical source area. The uniform clam tissue concentrations throughout the remainder of the Forebay and River Reference Area provides strong evidence that there are no significant residual PCB sources in other parts of the Forebay.

As would be expected via bioaccumulation, average tissue concentrations of total PCBs increased in higher trophic-level organisms. Total PCBs (as congeners) ranged from 0.54 to 42.7 µg/kg in crayfish, 8.15 to 4,780 µg/kg in sculpin, and 32.2 to 26,500 µg/kg in smallmouth bass (Figure 9-15e).

As with the clams, the crayfish and sculpin with the highest total PCB concentrations were all located along the shore of Bradford Island. The three crayfish samples with the highest PCB concentrations (P6-CF with 42.7 µg/kg, P5-CF with 16.9 µg/kg, and P4-CF with 16.8 µg/kg) were along the north shore and eastern tip of the island (Figure 9-15e). The two samples with the next highest concentrations (P7-CF with 12.4 µg/kg and P8-CF with 3.13 µg/kg) were along the south shore of the island; all other crayfish samples had total PCB concentrations less than 1.5 µg/kg.

Similarly, the highest concentration of total PCBs observed in sculpin was in sample SF-3 (4,780 µg/kg) at the tip of Bradford Island (Figure 9-15e). The next three highest total PCB concentrations measured in sculpin (915 µg/kg at SF-4, 559 µg/kg at SF-5, and 141 µg/kg at SF-6) were at progressively greater distances from the historical source area, along the southern shore of the island (Figure 9-15e). The lowest total PCB concentration in sculpin was measured in the targeted sample from Goose Island Slough.

The spatial distribution of total PCB concentrations in Smallmouth Bass (Figure 9-15e) was much more variable. Some of the bass with the highest concentrations caught adjacent to bass with the lowest concentrations. The highest total PCB concentration was measured in a bass caught off the tip of Bradford Island; the second-highest concentration was measured in a bass caught in the Goose Island Slough (Figure 9-15e). Other individual bass caught simultaneously in the slough have total PCB concentrations less than or comparable to those observed in the River Reference Area (22.3-499 µg/kg; see Appendix L, Table L-7). This lack of a spatial pattern is consistent with bass migrating into the Goose Island Slough to breed, taking with them a wide range of PCB body burdens picked up from various locations in the Forebay.

It is also important to remember that the Forebay bass were collected in 2006, before the 2007 sediment removal. Some of the older bass are estimated to have been up to 10 years old in 2006, meaning that they were exposed to conditions before the equipment was even removed (URS 2009k) There was a huge variation in tissue PCB concentration, reflecting a great deal of variability in exposure. However, there was no correlation between PCB concentration and either length (a proxy for fish age) or the location where the fish were caught. The implications of these observations are discussed in detail in the HHRA and ERA (Chapters 11 and 12)

9.6.3 Cross-media Patterns in PCB Congener Distributions

The PCB congener analytical method used to analyze all of the recent data from the River OU provides concentrations of all 209 congeners (with the recognition that some of these congeners are coeluting so that only the total concentration of the coeluting species), it can be a valuable tool for the identification of potential PCB sources. PCBs from different sources may have different patterns of relative abundances of the various PCB congeners. However, the patterns may be altered in environmental media due to mixing of PCBs from multiple sources, preferential biological uptake or preferential bioaccumulation of certain congeners, chemical or biological degradation, or other mechanisms.

To see what information the PCB congener distribution may provide regarding PCBs observed in various media analyzed in this study, Figures 9-16a through 9-16e (Forebay) and Figures 9-17a through 9-17e (Reference Area) were prepared showing histograms of PCB congener relative abundance. Different color segments on these figures show each detected PCB congener (or set of coeluting congeners) as a percentage of total PCB congener concentration in each sample. The total height of each bar is always 100%, but the percentages of component congeners vary from sample to sample. The total PCB (as congener) concentrations is listed below each sample name and the samples within each figure or sorted from highest to lowest total PCB concentration. Forebay samples are plotted separately from Reference Area samples, and different media are shown on different figures.

The following PCB congener patterns were noted:

- Of the 209 possible PCB congeners, approximately 16 PCB congener groups constituted 60 to 70% of the total PCB congener load in sediment in both the Reference Area and the Forebay. The same 16 PCB congener groups constituted approximately 80% the PCB congener load in clams and crayfish and approximately 70% of the PCB congener load in sculpin and bass.
- The most abundant PCB congener at a majority of the stations was PCB 11. This PCB congener constituted from approximately 7 to 27% of the total PCB congener burden, and contributes a larger percentage to samples with lower total PCB concentrations. This is consistent with the results of other regional studies have noted that airborne PCBs in the Willamette airshed have contributed to the ubiquitous occurrence of PCBs in sediments and that PCB 11 is one of the indicator PCB congeners for evidence of airborne deposition (Hope 2007, 2008). PCB 11 has also been found in water and air in urban environments (Hu et al. 2008, Du et al. 2009, Rodenburg et al. 2010), the great lakes watershed (Basu et al. 2009), and even the polar regions (Choi et al. 2008). Part of the reason it is so ubiquitous may be that it is not derived by Aroclor mixtures, but is instead found in unregulated paints and pigments (Fraser 2010, Hu and Hornbuckle 2010, Rodenburg et al. 2010).
- PCB 118, another ubiquitous PCB congener in the Willamette airshed, was also observed in all river media (surface water, sediment, clam, crayfish, sculpin, and smallmouth bass).

Therefore, risk from PCBs in the River OU likely includes both site-related sources, and non-site related sources, including those from upstream as well as from the ubiquitous presence of PCBs in the Willamette airshed.

- The homologue groups showing the greatest degree of accumulation are primarily the pentachloro- and hexachlorobiphenyls, with a few additional tetrachloro- and heptachlorobiphenyls. This pattern is generally consistent with the environmental behavior of PCBs, whereby the lower chlorinated homologues are relatively more soluble and less persistent and the higher chlorinated homologues tend to be less soluble, more persistent, and more available for biological uptake.
- Four dioxin-like PCB congeners (PCB 105, 118, 156, and 157) are among the 30 most abundant PCB congener groups in sediment. The dioxin-like PCB congeners make up approximately 10 to 15% of the total PCB congener burden in sediments. Only two dioxin-like PCB congeners were relatively abundant in tissue samples (PCB 105 and 118) and constitute approximately 10 to 20% of the overall PCB congener burden in tissues.
- Relative to the Reference Area, Forebay sediments appear to contain higher concentrations of four sets of PCB congeners (93+95+98+100+102, 86+87+97+108+119+125, 52, and 61+70+74+76). Although none of these groups includes dioxin-like PCB congeners, these co-eluting groups correspond to the pentachloro- and tetrachlorobiphenyl groups.

In summary, the same sub-set of about 30 PCB congeners constituted the majority of the PCB congener load in both Forebay and Reference Area sediments and that an even smaller sub-set of PCB congeners (the 16 dominant PCB congeners of the 30 observed in sediments) was noted in the Forebay and Reference Area tissues.

9.6.4 Correlation Between PCBs, TOC, and Fine-Grained Sediment

This section describes a correlation analysis between three sediment parameters: total PCB congener concentration (represented as sum of 209 congeners' concentrations), TOC, and percent fines (represented as sum of percent clay and percent silt). Organic contaminants such as PCBs are generally expected to be associated with fine-grained sediments or the TOC present in sediments. The objective of this statistical evaluation was to confirm that this was, indeed the case at this site and explore possible trends or patterns in the data which may further support site characterization and remedial investigation.

In order to examine potential correlation over the entire range of observed PCB concentrations, the Reference Area and Forebay data sediment samples were combined into a single data set. The bivariate relationships between these three parameters were examined using the non-parametric Kendall-Theil robust line and Kendall's Tau correlation coefficient, described in Helsel and Hirsch (2002). One Forebay location, P04, initially appeared to be an outlier; however, the nonparametric methods used to calculated correlation coefficients were not sensitive to the presence of outliers, and hence, the data from this location were included in all calculations.

The Kendall-Theil robust line method was used to test for any monotonic, not just linear, dependence of each pair of variables. This method did not depend on the normality of residuals for validity of significance tests, as in ordinary linear regression. The Theil slope estimate was computed by comparing each data pair to all others in a pair wise fashion, and the median of all possible pair wise slopes was taken as the nonparametric slope estimate. This line was closely related to Kendall’s Tau correlation coefficient, in that the significance of the test for H_0: slope = 0 was identical to the test for H_0: Tau = 0.

The results of this correlation analysis are presented in Figure 9-18. The bottom panel presents TOC versus percent fines. The middle panel presents total PCB congeners versus TOC. And the top panel presents total PCB congeners versus percent fines. The Kendall-Theil robust line equation, the Kendall’s Tau correlation coefficient, and the *p*-value associated with the test of significance are shown in each panel. For better scaling of the scatter plots, the aforementioned Forebay location (P04) is not shown in the middle and top panels, but this data point was used in the calculation.

As expected, for TOC versus percent fines, the Kendall’s Tau correlation coefficient was 0.530, which suggested a strong monotonic relationship. For total PCB congeners versus TOC and total PCB congeners versus percent fines, the Kendall’s Tau correlation coefficients were 0.318 and 0.356 respectively, an indication of a moderate monotonic relationship or positive association (i.e., the higher the TOC or percent fines, the higher the total PCB congener concentrations, or vice versa). The *p*-values associated with all three tests of significance were below 0.01, which indicated that the slope or the Tau was significantly different from (above) zero.

Thus, TOC is strongly correlated with percent fines. Higher TOC concentrations can be reliably predicted by smaller grain size distribution and therefore these two variables are not independent. Total PCBs as congeners are moderately correlated with the other two variables – sediment with higher TOC and percent fines typically have higher total PCB concentrations.

9.6.5 Trends Through Time

Figure 9-19 summarizes the sequence of removal actions and sample collection in the Forebay. Above the timeline, maximum concentrations of total PCBs measured in sediment during five different investigations are plotted on a logarithmic scale. As can be seen from this graph, the removal of the in-water sources of contamination has dramatically reduced both the maximum measured sediment concentrations along the north shore of Bradford Island.

Prior to 2007, data collection efforts in the river were focused on locating areas of potential sediment contamination, not documenting the distribution of sediment concentrations. Additionally, different sample collection and analytical methods were used. Therefore, it is not appropriate to compare the distribution of PCB concentrations measured during each sampling event. Instead, the highest observed sediment concentrations along the north shore of Bradford Island are presented to show the decrease in the “worst-case” concentrations on through time.

In 2001, the maximum total PCB concentration of 15 sediment samples was 23,900 µg/kg (URS 2002b). During February/March 2002, thirty-two tons of waste, including PCB-containing electrical equipment and collocated sediment were removed from three debris piles on the north side of Bradford Island. As part of this removal, approximately 100 sediment samples were collected to delineate the extent of impacted sediment. The highest total PCB concentration for sediments measured in 2003 was 690,000 µg/kg (URS 2003c and URS 2004c). Three years later, in 2006, divers collected sediment samples as close as possible to the locations of two of the 2003 samples with the highest total PCB concentrations. When resampled, the stations that had total PCB concentrations of 690,000 µg/kg and 2,400 µg/kg in 2003, had concentrations of only 440 µg/kg and 160-2,100 µg/kg, respectively, in 2006 (URS 2006b). The following year, five pre-removal sediment samples collected in September 2007 from the areas that were later dredged had total PCB concentrations ranging from 13 to 133 µg/kg (URS 2008d).

Overall, total PCBs decreased by two to four orders of magnitude in the sediments on the north shore of Bradford Island between 2003 and 2007 (Figure 9-19). In October 2007, during the dredging removal action, 63 tons of sediment was removed from the north side of Bradford Island (HAI 2007). Following this removal a sample collected along the north shore of Bradford Island in an area that was not dredged (station P04) contained only 27.9 µg/kg total PCBs.

Declining total PCB concentrations were also observed in the Forebay crayfish collected from the north shore of Bradford Island. Crayfish composite samples collected during May 2001, in the vicinity of Debris Piles 1 and 2, had total PCB concentrations ranging from 2,670 to 75,600 µg/kg (URS 2002a,b). The composite crayfish sample with the highest total PCB concentration (75,600 µg/kg) was collected from former Debris Pile 1 and is the highest measured total PCB concentration for any tissue sample, including smallmouth bass, collected from the Forebay. Crayfish composite samples collected in February 2008 from the north shore of Bradford Island (stations 4 and 5) had total PCB concentrations three to four orders of magnitude lower (16.8 to 16.9 µg/kg) than those collected in 2001 (URS 2009i). The clams collected from 2001 to 2008 show a similar natural attenuation trend of decreasing total PCB concentration.

As described in the Goose Island Slough Data Gap Summary Report (URS 2009k), similar reductions in total PCB concentrations were observed in other areas of the Forebay. For example, a composite sample of three crayfish sample was collected near the western tip of Goose Island in May of 2001, prior to the removal of the contaminated equipment or sediment. The total PCB concentration in this sample was 268 µg/kg. Crayfish samples collected in 2008 and 2009, in the vicinity of Goose Island, had two to three orders of magnitude lower concentrations of PCBs (0.578 to 0.960 µg/kg).

Recognition of this observed natural attenuation, and the timing of equipment and sediment removals relative to Forebay sample collection is important for understanding the relatively high concentrations of total PCBs measured in the Forebay smallmouth bass. Based on age to length relationships for smallmouth bass captured in Lake Ontario, New York and in the Columbia River (Adams et al. 1999, Henderson and Foster 1956), the approximate ages of the 19 smallmouth bass collected from the Forebay in 2006 range from 4 to 10 years (URS 2008c). Therefore, it is reasonable to assume that all of the smallmouth bass sampled in 2006 were spawned in or before 2002 – the year that the equipment was removed from the Forebay (Figure 9-19).

Although most of the Forebay smallmouth bass were caught in the Goose Island Slough, the slough is unlikely to represent their home pool. Instead, as discussed in the Goose Island Slough Data Gap Summary Report (URS 2009k), bass are believed to have migrated into the Slough to spawn, from their home pools in other areas of the Forebay. The 0.45 kilometers (km) distance from Bradford Island to the Goose Island slough is only slightly larger than the largest weekly recorded movement of 0.37 km observed in the Huron River (Beam 1990), and is well within the observed migratory distances traveled by smallmouth bass during the spawning season. Studies of migratory patterns of smallmouth bass in the Snake River in Idaho showed that fish found outside their home pool, in spring, traveled distances up to 1.2 km (Munther 1970). Radio-tagged bass in the Columbia River have been recorded traveling distance as much as 63 km (Montgomery et al. 1980). While long distance travel for smallmouth bass is uncommon, it is entirely reasonable to assume the smallmouth bass population living near Bradford Island would travel the short distance (0.45 km) to the slough, for the purposes of preferential spawning habitat.

It is reasonable to assume that the Forebay smallmouth bass sampled in 2006 were exposed to the sediments and were consuming lower trophic level organisms near the PCB-containing equipment on the northern side of Bradford Island prior to the equipment removal in 2002. And, since the second removal of contaminated sediments did not occur until 2007, all of the smallmouth bass caught in 2006 could have spent their entire lifespan exposed to the higher concentration sediments on the north shore of Bradford Island prior to the sediment removal (see Figure 9-19).

Therefore, it is highly probable the PCB concentrations observed in the smallmouth bass collected from the are related to a historical body burden associated with the contaminated equipment and sediments which have since been removed from the northern side of Bradford Island. Long term monitoring of the Forebay smallmouth bass population, will likely show decreases in PCB concentrations, as similar trends have already been observed for sediments and lower trophic level media.

10.0 FATE AND TRANSPORT OF CONTAMINANTS

This section describes the fate and transport of contamination associated with Bradford Island releases at the Upland OU and River OU.

10.1 Upland OU Fate and Transport of Contaminants

The fate and transport of contaminants is described below for each of the four Upland OU AOPCs. The sources and nature of releases of contaminants to the environment are summarized, followed by a description of potential or confirmed mechanisms for transport of contaminants from the AOPCs. The understanding of the fate and transport at each AOPC is based on knowledge of historical and ongoing waste management practices and activities, observations of existing site conditions that affect fate and transport, analytical data for soil, soil gas, groundwater, seep water, and surface water, and knowledge of the behavior of chemicals in the environment.

10.1.1 Landfill AOPC

The presence of contamination at the Landfill AOPC resulted from use of the area to manage, store, and dispose of waste materials. In addition to the placement of wastes within the Landfill AOPC, other historical activities included pesticide/herbicide mixing and rinsing activities, and historical storage areas. Discrete source areas have not been identified within the Landfill AOPC. Rather, the type and magnitude of contamination within the Landfill AOPC is variable, consistent with the variable waste management, storage, and disposal activities that occurred at the Landfill AOPC.

Inorganic and organic contaminants at the Landfill AOPC were initially released to surface and/or subsurface soils. Contaminants that adsorb strongly to soil (e.g., PCBs and PAHs) and are not readily soluble or volatile have likely remained at their point of release. The only potential transport mechanism for insoluble/non-volatile contaminants is to physically move the soil by surface erosion and/or mass wasting of soil. The surface of the landfill itself shows minimal evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable and there is minimal potential for off-site migration of contaminated soil by surface erosion. Around the perimeter of the Landfill AOPC, the potential for mass wasting of soil into the Columbia River appears low. However, metals, pesticides, PCBs, PAHs, and SVOCs were detected in the Landfill AOPC perimeter soil samples at concentrations exceeding the sediment SLVs. There is an ongoing but low potential for these contaminants to be transported off site to the river via mass wasting.

Volatile soil contaminants (e.g., VOCs and SVOCs) can be released to air from surface and subsurface soils. Dust generation can also release volatile and non-volatile soil contaminants in particulate form to air. VOCs and SVOCs were present in surface and subsurface soils at the Landfill AOPC, and therefore there is a potential for volatilization of these chemicals to outdoor air at the Landfill AOPC. However, since the Landfill AOPC is not occupied by site works, and the ambient conditions are typically windy, the potential for exposure of site workers to volatile constituents in air at levels of concern is extremely low, primarily due to the dispersion of these constituents in air. Since the Landfill surface is well vegetated and vehicles or heavy equipment are not operated on the Landfill surface, the potential for contaminant migration in dust is very low.

Contaminants that may have been initially released as a liquid phase (e.g., PCB-containing oils in buried electrical equipment) can potentially infiltrate into, and migrate through soil as a liquid phase. The extent to which the liquid phase would migrate through soil is in part a function of the release volume and the tendency of the liquid to adsorb to soil. Small releases of liquids that adsorb strongly to soil (e.g., PCB-containing oils) would likely not migrate far from the point of release. Subsurface investigations at the Landfill AOPC have not identified evidence of contaminants present in a liquid phase. In addition, contaminant concentrations measured in soil, groundwater, and seep water at the Landfill AOPC were well below concentrations that would be expected if contaminants were present in a concentrated, liquid phase. Therefore, it is very unlikely that off-site transport of contaminants in soil is an ongoing process at the Landfill AOPC.

A final potential mechanism for off-site transport of contaminants at the Landfill AOPC is leaching of contaminants from buried debris and/or contaminated soil to groundwater, and potential transport to surface water. The degree to which a contaminant may leach to water is mainly a function of its solubility in water although there are other factors that also affect its solubility. Few contaminants are completely insoluble in water and most contaminants are soluble to a lesser or greater degree. Leaching of contaminants from surface soil to surface water is a potential mechanism at the Landfill AOPC. Surface runoff has been observed originating at the base of the hill south of the Landfill. However, this runoff infiltrates into the ground before reaching the river, and no other evidence of direct discharge of surface water to the river has been observed at the Landfill AOPC.

Groundwater analytical data confirm that most contaminants detected in surface and subsurface soils were also detected in groundwater. The mechanism for this leaching is likely a combination of leaching directly to infiltrating precipitation in unsaturated soil and leaching directly to groundwater where Landfill wastes are saturated by the seasonal high water table. Seep water analytical data indicate that metals, DRO, and selected VOCs have migrated in groundwater to seeps at concentrations exceeding the surface water SLVs. However, seep water is rapidly diluted upon discharge to the river, as demonstrated by the fact that DRO and VOCs were not detected in concurrent samples of adjacent surface water. SVOCs also appear to have migrated to the seeps but at concentrations below the surface water SLVs. Butyltins, herbicides, pesticides, and PAHs were detected in groundwater but not seep water, indicating that they may be leaching to groundwater but are not migrating to the river. PCBs were not detected in groundwater or seep water, consistent with the very low solubility of PCBs in water.

In summary, the primary mechanism for off-site transport of contaminants from the Landfill AOPC appears to be leaching of contaminants from buried debris and/or contaminated soil to groundwater, and discharge of contaminants in groundwater zone to the river via seeps. The COPCs to this migration pathway are metals, TPHs, and VOCs. There is also a low potential for metals, pesticides, PCBs, PAHs, and SVOCs in soil to migrate to the river via mass wasting of soil.

10.1.2 Sandblast Area AOPC

Contamination at the Sandblast Area AOPC resulted from a variety of historical and ongoing uses that include equipment storage and management, as well as storage and disposal of various hazardous materials and wastes. The type and magnitude of contamination is variable, consistent with the variable hazardous substance and waste management, storage, and disposal practices that occurred at the various subareas within the Sandblast Area AOPC. Some contaminants are widespread in soil and groundwater and are not associated with a discrete source within the Sandblast Area AOPC. Other contaminants appear to be specifically associated with the sandblast grit disposal area, the equipment laydown area, and an inferred VOC release from a storage tank previously located where the HMSA is currently located.

Inorganic and organic contaminants at the Sandblast Area AOPC were initially released to surface and/or subsurface soils. Throughout much of the Sandblast Area AOPC, contaminants that adsorb strongly to soil and are not readily soluble or volatile have likely remained at their point of release. However, observation of the site conditions confirm that soil erosion is a historical and ongoing process that has mobilized and transported soil within portions of the Sandblast Area AOPC. Soil erosion is the result of stormwater runoff from impervious surfaces, as well as direct precipitation onto and runoff from soils recently disturbed by excavation and filling activities. Stormwater from the northwest portion of the Sandblast Area AOPC drains to four catch basins; two stormwater pipe outfalls convey runoff from the catch basins to the Columbia River. The catch basin drainage areas include areas where soil erosion and transport is documented. Metals, PCBs, TPH, butyltins, pesticides, SVOCs, PAHs, and VOCs were detected in erodible soil, and constituents of each of these analytical groups, except TPH and VOCs, exceeded sediment SLVs. Metals, butyltins, PCBs, and TPHs were detected in soil along the stormwater flow path to CB-1, and/or in soil immediately adjacent to CB-1. With the exception of the stormwater flow to CB-1, no other evidence of direct discharge of soil in stormwater to the river has been observed at the Sandblast Area AOPC.

Soil gas analytical data from soil borings confirm that VOCs were present in soil gas at, and downgradient of, the inferred PCE source area at the current HMSA. VOC concentrations exceeded soil gas SLVs but not at locations occupied by site workers. Thus, VOCs are potentially being released to air, but not likely at concentrations of concern to on-site workers. Volatile and non-volatile contaminants were present in surface soils at locations that are barren and/or experience infrequent vehicle traffic. There is a potential for transport of volatile and non-volatile soil contaminants in dust, but this transport mechanism is likely very minor. To the extent that soil adheres to vehicle tires in the Sandblast Area AOPC, there is also a potential for transport of contaminants along road ways within the Sandblast Area AOPC and elsewhere at Bonneville Dam, although this mechanism is likely minor due to the minimal vehicle traffic at the Sandblast Area AOPC.

A storage tank was reportedly present at the location of the current HMSA prior to its construction. VOC concentrations in soil, soil gas, and groundwater indicate that a PCE release occurred at this location, and the former storage tank is the inferred source of the release. Very high concentrations of PCE and TCE were reported in soil adjacent to the current HMSA; elsewhere, VOC concentrations were much lower. Evidence of liquid phase contamination was not observed in soil borings or monitoring wells downgradient of the current HMSA. Groundwater analytical data demonstrate that VOC concentrations at the inferred source area are decreasing over time. The analytical data and soil boring/monitoring well observations suggest that liquid phase contamination may have been present in soil at or in the vicinity of the former storage tank at the time of the release. But it appears unlikely that significant migration of liquid phase contamination occured. Evidence of liquid phase contamination has not been encountered elsewhere at the Sandblast Area AOPC.

Leaching of contaminants from surface soil to surface water is a potential mechanism at the Sandblast Area AOPC. As described above, metals, PCBs, TPH, butyltins, pesticides, SVOCs, PAHs, and VOCs have been detected in soil within the drainage area of the four stormwater catch basins. Since many of these contaminants are soluble in water, off-site transport of dissolved-phase contaminants in stormwater may be occurring at the Sandblast Area AOPC.

Groundwater analytical data confirm that most contaminants detected in surface and subsurface soils have leached to groundwater. Metals, butyltins, pesticides, PAHs, TPHs, SVOCs, and VOCs were detected in groundwater. PCBs were not detected in groundwater, consistent with the very low solubility of PCBs in water. Concentrations of metals, PAHs, and VOCs in groundwater exceeded their surface water SLVs, including at locations immediately adjacent to the river, indicating that these contaminants may be migrating to the river at concentrations of potential concern. Butyltin, pesticide, TPH, and SVOC concentrations did not exceed SLVs. Seeps have not been observed along the river bank at the Sandblast Area AOPC, but groundwater is assumed to discharge to the river as base flow.

In summary, the primary mechanisms for off-site transport of contaminants from the Sandblast Area AOPC appear to be soil erosion and transport in stormwater to the river, and leaching of contaminants from contaminated soil to groundwater followed by discharge of groundwater to the river via base flow. The potential contaminants of concern to one or both of these transport mechanisms include metals, butyltins, pesticides, PCBs, PAHs, TPH, SVOCs, and VOCs. There is also a potential for off-site migration of soluble contaminants in stormwater, but samples of stormwater have not been collected and analyzed to confirm this.

10.1.3 Pistol Range AOPC

Use of the Pistol Range AOPC as a firing range resulted in the contamination of soil with lead and zinc. The highest lead concentrations in soil are at and behind the backstop, and are likely associated with bullet fragments that remain in the soil. In lagoon sediment adjacent to the Pistol Range AOPC, zinc concentrations exceeded the sediment SLV, and were also higher than the maximum concentration of zinc detected elsewhere in Forebay sediments. The analytical data indicate that historically, when the pistol range was in use, off-site migration of metals to the river may have occurred as a result of soil erosion and/or soluble transport in stormwater. Currently, however, the Pistol Range AOPC is well vegetated and does not show evidence of surface runoff, soil erosion, or sediment deposition. Similarly, since the Pistol Range AOPC is well vegetated and vehicles or heavy equipment are not operated at the site, the potential for migration of metals in dust is very low.

Total concentrations of copper, lead, nickel, and zinc, and dissolved concentrations of copper, nickel, and zinc were detected in groundwater at the Pistol Range AOPC, although no detected concentrations exceeded the water SLVs. Although the soil conditions beneath the Pistol Range AOPC accommodate very little groundwater (most of the holes drilled were dry), the analytical data from the two samples collected suggest that metals have leached to groundwater to a limited extent. The discharge of this groundwater to the river as baseflow may provide a mechanism for transport of metals to the river, but not at concentrations of potential concern.

In summary, minor leaching to groundwater followed by discharge of groundwater to the river via base flow is the only (very limited) mechanism of transport of contaminants from the Pistol Range AOPC to the river.

10.1.4 Bulb Slope AOPC

Contamination at the Bulb Slope AOPC resulted from placement of glass and electrical light bulb debris directly onto a steep slope between the landfill access road and the Columbia River. Lead, mercury, PCBs, and TPH have been detected in surface soils at the Bulb Slope AOPC. The majority of the Bulb Slope AOPC is well vegetated, covered with organic debris, and exhibits no evidence of surface runoff or overland flow to the river. Wave erosion at the base of the slope has resulted in mass wasting of soil which appears to be a potential mechanism for transport of debris and/or contaminated soil into the river. Owing to the well vegetated nature of the Bulb Slope AOPC, the potential for migration of contaminants in dust is very low.

There is a low potential for metals and TPHs to leach from the soil into groundwater and discharge to the river as base flow. Given the thin soil layer and small footprint of the Bulb Slope AOPC, and the fact that it is well-vegetated with trees and shrubs, leaching to groundwater is likely an insignificant transport mechanism. PCBs have a very low solubility in water and are unlikely to leach to groundwater or surface water.

In summary, mass wasting of soil at the base of the Bulb Slope AOPC appears to be the primary mechanism for transport of contaminants to the river.

10.2 River OU Fate and Transport of Contaminants

Contamination in the River OU resulted from electrical equipment debris which were historically disposed of directly in the River on the north side of Bradford Island. The electrical debris contaminated the surrounding sediment, primarily with PCBs. The electrical equipment debris were removed in 2000 and 2002 (URS 2002b) and the majority of the associated PCB-contaminated sediment was removed in 2007 (URS 2008e,f,g). Residual contaminated sediment, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination. Transport of contaminants from the Upland OU, discussed above, may also be a current and/or historical source of contamination to the River OU.

During the post-removal sampling in 2008, PCBs, PAHs, metals, and TPH were detected in Forebay sediment. The same contaminants were also detected in Forebay surface water samples. Contaminants are exchanged between the surface water and sediment via sorption and dissolution. The partitioning of individual contaminants between the solid (sediment) and liquid (surface water) phases depends on their solubility. Generally, hydrophobic contaminants, such as PCBs, are strongly bound to the sediment, and tend to be concentrated in areas of fine-grained sediment with relatively high TOC. The Columbia River is a dynamic environment in which sediment is constantly being redistributed within the Forebay through human and natural processes. However, numerical modeling and direct sampling contain the extent of contamination to be between the upstream end of Goose Island and the Bonneville Dam.

11.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the methodology and findings of the HHRA that was performed for the Upland and River OUs in support of the RI. The HHRA process is similar for the River and Upland OUs, as described in the RI/FS MP (URS 2007a).

11.1 Purpose of HHRA

The overall purpose of the HHRA is to assist the USACE with achieving the management goals for the Upland and River OUs in a manner that complies with federal USEPA and state (DEQ) regulatory guidance. Based on the results of the risk assessment, additional evaluation, risk management or response actions may be needed to meet the management goals for these OUs.

HHRA for Upland OU

As listed in the RI/FS MP (URS 2007a), the management goals for the Upland OU that are relevant to the HHRA are:

1. Continued use of Bradford Island for occupational/ industrial uses in support of operations at Bonneville Lock and Dam
2. Protection of the health of on-site workers and visitors who may be present at the Upland OU
3. Protection of the River OU from upland sources of contamination

The objectives of the HHRA for the Upland OU and AOPCs have been developed on the basis of the management goals and are to:

1. Evaluate if risks from COPCs to human receptors exceed unacceptable levels at any of the Upland AOPCs or the Upland OU overall and,
2. Evaluate if the COIs in upland soils and groundwater can migrate into the River OU at levels of potential concern for receptors in the River OU

HHRA for River OU

The USACE’s management goals for the River OU that are relevant to the HHRA are:

1. Continued safe maintenance and operations of the Bonneville Lock and Dam complex
2. Support of and protection of the health and livelihood of people who may utilize the area for contact recreation, fishing recreation, or subsistence fishing purposes
3. Support of the beneficial uses of the Columbia River in this segment including the protection of anadromous and resident fish species utilizing the area

The Forebay is located downstream of several other potential sources of COIs that may overlap with the COIs for the River OU. Since one of the goals of the baseline risk assessment is to evaluate risks due to site-related COIs, the objectives of the risk assessment for the River OU are twofold:

1. Evaluate whether COIs in the Forebay should be identified as COPCs based on comparison with both risk screening values and upstream (reference) conditions
2. Evaluate whether risks to human receptors due to COPCs are at unacceptable levels

11.1.1 Scope of HHRA

According to USEPA and DEQ risk assessment guidance for human health, (DEQ 2000, 2003, 2010b; USEPA 1989), the HHRA process consists of a two-step process, the problem formulation, followed, if necessary, by the baseline risk assessment. The process begins with compiling information on the COIs. COIs are defined by DEQ as chemicals that are present or may be present at a site that have not been screened against any criteria (DEQ 2001). The COIs listed in the Appendix M tables represent chemicals detected at a frequency of 5% or more when 20 or more samples were available. When less than 20 samples were available, frequency of detection was not a consideration and this criterion was not used. Additionally, metals were also compared to Reference values and only those that were statistically greater than Reference, were included as COIs. Finally, if PCE or TCE were selected as COPCs, their degradation products were listed, even if they were not detected. The problem formulation step is used to narrow down the COIs to a smaller list of COPCs that warrant additional risk assessment or risk management actions. The baseline risk assessment is then performed to further narrow down the COPCs to a final list of chemicals of concern (COCs) for development of remedial action goals.

Problem formulation represents the first risk-based evaluation of all the relevant information and data pertaining to a site. By considering all the site information, current and likely future uses of land and water, and going through a comprehensive and exhaustive COPC selection process, the problem formulation process yields findings and conclusions that provide a solid basis for further decision-making. It provides screening-level estimates of carcinogenic risk and non-cancer hazards for the identified COPCs. The evaluation also allows for the identification and prioritization of the COPCs with regard to those which are most likely to be significant contributors to risk and will merit the most attention in terms of remedial action or further risk assessment. Similarly, if no COPCs are identified, the problem formulation process provides a strong foundation to base a decision of NFA.

The scope of the current HHRAs for the Upland and River OU is limited to the problem formulation phase of the HHRA. The problem formulation includes all four AOPCs in the Upland OU and the entire River OU. All the media that are relevant to human health exposure under current and reasonably likely future site conditions for which data have been collected (soil, soil gas, groundwater, sediment, surface water, tissue) are included in the evaluation.

11.1.2 Regulatory Framework

To achieve the objectives mentioned above, the steps that are used to conduct the problem formulation for the HHRA are based on USEPA and DEQ guidance (USEPA 1989; DEQ 2000, 2003, 2010b). Since DEQ is reviewing the RI/ FS, DEQ guidance was followed regarding the nature of the risk assessment process and the format and presentation of results. DEQ risk assessment protocols can be found in OAR Section 340-122-0084.

The guidance documents used in the performance of the HHRA include:

- Guidance for Conducting Beneficial Water Use Determinations at Environmental Cleanup Sites (DEQ 1998a)
- Final Guidance, Consideration of Land Use in Environmental Remedial Actions (DEQ 1998b)

- Guidance for Conduct of Deterministic HHRAs, Final (DEQ 2000)
- Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites (DEQ 2003, Updated 2009)
- Guidance for Evaluation of Bioaccumulative Chemicals of Concern in Sediment, Final (DEQ 2007)
- HHRA Guidance, Updated October 2010 (DEQ 2010b)
- Superfund Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (Part A), Interim Final (USEPA 1989)
- Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual. Part B, Development of Risk-Based Preliminary Remediation Goals, Interim (USEPA 1991)
- Guidance for Data Usability in Risk Assessment (USEPA 1992)
- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA 2002a)
- Calculating UCLs for Exposure Point Concentrations at Hazardous Waste Sites (USEPA 2002b)
- Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), Draft (USEPA 2002c)
- Human Health Toxicity Values in Superfund Risk Assessments (USEPA 2003a)
- User’s Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Draft (USEPA 2004)
- Regional Screening Levels (RSLs) and User’s Guide (USEPA 2010)

Based on the guidance listed above, the problem formulation phase for the HHRA for the Upland and River OUs includes the following elements, as defined by DEQ (2000, 2010b):

- Review of existing site information
- Land and water use determination
- Definition of data quality objectives
- Determination of the nature and extent of contamination
- Identification of potentially exposed populations
- Definition of exposure scenarios and exposure routes
- Contaminant screening procedures
- Development of a CEM
- Discussion of uncertainties

Much of the initial review of site information and identification of exposed populations, and development of preliminary CEMs were completed in the RI/FS MP (URS 2007a) for both the

Upland and River OUs. These elements are further refined in the current evaluation based on review of newly collected data and closing of previously identified data gaps.

Based on earlier discussions with DEQ and as outlined in the RI/FS MP, 95% UCL values are used to represent site concentrations of COIs when the sample size is sufficient. The 95% UCL is based on USEPA recommendations and is consistent with the USACE's desire to maintain compatibility with the CERCLA process. It is slightly different from DEQ's recommendation to use the 90% UCL. Since use of the 95% UCL will not lead to underestimation of risk when compared to the 90% UCL, the TAG agreed that representation of the 95% UCL is acceptable.

An additional difference between USEPA and DEQ guidance is the evaluation of the human milk ingestion pathway for infants for bioaccumulative chemicals. This pathway is included in DEQ's recently issued HHRA guidance (DEQ 2010b) but does not include pre-calculated risk-based screening concentrations. At the federal level, no final guidance or risk-based screening levels are available for this pathway. Therefore, this pathway is considered on a qualitative basis in this problem formulation phase of the HHRA.

11.1.3 Acceptable Risk Levels

For human health evaluations, chemicals are typically evaluated on the basis of whether they are considered to be carcinogenic or non-carcinogenic. The risks associated with carcinogenic chemicals are expressed as a probability of an exposed individual developing cancer over a lifetime of exposure for a particular receptor and pathway. The probability is expressed as excess lifetime cancer risk (ELCR). The risks associated with exposure to multiple chemicals within a single medium or multiple media are estimated by adding the individual ELCR probabilities and expressed as cumulative ELCR, typically expressed as the probability of developing one additional case of cancer per population of one million. This value may be expressed as 1×10^{-6} or 1E-06.

The risks associated with non-carcinogenic chemicals are designated as non-cancer hazard and are represented as a ratio of site-related dose to a "safe dose" for a particular receptor and pathway. A ratio (termed hazard quotient, HQ) of 1.0 or less is considered to not pose a threat to human health. A ratio greater than one indicates that the possibility exists for adverse effects and that further evaluation or action is warranted. Exposure to multiple non-carcinogens within a single medium or multiple media is estimated by adding the individual HQs and is expressed as the cumulative hazard index (HI).

For non-carcinogens, USEPA and DEQ use a HQ or HI exceeding 1.0 as the departure point for whether additional evaluation or action is necessary (USEPA 1991, DEQ 2010b). For carcinogens, USEPA and DEQ use slightly different target levels for acceptable risk levels. In determining need for remedial action, differences exist in acceptable risk levels between CERCLA and State of Oregon guidance. USEPA's (1991) Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, by Don Clay, entitled "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions," is quoted below.

> "Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum (RME) exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on RME for both current and future land use is less than 10^{-4}, action

> generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are non-carcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risks within the 10^{-4} to 10^{-6} risk range must explain why remedial action is warranted."

In contrast to USEPA, DEQ uses an acceptable risk level of 1E-06 for individual carcinogens (including congeners of chemicals groups such as PCBs and carcinogenic PAHs [cPAHs]) and a level of 1E-05 for cumulative cancer risks (OAR 340-122-0115(2)(a) and (4)(a).

11.1.4 Data Management for HHRA

In Sections 5.0 and 6.0, the datasets evaluated in the Problem Formulation for the Upland and River OUs are described, including the methods used to handle data qualifiers and non-detect sample results. The approach used to calculate PCB totals from Aroclor and congener data, and toxicity equivalence quotients (TEQs) for dioxin-like PCB congeners, as well as the approach used to calculate PAH totals, are discussed in Appendix H. Finally, an evaluation of the data usability for the HHRA is provided in Section 7.4, whereby MDLs and MRLs for non-detect samples and MRLs for J-flagged data are compared to SLVs protective of human receptors to assess the quality of the data. A more detailed discussion of the implications of using MDLs for non-detect samples in exceedance of human health-based SLVs is presented in the uncertainty assessment (Appendix O).

11.2 Problem Formulation - Upland OU

The problem formulation for the Upland OU evaluated potential exposures by human receptors and selected COPCs for each of the four upland AOPCs as well as for all the AOPCs combined.

11.2.1 Exposure Setting and Potentially Exposed Populations

The current and likely future uses of land and water are the basis of identifying human receptors who may be exposed to site media. Beneficial uses of land and water have been discussed earlier in Section 3.0. As noted in Section 3.0, Bradford Island is part of the Bonneville Dam Complex. Land uses at the Island are governed by the Bonneville Master Plan (USACE 1997a) and include land uses for management of hydropower, navigation, recreation, and natural resource and wildlife preservation. Residential uses do not currently occur at the Island and are not included in the Master Plan, thus making future residential use very unlikely.

Shallow perched groundwater in the Upland OU is encountered at depths of approximately 7.5 ft bgs in the winter but may drop to depths of 30 ft bgs in the summer (Appendix D).

There are two enclosed structures in the general vicinity of the Upland OU AOPCs – the service building and the equipment building (the sandblast building was recently demolished). The service building and the equipment building are occupied structures located outside the boundaries of the Sandblast Area AOPC.

The three distinct human populations in the general site area are the site staff, site visitors, and the nearby residents. There are currently no on-site residents. Although a hypothetical future resident is often considered in risk assessment, this scenario was not included in this HHRA because of the current and continuing industrial nature of the site and the requirements of the Master Plan.

Site Staff

As noted in Section 3.1.6.1.2, there are 162 full-time employees and approximately 475 part-time or seasonal contractors and researchers at the Bonneville Dam Complex. Among the full-time employees, 152 people may be engaged in a wide range of occupations, including maintenance, construction, office staff, visitor services, and natural resource management. An additional 10 additional staff from the Portland District headquarters are also stationed at the dam. Among the part-time personnel, approximately 300 fisheries-related staff (contractors/researchers from state and federal agencies) may work at the dam from April through September and an additional 175 construction and service contractors may also be employed at the project. Their number varies depending on workloads (McCavitt, personal communication, 2006).

The range of occupations may include soil-intrusive activities that may extend from the surface soils (e.g., mowing) to deeper soils (e.g., construction and utility services). They may also include indoor occupation of the service center building and equipment building (Figure 3-4), which are located adjacent to the Sandblast AOPC boundary but susceptible to vapor intrusion from VOCs in the soil and groundwater.

Construction workers engaged in long-term construction of new facilities (assumed exposure duration of 250 days for a year, per DEQ guidance) are not considered a reasonable scenario since major new construction is not planned for the Upland AOPC areas. However, the construction and service contractors may include excavation and trench workers engaged in utility repair or other types of soil-disturbing activities (assumed exposure duration of 9 days for a year, per DEQ 2010b) may be present. For the screening-level purposes of the problem formulation, both long-term construction workers and short-term excavation workers are included as potential receptors and are evaluated using DEQ’s SLVs for each of these receptor types.

Site Visitors

Direct access by the general public or trespassers to the Upland OU areas is unlikely. Although a road from Interstate 84 provides access to the Bonneville Dam complex, the access road is gated, and visitors are only allowed to access several dam facilities (visitor centers, fish ladders, etc.). The site and general vicinity on Bradford Island is gated and off limits to the public. Only USACE personnel and authorized visitors are allowed into these areas.

Nearby Residents

As described earlier, no permanent residential dwellings are located on the Project. The primary population center in proximity to the dam is the town of North Bonneville, situated on the Columbia River just west of the dam on the Washington side of the river. The 2009 population is estimated at approximately 950 persons.

In summary, based on considerations of land use and site access, the human receptors who may be directly or indirectly exposed to COIs and COPCs at or from the upland AOPCs include:

- On-site adult outdoor workers
- On-site adult indoor workers

- On-site long-term construction workers and short-term excavation workers
- Potable Water Users - Hypothetical consumers (i.e., staff workers) of on-site groundwater
- Off-site child and adult recreationists and recreational and subsistence fishers and consumers of river water

The exposure scenarios and exposure routes associated with these receptors are described below.

11.2.1.1 Exposure Scenarios

The on-site receptors may be exposed to soils and groundwater at the Upland OU in several ways, as described below:

- Adult outdoor site maintenance worker engaged in activities that do not involve a significant degree of soil disturbance (e.g., landscape workers). These receptors at Bradford Island may be exposed to COIs in surface soil (0-3 ft bgs) by incidental ingestion, inhalation (dusts and vapors), or dermal contact with contaminants in soil.
- Adult indoor workers may be exposed to VOCs emanating from subsurface soil and entering the indoor environment by vapor intrusion if occupied enclosed structures were to be constructed in the future at the Sandblast Area.
- Construction workers and excavation workers may be exposed to COIs in surface and subsurface soil by incidental ingestion, inhalation (dusts and vapors), or dermal contact with contaminants from surface and subsurface soil combined (0-10 ft bgs) on an intermittent, short-term basis. They also may be exposed to COIs in shallow groundwater by incidental ingestion, dermal contact, and vapor inhalation during those times of the year when the perched groundwater is at shallow depths. The only exception would be at the Bulb Slope AOPC, which is too steep to support routine excavation activities. Long-term exposure such as those experienced by construction workers is unlikely since there are no plans to build extensive new structures or facilities in the Upland OU.
- Adult workers at Bradford Island hypothetically may be exposed to COIs in groundwater if it was used as a drinking water supply – although such use of groundwater does not currently exist and is not anticipated in the future. If such use were to occur, it is assumed for this evaluation that the groundwater would be used “as is”, i.e., in an untreated and unfiltered condition.

Off-site receptors who may be indirectly exposed to chemicals from the Upland OU (and evaluated for the River OU, see Section 11.3) include:

- Child and adult recreationists who wade, swim, or boat in the Bonneville Forebay may be exposed by direct contact to COIs that may be discharged from groundwater to surface water.
- Child and adult subsistence and recreational fishermen may consume fish and shellfish contaminated with bioaccumulative COIs that erode from upland soils to offshore sediments or discharge from groundwater into the offshore surface water. Clams in the vicinity of the River OU are small and not of edible size. Sculpin are small fish that are an important component of the food-web but are not directly consumed by humans. Therefore, only crayfish and smallmouth bass are considered to be the most likely edible shellfish and resident finfish at the River OU. Although large-scale sucker are not popular

with subsistence or sport fishers, they may occasionally be consumed and are further evaluated in Appendix O. Subsistence fishers are likely to have higher fish ingestion rates than recreational fishers.

11.2.1.2 Exposure Areas

For the purpose of the problem formulation, exposure areas for the Upland OU and River OU (see Section 11.3) are defined on the basis of probable exposure by the identified receptors and the nature of the site data. It was assumed that an adult worker may be exposed solely to the exposure media at a single Upland AOPC (e.g., soil and groundwater at the Landfill) or could be exposed to multiple Upland AOPCs (all four AOPCs) during the course of their working life. Therefore, the exposure areas for the Upland OU include four individual AOPCs as well as a combined larger exposure area consisting of all four AOPCs combined.

Landfill AOPC

This area includes exposure to soil and groundwater at the Landfill.

Sandblast Area AOPC

This area includes exposure to soil, groundwater and soil gas at the Sandblast Area.

Pistol Range AOPC

This area includes exposure to soil and groundwater at the Pistol Range.

Bulb Slope AOPC

This area includes exposure to soil at the Bulb Slope.

All Four AOPCs Combined

This area includes exposure to soils from all four AOPCs, and to groundwater from the Landfill, Sandblast Area and Pistol Range AOPCs.

11.2.2 Conceptual Exposure Model

The CEM is a schematic representation of the source-receptor pathway at a site. The five elements that are required to be present in order to consider an exposure pathway complete or potentially complete are:

- A source of COIs (e.g., waste material in a landfill)
- A release mechanism (e.g., spills, releases)
- An exposure medium (e.g., surface soil)
- An exposure route (e.g., dermal contact with soil)
- A receptor (e.g., outdoor worker)

An exposure pathway is considered incomplete if any one of these elements is absent. Where there is no exposure, there is no risk, and no further evaluation of the pathway is warranted. A CEM should consider current and reasonably likely future land uses and exposures at a site.

A CEM was developed for each AOPC (Figures 11-1 through 11-4) on the basis of sources and site history, potentially exposed populations, the transport pathways and the routes of exposure. Exposure pathways are indicated as incomplete or potentially complete. The CEMs are generally similar for all the four AOPCs with some minor variations.

11.2.2.1 Landfill AOPC

The CEM for the Landfill AOPC is included as Figure 11-1. Releases from the waste materials disposed of at the Landfill have resulted in on-site exposure media that include surface soil, subsurface soil, and groundwater. The groundwater may also travel offsite, may daylight as seeps, and discharge to the surface water of the Columbia River.

The potential for erosion of landfill soils to occur is considered minimal or low, as discussed in Section 10.1.1. However, a portion of the soils along the north slope of the landfill are considered to be amenable to mass wasting (mass wasting soils) from potential slope failure. Further, evaluation of this pathway is addressed in this document and will be included in the upcoming FS. Because of the uncertainty associated with whether this pathway actually occurs and its magnitude, further discussion of this pathway is presented in the Uncertainty Assessment (Appendix O).

On-site receptors include outdoor workers who may be exposed to surface soils at the Landfill AOPC in their normal course of non-intrusive activities. Long-term construction workers and short-term excavation workers may be exposed to subsurface soils if they were to engage in soil-intrusive activities at the Landfill AOPC. Exposure routes related to soil include incidental ingestion, dermal contact, and outdoor inhalation of dusts and vapors. Those related to direct exposure to groundwater include dermal contact and inhalation of vapors within a trench setting for both construction and excavation workers. There are no enclosed structures present at the Landfill AOPC and none are planned. However, if enclosed structures were to be constructed in the future (assuming that constructability concerns are addressed), indirect exposures to groundwater would include volatilization of VOCs and subsequent vapor intrusion for indoor office workers.

In the unlikely event that new wells are installed, and untreated and unfiltered groundwater in the vicinity of the Landfill is used for potable uses, the on-site workers may be exposed to COIs in groundwater by ingestion, dermal contact, and inhalation of vapors. COIs in seep water and shoreline wells at the Landfill are unlikely to become part of the potable water supply for the Island but are included in the potable use evaluation as an intentionally conservative measure. These seep and groundwater COIs are more likely to become part of the transport pathway into the river.

COIs from soil washoff or groundwater discharge entering the river may subsequently be consumed by downstream users who use river water as their potable water supply source (assumed to be untreated and unfiltered). The bioaccumulative COIs may also enter the food web when taken up into the tissues of edible species such as the crayfish and smallmouth bass. Recreational and subsistence anglers (adults and children) may then consume these edible species. The anglers may also come in contact with COIs that may be discharged from groundwater into surface water, although this is likely to be an insignificant exposure. No direct contact exposures with sediment are considered likely for the mass wasting soils that may enter the Forebay since it is too deep for wading. Therefore, only bioaccumulation exposures are considered potentially complete and significant exposure pathways associated with the transport pathway to the River OU.

11.2.2.2 Sandblast Area AOPC

The CEM for the Sandblast Area AOPC (Figure 11-2) is similar to that for the Landfill AOPC. Transport pathways, receptors and potentially complete exposure pathways for on-site and off-site soil and groundwater are the same as for the Landfill AOPC. No seep water or shoreline surface water data were collected for this AOPC. The available groundwater data include data collected from monitoring wells and from direct-push samples. A limited portion of Pistol Range soils along the shoreline may be considered to be “erodible soils.” Discussion of the soil erosion pathway is provided in the Uncertainty Assessment (Appendix O).

In addition to these pathways, the Sandblast Area AOPC includes pathways related to VOCs. The release of VOCs associated with the historical AST and painting operations at this AOPC resulted in the presence of VOCs in soil gas and groundwater. Although there are no currently occupied buildings at this AOPC, the potential for intrusion of vapors from the subsurface (from soil gas and groundwater) into indoor environments exists, if enclosed structures were to be constructed here in the future. Therefore, exposure pathways for indoor inhalation of vapors by indoor workers may be potentially complete under future conditions.

11.2.2.3 Pistol Range AOPC

The CEM for the Pistol Range AOPC (Figure 11-3) illustrates the more limited set of receptors and potentially complete exposure pathways for this AOPC. Sources at the Pistol Range AOPC are related to its former use as a firing range. The exposure media are surface soil and groundwater. The groundwater is characterized by data for direct-push samples. Off-site transport pathways include the potential for surface soil to wash off into the adjacent lagoon and settle as sediment and for groundwater to discharge into the river. However, as described in Section 10.1.3, erosion of soils into the river is not likely to occur, due to the well-vegetated nature of the AOPC and the lack of soil-intrusive activities. Therefore, further discussion of this pathway is included in the Uncertainty Assessment (Appendix O) based on the assumption that erosion may have occurred in the past (historical erosion).

Adult outdoor workers may be exposed to surface soils by direct contact pathways. Although use of groundwater as a potable water source from this shoreline AOPC area is highly unlikely, grab sample data from the direct-push samples are used to evaluate this exposure pathway.

Off-site human receptors are also limited for this AOPC. Although wash-off from surface soils into the adjacent lagoon may occur, access is unlikely for human receptors to the lagoon and direct contact pathways are considered incomplete for lagoon sediment. Groundwater discharge to the river may lead to direct contact (potable use of surface water) and bioaccumulation (consumption of fish and shellfish) pathways that are complete for recreational and subsistence fishers.

11.2.2.4 Bulb Slope AOPC

The Bulb Slope AOPC is steep, rocky, and thickly vegetated with a thin layer of soil. The CEM for this AOPC (Figure 11-4) illustrates the fact that surface soil is the only medium of exposure.

Occasional exposure to surface soil may occur on the part of adult outdoor workers who may access this area for maintenance activities. Although very unlikely, the mass wasting soils may also wash off into the Forebay with subsequent potential for bioaccumulation of COPCs into edible aquatic species (e.g., bass and crayfish) which may then be consumed by recreational and subsistence fishers and is discussed further in the Uncertainty Assessment (Appendix O). No other on-site or off-site exposure pathways or receptors are associated with this AOPC.

11.2.3 Methodology for Identification of Chemicals of Potential Concern

DEQ's risk assessment guidance allows a screening process to be applied to site data in order to separate chemicals that warrant evaluation from those that may be eliminated from further consideration (DEQ 2000, 2010b).

11.2.3.1 Identification of Contaminants of Interest

In Sections 5 and 6, the historical and recent site investigations are described in detail, and the COIs in Upland media of the four AOPCs are identified. Based on the presence of potentially complete exposure pathways and associated analytical data, COIs in the Upland OU were identified for the following media:

- Soil, groundwater, and co-located seep and surface water of the Landfill AOPC
- Soil and groundwater of the Sandblast Area AOPC
- Soil, groundwater, and lagoon sediment of the Pistol Range AOPC
- Soil of the Bulb Slope AOPC

The categories of COIs that were detected in analytical data include metals (including butyltins), pesticides, herbicides, PCBs, TPH, PAHs, other SVOCs, and VOCs. Of these COIs, a subset is considered to be bioaccumulative in soils, groundwater or aquatic environments (for the groundwater to surface discharge scenario), as presented in Section 7.3 and Table J-6. The screening process begins with the designation of all chemicals detected at the site as COIs, as described earlier in Section 9.1. The following essential nutrients were eliminated from the COI list due to their low potential for toxicity: calcium, magnesium, iron, sodium, and potassium in soil; calcium, magnesium, sodium and potassium in groundwater. The remaining COIs are then evaluated further on the basis of three criteria: detection frequency, comparison with reference concentrations (inorganics only) and comparison with risk-based screening levels. The first two steps of the COPC selection process were performed in Section 9.1 for all media associated with each AOPC (Tables 9-1 through 9-6).

The concentrations of the chemicals retained following the first two steps of the COPC selection process are then compared with risk-based screening levels. The chemicals that fail the HHRA screening process are designated as COPCs and are carried through the risk assessment process. The screening process and the development of the list of COPCs is a critical element of the Problem Formulation phase of the HHRA. The results of each step of the screening process are described in this section.

For groundwater, the COIs are reported as "dissolved" and "total." However, more emphasis is placed on the results of the total concentrations for the HHRA since the presumed exposure pathways for consumption of groundwater and surface water assume that unfiltered, untreated water is consumed as a potable water supply.

11.2.3.2 Detection Frequency

In the first step of the COPC identification process, for each medium of exposure at each AOPC, all COIs were evaluated with respect to their frequency of detection in a given medium. COIs that were detected at a frequency of 5% or less, given a sample size of 20 or more, were eliminated as COPCs. This criterion was not applied where the sample size was less than 20. The detection frequency criterion was applied to the media at each AOPC and also for the medium-specific data for all four AOPCs combined. Soil COIs were evaluated separately for the 0-3 ft and 0-10 ft depth intervals.

The use of the 5% detection frequency criterion is based on the assumption that site characterization is adequate and representative. COIs that were detected at less than 5% frequency are discussed qualitatively with regard to their nature and occurrence and implications for the HHRA in the Uncertainty Assessment (Appendix O).

The results of the evaluation of detection frequency are presented in Tables 9-1 to 9-6 and discussed in Section 9.1.

11.2.3.3 Statistical Comparison with Reference Area Soils

In the second step, the concentrations of inorganic COIs in soil at each AOPC were compared to concentrations in reference soils from the Island on the basis of statistical tests. The results of this statistical comparison are presented in Appendix L and discussed in Section 8.0. Inorganic COIs in soil at any of the AOPCs or the combined AOPCs were eliminated as COPCs if they were not statistically higher than reference concentrations (Section 9.1). This comparison recognizes that naturally occurring chemicals generally do not need to be addressed in a remedial context if there is no site-related contribution.

Concentrations of PAHs in soil at each AOPC were also compared to concentrations in reference soils on the basis of statistical tests. All PAHs in soils at each of the AOPCs exceeded PAH concentrations in the Reference Area soils (Table 8-1). Although this comparison was not used to select organic COPCs (in accordance with DEQ guidance), the results are presented to provide perspective on the distribution of organics between AOPC and reference soils.

11.2.3.4 Concentration-Risk Screen

The third step of COPC identification for the HHRA consists of comparing COI concentrations to risk-based screening concentrations that are specific to the media, receptors and pathways that are relevant to the site. DEQ guidance (DEQ 2010b) requires this step to consider exposure to: i) individual COIs, (ii) multiple COIs simultaneously within a given medium, and (iii) individual or multiple COIs within different media.

Carcinogenic and non-carcinogenic chemicals are evaluated slightly differently in the concentration-risk screen process.

11.2.3.4.1 Selection of Screening Level Values and EPCs

The risk-based SLVs for this HHRA represent concentrations of chemicals in each medium (soil, groundwater, soil gas) that are associated with acceptable target ELCR levels of 1 E-06 or a non-cancer HQ of 1.0. The selection of human health-based SLVs is described in Section 7.3 of the RI and generally included a hierarchical source structure with highest preference given to SLVs published by DEQ followed by USEPA. A few exceptions to the hierarchy were made, to accommodate DEQ preference or to take advantage of more up-to-date values, as described below. For each medium, SLVs were selected for human health receptors, based on a hierarchy of sources (Appendix J, Tables J-4a through J-4f). The SLVs for each medium were selected to be protective of the human receptors that are likely to be exposed to that medium. Where multiple receptors and exposure pathways may exist for a single medium, the lowest of the relevant SLVs was selected.

SLVs for potable water use represent values that are protective of human health under the residential use scenario (i.e., ingestion of 2 liters/day as well as use of water for showering and household use) because of the designated beneficial uses for groundwater and surface water in this area and also because residential potable water use SLVs are available from both DEQ and USEPA to cover the range of COIs under evaluation. Therefore, use of the residential potable water SLVs is conservative since residential land use of groundwater will not occur at the Upland OU. Even if the groundwater were ever used as a potable water supply source on the Island, the assumed ingestion rate for the employees who may consume the water would be 0.7 liter per day (DEQ 2010b, USEPA 1997c) and would not include household use. Thus the residential potable water use SLVs may thus overestimate risk or hazard for the occupational consumption scenario by a factor of 3 due to the difference in water intake rates alone.

DEQ’s vapor intrusion-based SLVs for groundwater were used to evaluate vapor inhalation in outdoor and trench settings for adult outdoor workers and construction and excavation workers. DEQ’s soil gas SLVs were used to evaluate vapor inhalation in indoor settings for indoor office workers.

cPAHs were individually compared against their SLVs. For the benzofluoranthenes, historic data were reported as “total benzofluoranthenes” while recent data reported individual constituents such as benzo(b)fluoranthene and benzo(k)fluoranthene. The two types of data reporting were kept separate for SLV comparisons. In the absence of an SLV for total benzofluoranthenes, the lower of the SLVs for benzo(b)fluoranthene and benzo(k)fluoranthene was used for total benzofluoranthenes.

Each PCB Aroclor was compared to the Aroclor-specific SLV. In addition, the sum of the Aroclors, designated as Total PCBs, was compared to the SLV for PCBs. The source of the PCB SLVs were the RSLs from USEPA (USEPA 2010). The RSLs were identical for all the reported Aroclors in the Upland AOPC soils and were also used for Total PCBs.

For bioaccumulation-related pathways, bioaccumulation-based SLVs were identified or developed, as necessary. COIs were retained as COPCs for the bioaccumulation pathway under three conditions: (i) if they exceeded bioaccumulation-based SLVs for sediment, surface water or tissue; (ii) if they were considered bioaccumulative but lacked a bioaccumulation-based SLV; and (iii) if they were detected in tissue even if they were not considered bioaccumulative.

COIs without bioaccumulation-based SLVs were evaluated with regard to their bioaccumulation potential (Tables J-6 and J-7) to determine if they should be retained as COPCs. The bioaccumulation pathway applies to the Subsistence and Recreational Fishers and the exposure is highly dependent on chemical migration through multiple media. For example, the bioaccumulation exposure pathway may be direct for receptors consuming fish or shellfish and the COIs in the tissue, but SLVs for sediments and groundwater, derived based on the migration of the chemical between media to the surface water and ultimately in the fish tissue, should be considered highly variable and uncertain. .

11.2.3.4.2 Application of Screening Level Values

The SLVs were applied to the COPC selection process by comparing site concentration (C) to the SLV, where C is the lower of the 95% UCL or the maximum concentration, which is consistent with risk assessment guidance (USEPA 1989). For soil gas, only the maximum concentration was used.

Individual and Cumulative Screening

Exposure to Individual COIs (Carcinogens and Non-carcinogens) - COIs were retained as COPCs if the site concentration (lower of the 95% UCL or maximum concentration per USEPA 1989, DEQ 2010b) of an individual COI in soil and groundwater or the maximum concentration in soil gas exceeded the SLV, as illustrated in the C/SLV ratio below, where C is the concentration of the COI:

$$\frac{C}{SLV} > 1.0$$

Thus, in this first step, carcinogens with concentrations exceeding a screening risk level of 1E-06 and non-carcinogens exceeding a screening level of HQ of 1.0 in a single exposure medium were retained as COPCs. For some inorganics, the SLV in soil or sediment was based on the Reference UPL. For these chemicals, C/SLV does not indicate that an acceptable risk level was exceeded, only that the site concentration is greater than the Reference UPL. These were also retained as COPCs.

There were a few exceptions to this rule:

One exception was that, in any medium in which PCE or TCE was selected as a COPC, all the potential degradation products (dichloroethenes and vinyl chloride) were also retained as COPCs regardless of whether or not they were detected and whether or not they exceeded their own SLVs (if SLVs were available). This is meant to allow for the possibility that concentrations of these degradation products may increase in the future. This approach is recommended by DEQ (2010b).

The other exception was in the selection of COPCs for the pathway of groundwater discharge to surface water and subsequent bioaccumulation. Only those COIs in groundwater that had bioaccumulation-based SLVs or had bioaccumulation potential (even if no bioaccumulation-based SLVs were available) were evaluated for this pathway. When available, total analyte concentration data were used in preference to dissolved concentration data for the HHRA.

Exposure to Multiple COIs within a Single Medium (Non-carcinogens only) - Cumulative exposure to multiple COIs was performed for non-carcinogenic chemicals per DEQ's guidance. Recently published guidance from DEQ (2010b) does not require carcinogens to be included in this screening step since it is unlikely that more than 10 carcinogens would exceed their individual screening levels.

A non-carcinogenic COI was retained as a COPC if the individual ratio exceeded 0.1 when the sum of the C/SLV ratios for all the COIs in a given medium exceeded 1.0. This relationship is expressed as follows:

$$\frac{C}{SLV} > 0.1 \text{ when Sum } \frac{C}{SLV} > 1.0$$

Thus, in this second step, if the non-carcinogenic HI exceeds 1.0, contributing chemicals were identified as COPCs if they are present at one-tenth of their SLV.

The C/SLV ratio for lead was not included in the sum. Although it is classified as a probable human carcinogen, lead is evaluated on the basis of SLVs developed from the pharmacokinetic blood lead model (USEPA 2010). Lead was compared to its SLV and evaluated separately with regard to its adverse effects. Also for inorganics COIs whose SLVs were based on Reference UPLs and were therefore not risk-based, were not included in the sum C/SLV. Any inorganic that exceeded their Reference UPL was already included as a COPC in the first step.

Exposure to Single COIs from Multiple Media (Carcinogens and Non-carcinogens) - Cumulative exposure to a single COI that occurs in multiple media (e.g., soil, groundwater and soil gas) was addressed by retaining a COI as a COPC in all media when the cumulative multi-media ratio for a single chemical exceeds 1.0.

$$\text{Sum } \frac{C}{SLV} > 1.0$$

Based on the human health risk assessment guidance (DEQ 2010), the multi-media exposure evaluation was interpreted to identify new chemicals, from the list of COPCs based on single media exposure. This applies in cases where COIs with C/SLV ratios do not exceed 1 within a single medium, but exceeds the threshold when summed with C/SLV ratios from other relevant media for the receptor. Therefore, if a chemical has already been selected as a COPC, that chemical was not further evaluated for multi-media exposure (this interpretation of the guidance was confirmed during a phone conversation with DEQ [DEQ 2012a]).

Consistent with DEQ guidance (DEQ 2010b, 2012b), all COPCs within a single group with a similar mode of action were ultimately retained as COPCs even if individual members of the group passed the screening criteria. This applied to cPAHs and PCB congeners.

For the Upland AOPCs, the multiple media evaluation also included the multiple exposure pathways that could be reasonably assumed for a single receptor. These included outdoor workers who may be exposed simultaneously to soils by direct contact while also using groundwater as a potable water supply source, consuming food that may have been exposed to bioaccumulative chemicals in groundwater (after groundwater discharges to surface water) and inhaling VOCs from soil gas in an indoor setting (Sandblast Area only). Such a combination of multi-pathway and multi-media exposure is extremely unlikely and was, therefore. not postulated in the CEMs. It was included in the COPC selection process only to allow a high degree of confidence in the intentional conservatism of the screening process. Similarly, construction and excavation workers are assumed to be exposed to 0-10 ft bgs of soils, while also encountering groundwater in a trench setting with subsequent dermal contact and vapor inhalation.

Cumulative Risks and Hazards

At the conclusion of the Concentration-Risk screening, the sum of the C/SLV ratios for individual non-carcinogenic COIs (from Step 1) were summed to provide a screening-level estimate of the non-cancer Hazard Index (HI) for that medium. Lead was not included in the HI estimate but was evaluated and discussed separately. The C/SLV ratios for the carcinogens were also summed separately and multiplied by 1E-06 to provide an estimate of the ELCR. The purpose of these HI and ELCR estimates is to provide a screening-level estimate of non-cancer hazards and cancer risks.

Interpretation of the C/SLV ratios must be performed with caution and an understanding of the assumptions and limitations. For carcinogens, a single chemical C/SLV ratio of 1.0 corresponds to a screening level ELCR estimate of 1E-06 (one in one million). A ratio of 10 would represent a risk level of 1E-05. For non-carcinogens, a C/SLV ratio of 1.0 represents a HQ of 1.0 and any higher values represent corresponding increases in the HQ. Therefore, the cumulative non-carcinogenic C/SLV ratios listed at the bottom of the screening tables can be interpreted as a cumulative HI for the non-carcinogens.

The cumulative carcinogenic C/SLV ratios were multiplied by a factor of 1 E-06 to provide a screening-level estimate of cumulative ELCR. However, it is noted that the cumulative C/SLV ratios for carcinogens does not account for the non-carcinogenic effects associated with carcinogenic chemicals. If a quantitative estimation of risk were to be performed, the non-carcinogenic hazards associated with the carcinogenic COPCs would need to be included with the HQs for the non-carcinogens to arrive at an estimate of the HI. This uncertainty did not affect the COPC selection process since the lower of the cancer and non-cancer-based endpoints was the basis of the selected SLV. It also did not affect the findings and conclusions of the problem formulation since consideration of the cancer-based endpoints for carcinogenic COPCs generally leads to estimation of higher risk levels and the need for remedial responses at lower concentrations than consideration of the non-carcinogenic effects for the same chemicals. Therefore, decisions based on protection of the cancer effects are usually also protective of the non-cancer effects.

In addition, the SLV for arsenic in soil is based on the Reference Area UPL and is not a risk-based number since the concentration of naturally-occurring arsenic is higher than the risk-based SLV, as is typical of soils in the western United States. Therefore, the C/SLV ratio for arsenic only represents magnitude of exceedance above background. It cannot be multiplied by 1E-06 to provide a screening level estimate of risk as was done for other carcinogenic COPCs. Arsenic was retained as a COPC in soil if statistical testing (as described in Section 8) showed that the site concentration of arsenic was higher than the Reference Area concentration (as described in Section 8) and if the 95% UCL (or the maximum, whichever is lower) for arsenic in soil at the AOPC had a C/SLV ratio greater than 1.0.

COIs Without SLVs

For all media and exposure pathways, COIs without SLVs were generally retained as COPCs if they were reported at greater than 5% detection frequency, in accordance with DEQ and USEPA guidance. More detailed discussion of COIs without SLVs is found in Section 7.3 and Appendix O. An exception was inorganic COIs without SLVs were eliminated as COPCs if they did not exceed reference concentrations. For the groundwater to surface water discharge pathway, COIs detected in groundwater that did not meet bioaccumulation criteria (Table J-6 and J-7) and did not have SLVs were dropped. In some cases, DEQ SLVs were not available due to the calculated value exceeding either the solubility limit or the saturation point. In these cases the COIs were also eliminated as COPCs.

Identification of List of COPCs

At the end of multi-step process described above, COIs were identified as COPCs if they met the following two criteria:

- Detected at greater than 5% frequency

- Exceeded Reference Area concentrations (inorganics only)

Along with any one of the following criteria:

- Single-chemical C/SLV ratio greater than 1.0 (i.e., ELCR greater than 1E-06 for carcinogens and HQ greater than 1.0 non-carcinogens)
- Single-chemical C/SLV ratio greater than 0.1 and multi-chemical sum C/SLV greater than 1.0 (non-carcinogens only)
- Multimedia C/SLV ratio greater than 1.0 (carcinogens and non-carcinogens)
- No SLV available, or degradation product of PCE or TCE

11.2.3.5 Risk Interpretation

In this final phase of the screening level risk characterization process, the quantitative and qualitative components of the risk screening (i.e., toxicity ratios) and uncertainty assessment are evaluated to gain a better understanding of the actual potential for human health risk. Multiple lines of evidence are considered to provide qualitative information for the chemicals listed as COPCs and to support interpretation of the estimated health hazard and ELCR.

Confidence in the SLV was a key consideration to assess overall confidence in COPC selection. If primary sources did not provide SLVs, on a case-by-case basis, surrogate values were used and/or values from a more conservative receptor or exposure pathway. For screening based on surrogate SLVs, risk may be over-or under- estimated. If a SLV from a more conservative receptor or exposure pathway (i.e., an SLV for an Outdoor Worker for an Excavation Worker [who has less overall exposure] or using a tapwater water SLV for direct contact exposure), was used, which caused the COI to be selected as a COPC, it is most likely a highly conservative selection. In this scenario, development of a more representative SLV would be recommended for the baseline HHRA.

For each AOPC and receptor, the COPCs identified with toxicity ratios greater than 1 (and greater than 0.1 for noncancerous chemicals with HI greater than 1) and determined to be significant contributors to risk, are plotted in Figures 11-5 through 11-18, and discussed in the text below. Those COPCs where only a limited number of exceedances were noted or if their exceedances were minor, were not included on the spatial distribution maps.

11.2.4 Screening Risk Characterization

This section provides the results of the COPC selection process for each AOPC. The C/SLV ratios are also used to provide a preliminary discussion of the most significant chemicals for each receptor and pathway.

11.2.4.1 Landfill AOPC

COIs detected in Landfill AOPC soil included metals, SVOCs, pesticides, herbicides, and PCBs, PAHs, TPH, and VOCs. COIs detected in groundwater included metals, herbicides, PAHs, TPH, and VOCs; while seep COIs included metals, SVOCs TPH, and VOCs; and surface water COIs included metals and TPH. The applicable receptors for the Landfill AOPC are outdoor workers, construction and excavation workers, potable groundwater user, and recreational and subsistence fishers (from groundwater and erosional soil transport pathways). Indoor workers were not considered for this AOPC because construction of enclosed structures above the Landfill is unlikely but are discussed qualitatively below.

11.2.4.1.1 On-site Adult Outdoor Worker

The on-site adult outdoor worker is assumed to be exposed to soils 0-3 ft bgs by direct contact pathways (incidental ingestion, dermal contact, outdoor inhalation of dusts and vapors). The COIs were evaluated with reference to individual and cumulative exceedances of screening levels for the adult outdoor worker (Table M-1).

All chemicals that remained as COPCs after comparison with SLVs and the concentration-risk screen are summarized in Table M-12.

Non-carcinogenic COPCs – The overall non-cancer HI for multi-chemical exposure was 0.29 (excluding lead) and therefore below the health hazard threshold of 1 (Table M-1). All the COPCs that were evaluated as non-carcinogens have C/SLV ratios that were less than 1.0. Only lead was selected as a COPC, based on multi-media exposure to soil and groundwater. Lead concentrations exceeded their SLV at only three locations within the 0-3 ft bgs interval (BIL18, BIL22 and BIL27, Figure 11-5) but the EPC for lead (511 mg/kg) is lower than the SLV (800 mg/kg) and serves as an example of a COPC that is limited to very localized exceedances of low magnitude and unlikely to pose a significant risk to this receptor.

Carcinogenic COPCs – The cumulative screening level ELCR is 6.3E-05 (Table M-1) and falls within USEPA’s risk management range. Among the identified COPCs, those with the highest chemical C/SLV ratios were the cPAHs, primarily benzo(a)pyrene and a few others. ELCR related to the cPAHs is 6.1E-05 and thus accounts for the majority of the cumulative ELCR. Total benzo(b)fluoranthenes were not included in the PAH count since the individual benzo(b)fluoranthenes were retained as COPCs. (Total benzofluoranthenes were reported in earlier data sets and have since been supplemented with more recent data reporting individual fluoranthenes). Total benzofluoranthenes, evaluated separately, had a C/SLV ratio of 11.6 (ELCR= 1.1E-05) and fell within the range of ELCRs for the other cPAHs.

Arsenic was the only other carcinogenic COPC with a C/SLV ratio greater than 1, but, was low at 1.94. The SLV for arsenic (5.4 mg/kg) was based on the reference concentration and does not represent a risk-based SLV (i.e., excluded from in the ELCR sum). The SLV exceedance occurs at four locations, but the risk ratio is primarily due to a single location (BIL05) where arsenic occurs at a concentration of 30.1 mg/kg. At all other locations, arsenic was generally reported at concentrations similar to reference concentrations.

All the detected Aroclors and total PCBs had single-medium and multi-media C/SLV ratios less than 1.0 and were, therefore, not retained as COPCs. As noted earlier, the potential non-cancer effects associated with carcinogenic COPCs are not evaluated in this COPC selection process but are unlikely to affect COPC selection.

COPCs without SLVs – SLVs were available for all the COIs listed. Therefore, no COPCs were identified on the basis of a lack of SLVs.

Summary
There were eight COIs screened in as COPCs, which consist of metals and PAHs (Table 11-1). The COPCs contributing the most to health risk for the Adult Outdoor Worker at the Landfill AOPC include arsenic and cPAHs. Typically, two different patterns of spatial distribution were seen when a COI was identified as a COPC. The exceedances may either be due to substantially

elevated concentrations at a few locations (i.e., a few locations) or moderately elevated concentrations at many locations (dispersed). In some cases, the ratios exceeded 10 (i.e., screening risk level greater than 1E-05 or HQ greater than 10). The sample locations at the Landfill where SLVs were exceeded are shown in Figure 11-5. Among these, the locations where the C/SLV ratio exceeded 10 were primarily in the north-west corner of the Landfill AOPC. They included locations within the Gully Test Pit and nearby locations and in the Mercury Vapor Lamp Test Pit. The majority of the C/SLV ratios greater than 10 were for the cPAHs (in the Gully Test Pit). The modest exceedances of arsenic above its Reference Area UPL were dispersed throughout the Landfill AOPC and therefore are not indicative of any particular source area for arsenic.

11.2.4.1.2 Onsite Construction Worker

The construction worker is assumed to be exposed to a depth of 0-10 ft bgs soils for a period of 250 days for one year. Although some aspects of the construction worker’s activities may have higher exposures than outdoor workers (e.g., incidental soil ingestion rate of 330 mg/day versus 100 mg/day for the outdoor worker), their overall exposure dose is lower than the outdoor worker because of the much shorter duration of exposure (one year versus 25 years). Therefore, the SLVs developed for construction workers are generally higher (i.e., less stringent) than the SLVs for outdoor workers (except for certain non-carcinogenic chemicals which are not affected by the exposure duration difference). For COI’s lacking construction worker-specific risk based concentrations (RBCs) , the outdoor occupational worker RSLs were used and represents the use of SLVs that are probably more conservative than needed (from DEQ 2009b). For the deeper soil interval, the COPC list was almost identical to that of the shallow soil depth interval but contains fewer chemicals (Table M-2). The complete list of COPCs is summarized in Table M-12.

Non-carcinogenic COPCs – No non-carcinogenic COPCs exceeded a C/SLV ratio of 1, and the overall non-cancer HI for multi-chemical exposure was 0.90 (excluding lead) and therefore below the health hazard threshold of 1. The UCL for lead (796 mg/kg) was slightly lower than its SLV of 800 mg/kg (Table M-2).

*Carcinogenic COPCs –*The cumulative screening level ELCR is 1.2E-05 and falls within USEPA’s risk management range. This evaluation was conservative since the more stringent adult outdoor worker SLVs (based on USEPA industrial soil RSLs) were used for many COIs for which construction worker SLVs were not available.

The COPCs with the largest C/SLV ratios and major contributors to ELCR for this receptor were PCE and benzo(a)pyrene. The ELCR due to cPAH COPCs was estimated at 5.1E-06 (Table M-2). Individual Aroclors and total PCBs did not exceed a ratio of 1.0 either on a single-medium or a multi-media basis and were eliminated as COPCs.

COPCs without SLVs - SLVs were available for all the COIs listed. Therefore, no COPCs were selected solely due to a lack of SLVs.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes, TCE, and vinyl chloride) were also included in the list of COPCs for future consideration, but it should be noted that none of these degradation products were detected.

Summary

There were seven COIs screened in as COPCs, which consist of PAHs, SVOCs, and VOCs. The COPCs contributing the most to health risk the Construction Worker at the Landfill AOPC include benzo(a)pyrene and PCE (Table 11-1) . The locations with SLV exceedances for the construction worker risk contributing COPCs are shown in Figure 11-6. The locations with cPAHs exceeding a risk level of 1E-05 were limited to the Gully Test Pit, a few nearby locations and the Mercury Vapor Lamp Test Pit. Elevated PCE was only found at one location in the Gully Test Pit.

Onsite Excavation Worker

DEQ’s RBCs (2003, updated 2009) assume that an excavation worker may be exposed to contamination for nine days during one year of exposure. Therefore, a screening evaluation for the excavation worker was also performed (Table M-3). SLVs that are specific to the excavation worker are even lower than for the construction worker due to the fewer number of days exposed in a year.

The overall non-cancer HI for multi-chemical exposure was 0.73 and therefore, less than the threshold value of 1. The cumulative ELCR was 8.0E-07, which is below the threshold risk level of 1E-06. No COPCs were identified and therefore, there are no unacceptable risks to the Excavation Worker due to exposure to soils.

11.2.4.1.3 Groundwater Exposure – Construction/Excavation Worker

During the winter, there is a possibility that construction and excavation workers may encounter shallow perched groundwater during the course of soil-intrusive activities. Preliminary COPC concentrations in groundwater were compared to DEQ’s SLVs for this receptor and pathway (Table M-4).

Some metals and DNOP screened in as COPCs, but this was due to using the tapwater SLVs because DEQ did not list direct contact SLVs for these chemicals. Although the much more conservative tapwater SLVs were used, the C/SLV ratios were still very low with iron being the highest at 1.1. Upon closer evaluation, antimony, mercury, and DNOP lacked DEQ RBCs due to their calculated SLVs exceeding their respective solubility limits for this pathway. It should be noted that for metals, the listed direct contact to groundwater RBCs were four to six orders of magnitude greater than their respective tapwater RBCs. Given these reasons, the screened in COPCs should be dismissed. Therefore, there are no unacceptable risks to the Construction Worker and Excavation Worker due to direct contact exposure to groundwater.

11.2.4.1.4 Groundwater User for Potable Use

Groundwater data collected from monitoring wells over the period 1998 to 2009 were compared to the SLVs for potable water use. The targeted Landfill AOPC receptor, assumed to utilize the groundwater for potable use, is the Adult Outdoor Worker though this screen could conservatively apply to any hypothetical onsite worker who may be a potable water user. As listed in Table M-5, the COPCs identified included a number of metals, several VOCs, SVOCs, and TPH fractions. The chemical with the highest C/SLV ratio was arsenic, followed to a lesser degree, by PCE, vinyl chloride and DRO. The full list of COPCs is summarized in Table M-12.

Non-carcinogenic COPCs – The non-carcinogenic COPCs exceeded a C/SLV ratio of 1, and the overall non-cancer HI for multi-chemical exposure was 11. The primary contributor to this HI was DRO (C/SLV=4.3), followed, to a lesser degree, by manganese (C/SLV=2.2), DNOP

(C/SLV=1.1) iron (1.1) and RRO (C/SLV=1.2). None of these ratios were considered significant given the conservatism inherent in using residential potable water SLVs for this AOPC. If it were assumed that the occupational potable use of groundwater is one third that of the residential water use, then DRO would be the only one of these analytes that would exceed a C/SLV ratio of 1.0.

The remaining COPCs exceeded the potable use SLVs by relatively small margins or were included only because of multi-chemical (i.e., C/SLV greater than 0.1 when sum C/SLV exceeds 1.0) and multi-media exposures (antimony, lead, zinc, GRO, 1,2,4-trimethylbenzene). These analytes do not exceed their individual SLVs at any location. Further, even the multi-media C/SLV ratios for antimony, zinc and GRO were less than 1.0 and, therefore, health concerns related to these analytes are unlikely. Iron and zinc are essential trace elements for human nutrition and is typically not considered to be toxic at such low concentrations.

Carcinogenic COPCs – The cumulative ELCR was 3.2E-04, primarily due to arsenic. Arsenic had a C/SLV ratio of 274 (ELCR of 2.7E-04), due to its extremely low SLV of 0.000038 mg/L. It should be noted that total arsenic concentrations in the upgradient Reference Well were reported in the range of 0.00122 to 0.00168 mg/L (Table I-6) and were also above the SLV for potable water. The maximum reported concentration in Landfill AOPC groundwater (maximum reported concentration of 0.0213 mg/L (Table I-1) and a 95% UCL value of 0.010 mg/L) was about 10 times higher than the upgradient concentration. Thus, the upgradient arsenic concentrations were approximately 35 times higher than the SLV and Landfill AOPC groundwater was about 270 times higher than the SLV. Arsenic exceeded its SLV by more than a factor of 100 at several locations (Figure 11-7). The potable water SLV for arsenic is a strictly risk-based value that is routinely exceeded in groundwater just as naturally occurring arsenic in soil routinely exceeds the risk-based soil SLV. Therefore, it is common and useful to also compare arsenic to the maximum contaminant levels (MCL) of 10 µg/L (Appendix J, Human Health SLVs; DEQ 2010a) when considering potable water uses. By this standard, the 95% UCL for arsenic in landfill groundwater (10.4 µg/L, Table M-5) is essentially equal to the MCL. Therefore the ELCR of 2.7E-04 for arsenic is considered to be an artifact of the screening process and does not necessarily mean that the groundwater is unsuitable for potable use.

Other carcinogens with C/SLV ratios greater than 1 included PCE, vinyl chloride, chloroform, and B2EHP. Among these, PCE and vinyl chloride exceedances are significant because of their high potential for toxicity and they were detected in approximately 25% of the samples and their UCLs were associated with risk levels corresponding to 3E-05 and 1.2 E-05, respectively (Table M-12).

It should also be noted that potable water use SLVs for VOCs such as PCE, its degradation compounds and chloroform are influenced most by the inhalation route, i.e., inhalation of the VOCs during household uses such as showering (USEPA 2010). In the case of the Upland AOPCs, hypothetical potable use of groundwater would primarily consist of ingestion and minimal exposure by the inhalation route.

COPCs without SLVs - SLVs were available for all the detected preliminary COPCs. Therefore, no COPCs were selected solely due to a lack of SLVs.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes and TCE) were also included in the list of COPCs for future consideration, but it should be noted that these degradation products were detected minimally (less than 5% detection frequency) and in most cases not detected at all.

Summary

There were 19 COIs screened in as COPCs for potable use of groundwater, which consist of metals, TPH, SVOCs, and VOCs (Table 11-1). The COPCs contributing the most to health risk for the potable water user exposed to Landfill AOPC groundwater include arsenic, manganese, chloroform, PCE, vinyl chloride and DRO. Locations with metal SLV exceedances are shown on Figure 11-7. Exceedances for several COPCs occurred at all the monitoring wells within the Landfill AOPC. Arsenic exceeded 1E-05 risk levels at all the wells. Locations with organic SLV exceedances are shown on Figure 11-8. Exceedances of PCE above 1E-05 were noted along the northern side of the Landfill AOPC.

11.2.4.1.5 Groundwater Discharge to Surface Water

A description of the migration pathway for groundwater is included in Section 10.1.1 and concludes that the pathway exists for discharge to surface water, but that the water is subject to rapid dilution as soon as it reaches the river.

To evaluate the transport pathway from a human health standpoint, the recently collected groundwater data from the Landfill AOPC were compared to data collected from the seep locations and the adjacent surface water locations (Table M-6). COIs that were detected in groundwater, seeps, and shoreline surface water were considered to be representative of how COIs act within this transport pathway. The C/SLV ratios were calculated for the maximum concentrations reported in groundwater, seep water, and shoreline surface water. For the majority of the COIs, substantial reductions in concentrations and C/SLV ratios occurred along the flow path from groundwater to seep water to shoreline surface water locations. The exceptions were iron and lead which showed little reduction or a slight increase. The only COPC with a C/SLV ratio exceeding 1.0 at the shoreline surface water was arsenic. However the maximum arsenic concentration in the surface water (0.00117 mg/L) was similar to the maximum groundwater concentration observed at the Reference Area well (0.00168 mg/L) (Table M-6). This trend appears to hold for the other metals as well where the shoreline surface water concentrations are similar to reference area groundwater concentrations.

There is evidence of a transport pathway where COPCs may move between the groundwater to seep water to surface water, but the potential for discharge of COPCs in Landfill groundwater into the river surface at levels of concern appears to be low. The human health impacts of the media within this transport pathway are potable use and bioaccumulation into fish and selfish. This is discussed in further detail below.

Groundwater Discharge and Bioaccumulation

Groundwater for potable use is discussed in Section 11.2.4.1.4. Those COIs that exceeded bioaccumulation SLVs in groundwater were retained as COPCs for the bioaccumulation pathway (Table M-7) for the Subsistence Fisher and Recreational Fisher receptors. The bioaccumulation pathway is a potentially complete exposure pathway for all the receptors evaluated for the Landfill AOPC. Onsite workers may opt to fish recreationally on their time off. For the multi-media screening, the Adult Outdoor Worker was chosen to represent onsite receptors. The COPCs retained for this pathway are listed in Table M-12

Non-carcinogenic COPCs –The HI of 5.8 exceeds the health hazard threshold of 1.0 and is primarily due to DNOP. Although the C/SLV ratios for iron and manganese were greater than 1.0, the SLVs were based on aesthetic effects related to water consumption (Oregon Water Quality Criteria [WQC], Table 33b) and are not indicative of human health effects. Since these analytes are not considered to be bioaccumulative, their C/SLV ratios are not included in the HI. Some additional metals were also selected as COPCs due to their cumulative contribution to the non-cancer hazard. Their individual C/SLV ratios were less than 1.0 except thallium which had an C/SLV ratio of 1.0. It should be noted that DNOP was not selected as a COPC for tissue in the River OU.

Carcinogenic COPCs – The cumulative ELCR was 6.0E-04, which exceeds the risk management range and was primarily due to arsenic. Arsenic concentrations exceeded the SLVs by more than a factor of 10 at all monitoring well locations including seep and shoreline surface water locations (Figure 11-9). PCE and vinyl chloride also had C/SLV ratios greater than 1, but should be noted that these volatile compounds do not meet the criteria used to identify bioaccumulation potential (Table J-7). B2EHP concentrations exceeded the SLV at three locations: MW-1, MW-2 and MW-4 in the interior but not in any of the more exterior monitoring well locations and seep water samples (Figure 11-9; Table M-8); therefore the potential for discharge to the river at levels of concern appeared to be low.

COPCs without SLVs –Lead, mercury, tributyltin, and three VOCs (1,2,4-trimethylbenzene, isopropylbenzene, and n-propylbenzene) were screened in as COPCs because bioaccumulation-based SLVs are unavailable and they may have some potential for bioaccumulation based on their BCF or octanol-water coefficients (Table J-6). Mercury was detected at extremely low concentrations with a UCL of 0.000077 mg/L (Table M-7) and had a low detection rate (17%) in four of 24 samples. Also, detections were only in wells from the interior of the Landfill but not in any of the exterior wells (MW-01, MW-03, MW-08, MW-09, Appendix A). It also did not exceed the residential potable user SLV. Therefore, the potential for discharge of mercury into the river at concentrations of concern for human health appears to be low. VOCs are unlikely to persist in the aquatic environment after discharge to surface water and would typically not be expected to bioaccumulate in tissue. Although there is no bioaccumulation-based SLV for tributyltin, the residential potable water SLV for tributyltin is available (11 µg/L) and was not exceeded at any location.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes and TCE) were also included in the list of COPCs for future consideration, but it should be noted that these degradation products were detected minimally (less than 5% detection frequency) and in most cases not detected at all. Again, VOCs are unlikely to persist in the aquatic environment and typically do not bioaccumulate in tissue.

Summary

There were 18 COIs screened in as COPCs, which consist of metals, SVOCs, and VOCs (Table 11-1). The COPCs contributing the most to health risk for the Landfill AOPC groundwater for the bioaccumulation pathway include arsenic, DNOP, PCE, and vinyl chloride.

Seep Water

The seep water samples represent a limited data set that was collected primarily to evaluate the groundwater transport pathway. Use of seep water and shoreline surface water for potable water use is neither practical nor feasible due to their location. Similarly, the most robust evaluation of bioaccumulation potential is performed on the basis of River OU surface water and tissue data (see Section 11.3.4). No statistical analysis of these data was performed and the detected COIs were compared to SLVs and no inferences regarding HI or ELCR were made. Tables M-8 and M-9 list the COPCs for the two seep water sample locations that were identified for potable water use, and for discharge to surface water and subsequent bioaccumulation pathways, respectively.

COPCs identified for potable water use included metals, several VOCs, and TPH (Table M-8). Non-carcinogenic COPCs included antimony, iron, lead, manganese and DRO. Carcinogenic COPCs were arsenic, chloroform, and PCE. Degradation products of PCE were also included. Among the COPCs listed, arsenic is already retained as a COPC for the groundwater discharge pathway (Table M-6). Chloroform and PCE (and its degradation products) are unlikely to persist in the River OU since they are VOCs.

COPCs identified for the discharge and bioaccumulation pathway included arsenic, lead, mercury, and PCE (and its degradation products) (Table M-9).

Shoreline Surface Water

Tables M-10 and M-11 list the COPCs that were identified for potable use, and for discharge to surface water and subsequent bioaccumulation pathways, respectively, for the shoreline surface water samples. Arsenic was the only COPC identified for potable use and was already included as a COPC for groundwater (Table M-12). Arsenic and lead were screened in as COPCs for bioaccumulation.

11.2.4.1.6 11.2.4.1.6 Volatilization of VOCs from Groundwater

VOCs in groundwater at the landfill may volatilize to the outdoor air. In the extremely unlikely event that enclosed structures are built at the landfill, intrusion of VOCs into the indoor environment may also occur. VOC concentrations in the groundwater were compared to DEQ’s RBCs for outdoor inhalation of vapors and indoor inhalation of vapors in an occupational setting. All VOC concentrations were lower than their respective SLVs by more than two orders of magnitude. These comparisons are not presented in tables due to the infeasibility of construction at the landfill and the low likelihood of this pathway ever being complete.

11.2.4.2 Sandblast Area AOPC

COIs detected in Sandblast Area soil included metals, butyltins, SVOCs, pesticides, PCBs, PAHs, TPH, and VOCs. VOCs were also detected in soil gas. COIs detected in Sandblast groundwater included metals, butyltins, PAHs, TPH, and VOCs. Although PCE, TCE and dichloroethenes were detected in all media, vinyl chloride was detected only in groundwater. The applicable receptors for the Sandblast Area AOPC are outdoor workers, construction/excavation workers, potable groundwater user, indoor workers and recreational and subsistence fishers (from groundwater and erosional soil transport pathways).

COPC selection for the Sandblast Area AOPC included evaluation of data for soil, groundwater and soil gas, as described below. An additional set of data collected for surface soils at this AOPC included analysis of lead in two different soil particle soil fractions of less than 2 millimeter (mm) and less than 250 micrometers (μm). The goal of collecting these data was for subsequent site-specific evaluation of the lead ingestion pathway for adult workers, should lead be selected as a COPC for soil.

11.2.4.2.1 On-site Outdoor Worker

The COPCs associated with the upper 3 feet of soils for this receptor are listed in Table M-13. The COPCs in surface soils include three metals (chromium, lead and arsenic), a few VOCs (PCE and TCE), and a few PAH compounds. The potential degradation products of PCE were also retained (Table M-13). In addition, as requested by DEQ for this AOPC only, lead was also evaluated and is retained as a COPC for the 0-1 ft bgs depth interval (Table M-13).

Non-carcinogenic COPCs - The cumulative C/SLV ratio resulted in an HI of 0.087, well below the health hazard threshold of 1, excluding the C/SLV ratios for lead. No single non-carcinogenic chemical other than lead had a single-medium C/SLV ratio greater than 1.0.

Lead was reported and evaluated in a more detailed manner than other analytes for this AOPC because of its known source and its potential toxicity. Its evaluation is consistent with USEPA recommendations for lead (USEPA 2000). Its occurrence as part of sandblast grit means that it may occur at higher concentrations in association with finer-grained soil particles and thus, may be more available for intake as part of inhalation and incidental ingestion pathways with subsequent release into the bloodstream. In addition, the particle-size relationship may also allow higher concentrations of lead in grit to be present in the surface soils from which most of the occupational exposure may occur. Therefore, lead samples were collected and analyzed to represent 2 surface depth intervals and three size fractions at this AOPC. The two surficial depth intervals were 0-3 ft bgs and 0-1 ft bgs. The size fractions included unsieved fractions, particle size fraction less than 2 millimeter (mm) and particle size fraction less than 250 micrometers (μm). The unsieved fraction provides total lead concentrations similar to all other analytes for soil samples. The 2 mm fraction represents total soil lead (without included chunks or larger particles that would typically not enter the ingestion and inhalation pathways). The less than 250 μm fraction represents the lead fraction most likely to be deposited on hands and other exposed body parts during direct contact followed by incidental ingestion.

The lead results shown in Table M-13 indicate that higher lead concentrations were reported in the 0-1 ft bgs interval and UCLs decreased when the 0-3 ft bgs interval was considered. In the 0-3 ft bgs interval, lead UCLs did not exceed the SLV of 800 mg/kg for any of the size fractions. In the 0-1 ft bgs interval, the lead UCL was close to the SLV for the 2 mm and the 250 um fraction (C/SLV ratios of 0.96 and 1.15, respectively). The unsieved total lead UCL was higher than the SLV and resulted in a C/SLV ratio of 4.08.

Because the C/SLV ratio for the most bioavailable lead fraction exceeded 1.0, lead is recommended for additional and more rigorous evaluation for this AOPC (Table M-20).

Carcinogenic COPCs – The cumulative ELCR was 2.2E-05, which falls within the risk management range. The COPCs with the greatest contribution to cumulative ELCR (i.e., highest single chemical C/SLV ratios) were PCE, and three cPAHs (benzo(a)pyrene, benzofluoranthenes, and dibenz(a,h)anthracene). cPAH COPCs were associated with an ELCR of 9.7-06 (Table M-13). Chromium was also included as a COPC based on the use of the SLV for hexavalent chromium. In the absence of site-specific chromium speciation data, it was conservatively assumed that all the detected chromium was the more toxic hexavalent chromium rather than the more common and much less toxic trivalent chromium. Arsenic was included as a carcinogenic COPC but had a relatively low C/SLV of 1.8. The ratio exceeded 1.0 primarily because of a single location where it was reported at 80.9 mg/kg.

The distribution of the SLV exceedances is shown in Figure 11-9. The seven locations where total lead exceeded the SLV of 800 mg/kg (concentrations range from 921 mg/kg to 3,260 mg/kg) are primarily along the northern portion of the AOPC. Concentrations of VOCs exceeded their SLVs by more than a factor of 10 at only two locations near the current HMSA. Therefore, the areas of concern for VOCs are quite limited. Locations where PAHs exceeded their SLVs were more widespread and included the eastern edge and northwestern corner of the AOPC and two other isolated locations (HA3 to the north and DSA11 to the south). Arsenic had low level exceedances (C/SLV less than 10) at numerous locations throughout the AOPC. In addition, one station (SBB18) had a concentration (80.9 mg/kg) significantly higher than the SLV (5.4 mg/kg). Arsenic, chromium, PCE and TCE were retained as carcinogenic COPCs that are recommended for further and more rigorous evaluation.

COPCs without SLVs - SLVs were available for all the preliminary COPCs. Therefore, no COPCs were selected solely due to a lack of SLVs.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes, TCE, and vinyl chloride) were also included in the list of COPCs for future consideration, but it should be noted that these degradation products were detected minimally (less than 5% detection frequency) and in most cases not detected at all.

Summary

There were 11 COIs screened in as COPCs, which consist of metals, PAHs, and VOCs (Table 11-2). The COPCs contributing the most to health risk at Sandblast AOPC soil for the adult outdoor worker include lead, arsenic, chromium, benzo(a)pyrene, total benzofluoranthenes, and PCE. The locations with SLV exceedances are illustrated in Figure 11-10 and are seen to be fairly widespread in distribution.

11.2.4.2.2 On-site Construction Worker and Excavation Worker

Construction Worker

COPCs for the deeper soil depth interval are similar to the shallow soils, but fewer in number as shown in Table M-14.

Non-carcinogenic COPCs - The cumulative C/SLV ratio resulted in an HI of 0.11, which is well below the health hazard threshold of 1. No single chemical had a C/SLV ratio that exceeded 1.0 either on a single-medium or multi-media basis. Lead in the 0-1 ft bgs interval was not separately evaluated for this receptor (as it was for the Adult Outdoor Worker) due to the intrusive nature of their expected activities. Lead in the 0-10 ft bgs interval had a C/SLV ratio of less than 1.0 and was not identified as a COPC.

Carcinogenic COPCs - PCE and benzo(a)pyrene had single chemical C/SLV ratios greater than 1.0 and contribute the most to the cumulative ELCR of 7E-06, which is within the risk management range. The C/SLV ratio for PCE was on the order 2E-06. The risk levels associated with PAHs were slightly higher, up to a high of approximately 1.9E-06. All other COPCs had ratios less than 1.0 (Table M-14).

COPCs without SLVs - SLVs were available for all the COIs. Therefore, no COPCs were selected solely due to a lack of SLVs.

***Degradation Products Of PCE* –** Since PCE was selected as a COPC, its degradation products (dichloroethenes, TCE, and vinyl chloride) were also included in the list of COPCs for future consideration, but it should be noted that these degradation products were detected minimally (less than 5% detection frequency) and in most cases not detected at all.

Summary

There were seven COIs screened in as COPCs, which consist of benzo(a)pyrene, PCE, and PCE degradation products (Table 11-2). The locations where C/SLV ratios exceeded 1.0 for PCE and benzo(a)pyrene are shown in Figure 11-11. The locations with exceedances of COPCs at levels greater than a factor of 10 are similar to those noted for the outdoor worker and are related primarily to the cPAHs.

Excavation Worker

The cumulative C/SLV ratio resulted in an HI well below the threshold of 1.0 and the cumulative ELCR was 8.1E-07, which is below the risk threshold. Likewise, there were no COPCs selected for the excavation worker (Table M-20).

Construction/Excavation Worker Exposure to Groundwater

As noted earlier, there is a possibility that construction and excavation workers may encounter shallow perched groundwater during the course of soil-intrusive activities. Preliminary COPC concentrations in groundwater were compared to DEQ's SLVs for this receptor and pathway (Table M-17).

The HI of 1.0 was primarily due to the only COPC, vanadium, which had an C/SLV ratio of 0.98. A DEQ SLV for direct contact to groundwater in a trench was not available for vanadium and, therefore, the tapwater SLV was used, which is considerably more conservative. As noted earlier, the groundwater direct contact RBC for metals are typically four to six orders of magnitude more than the tapwater RBCs and therefore vanadium should be dismissed. No non-carcinogenic or carcinogenic compounds had C/SLV ratios greater than 1.0. The cumulative ELCR was 3.6E-07 and below the threshold of 1E-06.

11.2.4.2.3 Indoor Office Worker

The maximum detected concentration of COIs in soil gas were used to identify COPCs in soil gas (Table M-16).

Non-carcinogenic COPCs - No non-carcinogenic VOCs were identified as COPCs since the cumulative C/SLV ratio was less than 1.0. No single chemical had a C/SLV ratio that exceeded 1.0 either on a single-medium or multi-media basis.

Carcinogenic COPCs - PCE and TCE were the only primary COPCs with a cumulative ELCR of 2.1E-05. PCE and TCE were the only COPCs with single chemical ratios greater than 1.0. The ratios for these chemicals were approximately 16 and 4, respectively, and correspond to risk levels of approximately 2E-05 and 4E-06. These fall within USEPA's risk management range but exceed DEQ's target risk levels for individual COPCs.

COPCs without SLVs - Soil gas SLVs were available for all detected COPCs with the exception of ethanol. Ethanol was reported in two of five samples with a maximum concentration of 13 µg/m^3 (Table I-13). Although it is volatile, ethanol is not considered to be a toxic VOC (USEPA 2002c). Therefore, ethanol was not retained as a COPC.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes, TCE, and vinyl chloride) were also included in the list of COPCs for future consideration. cis- and trans-1,2-DCE were detected well below their soil gas SLV. Vinyl chloride and 1,1-dichloroethene were not detected in soil gas. The degradation products for the soil gas medium is pertinent because once they are released into soil gas, the exposure potential for human receptors through the inhalation pathway is higher than if they were in soil or groundwater media.

Summary

There were six volatile COIs screened in as COPCs (M-20). The COPCs contributing the most to health risk at the Sandblast AOPC soil gas for the vapor intrusion pathway for the indoor worker include PCE and TCE. The locations with exceedances of the SLVs are shown in Figure 11-12. SB-12 had a C/SLV ratio of greater than 10 for PCE. SB-10 had a ratio less than 10. Although the locations of PCE and TCE exceedance in soil gas are not co-located with the exceedances for soil (see Figure 11-10), as discussed in Section 9.3.3, they are located within the footprint of the PCE groundwater plume and downgradient from the inferred PCE source area (storage tank historically stored at the location of the current HMSA). The exceedances of the soil gas SLVs are quite localized and limited to just 2 of the 5 sample locations neither of which is close to any occupied structures. The two locations with the exceedances are near the HMSA and the former sandblast building.

11.2.4.2.4 Groundwater - Potable Water User

COPCs in groundwater data from the monitoring wells were identified for the potable use exposure pathway and include metals, PAHs, VOCs and TPH (Table M-18).

Non-carcinogenic COPCs - Vanadium, several VOCs, DRO and GRO were identified as COPCs as contributors to the cumulative HI of 3.2, which exceeds the health hazard threshold of 1.0 (Table M-18). cis-1,2-DCE (detected in 15 of 20 samples) was the most significant exceedance with a C/SLV ratio of 1.8, all other non-carcinogenic COPCs had C/SLV ratios <1, but several exceeded 0.1, which is the threshold when cumulative HI is greater than 1.

Carcinogenic COPCs - Arsenic, PAHs (direct push), and some chlorinated VOCs were selected as COPCs with a cumulative ELCR of 2.6E-04, which exceeds the risk management range. No SVOCs were identified as COPCs. The COPCs with the highest single chemical C/SLV ratios were arsenic, PCE, TCE and vinyl chloride. However, arsenic in groundwater at the Sandblast Area AOPC was reported at a maximum of 0.0136 mg/L and while this concentration is higher than the Reference Area (0.001 mg/L) (Table I-6), the C/SLV ratio is elevated primarily because of the extremely low SLV (0.000038 mg/L).

COPCs without SLVs – SLVs were available for all preliminary COPCs.

Degradation Products Of PCE – Since PCE was selected as a COPC, its degradation products (dichloroethenes) were also included in the list of COPCs for future consideration, but it should be noted that these degradation products were detected below SLVs.

Summary

There were 13 COIs screened in as COPCs, which consist of metals, PAHs, TPH, and VOCs (Table 11-2). The COPCs contributing the most to health risk at the Sandblast AOPC groundwater for the potable water user include vanadium, arsenic, cis-1,2-DCE, 1,1-DCA, PCE, TCE and vinyl chloride. The locations where potable water SLVs were exceeded are shown in Figure 11-13. All of the five monitoring well locations had COPC concentrations with exceeding the SLVs by a factor of 10 or more. Arsenic SLVs were exceeded at all locations and the SLVs for VOCs (primarily PCE and TCE) were exceeded at four of the five locations.

11.2.4.2.5 Groundwater - Discharge to Surface Water and Bioaccumulation

Table M-19 provides the results of the comparison of COI data in groundwater against SLVs for the discharge and bioaccumulation pathway. Selected COPCs include metals, PAHs, and VOCs.

The groundwater data were evaluated in relation to the surface water and tissue data for the River OU to assess the potential for release of bioaccumulative COPCs. Results of this pathway screen should be considered along with the River OU results which incorporate tissue data and a broader dataset. Of the metal COPCs, vanadium was selected due to the lack of a bioaccumulation SLV and its bioaccumulation potential has not been evaluated. Concentrations of arsenic in the groundwater were only marginally higher than upgradient arsenic concentrations. It should be noted that the less reliable direct push groundwater data (due to the lack of monitoring well data for PAHs) was used for evaluating the PAHs, which adds to the uncertainty of the relatively low C/SLV ratios for benzo(a)pyrene and indeno(1,2,3-cd)pyrene and the multi-media exposure exceedance of dibenz(a,h)anthracene. Both PCE and vinyl chloride had significant C/SLV ratios of 3.9 and 44, respectively, but VOCs are typically not expected to persist in the water and bioaccumulate. Except for arsenic, the bioaccumulation potential for the COPCs identified was considered to be low since they were not supported by evidence of bioaccumulation in the River OU (Section 11.3.4).

Figure 11-14 shows the locations where the SLVs were exceeded for arsenic. All locations exceeded the bioaccumulation SLV for arsenic by more than a factor of 10. However, the potential for bioaccumulation is best evaluated by review of the River OU data.

11.2.4.3 Pistol Range AOPC

The media sampled at the Pistol Range include soil and groundwater collected by means of direct push sampling and sediment. Based on site history and prior site investigations, the COIs for this AOPC included copper (groundwater and sediment), lead, nickel and zinc in all media.

11.2.4.3.1 On-site Adult Outdoor Worker (0-1.5 ft bgs)

Soil data for the Pistol range were collected from the 0-1.5 ft bgs depth interval, as discussed in Section 5.2.3 and 6.1.3. Table M-21 provides the comparison of soil data for COIs to the SLVs for the Adult Outdoor Worker. For the screening of the Pistol Range AOPC for exposure to soil, the Adult Outdoor Worker is considered protective of both the Construction worker and Excavation worker receptors. The list of COPCs is summarized in Table M-26.

Non-Carcinogenic COPCs - No individual chemical exceeded the corresponding SLV. The cumulative non-carcinogenic C/SLV ratio was also less than 1.0.

The on-site exposure pathways appear to be of low significance for soils and groundwater at the Pistol Range. For on-site receptors, only one COPC, lead, was identified for soil and groundwater at the Pistol Range. The 95% UCL for lead in soil was 365 mg/kg and was lower than the selected SLV of 800 mg/kg (Table M-21). Similarly, the maximum detected concentration of total lead in grab groundwater samples was 0.0125 mg/L which is below the potable use SLV of 0.015 mg/L (Table M-23). The cumulative multi-media C/SLV (1.29) value was marginally greater than 1.0 (Table M-21). It is highly unlikely that unfiltered groundwater from the area of the Pistol Range AOPC would be used for potable water use. Therefore, no additional consideration of lead is warranted in soil and groundwater for the Pistol Range AOPC and it recommended for no further evaluation.

Carcinogenic COPCs - No carcinogenic COPCs were identified. The cumulative ELCR was 4.2E-09 and is associated with the low concentrations of nickel in soil (Table M-21).

Summary

The only two locations at which the SLV for lead is exceeded are PFR48 and PFR50, where lead concentrations (835 mg/kg and 1,110 mg/kg) are slightly higher than the SLV of 800 mg/kg. These locations are behind the former backstop. Given that lead is not recommended for any further evaluation, these minor exceedances are of low significance and are not a concern for human health.

Construction/Excavation Worker Exposure to Groundwater

As shown in Table M-22, none of the COIs for which SLVs were available for this receptor exceed their SLVs. HI (0.014) and ELCR (4.2E-12) were well below the health hazard and risk thresholds and no COPCs were identified (Table M-26).

Table M-22 shows lead to have a multi-media exposure C/SLV ratio slightly above 1, but lead is not considered a COPC due to low confidence in the SLV used. Lead did not have a DEQ direct contact exposure SLV (exposure to groundwater in a trench) listed and therefore a tapwater SLV was used which still resulted in a C/SLV ratio less than 1.0. If this conservative screen were to be summed with the conservative Adult Outdoor Worker soil exposure (since Construction and Excavation Workers were not screened separately), the multi-media exposure would result in a C/SLV of 1.3. It should also be noted that the DEQ groundwater direct contact SLV was not listed due to the calculated value being above the solubility limit for lead. Given these compelling reasons, lead was not selected as a COPC for this receptor and pathway.

11.2.4.3.2 Groundwater – Potable Water User

In the absence of monitoring well data for the Pistol Range AOPC, groundwater data from the direct-push measurements were reviewed (Table M-23).

Non-Carcinogenic COPCs - The only COPC retained from the direct-push groundwater data was lead. Although lead in groundwater did not exceed the SLVs for potable water use, it was retained on the basis of multi-media exposure in soil and groundwater (Table M-23). No other COPCs were identified (Table M-26).

Although lead was identified as a COPC, it is unlikely that this pathway will constitute a significant health risk since the overall multi-media C/SLV ratio is only marginally higher than 1 (1.29). Use of groundwater form this area, where a very low quantity of perched groundwater is available, is as a potable water source is extremely unlikely.

Carcinogenic COPCs – No carcinogenic COPCs were retained (Table M-26). The cumulative ELCR was 6.9E-08 which is well below the threshold risk level of 1E-06.

In summary, lead is the only possible COPC and due only to multimedia exposure which includes an unlikely scenario of groundwater for potable use. Due to the significant unlikelihood of groundwater at the Pistol Range being used as an unfiltered potable water source and the marginal exceedance based on multi-media exposure, no further evaluation of lead for this receptor and pathway is warranted.

11.2.4.3.3 Groundwater Discharge to Surface Water and Bioaccumulation

Identification of COPCs for this pathway is shown in Table M-24. Lead screened in as a COPC due to a lack of an SLV. It should be noted lead was not identified as a COPC for the River OU media (Section 11.3.4) and is typically considered to have low potential for bioaccumulation. Therefore, this pathway is unlikely to be of concern for human health and lead was not retained as a COPC that warrants further evaluation..

11.2.4.3.4 Bioaccumulation of COIs from Pistol Range Lagoon Sediments

Off-site exposure pathways are of low significance for the Pistol Range AOPC. Although soils may wash off into the adjacent lagoon, no direct contact pathways related to lagoon sediment are complete for human receptors. Therefore, only bioaccumulation pathways may be complete whereby edible sport fish or their prey may take up COIs that may have washed off into the lagoon.

The metal concentrations in sediment samples collected from the Pistol Range Lagoon were compared to sediment SLVs (Table M-25). Lead and zinc both slightly exceeded their SLV with C/SLV ratios of 2.3 and 1.6 respectively.

Of the four COIs, only lead and zinc are considered potentially bioaccumulative but with low potential (Table J-6). Concentrations of copper and nickel in the adjacent lagoon sediments were comparable to or lower than Forebay area concentrations in sediment. Lead and zinc were slightly higher than Forebay sediments (Table 9-3). None of these COIs were detected in crayfish or smallmouth bass tissue in the Forebay at concentrations that exceed reference area tissue concentrations (Section 8). Neither lead nor zinc has been identified as a COPC in the River OU (Section 11.3.4). Zinc is an essential element that organisms are able to regulate with regard to intake. Thus, there is low potential for bioaccumulation of Pistol Range COIs into aquatic species of interest to human receptors. In the absence of direct contact exposures for sediment in the lagoon, the low bioaccumulation potential for lead and zinc and their low C/SLV ratios, lead and zinc were not do not warrant any further consideration and no further evaluation of these chemicals is warranted for sediments in the Pistol Range lagoon.

11.2.4.4 Bulb Slope AOPC

Surface soil was the only medium evaluated for this AOPC.

11.2.4.4.1 Onsite Adult Outdoor Worker

Six COIs detected in surface soil were compared to their respective SLVs (Table M-27).

Non-carcinogenic COPCs - None of the non-carcinogenic COIs exceeded their SLVs on a single or multi-media basis and the cumulative HI was less than 1.0. Therefore no non-carcinogenic COPCs were identified.

Carcinogenic COPCs - No carcinogenic COPCs were identified since the cumulative ELCR was 1.4E-07 which is below the threshold level of 1E-06. Therefore, no COPCs were identified for this receptor. (Table M-27).

No COPCs were retained for this AOPC. No further evaluation is recommended.

11.2.4.5 All Four AOPCs Combined

Soil and groundwater data from all four AOPCs were pooled to identify COPCs that are relevant to receptors who may be exposed to all the AOPCs. By combining the datasets, the values affected are the frequency of detection rate and the 95% UCL used as the EPC. The primary objective was to identify any new COPCs which were not selected in the individual AOPC screenings. Tables M-28 through M-33 show the screening process. Table M-34 provides a summary of all identified COPCs. No new COPCs (when compared to the individual AOPC COPCs) were identified when considering receptors exposed to all four AOPCs combined.

11.2.4.5.1 Adult Outdoor Worker

The COPC list for this receptor for the combined AOPCs is similar to those identified for the Landfill and Sandblast Area AOPCs.

Non-carcinogenic COPCs - The HI was estimated at 0.12. The COPC list was similar to the COPCs identified for this receptor (Table M-34) for the Landfill AOPC (Table M-12) and Sandblast Area AOPCs (Table M-20).

Carcinogenic COPCs - The cumulative ELCR was estimated at 5.0E-05 (Table M-28). No new COPCs were identified other than those already identified for the individual AOPCs. Arsenic, chromium, PCE and the cPAHs were associated with individual C/SLV ratios that exceeded 1.0 and were retained as COPCs. All other COPCs were identified on the basis of multi-media ratios (lead, TCE, and DRO) or as degradation compounds of PCE and TCE (e.g., dichloroethenes).

In summary, no additional COPCs were retained as COPCs for this receptor (when compared to the COPCs retained for the individual AOPCs).

11.2.4.5.2 Construction Worker and Excavation Worker

Identification of COPCs for these receptors is shown in Table M-29 and M-30. The summary of all initial COPCs is listed in Table M-34..

Construction Worker

Non-Carcinogenic COPCs - The estimated HI was 0.25 and therefore no COI exceeded their respective SLVs. The non-carcinogenic COPCs listed were degradation products of PCE (Table M-29).

Carcinogenic COPCs - The estimated cumulative ELCR was 7.3E-06. PCE and benzo(a)pyrene were the only COPCs with individual C/SLV ratios greater than 1.0 (Table M-29) with all others retained due to degradation products of PCE.

In summary, no new COPCs (when compared to the COPCs retained for the individual AOPCs) were identified with noncancer hazard and cancer risk both below thresholds.

Excavation Worker

Non-carcinogenic COPCs - The cumulative HI is 0.20 (Table M-30) and no COPCs were identified.

Carcinogenic COPCs - The cumulative ELCR was 6.2E-07. and no COPCs were identified.

In summary, no new COPCs were identified with noncancer hazard and cancer risk both below thresholds.

Construction and Excavation Worker Exposure to Groundwater

The identification of COPCs for this pathway is shown in Table M-31. The identified COPCs are summarized in Table M-34.

Non-carcinogenic COPCs - The HI was 3.3 and, while metals and DNOP did not exceed their SLVs on a single medium basis, their C/SLVratios were greater than 0.1 (Table M-31). The elevated HI are completely due to the lack of groundwater direct contact in a trench SLVs and the subsequent use of tapwater values.

Carcinogenic COPCs - The cumulative ELCR was 1E-06 (Table M-31). None of the COIs exceeded their SLVs.

In summary, no new COPCs (when compared to the COPCs retained for the individual AOPCs) were identified.

11.2.4.5.3 Groundwater Potable Water User

The COPC screening process for this receptor is shown on Table M-32. The identified COPCs are listed on Table M-34.

Non-carcinogenic COPCs - The cumulative HI was 11.2 (Table M-32). The primary contributors were manganese and DRO. Because the HI exceeded 1.0, several other COPCs were also identified because their C/SLV ratios were higher than 0.1, per DEQ guidance (Table M-34). However, as discussed for the landfill groundwater, use of residential SLVs to evaluate occupational potable water use is conservative, in addition to the low probability of shallow perched groundwater use as a potable water supply for the Island.

Carcinogenic COPCs - The cumulative ELCR was 2.9E-04 (Table M-32). The ELCR is primarily due to arsenic, chloroform, PCE, TCE and vinyl chloride which were all retained as COPCs.

In summary, no new COPCs (when compared to the COPCs retained for the individual AOPCs) were identified on the basis of screening groundwater data from the combined AOPCs for the potable water use pathways.

11.2.4.5.4 Groundwater Discharge to Surface Water and Bioaccumulation

The evaluation of COPCs is shown in Table M-33. The identified COPCs are summarized in Table M-34. As stated earlier, the River OU better identifies COPCs for this pathway due to the inclusion of tissue data and broader datasets.

There were no new COPCs (when compared to the COPCs retained for the individual AOPCs) from the combined AOPCs for the discharge to surface water and subsequent bioaccumulation pathway.

11.2.4.6 Uncertainty Assessment for Upland OU

Uncertainties are inherent in any risk-based approach to evaluation and decision-making for potentially contaminated sites. The uncertainties may be general and systemic as well as specific to the site. The objective of the uncertainty assessment is to identify the sources of uncertainty in the risk assessment process, understand their potential to contribute to either underestimation or overestimation of risk for the selected receptors and pathways and describe how the uncertainty is addressed. By describing the nature and magnitude of the uncertainties, the findings and conclusions of the risk assessment can be better understood and used as a tool for decision-making .

The major potential sources of uncertainty in the problem formulation process are associated with the level of confidence in the following:

- identified receptors and exposure pathways, particularly the mass wasting and soil erosion pathway,
- the adequacy of the analytical data used for site characterization,
- SLVs selected for use
- the COPC selection process
- screening-level risk and hazard estimates.

These sources of uncertainty are discussed in detail in the Uncertainty Assessment (Appendix O). In addition, an evaluation of potentially mass wasting and erodible soils at the Landfill AOPC, Sandblast Area AOPC, and Bulb Slope AOPC is presented in Appendix O. Other factors considered include uncertainties associated with COIs eliminated on the basis of frequency of detection and with the statistical background comparison screening.

11.2.5 Conclusions of Problem Formulation - Upland OU

The COPC selection process was performed in the context of the current and reasonably likely future land uses and water uses at the four AOPCs. Of the comprehensive suite of chemical analyses that were performed for soil, groundwater and soil gas samples, the detected analytes were designated as COPCs based on the COPC selection methodology. Tables 11-1 and 11-2 list the COPCs for the AOPCs recommended for risk management at the Upland OU. No additional COPCs were retained based on the all four AOPCs combined evaluation (when compared to the COPCs retained for individual AOPCs).

The evaluation of potentially mass wasting and erodible soils at the Landfill AOPC, Sandblast Area AOPC, and Bulb Slope AOPC is presented in the uncertainty assessment (Appendix O).

11.2.5.1 Landfill AOPC

The Landfill AOPC has exposure pathways that are complete or potentially complete for soil, groundwater, seep water and shoreline surface water for both on-site and off-site receptors. No further evaluation of the Excavation Worker receptor is recommended. The Excavation Worker direct contact exposure to soil (0-10 ft bgs) had acceptable non-carcinogenic hazard and carcinogenic risk and no COPCs were identified. The Construction Worker and Excavation Worker exposure pathway through direct contact to groundwater, likewise had acceptable hazard and risk estimates and no COPCs. These two exposure pathways can be deemed insignificant on the CEM. All other receptors and pathways as shown in the CEM are recommended for further evaluation for this AOPC (see also Table 11-1).

11.2.5.2 Sandblast Area AOPC

Complete or potentially complete exposure pathways related to soil, groundwater and soil gas are noted for the Sandblast Area AOPC. Similar to the Landfill AOPC, the two exposure pathways: Excavation Worker exposure to soil and Construction Worker and Excavation Worker exposure to groundwater, can be deemed insignificant on the CEM. All other pathways and receptors as shown in the CEM are recommended for further evaluation for the Sandblast Area AOPC (see also Table 11-2).

11.2.5.3 Pistol Range AOPC

The Pistol Range AOPC had a limited number of complete or potentially complete exposure pathways related to surface soil, groundwater, and sediment. Both on-site and off-site pathways were identified. All the receptors and exposure pathways evaluated, except sediment had acceptable non-carcinogenic hazard and carcinogenic risk. Due to the low magnitude of their exceedance and the low likelihood of exposure, lead and zinc were not recommended for any further consideration in lagoon sediment. Because of a marginal multi-media exposure exceedance dependent on the unlikely use of groundwater as a potable water source (Table M-26), lead was not recommended for further consideration in soil or groundwater.. Therefore, the COPCs in the Pistol Range AOPC are not considered to pose a threat to human health. No additional evaluation of this AOPC is warranted.

11.2.5.4 Bulb Slope AOPC

Soil was the only medium of concern identified for the Bulb Slope AOPC with a limited number of potentially complete pathways. No COPCs were identified for this area. None of the COIs exceeded their SLVs at any location and no COPCs were identified. No change in land or water use is likely for this AOPC in the future.

Given the absence of COPCs, the limited number of receptors, exposure pathways and exposure media for the Bulb Slope AOPC, this area is unlikely to pose a threat to human receptors. No additional evaluation of this AOPC is warranted.

11.3 Problem Formulation – River OU

The problem formulation for the River OU focused primarily on the Bonneville Forebay and some of the peripheral areas in the vicinity of the Forebay.

11.3.1 Exposure Setting and Potentially Exposed Populations

Although this portion of the Columbia River is popular with anglers and contact water recreationists, public access to the Forebay and the immediate downstream area is limited. The nearest known fishing platform is located 0.5 mile east of the Forebay, in the Eagle Creek vicinity.

A stakeholder survey was conducted for the Bonneville Dam area (Jones and Stokes 2006). The most popular recreational activities in the area are boating and fishing. Jet-skiing, kayaking, and canoeing were also mentioned as preferred activities by respondents in the survey.

Swimming and wading were not identified as popular activities within the River OU. Anglers are known to wade while fishing near the mouth of Eagle Creek, which is within the backwater area of the dam, and so could have received sediments by current transport. It is also possible that anglers may boat across to Goose Island and fish from the shoreline of the island. Therefore, exposure by direct contact to COPCs in surface water of the Forebay may occur.

Fishing and Fish Consumption Preferences

Since fish consumption is the pathway of greatest interest for the River OU, additional information regarding this pathway is provided in this section. As described in the RI/FS MP

(URS 2007a), several sources of information were consulted to identify suitable fish species for evaluation of the fish ingestion pathway. This identification is important because fish species vary widely in their COPC concentrations as well as in their appeal for human consumption. Factors that may affect the concentrations of COPCs in fish tissue with respect to site-related contamination include resident/anadromous status, home range, trophic level, and lipid content. Surveys of anglers have also shown that different angler groups have different preferences for the species consumed. Abundant resident fish species with small home ranges and high site fidelity are more likely to be exposed to COPCs than anadromous and wide-ranging fish species. Therefore, the data collection and HHRA focused on evaluating risks from consumption of resident fish. The conservative assumptions associated with the resident fish consumption scenario are expected to be sufficient to address risks related to consumption of nonresident fish species as well.

To select the fish species of interest that may have a high degree of exposure to COPCs while at the same time being an edible species of interest to fish consumers, available sources of literature and surveys were consulted. Regional or site-specific studies are preferred since they are expected to be more relevant. For the tribal subsistence fisher, the CRITFC consumption study (CRITFC 1994) provided information on the fish species that are popular with tribal anglers and their consumption rates. The HHRA work plan for Portland Harbor (Lower Willamette Group [LWG] 2004; Agency for Toxic Substance and Disease Registry [ATSDR] 2006) also provided limited information on tribal fish consumption preferences. A recent survey of 43 stakeholders for the Bonneville area was also useful (Jones and Stokes 2006). According to the Bonneville stakeholder survey, the fish species popular with tribal respondents are salmon and sturgeon, while nontribal respondents consumed smallmouth bass and shad. Many, but not all, of the respondents consumed all of the fish caught. Respondents generally fished from a minimum of two to three locations. None of the respondents referred to consumption of shellfish or crayfish from the area.

The Bonneville area is considered to be relatively poor in habitat quality for the popular resident sportfish, due to its high steep banks and lack of vegetated areas and weedbeds (ODFW, personal communication, 2007). It is also unattractive to the general public due to its lack of access, winds and currents (Oregon Bass and Panfish Club 2006). The most popular fishing in this area is for salmon on the Oregon side and sturgeon on the Washington side (ODFW, personal communication, 2007).

Among the species listed, the smallmouth bass is a resident species that is known to occur in the Forebay. It has a small home range and high fidelity to its range and, therefore, has the potential to spend its entire lifetime in the Forebay. It is a trophic level 3/4 species feeding on smaller fish such as sculpin, peamouth, and juvenile fish, as well as crayfish and insect larvae. All these characteristics make it likely that the smallmouth bass is a fish species that may represent maximal exposure to COPCs. It is also extremely popular with sport fishers, nontribal high consumption anglers, and also, to some extent, tribal anglers.

For these reasons, the smallmouth bass was selected as the finfish species that will be used to estimate exposure doses for the fish consumption scenario for all receptors.

At the request of DEQ, an additional fish species (large-scale sucker) is also evaluated but with a higher degree of uncertainty. The large-scale sucker is a fish species belonging to the foraging guild (trophic level 2/3) rather than the carnivorous guild represented by the smallmouth bass. Its diet consists of phytoplankton and zooplankton, clams, insect larvae, crayfish and oligochaetes. Its home range may be from 0.5 to 10 miles. As discussed in Section 6.2.1, in June and August 2006, the USACE used one sucker composite sample from the Forebay (URS 2008c). The sucker sample is the composite of the five specimens collected from two locations, the south shore of Cascade Island and the south shore of Bradford Island, by the USACE in 2006. The specimens were composited to generate enough tissue mass for analytical testing. The analytical results of the composite sample are included in Table 6-6 and are considered qualitatively in the risk assessments, in Section O (Table O.1-1).

The usefulness of large scale sucker data to evaluate site-related contributions to fish tissue concentrations is limited and subject to a high degree of uncertainty because of its much larger home range and lower site fidelity. The use of and uncertainties associated with use of large-scale sucker tissue data in the HHRA are described in Appendix O.

Although shellfish consumption appears to be relatively minor or minimal, relative to finfish consumption, crayfish were selected as the shellfish species to represent this dietary item. Crayfish are known to occur in the Forebay. They have a large home range and may be exposed to COPCs from sources other than the Forebay. However, they are included in this evaluation to provide a comprehensive estimate of the potential exposure pathways. Consumption of crayfish will be evaluated separately from the consumption of finfish due to the uncertainties involved in whether this pathway is even likely to be complete at the site as well as the home range of the crayfish themselves.

11.3.1.1 Exposure Scenarios

The following human receptors and associated exposure pathways are considered to be potentially exposed to COPCs in the Forebay:

- Adult and child Native American fish harvesters that fish above Bonneville Dam (near the Forebay), who consume potentially contaminated shellfish and finfish at a subsistence level
- Adult and child recreationists who may fish near Eagle Creek who may be exposed to COIs by direct contact with sediments there, and may also consume potentially contaminated shellfish and finfish
- Hypothetical adult or child resident downstream from the dam who could use the Columbia River as a water supply, or whose wells could be recharged from the river

11.3.1.2 Exposure Areas

For the purpose of the problem formulation, exposure areas for the Upland OU (see Section 11.2) and the River OU are defined on the basis of probable exposure by the identified receptors and the nature of the site data. The River OU consists of the Bonneville Forebay, including randomly collected data for the entire Forebay and data collected from targeted areas within the Forebay. Exposure areas are defined for the River OU based on receptor and type of activity, as follows:

Forebay (Random Forebay Samples)

Adult and child Native American fish harvesters and recreational fishers are assumed to consume fish and shellfish that may be exposed to COPCs from the Forebay. Therefore, the Forebay (excluding Eagle Creek and Goose Island targeted areas) comprises an exposure area for fish and shellfish consumption (as represented by the bass and crayfish random samples). Direct contact with surface water may also occur over the entire Forebay since the fishers most commonly fish by boat.

Mouth of Eagle Creek (Targeted Forebay Samples)

Adult and child recreational fishers fishing from the shoreline at the mouth of Eagle Creek, located along the Oregon side of the Forebay, may be exposed to sediments and surface water by direct contact, if they were to wade in the shallow areas. Therefore, sediments at the mouth of Eagle Creek comprise an exposure area solely for direct contact exposures to sediments within this targeted area.

Goose Island (Targeted Forebay Samples)

The potential for human exposure to Goose Island Slough is limited, although it is accessible to the occasional boater. Edible shellfish and finfish from Goose Island Slough may be part of the bioaccumulation pathway for fishers if they also frequent the rest of the Forebay (Note: the bass collected around Goose Island are evaluated as part of the Random Forebay evaluation).

11.3.2 Conceptual Exposure Model

A CEM for river-related human health risks is presented as Figure 11-15. This CEM focuses on potential risks from contaminated sediments located in the Forebay and near the mouth of Eagle Creek. It also considers the consumption of fish contaminated by sediments and incidental ingestion of, or dermal contact with, river water and sediment. The contact with sediment potentially occurs near the mouth of Eagle Creek. The primary receptors are subsistence fishers, recreational fishers, and hypothetical consumers of unfiltered, untreated river water. As noted earlier, the milk ingestion pathway for infants, described in DEQ’s recent Draft guidance, is qualitatively addressed in the Uncertainty Assessment (Appendix O).

11.3.3 Methodology for Identification of COPCs

The process of identification of COPCs for the River OU was similar to the process for the Upland OU and included evaluation of several media (water, sediment, crayfish and smallmouth bass tissue) that were relevant to human receptors. As explained earlier, clam and sculpin tissue were not evaluated for the HHRA since they are not directly consumed by subsistence or recreational fishers.

11.3.3.1 Identification of Contaminants of Interest

The COIs for the River OU include metals, SVOCs, and PCBs and are identified on the basis of chemicals detected in the current datasets that were used to represent the River OU. As previously discussed in Section 11.2.3.1, the COIs are then evaluated further on the basis of three criteria: detection frequency, comparison with reference concentrations (inorganics only), and comparison with risk-based screening levels. The first two steps of the COPC selection process were performed in Section 9.1 (Tables 9-8 through 9-10).

The concentrations of the chemicals retained following the first two steps of the COPC selection process are then compared with risk-based screening levels. The chemicals that fail the HHRA screening process are designated as COPCs and are carried through the risk assessment process. The screening process and the development of the list of COPCs is a critical element of the

Problem Formulation phase of the HHRA. The results of each step of the screening process are described in this section.

11.3.3.2 Detection Frequency

In the first step, COIs that are infrequently detected (less than 5% of samples) may be artifacts in the data due to sampling, analytical, or other errors and need not be selected as COPCs (DEQ 2000, 2010b). However, because none of the River OU media had at least 20 samples, no COIs were removed from COPC evaluation based on detection frequency.

11.3.3.3 Comparison with Reference Area

Similar to the Upland OU, the second step in the COPC screening process involves a statistical (population-to-population) comparison of two independent data sets for each medium was performed between the Reference Area sediment and tissues (crayfish and smallmouth bass) and the random Forebay sediment and tissues, including the 2006 smallmouth bass tissue. Large-scale sucker data were not evaluated with statistical or other quantitative comparisons since only one composite sample is available. As discussed in Section 6.2.1, in June and August 2006, the USACE used one sucker composite sample from the Forebay (URS 2008c). The sucker sample is the composite of the five specimens from two locations that were collected by USACE in 2006. The specimens were composited in order to generate enough tissue mass for analytical testing. The analytical results of the composite sample are included in Table 6-6 and were considered qualitatively in the risk assessment.

The objective of the statistical analysis was to assess whether the mean inorganic COI concentrations in the random Forebay sediment and tissue samples were significantly higher than the mean Reference Area sediment and tissue concentrations. The methodology for this statistical comparison is presented in the Upland OU DSR (URS 2009e). The results of this statistical comparison are presented in detail in Section 8 (Tables 8-3 and 8-4) and Appendix L. The comparison was also performed for organic COIs although it was not used as a factor in selection of COPCs.

For the targeted Forebay sampling locations at Goose Island and Eagle Creek, which do not have enough samples to perform a statistical (population-to-population) comparison, the maximum detected inorganic concentrations in sediment and tissue (clam and crayfish) were compared to the inorganic concentrations in the Reference Area. The results of this comparison are presented in detail in Section 8 and Table L-7 in Appendix L.

The inorganic COIs in sediment and tissue at the Forebay (random and targeted) that were found to not be elevated above the Reference Area were eliminated as COPCs (Section 9.1, Table 9-8 through Table 9-10) . This comparison recognizes that naturally occurring chemicals generally do not need to be addressed in a remedial context if there is no site-related contribution.

11.3.3.4 Concentration-Risk Screen

In the third COPC screening step, the concentration as well as the potential toxicity of the COIs is taken into account by comparing COI concentrations to risk-based screening concentrations that are specific to the media, receptors and pathways that are relevant to the site..

11.3.3.4.1 Selection of Screening Level Values

The human health SLVs used for the River OU evaluation are described in Section 7.3 and listed in Appendix J. The target risk levels and target HQs are similar to the Upland OU SLVs and correspond to an ELCR of 1 E-06 and non-cancer HQ of 1.0. SLVs were identified for the following media: sediment, surface water, shellfish tissue (crayfish) and finfish tissue (smallmouth bass). The receptors associated with these media included subsistence and recreational fishers and fish consumers and users of river water as a source of potable water.

Some exceptions of note include:

No sediment bioaccumulation SLVs were available for cPAHs in DEQ due to the low frequency and magnitude of their detections in fish in Oregon waters (2010b). The lower of the SLVs (pyrene) for the 2 non-carcinogenic PAHs (fluoranthene and pyrene) was used to evaluate cPAHs in sediment, with the recognition that this may not be sufficiently protective of the cancer endpoint. This issue is further addressed in the uncertainties discussion (Appendix O).

SLVs for PCBs were based on both Total PCBs (as Aroclors and Sum of 209 congeners), TEQ, and the SLVs for the individual dioxin-like congeners.

11.3.3.4.2 Application of Screening Level Values

The concentration-risk screen approach for the River OU was generally similar for the River OU and the Upland AOPCs. It included the two-step process of screening a COI on the basis of exposure to single chemicals, multiple chemicals, and multiple media. However, there were some differences among media and pathways.

Exposure to Individual COIs – Carcinogens and Non-carcinogens

Single COIs that exceeded the appropriate SLVs (i.e., C/SLV > 1.0) were retained as COPCs if they met the conditions described below.

Direct Contact Pathways

Surface Water COIs in surface water for the Forebay were retained as COPCs if the C/SLV exceeded 1.0 using SLVs applicable to potable water use (e.g., drinking WQC, tap water RSLs).

Sediment There are no SLVs based upon protection of direct contact exposures to sediments. Therefore the C/SLV ratio could not be estimated. All COIs in Eagle Creek sediments were retained as COPCs for the direct contact pathway for waders, with the exception of inorganic COIs that were observed at concentrations similar to or lower than Reference Area sediments.

Bioaccumulation Pathways

Tissue COIs in crayfish and smallmouth bass from the Forebay were evaluated by comparison to SLVs for tissue consumption. Inorganics typically had detected frequencies of 100% in tissue and were retained if they exceeded reference tissue values.

Surface Water COIs in water media were first evaluated by comparison to available federal or state WQC for the consumption of organisms or organism + water and subsequently by their bioaccumulation potential. Bioaccumulative COIs without organism-based WQC were reviewed further. Non-bioaccumulative COIs without SLVs were eliminated.

Sediment Only tissue COPCs evaluated in sediment were compared to sediment bioaccumulation SLVs. Inorganics were also compared to reference sediment values. To be conservative and comprehensive, COIs that did not exceed sediment SLVs were retained as COPCs if they were already selected as tissue COPCs.

For all the single COI pathways, each form of PCB results (individual Aroclors, Total PCBs as Aroclors, Total PCBs as Sum of 209 congeners, PCBs as TEQ, and individual dioxin-like congener) was compared to an appropriate SLV.

Exposure to Multiple COIs in a Single Medium

COIs that did not exceed their individual SLVs but whose C/SLV ratios exceeded 0.1 were retained as COPCs if the sum of the individual ratios in surface water, tissue or sediment exceed 1.0, with some exceptions. The ratios were separated into the sum of the non-carcinogenic C/SLV ratios and sum of the carcinogenic C/SLV ratios. To avoid double-counting the ratios of PCBs which were reported in multiple forms, only the ratios associated with the 12 dioxin-like congeners were included in the Sum carcinogenic C/SLV value (cumulative ELCR).

Multimedia Exposure to a Single COI

The multiple media in the River OU include sediment, water, and tissue. Multimedia exposure scenarios include anglers who may wade in the sediments near Eagle Creek while consuming crayfish and smallmouth bass from the Forebay at subsistence levels of consumption and also using untreated river water as a potable water supply source.

COPCs without SLVs - COPCs without SLVs were evaluated further with respect to spatial trends and frequency of occurrence.

COPCs - The list of COPCs for each medium was further evaluated based on the process outlined above. The COPCs were then reviewed with regard to the basis of the designation, magnitude of their exceedances above SLVs, spatial distribution, and the relevant receptors and exposure pathways. Note that all tissues are evaluated on a whole body, wet weight basis.

11.3.4 Screening Level Risk Characterization

This section describes the results of the COPC identification and screening-level risk results for the River OU.

11.3.4.1 Forebay

The media evaluated for the Forebay included sediment, surface water, crayfish tissue and smallmouth bass tissue.

11.3.4.1.1 Subsistence Fishers

The media that may contribute to risk to the subsistence fisher include crayfish tissue and smallmouth bass tissue, which would be consumed directly. The tissue data were the primary line of evidence to select COPCs for the finfish and shellfish consumption pathway. The sediment data were evaluated to select bioaccumulative COPCs that might be taken up by shellfish and finfish.

Identification of COPCs for this receptor is presented in Tables M-35 for the tissue data and Table M-36 for the sediment data. Table M-46 presents a summary of the identified COPCs by medium.

Crayfish Tissue

For subsistence fishers, after the elimination of COIs based on comparison to Reference Area tissue (inorganics only) and concentration-risk screen ratios, the selected COPCs for crayfish tissue included only carcinogenic COPCs (Table M-35). These COPCs may warrant further evaluation in shellfish consumption pathways for subsistence-level fish consumers.

Non-carcinogenic COPCs – No non-carcinogenic COPC was identified either on a single-medium or multi-media basis. The cumulative HI was 0.67 (Table M-35). Therefore, non-carcinogens are not of concern.

Carcinogenic COPCs – The cumulative ELCR was 7.5E-04, primarily due to arsenic and PCBs (Table M-35). The ELCR reported for crayfish consumption should be interpreted with caution. Crayfish may live to 5 or 6 years and often may live as long as 10 years (URS 2007a). Therefore, although the Forebay Random crayfish were collected after the sediment removal action, they are very likely to have had exposure to pre-removal concentrations of Forebay COPCs for several years prior to their sample collection. Thus this ELCR does not represent current Forebay exposures for crayfish.

As shown on Figure 11-16, exceedances of the PCB and arsenic SLVs occurred in almost all the crayfish samples. These COPCs are discussed further below.

Arsenic

Arsenic was retained as a COPC because it was higher than in the Reference Area crayfish (Table 8-3). However, this is more a measure of the precision of the data and the sensitivity of the comparison than actual differences. Although arsenic had a relatively high C/SLV ratio (683, the 95% UCL for arsenic in Forebay crayfish tissue (0.519 mg/kg; Table M-35) was actually slightly lower than the Reference Area 95% UPL of 0.535 mg/kg (Table I-20). The range also is very similar with the Forebay random crayfish concentrations ranging from 0.380 to 0.680 mg/kg (Table I-8) and the Reference crayfish ranging from 0.275 to 0.636 mg/kg (Table I-11). The mean concentration in Forebay crayfish was 0.479 mg/kg compared to 0.383 mg/kg for the Reference area (Tables I-18 and I-20). Therefore, the potential for contributions from the Forebay to arsenic in crayfish tissues is low.

The SLV for arsenic is based on the assumption that all of the arsenic is inorganic which is the most toxic form of arsenic for humans. In reality, the majority of the arsenic in fish and shellfish tissue is likely to undergo methylation into the less toxic organic form. Although estimates of inorganic arsenic as a fraction of total arsenic that are specific to freshwater crustaceans and mollusks are not available, recent reviews have estimated that inorganic arsenic may typically constitute less than 10% of total arsenic in freshwater finfish, but may range up to 30% in contaminated sites (Lorenzana et al 2009). These and other authors do not make a distinction between finfish and shellfish regarding the speciation of arsenic and they are presumed to be similar (Schoof et al 2007). Estimates of the organic portion of the arsenic body burden of shellfish tissues in the Columbia River range from 0.1 to 27% (TetraTech 1996). Using an estimate of 10 to 25% of total arsenic as inorganic arsenic would result in C/SLV values of 68 to 170 for the subsistence fisher.

The fish ingestion rates used in the development of the acceptable tissue levels (ATLs) for subsistence fishers (142 g/day) are higher than the assumed rates for recreational fishers (17.5 g/day). In the approved RI/FS MP (URS 2007a), it was noted that consumption of shellfish from the Bonneville Forebay was not known to occur, particularly for subsistence fishers, and evaluation of subsistence-level consumption of shellfish is not proposed for further evaluation.

The highest concentrations of arsenic in crayfish tissue were noted in two samples in the vicinity of the south shore of Cascades Island and north shore of Bradford Island (Figure 11-16). The highest concentration 0.680 mg/kg from location P2-CF (Table 6-10) was only marginally higher than the Reference Area 95% UPL of 0.535 mg/kg (Table I-20).

Given the low potential for shellfish consumption by subsistence fishers in the Forebay, and the fact that much of the arsenic in tissue is likely to be in the less toxic form, it is concluded that the potential is low for arsenic to pose a significant risk through the shellfish consumption pathway.

PCBs

The C/SLV ratios for total PCBs and individual congeners ranged from a low of 0.018 (Congener 81) to a high of 64.0 (Total PCBs as Congeners) (Table M-35). Of the six dioxin-like congeners, congeners 118, 126 and 156+157 have the highest C/SLV ratios. Among these, the C/SLV ratio for Congener 126 is similar to the ratio for Reference crayfish and illustrates that not all congeners are uniformly elevated in the Forebay. The highest ratio corresponds to an approximate ELCR of 6.4E-05. This falls within USEPA’s risk management range although it exceeds DEQ’s target risk level of 1E-05 for total risk.

The SLV for total PCBs was exceeded in almost all the crayfish samples (Figure 11-16). The highest PCB concentrations were measured in crayfish samples collected from the north shore, south shore and eastern tip of Bradford Island, where the SLV was exceeded by more than an order of magnitude. Total PCBs and several dioxin-like congeners were significantly higher in Forebay Random crayfish when compared to Reference crayfish.

COPCs without SLVs All COIs had SLVs available.

Summary

In summary, arsenic and PCBs were retained as COPCs for this receptor (Table 11-3). As illustrated in Figure 11-16, exceedances of the PCB SLV were evident in most of the crayfish samples.

Smallmouth Bass Tissue

Using a process similar to that used for crayfish, the COPCs identified for smallmouth bass tissue included barium, mercury, PCBs (Aroclor 1242, Aroclor 1254, Total PCBs and all dioxin-like congeners), B2EHP, and five cPAHs (Table M-35) and are summarized in Table M-46. The COPCs are summarized in Table 11-3.

Non-carcinogenic COPCs - Barium screened in as a COPC based on cumulative exposure, but individually, its C/SLV ratio of 0.44 was less than 1.0 and it is unlikely to contribute significantly to non-cancer hazard. Mercury was the only non-carcinogenic COPC retained based on its individual C/SLV ratio of 6.47 (Table M-35). It was detected in all Forebay bass samples and exceeded Reference Area concentrations (Table 8-3). It may be reliably assumed that almost all the mercury detected in bass tissue is likely to be present in its more toxic form as methyl mercury. Smallmouth bass are known to be consumed by subsistence and recreational fishers.

The Forebay UCL for mercury was 0.317 mg/kg (Table I-18), in comparison to the Reference Area 95% UPL of 0.268 mg/kg (Table I-20). The range of mercury concentrations in Forebay smallmouth bass was 0.0710 mg/kg to 0.512 mg/kg (Table I-8) while the range in Reference bass was 0.0548 mg/kg to 0.333 mg/kg (Table I-11). The two highest concentrations were found in a sample collected near the eastern tip of Bradford Island (18) and a sample collected in the vicinity of Goose Island (13) (Figure 11-16). Mercury concentrations in sediment are not significantly different between the Forebay and Reference areas (Table 8-3).

Finally, the C/SLV ratio for the Reference area smallmouth bass for mercury, based on the UPL, is 5.47 compared to the Forebay C/SLV of 6.47, i.e., there is an incremental increase of a HQ unit of 1.0 between the Forebay bass and Reference area bass. This small difference may be due to variability in the data or may represent mercury from non-site-related sources since the mercury concentrations in sediments are similar.

Carcinogenic COPCs - As shown in Figure 11-16, exceedances of one or more COPCs were noted in all bass samples. B2EHP, PCBs, and some cPAHs are retained as COPCs and discussed further below (Table M-46). The cumulative ELCR was 3.4E-02, however, this value is highly uncertain and misleading due to the uncertainties in the PCB data for smallmouth bass, the major uncertainty being that the bass were collected prior to the interim removal action of 2008 and their tissue concentrations probably reflect uptake from an earlier period when PCB concentrations in the Forebay were higher. Therefore, this ELCR does not represent current conditions in the Forebay smallmouth bass to an even greater degree than the crayfish tissue data. This is discussed in more detail in Appendix O.

A wide variation in PCB concentrations (as Aroclors, total PCBs and as individual congeners) were observed in the smallmouth bass. Total PCBs as well as all the individual dioxin-like congeners are associated with elevated C/SLV ratios for all smallmouth bass samples. However, the magnitude of exceedances ranged over five orders of magnitude. Additional evaluation, monitoring or risk management of PCBs as COPCs for smallmouth bass tissue is warranted (Table 11-3).

B2EHP and five cPAHs were identified as COPCs because the single chemical C/SLV ratios exceed 1.0 (Table M-35). The magnitude of exceedance was relatively small and was generally less than a factor of 4. Consistent with DEQ guidance, all the cPAHs are retained as COPCs even if individual cPAHs did not exceed their SLVs.

The UCL for B2EHP in Forebay bass was 349 µg/kg, with concentrations ranging from 89 to an outlier sample that was reported at 1600 µg/kg (Table I-8). The UPL (based on maximum) and range for the Reference area fish was 150 µg/kg (Table I-20) with a range of concentrations of 81 µg/kg to 150 µg/kg (Table I-11). The ELCR associated with B2EHP is approximately 4E-06 (Table M-35). However, B2EHP had a relatively low detection frequency in Forebay bass tissue (37%) (Table I-8a). Of the seven detections, six samples had concentrations ranging from 89 µg/kg to 190 µg/kg which are generally similar to the Reference Area 95% UPL of 150 µg/kg. The relatively low concentrations detected in fish tissue supports the position that these compounds are readily metabolized and only weakly bioaccumulate (similar to the metabolic action noted in PAHs). At other contaminated sediment sites, including the Lower Duwamish Waterway, phthalates often occur with other compounds (e.g., PCBs) that dominate risk. The phthalates are typically overshadowed by these more potent risk-drivers (Sediment Phthalate Work Group 2007).

Among the five cPAHs selected as COPCs, benzo(a)pyrene and dibenz(a,h)anthracene had the highest ratios. However, whether any of the cPAHs are likely to pose a threat to human health is uncertain. PAH levels in fish are usually low because this group rapidly metabolizes PAHs (Lawrence and Weber 1984); furthermore, higher molecular weight PAHs, which include the largest class of chemical carcinogens, do not seem to accumulate in fish (West et al. 1984). In general, free (unmetabolized) PAHs are detected at lower concentrations in muscle than in liver, gonads, stomach, or gall bladder (bile), although liver concentrations are probably more associated with short-term exposure and muscle concentrations are probably more associated with long-term bioaccumulation (Hellou 1996). Whether the PAHs in the smallmouth bass are present in the edible portions of the fish such as muscle, or in the portions that are discarded during cooking (e.g., viscera) is unknown since the smallmouth bass data for the Forebay are based on whole-body analyses. Although the Forebay smallmouth bass had higher concentrations of cPAHs than Reference Area bass, this trend was not observed in sediments (Table 8-3). Therefore, the occurrence of higher PAH concentrations in Forebay bass cannot be definitively attributed to sources in Forebay sediments.

COPCs without SLVs - SLVs were available for all COIs.

Summary

In summary, metals, B2EHP, cPAHs, and PCBs were retained as COPCs for this receptor (Table 11-3), with PCBs posing the greatest risk.

Sediment

COIs in Forebay sediment were evaluated only for the bioaccumulation pathway since the water depths make direct contact with these sediments highly unlikely for human receptors. Only COIs detected in tissue were retained and inorganics were also compared to reference sediment values. As described earlier, all sediment COIs were retained as sediment COPCs if the same COIs in tissue exceeded tissue ATLs for either crayfish or smallmouth bass. COPCs for sediment were also identified if the C/SLV ratio exceeded 1.0. The list of COPCs is summarized in Table M-46.

Non-carcinogenic COPCs - No non-carcinogenic COPCs were retained since both single medium and multi-media ratios were less than 1.0 for all non-carcinogenic COIs (Table M-36). However, mercury was selected as a COPC, even though it is comparable to Reference Area concentrations, because it is a bioaccumulative chemical that has been retained as a tissue COPC for smallmouth bass. But any contribution from Forebay sediments to tissue mercury levels is likely to be minor.

Carcinogenic COPCs - The cumulative ELCR was 7.5E-05 (Table M-36). The COPCs identified in sediment for bioaccumulation included PCBs (Aroclor 1254, Total PCBs as Aroclors, 6 congeners, Total PCBs as Congeners and Total PCBs as mammalian TEQ) and B2EHP, = (Table M-45). The single chemical C/SLV ratios for PCBs were far lower in sediments than in smallmouth bass. This is likely due to the fact that the sediment samples were collected after the sediment removal action and are more representative of current conditions in the Forebay. In contrast, the smallmouth bass samples were collected prior to the sediment removal and represent historical conditions. The sediment C/SLV ratios ranged from 7.45 to 598 (for Total PCBs as Aroclors), corresponding an approximate ELCR range of 7E-11 to 6E-04 for subsistence fishers. However, when the more accurate estimate of PCB sums (sum of dioxin-like congeners) was used, the cumulative ELCR was 7.5 E-05. This falls within the risk management range.

Bioaccumulation SLVs are available for two non-carcinogenic PAHs, fluoranthene, and pyrene. The lower of the two, the SLV for pyrene, was used to screen all the other individual PAHs. All C/SLV ratios were several orders of magnitude lower than 1.0.

COPCs without SLVs - B2EHP, was identified as a COPC without SLVs (Table M-35). It was also reported in only three of 19 sediment samples, at concentrations of 0.3 mg/kg or less (Table I-18).

Summary

PCBs, mercury and B2EHP are the only COPCs retained for sediment (Table 11-3) with PCBs being noteworthy based on significance of exceedance. The locations of SLV exceedances for sediments are shown in Figure 11-16. All sediment samples have SLV exceedances for total PCBs, primarily because of the extremely low SLV for subsistence fishers.

11.3.4.1.2 Recreational Fisher

The recreational fisher is assumed to consume both finfish and shellfish from the Forebay, but at lower rates of consumption than the subsistence fishers. In DEQ's assumptions, the recreational fisher's fish consumption rate is about 12% of the subsistence fisher's rate. Therefore, the C/SLV ratios for this receptor are about eight-fold lower. The comparison of COPCs to SLVs is shown in Table M-37. The identified COPCs are listed in Table M-46.

Crayfish Tissue

Non-carcinogenic COPCs - No non-carcinogenic COPCs were retained since the HI was 0.08 and no multi-media ratios exceed 1.0 (Table M-37). The locations of SLV exceedances are shown on Figure 11-17. The majority of the exceedances were for arsenic with fewer locations having significant exceedances for PCBs.

Carcinogenic COPCs – The cumulative ELCR is estimated at 9.2E-05 (Table M-37). Similar to the case of the subsistence fisher and to an even greater degree, arsenic is unlikely to contribute to significant risk for the recreational fisher. Using the arsenic ATL for recreational fishers (0.0062 mg/kg) results in C/SLV ratio of 83.7. Further, assuming 10 to 25% inorganic arsenic fraction would result in C/SLV ranges from 8.3 to 21. Finally, since the Forebay average for arsenic is comparable to the Reference Area average as discussed in the evaluation of the Subsistence Fisher, and should be considered with arsenic's selection as a COPC for the recreational fisher.

The C/SLV ratios for PCBs for recreational fishers are substantially lower than for subsistence fishers and fall within a risk range between 1E-06 and 1E-05. Using the ATL for recreational fishers (0.0047 mg/kg) results in a C/SLV ratio of 7.8 (approximate ELCR of 8E-06). DEQ applies an acceptable cumulative risk level of 1E-05 to multiple congeners as well as to total PCB measurements based on sum of congeners (DEQ 2010b). Using this standard, PCBs in Forebay crayfish tissue fall within acceptable risk levels for recreational fishers according to both USEPA and DEQ guidance. Nonetheless, PCBs were retained as COPCs.

COPCs without SLVs – All COIs had SLVs available.

Summary

Arsenic and PCBs were retained as the COPCs for this receptor (Table 11-3). The spatial distribution of concentrations is illustrated in Figure 11-17.

Smallmouth Bass Tissue

Non-carcinogenic COPCs – Similar to the subsistence fisher, barium and mercury are COPCs based on their cumulative health hazard, though they individually had C/SLV ratios less than 1.0 (Table M-37).

Carcinogenic COPCs - The Smallmouth Bass COPCs for the recreational fisher included PCBs, benzo(a)pyrene and dibenz(a,h)anthracene (Table M-37). The cumulative ELCR is 4.1E-03, a misleadingly elevated value that is dominated by the ratios for PCB congeners 118 and 126. Among these, the cPAHs are unlikely to contribute significant risk to this receptor due to their low C/SLV ratios. The ratios for the two cPAHs were less than 10, indicating that the associated risk levels are less than 1E-05. The C/SLV ratios for PCBs ranged from one to four orders of magnitude higher than the SLVs. Therefore, the primary risk contributors for recreational fishers are PCBs. The locations of SLV exceedances are shown in Figure 11-17 and include most of the bass samples.

COPCs without SLVs - All COIs had SLVs available.

Summary

The COIs retained as COPCs were metals, PCBs and cPAHs (Table 11-3).

Sediment

Sediment COPCs for the bioaccumulation pathway were identified based on comparison to bioaccumulation SLVs and detection in tissue COPCs (Table M-38).

Non-carcinogenic COPCs – No non-carcinogenic COPCs were selected. The HI was below 1.0 and no multi-media ratios exceeded 1.0.

Carcinogenic COPCs – The cumulative ELCR was estimated at 9.2E-06. As was the case for the smallmouth bass, PCBs were the primary risk-driving COPCs in sediment for the recreational fisher. The highest C/SLV ratios were associated with Aroclor 1254, Total PCBs as Aroclors, Total PCBs as Congeners, congeners 118 and 126 and Total PCBs as Mammalian TEQ. The ratio for Total PCBs as Aroclors was 73.6 , and for Total PCBs as Congeners was 9.19, corresponding to screening risk levels of 7E-05 and 9E-06, respectively. These values slightly exceed the acceptable risk level when Aroclor 1254 is considered in isolation, but fall within the acceptable risk range for Total PCBs. Greater confidence is placed in the PCB data for congeners than for Aroclors.

COPCs without SLVs – All COIs had SLVs available.

Summary

COIs that were retained are PCBs (Table 11-3). As shown in Figure 11-17, the locations with PCB C/SLV ratios greater than 10 were generally along the north shore of Bradford Island, adjacent to were the sediment removal took place. PCB concentrations in the majority of the sediment sample locations along the south shore of Bradford Island and in the vicinity of Goose Island had total PCB concentrations which exceeded the SLV by a factor of less than 10.

11.3.4.1.3 Hypothetical Potable Water Use and Water-Based Bioaccumulation

Surface water data were evaluated for a hypothetical resident who may use river water for potable water use and also consume fish from the Forebay.

Overall, only a few COPCs were retained in surface water for either the potable water use or bioaccumulation pathways (Tables M-39 and M-40, respectively).

Potable Use/ Direct Contact

Non-carcinogenic COPCs – No non-carcinogenic COPCs were retained.

Carcinogenic COPCs - The evaluation of surface water COIs for the potable water use-related pathways resulted in the selection of arsenic and PCBs and a few cPAHs as COPCs (Table M-39). The cumulative ELCR was 2.7E-05 (Table M-45). The C/SLV ratios were two to three orders of magnitude below 1.0 for all chemicals except arsenic.

The levels of total PCBs and the individual congeners and cPAHs were associated with single-medium C/SLV ratios three to four orders of magnitude lower than 1.0. They were identified as COPCs only on the basis of multi-media ratios that are influenced by the bioaccumulation pathway. PCB concentrations in Forebay surface water were very similar to Reference Area ranges (Table M-40). In practice, it is unlikely that PCBs in surface water would contribute significantly to risk.

Summary

In summary, arsenic, PCBs, and cPAHs screened in as COPCs for this pathway. As shown in Figure 11-18, all the five sample locations for surface water had SLV exceedances for arsenic and PCBs.

Bioaccumulation

Comparison of surface water data to bioaccumulation SLVs is shown in Table M-40. The summary of identified COPCs is presented in Table M-45.

Non-carcinogenic COPCs – No non-carcinogenic COPCs were retained due to exceedance to SLVs since the HI was well below 1.0.

Carcinogenic COPCs – Only arsenic and PCBs were identified as COPCs for the bioaccumulation pathway for surface water (Table M-40). Arsenic was retained as a COPC because the C/SLV ratios was greater than 1.0 (56.1). PCBs were retained because total PCBs C/SLV ratio was approximately 3.3, indicating an associated screening level risk of 3E-06.

COPCs without SLVs – Aluminum and lead did not have bioaccumulation-based SLVs.

Summary

In summary, metals and PCBs were selected as COPCs for this receptor (Table 11-3).

11.3.4.1.4 Wader at Mouth of Eagle Creek

Sediments were collected from two locations at the mouth of Eagle Creek to represent the potential for direct contact pathways for waders. There are no readily available SLVs for evaluation of direct contact pathways for sediments. As a result, with the exception of inorganic COIs that were not higher than reference area sediments, all other COIs in Eagle Creek sediments were retained as COPCs for the direct contact pathway (Table M-41). These included Aroclor 1248, Total PCBs as Aroclors, carbazole, most PAHs, and DRO.

Non-carcinogenic COPCs - All non-carcinogenic metals were lower than in the Reference Area sediments (Tables L-7 and M-41). Several non-carcinogenic PAHs were detected at low concentrations (Table M-41). Discussion of the significance of these PAHs is included with the cPAHs below.

Carcinogenic COPCs – Of the COPCs, Aroclor 1248 Total PCBs as Aroclors, carbazole and a few PAHs had concentrations that were slightly higher in Eagle Creek sediments than in Reference sediments (Table L-7). Although there are no direct contact SLVs for PAHs in sediments, it is notable that all the PAHs, both carcinogenic and non-carcinogenic, in Eagle Creek sediments were lower than the soil SLVs for occupational worker and were even lower than the residential SLVs (DEQ 2010). For example, the DEQ SLV for benzo(a)pyrene in residential soil is 15 µg/kg. This is the most potent of the cPAHs. The maximum values of all PAHs in Eagle Creek sediments ranged from 1.1 to 17.0 µg/kg (Table M-41). Since only direct contact pathways are envisaged at Eagle Creek, the use of the soil SLVs provides a reasonable substitute for the lack of sediment SLVs. Although PAHs are not expected to significantly contribute to risks for waders in the Eagle Creek sediments, they were retained as COPCs.

COPCs without SLVs - As a proxy for sediment, soil-based screening concentrations were derived for carbazole using the standardized USEPA (2010) input values for residential (24 hrs per day, 350 days per year, 6 years as a 15 kg child and 24 years as a 70 kg adult) and commercial/industrial (8 hrs per day, 250 days per year for 25 years as a 70 kg adult) exposure scenarios. For the residential scenario, the USEPA's method of childhood-only exposure (USEPA 2010) resulted in a slightly less stringent screening concentration. Exposure was assumed to occur through incidental ingestion, dermal contact, and particulate inhalation, also using standardized Department of Toxic Substances Control (DTSC) or USEPA factors for skin surface area, skin adherence factors, the particulate emission factor, and oral and dermal absorption factors (USEPA 2010). The toxicity factor was an oral slope factor (0.02 mg/kg-day)$^{-1}$, based on liver tumors in mice fed carbazole in the diet for 96 weeks (as cited in USEPA 1997c). The screening concentrations were derived to meet a target cancer risk level of 1E-06. Based on carcinogenic effects, the screening concentration for the residential receptor is 24 mg/kg and is 67 mg/kg for the commercial/industrial receptor. The detected concentration of carbazole (2.2 µg/kg) was orders of magnitude lower than the SLV.

Summary

All COIs were retained (except for metals below reference and carbazole) as COPCs of which PCBs as Aroclors is noteworthy based on the significance of exceedance. PCBs were also identified for Eagle Creek sediments higher than in the Reference sediments (Table 11-3).

11.3.4.2 Goose Island Slough

Collection and evaluation of sediment and tissue samples from Goose Island Slough was not included in the RI/FS MP (URS 2007a) but was conducted at DEQ's request (URS 2009k). Although there are no barriers restricting public access to Goose Island Slough, direct contact with sediments in this area for human receptors is highly unlikely due to the depth of the slough and the rocky banks. The COIs detected at Goose Island were evaluated as follows:

Crayfish tissue

Metals, PCBs, and PAHs were detected in crayfish tissue. However, all the COIs were generally detected at concentrations that were lower than in crayfish tissues from the Forebay. Inorganics were generally lower than in reference area crayfish tissue (Table L-7). Therefore, only PCBs were identified as COPCs based on Goose Island crayfish tissue (Table M-42).

Smallmouth Bass Tissue

All smallmouth bass tissue samples collected in Goose Island Slough were included in the Forebay tissue data set. Therefore, no additional COPC selection for bass for Goose Island was necessary.

Sediment

Metals, PCBs, PAHs and phthalates were detected in Goose Island sediment. However, the majority of the COIs were generally detected at concentrations that were lower than in sediment from the Forebay (Table L-7). The COPC selection results for the two targeted Goose Island sediment samples are already included in lists for the subsistence and recreational fishers (Tables M-43 and M-44). Inorganics were generally lower than in reference area sediment (Table L-7). A few PCB congeners were detected at concentrations exceeding the Reference Area (Table L-7) but were not comparable to or less than Forebay concentrations. B2EHP screened in due to the lack of an SLV. Therefore, B2EHP and PCBs were identified as COPCs based on Goose Island sediment data.

Summary

In summary, PCBs were the COPCs identified in crayfish tissue and B2EHP and PCBs were the COPCs identified in sediment from Goose Island (Table 11-3), of which PCBs are noteworthy based on significance of exceedance.

11.3.4.3 Uncertainty Assessment

The major sources of uncertainty for the problem formulation process for the River OU include the level of confidence in the following:

- Occurrence and magnitude of exposure pathways and receptors, particularly for subsistence fisher and hypothetical use of river water as potable water supply
- Quality of analytical data for analytes occurring at low concentrations
- Representativeness of tissue data
- COIs without SLVs
- Screening-level risk and hazard estimates

Each of these factors is discussed in more detail in the Uncertainty Assessment (Appendix O). Other factors considered include the uncertainties associated with COIs eliminated on the basis of frequency of detection.

11.3.5 Conclusions of Problem Formulation – River OU

11.3.5.1 Forebay

The media evaluated for COPC selection for the Forebay included surface water, crayfish tissue, smallmouth bass tissue, and sediment. Clam and sculpin tissue were not considered relevant because the species are not consumed by humans. Data from the single large-scale sucker sample was not directly evaluated, but a comparison of the data to smallmouth bass data revealed that the addition of large-scale sucker data to a quantitative evaluation (in addition to smallmouth bass) is not likely to add either precision or accuracy to the risk estimates, and will not result in underestimation risk. The receptors of concern were subsistence and recreational anglers, potable water users and waders near the mouth of Eagle Creek. The results are discussed by receptor and then media below, and the COPCs recommended for risk management are summarized in Table 11-3.

Subsistence Fisher

Carcinogenic risks to the subsistence fisher may exceed USEPA's and DEQ's acceptable risk levels in the screening level problem formulation. The risks are associated primarily with consumption of smallmouth bass tissue, and secondarily, crayfish tissue. Fish consumption risks estimated on the basis of sediment data are lower than those estimated using tissue data. The greatest uncertainty is in the use of tissue data that include exposure to pre-removal conditions.

Recreational Fisher

The exposure pathways for the recreational fisher include ingestion of fish and exposure to sediment via direct contact. PCB risks to this receptor from sediment fall within the risk management range (Table M-38). Risks to this receptor from fish and shellfish ingestion range from unacceptable to falling within the risk management range for this receptor.

Surface Water User

The exposure pathways for surface water included potable water use and bioaccumulation (i.e., consumption of fish exposed to bioaccumulative COPCs in water). The organic COPCs, PCBs and cPAHs, are expected to be negligible contributors to risk due to the lack of exceedance of their individual SLVs. Therefore, risks associated with these COPCs in surface water are likely to be at acceptable risk and hazard levels for the potable use and bioaccumulation pathways of exposure.

11.3.5.1.1 Surface Water

Only a few COPCs were retained in surface water for either the potable water use or bioaccumulation pathways (Table 11-3). PCBs and arsenic are the main surface water COPCs that may influence tissue bioaccumulation pathways.

In summary, the detected COPCs in surface water of the Forebay is not expected to pose a significant risk for the potable user and as a transport pathway for bioaccumulation to edible fish and shellfish.. This conclusion is based on the limited number of COPCs identified in Forebay surface water, the similarity to Reference Area concentrations and the lack of exceedance of the associated SLVs.

11.3.5.1.2 Tissue

Two types of edible tissue were evaluated for the human health problem formulation: crayfish and smallmouth bass. This tissue discussion focuses on the subsistence user results.

Crayfish

The COPCs retained for crayfish tissue include arsenic and PCBs (Table 11-3). The screening-level risk estimates developed on the basis of crayfish tissue are likely to overestimate risks since the crayfish are likely to have been exposed to COPCs under pre-removal conditions in the Forebay.

Smallmouth Bass

The primary COPCs for smallmouth bass are PCBs, and secondarily mercury and cPAHs (Table 11-3). The major uncertainty associated with smallmouth bass data relates to whether the data are representative of current conditions. The samples were collected prior to the removal of PCB-contaminated sediment from the Forebay. Therefore, the data represent exposures to higher PCB concentrations in sediment and prey than are present currently. Tissue concentrations in bass hatched after the sediment removal are likely to be lower and would be more reflective of current conditions. It is likely that cPAHs may be minor contributors to risk if data regarding their distribution in the edible portions of fish tissue were available.

11.3.5.1.3 Random Forebay Sediment

The COPCs for sediment in the Forebay were selected on the basis of potential for bioaccumulation into the food-web with ultimate exposures to subsistence and recreational fishers. The COPCs were selected on the basis of two major criteria: exceedance of the bioaccumulation SLVs for sediments, and selection as tissue COPCs for either crayfish or smallmouth bass. COPCs for sediment include only PCBs (Table 11-3). B2EHP was also identified as a COPC due to the lack of a sediment bioaccumulation SLV.

11.3.5.2 Mouth of Eagle Creek

Only organic compounds were selected as COPCs for Eagle Creek sediments (Table 11-3). With the exception of Aroclor 1248, concentrations of all other COPCs such as carbazole, PAHs, and DRO were lower than or only marginally higher than concentrations in Reference Area sediments. Therefore, risks related to direct contact with sediments for waders are unlikely to be contributed from the Forebay, and are likely to be relatively low, for all the COPCs except Aroclor 1248.

11.3.5.3 Goose Island Slough

No unique COPCs were selected for Goose Island Slough (Table 11-3). All COPCs with bioaccumulation potential that were selected for Goose Island sediments were already included among the Forebay sediment COPCs. No other COPCs were selected for sediment since direct contact with sediments is not likely. All COPCs identified for crayfish tissue from Goose Island Slough were already included as COPCs for crayfish tissue for the rest of the Forebay. All smallmouth bass collected from this area were included in the 95% UCL calculations for with the Forebay bass samples.

In summary, COPCs that are unique to Goose Island Slough were not identified.

11.4 Recommendations

Following the completion of the problem formulation, the recommendations for each AOPC and OU are presented in this section.

11.4.1 Upland OU

The Upland OU COPCs recommended for Risk Management are summarized in Tables 11-1 and 11-2.

Landfill AOPC

One of two options is recommended for the Landfill AOPC.

1. Perform a Baseline HHRA since no medium could be eliminated during the problem formulation. All the receptors except Excavation Worker are also retained.

2. Evaluate targeted removal or response actions to achieve acceptable residual concentrations of COPCs. Areas for such consideration include the Gully Test Pit and the Mercury Vapor Lamp Test Pit.

Sandblast Area AOPC

One of two options is recommended for the Sandblast Area AOPC.

1. Perform a Baseline HHRA since no medium could be eliminated during the problem formulation. All the receptors except Excavation Worker are also retained.

2. Evaluate targeted removal or response action for soil, groundwater, and soil gas to achieve acceptable residual concentrations of COPCs.

Pistol Range AOPC

Due to the lack of COPCs for the exposure pathways identified in the CEM, the Pistol Range AOPC is not considered to pose a threat to human health. No additional evaluation of this AOPC is warranted and a baseline human health risk assessment (BHHRA) is not necessary.

Bulb Slope AOPC

Given the absence of COPCs, the limited number of receptors, exposure pathways and exposure media for the Bulb Slope AOPC, this area is not considered to pose a threat to human receptors. No additional evaluation is warranted and a BHHRA is not necessary.

11.4.2 River OU

The River OU COPCs recommended for Risk Management are summarized in Table 11-3.

Forebay Area

Further evaluation is recommended for the Forebay, which may include the monitoring of PCB concentrations in Forebay tissue.

Mouth of Eagle Creek

Similar to the Forebay, further risk evaluation is recommended for sediments at the mouth of Eagle Creek, which may include the monitoring of PCB concentrations in Forebay tissue.

Goose Island Slough

No further evaluation of Goose Island media is necessary for the HHRA process because all COPCs identified for Goose Island were already identified for the Forebay.

12.0 ECOLOGICAL RISK ASSESSMENT

This section presents the methodology and findings of the Level I/Level II ERA that was performed for the Upland and River OUs (Figure 1-3) in support of the RI. The ERA process is similar for the River and Upland OUs, as described in the RI/FS MP (URS 2007a).

The overall purpose of the ERAs for the Upland and River OUs is to determine whether site-related chemicals are present at concentrations that could have adverse effects on the environment and to guide future decision-making for risk management, if warranted. Due to the very different site conditions and habitat types found within these two OUs, the ERAs also answer questions specific to each OU that will assist with risk management decisions. For example, in the River OU, PCBs in sediments and tissues have been the main focus of site characterization and investigation efforts over the last several years. Although other site-related chemicals are likely present within the Forebay area of the River OU and will be evaluated, the exposure scenarios associated with this aquatic environment create an emphasis on the importance of assessing bioaccumulation and ingestion pathways. In contrast, based on historical operations in the Upland OU and associated exposure pathways, bioaccumulation is also important, but not due to the presence of PCBs (other bioaccumulative COIs are present). In addition, the potential for transport of Upland media (soil and groundwater) to the River OU was an important evaluation conducted in the ERA for the Upland OU.

The primary objectives for the ERAs for the Upland and River OUs are as follows:

Upland

- Are site-related chemicals in soil of each AOPC at levels potentially harmful to terrestrial biota?
- Is exposure to all AOPCs combined a potential concern for wide-ranging terrestrial receptors?
- Are site-related chemicals in upland groundwater entering the adjacent River OU at levels of potential concern for benthic and aquatic biota?
- Is there a potential for site-related chemicals in upland soils to erode into the River OU at levels of potential concern for benthic and aquatic biota?

River

- Are site-related chemicals in Forebay sediment and tissue at levels potentially harmful to aquatic biota?
- What is the upstream contribution to chemicals detected in Forebay media at levels of potential concern for aquatic biota?
- Do site conditions support the beneficial uses of the Columbia River in this segment including the protection of anadromous and resident fish species and wildlife preservation?

If the findings of the ERAs indicate that further investigation or risk management may be necessary to address potential concerns in either OU, then recommendations will be made as to the scope and focus of these efforts.

The following section summarizes the framework that was used to conduct the ERAs and the scope of the current risk assessments.

12.1 Overview of Level I and Level II Screening Assessments

This section describes the tiered framework that was followed for the ERA, including a summary of the evaluation that was performed during each phase of the assessment.

12.1.1 Regulatory Framework

To achieve the objectives mentioned above, the steps that were used to conduct the Level I Scoping and Level II Screening ERAs concur with federal and state guidance documents (USEPA 1997a,b, 1998, and 2005a; DEQ 2001 and 2007). Since DEQ is reviewing the RI/ FS, DEQ guidance was followed regarding the nature of the risk assessment process and the format and presentation of results. DEQ risk assessment protocols can be found in OAR Section 340-122-0084.

The guidance documents used in the performance of the ERA include:

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997a)
- EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund (USEPA 1997b)
- Guidelines for Ecological Risk Assessment (USEPA 1998)
- Guidance for Developing Ecological Soil Screening Levels, Revised Draft (USEPA 2005a)
- Ecological Soil Screening Levels, Interim Final (USEPA 2005-2008)
- Guidance for Ecological Risk Assessment, Final (DEQ 2001)
- Comments on Revised Draft Level II Ecological Risk Assessment and Baseline Human Health Risk Assessment, Bonneville Lock and Dam Project (DEQ 2004)
- Guidance for Conducting Beneficial Water Use Determinations at Environmental Cleanup Sites (DEQ 1998a)
- Guidance for Evaluation of Bioaccumulative Chemicals of Concern in Sediment, Final (DEQ 2007)
- Data Usability Guidelines for Risk Assessment (USEPA 1992)
- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA 2002a)
- Calculating UCLs for Exposure Point Concentrations at Hazardous Waste Sites (USEPA 2002b)

As discussed in Appendix C of the RI/FS MP (URS 2007a), a tiered framework was implemented in accordance with USEPA and DEQ guidance (USEPA 1997a,b; DEQ 2001) and consists of the following steps: Level 1 Scoping, Level II Screening, Level III Baseline, and

Level IV Field Baseline. A brief description of the first three steps is provided below. The first two steps were conducted for both the River and Upland OU ERAs:

Level I Scoping Assessment

- Provide a conservative qualitative determination of whether ecological receptors and exposure pathways are present or potentially present at a site or in the vicinity.
- Identify sites that are obviously devoid of ecological important receptors or habitats and where exposure pathways are obviously incomplete.
- Identify sites and COIs that warrant additional risk-based evaluation.

Level II Screening Assessment

- Construct a site description based on information from site visits and/or surveys, the existing literature, any prior PAs, and site history (including past and present uses).
- Identify site-specific ecologically important receptors, and the relevant and complete exposure pathways between each source medium of concern and these receptors. Identify CPECs from among the COIs associated with the site.
- Discuss how the physicochemical and toxicological properties of each CPEC may influence exposure pathways and adverse effects.
- Define ecologically appropriate assessment endpoints.
- Establish potential links between CPECs and responses in site-specific receptors by means of a preliminary CEM.
- Make an initial evaluation of the potential for site-related risk.

Level III Baseline Assessment

- Determine whether a site, if left unremediated, would pose unacceptable current or reasonably likely future risks to endpoint species.
- Provide the basis for determining if remediation is needed.
- Provide information for developing remedial alternatives.
- Identify contaminants of ecological concern (CECs) to be addressed further.

At the end of each tier of the evaluation, stakeholders have an opportunity to discuss the best path forward for the project, whether it be supporting a decision for NFA, deciding to take a remedial action, or continuing to the next phase of the ERA process. In order to ensure all stakeholders are comfortable with the results of the first quantitative step of the ERA process in which CPECs are identified from the initial list of COIs, this combined Level I Scoping/Level II Screening ERA is being submitted for review prior to moving forward to Level III BERA).

12.1.2 Scope of ERA

Based on the extensive site characterization that has been performed in the River and Upland OUs and the biological information that has been documented near the island, the findings of the Level I Scoping ERAs are predictable (i.e., complete exposure pathways exist that should be evaluated further in a quantitative manner). This is the reasoning behind the combined Level I Scoping/Level II Screening ERA. At the completion of the Level II Screening, the utility of a Level III BERA, which would involve a more rigorous evaluation of the site data, is considered and recommendations are made accordingly.

12.1.3 Data Management for ERA

In Sections 5.0 and 6.0, the datasets evaluated in the Level II Screening Assessments for the Upland and River OUs are described, including the methods used to handle data qualifiers and non-detect sample results. The approach used to calculate PCB totals from Aroclor and congener data, as well as the approach used to calculate PAH totals, are also discussed in Section 5.1. Finally, an evaluation of the data usability for the ERA is provided in Section 7.4, whereby MDLs and MRLs for non-detect samples and MRLs for J-flagged data are compared to SLVs protective of ecological receptors to assess the quality of the data. A more detailed description of MDLs for non-detect samples in exceedance of ecological SLVs is presented in the uncertainty assessment (Appendix O).

12.2 Level I Scoping Assessment For Upland OU

The tasks required to complete the Level I Scoping Assessment are as follows:

- Review existing data
- Perform initial site visit
- Identify COIs
- Evaluate receptor-pathway interactions

In an effort to streamline the risk assessment process, the Level I Scoping Assessment (URS 2002d) originally performed for the Landfill was expanded to the other three AOPCs. The close proximity of the Upland AOPCs to each other and the similarities in habitats and organisms present support this approach. To fulfill the requirements listed above, the ecological setting, site features (topography, structures), nature and extent of all known chemical releases, current and future uses of land and water, and any unique site-specific characteristics described in previous sections were carefully considered.

12.2.1 Identification of COIs and CPECS

COIs are defined as chemicals that are present or may be present at a site that have not been screened against any criteria (DEQ 2001). For the purposes of an ERA, COIs may be further evaluated on the basis of detection frequency, comparison with background levels, and risk-based screening. COIs that fail the evaluation, or those COIs without screening levels, are retained as CPECs and may be recommended for risk management, while COIs that pass the evaluation are dropped from further consideration.

The following steps comprise DEQ’s general screening criteria used to identify CPECs. COIs for which any of these criteria are met need not be retained as CPECs (DEQ 2001):

4. COIs detected at less than a 5% detection frequency, assuming adequate nature and extent delineation and acceptable reporting limits (i.e., below benchmarks protective of ecological receptors);

5. Inorganic COIs present at concentrations below naturally occurring levels that are either site-specific or derived from regional concentrations;
6. COIs that are below toxicity-based criteria established for ecological receptors based on exposure to individual COIs, as well as cumulative exposure to all COIs and all possible media available to a given receptor.

Although these criteria may be met, a COI may still be retained as a CPEC under the following two circumstances:

1. COIs that are detected at least once and are bioaccumulative require further investigation for their potential to impact upper-trophic-level ecological receptors through the dietary pathway (if a bioaccumulation-based benchmark is not available);
2. COIs that lack toxicity-based criteria (e.g., SLVs) require further consideration, such as a qualitative assessment of risk.

All CPECs identified on the basis of exceedances of SLVs or concerns related to the bioaccumulation pathway for CPECs exceeding dietary based SLVs or lacking dietary based SLVs are retained for further evaluation or remediation. In the uncertainty assessment (Appendix O), COIs that were eliminated based on detection frequency were evaluated to ensure these COIs do not pose an unacceptable risk. Groundwater and soil of the Landfill and Sandblast Area AOPCs were the only areas where elimination of COIs based on frequency of detection occurred.

In Sections 5 and 6, the historical and recent site investigations are described in detail, and the COIs in Upland media of the four AOPCs are identified. Based on the presence of potentially complete exposure pathways and associated analytical data, COIs in the Upland OU were identified for the following media:

- Soil, groundwater, seep, and co-located surface water of the Landfill AOPC
- Soil and groundwater of the Sandblast Area AOPC
- Soil and lagoon sediment of the Pistol Range AOPC
- Soil of the Bulb Slope AOPC

To summarize, the categories of COIs that were detected in analytical data include metals (including butyltins), pesticides, herbicides, PCBs, TPH, PAHs, other SVOCs, and VOCs. Of these COIs, a subset is considered to be bioaccumulative in terrestrial soils, or aquatic environments (for the groundwater to surface discharge scenario), as presented in Section 7.3 and Table J-6. The screening tables described in Section 12.3.4 and presented in Appendix N include the bioaccumulative COIs detected at each individual AOPC.

12.2.2 Ecological Exposure Pathways

All Upland AOPCs on Bradford Island are similar with regard to land and water uses, habitats present, potentially exposed receptors, and exposure routes, but the sources of contamination and COIs vary from one AOPC to another. The affected Upland media include surface soils (0 to 1 foot bgs), subsurface soils (1 to 3 feet bgs), and groundwater. Soils are the source for uptake of bioaccumulative chemicals by terrestrial plants, soil invertebrates, and small mammals, which are consumed by upper trophic level receptors.

The following Upland-related exposure pathways are identified as potentially complete for the Upland OU, and these pathways were more thoroughly investigated to identify those that warrant a quantitative evaluation in the Level II Screening Assessment (Section 12.3.2.1):

- Root uptake of contaminants in surface and subsurface soil by terrestrial plants
- Direct contact (ingestion of and dermal contact) with surface and subsurface soil by soil invertebrates
- Dermal contact with and incidental ingestion of surface and subsurface soil by birds and mammals (although in the absence of burrowing birds at the site, ingestion of subsurface soils by birds is questionable)
- Inhalation of soil-related particulates and VOCs originating from shallow and subsurface soils by burrowing animals
- Ingestion of terrestrial dietary components (e.g., plants, soil invertebrates, and small mammals) by upper trophic level receptors
- Incidental ingestion of and direct contact with potentially contaminated sediment or surface water by aquatic life and aquatic-dependent wildlife, including aquatic prey consumption by upper trophic levels (e.g., fish and wildlife)

Rooting depths for plants and burrowing depths for invertebrates and mammals were assumed to occur within the upper 3 feet of soil, and it will be assumed that all terrestrial receptors are exposed to soils from this depth interval. This is a conservative assumption for birds, which typically do not burrow and forage on the ground surface, and mammals that burrow are more likely to consume organisms that are exposed to soils below the surface. The Landfill and Sandblast Area AOPCs were evaluated for both the surface (0-1 foot bgs) and shallow (0 to 3 feet bgs) intervals. For the Pistol Range and Bulb Slope AOPCs, only surface soil-related pathways were evaluated (0 to 1.5 feet bgs and 0 to 1 foot bgs, respectively).

As noted in Section 3.5.1.3, a review of historical activities and the source of contamination at the Pistol Range AOPC (bullets and casings from firing practice) are consistent only with surface impacts; therefore, deeper samples do not need to be evaluated for this AOPC. Since the Bulb Slope AOPC only has a thin layer of soil underlain by a bedrock base, there are no soils deeper than 1 ft bgs in this area and the existing surface soil data are sufficient to evaluate risk.

Groundwater is only a medium of concern if it has the potential to enter a surface water body; otherwise, exposure to groundwater is an incomplete pathway for most terrestrial receptors with the possible exception of plants. Groundwater levels in the Upland OU are deeper than 3 feet bgs, i.e., root depth zone for terrestrial plants. Therefore, exposure of plants to groundwater is not expected to occur. The potential for groundwater discharge to surface water and ultimate exposure by aquatic biota is discussed in the following section.

Sections 4.3 and 10.1 describe the potential Upland OU to River OU transport pathways, and the key physical migration pathways may be summarized as followed:

- Slope failure
- Mobilization of soils via erosion
- Groundwater seepage

The exposure pathways that are complete at each AOPC and their associated receptors were quantitatively evaluated in the Level II Screening Assessment.

12.3 Level II Screening Assessment for Upland

This section describes the methodology and findings of Level II Screening Assessment for the Upland OU. The comprehensive investigation of the nature and extent delineation is provided in Section 9.0. In Section 9.1.1, the first two steps of the CPEC selection process (evaluation of detection frequency and comparison to background levels for inorganics) were performed for all media associated with each AOPC (Tables 9-1 through 9-6). In addition, the lowest of the SLVs for human and ecological receptors was used for this initial screening to identify preliminary COPCs to assist in evaluating the nature and extent of contamination.

12.3.1 Receptors of Interest

A simplified model of the terrestrial food web for the Upland OU is presented on Figure 12-1. Discussion regarding the selection of avian and mammalian receptors of interest (or “target receptors”) occurred in several meetings during 2005 and early 2006 with the TAG for Bradford Island and in RTC received from DEQ (2004). The following terrestrial receptors of interest were selected in the RI/FS MP (URS 2007a):

- Terrestrial plants
- Soil invertebrates
- American kestrel (*Falco sparverius*)
- American robin (*Turdus migratorius*)
- Canada goose (*Branta canadensis*)
- Vagrant shrew (*Sorex vagrans)*

In addition, the American mink (*Mustela vison*) was selected as a large mammal predator to address exposure through consumption of chemically-impacted rodents. In the Level II Screening Assessment, these organisms are evaluated as receptor groups (plants, invertebrates, terrestrial birds and mammals) through a comparison to generic SLVs for each group. During a Level III BERA, the specific receptors listed above, which represent the feeding guilds present in the Upland OU, would be assessed for exposure and risk.

12.3.2 Exposure Assessment

Exposure assessment is the process of estimating the magnitude, frequency, and duration of site-specific exposure concentrations of chemicals to a receptor. To assess whether COI concentrations at the site have the potential to cause adverse effects in the selected ecological receptors, it is first necessary to develop reasonable estimates of the concentrations to which the receptors might be exposed.

12.3.2.1 Conceptual Exposure Model for Ecological Receptors

CEMs for ecological receptors that may be present at each Upland AOPC are presented as Figures 12-2 through 12-5. An exposure pathway is considered complete when the following components are present:

- A source of COIs (e.g., waste material in a landfill)
- A release mechanism (e.g., spills and releases)
- An exposure medium (e.g., surface soil)
- A receptor (e.g., plant community, small mammals)
- An exposure route (e.g., route uptake, ingestion)

When any of these elements is missing, the pathway is considered incomplete. By definition, no risk occurs where no complete pathway exists.

In general, all Upland AOPCs on Bradford Island are similar with regard to land and water uses, habitats present, potentially exposed receptors, and exposure routes, although the sources of contamination and COIs vary from one AOPC to another. Most of the AOPCs in the Upland OU generally provide good habitat for animals that occur in the Lower Columbia River watershed, i.e., the Landfill AOPC, which is managed as wildlife habitat (primarily for Canada geese) and the Pistol Range AOPC. The Sandblast Area AOPC is more highly disturbed and is still partially occupied by the current HMSA, paved roads and areas, and an equipment lay-down area (Section 3.1.5).

The CEM for each AOPC illustrates the current understanding of potential contamination sources, receptors of interest, and routes of exposure. The ecological exposure pathways discussed in the Level I Scoping Assessment (Section 12.2.2) are shown on the CEM figures, and the ones designated as potentially complete and significant were included in the quantitative analysis:

- Root uptake of contaminants potentially present in surface and subsurface soil by terrestrial plants
- Direct contact with contaminants potentially present in surface and subsurface soil by soil invertebrates
- Incidental ingestion of surface and subsurface soil by birds and mammals (although in the absence of burrowing birds at the site, ingestion of subsurface soils by birds is questionable)
- Ingestion of terrestrial dietary components (e.g., plants, soil invertebrates, and small mammals) by birds and mammals
- Incidental ingestion of and direct contact with COIs in Upland groundwater by aquatic biota
- Consumption of aquatic prey that has been exposed to bioaccumulative COIs in Upland groundwater or erodible and mass wasting soils by upper trophic levels (e.g., fish and piscivorous wildlife)
- Direct contact with contaminants potentially present in the Pistol Range lagoon sediments by sediment-dwelling invertebrates; these upland contaminants may have been impacted by historically erodible soils that were transported to the lagoon

- Direct contact with contaminants potentially present in erodible and mass wasting soils that have or may have been transported to the River OU by sediment-dwelling invertebrates

All of these pathways are potentially complete for the Landfill and Sandblast Area AOPCs and were quantatively evaluated. For the Pistol Range and Bulb Slope AOPCs, only surface soil-related pathways were evaluated (0 to 1.5 feet bgs and 0 to 1 foot bgs, respectively). Groundwater-related pathways were also evaluated for the Pistol Range AOPC; there are no groundwater-related pathways from the Bulb Slope AOPC. Finally, sediment data collected from the lagoon adjacent to the Pistol Range AOPC were evaluated for potential exposure by benthic organisms and fish and wildlife.

12.3.2.2 Assessment Endpoints

Assessment endpoints are explicit expressions of the actual environmental value to be protected, and may be perceived as an environmental characteristic. If these endpoints are found to be significantly affected they can trigger further action. The following assessment endpoints were selected for the ecological receptors addressed in the Upland OU:

- Protection of the terrestrial plant community and soil-dwelling invertebrate populations that may be exposed to COIs in soil to maintain species diversity, abundance, and nutrient cycling
- Protection of herbivorous small birds (Trophic Level 1), such as Canada geese, with no unacceptable effects on reproduction, growth, or development at the population level due to COIs in soil and terrestrial plants
- Protection of invertivorous birds (Trophic Level 2), such as the American robin, with no unacceptable effects on reproduction, growth, or development on a population level due to COIs in soil and invertebrates
- Protection of carnivorous small mammals (Trophic Level 2-3), such as the vagrant shrew, with no unacceptable effects on reproduction, growth, or development on a population level due to COIs in soil and invertebrates
- Protection of top-level predatory birds (Trophic Level 3-4), such as the American kestrel, with no unacceptable effects on reproduction, growth, or development on a population level due to COIs in soil and small mammals
- Protection of predatory mammals (Trophic Level 3-4), such as the American mink, with no unacceptable effects on reproduction, growth, or development on a population level due to COIs in soil and small mammals
- Protection of aquatic biota (invertebrates, fish, and wildlife) that may be exposed to COIs in groundwater or erodible soils from the Upland OU that have been transported to the River OU

The disturbed nature of some of the Upland AOPCs, e.g., Sandblast Area, precludes high quality habitat and species diversity. Furthermore, no state- or federally listed threatened and endangered terrestrial species are known to occur on the island, with the exception of the bald eagle (which is evaluated for the River OU), and site-related effects on an individual basis are only of concern for this receptor. The methodology for evaluating risks to both threatened and endangered and nonthreatened and endangered species was included in the assessment. Recommendations in support of risk-management decisions were primarily based on risks to non-threatened and endangered terrestrial species.

According to Section 3.5 of the Level I Scoping Assessment that was performed for the Landfill (URS 2002d), which included a thorough biological characterization of the Landfill and all habitats on the island, "large mammalian predators do not occur on the island." The only mammals on the island that are described in the Scoping Assessment are small mammals (rodents) and feral cats: "Although the island harbors small mammals, feral cats, Canadian geese, and other bird species, the minimal amount of available habitat (~12 acres) makes it unsuitable for supporting viable populations of wildlife species with larger home ranges" (URS 2002d). For this reason, large mammals were not included in the assessment endpoints described in the approved RI/FS MP (URS 2007a). However, because mink are present in the area and could feasibly access the island and forage there, exposure by predatory mammals that consume rodents was considered in the assessment endpoints.

12.3.2.3 Estimation of Exposure Point Concentrations

The EPC is the concentration of a chemical in an environmental medium at the point of contact for the receptor (e.g., the concentration of a chemical in soil at a sampling location that could serve as habitat for the receptor). For terrestrial plants and soil invertebrates, the EPC is estimated as a function of the COI concentration measured in soil. For higher trophic level receptors, the exposure dose may be estimated as a function of the COI concentration in relevant environmental media and several other parameters related to biological transfer through the food web and the manner in which receptors use the site (e.g., dietary composition, feeding strategy, food ingestion rate, length of time a receptor is expected to forage/nest at the site based on their home range size and seasonal behavior).

Soil EPCs were developed for surface soils (0 to 1 foot bgs) and shallow soil (surface and subsurface soils; 0 to 3 feet bgs) for all terrestrial receptors. More refined exposure depths may be considered for nonburrowing animals for COIs that fail the Level II Screening Assessment. Additionally EPCs were developed for groundwater, seep water, surface water, and lagoon sediment for semi-aquatic and/or aquatic receptors.

Plants and Invertebrates - EPCs in soil were estimated for receptors with limited or no mobility (i.e., plants and invertebrates) using the maximum detected concentration in soil and sediment. Use of the maximum concentration of each COI is a conservative approach that serves to protect stationary receptors that could conceivably be exposed to the maximum concentration throughout their entire life span. In addition, for many CPECs, point by point evaluations were performed through spatial mapping to understand the spatial distributions of SLV exceedances for these receptor groups.

Birds and Mammals - For food web-based receptors such as birds and mammals, the EPC was based on the 95% UCL on the mean concentration in soil and was estimated using statistical methods recommended by USEPA (generated from the USEPA's ProUCL software [USEPA 2011]). The lower of the 95% UCL and maximum detected concentration in soil was used as the EPC for birds and mammals. This value provides an estimate of the representative concentration more relevant to terrestrial wildlife receptors that generally are mobile and not continuously exposed to site-related COIs in one geographic location. Soil EPCs were directly compared to DEQ's SLVs protective of birds and mammals or equivalent soil benchmarks in the screening (Sections 12.3.4.1).

Aquatic Biota of River OU - EPCs in potentially mass wasting or erodible soils and groundwater evaluated for aquatic biota, with the exception of benthic invertebrates, are represented by the lower of the 95% UCL and maximum detected concentration, as described above for birds and mammals. Since some types of benthic invertebrates in the River OU have limited mobility (i.e., clams), the maximum detected concentration in potentially mass wasting or erodible soils was used as the EPC for this receptor group. The evaluation of potentially mass wasting and erodible soils is presented in the uncertainty assessment (Appendix O).

12.3.3 Effects Analysis

The identification of toxic effects and chronic toxicity thresholds resulting from exposure to COIs comprises the effects assessment phase of the Screening Assessment. A qualitative and quantitative description of the relationships between COI concentrations or doses and the nature of possible effects elicited in exposed receptors, populations, or ecological communities is discussed in this section. The goal of this effects assessment is to identify risk-based screening levels, or SLVs, that are most relevant to the receptors and assessment endpoints identified for the Upland OU. SLVs are expressed as concentrations in media (e.g., mg/kg of soil).

Although "screening levels" are typically associated with exposure via direct contact, and are also commonly referred to as direct toxicity benchmarks, there are sources of generic media-based screening levels that address both direct contact and dietary exposure for birds and mammals. SLVs for birds and mammals are derived from diet-based toxicity reference values (TRVs) that are expressed as a daily dose normalized to body weight (mg of chemical/kg of body weight/day).

12.3.3.1 Measurement Endpoints

Measurement endpoints are measurable changes in an attribute of an assessment endpoint that allow an evaluation of whether or not the ecological resource is being sufficiently protected. Measurement endpoints are typically characterized in two parts: measures of exposure and measures of effect. Measures of exposure are measurable characteristics or attributes of an assessment endpoint or an acceptable surrogate (e.g., COI concentrations in soil or tissue). Measures of effect are measurable responses in the assessment endpoint or its surrogate associated with lowest adverse effects or acceptable no-effect thresholds (e.g., ecologically protective screening values for soil and tissue). The measures of exposure and measures of effect proposed for the assessment endpoints were provided in Table C-1 of the RI/FS MP (URS 2007a).

Measurement endpoints for the Upland ERA include measured EPCs in soil and groundwater (and seep/co-located surface water for the Landfill AOPC), modeled concentrations of CPECs in terrestrial organism tissues, and field observations (e.g., areas of distressed vegetation or bare soil, visible sandblast grit, or lack thereof).

12.3.3.2 Direct Toxicity and Bioaccumulation SLVs

The EPCs derived for soils, sediment, and water were compared to the SLVs protective of the individual receptor groups of interest (e.g., terrestrial plants, soil-dwelling invertebrates, terrestrial wildlife, and aquatic biota). The primary literature sources of SLVs protective of ecological receptors that were used in the Level II Screening Assessment were presented in Section 7.3.1 and Appendix J.

12.3.3.3 Identification of Chemicals of Potential Ecological Concern

The first two steps of the CPEC identification process presented in Section 12.2.1 (i.e., evaluation detection frequency and comparison to Reference Area concentrations for inorganics) were performed for each AOPC dataset and the combined AOPCs dataset in Section 9.1.1. In the first step, Upland OU COIs that were detected in ≤ 5% of samples per media and AOPC were not retained as CPECs, as long as there were at least 20 samples collected. Multiple COIs were eliminated as potential CPECs in this first step of the evaluation. In the uncertainty assessment (Appendix O), COIs that were eliminated based on detection frequency were evaluated to ensure these COIs do not pose an unacceptable risk. Groundwater and soil of the Landfill and Sandblast Area AOPCs were the only areas where elimination of COIs based on frequency of detection occurred.

For the second step, a statistical comparison of two independent datasets was performed between the Reference Area surface soil data and the Upland OU soil data (for each depth interval; 0-1 and 0-3 ft bgs) within each AOPC. In addition, the comparison to Reference Area soils was performed for the combined data sets (including all four Upland AOPCs) for each depth interval. The objective of the statistical analysis was to assess whether the mean inorganic COI concentrations in soil within each AOPC, as well as the mean soil COI concentrations for all four AOPCs combined, were significantly higher than the mean Reference Area concentrations. This approach is commonly known as a population-to-population comparison. The results of this statistical comparison are presented in detail in Section 8.2.1 and Appendix L and summarized in Table 8-1.

There are insufficient groundwater data to perform statistical comparisons between site and reference area data. Therefore the groundwater and seep water data were evaluated by comparing the range of COI concentrations observed in groundwater samples from monitoring wells and in seep samples with the range of concentrations observed in the Reference Area monitoring well (MW-10). The results are summarized in Appendix L, Table L-3 and Table 8-2

The COIs detected above a 5% detection frequency and inorganic COIs with concentrations higher than Reference Area levels (see Tables 9-1 through 9-7), were retained for the third step of the CPEC identification process, (i.e., toxicity-based screening). The approach used for this evaluation is described in the following section.

In addition to the first three quantitative steps of the process, the potential for bioaccumulation and the availability of SLVs are two additional qualitative elements that were evaluated in the identification of CPECs.

12.3.3.3.1 Toxicity Ratios for Individual COIs within a Given Medium

Toxicity ratios were developed based on the following equations and logic:

$$T_{ij} = \frac{C_{ij}}{SLV_{ij}}$$

$$\text{COIs with } T_{ij} > Q$$

were retained as CPECs.

where:

T_{ij} = Toxicity ratio for COI *i* in medium *j* (unitless)

C_{ij} = Environmental concentration of COI *i* in medium *j* (mg COI per kg environmental medium);

SLV_{ij} = Screening level value for COI *i* in medium *j* (mg COI per kg environmental medium)

Q = Receptor designator that dictates the level of protection appropriate for a certain site (unitless)

If T_{ij} for a specific COI is greater than the receptor designator (Q) appropriate for the site, then further investigation of the COI is warranted and it was retained as a CPEC. As defined by DEQ (2001), Q is equal to 1.0 for listed threatened and endangered species and Q equals 5.0 for nonthreatened and endangered species. However, for this project, CPECs were identified when Q is equal to 1.0 for terrestrial plants, soil invertebrates, and birds, and Q is equal to 5.0 for mammals. Although no threatened and endangered plant or soil invertebrate species are potentially present, a Q of 1.0 was applied for these receptor groups at request of DEQ due to basis of certain SLVs (e.g., USEPA's Eco-SSLs, 2005 - 2008). Nonetheless, consideration of a Q equal to 5.0 was also considered during the risk interpretation phase. Likewise, selection of CPECs at the Q equal to 1.0 level to account for the bald eagle, and possible transient juvenile spotted owls is appropriate, but these special-status species are not likely to forage at the 1.36 acre Landfill AOPC. For this reason, the Q equal to 5.0 level for birds in the Upland OU is also considered in the risk interpretation. For all aquatic (and benthic) organisms, the Q is equal to 1.0 threshold was used (DEQ 2001).

12.3.3.3.2 Evaluation of Multiple COIs Simultaneously within a Given Medium

To assess the potential for cumulative effects attributed to multiple COIs within soil, all COIs present in a given medium was collectively compared to SLVs. Based on the toxicity ratios estimated from the equation above, the incremental effects from each COI was identified from the approach expressed in the following equation:

$$\text{COIs with } \frac{T_{ij}}{T_j} \geq \frac{1}{N_{ij}} \times Q$$

was retained as CPECs.

where :

T_{ij} = Toxicity ratio for COI *i* in medium *j* (unitless)

T_j = Summation of toxicity ratios for *i* COIs in medium *j* (unitless)

N_{ij} = Total number of *i* COIs in medium *j* for which an SLV is available (unitless)

Q = Receptor designator that dictates the level of protection appropriate for a certain site

(unitless)

If the toxicity ratio for a specific COI is a high contributor to the total risk for a given medium, represented by the summation of all toxicity ratios (T_j), then further investigation of the COI is warranted and it was retained as a CPEC. This approach allows evaluation of the incremental risks associated with simultaneous exposure to multiple COIs. As stated previously (Section 12.3.3.3.1), Q is equal to 1.0 for terrestrial plants, soil invertebrates, birds, and aquatic and benthic organisms, and Q equals 5.0 for mammals.

12.3.4 Risk Characterization

Risk characterization is the process of integrating the previous elements of the risk assessment into quantitative or semiquantitative estimates of risk. Risk characterization consists of risk estimation and uncertainty assessment. Risk estimation or the quantification of risk is then used as an integral component in remedial decision making and selection of potential remedies or actions. Uncertainty assessment describes the level of confidence in the risk estimation.

12.3.4.1 Results of Screening for Each AOPC

The toxicity screening for COIs in soil at all four AOPCs, groundwater at all AOPCs except the Bulb Slope AOPC, seep and surface water for the Landfill AOPC, and lagoon sediment for the Pistol Range AOPC involved a comparison of appropriate EPCs to soil, water, and sediment SLVs protective of the receptor groups evaluated in this Level II Screening Assessment. The potential for ecological risk to occur was evaluated based on exposure to individual COIs within a specific medium and from exposure to multiple COIs simultaneously within a given medium.

Toxicity ratios were estimated for each COI, and COIs were retained as CPECs as described above (Section 12.3.3.3). COIs were also retained as CPECs if there are no SLVs available (referred to as "Yes – No SLV" in the risk tables) or if the COI is bioaccumulative but lack of a dietary-based SLV and precluded appropriate evaluation of this pathway (referred to as "Yes-Bio" in the risk tables). The implications of not performing a quantitative evaluation for CPECs without SLVs and bioaccumulative CPECs without dietary-based SLVs are explained in Section 7.4 and in the uncertainty assessment (Appendix O).

The following sections present the results of the screening process for each AOPC for all receptors and all four AOPCs combined for birds and mammals. For soils, the screening results for the 0 to 1 foot-depth interval and 0 to 3 feet-depth interval are shown on the same tables. In the following sections, if individual benzofluoranthenes (e.g., benzo(b)fluoranthene) were retained as a CPEC, then the total benzofluoranthenes were not included in the CPEC counts. For soil invertebrates and mammals, individual LPAHs and HPAHs were screened by their respective total PAH SLVs in order to determine which individual PAHs drive risk.

The data from the surface soil samples (0-1 ft bgs) collected within the potentially erodible/mass wasting areas identified within the Upland OU were utilized for evaluation of the overland transport pathway. The results of the evaluation to address overland transport through mass wasting and soil erosion into the River OU is provided in Appendix O (Tables O.3-5 through O.3-11).

12.3.4.1.1 Landfill AOPC

Tables N-1 through N-5 of Appendix N present the results of the screening for individual COIs evaluated for terrestrial plants, soil invertebrates, birds, mammals, and aquatic organisms. Tables

N-6 through N-10 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

Terrestrial Plants - In surface and shallow soil, arsenic (shallow soil only), lead, mercury, zinc, LPAHs , and HPAHs have toxicity ratios greater than 1.0 (Table N-1) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the plant community at the Landfill AOPC.

Lead (shallow soil only), mercury, and nine HPAHs contribute to a cumulative risk greater than 1.0 (Table N-6). All of these HPAHs were already identified as CPECs based on the individual COI screening evaluation.

Soil Invertebrates - Two metals (mercury and zinc), ethylbenzene, carbazole, and Total HPAHs have toxicity ratios greater than 1.0 (Table N-2) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the soil invertebrate community at the Landfill AOPC. To be consistent with the Ecological Soil Screening Levels (EcoSSL) guidance, total HPAHs (and total LPAHs) were screened against the corresponding SLVs, and the individual HPAHs were evaluated from the perspective of their contribution to the toxicity ratio for total HPAHs.

These same three CPECs contribute to a cumulative risk greater than 1.0 (Table N-7).

Birds - Five metals (antimony, cadmium, lead, mercury and zinc), two herbicides, and B2EHP have toxicity ratios greater than 1.0 (Table N-3) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual birds at the Landfill AOPC. Of these eight CPECs, antimony, lead, mercury (and zinc at 0 to 3 foot bgs only) and MCPP (an herbicide) have toxicity ratios greater than 5.0. All PAHs except naphthalene, as well as eight other bioaccumulative COIs, were retained as CPECs due to the lack of SLVs that address the dietary pathway.

Antimony (shallow soils only), lead, mercury, and MCPP contribute to a cumulative risk greater than 1.0 (Table N-8). All of these COIs were already identified as CPECs based on the individual COI screening evaluation.

Mammals - In surface and shallow soil, antimony, lead, mercury, zinc (shallow soil only), two herbicides, dibenzofuran, and HPAHs have toxicity ratios greater than 5.0 (Table N-4) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in mammal populations at the Landfill AOPC. To be consistent with the EcoSSL guidance, total HPAHs (and total LPAHs) were screened against the corresponding SLVs, and the individual HPAHs were evaluated from the perspective of their contribution to the toxicity ratio for total HPAHs. There are eight bioaccumulative COIs that were retained as CPECs due to the lack of SLVs that address the dietary pathway. Even though three individual HPAHs have toxicity ratios less than 5.0, all HPAHs were retained as CPECs for mammals because the total HPAH toxicity ratio is above 5.0 and all are potentially bioaccumulative.

When evaluating cumulative risk, no additional COIs contribute to a risk greater than 5.0 for mammals (Table N-9).

Aquatic Organisms and Aquatic-Dependent Wildlife - Four metals (barium, iron, manganese and zinc) and B2EHP in groundwater have toxicity ratios greater than 1.0 (Table N-5) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual aquatic organisms or wildlife that could be exposed to surface water that has been impacted by COIs in groundwater of the Landfill. Barium, iron, manganese, and zinc also have toxicity ratios greater than 1.0 for seep water (Table N-5). No COIs for surface water samples that are co-located with the seep samples have toxicity ratios greater than 1.0. There are 11 bioaccumulative COIs in groundwater, as well as two in seep water and two in surface water, that were retained as CPECs due to the lack of SLVs that address the dietary pathway (Table N-5).

Barium, iron, and manganese contribute to a cumulative risk greater than 1.0 for groundwater, and barium and manganese also contribute to a cumulative risk greater than 1.0 for seep water (Table N-10). No individual COI contributes to a cumulative risk greater than 1.0 for co-located surface water. All of these COIs were already identified as CPECs based on the individual COI screening evaluation.

12.3.4.1.2 Sandblast Area AOPC

Tables N-11 through N-15 of Appendix N present the results of the screening for individual COIs evaluated for terrestrial plants, soil invertebrates, birds, mammals, and aquatic organisms. Tables N-16 through N-20 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

Terrestrial Plants - Seven metals (antimony, arsenic, chromium, lead, nickel, selenium and zinc), o-xylene (shallow soils only), PCE (shallow soils only), LPAHs (shallow soils only) and HPAHs have toxicity ratios greater than 1.0 (Table N-11) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the plant community at the Sandblast Area AOPC.

Chromium, lead, nickel, zinc (surface soils only), PCE (shallow soils only), and HPAHs (four in surface soils and six in shallow soils) contribute to a cumulative risk greater than 1.0 (Table N-16). These chemicals were already identified as CPECs based on the individual COI screening evaluation.

Soil Invertebrates - Five metals (arsenic, chromium, lead, nickel, and zinc), and HPAHs have toxicity ratios greater than 1.0 (Table N-12) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the soil invertebrate community at the Sandblast Area AOPC. To be consistent with the EcoSSL guidance, total HPAHs (and total LPAHs) were screened against the corresponding SLVs, and the individual HPAHs were evaluated from the perspective of their contribution to the toxicity ratio for total HPAHs.

Only chromium and zinc contribute to a cumulative risk greater than 1.0 (Table N-17), which was already identified as CPECs based on the individual COI screening evaluation.

Birds - Six metals (antimony, cadmium, chromium, lead, nickel, and zinc), Total DDTs (surface soil only), and B2EHP have toxicity ratios greater than 1.0 (Table N-13) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual birds at the Sandblast Area AOPC. All PAHs except naphthalene, as well as 21 other bioaccumulative COIs, were retained as CPECs due to the lack of SLVs that address the dietary pathway.

Antimony, cadmium, chromium, lead, zinc (shallow soils only), and B2EHP contribute to a cumulative risk greater than 1.0 (Table N-18), which were already identified as CPECs based on the individual COI screening evaluation.

Mammals - Four metals (antimony, cadmium, chromium, and lead), dibenzofuran, and HPAHs have toxicity ratios greater than 5.0 (Table N-14) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in mammal populations at the Sandblast Area AOPC. To be consistent with the EcoSSL guidance, total HPAHs (and total LPAHs) were screened against the corresponding SLVs, and the individual HPAHs were evaluated from the perspective of their contribution to the toxicity ratio for total HPAHs. There are 21 bioaccumulative COIs that were retained as CPECs due to the lack of SLVs that address the dietary pathway. Even though the majority of individual HPAHs have toxicity ratios greater less than 5.0, all HPAHs were retained as CPECs for mammals because the total HPAH toxicity ratio is above 5.0 and all are potentially bioaccumulative.

Antimony (surface soils only), chromium, dibenzofuran, and total HPAHs contribute to a cumulative risk greater than 5.0 (Table N-19), which were already identified as CPECs based on the individual COI screening evaluation.

Aquatic Organisms and Aquatic-Dependent Wildlife - The toxicity ratio for cis-1,2-DCE is only slightly greater than 1.0 (at 1.12, Table N-15), and since this is the only CPEC with a detection above the benchmark, no further investigation is recommended to assess the potential for adverse effects to aquatic organisms or wildlife that could be exposed to surface water that has been impacted by COIs in groundwater of the Sandblast Area AOPC. Arsenic, four LPAHs, and five HPAHs are bioaccumulative COIs that were retained as a CPECs due to the lack of SLVs that address the dietary pathway.

Calcium, magnesium, monobutyltin, 1,1-trichloroethane, carbon disulfide, cis-1,2-DCE, and benzo(a)pyrene (only direct push groundwater data available for this HPAH) contribute to a cumulative risk greater than 1.0 (Table N-20). With the exception of cis-1,2-DCE, none of these CPECs have individual toxicity ratios above 1.0. The sum of the toxicity ratios for all PAHs in groundwater is less than 1.0 (sum toxicity ratio of 0.7). Due to the very low toxicity ratios, the fact that two of these CPECs are essential nutrients, and three are VOCs that would not be expected to persist in surface water or bioaccumulate, no further investigation is recommended.

12.3.4.1.3 Pistol Range AOPC

Tables N-21 through N-27 of Appendix N present the results of the screening for individual COIs evaluated for terrestrial plants, soil invertebrates, birds, mammals, aquatic organisms, and the two receptor groups potentially exposed to lagoon sediment (benthic invertebrates exposed via direct contact and fish and wildlife exposed through bioaccumulation). Tables N-28 through N-34 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

Terrestrial Plants – Lead and zinc have toxicity ratios greater than 1.0 (Table N-21) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the plant community at the Pistol Range AOPC.

Only lead contributes to a cumulative risk greater than 1.0 for terrestrial plants (Table N-28), which was already identified as a CPEC based on the individual COI screening evaluation.

Soil Invertebrates - Zinc has a toxicity ratio greater than 1.0 (Table N-22) and requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in the plant community at the Pistol Range AOPC.

Zinc also contributes to a cumulative risk greater than 1.0 for terrestrial plants (Table N-29).

Birds - Lead and zinc have toxicity ratios greater than 1.0 (Table N-23) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual birds at the Pistol Range AOPC. Of these two CPECs, only lead has a toxicity ratio greater than 5.0.

Only lead contributes to a cumulative risk greater than 1.0 (Table N-30), which was already identified as a CPEC based on the individual COI screening evaluation.

Mammals - Lead has a toxicity ratio greater than 5.0 (Table N-24) and requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in mammal populations at the Pistol Range AOPC.

No individual COI contributes to a cumulative risk greater than 5.0 for mammals (Table N-31).

Aquatic Organisms and Aquatic-Dependent Wildlife - No toxicity ratios for groundwater of the Pistol Range AOPC are greater than 1.0 (Table N-25). Zinc is the only bioaccumulative COI that was retained as a CPEC due to the lack of SLVs that address the dietary pathway.

No individual COI contributes to a cumulative risk greater than 1.0 for groundwater (Table N-32). Since zinc was already evaluated for its potential to bioaccumulate in the ERA for the River OU (Section 12.5), no further investigation of groundwater at the Pistol Range AOPC is recommended.

Benthic Invertebrates - Zinc has a toxicity ratio slightly greater than 1.0 (1.41) for the benthic invertebrate community at the lagoon adjacent to the Pistol Range AOPC (Tables N-26). Lead and zinc contribute to a cumulative risk greater than 1.0 for the benthic community (Table N-33). However, the individual toxicity ratio for lead is below 1.0. As discussed in the RI/FS MP (URS 2007a), sediment samples from the lagoon were collected to determine if any COIs that could have originated from the former Pistol Range AOPC should be added to the list of COIs evaluated for the River OU. Both lead and zinc were already included in the list of COIs evaluated for their potential to bioaccumulate in the ERA for the River OU (Section 12.5), so no further action was required.

Fish and Aquatic-Dependent Wildlife - The maximum detected concentrations of lead and zinc in lagoon sediment are greater than the Reference Area 95% UPLs (Tables N-27 and N-34), which were used in the absence of sediment SLVs that are protective of fish and wildlife. As discussed in the RI/FS MP (URS 2007a), these sediment samples were collected to determine if any COIs that could have originated from the former Pistol Range AOPC should be added to the list of COIs evaluated for the River OU. Both lead and zinc were already included in the list of COIs evaluated for their potential to bioaccumulate in the ERA for the River OU (Section 12.5), so no further action was required.

12.3.4.1.4 Bulb Slope AOPC

Tables N-35 through N-38 of Appendix N present the results of the screening for individual COIs evaluated for terrestrial plants, soil invertebrates, birds, and mammals. Tables N-39 through N-42 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

Terrestrial Plants – Lead and mercury have toxicity ratios greater than 1.0 (Table N-35) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the plant community at the Bulb Slope AOPC.

These two metals also contribute to a cumulative risk greater than 1.0 for terrestrial plants (Table N-39), and were already identified as CPECs based on the individual COI screening evaluation.

Soil Invertebrates - Mercury has a toxicity ratio greater than 1.0 (Table N-36) and requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in the soil invertebrate community at the Bulb Slope AOPC.

Mercury also contributes to a cumulative risk greater than 1.0 for soil invertebrates (Table N-40) and was already identified as CPECs based on the individual COI screening evaluation.

Birds - Lead and mercury have toxicity ratios greater than 1.0 (Table N-37) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual birds at the Bulb Slope AOPC. Both of these CPECs, have a toxicity ratio greater than 5.0.

Lead and mercury also contribute to a cumulative risk greater than 1.0 (Table N-41) and were already identified as CPECs based on the individual COI screening evaluation.

Mammals - Lead has a toxicity ratio greater than 5.0 (Table N-38) and requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in mammal populations at the Bulb Slope AOPC.

No individual COI contributes to a cumulative risk greater than 5.0 for mammals (Table N-42).

12.3.4.1.5 All Four AOPCs Combined

Tables N-43 and N-44 of Appendix N present the results of the screening for individual COIs evaluated for birds and mammals that have home ranges equal to or larger than the size of the entire Upland OU and could, therefore, forage over all four AOPCs. Tables N-45 and N-46 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

Birds - Seven metals (antimony, cadmium, chromium, lead, mercury, nickel and zinc), two herbicides, and B2EHP have toxicity ratios greater than 1.0 (Table N-43) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual birds over the four AOPCs combined. Of these ten CPECs, antimony, chromium, lead, mercury, MCPP (an herbicide), and B2EHP have toxicity ratios greater than 5.0. All PAHs except naphthalene, as well as 18 other bioaccumulative COIs, were retained as CPECs due to the lack of SLVs that address the dietary pathway.

Antimony, chromium, lead, mercury (surface soils only), MCPP, and B2EHP contribute to a cumulative risk greater than 1.0 (Table N-45), which were already identified as CPECs based on the individual COI screening evaluation.

Mammals - Four metals (antimony, cadmium, chromium, and lead), two herbicides, and total HPAHs have toxicity ratios greater than 5.0 (Table N-44) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in mammal populations over the four AOPCs combined. To be consistent with the EcoSSL guidance, total HPAHs (and total LPAHs) were screened against the corresponding SLVs, and the individual HPAHs were evaluated from the perspective of their contribution to the toxicity ratio for total HPAHs. There are 18 bioaccumulative COIs that were retained as CPECs due to the lack of SLVs that address the dietary pathway. Even though not all HPAHs have toxicity ratios greater than 5.0, all were retained as CPECs for mammals because the toxicity ratio for Total HPAHs is above 5.0 and all of these individual HPAHs are potentially bioaccumulative.

MCPP contributes to a cumulative risk greater than 5.0 (Table N-46), which were already identified as CPECs based on the individual COI screening evaluation.

12.3.4.2 Uncertainty Assessment

Uncertainty and the relative degree of such uncertainty should be considered when interpreting the results of the ERA. Uncertainty is introduced at each step of the process, and occurs because risk assessment is complex and requires the integration of many factors:

- Fate and transport of constituents in a variety of different and variable environments
- Selection of EPCs representative of actual exposure experienced by mobile receptors
- Potential for adverse health effects in ecological receptors as extrapolated from laboratory bioassays for which SLVs are often based
- Probability of adverse effects on ecological receptors is highly variable based on genetics, life stage, and trophic level.

Specific sources of uncertainty for this Level II ERA are presented in Appendix O.

12.3.4.3 Risk Interpretation

In this final phase of the risk characterization process, the quantitative and qualitative components of the risk screening (i.e., toxicity ratios) and uncertainty assessment are evaluated to gain a better understanding of the actual potential for ecological risk. Multiple lines of evidence are considered during risk interpretation to identify actual risk drivers at the site and to develop a supportable recommendation for risk managers to review. The outcome of the risk characterization will constitute the basis of remedial decisions for the protection of ecological receptors and risk driving exposure pathways.

For each AOPC and receptor, the CPECs identified in the previous section with toxicity ratios greater than 5.0 for mammals and toxicity ratios greater than 1.0 for all other receptors are plotted in Figures 12-6 through 12-17, and discussed in the text below. Those CPECs where a limited number of exceedances were noted (e.g., zinc for plants in the Landfill AOPC) were not included on the spatial distribution maps and the rationale for their exclusion is discussed prior to discussing the other CPECs.

To summarize the risk screening process, first the SLVs protective of ecological receptors were compared to the EPCs (i.e., 95% UCLs for mobile receptors and maximum concentrations for stationary receptors) for each analyte to identify CPECs that could require further assessment. The magnitude of the exceedance, detection frequency, confidence in the SLV, and other lines of evidence were considered to identify those CPECs that warrant a more rigorous evaluation of the data. For this whittled down list of CPECs, the spatial distribution of the concentrations relative to the SLVs was assessed through a review of this information on figures presented in this section. Based on this weight of evidence approach, those CPECs that truly warrant additional investigation or risk management are identified and discussed below.

12.3.4.3.1 Landfill AOPC

Terrestrial Plants - Arsenic (shallow soil only), lead, mercury, zinc, Total LPAHs, and Total HPAHs have toxicity ratios greater than 1.0 (Table N-1) and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the plant community at the Landfill AOPC. Arsenic, lead, and zinc were detected in all soil samples, and mercury was detected in approximately 80% of the samples (Table 9-1). Maximum concentrations of lead, zinc, and most LPAHs were detected below 1 foot bgs, while the maximum concentrations of arsenic, mercury and most HPAHs were detected at the surface. As shown in Tables 8-1, L-1, and L-2, all of the LPAHs and HPAHs were detected at concentrations statistically higher than the Reference Area data.

No further assessment of arsenic is recommended for plants, given that only the maximum concentration, which was collected below the surface, exceeded the SLV and the toxicity ratio is low (1.67). In addition, concentrations of arsenic in surface soils are statistically lower than the Reference Area data (Table L-1).

No further assessment of zinc is recommended for plants. Seven surface soil and a single shallow soil sample exceeded the SLV for plants. The toxicity ratio based on the maximum surface soil concentration is 3.97, and the remaining few surface soil exceedances result in low sample-specific toxicity ratios ranging from 1.13 to 1.64. Only the maximum zinc concentration, which was collected below the surface, exceeded the 5 times the SLV (BIL22). In addition, no sensitive plant species exist at the Landfill, which is maintained as goose pasture (Section 3.1.6.1.1), and zinc is an essential nutrient for plants (USEPA 2005-2008; Efroymson et al. 1997a).

The toxicity ratio for Total LPAHs of 1.87 for the 0 to 1 foot interval and 3.48 for the 0 to 3 feet interval are driven primarily by concentrations of phenanthrene, and secondarily by concentrations of anthracene (Table N-1). Three samples had concentrations in exceedance of the SLV for plants (BIl04SSI, BIL18, and L-02), and no samples have concentrations in exceedance of 5 times the SLV (Table H-1). The highest concentration of LPAHs occurred at the Gully Test Pit (BIL18). No further assessment of LPAHs is recommended for plants, given the low and infrequent exceedances of the SLV.

Figure 12-6 shows observed soil concentrations compared to SLVs for lead, mercury, and HPAHs for plants. One detected concentration of mercury was between 10 and 50 times the SLV (at the mercury vapor-lamp test pit). Three lead samples collected at the surface and five collected from the subsurface had concentrations in exceedance of the corresponding SLV. Concentrations exceeding 5 times the SLV were observed at the Lead Hotspot Test Pit #1, one location in the Gully Test Pit, and one just north of the Gully Test Pit. The highest concentrations of HPAHs (greater than 50 times the SLV) also occurred at Lead Hotspot Test Pit #1 and the Gully Test Pit, with some lower level exceedances at a few locations outside of these areas.

Based on the assessment for plants at the Landfill AOPC, it is possible that localized impacts could occur from exposure to the primary risk drivers: lead, mercury, and HPAHs. Potential effects to the terrestrial plant community as a whole are likely overestimated, as only a few individual plants (i.e., grasses) are exposed to the maximum concentration of each CPEC throughout their life span. In addition, the studies upon which terrestrial plant SLVs were derived typically use crops as the test species, and sensitivity levels of undomesticated plant species are likely to be different from crops species. Furthermore, the types of plants found at the Landfill AOPC (ruderal vegetation and some remaining ornamental plants) are not considered sensitive species. Based on these considerations, adverse effects to the terrestrial plant community at the Landfill AOPC are not expected to occur. However, these three CPECs are recommended for further investigation in a Level III BERA because they been identified as CPECs for other receptors at the Landfill as well as plants.

Soil Invertebrates - Two metals (mercury and zinc), ethylbenzene (shallow soil only), carbazole, and total HPAHs had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the soil invertebrate community at the Landfill AOPC. Zinc was detected in all soil samples, and mercury was detected in approximately 80% of the samples (Table I-1). Ethylbenzene was detected in 6% of soil samples collected from 0 to 1 foot bgs, and in 5% of samples collected from 0 to 3 feet bgs (not a CPEC for this depth interval). Carbazole had detection frequencies of 70% (0 to 1 foot bgs) and 72% (0 to 3 feet bgs). The maximum concentrations of zinc and carbazole were detected below 1 foot bgs, while the maximum concentrations of mercury, ethylbenzene, and most HPAHs were detected at the surface. As shown in Tables 8-1, L-1, and L-2, all of the HPAHs were detected at concentrations statistically higher than the Reference Area data.

Toxicity ratios for zinc were 5.29 and 9.50 for surface and shallow soil, respectively. However, as shown in Figure 12-7, the majority of concentrations of zinc above the SLV were between 1 and 5 times greater than the SLV for soil invertebrates (12 samples). Only two locations (maximum surface and shallow) had concentrations of zinc between 5 and 10 times the SLV, one of which is below the surface. No further assessment of zinc is recommended for soil invertebrates, given the low-level exceedances of the SLV, lack of special status soil invertebrate species at the Landfill AOPC, and because zinc is an essential nutrient (USEPA 2005-2008; and Efroymson et al. 1997b).

The toxicity ratio for ethylbenzene was 1.19, and the toxicity ratios for carbazole were 1.17 and 1.26 for surface and shallow soil, respectively (Table N-2). The only detection of ethylbenzene out of 18 samples collected from 0 to 1 foot bgs exceeded the SLV. Two of 29 samples from the 0 to 3 feet depth interval had concentrations of carbazole slightly greater than the SLV. No further assessment of ethylbenzene and carbazole are recommended for soil invertebrates, given the low and infrequent exceedances of their SLVs and lack of special status soil invertebrate species at the Landfill AOPC.

Figure 12-7 also shows observed soil concentrations compared to SLVs for mercury and HPAHs for soil invertebrates. Concentrations of mercury were greater than the SLV in 15 samples. Of these 15 SLV exceedances, three samples had concentrations between 5 and 10 times the SLV and two had concentrations between 10 and 50 times the SLV. Four of the highest detections of mercury occurred at the mercury vapor-lamp test pit, and the other occurred just east of the Pesticide/Herbicide Wash Area.

Concentrations of HPAHs were greater than the SLV in 12 samples (Figure 12-7). Of these 12 SLV exceedances, three had concentrations between 10 and 50 times the SLV, while the remaining exceedances were less than 5 times the SLV. The highest concentrations of HPAHs (between 10 and 50 times the SLV) occurred at Lead Hotspot Test Pit #1 and the Gully Test Pit.

Based on the assessment for invertebrates at the Landfill AOPC, it is possible that localized impacts could occur from exposure to the primary risk drivers: mercury and HPAHs. Effects to the soil invertebrate community are likely to be overestimated due to the assumption that these organisms are exposed to the maximum concentration of each CPEC throughout their life span. No sensitive invertebrate species are known to be present at the Landfill AOPC. Based on these considerations, adverse effects to the soil invertebrate community at the Landfill AOPC are not expected to occur. Nonetheless, mercury and HPAHs are recommended for further investigation in a Level III BERA because they been identified as CPECs for other receptors at the Landfill as well as soil invertebrates.

Birds - Five metals (antimony, cadmium, lead, mercury, and zinc), two herbicides, and B2EHP had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in individual birds at the Landfill AOPC. Antimony, lead, mercury, zinc (shallow soils only) and MCPP (an herbicide) had toxicity ratios greater than 5.0 and were assessed for potential impacts to bird populations. The approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls, but these special-status species are not likely to forage at the 1.36-acre Landfill AOPC. Owls have not been documented to occur on the island, and bald eagles have been seen roosting in the vicinity of the Landfill AOPC, but these piscivorous birds would be much more likely to forage in the adjacent River OU. Piscivorous birds were evaluated in the Level II Screening Assessment for the River OU (Section 12.5).

In the absence of an avian SLV for antimony, the Reference Area UPL for soil was used in the screening evaluation. Antimony is not considered bioaccumulative (Table J-6) and therefore, would not be expected to be present in dietary tissues at levels of concern for birds. However, antimony was identified as a CPEC for mammals at the Landfill and will be included in the Level III BERA. In the Level III BERA, antimony will be evaluated for all receptors at the Landfill AOPC for consistency purposes.

Based on the low toxicity ratios for cadmium (1.26 for the 0 to 1-foot interval and 1.52 for the 0 to 3-feet interval), high confidence in the SLV (USEPA EcoSSL), and absence of protected species of terrestrial birds, no further evaluation is recommended for cadmium.

The two herbicides with toxicity ratios greater than 1.0 were dichloroprop and MCPP. These CPECs were detected in two of 14 samples (14% detection frequency) for the 0 to 3-feet interval (Table I-1). In the absence of avian toxicity data for these herbicides, the SLV for Total DDTs was used as a surrogate. Use of DDT as a surrogate for these herbicides is expected to be very conservative due to the high bioaccumulation potential associated with DDTs, which is the basis of the SLV, compared to that of these two herbicides, which are not expected to bioaccumulate (Section 7.3 and Table J-6; log $K_{ow} < 3.5$). For these reasons, no further evaluation is recommended for dichloroprop or MCPP.

Figure 12-8 shows a sample by sample comparison to SLVs for the following CPECs that remain for birds: lead, mercury, zinc, and B2EHP. As described in Section 5.1.1, the two mercury vapor-lamp test pit samples shown in the figure (BIL28TPM and BIL29TPM) were collected from stockpiled soils that were used to backfill their respective excavation pits. The soil may have been placed anywhere within the 0-10 feet bgs depth of the test pits. Since there is no way to assign a depth at which the results for these samples occur, both samples were used to assess risk to ecological receptors exposed to surface and shallow soils.

Low toxicity ratios were calculated for zinc (2.89 for the 0 to 1-foot interval and 5.82 for the 0 to 3-feet interval) – these ratios were calculated using the Reference Area UPL as the SLV because the USEPA EcoSSL for zinc is below the site-specific UPL.

As shown on the figure, the majority of locations at the Landfill AOPC had zinc concentrations between 1 to 5 times the UPL. Only one location east of Lead Hot Spot Test Pit # 1 (BIL05SSI) had a detected zinc concentration between 5 to 10 times the UPL, and only the maximum detected concentration from the Gully Test Pit (BIL22) was between 10 and 50 times the UPL. The later sample is from a depth (1 to 3 ft bgs) where exposure to birds is reduced. Given that this sample was detected below the surface and because zinc has a low toxicity ratio for surface soil and is an essential nutrient for birds (metabolically regulated; USEPA 2005-2008), no further evaluation is recommended for zinc.

Only two detected concentrations of B2EHP were above the soil SLV. These samples, with concentrations between 1 to 5 times the SLV, were collected at the Lead Hot Spot Test Pit #1 and adjacent to that test pit. The toxicity ratios for B2EHP were relatively low (2.15 for the 0 to 1-foot interval and 1.42 for the 0 to 3-feet interval). Based on the low frequency of SLV exceedances and low magnitude of these exceedances, no further evaluation is recommended for B2EHP.

As shown on Figure 12-8, several locations had concentrations of lead and mercury in exceedance of the avian SLVs. For lead, several locations are between 1 to 5 times the SLV, eight locations are between 5 to 10 times the SLV, seven locations were between 10 to 50 times the SLV, and a single location (subsurface soil) was greater than 50 times the SLV. For mercury, the majority of the samples had concentrations between 1 to 5 times the SLV, two locations were between 5 to 10 times the SLV, two locations were between 10 to 50 times the SLV, and a single location had a concentration greater than 50 times the SLV.

The highest concentrations of these CPECs in soil (10 times or 50 times greater than the SLVs) were detected in the Mercury Vapor-Lamp Test Pit, Gully Test Pit, Lead Hot-Spot Test Pit #1, and a sample collected just outside of the Pesticide/Herbicide Wash Area. Due to the elevated toxicity ratios for lead and mercury, which are potentially bioaccumulative (mercury is known to bioaccumulate), and the fact that several locations have concentrations greater than the SLVs, further assessment or remediation of the locations with elevated lead and mercury is recommended.

In a Level III BERA to evaluate exposure to lead and mercury in soil by birds, the following site-specific factors should be considered:

- First, as discussed above, the approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls, but these special-status species are not likely to forage at the 1.36 acre Landfill AOPC. For this reasons, protection of terrestrial bird species at the population-level would be emphasized in the Level III BERA for the Upland OU.
- Second, the site-specific Reference UPLs were greater than the risk-based soil SLVs (EcoSSL for lead and Avian PRG for mercury) and, therefore, the SLVs were replaced by the UPLs in the screening evaluation. In addition to evaluating specific bird target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution.

- Third, the size of the Landfill AOPC relative to the size of a birds' home range would be factored into the daily dose estimation.

Mammals - Four metals (antimony, lead, mercury, and zinc), two herbicides, dibenzofuran and HPAHs had toxicity ratios greater than 5.0 and were assessed for their potential to elicit adverse effects in mammal populations at the Landfill AOPC. As shown in Tables 8-1, L-1, and L-3, all of the HPAHs were detected at concentrations statistically higher than the Reference Area data.

The two herbicides with toxicity ratios greater than 5.0 were dichloroprop and MCPP. As discussed above for birds, these CPECs were detected in two of 14 samples (14% detection frequency for the 0 to 3-feet interval; Table I-1). In the absence of chemical-specific SLVs for these herbicides, the mammal SLV for Total DDTs was used as a surrogate. Use of DDT as a surrogate for these herbicides is expected to be very conservative due to the high bioaccumulation potential associated with DDTs, which is the basis of the SLV, compared to that of the two herbicides, which are not expected to bioaccumulate (Table J-6; log $K_{ow} < 3.5$). For these reasons, no further evaluation is recommended for of dichloroprop and MCPP.

Figure 12-9 shows a sample by sample comparison to SLVs for the following CPECs that remain for mammals: antimony, lead, mercury, zinc, dibenzofuran, and total HPAHs. Several locations had concentrations of these CPECs in exceedance of the mammal SLVs, and the highest concentrations of these CPECs in soil (10 times or 50 times greater than the SLVs) were detected in the Mercury Vapor-Lamp Test Pit, the Gully Test Pit, Lead Hot Spot Test Pit #1, and a couple of locations in and near the Pesticide/Herbicide Wash Area. There were also a few elevated detections just outside the boundaries of the Gully Test Pit and Lead Hot Spot Test Pit #1.

Based on the low toxicity ratios for zinc (<5.0 for the 0 to 1-foot interval and 5.28 for the 0 to 3-feet interval), high confidence in the SLV (USEPA EcoSSL), and because zinc is an essential nutrient for mammals (metabolically regulated), no further evaluation is recommended for zinc.

Dibenzofuran in soil does have the potential to bioaccumulate (log $K_{ow} < 3.5$), but little toxicity data exist to evaluate the consumption pathway for mammals. TRVs could not be found in USEPA or Oak Ridge National Laboratory (ORNL) publications or databases, nor does USEPA's Integrated Risk Information System (IRIS) database provide an oral reference dose for dibenzofuran. Given the lack of toxicity data, a meaningful Level III BERA is not possible for dibenzofuran, and no further evaluation is recommended for this COPC. Furthermore, as shown on Figure 12-9, dibenzofuran co-occurred with elevated detections of the other risk-driver CPECs at the following main areas of the Landfill: Lead Hot Spot Test Pit #1 (lead and HPAHs), Mercury Vapor-Lamp Test Pit (antimony, mercury and HPAHs), and Gully Test Pit (lead, and HPAHs). A few other locations just outside of the boundaries of the Lead Hot Spot and Gully Test Pits demonstrate co-occurrence of dibenzofuran with these other CPECs. Since antimony, lead, mercury, and HPAHs are recommended for further investigation and there is more confidence in the available data for these CPECs, lack of a site-specific evaluation of dibenzofuran is a manageable uncertainty for the Upland OU ERA.

Due to toxicity ratios greater than 10 times the SLV for antimony, lead, mercury, and total HPAHs, which are potentially bioaccumulative (with the exception of antimony), and the fact that several locations had concentrations greater than the SLVs, further investigation of these CPECs is recommended in the form of a Level III BERA or remediation of the locations with elevated concentrations.

In a Level III BERA to evaluate exposure to antimony, lead, mercury, and HPAHs in soil by mammals, site-specific factors should be considered. In addition to evaluating specific mammal target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution. Also, the size of the Landfill AOPC relative to the size of a mammals' home range would be factored into the daily dose estimation.

Aquatic Organisms and Aquatic-Dependent Wildlife - Four metals (barium, iron, manganese and zinc) and B2EHP had toxicity ratios greater than 1.0 for groundwater and were assessed for their potential to elicit adverse effects in individual aquatic organisms or wildlife that could be exposed to surface water that has been impacted by COIs in groundwater of the Landfill AOPC. Barium, iron, manganese, and zinc had toxicity ratios greater than 1.0 for seep water, of which barium and manganese had toxicity ratios above 5.0. No CPECs were identified in the surface water samples that are co-located with the seep samples.

Based on the low toxicity ratios for zinc in groundwater and seep water (2.56 and 1.12, respectively), and the absence of a detection in co-located surface water, and because zinc is an essential nutrient (metabolically regulated), no further evaluation is recommended for zinc.

Figure 12-10 compares observed concentrations to SLVs for aquatic biota for the following CPECs: barium, iron, manganese, and B2EHP. The direction of groundwater flow beneath the Landfill AOPC is to the north. B2EHP was detected above the SLV in two groundwater wells (MW-1 and MW-2). MW-2 is the well farthest from the shoreline (south) of the River OU, and MW-1 is approximately 60 feet from the shoreline. This CPEC was not detected in other wells located closer to the shoreline and was not detected in seep or co-located surface water. Based on these reasons and given the generally low toxicity ratio for groundwater (1.57), no further evaluation is recommended for B2EHP.

Neither USEPA National Recommended Water Quality Criteria (NRWQC; USEPA 2009) nor DEQ WQC (Table 33A) were available for barium and manganese. Therefore, DEQ's Level II SLVs for surface water were used, which are Tier II secondary chronic values (Suter and Tsao 1996). Confidence in these surface water SLVs is lower than in SLVs derived from the NRWQC or WQC. The surface water SLV used for iron is a DEQ WQC.

Dissolved barium concentrations exceeded the SLV in three groundwater samples (Figure 12-10). The maximum detected dissolved phase barium concentration occurred in a seep sample collected in 2000 ("SEEP"). In the absence of dissolved barium data for wells MW-1 and MW-5 through MW-9, total barium concentrations from these wells are shown on Figure 12-10 for these wells. Using data from unfiltered samples contributes to an overestimate of risk to aquatic biota since the SLVs are typically based on the dissolved phase, as this is the most bioavailable fraction. All dissolved and total concentrations of barium in Landfill and Reference Area groundwater exceeded the surface water SLV for barium, illustrating the conservativeness of the SLV.

Iron is well known to occur in leachate from landfills, and was detected in Landfill AOPC groundwater at concentrations exceeding the surface water SLVs in 15 samples representing four monitoring wells (Figure 12-10). It was also detected at approximately three times the SLV in the seep sample collected in 2000. The toxicity ratios for groundwater and seep water were 31 and 3.21, respectively (Table N-5), and the mean concentration of iron in groundwater generated a toxicity ratio of 9.8 (the mean seep concentration is below the SLV). Iron was not detected above the SLV in the seep samples collected in 2008 and 2009 (S2 and S4). The co-located surface water samples result in an iron toxicity ratio of 0.0092 (Table N-5). Given the low detections of iron in seep and co-located surface water, which are more likely to represent actual exposure by aquatic biota, and because iron is an essential nutrient, no further evaluation is recommended for iron.

Manganese concentrations were above the SLV in several of the groundwater wells, and were co-located with elevated levels of barium and iron. Manganese was approximately ten times the SLV in the seep sample collected in 2000. The toxicity ratios for groundwater and seep water were 29.2 and 12.3, respectively (Table N-5), and the mean concentrations of manganese (dissolved) in groundwater and seep water generated toxicity ratios of 9.0 and 2.4, respectively. Manganese was not detected above the SLV in the seep samples collected in 2008 and 2009 or in the co-located surface water samples (toxicity ratio of 0.00842). Given the low detections of manganese in seep and co-located surface water, which are more likely to represent actual exposure by aquatic biota, no further evaluation is recommended for manganese.

Concentrations of iron and manganese measured in the seep sample collected in 2000 were two orders of magnitude higher than those measured in 2008 and 2009. Although barium was not analyzed for in the new seep samples, it is likely that concentrations of this CPEC have also decreased. Based on this trend in the data, the low concentrations of CPECs in seep and surface water samples compared to the groundwater samples from interior of the Landfill AOPC, and the other lines of evidence discussed above for each CPEC, no further investigation of groundwater at the Landfill AOPC is recommended to protect aquatic biota.

12.3.4.3.2 Sandblast Area AOPC

Terrestrial Plants - Seven metals (antimony, arsenic, chromium, lead, nickel, selenium and zinc), o-xylene (shallow soils only), PCE (shallow soils only), LPAHs (shallow soils only) and HPAHs have toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the plant community at the Sandblast Area AOPC. Chromium, lead, nickel, and zinc were detected in all soil samples, while arsenic was detected in 98% to 99% of the samples (Table I-2). Antimony was detected in 71% to 73% of the samples, and selenium was detected 52% to 57% of the samples. o-xylene and PCE were detected in 11% of the samples collected from the 0 to 3 foot depth interval. LPAHs and HPAHs were detected in nearly all samples. Maximum concentrations of all seven metals were detected at the surface, while the maximum concentrations of o-xylene, PCE and several PAHs were detected below 1 foot bgs (maximum concentrations of some individual PAHs were detected at the surface). As shown in Tables 8-1, L-1, and L-2, all of the PAHs were detected at concentrations statistically higher than the Reference Area data.

Four samples had antimony concentrations in exceedance of the plant SLV, all of which were detected in the surface soil interval. The maximum concentration (SBB12) resulted in a relatively low toxicity ratio of 2.74. Therefore, adverse effects to the terrestrial plant community at the Sandblast AOPC are not expected to occur. However, antimony is recommended for further investigation in a Level III BERA because it was also identified as a CPEC for mammals at the Sandblast Area AOPC (see below). In the Level III BERA, antimony will be evaluated for all receptors at the Sandblast Area AOPC for consistency purposes.

No further assessment of arsenic is recommended for plants, given the low, limited exceedances of the SLV and lack of special status plant species at the Sandblast Area AOPC. Only the three highest detected concentrations of arsenic exceeded the plant SLV (DSA07, DSA11, and SBB18), all of which were detected in the surface soil interval. The maximum concentration, which was detected near the southwest corner of the current HSMA (SBB18), resulted in a relatively low toxicity ratio of 4.49.

No further assessment of selenium is recommended for plants, given the low toxicity ratio of 1.73 and lack of sensitive plant species at the Sandblast Area AOPC. Although selenium is one of the few metals with the potential for significant bioaccumulation, it was not identified as a CPEC for birds and mammals.

No further assessment of LPAHs is recommended for plants, given the low, single exceedance of the SLV and lack of special status plant species at the Sandblast Area AOPC. The toxicity ratio for Total LPAHs of 1.31 for the 0 to 3 feet interval is driven primarily by concentrations of phenanthrene, and secondarily by concentrations of anthracene (Table N-11). Only the maximum concentration, which was detected below the surface, exceeded the SLV for plants. The toxicity ratio for the 0 to 1 foot depth is 0.569.

No further evaluation of o-xylene and PCE is recommended for plants, given that only the maximum concentration of each exceeded the SLVs, and were located in a single sample below the surface. In addition, the toxicity ratios for the 0 to 1 foot depth are notably low at 0.00018 (o-xylene) and 0.00031 (PCE) (Table N-11).

Figure 12-11 shows a sample by sample comparison to SLVs for the following CPECs for plants:, chromium, lead, nickel, zinc, and HPAHs.

The toxicity ratio for zinc based on the maximum concentration, which was detected in the surface soil interval, is 7.25 (Table N-12). When the 95% UCL (212 mg/kg) or mean (173 mg/kg) zinc concentrations in the 0 to 1-foot interval are used, the toxicity ratio drops to 1.3 and 1.08, respectively. With the exception of the maximum concentration of zinc at SBB15, all remaining locations with exceedances of the SLV shown on Figure 12-11 have concentrations between 1 and 5 times the SLV. Therefore, no further assessment of zinc is recommended for plants, given the low exceedances of the SLV, lack of special status plant species at the Sandblast Area AOPC, high confidence in the SLV (USEPA EcoSSL), and the fact that zinc is an essential nutrient for plants.

Chromium concentrations exceeded 5 times the SLV at 25 surface locations, seventeen of which were between 10 and 50 times the SLV and three were greater than 50 times the SLV. Lead exceeded 5 times the SLV at 11 surface locations and 1 subsurface location, of which, only one surface location was between 10 and 50 times the SLV. Nickel exceeded 5 times the SLV at 16 surface locations, ten of which were between 10 and 50 times the SLV. The majority of the chromium, lead, and nickel exceedances occurred throughout the spent sandblast grit disposal area and surrounding CB-1.

Total HPAH concentrations exceeded 5 times the SLV at 10 surface locations, of which five had concentrations between 10 and 50 times the SLV, and one had a concentration greater than 50 times the SLV (HA-3). Total HPAH concentrations also exceeded the SLV at two subsurface locations, one of which had a concentration between 10 and 50 times the SLV, and one had a concentration greater than 50 times the SLV. The locations with elevated HPAH concentrations occur in the northeast portion of the equipment laydown area, adjacent to the current HMSA, adjacent to the roadway in the south, and within the area of erodible soils within the AOPC.

Based on the assessment for plants at the Sandblast Area AOPC, it is possible that impacts could occur from exposure to the primary risk drivers: chromium, lead, nickel, and HPAHs. However, the studies upon which terrestrial plant SLVs were derived typically use crops as the test species, and sensitivity levels of undomesticated plant species are likely to be different than crop species. Potential effects to the plant community are likely to be overestimated due to the assumption that these organisms are exposed to the maximum concentration of each CPEC throughout their life span. No sensitive plant species are known to be present at the Sandblast Area AOPC.

However, due to the elevated toxicity ratios for chromium, lead, nickel, and HPAHs, further investigation of these CPECs is recommended in the form of either a Level III BERA or remediation at the locations of highest elevations: the northeastern portion of the equipment laydown area, south of the current HMSA, within the central portion of the spent sandblast grit area, and around CB-1.

Soil Invertebrates - Five metals (arsenic, chromium, lead, nickel, and zinc), and HPAHs have toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the soil invertebrate community at the Sandblast Area AOPC. Chromium, lead, nickel and zinc were detected in all soil samples. Arsenic was detected in 98% to 99% of the samples, while the detections of individual HPAHs varied. Maximum concentrations of all five metals were detected at the surface, while the maximum concentration of total HPAHs was detected below 1 foot bgs. As shown in Tables 8-1, L-1 and L-2, all of the HPAHs were detected at concentrations statistically higher than the Reference Area data.

No further assessment of arsenic is recommended for soil invertebrates, given the low, single exceedance of the SLV and lack of special status invertebrate species at the Sandblast Area AOPC. Only the maximum concentration of arsenic exceeded the invertebrate SLV, resulting in a low toxicity ratio of 1.35.

Only the maximum concentration of lead exceeded the soil invertebrate SLV, resulting in a toxicity ratio of 1.92. Given the low, single exceedances of the SLV and lack of special status invertebrate species at the Sandblast Area AOPC, adverse effects to the soil invertebrate community are not expected to occur from exposure to lead. However, lead is recommended for further investigation if a Level III BERA is performed because it was identified as a CPEC for other receptors at the Sandblast Area AOPC as well as soil invertebrates.

Figure 12-12 shows a sample by sample comparison to SLVs for the following CPECs for soil invertebrates: chromium, nickel, zinc, and HPAHs.

No further assessment of nickel is recommended for soil invertebrates, given the low exceedances of the SLV (Figure 12-12) and lack of special status invertebrate species at the Sandblast Area AOPC. The toxicity ratio for nickel based on the maximum concentration is 3.79 (Table N-12), and when the 95% UCL (353 mg/kg) or mean (167 mg/kg) nickel concentrations for the 0 to 1-foot interval are used the toxicity ratio drops to 1.26 and 0.60, respectively. All locations with exceedances of the SLV shown on Figure 12-12 have concentrations between 1 and 5 times the SLV (primarily within Spent Sandblast Grit Disposal Area).

No further assessment of zinc is recommended for soil invertebrates, given the relatively low exceedances of the SLV, lack of special status soil invertebrate species at the Sandblast Area AOPC, high confidence in the SLV (USEPA EcoSSL), and the fact that zinc is an essential nutrient for invertebrates. The toxicity ratio for zinc based on the maximum concentration is 9.67

(Table N-12), and when the 95% UCL (212 mg/kg) or mean (173 mg/kg) zinc concentrations are used the toxicity ratio drops to 1.77 and 1.44, respectively.

Four samples had concentrations of total HPAHs greater than the SLV for soil invertebrates, and one sample had a concentration greater than 5 times the SLV. The toxicity ratios of 4.02 for surface soils and 5.84 for shallow soils are driven primarily by concentrations of fluoranthene and pyrene. Concentrations of chromium were greater than 5 times the SLV at 25 surface soil locations, of which sixteen were between 10 and 50 times the SLV and three were greater than 50 times the SLV. The majority of the chromium exceedances occurred throughout the spent sandblast grit disposal area and surrounding CB-1.

Based on the assessment for soil invertebrates at the Sandblast Area AOPC, it is possible that localized impacts could occur from exposure to the primary risk drivers: chromium, and to a lesser extent, HPAHs. Potential effects to the soil invertebrate community are likely to be overestimated due to the assumption that these organisms are exposed to the maximum concentration of each CPECs throughout their life span. No sensitive invertebrate species are known to be present at the Sandblast Area AOPC. Due to the elevated toxicity ratios for chromium, further investigation of this CPEC is recommended in the form of either a Level III BERA or remediation at the locations of highest elevations: south of the Current HMSA, within the central portion of the spent sandblast grit disposal area, and around CB-1.

Given the lower and less frequent exceedances of the SLV for HPAHs, the potential for adverse effects to the soil invertebrate community from exposure to HPAHs is expected to be lower than for chromium. However, HPAHs are recommended for further investigation if a Level III BERA is performed because they were identified as a CPEC for other receptors at the Sandblast Area AOPC as well as soil invertebrates.

Birds - Six metals (antimony, cadmium, chromium, lead, nickel, and zinc), Total DDTs (surface soil only), and B2EHP had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the individual birds at the Sandblast Area AOPC. Antimony, chromium, lead, and B2EHP had toxicity ratios greater than 5.0 and were assessed for potential impacts to bird populations.

In the absence of an avian SLV for antimony, the Reference Area UPL for soil was used in the screening evaluation. Antimony is not considered bioaccumulative (Table J-6) and therefore, would not be expected to be present in dietary tissues at levels of concern for birds. No further evaluation is recommended for antimony.

As stated previously in the Landfill AOPC risk interpretation, there are no protected species of terrestrial birds at the site. Based on the low toxicity ratios for nickel (1.68 for the 0 to 1-foot interval and 1.2 for the 0 to 3-feet interval), high confidence in the SLV (USEPA EcoSSL), and absence of protected species of terrestrial birds, no further evaluation is recommended for nickel.

The toxicity ratio for Total DDTs is essentially equivalent to 1.0 for the 0 to 1-foot interval (toxicity ratio of 1.029). 4,4'-DDT has the highest toxicity ratio of 0.347, and the toxicity ratios for the remaining two isomers are much lower (0.0078 for 4,4'-DDD and 0.0068 for 4,4'-DDE). The slight exceedance of 1.0 by the estimated concentration of Total DDTs is likely an artifact of the summation process. Based on the low toxicity ratios for Total DDTs, high confidence in the SLV (USEPA EcoSSL), and absence of protected species of terrestrial birds, no further evaluation is recommended for Total DDTs or the individual DDT isomers.

Figure 12-13 shows a sample by sample comparison to SLVs for the following CPECs that remain for birds: cadmium, chromium, lead, zinc, and B2EHP. The ratios for chromium, lead, and zinc were calculated using the Reference Area UPL as the SLV because the USEPA EcoSSLs for these metals are below the site-specific UPLs.

Low toxicity ratios were calculated for cadmium (4.16 for the 0 to 1-foot interval and 3.42 for the 0 to 3-feet interval) and zinc (2.96 for the 0 to 1-foot interval and 3.31 for the 0 to 3-feet interval) (Table N-13). As shown on the figure, the majority of locations at the Sandblast Area AOPC had concentrations of cadmium and zinc ranging between 1 to 5 times the SLV/UPL. Cadmium concentrations were between 5 and 10 times the SLV at three locations and between 10 and 50 times the SLV at three additional locations, all of which were located in the northeastern portion of the equipment laydown area. Zinc concentrations were between 5 and 10 times the UPL at a five scattered locations and between 10 and 50 times the UPL at a single location adjacent to the road east of the former sandblast building. Given that the equipment laydown area with the elevated cadmium concentrations is actively used and currently covered by equipment, the location with the maximum concentration of zinc is adjacent to an active roadway the fact that zinc is an essential nutrient for birds, and the low toxicity ratios, no further evaluation is recommended for cadmium or zinc. If, in the future, the equipment is removed and the habitat at the equipment laydown area is allowed to naturally restore, the potential for risk tor birds may need to be reevaluated.

As shown on Figure 12-13, B2EHP concentrations were between 1 and 5 times the SLV at eight surface soil locations and two subsurface soil locations. Only one surface soil location had a concentration of B2EHP between 10 and 50 times the SLV and only one surface soil sample had a concentration greater than 50 times the SLV, both of which were composite samples of the erodible area north of the former sandblast building. Many of the surface soil and several subsurface soil locations had concentrations of chromium and lead in exceedance of the Reference Area UPLs. The highest concentrations of these metals in soil (greater than 5 times the UPLs) were detected throughout the spent sandblast grit disposal area, the equipment laydown area, surrounding CB-1, within the area of erodible soils, and at two locations along the southeastern roadway. The locations with the highest concentrations (greater than 50 times the UPL) of chromium and lead were located along the northern area of the spent sandblast grit disposal area (HA6 through HA8; chromium and others for lead) and in the northern equipment laydown area (HA3), respectively.

Due to the elevated toxicity ratios for chromium, lead, and B2EHP, which are potentially bioaccumulative and the fact that several locations had concentrations greater than the SLVs, further investigation of these CPECs is recommended in the form of either a Level III BERA or remediation of the locations with elevated locations described above. In a Level III BERA to evaluate exposure to chromium, lead, and B2EHP in soil by birds, the following site-specific factors should be considered:

1. As previously described in the Sandblast Area AOPC risk interpretation, the approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls. However, these special-status species are not likely to forage at the 3.1 acre Sandblast Area AOPC and protection of terrestrial bird species at the population-level would be emphasized in the BERA for the Upland OU.

2. The site-specific Reference UPLs were greater than the risk-based soil SLVs (EcoSSLs) for chromium and lead and, therefore, the SLVs were replaced by the UPLs in the screening evaluation. In addition to evaluating specific bird target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution.
3. The size of the Sandblast Area AOPC relative to the size of a birds' home range would be factored into the daily dose estimation.

Mammals - Four metals (antimony, cadmium, chromium, and lead), dibenzofuran, and total HPAHs had toxicity ratios greater than 5.0 and were assessed for their potential to elicit adverse effects in mammal populations at the Sandblast Area AOPC. As shown in Tables 8-1, L-1 and L-2, all of the HPAHs were detected at concentrations statistically higher than the Reference Area data.

Figure 12-14 shows a sample by sample comparison to SLVs for the following CPECs that remain for mammals: antimony, cadmium, chromium, lead, dibenzofuran, and total HPAHs. Several locations had concentrations of these CPECs in exceedance of the mammal SLVs. The highest concentrations of these CPECs in soil (greater than 10 times the SLVs) were detected along the roadway in the southern portion of the AOPC, in the northeastern portion of the equipment laydown area, within the spent sandblast disposal area, in the erodible soils north of the former sandblast building, and around CB-1.

Due to the elevated toxicity ratios for antimony, cadmium, chromium, lead, and total HPAHs (Table N-14), which are potentially bioaccumulative with the exception of antimony, and the fact that several locations have concentrations greater than the SLVs (EcoSSLs that account for bioaccumulation), further investigation of these CPECs is recommended in the form of a Level III BERA or remediation of the locations with elevated concentrations. Antimony is not considered bioaccumulative (Table J-6) and therefore, would not be expected to be present in dietary tissues at levels of concern for mammals. However, due to the elevated toxicity ratios for this CPEC, which is based on the EcoSSL, additional evaluation is warranted. Studies have also demonstrated that PAHs are rapidly metabolized upon ingestion by birds and mammals, according to the USEPA EcoSSLs guidance document (2005a), and the potential for bioaccumulation in terrestrial habitats of PAHs is expected to be limited.

Dibenzofuran in soil does have potential to bioaccumulate, but little toxicity data exist to evaluate the consumption pathway for mammals precluding a meaningful Level III BERA for this CPEC. TRBs could not be found in USEPA or ORNL publications or databases, nor does USEPA's IRIS database provide an oral reference dose for dibenzofuran. As shown on Figure 12-14, dibenzofuran co-occurs with elevated detections of the other risk-driver CPECs at the northeastern portion of the equipment laydown area (cadmium, lead, and/or HPAHs), south of the current HMSA (HPAHs), and along the roadway in the southern portion of the AOPC (HPAHs). Since cadmium, lead, and HPAHs are recommended for further investigation and there is more confidence in the available data for these CPECs, lack of a site-specific evaluation of dibenzofuran is a manageable uncertainty for the Upland OU ERA. For these reasons, no further evaluation is recommended for dibenzofuran.

In a Level III BERA to evaluate exposure to antimony, cadmium, chromium, lead, and total HPAHs in soil by mammals, site-specific factors should be considered. In addition to evaluating specific mammal target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution. Also, the size of the Sandblast Area AOPC relative to the size of a mammals’ home range would be factored into the daily dose estimation.

Aquatic Organisms and Aquatic-Dependent Wildlife - Only one COI, cis-1,2-DCE, has a toxicity ratio greater than 1.0 and was assessed for its potential to elicit adverse effects in individual aquatic organisms or wildlife that could be exposed to surface water that has been impacted by COIs in groundwater from the Sandblast Area AOPC. However, based on the low toxicity ratio for cis-1,2-DCE (1.12; Table N-15), that it is not expected to bioaccumulate (log Kow < 3.5, Table J-6), and the fact that the wells immediately down gradient and adjacent to the river have concentrations below the SLV (Figure 12-15), no further evaluation is recommended for cis-1,2-DCE and no further investigation of groundwater at the Sandblast Area AOPC is recommended for protection of aquatic biota.

12.3.4.3.3 Pistol Range AOPC

Terrestrial Plants - Lead and zinc had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the plant community at the Pistol Range AOPC. Lead was detected in all soil samples (63 total from 0 to 1.5 feet bgs) at concentrations ranging from 7.5 to 1,100 mg/kg (Table I-3). Zinc was detected in all soil samples (10 total from 0 to 1.5 feet bgs) at concentrations ranging from 74 to 199 mg/kg (Table I-3). Based on the low toxicity ratio for zinc (1.24), high confidence in the SLV (USEPA EcoSSL), the fact that zinc is an essential nutrient, and the absence of protected species of terrestrial plants, no further evaluation is recommended for zinc.

Figure 12-16 shows a sample by sample comparison of lead concentrations to plant SLVs. The highest concentrations of lead, including the maximum concentration, were detected at and behind the backstop. Lead concentrations in this area of the site range between 5 and 10 times the SLV. The toxicity ratio for lead based on the maximum concentration is 9.25 (Table N-21), and when the 95% UCL (365 mg/kg) or mean (208 mg/kg) lead concentrations are used the toxicity ratio drops to 3.04 and 1.73, respectively.

Currently, the ground surface is vegetated with a mix of scrub-shrub and herbaceous vegetation, with no special status plant species. A meadow covers the firing range, and the hillside behind the backstop is densely vegetated with herbaceous vegetation and shrub/forest fringe communities.

Based on the assessment for plants at the Pistol Range AOPC, it is possible that very localized impacts could occur from exposure to lead, although no visible signs of distress have been observed in the areas with highest lead concentrations. Potential effects to the terrestrial plant community are likely overestimated due to the assumption that these organisms are exposed to the maximum concentration of each CPEC throughout their life span. In addition, the studies upon which terrestrial plant SLVs were derived typically use crops as the test species, and sensitivity levels of undomesticated plant species are likely to be different than crops species. Based on these considerations, adverse effects to the terrestrial plant community at the Pistol Range are not expected to occur. However, lead is recommended for further investigation if a Level III BERA is performed because it was identified as a CPEC for other receptors at the Sandblast Area AOPC as well as plants..

Soil Invertebrates - Zinc has a toxicity ratio greater than 1.0 and was assessed for its potential to elicit adverse effects in the soil invertebrate community at the Pistol Range AOPC. Zinc was detected in all soil samples (10 total from 0 to 1.5 feet bgs) at concentrations ranging from 74 to 199 mg/kg (Table I-3). Based on the low toxicity ratio for zinc (1.66), high confidence in the SLV (USEPA EcoSSL), the fact that zinc is an essential nutrient, and the absence of protected species of soil invertebrates, no further evaluation is recommended for zinc.

Birds - Lead and zinc had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in individual birds at the Pistol Range AOPC. Of these two CPECs, only lead had a toxicity ratio greater than 5.0 and was assessed for potential impacts to bird populations. Figure 12-16 shows a sample by sample comparison to the SLVs for lead and zinc for birds. The toxicity ratios for lead and zinc were calculated using the Reference Area UPL as the SLV because the USEPA EcoSSLs for these metals are below the site-specific UPLs.

As shown on Figure 12-16, six locations near the former firing shed had zinc concentrations ranging between 1 to 5 times the SLV/UPL. The toxicity ratio for zinc was 2.06 (Table N-23). As stated previously in the Landfill AOPC risk interpretation, there are no protected species of terrestrial birds at the site. Based on the low toxicity ratio for zinc, absence of protected species of terrestrial birds, and because zinc is an essential nutrient for birds (metabolically regulated), no further evaluation is recommended for zinc.

The toxicity ratio for lead was 14.3 (Table N-23), and the highest concentrations of lead were detected at and behind the backstop. Although the majority of lead concentrations were between 1 to 5 times the SLV, lead concentrations were between 5 and 10 times the SLV at five locations around the former firing shed and between 10 and 50 times the SLV at nine locations around the backstop and at two locations around the former firing shed. Due to the elevated toxicity ratio for lead, which is potentially bioaccumulative, and the fact that several locations have concentrations greater than the SLV, further investigation of this CPECs is recommended in the form of either a Level III BERA or remediation of the locations with elevated locations described above. In a Level III BERA to evaluate exposure to lead in soil by birds, the following site-specific factors should be considered.

1. As previously described in the Landfill AOPC risk interpretation, the approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls; however, these special-status species are not likely to forage at the 0.26-acre Pistol Range AOPC and protection of terrestrial bird species at the population-level would be emphasized in the BERA for the Upland OU.
2. The site-specific Reference UPL was greater than the risk-based soil SLV (EcoSSL) for lead and, therefore, the SLV was replaced by the UPL in the screening evaluation. In addition to evaluating specific bird target species and using literature-based BAFs to estimate dose, the contribution of background levels of lead would also be considered to better understand site-related dose contribution.
3. The small size of the Pistol Range AOPC and the size of a birds’ home range would be factored into the daily dose estimation.
4. A qualitative evaluation of the potential bioavailability of lead originating from the former firing range activities (i.e., lead shot) would be performed.

Mammals - Only lead had a toxicity ratio greater than 5.0 and was assessed for its potential to elicit adverse effects in mammal populations at the Pistol Range AOPC. The toxicity ratio for lead was 6.52 (Table N-24), and the highest concentrations of lead were detected at and behind the backstop. Lead concentrations were between 10 and 50 times the SLV at six locations around the backstop and at one location on the eastern corner of the former firing shed. Two other locations near the backstop had lead concentrations between 5 and 10 times the SLV. Lead was elevated above the SLV/UPL in 14 of the 63 soil samples collected. Due to the elevated toxicity ratio for lead, which is potentially bioaccumulative, and the fact that several locations have concentrations greater than the SLV, further investigation of this CPEC is recommended in the form of either a Level III BERA or remediation of the locations with elevated locations described above.

In a Level III BERA to evaluate exposure to lead in soil by mammals, site-specific factors should be considered. In addition to evaluating specific mammal target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution. Also, the size of the Pistol Range AOPC and the size of a mammals' home range would be factored into the daily dose estimation.

Aquatic Organisms and Aquatic-Dependent Wildlife - Although no CPECs were identified for the aquatic organisms potentially exposed to groundwater at the Pistol Range AOPC (based on their toxicity ratios all less than 1.0), zinc, a bioaccumulative COI, was retained as a CPEC due to the lack of a dietary-based SLV.

Benthic Invertebrates - Zinc has a toxicity ratio slightly greater than 1.0 (1.41), and the maximum concentration of zinc in lagoon sediment (174 mg/kg; Table I-14) was higher than the concentration detected in random Forebay sediment samples (113 mg/kg; Table I-18a). However, the low toxicity ratio for zinc detected in lagoon sediment and lack of special status benthic invertebrate species suggests a low potential for risk to the benthic community in the lagoon from exposure to zinc.

As mentioned previously, sediment samples from the lagoon were collected to determine if any COIs that could have originated from the former Pistol Range AOPC should be added to the list of COIs evaluated for the River OU. Zinc was assessed for its potential to elicit adverse effects in the benthic invertebrate community in the ERA for the River OU through an evaluation of zinc detected in sediment of the River (Section 12.5). Protection of the benthic community in the River is discussed in that section of the ERA.

Fish and Aquatic-Dependent Wildlife - The maximum detected concentrations of lead and zinc in lagoon sediment were greater than the Reference Area UPLs, which were used in the absence of sediment SLVs that are protective of fish and wildlife. Maximum concentrations of lead and zinc in lagoon sediment (33 and 174 mg/kg, respectively; Table I-14) were higher than concentrations detected in random Forebay sediment samples (16.8 and 113 mg/kg, respectively; Table I-18a). However, these metals were evaluated for their potential to bioaccumulate in the ERA for the River OU through an evaluation of these metals in detected in site tissue samples (Section 12.5), and the protection of fish and aquatic-dependent wildlife is discussed in that section of the ERA.

12.3.4.3.4 Bulb Slope AOPC

Terrestrial Plants – Lead and mercury had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in the plant community at the Bulb Slope AOPC. Lead was detected in all soil samples (12 total from 0 to 1-foot bgs) at concentrations ranging from 25 to 597 mg/kg (Table I-4). Mercury was also detected in all soil samples (12 total from 0 to 1-foot bgs) at concentrations ranging from 0.05 to 1.54 mg/kg (Table I-4). The topography is steep and the substrate at the Bulb Slope AOPC consists of a mixture of soils, rock that may have been placed in some areas, and what appear to be natural rock outcrops, all of which is underlain by siltstone bedrock. The majority of the Bulb Slope AOPC is herbaceously vegetated and/or covered with organic debris.

Figure 12-17 shows a sample by sample comparison of soil concentrations to the plant SLV for lead and mercury. The toxicity ratio for lead based on the maximum concentration was 4.98 (Table N-35), and when the 95% UCL of 307 mg/kg or mean of 222 mg/kg lead concentrations at 0 to 1 foot (Table I-15) are used the toxicity ratio dropped to 2.6 and 1.85, respectively. Nine samples had concentrations in exceedance of the SLV, and no samples have concentrations in exceedance of 5 times the SLV.

The toxicity ratio for mercury based on the maximum concentration was 5.13 (Table N-35), and when the 95% UCL of 0.72 mg/kg or mean of 0.4 mg/kg mercury concentrations (Table I-15) are used the toxicity ratio dropped to 2.4 and 1.35, respectively. Six samples had concentrations in exceedance of the SLV (between the SLV and 5 times the SLV), and only one of these six samples (Pile #3 Bank #4) had a concentration between 5 and 10 times the SLV (Figure 12-17).

Given the relatively low exceedances of the plant SLVs for lead and mercury and lack of special status plant species at the Bulb Slope AOPC, the potential for adverse effects to the terrestrial plant community is expected to be limited. However, these CPECs are recommended for further investigation in a Level III BERA because they were identified as CPECs for other receptors at the Bulb Slope Area AOPC as well as plants.

Soil Invertebrates - Mercury had a toxicity ratio greater than 1.0 and was assessed for its potential to elicit adverse effects in the invertebrate community at the Bulb Slope AOPC. As stated above, mercury was detected in all soil samples, with concentrations ranging from 0.05 to 1.54 mg/kg.

Figure 12-17 shows a sample by sample comparison of soil concentrations to the invertebrate SLV for mercury. Nine soil samples had concentrations in exceedance of the SLV, and three of these nine samples had concentrations higher than 5 times the SLV (one of these also exceeded ten times the SLV). The toxicity ratio for mercury based on the maximum concentration was 15.4 (Table N-36), and when the 95% UCL (0.72 mg/kg) or mean (0.4 mg/kg) mercury concentrations (Table I-15) were used the toxicity ratio dropped to 7.2 and 4.0, respectively.

Based on the number of exceedances of the soil invertebrate SLVs for mercury and elevated toxicity ratios, further investigation of this CPEC is recommended in the form of either a Level III BERA or remediation of the locations with elevated locations.

Birds - Lead and mercury had toxicity ratios greater than 1.0 and were assessed for their potential to elicit adverse effects in birds at the Bulb Slope AOPC. Figure 12-17 shows a sample by sample comparison of soil concentrations to the avian SLVs for lead and mercury. The toxicity ratios for lead and mercury were calculated using the Reference Area UPL as the SLV because the USEPA EcoSSLs for these metals are below the site-specific UPLs. The toxicity ratios for lead and mercury were 12.0 and 10.9, respectively (Table N-37).

As shown on Figure 12-17, lead and mercury concentrations at most locations (9 of 12) exceeded the UPLs/SLVs. Of these nine samples, five locations had concentrations between 5 and 10 times the SLV and four locations had concentrations between 10 and 50 times the SLV for one or both of these CPECs. Due to the elevated toxicity ratios for lead and mercury, which are potentially bioaccumulative, and the fact that several locations had concentrations greater than the SLV, further investigation of these CPECs is recommended in the form of either a Level III BERA or remediation of the locations with elevated locations described above. In a Level III BERA to evaluate exposure to lead and mercury in soil by birds, the following site-specific factors should be considered.

1. As previously described in the Landfill AOPC risk interpretation, the approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls; however, these special-status species are not likely to forage at the 0.05-acre Bulb Slope AOPC and protection of terrestrial bird species at the population-level would be emphasized in the BERA for the Upland OU.
2. The site-specific Reference UPL was greater than the risk-based soil SLV (EcoSSL) for lead and mercury and, therefore, the SLVs were replaced by the UPLs in the screening evaluation. In addition to evaluating specific bird target species and using literature-based BAFs to estimate dose, the contribution of background levels of these CPECs would also be considered to better understand site-related dose contribution.
3. The small size of the Bulb Slope AOPC and the size of a birds' home range would be factored into the daily dose estimation.

Mammals - Lead had a toxicity ratio greater than 5.0 and was assessed for its potential to elicit adverse effects in mammal populations at the Bulb Slope AOPC. Figure 12-17 shows a sample by sample comparison of soil concentrations to the mammalian SLV for lead. Two soil samples had concentrations between 5 and 10 times the SLV, and one sample had a lead concentration between 10 and 50 times the SLV. The toxicity ratio for lead was only slightly above 5.0 (5.48) (Table N-38).

The topography is steep and the substrate at the Bulb Slope AOPC consists of a mixture of soils, rock that may have been placed in some areas, and what appear to be natural rock outcrops, all of which is underlain by siltstone bedrock. Access to this area would be challenging for larger mammals, given the steep slope and rocks. Based on the low magnitude of the toxicity ratio for lead, lack of special status mammals, and in consideration of small size of this rocky area, adverse effects to mammal populations at the site are not expected to occur. However, lead is recommended for further investigation in a Level III BERA because it has been identified as CPEC for other receptors at the Bulb Slope as well as mammals.

12.3.4.3.5 All Four AOPCs Combined

Tables N-43 and N-44 present the results of the screening for individual COIs evaluated for birds and mammals, respectively, that potentially have home ranges equal to or larger than the size of the entire Upland OU and could, therefore, forage over all four AOPCs. Tables N-45 and N-46 provide the results of the toxicity-based screening analysis that involved an evaluation of the cumulative risks associated with simultaneous exposure to multiple COIs present in a given medium.

A comparison of the soil CPECs identified for the four AOPCs combined versus those identified for the individual AOPCs was performed to determine if any discrepancies exist in this lists of CPECs. No additional CPECs for birds and mammals were identified for the combined AOPCs dataset that were not already identified for the individual AOPC datasets. To address exposures for birds and mammals that could forage over all four AOPCs, the CPECs identified through the individual AOPC screening evaluations should also be assessed for exposures to all four AOPCs by birds and mammals, as appropriate, in a Level III BERA.

12.3.5 Summary of Level II Screening Assessment for Upland OU

Table 12-1 summarizes the CPECs identified through the Level II Screening Assessment that are recommended for risk management, which could entail further investigation or focused remediation.

In addition to the receptors and CPECs listed in Table 12-1 for the Upland AOPCs, the bioaccumulative CPECs at the Landfill and Sandblast Area AOPCs for which dietary-based SLVs are not available (Tables N-3, N-4, N-13, and N-14) also warrant further consideration for birds and mammals. If a Level III BERA is performed, a first critical step would be to determine which bioaccumulative CPECs have corresponding TRVs, as the absence of TRVs for these CPECs could preclude a full quantitative evaluation. At a minimum, all bioaccumulative CPECs would be discussed qualitatively. Finally, risk management is recommended to address the potential erosional soils at the Landfill, Sandblast Area, and Bulb Slope AOPCs that could be mobilized and transported to the River OU if erosion/mass wasting were to occur (e.g., localized soil removal, erosion control measures).

As discussed in Section 8.2.1, to address the uncertainty with the results of the statistical background comparison, metals with high MDDs were subjected to a risk-based screening evaluation in Appendix O. The purpose of this evaluation is to explore whether or not these metals should be included as COPCs, and ultimately advanced to the next level of risk assessment or directly to the FS. A weight-of-evidence approach similar to the one implemented in Section 12 was used to evaluate these metals, as described in Appendix O.

12.4 Level I Scoping Assessment For River OU

The general tasks involved in a Level I Scoping Assessment summarized in Section 12.1.1 for the Upland OU also apply to the River OU. The main goal of the Level I evaluation is to determine if complete exposure pathways potentially exist at a site, and if a Level II Screening Assessment should be performed. To fulfill the requirements of a Scoping Assessment, the ecological setting, site features (topography, structures), nature and extent of all known chemical releases, current and future uses of land and water, and any unique site-specific characteristics described in previous sections were carefully considered. The identification of COIs and CPECs described for the Upland OU in Section 12.2.1 is equivalent to the process used for the River OU.

12.4.1 COIs in River Media

The physical environment of the River OU is much more dynamic than the Upland OU. As discussed previously, the electrical equipment and debris and the majority of the contaminated sediment have been removed from the river, and water movement and human activities have redistributed sediment within the Forebay. In Section 6.2, recent site investigations are described in detail, and the COIs in River media are identified.

In order to focus on the current river conditions and the identification of current COIs, only analytical results from investigations in the River OU since 2007 are included in the RI River OU data set and used in the ERA, with the exception of smallmouth bass collected in 2006. Based on the presence of potentially complete exposure pathways and associated analytical data, COIs in the River OU were identified for the following media: sediment, surface water, and fish and benthic invertebrate tissue.

The categories of COIs that were identified in the recent River OU and 2006 Forebay smallmouth bass analytical data include metals, PCBs, TPH, and SVOCs including PAHs. Of these COIs, a subset is considered to be bioaccumulative in aquatic environments, as presented in Section 7.3 and Table J-7. The screening tables described in Section 12.5.4.1 and presented in Appendix N provide the potentially bioaccumulative COIs detected in the random Forebay, Goose Island, and Eagle Creek sediment data sets. The tissue data collected from the Forebay (including Goose Island) were emphasized in the identification of truly bioaccumulative COIs for this project.

12.4.2 Ecological Exposure Pathways

Sediment and water are sources for uptake of bioaccumulative chemicals by benthic and aquatic organisms, which are consumed by upper trophic level receptors. The following potential exposure pathways are identified for the River OU, and these pathways were more thoroughly investigated to identify those that warrant a quantitative evaluation in the Level II Screening Assessment (Section 12.5.2.1):

- Uptake of contaminants potentially present in surface water by aquatic organisms (plants, aquatic invertebrates, and fish)
- Ingestion of and dermal contact with contaminants potentially present in sediment and surface water by benthic invertebrates
- Incidental ingestion of and dermal contact with potentially contaminated surface water and sediment by aquatic-dependent wildlife (dermal contact is expected to be minor due to the barriers offered by fur and feathers)
- Ingestion of benthic and aquatic dietary components (e.g., invertebrates and fish) by upper trophic level receptors (fish and wildlife)

The exposure pathways that are complete at the River OU and their associated receptors were quantitatively evaluated in the Level II Screening Assessment.

12.5 Level II Screening Assessment For River OU

This section describes the methodology and findings of Level II Screening Assessment for the River OU.

The comprehensive description of the nature and extent of COIs in the River OU is provided in Section 9.6. In Sections 9.1.2, the first two steps of the CPEC selection process (evaluation of detection frequency and comparison to background levels for inorganics) were performed for all media associated with the Forebay, Goose Island, and Eagle Creek (Tables 9-9 to 9-11).

The two targeted sediment sample locations placed on the eastern bank of the mouth of Eagle Creek were collected to evaluate potential exposure by recreational waders, and these samples are also included as a targeted dataset in this ecological Level II Screening Assessment. The two targeted sample locations placed in the slough on the southern side of Goose Island, where sediment, clams, crayfish, and sculpin were collected at the request of DEQ, were also included in the screening.

12.5.1 Receptors of Interest

A simplified food-web model for the River OU is presented on Figure 12-18. Discussion regarding the selection of aquatic receptors of interest (or “target receptors”) occurred in several meetings during 2005 and early 2006 with the TAG for Bradford Island. The following terrestrial receptors of interest were selected in the RI/FS MP (URS 2007a):

- Benthic invertebrates represented by the clam (*Corbicula fluminea*) and crayfish (*Pacifastus spp.*)
- Aquatic plants and water-column invertebrates
- Resident fish represented by the sculpin (*Cottus spp.*) and smallmouth bass (*Micropterus dolomieu*) (Although salmonids are known to be particularly sensitive to exposure to PAHs and PCBs (Meador 2000; Johnson et al 2000), evaluation of the resident species is expected to be protective of anadromous and transient species due to their higher level of site use at all life stages.)
- Osprey (*Pandion haliaetus)*
- Bald eagle
- Mink

In the Level II Screening Assessment, these organisms are evaluated as receptor groups (aquatic plants and invertebrates, benthic invertebrates, fish, and piscivorous birds and mammals) through a comparison to generic SLVs for each group. During a Level III BERA, the specific receptors listed above, which represent the feeding guilds present in the River OU, would be assessed for exposure and risk.

Although considered to be semiaquatic and highly reliant upon the riverine environment for resources, the bald eagle and the mink may both frequent the uplands, where they would likely supplement their primarily aquatic diet with upland prey items, such as small mammals. In the event that unacceptable risks are demonstrated for piscivorous birds and mammals from exposure to media of the River OU, more realistic assumptions that incorporate refinements to their dietary compositions may be considered if a Level III BERA is warranted.

12.5.2 Exposure Assessment

Exposure assessment is the process of estimating the magnitude, frequency, and duration of site-specific exposure concentrations of chemicals to a receptor. To assess whether COI concentrations at the site have the potential to cause adverse effects in the selected ecological receptors, it is first necessary to develop reasonable estimates of the concentrations to which the receptors might be exposed.

12.5.2.1 Conceptual Exposure Model for Ecological Receptors

A CEM for ecological receptors of the River OU is presented on Figure 12-19. This CEM focuses on potentially complete pathways associated with the Forebay, which are also applicable to Goose Island Slough and Mouth of Eagle Creek. The aquatic-related exposure pathways identified for the River OU in Section 12.4.2 are reflected in the CEM :

- Uptake of contaminants potentially present in surface water by aquatic organisms
- Ingestion of and dermal contact with contaminants potentially present in sediment and surface water by benthic invertebrates, fish, and wildlife (dermal contact is expected to be minor for aquatic-dependent wildlife due to the barriers offered by fur and feathers)
- Ingestion of benthic and aquatic dietary components (e.g., invertebrates and fish) by piscivorous fish and wildlife

These pathways are potentially complete for the River OU and were quantitatively evaluated.

12.5.2.2 Assessment Endpoints

The recommended assessment endpoints for the ecological receptors addressed in the River OU are listed below.

- Protection of aquatic biota (invertebrates and fish) that may be exposed to COIs in sediment or surface water or from Upland OU sources (e.g., groundwater or soil washoff).
- Protection of piscivorous mammals, such as the mink, against unacceptable effects on reproduction, growth, or development at the population level due to COIs in sediment, invertebrates, water, and aquatic food.
- Protection of top-level predatory birds, such as the American bald eagle and osprey, against unacceptable effects on reproduction, growth, or development at the population level due to COIs in sediment, water, and aquatic food.

Protection on an individual basis was the focus for state- or federally listed threatened and endangered species (i.e., bald eagle, salmon) that may occur from exposure to media of the River and/or Upland OUs.

12.5.2.3 Estimation of Exposure Point Concentrations

For plankton, aquatic plants and invertebrates, fish, and benthic invertebrates, the EPC is estimated as a function of the COI concentration measured in water, sediment, or tissue. For piscivorous birds and mammals, the exposure dose may be estimated as a function of the COI concentration in relevant environmental media and several other parameters related to biological transfer through the food web and the manner in which receptors use the site.

All samples collected from the River were analyzed for both PCB congeners (all 209 congeners) and Aroclors, volume permitting. Therefore, EPCs in abiotic and biotic media collected from the site may be calculated for the following PCB groupings:

- Individual Aroclors
- Total PCBs as the sum of Aroclors
- Total PCBs as sum of 209 congeners
- 2,3,7,8-TCDD TEQs for the 12 dioxin-like PCB congeners

Aquatic Organisms (plankton, aquatic plants, pelagic invertebrates, and fish) and Aquatic-Dependent Wildlife - For the Level II Screening Assessment, EPCs in flowing surface water are represented by the maximum concentration detected in the five surface water samples.

Benthic Invertebrates - The maximum detected concentration was selected as the EPC for sediment, clam, and crayfish data evaluated to assess risk to the benthic community (as represented by these two organisms). Use of the maximum concentration of each COI is a conservative approach that serves to protect sessile organisms that could conceivably be exposed to the maximum concentration throughout their entire life span.

Piscivorous Birds, Mammals, and Fish - For food web-based receptors such as birds, mammals, and piscivorous fish, the EPC was based on the 95% UCL on the mean concentration in sediment and tissue. The lower of the 95% UCL and maximum detected concentration was ultimately used as the EPC for these receptors. This value provides an estimate of the representative concentration more relevant to terrestrial wildlife receptors that generally are mobile and not continuously exposed to site-related COIs in one geographic location.

As presented in the RI/FS MP (URS 2007a), site-specific bird and mammals target receptors that would be evaluated if a Level III BERA is warranted for the River OU include bald eagle, osprey, and mink. The tissue sampling performed in the River between 2008 and 2009 to support the RI was designed with a specific aquatic food web model in mind and the following assumptions regarding dietary intake by these target receptors:

- Bald eagle and osprey consume 100% smallmouth bass (i.e., Level 3-4 fish)
- Mink consumes 33% crayfish (benthic invertebrates), 33% sculpin (Level 2-3 fish), and 33% smallmouth bass

The bald eagle and osprey would not likely consume significant amounts of smaller fish (e.g., sculpin) and invertebrates (e.g., crayfish) in the River OU, and the assumption that they solely consume top predatory fish, like smallmouth bass, is expected to result in worst-case exposure to bioaccumulative and biomagnifying COIs. However, for purposes of this Level II Screening Assessment, aquatic-dependent birds as a general category were assumed to feed on crayfish, sculpin, and bass.

Although a specific target fish species was not selected, several species were identified that could inhabit the Forebay in Table C-4 of the RI/FS MP (URS 2007a). These fish species occupy various feeding guilds in the food web and, therefore, it was assumed that all types of tissue collected (clams, crayfish, sculpin, and bass) could be consumed by fish as a generic receptor group. The single sample of sucker was considered too small of a sample size to be included in the tissue dataset. However, the data from the sucker were evaluated relative to the bass tissue concentrations and tissue SLVs protective of fish (i.e., critical tissue levels [CTLs]) and wildlife (i.e., ATLs) in the uncertainty analysis (Appendix O).

12.5.3 Effects Analysis

A brief introduction to the Effects Analysis phase of the ERA was provided for the Upland OU (Section 12.3.3). The same process was applied to the River OU.

12.5.3.1 Measurement Endpoints

As discussed in Section 12.3.3.1, the measures of exposure and measures of effect proposed for the assessment endpoints were provided in Table C-1 of the RI/FS MP (URS 2007a). Measurement endpoints for the River ERA primarily include measured EPCs in sediment, tissue, and surface water collected from the Forebay. No modeling of sediment or water to tissue was necessary, as site-specific COI concentrations in two types of benthic invertebrates (clams and crayfish) and two types of fish (sculpin and smallmouth bass) were compared directly to tissue SLVs protective of these receptors groups, as well as to SLVs protective of upper-trophic-level receptors that may consume these organisms.

12.5.3.2 Direct Toxicity and Bioaccumulation SLVs

The EPCs for sediment, water, and tissue were compared to the SLVs protective of the individual receptor groups of interest evaluated for the River OU (e.g., aquatic plants and invertebrates, benthic invertebrates, fish, and piscivorous birds and mammals). The primary literature sources of SLVs protective of ecological receptors that were used in the Level II Screening Assessment were presented in Section 7.3 and Appendix J.

The tissue SLVs were compared to the types of tissue that correspond to the dietary intake assumptions described in Section 12.5.2.3:

1. SLVs protective of fish/shellfish were compared to all tissue data
2. SLVs protective of birds were compared to crayfish, sculpin, and smallmouth bass tissue data (as three distinct datasets; no combination of tissues indicating dietary proportions were performed for this Screening Assessment)
3. SLVs protective of mammals were compared to crayfish, sculpin, and smallmouth bass data (as three distinct datasets; no combination of tissues indicating dietary proportions were performed for this Screening Assessment)

The following section describes the methods used to screen the site data against these SLVs for the identification of CPECs.

12.5.3.3 Identification of Chemicals of Potential Ecological Concern

The first two steps of the CPEC identification process presented in Section 12.2.1 (i.e., evaluation detection frequency and comparison to Reference Area concentrations for inorganics) were considered for the random and target Forebay data sets in Section 9.1. River OU COIs that were detected in ≤ 5% of samples per media could potentially be eliminated as CPECs, as long as there were at least 20 samples collected. However, because none of the River OU media had at least 20 samples no COIs were removed from CPEC evaluation based on detection frequency (Tables 9-9 through 9-11).

For the second step, a comparison of two independent data sets for each media was performed between the Reference Area sediment and tissues (clam, crayfish, smallmouth bass, and sculpin) and the random Forebay sediment and tissues, including the 2006 smallmouth bass tissue. The objective of the statistical analysis was to assess whether the mean inorganic COI concentrations in the random Forebay post-removal sediment and tissues were significantly higher than the mean Reference Area sediment and tissue concentrations. This approach is commonly known as a population-to-population comparison. The results of this statistical comparison are presented in detail in Section 8.0 and Appendix L and summarized in Table 8-3.

Since the comparisons for between Forebay and Reference Area surface water only evaluated total concentrations, and the screening level ERA uses dissolved concentrations, no inorganic compounds were eliminated based on comparison to Reference Area concentrations. All detected metals were screened against surface water SLVs.

The following summarizes the inorganic COIs in sediment and tissue at the Forebay (random) with significantly higher concentrations than the Reference Area (Tables 8-3):

- Sediment – None.
- Clam – Beryllium and cadmium.
- Crayfish – Antimony, arsenic, chromium, mercury, methyl mercury, and nickel.
- Sculpin – Cadmium, lead, and mercury.
- Smallmouth bass – Aluminum, barium, copper, mercury, and zinc.

For the targeted Forebay sampling locations at Goose Island Slough and the mouth of Eagle Creek, which do not have enough samples to perform a statistical (population-to-population) comparison, the maximum detected inorganic concentrations in sediment and tissue (clam and crayfish) were compared to the inorganic 95% UPLs in the Reference Area. The following summarizes the inorganic COIs in sediment and tissue at Goose Island and Eagle Creek with maximum detected concentrations greater than the Reference Area 95% UPLs (Table L-7).

- Eagle Creek Sediment – None.
- Goose Island Sediment – Antimony, cadmium, thallium, and zinc.
- Goose Island Clam – Beryllium.
- Goose Island Crayfish – Mercury.

The inorganic COIs in sediment and tissue at the Forebay (random and targeted) that were found to not be elevated above the Reference Area were not retained as CPECs.

All detected organic COIs and all inorganic COIs with concentrations above Reference Area levels were retained for the third step of the CPEC identification process, i.e., toxicity-based screening. The approach used for the screening to evaluate direct toxicity for benthic invertebrates (exposed to sediment) and aquatic organisms (exposed to surface water) is the same as the approach described in Section 12.3.3.3 for the Upland OU (i.e., toxicity ratios for individual COIs and multiple COIs).

The potential for bioaccumulation and the availability of SLVs are two additional qualitative elements that were evaluated in the identification of CPECs. Bioaccumulation potential of COIs in sediment was assessed using the methods presented in Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment (DEQ 2007). COIs detected in sediment and tissue were screened against DEQ's bioaccumulation SLVs (including ATLs and CTLs) for freshwater fish and shellfish, bird, mammal populations by creating bioaccumulation indices, calculated using the following equation:

$$R_{BAC} = \frac{EPC}{Bioaccumulation\ SLV}$$

where :

R_{BAC} = bioaccumulation index for chemical

EPC = Exposure point concentration

Bioaccumulation SLV = DEQ's Bioaccumulation SLV (2007)

In general, bioaccumulation indices less than 1 indicate sediment or tissue concentrations at which adverse environmental effects are not expected to occur. Any individual bioaccumulative COI in a given medium with $R_{BAC} > 0.1$, and for which the sum $R_{BAC} > 1$ for a given medium (i.e., addition of all R_{BAC}s for that medium), was identified as a CPEC to account for both exposures to individual COIs, as well as simultaneous exposure to all COIs.

The tissue data were the primary line of evidence to select CPECs for the fish and benthic invertebrate consumption pathway for predatory fish and wildlife. Given the uncertainties regarding chemical transfer, uptake, and accumulation in organisms that are ingested by predators inherent to sediment bioaccumulation SLVs, site-specific tissue data are always a better representation of EPCs that receptors would encounter at a site. For this reason, all COIs in tissue were evaluated in the Screening Assessment, and then the list of CPECs in tissue was carried to the sediment data evaluation. The list of CPECs in tissue comprises the list of COIs which were evaluated in sediment, and this analysis will assist with risk management decisions for the River OU based on the two possible outcomes:

- If a CPEC in tissue is also present in sediment at concentrations in exceedance of the bioaccumulation SLV (i.e., it is also a CPEC in sediment), then further risk assessment may be helpful to evaluate the actual potential for adverse effects to occur from exposure to site-related CPEC concentrations.
- If a CPEC in tissue is undetected in sediment, present below Reference Area levels (inorganics only), or present at concentrations below sediment SLVs, further risk assessment may not be helpful because tissue concentrations likely do not correlate with current sediment concentrations at the site. If this is the case, the tissue levels could reflect exposure to other sources in the river or could reflect historical body burdens. Risk management or some level of monitoring may be warranted for certain tissue CPECs that are not found to be CPECs in sediment.

Since the objective of collecting the samples at the mouth of Eagle Creek was to assess exposure by people wading, no tissue data were collected from that area. Therefore, the potentially bioaccumulative COIs in these samples were compared to the bioaccumulation SLVs for sediment.

12.5.4 Risk Characterization

A brief introduction to the Risk Characterization phase of the ERA was provided for the Upland OU (Section 12.3.4). The same process was applied to the River OU.

12.5.4.1 Results of Toxicity Screening

The toxicity screening for COIs in sediment, tissue, and surface water of the River OU involved a comparison of appropriate EPCs to corresponding media-specific SLVs protective of the receptor groups evaluated in this Level II Screening Assessment. The potential for ecological risk to occur was evaluated based on exposure to individual COIs within a specific medium and from exposure to multiple COIs simultaneously within a given medium.

Toxicity ratios for benthic invertebrates exposed directly to sediment and aquatic organisms exposed to surface water were estimated for each COI, as described in Section 12.5.3.3. If the toxicity ratio (T_{ij}) for a specific COI is greater than the receptor designator (Q) appropriate for the site, or if the toxicity ratio for a specific COI is a high contributor to the total risk for a given medium (summation of all toxicity ratios), then further investigation of the COI is warranted and it was retained as a CPEC. As defined by DEQ (2001), Q is equal to 1.0 for all benthic and aquatic organisms exposed to sediment and surface water.

Any individual bioaccumulative COI in a given medium with $R_{BAC} > 0.1$, and for which the sum $R_{BAC} > 1$ for a given medium, was identified as a CPEC. The bioaccumulation SLVs protective of individuals of listed threatened and endangered wildlife species (birds and mammals) and SLVs protective of populations of these receptors groups were applied in the screening comparison.

The results of the screening are presented for the Random Forebay, Goose Island, and Eagle Creek in the following sections.

12.5.4.1.1 Random Forebay Data

Tables N-47 through N-50 of Appendix N present the results of the screening for individual COIs in Forebay sediments and surface water, and simultaneous exposure to multiple COIs, to evaluate direct toxicity to benthic invertebrates and aquatic organisms. Tables N-51, N-53, N-54, N-57, and N-58 present the results of the screening for COIs in tissue to evaluate the dietary exposure pathway for predatory fish and shellfish (and other aquatic organisms) and aquatic-dependent wildlife at both the individual and population levels. Tables N-52, N-55, N-56, N-59, and N-60 present the results of the screening for COIs in sediment to evaluate the dietary exposure pathway and essentially assess the potential current site contribution to tissue levels. As discussed in Section 12.5.3.3, the information gathered through the comparison of tissue CPECs and sediment CPECs was used to guide recommendations for the next steps of the site investigation process, including the utility of future risk assessment.

Benthic Invertebrates

Direct Toxicity Evaluation - Only Aroclor 1254 was identified for the benthic invertebrate community in the Forebay based on the individual COI screening evaluation for sediment (Table N-47). Maximum concentrations of total PCBs as the sum of all Aroclors and as the sum of all congeners were below the corresponding SLVs. Aroclor 1254 also contributes to a cumulative risk greater than 1.0 (Table N-48) and requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in the benthic community.

DRO and RRO were retained as CPECs in sediment due to the lack of SLVs protective of benthic invertebrates. The implications to the findings of the Screening Assessment are discussed in the uncertainty assessment (Appendix O).

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which were based on a comparison of measured clam and crayfish concentrations from the site to tissue SLVs protective of fish and shellfish.

Aquatic Organisms and Aquatic-Dependent Wildlife

Direct Contact Evaluation - Barium was the only CPEC identified for the aquatic receptors in the Forebay based on the individual and multiple COI screening evaluations for surface water (Tables N-49 and N-50). Barium requires further investigation in the risk interpretation section to assess its potential to elicit adverse effects in aquatic receptors.

DRO were retained as CPECs in surface water due to the lack of SLVs protective of aquatic organisms and wildlife. The implications to the findings of the Screening Assessment are discussed in the uncertainty assessment (Appendix O).

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which were based on a comparison of measured clam and crayfish concentrations from the site to tissue SLVs protective of fish and shellfish. Likewise, the findings of the evaluation for birds and mammals were based on a comparison of measured sculpin, crayfish, or bass concentrations from the site to tissue SLVs protective of birds and mammals (Section 12.5.3.2).

Fish and Shellfish

Tissue. Table N-51 presents the bioaccumulative CPECs with a tissue $R_{BAC} > 0.1$ and sum tissue $R_{BAC} > 1.0$ for each type of organism collected in the Forebay. The tissue SLVs (i.e., DEQ’s CTLs) are protective of upper trophic level fish and shellfish in and of themselves and, therefore, were screened against the Forebay clam, crayfish, sculpin, and smallmouth bass data. Cadmium, PCBs (as total congeners only), and B2EHP were identified as CPECs in clam tissue. There were no CPECs identified for crayfish due to exceedance of tissue SLVs. Cadmium, lead, mercury, and PCBs (Aroclor 1254, total Aroclors, total PCB congeners, three of 12 dioxin-like congeners, and PCB TEQ for Fish [i.e., Fish TEQ]) were identified as CPECs in sculpin tissue. Mercury, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, five of 12 dioxin-like congeners, and Fish TEQ), B2EHP, and butyl benzyl phthalate were identified as CPECs in smallmouth bass tissue. All of these CPECs require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in upper trophic level fish and shellfish that consume these tissues. In addition, beryllium and p-cresol (4-Methylphenol) in clam tissue, antimony, chromium, and nickel in crayfish tissue, and aluminum, barium, copper, and zinc in bass tissue were retained as CPECs due to the lack of SLVs for tissue.

Sediment. Of the CPECs listed above for the various tissue types, only PCBs (Aroclor 1254 and total Aroclors) were also identified as CPECs in sediment (Table N-52). B2EHP was detected in sediment and was retained as a CPEC due to the lack of a sediment SLV that addresses the dietary pathway. The results of the population to population statistical comparisons demonstrated that the metals detected in tissue above Reference Area concentrations were not present in the Forebay sediment at concentrations above Reference Area sediment concentrations (Tables L-4 and N-52). Therefore, it is difficult to assess the site contribution of the metal CPECs in site sediment to the Forebay tissue levels. Due to this difficulty, all CPECs in sediment (and tissue) were carried to the risk interpretation section.

Piscivorous Birds

Tissue. Tables N-53 and N-54 present the bioaccumulative CPECs with a tissue $R_{BAC} > 0.1$ and sum tissue $R_{BAC} > 1.0$ for crayfish, sculpin, and smallmouth tissue collected in the Forebay that could be consumed by piscivorous birds (such as bald eagles and osprey) known to occur in the vicinity of Bradford Island. Table N-53 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-54 shows the results of the population level assessment.

The tissue SLVs (or DEQ’s ATLs) are protective of piscivorous birds that could forage in the Forebay. Mercury, methyl mercury and total PCB congeners were identified as CPECs in crayfish tissue. Mercury and PCBs (Aroclor 1254, total Aroclors, total PCB congeners, five of the 12 dioxin-like congeners, and PCB TEQ for birds [i.e., Avian TEQ]) were identified as CPECs in sculpin tissue. Mercury, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, seven dioxin-like congeners, and Avian TEQ), and di-n-butyl phthalate were identified as CPECs in smallmouth bass tissue. All of these CPECs require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered birds. Mercury and most of the PCBs listed above also require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in bird populations (Table N-54).

In addition, antimony, chromium, and nickel in crayfish tissue and aluminum, barium, copper, and zinc in bass tissue were retained as CPECs due to the lack of SLVs for tissue. PAHs were also retained as tissue CPECs due to the lack of tissue SLVs for birds, and the implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O.

Sediment. Of the CPECs listed above in the various tissue types, PCBs (Aroclor 1254, total Aroclors, total PCB congeners, and one dioxin-like congener) were also identified as CPECs in sediment and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered birds (Table N-55). None of these CPECs were found in sediment at concentrations that could cause adverse effects in piscivorous bird populations (Table N-56).The results of the population to population statistical comparisons demonstrated that metals detected in tissue above Reference Area concentrations were not present in the Forebay sediment at concentrations above Reference Area sediment concentrations (Tables L-4, N-55, and N-56).Therefore, it is difficult to assess the site contribution of the metal CPECs in site sediment to the Forebay tissue levels. Due to this, all CPECs in sediment (and tissue) were carried to the risk interpretation section.

Piscivorous Mammals

Tissue. Tables N-57 and N-58 present the bioaccumulative CPECs with a tissue $R_{BAC} > 0.1$ and sum tissue $R_{BAC} > 1.0$ for crayfish, sculpin, and smallmouth tissue collected in the Forebay that could be consumed by piscivorous mammals (such as mink) that are known to occur in the vicinity of Bradford Island. Table N-57 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-58 shows the results of the population level assessment.

The tissue SLVs (or DEQ's ATLs) are protective of piscivorous (and invertivorous) mammals that could forage in the Forebay. With the exception of CPECs retained due to lack of SLVs, only PCBs (three dioxin-like congeners and the PCB TEQ for mammals [i.e., Mammalian TEQ]) are CPECs for crayfish tissue. Mercury and PCBs (Aroclors 1254, total Aroclors, total PCB congeners, eight of the 12 dioxin-like congeners, and Mammalian TEQ) are CPECs in sculpin tissue. Mercury and PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, ten dioxin-like congeners, and Mammalian TEQ) were identified as CPECs in smallmouth bass tissue. All of these tissue CPECs require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered mammals. Mercury and most of the PCBs listed above also require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in mammal populations.

In addition, antimony, chromium, and nickel in crayfish tissue and aluminum, barium, copper, and zinc in bass tissue were retained as CPECs due to the lack of SLVs for tissue.

Sediment. Of the CPECs listed above in the various tissue types, PCBs (four dioxin-like congeners and the Mammalian TEQ) were also identified as CPECs in sediment and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected mammals (Tables N-59). No CPECs were found in sediment at concentrations that could cause adverse effects in piscivorous mammal populations (Table N-60). The results of the population to population statistical comparisons demonstrated that metals detected in tissue above Reference Area concentrations were not present in the Forebay sediment at concentrations above Reference Area sediment concentrations (Tables L-4, N-57, and N-58). Therefore, it is difficult to assess the site contribution of the metal CPECs in site sediment to the Forebay tissue levels. Due to this, all CPECs in sediment (and tissue) were carried to the risk interpretation section.

12.5.4.1.2 Mouth of Eagle Creek

Tables N-61 and N-62 of Appendix N present the results of the screening for individual COIs in sediments collected from the mouth of Eagle Creek (two samples), and simultaneous exposure to multiple COIs, to evaluate direct toxicity to benthic invertebrates. Tables N-63 through N-67 present the results of the screening for bioaccumulative COIs in sediment to evaluate the dietary exposure pathway for predatory fish and shellfish and aquatic-dependent wildlife at both the individual and population levels. Since the objective of collecting the samples from Eagle Creek was to assess the direct contact pathway for waders in the HHRA (URS 2007a), no tissue samples were collected from this area. The sediment samples were analyzed for PCBs as Aroclors, in addition to metals, SVOCs (PAHs), and TPH. No PCB congener data were collected.

Because tissue data have been collected from the greater Forebay (the random samples), the purpose of the bioaccumulation evaluation for Eagle Creek sediment was to identify any additional CPECs that have not already been identified through the random Forebay sampling event. Any bioaccumulative CPECs identified in Eagle Creek sediments (i.e., maximum sediment concentration above the bioaccumulation SLV) were compared to the tissue data to determine their actual presence in measured tissue data from the Forebay.

Benthic Invertebrates

Direct Toxicity Evaluation – PCBs (Aroclor 1248 and total Aroclors) were the only CPECs identified for the benthic community at the mouth of Eagle Creek based on the individual and multiple COI screening evaluations for sediment (Tables N-61 and N-62). PCBs require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in the benthic community.

DRO were retained as CPECs in sediment due to the lack of SLVs protective of benthic invertebrates, and the implications of these uncertainties to the findings of the Screening Assessment are discussed in the uncertainty assessment (Appendix O).

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which are based on a comparison of bioaccumulative COI concentrations in sediment to sediment SLVs protective of fish and shellfish.

Fish and Shellfish

Table N-63 presents the bioaccumulative CPECs with a sediment R_{BAC} > 0.1 and sum sediment R_{BAC} > 1.0 that could pose a health risk to upper trophic level fish and shellfish. PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above the bioaccumulative SLV protective of fish and shellfish. These CPECs require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in upper trophic level fish and shellfish.

Carbazole and DRO were retained as CPECs in sediment due to the lack of a bioaccumulation SLV protective of fish and shellfish, and the implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O. Of these two CPECs, only carbazole was identified as potentially bioaccumulative in aquatic environments based on the criteria discussed in Section 7.3 (Table J-7).

Aroclor 1248 was not detected in the random Forebay sediment samples (it was only detected in one sample at Eagle Creek). Instead, Aroclor 1254 is the primary PCB mixture detected in random sediment and tissue samples. Aroclor 1254 and total PCBs as Aroclors are bioaccumulative CPECs in Forebay sediment, crayfish, and smallmouth bass for which the Screening Assessment indicates the potential for adverse effects in upper trophic level fish and shellfish that consume these tissues and are exposed to CPECs in sediment.

Piscivorous Birds

Tables N-64 and N-65 present the bioaccumulative CPECs with a sediment R_{BAC} > 0.1 and sum sediment R_{BAC} > 1.0 that could pose a health risk to piscivorous birds (such as bald eagles and osprey) known to occur in the vicinity of Bradford Island. Table N-64 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-65 shows the results of the population level assessment.

PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above the bioaccumulative SLV protective of birds, and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered birds. Except for potential CPECs that were retained due to lack of SLVs, no CPECs were identified that could elicit adverse effects in bird populations.

Carbazole, PAHs, and DRO were retained as CPECs in sediment due to the lack of a bioaccumulation SLVs protective of birds, and the implications of these uncertainties to the findings of the Screening Assessment are discussed in Appendix O. Of these CPECs, carbazole and PAHs were identified as potentially bioaccumulative in aquatic environments based on the criteria discussed in Section 7.3 (Table J-7).

As stated above, Aroclor 1248 was not detected the random Forebay sediment samples (it was only detected in one sample at Eagle Creek). Instead, Aroclor 1254 is the primary PCB mixture detected in random sediment and tissue samples.

Piscivorous Mammals

Tables N-66 and N-67 present the bioaccumulative CPECs with a sediment R_{BAC} > 0.1 and sum sediment R_{BAC} > 1.0 that could pose a health risk to piscivorous mammals (such as mink) that are known to occur in the vicinity of Bradford Island. Table N-66 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-67 shows the results of the population level assessment.

PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above the bioaccumulative SLV protective of mammals, and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered mammals. Except for potential CPECs that were retained due to lack of SLVs, no CPECs were identified that could elicit adverse effects in mammal populations.

Carbazole and DRO were retained as CPECs in sediment due to the lack of a bioaccumulation SLV protective of mammals, and the implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O. Of these two CPECs, only carbazole was identified as potentially bioaccumulative in aquatic environments based on the criteria discussed in Section 7.3 (Table J-7).

As stated above, Aroclor 1248 was not detected in the random Forebay sediment samples (it was only detected in one sample at Eagle Creek). Instead, Aroclor 1254 is the primary PCB mixture detected in random sediment and tissue samples.

12.5.4.1.3 Goose Island Slough

Tables N-68 through N-69 of Appendix N present the results of the screening for individual COIs in Goose Island sediment samples, and simultaneous exposure to multiple COIs, to evaluate direct toxicity to benthic invertebrates. No surface water data have been collected at Goose Island. Tables N-70 and N-71 presents the results of the screening for COIs in tissue and sediment to evaluate the dietary exposure pathway for predatory fish and shellfish. Tables N-72 through N-75 present the results of the screening for COIs in tissue and sediment to evaluate dietary exposure to aquatic-dependent birds at both the individual and population levels. Tables N-76 through N-79 present the results of the screening for COIs in tissue and sediment to evaluate the dietary exposure pathway and essentially assess the potential current site contribution to tissue levels for aquatic-dependent mammals. As discussed in Section 12.5.3.3, the information gathered through the comparison of tissue CPECs and sediment CPECs will be used to guide recommendations for the next steps of the site investigation process, including the utility of future risk assessment.

Many of the smallmouth bass collected in 2006 were from the Goose Island slough. These samples were collected as part of the random Forebay sampling effort and are, therefore, presented under the Random Forebay Data discussion above. Since bass are one of the primary food source for piscivorous birds and mammals and predatory fish that could forage at the Forebay, including Goose Island, a summary of the screening results for bass tissue collected from the Forebay is provided below for these three receptor groups.

Benthic Invertebrates

Direct Toxicity Evaluation - Cadmium, thallium, zinc, and Aroclor 1254 were identified for the benthic invertebrate community in the Goose Island slough based on the individual and cumulative COI screening evaluations for sediment (Tables N-68 and N-69) and require further investigation in the risk interpretation section to assess its potential to elicit adverse effects in the benthic community.

DRO and RRO were retained as CPECs in sediment due to the lack of SLVs protective of benthic invertebrates, and the implications of these uncertainties to the findings of the Screening Assessment are discussed in Appendix O.

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which are based on a comparison of measured clam and crayfish concentrations from the site to tissue SLVs protective of fish and shellfish.

Fish and Shellfish

Tissue. Table N-70 presents the bioaccumulative CPECs with a tissue $R_{BAC} > 0.1$ and sum tissue $R_{BAC} > 1.0$ for clams, crayfish, and sculpin collected from Goose Island. The tissue SLVs (or DEQ’s CTLs) are protective of upper trophic level fish and shellfish in and of themselves and, therefore, were screened against these tissue data. No CPECs were identified in these targeted tissue samples from Goose Island, with the exception of beryllium and p-cresol (4-methylphenol), which were detected in clam tissue, due to the absence of tissue SLVs. As shown in Table N-51 and previously discussed in Section 12.5.4.1.1, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, five of 12 dioxin-like congeners, and Fish TEQ), B2EHP, and butyl benzyl phthalate are CPECs in randomly-collected smallmouth bass tissue samples from the Forebay. Of the metals identified as tissue CPECs, a tissue SLV was only available for mercury. The EPC for mercury in randomly-collected bass tissue exceeded the tissue SLV; however, the EPC for mercury in crayfish tissue collected from the targeted locations at Goose Island is below the tissue SLV.

Sediment. Of the random Forebay smallmouth bass tissue organic CPECs, PCBs (Aroclor 1254 and total Aroclors) are also CPECs in Goose Island sediment (Table N-71). P-cresol (4-methylphenol), which was detected in Goose Island clam tissue but lacked a tissue SLV, was also detected in sediment and was retained as a sediment CPEC due to the lack of a sediment SLV that addresses the dietary pathway. In addition, B2EHP was detected in Goose Island sediment (but not in Goose Island clams, crayfish, and sculpin) and was retained as a CPEC due to the lack of a SLV that addresses the dietary pathway.

Of the metals identified above as tissue CPECs in Goose Island clam tissue and random Forebay bass tissue, zinc was also identified as a Goose Island sediment CPEC due to SLV exceedance

(Table N-71). The results of the Reference Area comparison demonstrated that all the remaining metals identified above were present in the targeted Goose Island sediment samples at concentrations similar to or less than Reference Area sediment concentrations (Tables L-7 and N-71). Therefore, it is difficult to assess the contribution of the metal CPECs in Goose Island sediment to the Forebay bass tissue levels, with the possible exception of zinc. Due to this difficulty, all CPECs in Goose Island sediment (and tissue) were carried to the risk interpretation section.

Piscivorous Birds

Tissue. Tables N-72 and N-73 present the bioaccumulative CPECs with a tissue $R_{BAC} > 0.1$ and sum tissue $R_{BAC} > 1.0$ for crayfish and sculpin tissue collected at Goose Island that could be consumed by piscivorous birds. Table N-72 shows the results of the bioaccumulation screening to assess potential adverse effects in birds at the individual level; Table N-73 shows the results of the population level assessment. The tissue SLVs (or DEQ's ATLs) are protective of piscivorous birds that could forage in the Forebay, including Goose Island.

No CPECs were identified in crayfish or sculpin tissue collected from Goose Island, with the exception of those without SLVs (i.e., PAHs.). As shown in Tables N-53 and N-54 and previously discussed in Section 12.5.4.1.1, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, seven dioxin-like congeners, and Avian TEQ), di-n-butyl phthalate, and PAHs were identified as CPECs in the randomly-collected smallmouth bass tissue collected from the Forebay.

PAHs were retained as tissue CPECs due to the lack of SLVs for birds. The implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O.

Sediment. Tables N-74 and N-75 present the bioaccumulative CPECs in targeted Goose Island sediment samples with $R_{BAC} > 0.1$ and sum sediment $R_{BAC} > 1.0$. Table N-74 shows the results of the bioaccumulation screening to assess potential adverse effects in birds at the individual level; Table N-75 shows the results of the population level assessment. Of the CPECs listed above in smallmouth bass, zinc, PCBs (Aroclor 1254, total Aroclors, total PCB congeners, one dioxin-like congener, and Avian TEQ) were also identified as CPECs in sediment and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered birds. Zinc and PCBs (Aroclor 1254 and total Aroclors) were detected in sediment at levels that could elicit adverse effects in piscivorous bird populations (Table N-75). It is worth noting that the sediment SLV for zinc is represented by the Reference Area UPL (i.e., not a risk-based SLV). In addition, di-n-butyl phthalate and PAHs were retained as CPECs in sediment due to the lack of SLVs protective of birds.

Of the metals identified above as tissue CPECs in random Forebay bass tissue, the results of the Reference Area sediment comparison demonstrated that all but zinc were present in the targeted Goose Island sediment samples at concentrations similar to or less than Reference Area sediment concentrations (Tables L-7, N-74, and N-75). Therefore, it is difficult to assess the contribution of the metal CPECs in Goose Island sediment to the Forebay tissue levels, with the possible exception of zinc. Due to this, all CPECs in Goose Island sediment (and tissue) were carried to the risk interpretation section.

Piscivorous Mammals

Tissue. Tables N-76 and N-77 present the bioaccumulative CPECs with a tissue R_{BAC} > 0.1 and sum tissue R_{BAC} > 1.0 for clams, crayfish, and sculpin collected from Goose Island that could be consumed by piscivorous mammals. Table N-76 shows the results of the bioaccumulation screening to assess potential adverse effects in mammals at the individual level; Table N-77 shows the results of the population level assessment. No CPECs were identified in the targeted tissue samples from Goose Island at either the individual or population level. As shown in Tables N-57 and N-58 and previously discussed in Section 12.5.4.1.1, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, ten of 12 dioxin-like congeners, and Mammalian TEQ) were identified as CPECs in randomly-collected smallmouth bass tissue samples from the Forebay that could be consumed by piscivorous mammals.

Sediment. Tables N-78 and N-79 present the bioaccumulative CPECs in targeted Goose Island sediment samples with R_{BAC} > 0.1 and sum sediment R_{BAC} > 1.0 at the individual and population level, respectively, for aquatic-dependent mammals. Of the CPECs identified for smallmouth bass, zinc and PCBs (Aroclor 1254 and total Aroclors) were also identified as CPECs in sediment and require further investigation in the risk interpretation section to assess their potential to elicit adverse effects in individual protected threatened and endangered mammals, as well as in mammal populations. It is worth noting that the sediment SLV for zinc is represented by the Reference Area UPL (i.e., not a risk-based SLV).

Of the metals identified above as tissue CPECs in random Forebay bass tissue, the results of the Reference Area sediment comparison demonstrated that all but zinc were present in the targeted Goose Island sediment samples at concentrations similar to or less than Reference Area sediment concentrations (Tables L-7, N-78, and N-79). Therefore, it is difficult to assess the contribution of the metal CPECs in Goose Island sediment to the Forebay tissue levels, with the possible exception of zinc. Due to this, all CPECs in Goose Island sediment (and tissue) were carried to the risk interpretation section.

12.5.4.2 Uncertainty Assessment

A brief introduction to the Uncertainty Assessment phase of the ERA was provided for the Upland OU (Section 12.3.4.2), which also applies to the River OU. Specific sources of uncertainty for this Level II ERA are presented in Appendix O.

12.5.4.3 Risk Interpretation

In this final phase of the risk characterization process, the quantitative and qualitative components of the risk screening (i.e., toxicity ratios and R_{BACs}) and the uncertainty assessment are evaluated to gain a better understanding of the actual potential for ecological risk. Multiple lines of evidence are considered during risk interpretation to identify actual risk drivers at the site and to develop a supportable recommendation for risk managers to review. The outcome of the risk characterization constitutes the basis of remedial decisions for the protection of ecological receptors and risk-driving exposure pathways.

For the screening to evaluate direct toxicity to benthic and aquatic receptors through exposure to sediment and surface water, the CPECs with toxicity ratios greater than 1.0 for benthic invertebrates and aquatic biota are retained for further investigation in this section. For the bioaccumulation screening to evaluate the dietary exposure pathway for fish and wildlife, the CPECs with a R_{BAC} > 0.1 and sum R_{BAC} > 1.0 are further investigated in this section.

The summary of the risk screening process described in Section 12.3.4.3 for the Upland OU, whereby SLVs were compared to 95% UCLs (mobile receptors) and maximum concentrations (stationary receptors) and a whittled down list of CPECs was identified to plot on figures to evaluate spatial distribution, also applies to the approach used for the River OU. Based on this weight of evidence approach, those CPECs that truly warrant additional investigation or risk management were identified and discussed.

Since evaluation of the tissue data was the preferred method to identify tissue CPECs for predatory fish and wildlife, all COIs in tissue were evaluated in the Screening Assessment, and then the list of CPECs in tissue was carried to the sediment data evaluation. The results of this phased screening process for tissue followed by sediment will assist with risk management decisions for the River OU based on the two possible outcomes previously presented (Section 12.5.3.3):

- If a CPEC in tissue is also present in sediment at concentrations in exceedance of the bioaccumulation SLV (i.e., it is also a CPEC in sediment), then further risk assessment may be helpful to evaluate the actual potential for adverse effects to occur from exposure to site-related CPEC concentrations.
- If a CPEC in tissue is either undetected, present below Reference Area concentrations (inorganics only), or present below sediment SLVs, further risk assessment may not be helpful because tissue concentrations likely do not correlate with current sediment concentrations at the site. If this is the case, the tissue levels could reflect exposure to other sources in the river or could reflect historical body burdens. Risk management or some level of monitoring may be warranted for certain tissue CPECs that are not found to be CPECs in sediment.

Those CPECs for which a limited number of exceedances were noted (e.g., Aroclor 1248 for benthic invertebrates in Eagle Creek) were generally not included on the spatial distribution maps, but were still discussed using a similar weight-of-evidence approach as the remaining CPECs. The CPECs identified in Section 12.5.4.1 for the Forebay (both random and targeted sample areas) and associated receptors are discussed below.

12.5.4.3.1 Random Forebay Data

<u>Benthic Invertebrates</u>

Direct Toxicity Evaluation - Only Aroclor 1254 was identified for the benthic invertebrate community in the Forebay based on the individual and cumulative COI risk screening evaluations for sediment (Tables N-47 and 48) and was assessed for its potential to elicit adverse effects in the benthic community. Maximum concentrations of total PCBs as the sum of all Aroclors and as the sum of all congeners were below the corresponding SLVs.

Aroclor 1254 was detected in two of 19 randomly-collected sediment samples (detection frequency of 11%), and exceeded the SLV in one of these samples (location P4 on the north side of Bradford Island, Figure 12-20). The toxicity ratio calculated using the maximum detected concentration of Aroclor 1254 was 3.86 (Table N-47), and decreases to 0.826 if the K-M mean concentration was used as the EPC (the maximum concentration was selected as the 95% UCL given the large number of non-detects) (Table I-18a). The elevated toxicity ratio for Aroclor 1254 indicates the potential for localized impacts (at P4) to benthic invertebrates. Given the low detection frequency for Aroclor 1254 in sediment and low toxicity ratios based on the maximum and mean concentrations, adverse effects to the benthic invertebrate community at the Forebay are not expected to occur. However, PCBs (including Aroclor 1254) are recommended for further investigation because they been identified as CPECs for other receptors in the River as well as benthic invertebrates.

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below for a comparison of measured clam and crayfish concentrations from the site to tissue SLVs protective of fish and shellfish.

Aquatic Organisms and Aquatic-Dependent Wildlife

Direct Contact Evaluation - Barium was the only CPEC identified for the aquatic receptors in the Forebay based on the individual and multiple COI screening evaluations for surface water (Tables N-49 and N-50) and was assessed for its potential to elicit adverse effects in aquatic receptors.

Barium was detected above the surface water SLV in all five Forebay filtered surface water samples as well as the five filtered surface water samples collected from the Reference Area. Dissolved barium concentrations in surface water in the Forebay ranged from 0.021 to 0.024 mg/L (Table 6-12c) and concentrations in the Reference Area ranged from 0.0215 to 0.0235 mg/L (Table 6-12d). The toxicity ratio for barium in surface water was 6.0 (Table N-49). Given the very similar concentrations of barium detected in Forebay and Reference Area surface water samples, and the relatively low toxicity ratio that is based on a Tier II Secondary Chronic Value (DEQ 2001), no further evaluation is recommended for aquatic receptors exposed through direct contact with Forebay surface water.

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below for a comparison of measured sculpin and bass concentrations from the site to tissue SLVs protective of fish and shellfish. Likewise, the findings of the evaluation for birds and mammals are based on a comparison of measured sculpin, crayfish, or bass concentrations from the site to tissue SLVs protective of birds and mammals (Section 12.5.3.2).

Fish and Shellfish

Tissue SLVs protective of upper trophic level fish and shellfish were screened against the Forebay clam, crayfish, sculpin, and smallmouth bass data. Table N-80 summarizes the CPECs for fish and shellfish based on a comparison to SLVs that were identified in the various tissues randomly collected from the Forebay (Table N-51). The CPECs shown with an asterisk on Table N-80 were also identified as CPECs in Forebay sediment (Table N-52).

As described in Section 12.5.4.1, EPCs for cadmium, lead, and mercury exceeded the tissue SLVs. Eight other metals were detected in Forebay tissues and retained as CPECs due to the lack of tissue SLVs. However, the results of the population to population statistical comparisons demonstrated that none of these metals were present in Forebay sediment at concentrations above Reference Area sediment concentrations (Table L-4). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels. Although none of these metals are CPECs in sediment, those that are present above the tissue SLVs (cadmium, lead, and mercury) are recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

In addition, p-cresol (4-methylphenol) was detected in the Forebay in six of 19 sediment samples (at concentrations ranging from 4.8 to 21 µg/kg) and ten of 19 clam samples (at concentrations ranging from 8.6 to 31 µg/kg). It was retained as a CPEC due to the lack of SLVs for sediment and tissue. p-Cresol was not detected in Forebay crayfish (15 samples) or smallmouth bass (19 samples). Furthermore, the concentrations detected in Forebay sediment and clam tissue were not statistically higher than the concentrations detected in the Reference Area for any of the media (Table 8-3). Based on the low concentrations of p-cresol detected in Forebay sediment and clams in comparison to the Reference Area, and the low bioaccumulation potential for p-cresol (log K_{ow} = 1.94; Table J-7), which is supported by the absence this CPEC in sculpin, crayfish, and bass, lack of a quantitative risk-based screening for p-cresol is not expected to influence the findings of the ERA. No further investigation of p-cresol is recommended.

Figure 12-20 shows a sample by sample comparison of CPEC concentrations to SLVs for the protection of upper trophic level fish and shellfish. Tissue concentrations are shown for cadmium, lead, mercury, PCBs, and the two phthalates. Sediment concentrations are shown for PCBs, which was the only sediment CPEC identified due to exceedance of its SLV (Table N-52). For simplicity, due to the higher level of confidence in PCB analytical data reported as congeners for weathered or metabolized PCBs, and due to the consistently higher risk estimates of total PCBs as congeners in tissue, only the PCB congener totals are presented on Figure 12-20. Additionally, B2EHP was identified as a CPEC due to lack of an SLV and potential to bioaccumulate (not shown on Figure 12-20).

Clams

The clam tissue R_{BACs} (i.e., EPC divided by bioaccumulation SLV) for cadmium, total PCB congeners, and B2EHP were 2.55, 0.298, and 0.407, respectively. The population to population comparison for clam tissue found that cadmium was present in the Forebay at concentrations above those measured in Reference Area clam tissue. Cadmium concentrations in clam tissue were between 1 and 10 times the SLV in all random samples collected from the Forebay (Figure 12-20). However, the cadmium concentration ranges were similar (0.286 and 0.461 mg/kg in the Forebay [Table 6-9a] and between 0.247 and 0.405 mg/kg in the Reference Area [Table 6-9b]; see Figure L-3a). Given the low R_{BACs} calculated with clam tissue from the Forebay, absence of CPECs in crayfish tissue, and similarity in cadmium concentration ranges in Forebay and Reference Area clams and sediment, there is a low potential for adverse effects to the benthic community from exposure through the dietary pathway.

Sculpin

The sculpin tissue R_{BACs} for cadmium, lead, and mercury were 0.162, 0.858, and 2.13, respectively (Table N-51). The sculpin tissue R_{BACs} for PCBs ranged from 0.186 (PCB 156+157) to 7.40 (total PCBs as congeners). For simplicity and due to the higher level of confidence in PCB analytical data reported as congeners for weathered or metabolized PCBs, total PCBs as congeners was used to represent all PCB CPECs on the figures. The tissue R_{BAC} for the Fish TEQ of 0.668 is much lower than the tissue R_{BAC} for total PCBs as congeners (7.40). The Fish TEQ SLV for tissue (0.0064 µg/kg) is only exceeded at SF-3, i.e., the location with the maximum concentration of total PCBs as congeners in sculpin tissue. The two other locations with the highest PCBs levels in sculpin tissue have concentrations in exceedance of 0.1 times the SLV for the Fish TEQ (SF-4 and SF-5). .

As stated previously, total PCBs as congeners was used to represent all PCB CPECs on Figure 12-20. The highest concentrations of PCBs in sculpin tissue occurred at SF-3, SF-4, and SF-5, on the southeastern tip of the island, and these are the only three samples that exceed the SLV (but are less than 10 times the SLV). Co-located PCB sediment concentrations in this area were less than 0.1 times the SLV, and clam concentrations were between 0.1 and 1 times the SLV. Cadmium, mercury, and to a lesser extent, lead, concentrations were between 0.1 and 10 times the SLV in several sculpin samples collected throughout the Forebay, and did not appear attributable to site sediment concentrations (the Forebay sediment data were not statistically higher than the Reference Area data) (Table L-4).

Since cadmium, mercury, and lead concentrations in sculpin tissue were comparable throughout the Forebay (R_{BACs} are relatively low), and sediment concentrations of these metals were no different from the Reference Area (Table L-4), further risk assessment is unlikely to be helpful for these metals. Tissue concentrations likely do not correlate with current sediment concentrations in the Forebay. Based on the elevated sculpin tissue concentrations throughout the Forebay, it is likely that other sources (besides sediment concentrations) influence the cadmium, lead, and mercury concentrations measured in the sculpin. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway.

Risk management or monitoring is recommended for PCBs, and possibly cadmium, lead, and mercury, in sculpin tissue to protect predatory fish that may be exposed through their diet. The size of a sculpin's home range (1.61 km) is greater than the distance between the SF-3, SF-4, and SF-5 cluster, and sediment station P4 (approximately 0.36 km). Therefore, it is possible for the sculpin in these areas to have foraged in the vicinity of P4, where sediment concentrations of PCBs were between 1 and 10 times the SLV and clam concentrations were between 0.1 and 1 times the SLV. However, the implications of this localized exceedance of the sediment SLV in terms of current site contributions to concentrations of PCBs in sculpin tissue are unknown. It is likely that the sculpin tissue levels reflect historical body burdens, influences from upstream sources, or a combination of the two.

Smallmouth Bass

The smallmouth bass tissue R_{BACs} for mercury, B2EHP, and butylbenzyl phthalate were 3.60, 0.192, and 0.771, respectively (Table N-51). The bass tissue R_{BACs} for PCBs ranged from 0.153 (PCB 114) to 44.9 (total PCBs as congeners). The tissue R_{BAC} for the Fish TEQ of 4.58 is much lower than the tissue R_{BAC} for total PCBs as congeners (44.9), and the Fish TEQ SLV for tissue (0.0064 μg/kg) is only exceeded at bass locations 11 and 17, i.e., the locations with the maximum concentrations of total PCBs as congeners. The six remaining locations that exceed 0.1 times the SLV for the Fish TEQ (2, 3, 8, 13, 16 and 18) also exceed either 0.1 times the SLV or the whole SLV for total PCBs as congeners.

As stated previously, total PCBs as congeners was used to represent all PCB CPECs on Figure 12-20. The highest concentrations of PCBs in bass tissue occurred at location 17, on northeastern tip of the island, and location 11 in the Goose Island slough. Total PCB concentrations in bass at these locations exceed 10 times the SLV. Several other bass caught from locations had PCB concentrations between 0.1 and 10 times the SLV.

Mercury was also present in bass tissue at concentrations between 1 and 10 times the SLV. Although concentrations of mercury in Forebay bass were significantly higher than in the Reference Area (Table L-4), the concentration ranges in bass tissue were generally comparable between the Forebay (0.0710 – 0.512 mg/kg) (Table 6-6a) and the Reference Area (0.0548 –

0.333 mg/kg) (Table 6-6b). This is consistent with the fact that mercury concentrations in Forebay sediments were not significantly higher than those in the Reference Area (Table L-4).

B2EHP was detected between 0.1 and 1 times the SLV in two bass tissue samples (8 and 15) collected from the Goose Island slough, but did not have a sediment SLV for evaluation of the sediment samples (Figure 12-20). Butylbenzyl phthalate was detected at a concentration between 1 and 10 times the SLV in only one bass sample (16), and was undetected in all sediment samples (Figure 12-20).

The low detection frequency for B2EHP and butylbenzyl phthalate in Forebay bass tissue (37% and 11%, respectively, Table I-8a) and low concentrations detected supports the position that these compounds are readily metabolized and only weakly bioaccumulate (similar to the metabolic action noted in PAHs). At other contaminated sediment sites, including the Lower Duwamish Waterway, phthalates often occur with other compounds (e.g., PCBs) that drive risk. The phthalates are typically overshadowed by these more potent risk-drivers (Sediment Phthalate Work Group 2007). Given the low frequency of tissue SLV exceedances and low R_{BACs} for the phthalates, there is a low potential for adverse effects to fish from exposure through the dietary pathway. However, it is recommended that future investigations analyze for and evaluate all SVOCs.

Since mercury bass tissue concentrations were elevated throughout the Forebay, mercury bass tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful for mercury. Based on the ubiquitously elevated bass tissue levels for mercury in the River as a whole, it is likely that other sources influenced the concentrations measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway).

Risk management or monitoring is recommended for PCBs, and possibly mercury, in bass tissue to protect predatory fish that may be exposed through their diet. While it is possible for the bass to forage in the vicinity of P4, where the maximum sediment concentration of PCB was between 1 and 10 times the SLV and clam concentrations were between 0.1 and 1 times the SLV, this small area is unlikely to account for the PCB concentrations measured in bass tissue. Although the implications of this localized exceedance of the sediment SLV in terms of current site contribution to concentrations of PCBs and mercury in bass tissue are unknown, it is likely that the measured bass tissue concentrations reflect historical body burdens, influences from upstream sources, or a combination of the two.

Piscivorous Birds

The Forebay crayfish, sculpin, and smallmouth bass data were screened against tissue SLVs protective of piscivorous birds. Table N-81 summarizes the CPECs for piscivorous birds identified in crayfish and fish tissues based on a comparison to SLVs (Tables N-53 and Table N-54). The CPECs shown with an asterisk in Table N-81 were also identified as CPECs in Forebay sediment (Tables N-55). No population-level CPECs were identified for sediment.

As described in Section 12.5.4.1, EPCs for mercury exceeded the tissue SLVs. Seven other metals were detected in Forebay tissues and retained as CPECs due to the lack of tissue SLVs. However, the results of the population to population statistical comparisons demonstrated that none of these metals were present in the Forebay sediment at concentrations above Reference

Area sediment concentrations (Table L-4). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels.

Although none of these metals are CPECs in sediment, the one present above the tissue SLVs (mercury) is recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

Figure 12-21 shows a sample by sample comparison of CPEC concentrations to SLVs for the protection of piscivorous birds at the individual level. Tissue and sediment concentrations are shown for mercury, total PCBs as congeners, and Avian TEQs.

Crayfish

The crayfish tissue R_{BACs} for mercury at the avian individual and population levels were 0.320, and 0.158, respectively (Table N-53 and Table N-54). The crayfish tissue R_{BACs} for methyl mercury at the avian individual and population levels were very similar at 0.445, and 0.219, respectively. Only the crayfish tissue R_{BAC} for total PCBs as congeners was above 0.1 times the SLV at the individual level (R_{BAC} = 1.04). All other R_{BACs} for PCBs, including the Avian TEQ, are below 0.1 times the SLV protective of individual birds and, therefore, only total PCBs as congeners in crayfish tissue was identified as a CPEC.

As shown on Figure 12-21, the highest concentration of PCBs in crayfish tissue (between 1 and 10 times the SLV protective of individual birds) occurred at P6-CF on the southeastern tip of the island. PCB concentrations in crayfish from P4-CF, P5-CF, P7-CF, and P14-CF were between 0.1 and 1 times the SLVs protective of individual birds. PCBs detected in sediment were greater than 10 times the SLV for individual birds in one sample (P4), between the SLV and 10 times the SLV in one sample (P9), and between 0.1 times the SLV and the whole SLV in most of the remaining samples.

Mercury (and methyl mercury) concentrations in crayfish tissue were below the SLV protective of individual birds in all samples, and between 0.1 times the SLV and the whole SLV in all samples collected throughout the Forebay. Although concentrations of methyl mercury in Forebay crayfish were significantly higher than in the Reference Area (Table L-4), the concentration ranges in crayfish tissue were generally comparable between the Forebay (0.025 – 0.04 mg/kg) and the Reference Area (0.0181 – 0.0367 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediment were no higher than in Reference Area sediment (Table L-4 and N-55). Based on the low methyl mercury concentrations in crayfish, the potential for adverse effects in birds is expected to be low.

Risk management or monitoring is recommended for PCBs in crayfish tissue to protect piscivorous birds that may be exposed through their diet. The low R_{BACs} for crayfish tissue of 1.04 (Table N-53) and sediment of 1.99 (Table N-55) based on exposure by individual birds should be considered, as crayfish are not likely a driver species for birds (higher concentrations were detected in sculpin and bass tissue).

Sculpin

The sculpin tissue R_{BACs} for mercury at the avian individual and population levels were 2.53, and 1.25, respectively (Table N-53 and Table N-54). The sculpin tissue R_{BACs} greater than 0.1 times the SLVs for PCBs at the individual level ranged from 0.309 (PCB 126) to 90.9 (total PCBs as congeners), and at the population level ranged from 0.125 (PCB 118) to 1.77 (total PCBs as congeners). The sculpin tissue R_{BACs} for the Avian TEQ at the individual and population levels were 1.59, and 0.754, respectively.

As shown on Figure 12-21, the highest concentrations of PCBs in sculpin tissue (greater than 10 times the SLV) occurred at SF-3, SF-4 and SF-5 on the southeastern tip of the island. PCB concentrations in sculpin from SF-2. SF-6, SF-12, SF-14, SF-16, and SF-17 were between the SLV and 10 times the SLV, and concentrations at the remaining locations are between 0.1 times the SLV and the whole SLV. The highest concentration of the Avian TEQ in sculpin tissue (between the SLV and 10 times the SLV) occurred at SF-3, and most of the remaining concentrations fall between 0.1 times the SLV and the whole SLV.

As indicated above, PCBs detected in sediment were greater than 10 times the SLV for individual birds in one sample (P4), between the SLV and 10 times the SLV in one sample(P9), and between 01 times the SLV and the whole SLV in most of the remaining samples. Sample P04 is the only location with an Avian TEQ concentration between 0.1 times the SLV and the whole SLV, all remaining sediment concentrations are below 0.1 times the SLV (Figure 12-21).

Mercury concentrations were between the SLV and 10 times the SLV in several sculpin samples collected throughout the Forebay. Although concentrations of mercury in sculpin were significantly higher than in the Reference Area (Table L-4), the concentration ranges in sculpin tissue were generally comparable between the Forebay (0.037 – 0.308 mg/kg) and the Reference Area (0.0448 – 0.141 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediment were no higher than in Reference Area sediment (Table L-4 and N-55).

Since mercury sculpin tissue concentrations were elevated throughout the Forebay (R_{BACs} were relatively low), mercury sculpin tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful. Based on the ubiquitously elevated bass tissue levels for mercury in the River as a whole, it is likely that other sources influenced the concentrations measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway).

Risk management or monitoring is recommended for PCBs, and possibly mercury, in sculpin tissue to protect piscivorous birds that may be exposed through their diet. However, the low sediment R_{BACs} for PCBs, and low concentrations detected in the sediment samples relative to the tissue data, do not indicate a current source of PCBs in the Forebay. It is likely that the sculpin tissue levels reflect historical body burdens, influences from upstream sources, or a combination of the two.

Smallmouth Bass

Di-n-butyl phthalate was detected in one of 19 bass tissue samples (Table I-8a) and was not detected in any other medium collected from the Forebay. It was not detected in Reference Area tissues, but was detected in Reference Area sediment (Table I-11). The R_{BAC} for di-n-butyl phthalate in bass tissue from the Forebay is 0.24 (Table N-53). Based on the absence of this compound from all but one Forebay tissue sample and low detection in this sample, no further investigation of di-n-butyl phthalate is recommended.

PAHs were retained as tissue CPECs due to the lack of tissue SLVs for birds, and the implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O.

Figure 12-21 shows a sample by sample comparison of CPEC concentrations to SLVs for the protection of birds. Tissue concentrations are shown for mercury and PCBs (total PCBs as congeners and Avian TEQs). Sediment concentrations are shown for PCBs (total PCBs as congeners and Avian TEQs), which were the only sediment CPECs identified (Table N-55), as well as mercury.

The smallmouth bass tissue R_{BACs} for mercury at the individual and population levels were 4.28, and 2.11, respectively (Tables N-53 and N-54). The bass tissue R_{BACs} for PCBs at the individual level ranged from 0.135 (PCB 167) to 552 (total PCBs as congeners), and at the population level ranged from 0.144 (Aroclor 1242) to 10.7 (total PCBs as congeners). The bass tissue R_{BACs} for the Avian TEQ at the individual and population levels were 36.4, and 17.3, respectively.

As shown on Figure 12-21, the highest concentrations of total PCBs as congeners in bass tissue occurred at locations 17 and 18, on the tip of the Bradford island, locations 3 and 16, which were also located adjacent to the island, and locations 2, 8, 11 and 13 in the Goose Island slough. Total PCBs as congeners concentrations in bass at these locations exceeded 10 times the SLV protective of individual birds, and PCB concentrations at locations 11 and 17 also exceeded 10 times the SLV protective of bird populations. Several other bass sample locations throughout the Forebay had PCB concentrations between 0.1 and 10 times the SLVs (Figure 12-21). The highest concentrations of the Avian TEQ in bass tissue (greater than 10 times the SLV) also occurred at locations 11 and 17, while concentrations in six samples fall between the SLV and 10 times the SLV, and concentrations in the remaining samples are between 0.1 times the SLV and the whole SLV.

The Avian TEQ was not identified as a CPEC in sediment (Tables N-55 and N-56). Total PCBs as congeners are a sediment CPEC and were detected in sediment from P4 at a concentration greater than 10 times the sediment SLV protective of individual birds and between 0.1 and 1 times the SLV protective of bird populations. Sediment total PCB concentrations were greater than 0.1 times the SLV protective of individual birds at several other locations. However, the affected area is unlikely to account for the PCB concentrations observed in the bass. Although the implications of these localized exceedances of the sediment SLV in terms of current site contribution to concentrations of PCBs in bass tissue are unknown, it is likely that the observed bass tissue levels reflect historical body burdens, influences from upstream sources, or a combination of the two.

Mercury was also measured in several bass samples at concentrations between 0.1 and 10 times the SLV (Figure 12-21). Although concentrations of mercury in Forebay bass were significantly higher than in the Reference Area (Table L-4), the concentration ranges in bass tissue were generally comparable between the Forebay (0.0710 – 0.512 mg/kg) and the Reference Area (0.0548 – 0.333 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediments were not significantly higher than those in the Reference Area.

Since mercury bass tissue concentrations are elevated throughout the Forebay, mercury bass tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful. Based on the ubiquitously elevated bass tissue concentrations for mercury, it is likely that other sources influenced the levels measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway) .

Risk management or monitoring is recommended for PCBs, and possibly mercury, in bass tissue to protect piscivorous birds that may be exposed through their diet. More confidence is placed in the R_{BACs} for PCBs measured as congeners, including totals as congeners and TEQs, for reasons previously stated. The low sediment R_{BAC} for PCB congeners in the Forebay and absence of mercury sediment concentrations above Reference Area sediment concentrations should be considered in risk management decisions regarding the best way to proceed with the ERA process.

Piscivorous Mammals

Tissue SLVs protective of piscivorous mammals were screened against the Forebay crayfish, sculpin, and smallmouth bass tissue data. Table N-82 summarizes the CPECs for piscivorous mammals identified in these randomly-collected tissues from the Forebay (Table N-57 and Table N-58). The CPECs shown with an asterisk in Table N-82 were also identified as CPECs in Forebay sediment (Tables N-59 and N-60). No population-level CPECs were identified for sediment.

As described in Section 12.5.4.1, EPCs for mercury exceeded the tissue SLVs. Seven other metals were detected in Forebay tissues and retained as CPECs due to the lack of tissue SLVs. However, the results of the population to population statistical comparisons demonstrated that none of these metals were present in the Forebay sediment at concentrations above Reference Area sediment concentrations (Table L-4). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels.

Although none of these metals are CPECs in sediment, the one present above the tissue SLVs (mercury) is recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

Figure 12-22 shows a sample by sample comparison of CPEC concentrations to SLVs for the protection of piscivorous mammals, both at the individual and population levels. Tissue and sediment concentrations are shown for mercury, total PCBs as congeners, and Mammalian TEQs.

Crayfish

The crayfish tissue R_{BACs} for total mercury at the individual and population levels were 0.198, and 0.119, respectively, and the R_{BACs} for methyl mercury were 0.274 and 0.165 (Table N-57 and Table N-58). Although total PCBs as congeners in crayfish tissue were not identified as a CPEC for mammals, three dioxin-like PCB congeners and the Mammalian TEQ were selected as CPECs (Tables N-57 and Table N-82). The crayfish tissue R_{BACs} for PCBs at the individual level ranged from 0.177 (PCB 156+157) to 2.01 (Mammalian TEQ), and no tissue CPECs were identified based on the population level evaluation for mammals.

As shown on Figure 12-22, the highest concentrations of Mammalian TEQs in crayfish tissue (between 1 and 10 times the SLV protective of individual mammals) occurred at P5-CF and P6-CF on the southeastern tip of the island. Mammalian TEQ concentrations in crayfish from P1-CF, P4-CF, and P7-CF were between 0.1 times the SLV and the whole SLV protective of individual mammals, and the remaining concentrations are below 0.1 times the SLV.

Total PCBs as congeners detected in sediment were below the SLVs (and sum $R_{BAC} < 1.0$) (Tables N-59 and N-60). The Mammalian TEQ and PCBs 105, 118, 126, and 156+157 were identified as CPECs in Forebay sediment (Tables N-59) based on exceedances of the sediment

SLV protective of individual mammals. Mammalian TEQ concentrations in sediment were below the SLVs protective of mammal populations (Table N-60). The Mammalian TEQ concentration in sediment at P4 is the only one in exceedance of the SLV protective of individual mammals (Figure 12-22), while Mammalian TEQ concentrations were between 0.1 times the SLV and the whole SLV at five locations.

Concentrations of mercury, including methyl mercury, in crayfish were all below the SLVs protective of mammals (individuals and the population). Mercury concentrations were between 0.1 times the SLVs and the SLVs protective of individual mammals and mammal populations in all but three crayfish samples collected throughout the Forebay. These three samples, which only had concentrations between 0.1 times the SLV and the SLV protective of individual mammals (below 0.1 times the SLV protective of populations), were P4-CF (former removal area), P20-CF (northwest shore of Goose Island), and P3-CF (southeast shore of Cascade Locks). Although concentrations of mercury in crayfish were significantly higher than in the Reference Area (Table L-4), the concentration ranges in crayfish tissue were generally comparable between the Forebay (0.0157 – 0.0315 mg/kg) and the Reference Area (0.0105 – 0.0246 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediment were no higher than in Reference Area sediment (Table L-4).

Since mercury crayfish tissue concentrations were only greater than 0.1 times the mammalian SLVs throughout the Forebay (R_{BACs} were low), mercury crayfish tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful. Based on the relatively uniform crayfish tissue levels for mercury in the River as a whole, it is likely that other sources influenced the concentrations measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway).

Given the lack of CPECs in crayfish tissue based on the comparison to SLVs protective of mammal populations, low R_{BACs} for the individual level evaluation, the absence of sensitive mammalian species at the site, the potential for adverse effects to mammals from consumption of crayfish tissue is low. No further investigation of crayfish for the protection of mammal populations is recommended.

Sculpin

The sculpin tissue R_{BAC} for mercury at the individual and population levels were 1.56, and 0.935, respectively (Table N-57 and Table N-58). The sculpin tissue R_{BACs} for PCBs at the individual level ranged from 0.183 (PCB 169) to 25 (PCB 118), and at the population level ranged from 0.148 (PCB 156+157) to 1.87 (total PCBs as congeners). The sculpin tissue R_{BACs} for the Mammalian TEQ at the individual and population levels were 25.2, and 0.913, respectively.

As shown on Figure 12-22, the highest concentrations of total PCBs as congeners in sculpin tissue (between 1 and 10 times the SLVs), occurred at SF-3, and SF-5 on the southeastern tip of the island. Total PCB concentrations in sculpin from SF-4 and SF-6 were between 0.1 and 1 times the SLVs. Mammalian TEQ concentrations in SF-3, SF-4, and SF-5 are greater than 10 times the tissue SLV, between the SLV and 10 times the SLV in nine samples, and concentrations in the remaining samples fall between 0.1 times the SLV and the whole SLV.

Total PCBs as congeners detected in sediment were below the SLVs (and sum $R_{BAC} < 1.0$) (Tables N-59 and N-60). The Mammalian TEQ and PCBs 105, 118, 126, and 156+157 were identified as CPECs in Forebay sediment (Tables N-59) based on exceedances of the sediment SLV protective of individual mammals. Mammalian TEQ concentrations in sediment were below the SLVs protective of mammal populations (Table N-60). The Mammalian TEQ concentration in sediment at P4 is the only one in exceedance of the SLV protective of individual mammals (Figure 12-22), while Mammalian TEQ concentrations were between 0.1 times the SLV and the whole SLV at five locations.

Mercury concentrations were between 0.1 and 10 times the SLV in several sculpin samples collected throughout the Forebay. Although concentrations of mercury in sculpin were significantly higher than in the Reference Area (Table L-4), the concentration ranges in sculpin tissue were generally comparable between the Forebay (0.037 – 0.308 mg/kg) and the Reference Area (0.0448 – 0.0141 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediment were no higher than in Reference Area sediment (Table L-4).

Since mercury sculpin tissue concentrations were elevated throughout the Forebay (R_{BACs} were relatively low), mercury sculpin tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful. Based on the ubiquitously elevated sculpin tissue levels for mercury in the River as a whole, it is likely that other sources influenced the concentrations measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway).

Risk management or monitoring is recommended for PCBs, and possibly mercury, in sculpin tissue to protect piscivorous mammals that may be exposed through their diet. However, the low sediment R_{BACs} for PCBs (including the Mammalian TEQs), and low concentrations of PCBs and mercury detected in the sediment samples relative to the tissue data, do not indicate a current source of PCBs and mercury in the Forebay. It is likely that the sculpin tissue levels reflect historical body burdens, influences from upstream sources, or a combination of the two.

Smallmouth Bass

The smallmouth bass tissue R_{BAC} for mercury at the individual and population levels were 2.64, and 1.59, respectively (Tables N-57 and N-58). The bass tissue R_{BACs} for PCBs at the individual level ranged from 0.295 (Aroclor 1242) to 331 (PCB 126), and at the population level ranged from 0.121 (PCB 114) to 12 (PCB 126). As stated previously, total PCBs as congeners was used to represent all PCB CPECs on the figures.

As shown on Figure 12-22, the highest concentrations of PCBs in bass tissue occurred at location 17, on northeastern tip of the island, and 11 in the Goose Island slough. Bass concentrations at these locations exceeded 10 times the SLVs protective of mammals at the individual and population levels. Several other locations near Bradford Island and Goose Island had PCB concentrations between 0.1 and 10 times the tissue SLVs.

Total PCBs as congeners detected in sediment were below the SLVs (and sum $R_{BAC} < 1.0$) (Tables N-59 and N-60). The Mammalian TEQ and PCBs 105, 118, 126, and 156+157 were identified as CPECs in Forebay sediment (Tables N-59) based on exceedances of the sediment SLV protective of individual mammals. Mammalian TEQ concentrations in sediment were below the SLVs protective of mammal populations (Table N-60). The Mammalian TEQ concentration in sediment at P4 is the only one in exceedance of the SLV protective of individual mammals (Figure 12-22), while Mammalian TEQ concentrations were between 0.1 times the SLV and the whole SLV at five locations.

Mercury was also present at concentrations between 0.1 and 10 times the SLV in several bass samples. Although concentrations of mercury in Forebay bass were significantly higher than in the Reference Area (Table L-4), the concentration ranges in bass tissue were generally comparable between the Forebay (0.0710 – 0.512 mg/kg) and the Reference Area (0.0548 – 0.333 mg/kg). This is consistent with the fact that mercury concentrations in Forebay sediments were not significantly higher than those in the Reference Area sediment (Table L-4).

Since mercury bass tissue concentrations were elevated throughout the Forebay (R_{BACs} were relatively low), mercury bass tissue concentrations were similar between the Forebay and Reference Area, and concentrations of mercury in Forebay sediment were not elevated relative to the Reference Area, further risk assessment may not be helpful. Based on the ubiquitously elevated bass tissue concentrations for mercury, it is likely that other sources influenced the levels measured in the Forebay. It is recommended that future investigations evaluate potential site-related sources (e.g., Upland OU overland pathway).

Risk management or monitoring is recommended for mercury and PCBs in bass tissue to protect piscivorous mammals that may be exposed through their diet. More confidence is placed in the R_{BACs} for PCBs measured as congeners for reasons previously stated. The absence of sediment concentrations in exceedance of the bioaccumulation SLVs for PCBs and absence of mercury sediment concentrations above Reference Area sediment concentrations should be considered in risk management decisions regarding the best way to proceed with the ERA process.

12.5.4.3.2 Mouth of Eagle Creek

<u>Benthic Invertebrates</u>

Direct Toxicity Evaluation - PCBs (Aroclor 1248 and total Aroclors) were the only CPECs identified for the benthic community at the mouth of Eagle Creek based on the individual and multiple COI screening evaluations for sediment (Tables N-61 and N-62). Aroclor 1248 was assessed for its potential to elicit adverse effects in the benthic community.

Aroclor 1248 was detected at one of the two targeted sampling locations at Eagle Creek (Table I-9). The toxicity ratio for this sediment CPEC was 10.9. The toxicity ratio for total PCBs as Aroclors was 2.29. Aroclor 1248 was not detected in any other random or targeted locations in the Forebay (Table I-9) or in the Reference Area (Table I-11), including sediment and tissue samples. Aroclor 1254 was the primary PCB mixture detected in random sediment and tissue samples in the Forebay.

The elevated toxicity ratio for Aroclor 1248 indicates the potential for localized impacts to benthic invertebrates at the mouth of Eagle Creek. The absence of this CPEC in any other samples collected from the Forebay suggests that the Aroclor 1248 detection is not site-related. Given the potential for localized effects to the benthic community, however, Aroclor 1248 should be maintained as a CPEC for further investigation.

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which are based on a comparison of bioaccumulative COI concentrations in sediment to sediment SLVs protective of fish and shellfish.

Fish and Shellfish

Sediment SLVs protective of upper trophic level fish and shellfish that may be exposed through their diet were screened against the Eagle Creek sediment data (Table N-63). PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above the bioaccumulation SLVs. Aroclor 1248 was detected at one of the two targeted sampling locations at Eagle Creek (Table I-9). The toxicity ratios for Aroclor 1248 and total PCBs as Aroclors were 3.45 and 3.53, respectively. Aroclor 1248 was not detected in any other random or targeted locations in the Forebay or in the Reference Area, including sediment and tissue samples. Aroclor 1254 was the primary PCB mixture detected in random sediment and tissue samples in the Forebay.

The elevated toxicity ratios for Aroclor 1248 and total PCBs as Aroclors indicate the potential for localized impacts to fish and shellfish at the mouth of Eagle Creek. The absence of this CPEC in any other samples collected from the Forebay indicates that the Aroclor 1248 detection is not likely site-related. Given the influence of weathering and metabolic processes on the ability to identify PCBs measured as Aroclors in tissue, however, Aroclor 1248 is recommended for further investigation in Eagle Creek sediments as a possible contributor to PCB levels measured in fish tissue from the Forebay.

Carbazole was retained as a CPEC in sediment due to the lack of a bioaccumulation SLV. This sediment CPEC was detected in one of 19 Forebay random samples and was not detected in any of the clam (19 samples), crayfish (15 samples), or smallmouth bass (19 samples) random Forebay samples (Table L-4). Lack of evidence for bioaccumulation in site tissues is consistent with the low log K_{ow} for carbazole of 3.72 – which just barely falls within the optimal range for bioaccumulation of 3.5 to 6.5 (Suter 1993). Given the lack of carbazole in tissue collected from the Forebay, no further investigation is recommended.

Piscivorous Birds

Tissue SLVs protective of piscivorous birds were screened against the Eagle Creek data (Tables N-64 and N-65). Table N-64 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-65 shows the results of the population level assessment. PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above these bioaccumulative SLVs protective of individual birds. No CPECs were identified that could elicit adverse effects in bird populations.

Aroclor 1248 was detected at one of the two targeted sampling locations at Eagle Creek. The R_{BACs} for Aroclor 1248 and total PCBs as Aroclors based on the SLVs protective of individuals were 42.2 and 43.2, respectively. With the exception of these Eagle Creek samples, Aroclor 1248 was not detected in any random or targeted locations in the Forebay or the Reference Area, including sediment and tissue samples. Aroclor 1254 is the primary PCB mixture detected in random sediment and tissue samples.

The elevated R_{BACs} for Aroclor 1248 and total PCBs as Aroclors indicate the potential for localized impacts to individual protected threatened and endangered birds at the mouth of Eagle Creek. The absence of this CPEC in any other samples collected from the Forebay indicates that the Aroclor 1248 detection is not likely site-related. Given the influence of weathering and metabolic processes on the ability to identify PCBs measured as Aroclors in tissue, however, Aroclor 1248 is recommended for further investigation in Eagle Creek sediments as a possible contributor to PCB levels measured in fish tissue from the Forebay.

As stated above, carbazole was retained as a CPEC in sediment due to the lack of a bioaccumulation SLV. This sediment CPEC was detected in one of 19 Forebay random samples and was not detected in any of the clam (19 samples), crayfish (15 samples), or smallmouth bass (19 samples) random Forebay data (Table L-4). Lack of evidence for bioaccumulation in site tissues is consistent with the low log K_{ow} for carbazole of 3.72, which just barely falls within the optimal range for bioaccumulation of 3.5 to 6.5 (Suter 1993). Given the lack of carbazole in tissue collected from the Forebay, no further investigation is recommended.

Piscivorous Mammals

Tissue SLVs protective of piscivorous mammals were screened against the Eagle Creek sediment data (Tables N-66 and N-67). Table N-66 shows the results of the bioaccumulation screening to assess potential adverse effects at the individual level, and Table N-67 shows the results of the population level assessment. PCBs (Aroclor 1248 and total Aroclors) were detected in sediment at concentrations above these bioaccumulative SLVs protective of individual mammals. No CPECs were identified that could elicit adverse effects in mammal populations.

Aroclor 1248 was detected at one of the two targeted sampling locations at Eagle Creek. The R_{BACs} for Aroclor 1248 and total PCBs as Aroclors based on the SLVs protective of individuals were 1.73 and 1.77, respectively. With the exception of these Eagle Creek samples, Aroclor 1248 was not detected in any random or targeted locations in the Forebay or the Reference Area, including sediment and tissue samples. Aroclor 1254 is the primary PCB mixture detected in random sediment and tissue samples.

The elevated R_{BACs} for Aroclor 1248 and total PCBs as Aroclors indicate the potential for localized impacts to individual protected threatened and endangered mammals at the mouth of Eagle Creek. No impacts to mammal populations were demonstrated. No threatened or endangered mammal species are known to be present in the Forebay. Piscivorous mammals could access the sediment at the mouth of Eagle Creek during foraging due to the shallow water level and less challenging terrain compared to other areas of Forebay. However, the absence of Aroclor 1248 in any other samples collected from the Forebay indicates that the Aroclor 1248 detection is not likely site-related. Given the influence of weathering and metabolic processes on the ability to identify PCBs measured as Aroclors in tissue, however, Aroclor 1248 is recommended for further investigation in Eagle Creek sediments as a possible contributor to PCB levels measured in fish tissue from the Forebay. The low R_{BACs} for Aroclor 1248 in sediment of Eagle Creek should be considered, especially given the absence of threatened and endangered mammal species.

As stated above, carbazole was retained as a CPEC in sediment due to the lack of a bioaccumulation SLV. This sediment CPEC was detected in one of 19 Forebay random samples and was not detected in any of the clam (19 samples), crayfish (15 samples), or smallmouth bass (19 samples) random Forebay data (Table L-4). Lack of evidence for bioaccumulation in site tissues is consistent with the low log K_{ow} for carbazole of 3.72, which just barely falls within the optimal range for bioaccumulation of 3.5 to 6.5 (Suter 1993). Given the lack of carbazole in tissue collected from the Forebay, no further investigation is recommended.

12.5.4.3.3 Goose Island Slough

Benthic Invertebrates

Direct Toxicity Evaluation - Cadmium, thallium, zinc, and Aroclor 1254 were identified for the benthic invertebrate community in the Goose Island slough based on the individual and cumulative COI screening evaluations for sediment (Tables N-68 and N-69). The toxicity ratios for these CPECs range from 1.20 (zinc) to 1.74 (cadmium), and their concentrations in Goose Island sediment are fairly comparable to Reference Area sediment (Table L-7). Given the low toxicity ratios for these CPECs and lack of sensitive benthic invertebrate species in the Forebay, the potential for adverse effects to the benthic community through direct toxicity is low.

Bioaccumulation Evaluation - Refer to the findings of the evaluation for “Fish and Shellfish” below, which are based on a comparison of measured clam and crayfish concentrations from the site to tissue SLVs protective of fish and shellfish.

<u>Fish and Shellfish</u>

Tissue SLVs protective of upper trophic level fish and shellfish were screened against the targeted Goose Island clam, crayfish, and sculpin data (Table N-70). No CPECs were identified in these targeted tissue samples from Goose Island, with the exception of those for which no SLV is available: beryllium and p-cresol (4-methylphenol) (discussed below). PCBs were not identified as CPECs in clams, crayfish, or sculpin collected from Goose Island. As shown in Table N-51 and discussed above, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, and five of 12 dioxin-like congeners, and Fish TEQ), B2EHP, and butyl benzyl phthalate were identified as CPECs in randomly-collected smallmouth bass tissue samples from the Forebay. These bass tissue CPECs were evaluated in Goose Island sediments.

As described in Section 12.5.4.1, the EPC for mercury in bass tissue from the Forebay exceeded the tissue SLV. Four other metals were detected in Forebay bass tissue (aluminum, barium, beryllium, copper, and zinc) and beryllium was detected in clam tissue from Goose Island; all five metals were retained as CPECs due to the lack of tissue SLVs. However, the results of the comparison of maximum metals concentrations in Goose Island sediment to the Reference Area UPL concentrations in sediment demonstrated that only zinc was elevated in Goose Island sediment (Table L-7). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels, with the possible exception of zinc. The R_{BAC} for zinc in sediment based on the comparison to the Reference Area sediment UPL is low (1.40) (Table N-71). Since the maximum concentration of zinc in Goose Island sediment (148 mg/kg) is similar to the Reference Area sediment UPL (106 mg/kg) (Table L-7), , and zinc is an essential nutrient, the contribution of zinc in Goose Island sediment to Forebay bass tissue concentrations is questionable, especially since zinc was not elevated in the targeted clam and crayfish sample from Goose Island (these invertebrates are generally less mobile and more likely to accumulate localized CPECs than fish species).

None of the other metals are CPECs in sediment (Table N-71). However, because mercury is present in Forebay bass tissue above the tissue SLV protective of fish, mercury is recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

P-cresol was detected in one of the two sediment samples and in the single clam sample collected from Goose Island (Table L-6) and was retained as a CPEC due to the absence of SLVs. It was not detected in crayfish or smallmouth bass. P-cresol was detected in 11 of 18 sediment samples and 18 of 18 clam samples collected from the Reference Area (Table I-20a). Maximum concentrations of p-cresol in the Reference Area sediment (210 µg/kg) and clams (110 µg/kg) (Table I-20a) are higher than concentrations detected in the Goose Island sediment (maximum of 8.5 µg/kg) and clams (maximum of 29 µg/kg) (Tables N-71 and N-70). Based on the low concentrations of p-cresol detected in Forebay sediment and clams in comparison to the Reference Area, and the low bioaccumulation potential for p-cresol (log K_{ow} = 1.94; Table J-7), which is consistent with the fact that P-cresol was not identified as a CPEC in sculpin, crayfish, or bass, lack of a quantitative risk-based screening for p-cresol is not expected to influence the findings of the ERA. No further investigation of p-cresol is recommended.

Of the organic CPECs listed above for randomly collected smallmouth bass tissue samples from the Forebay, PCBs (Aroclor 1254 and total Aroclors) were also identified as CPECs in Goose Island sediment (Table N-71) with sediment R_{BACs} of 0.45 and 0.57. These were approximately 3 times lower than the corresponding R_{BACs} for the randomly collected Forebay sediment samples (Table N-52). The low R_{BACs} for targeted Goose Island sediments (P110 and P111) and tissue (P110) samples do not suggest that sediment or food sources in the Goose Island slough contribute to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay (Figure 12-20).

Of the two phthalates identified as CPECs in randomly-collected smallmouth bass tissue samples from the Forebay (B2EHP and butyl benzyl phthalate), B2EHP was also detected in Goose Island sediment (Table 6-13b) and was retained as a CPEC due to the lack of a SLV that addresses the dietary pathway. B2EHP was not detected in the targeted samples of clams and crayfish from Goose Island (Table 6-13a). Butyl benzyl phthalate was not detected in any targeted samples collected from Goose Island (sediment, clams, or crayfish). Even for the bass tissue samples, the R_{BACs} for these two phthalates were low because neither are greater than the SLVs (they were retained as CPECs because their R_{BACs} are between 0.1 times the SLV and the whole SLV; Table N-51). Given the low concentration of butyl benzyl phthalate in Forebay bass tissue (below the SLV) and lack of detections in Goose Island media (sediment and tissue), no further investigation of butyl benzyl phthalate is recommended.

B2EHP was detected at concentrations between 0.1 and 1 times the SLV in two bass tissue samples collected from the Goose Island slough (Figure 12-20). The maximum detected concentration of this CPEC in Goose Island sediment (13 µg/kg; Table L-7) was more than 25 times lower than the maximum detected concentration in the random Forebay sediment samples (340 µg/kg; Table I-18a). The lower concentrations in Goose Island samples do not suggest a significant contribution on the elevated concentrations of B2EHP in smallmouth bass tissue from the Forebay. As discussed in Section 12.5.4.3.1 for the Random Forebay data, the low detection frequency (16%) for B2EHP in Forebay bass tissue (Table I-8a), low concentrations detected in bass (Table N-51), and absence of this CPEC in Goose Island tissues supports the position that phthalates are readily metabolized and weakly bioaccumulate (similar to the metabolic action noted in to PAHs). Given the low R_{BACs} for bass tissue and the minimal sediment B2EHP concentrations at Goose Island, no further evaluation of B2EHP is recommended to protect fish from exposure through the dietary pathway.

Piscivorous Birds

Tissue SLVs protective of individual piscivorous birds and bird populations were screened against the targeted Goose Island crayfish and sculpin data (Tables N-72 and N-73, respectively). No CPECs were identified in these targeted tissue samples from Goose Island, with the exception of those for which no SLV is available: PAHs. PCBs were not identified as CPECs in crayfish or sculpin tissues collected from Goose Island.

As shown in Tables N-53 and N-54, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, seven dioxin-like congeners, and Avian TEQ), di-n-butyl phthalate, and PAHs were all identified as CPECs in randomly collected smallmouth bass tissue samples from the Forebay. PAHs were retained as CPECs due to the absence of tissue SLVs, and the implications of this uncertainty to the findings of the Screening Assessment are discussed in Appendix O.

As described in Section 12.5.4.1, the EPC for mercury in bass tissue from the Forebay exceeded the tissue SLV. Four other metals were detected in Forebay bass tissue and were retained as CPECs due to the lack of tissue SLVs. However, the results of the comparison of maximum metals concentrations in Goose Island sediment to the Reference Area UPL concentrations in sediment demonstrated that only zinc was elevated in Goose Island sediment (Table L-7). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels, with the possible exception of zinc. The R_{BAC} for zinc in sediment based on the comparison to the Reference Area sediment UPL is low (1.40). As the maximum concentration of zinc in Goose Island sediment (148 mg/kg) is similar to the Reference Area UPL (106 mg/kg) (Table L-7), and because zinc is an essential nutrient, the contribution of zinc in Goose Island sediment to Forebay bass tissue concentrations is questionable, especially since zinc was not elevated in the targeted clam and crayfish sample from Goose Island (these invertebrates are generally less mobile and more likely to accumulate localized CPECs than fish species).

None of the other metals are CPECs in sediment (Table N-74). However, because mercury is present in Forebay bass tissue above the tissue SLV protective of fish, mercury is recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

Of the smallmouth bass tissue organic CPECs listed above, PCBs (Aroclor 1254, total Aroclors, total congeners, one dioxin-like congener, and Avian TEQ) were also identified as CPECs in Goose Island sediment, with sediment R_{BACs} based on the protection of individual birds ranging from 0.107 (Avian TEQ) to 7.0 (total PCBs as Aroclors) (Table N-74). The R_{BACs} for the randomly collected Forebay sediment samples (Table N-55) are higher than the Goose Island sediment R_{BACs} for Aroclor 1254, total Aroclors, and total congeners (Table N-74), while the Goose Island sediment R_{BACs} for PCB 77 and the Avian TEQ are slightly higher than R_{BACs} for the randomly collected Forebay sediment samples. Sediment R_{BACs} for the Goose Island data based on the protection of bird populations are less than the SLV, but greater than 0.1 times the SLV for Aroclor 1254 and total Aroclors (Table N-75). Population level-based sediment R_{BACs} for the Goose Island data are less than 0.1 times the SLV for total congeners, PCB 77, and the Avian TEQ. The low R_{BACs} for PCBs (total congeners and Avian TEQ) in targeted Goose Island sediments and absence of CPECs in Goose Island tissue suggest that sediment and food sources in the Goose Island slough contribute minimally to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay (Figure 12-21).

Di-n-butyl phthalate was also detected in both Forebay bass and Goose Island sediment (Table 6-13b) (but not in clams and crayfish from Goose Island; Table 6-13a) and was retained as a CPEC.. Di-n-butyl phthalate was detected in one of 19 Forebay bass tissue samples and was not detected in any other medium collected from the Forebay. It was not detected in Reference Area tissues, but was detected in Reference Area sediment at concentrations similar to those detected in the Goose Island sediment samples. The R_{BAC} for di-n-butyl phthalate in bass tissue from the Forebay was 0.24. Based on the absence of this compound from all but one Forebay tissue sample, the low concentration in this bass sample, and low concentrations in Goose Island sediment, no further investigation of di-n-butyl phthalate is recommended.

Piscivorous Mammals

Tissue SLVs protective of individual piscivorous mammals and mammal populations were screened against the targeted Goose Island crayfish and sculpin data (Tables N-76 and N-77, respectively). No CPECs were identified in these targeted tissue samples from Goose Island. As shown in Tables N-53 and N-54 and discussed above, aluminum, barium, copper, mercury, zinc, PCBs (Aroclors 1242 and 1254, total Aroclors, total PCB congeners, seven dioxin-like congeners, and Mammalian TEQ) are CPECs in randomly-collected smallmouth bass tissue samples from the Forebay. These bass tissue CPECs were evaluated in Goose Island sediments.

As described in Section 12.5.4.1, the EPC for mercury in bass tissue from the Forebay exceeded the tissue SLV. Four other metals were detected in Forebay bass tissue and were retained as CPECs due to the lack of tissue SLVs. However, the results of the comparison of maximum metals concentrations in Goose Island sediment to the Reference Area UPL concentrations in sediment demonstrated that only zinc was elevated in Goose Island sediment (Table L-7). Therefore, it is difficult to assess the contribution of the metal CPECs in site sediment to the Forebay tissue levels, with the possible exception of zinc. The R_{BAC} for zinc in sediment based on the comparison to the Reference Area sediment UPL is low (1.40). As the maximum concentration of zinc in Goose Island sediment (148 mg/kg) is similar to the Reference Area UPL (106 mg/kg) (Table L-7), and because zinc is an essential nutrient, the contribution of zinc in Goose Island sediment to Forebay bass tissue concentrations is questionable, especially since zinc was not elevated in the targeted clam and crayfish sample from Goose Island.

None of these metals are CPECs in sediment (Table N-78 and N-79). However, because mercury is present in Forebay bass tissue above the tissue SLV protective of fish, mercury is recommended for further investigation in tissue and sediment during future data collection efforts to better understand the potential site contribution.

Of the smallmouth bass tissue organic CPECs listed above, PCBs (Aroclor 1254 and total Aroclors) were also identified as CPECs in Goose Island sediment, with sediment R_{BACs} of 0.225 and 0.286 based on the protection of individual mammals (Table N-78). These are approximately 3 times lower than the corresponding R_{BACs} for the randomly collected Forebay sediment samples of 0.614 and 0.652 (Table N-59). Total PCBs as congeners, individual dioxin-like congeners, and the Mammalian TEQ were not identified as CPECs in sediment based on the individual and population level evaluations for mammals. Because PCBs (total congeners, individual dioxin-like congeners, and the Mammalian TEQ) were not identified as CPECs in targeted Goose Island sediments and tissue, it is likely that sediment and food sources in the Goose Island slough contribute minimally to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay (Figure 12-22).

12.5.5 Summary of Level II Screening Assessment for River OU

Tables N-80 through N-82 summarize the initial sediment and tissue CPECs for the benthic community, fish and shellfish (Table N-80), piscivorous birds (Table N-81), and piscivorous mammals (Table N-82) identified in the ERA screening tables for the River OU (both random and targeted Forebay datasets). As discussed in the Risk Interpretation (Section 12.5.4.3), some of these CPECs were eliminated from further evaluation based on low R_{BACs}, lack of detections in other tissue types, similarity between Forebay and Reference Area tissue concentrations, or concentrations in sediment below Reference Area sediment levels. Table 12-2 presents the CPECs for the Forebay that are recommended for risk management, which are cadmium, lead, mercury, and PCBs. Unlike the Upland OU, the River OU is not comprised of individual AOPCs. The Forebay was considered one exposure are, and the only differentiation between the Forebay data sets is a reflection of the specific sampling techniques employed (i.e., random or targeted). These four CPECs for the Forebay were identified through an evaluation of the random Forebay dataset. PCBs in sediment from Eagle Creek (targeted samples) are also recommended for risk management. Based on the evaluation of Goose Island sediment and tissue samples, no CPECs are recommended for risk management at these targeted locations (see further discussion below). All CPECs recommended for risk management based on the evaluation of clam, crayfish, sculpin, and smallmouth bass tissue are also recommended for risk management in sediment even though measured concentrations in Forebay sediment do not likely account for all of the elevated tissue levels.

Risk management or monitoring is recommended for cadmium, lead, mercury, and PCBs (Aroclors and 209 PCB congeners) in sediment and tissue from the Forebay to protect predatory fish and piscivorous wildlife that may be exposed through their diet. Aroclor 1248 was the only Aroclor detected at Eagle Creek and was not detected in any other random or targeted locations in the Forebay or in the Reference Area, including sediment and tissue samples. Aroclor 1254 is the primary PCB mixture detected in random Forebay sediment and tissue samples. The absence of Aroclor 1248 in any other samples collected from the Forebay indicates that the Aroclor 1248 detection in Eagle Creek sediment is not likely site-related. Given the influence of weathering and metabolic processes on the ability to identify PCBs measured as Aroclors in tissue, however, Aroclor 1248 is recommended for further investigation in Eagle Creek sediments as a possible contributor to PCB levels measured in fish tissue from the Forebay.

Based on the low R_{BACs} for targeted Goose Island sediments samples relative to the random Forebay R_{BACs} for PCBs, and the absence of elevated PCB concentrations in Goose Island tissues, PCB concentrations in the targeted Goose Island samples are likely to have contributed minimally to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay. Although the Aroclor data demonstrated elevated R_{BACs} in sediment, the available congener data, which is expected to provide a more accurate measure of total PCB concentrations, demonstrate acceptable R_{BAC} values. Although CPEC concentrations in media collected from the targeted Goose Island samples indicate acceptable risk levels, Goose Island will be maintained as part of the Forebay evaluation in the forthcoming FS in response to DEQ’s request.

12.6 Recommendations

One of two options is recommended for the Upland AOPCs:

1. Evaluate targeted removal or remedial actions to decrease residual concentrations to acceptable risk levels or
2. Perform a site-specific Level III BERA to determine if risks are unacceptable.

If a Level III BERA is performed for soil in the Upland OU, the evaluation would be focused solely on the CPECs recommended for risk management for each AOPC (Table 12-1). Site-wide exposure to the combined AOPCs would be evaluated for wildlife receptors with larger home ranges (e.g., predatory birds).

The River OU is recommended for risk management, which may include further risk assessment or a feasibility study and long-term monitoring of cadmium, lead, mercury, and PCB concentrations (Table 12-2).

13.0 SUMMARY AND RECOMMENDATIONS

This RI report, including the screening level HHRA and ERA presented in Sections 11 and 12, documents the current conditions at the Bradford Island Upland and River OUs. The results are summarized separately for each of the Upland AOPCs and for the River OU, below. The HHRA and ERA also evaluated all four AOPCs combined for receptors that could regularly utilize all four AOPCs (i.e., on-site maintenance worker or terrestrial birds and mammals); however, no additional COPCs or CPECs were identified (when compared to those identified for the individual AOPCs).

13.1 Landfill AOPC

Physical and Chemical Characteristics

Historical use of the Landfill AOPC to manage, store, and dispose of waste materials has resulted in contamination of soil, groundwater, and seep water with chemicals associated with the wastes. The extent of the waste disposal area is well defined based on topography, review of historical aerial photographs, a geophysical survey, excavation of test pits, observation of wastes on the ground surface, and the analysis of soil, groundwater, seep ,and surface water samples. The type and magnitude of contamination is variable, consistent with the variable waste management, storage, and disposal activities that occurred at the Landfill AOPC.

Soil throughout the Landfill AOPC is impacted by metals, PAHs, and other SVOCs. Impacts to soil from butyltins, herbicides, pesticides, PCBs, TPH, and VOCs are much more limited. Similarly, metals, TPHs, and VOCs were detected in groundwater throughout the Landfill AOPC, as well as at low concentrations in seep water sampled along the northern perimeter of the AOPC. Butyltins, herbicides, pesticides, PCBs, PAHs, and SVOCs had generally limited detections in groundwater. Butyltins, herbicides, pesticides, PCBs, and PAHs were not detected in seep water.

The majority of the ground surface at the Landfill AOPC is relatively flat, well vegetated, and shows minimal evidence of surface runoff, soil erosion, or sediment deposition, indicating that the ground surface is stable and there is minimal potential for off-site migration of contaminated soil or buried debris. The north and east sides of the Landfill AOPC include steep slopes leading down to the Columbia River. Although the potential for mass wasting appears low, soil on these slopes has the potential to migrate to the Columbia River via mass wasting.

Human Health Risk Screening

Soils were evaluated for direct contact under occupational and soil-intrusive exposure scenarios and groundwater was evaluated for hypothetical use as a potable water supply source as well as discharge to the river. COPCs warranting additional consideration in soil at the Landfill AOPC included arsenic, cPAHs, and PCE. In addition, the degradation products of PCE as well as chromium and lead were also retained as COPCs based on DEQ’s selection process. In groundwater, the COPCs warranting further consideration included arsenic, manganese, B2EHP, DNOP, TPH and several chlorinated VOCs. Several other VOCs and metals were also identified based on DEQ’s selection process. The vast majority of non-carcinogenic compounds were not a concern.. Arsenic and cPAHs emerged as the carcinogenic COPCs contributing most to risk, along with PCE and TCE. Arsenic was retained in soil and groundwater at the Landfill AOPC for the Adult Outdoor worker and potable use exposure scenarios; cPAHs were retained in soils for potential direct contact exposures for Adult Outdoor and Construction workers. Areas of the Landfill AOPC that pose the highest potential risk to human health include the Gully Test Pit and the Mercury Vapor Lamp Test Pit.

Finally, COPCs in Landfill soils identified through the evaluation of potential transport to the River OU via mass wasting or erosion are also recommended for risk management.

Ecological Risk Screening

Only soil was identified as a medium concern for ecological receptors at the Landfill AOPC. The following CPECs warrant further consideration for all terrestrial receptors potentially exposed to soil (plants, soil invertebrates, birds, and mammals): antimony, chromium, copper, lead, mercury, nickel, and total HPAHs. The areas where the highest concentrations of these CPECs were observed include the mercury vapor-lamp test pit, lead hot-spot test pits #1 and #2, gully test pit, and pesticide/herbicide wash area. In addition, the bioaccumulative CPECs for which dietary-based SLVs are not available also warrant further consideration for birds and mammals (primarily pesticides and herbicides). Finally, CPECs in Landfill soils identified through the evaluation of potential transport to the River OU via mass wasting or erosion are also recommended for risk management.

13.2 Sandblast Area AOPC

Physical and Chemical Characteristics

Historical and ongoing uses of the Sandblast Area AOPC include equipment storage and management, storage, and disposal of various hazardous substances and wastes. These uses have resulted in contamination of soil, groundwater, and soil gas with chemicals associated with the equipment and wastes. The extent of the contaminated area is defined based on topography, location of former and existing site features and structures, knowledge of former and current site uses, visual observation of wastes (i.e. sandblast grit) and equipment on the ground surface, and the analysis of soil, groundwater, and soil gas samples. The sandblast grit disposal area, the equipment laydown area, and an inferred VOC release at the current HMSA appear to be the primary sources of contamination.

Metals, pesticides, PCBs, PAHs, SVOCs, and VOCs were detected in soil samples from throughout the Sandblast Area AOPC. The type and magnitude of contamination is variable, consistent with the variable hazardous substance and waste management, storage, and disposal practices that occurred at the various subareas within the Sandblast Area AOPC. Metals, butyltins, pesticides, PAHs, TPHs, SVOCs, and VOCs were detected at low concentrations in groundwater, indicating that these contaminants are leaching from source area soils to groundwater. PCBs were not detected in groundwater. VOCs were detected in soil gas at locations corresponding to the footprint of the VOC plume originating at the current HMSA. This plume is in an area where there are currently no structures that could be occupied by site workers.

An area of potentially erodible soils, resulting from recent construction activities, was identified during a site visit in 2009. During the past year, this area has become revegetated and the soils are no longer considered erodible. Stormwater runoff from impervious surfaces (asphalt) drains to four catch basins that discharge to the Columbia River through two outfalls. It appears, however, that the majority of the runoff from asphalt immediately southeast of the former sandblast building flows northeast and discharges onto a short, steep, forested hill slope, where it causes rills to develop on the hill slope. This runoff travels down the slope to the equipment laydown area and adjacent Landfill access road, and onto a vegetated area between the Landfill road and the river. Evidence of surface runoff or erosion is absent in this vegetated area, suggesting that runoff flowing onto this area infiltrates before reaching the river.

Human Health Risk Screening

At the Sandblast Area, soils were evaluated for direct contact under occupational and soil-intrusive exposure scenarios and groundwater was evaluated for hypothetical use as a potable water supply as well as discharge to the river. In addition, soil gas was also evaluated for vapor intrusion into future enclosed structures. The COPCs identified in soil were primarily arsenic, chromium, lead, PCE, and cPAHs. In addition, the degradation products of PCE were also identified as COPCs based on DEQ’s selection process. The COPCs in groundwater were arsenic, cPAHs, PCE, TCE and vinyl chloride. Vanadium and some TPH fractions were also identified as COPCs based on DEQ’s selection process. The COPCs in soil gas were primarily PCE, TCE and their degradation compounds. Lead in soil may be a minor contributor to non-cancer hazards at the Sandblast Area AOPC. Arsenic, chlorinated VOCs, and cPAHs were the primary carcinogenic COPCs. VOCs in soil and soil gas are a concern in the vicinity of SB-10 and SB-12.

Ecological Risk Screening

Only soil was identified as a medium concern for ecological receptors at the Sandblast Area AOPC. The following CPECs warrant further consideration for all terrestrial receptors potentially exposed to soil: antimony, cadmium, chromium, lead, mercury, nickel, B2EHP, and total HPAHs. Areas with soil concentrations exceeding ecological screening values occurred throughout the AOPC, including the spent sandblast grit disposal area, around CB-1, the equipment laydown area, south of the current HMSA, and within the area where soils were identified as erodible in 2009. In addition, the bioaccumulative CPECs for which dietary-based SLVs are not available also warrant further consideration for birds and mammals (primarily pesticides and herbicides). Finally, CPECs in Sandblast Area soils identified through the evaluation of potential transport to the River OU via erosion are also recommended for risk management.

13.3 Pistol Range AOPC

Physical and Chemical Characteristics

Historical use of the Pistol Range AOPC as a firing range has resulted in the contamination of surface soil with lead and zinc. It is unlikely that significant concentrations of lead or zinc are leaching to groundwater. The Pistol Range AOPC may also be a historical source of zinc to the adjacent lagoon sediment. Currently, the area is well vegetated and does not show evidence of surface runoff, soil erosion, or sediment deposition.

Human Health Risk Screening

At the Pistol Range, soils were evaluated for direct contact under occupational exposure scenarios. Groundwater was evaluated as a hypothetical potable water supply source and for discharge to the river. Lagoon sediments were also evaluated for off-shore exposures. Current and likely exposure pathways for offsite human receptors to COIs from the Pistol Range are insignificant. No COPCs warranting further consideration were identified in soil, groundwater or sediments at this AOPC. The Pistol Range AOPC is not considered to pose a threat to human health and is not recommended for any further human health risk evaluation

Ecological Risk Screening

Only lead in soil was identified as a CPEC and medium of concern for the Pistol Range AOPC. Areas with soil lead concentrations exceeding ecological screening values occurred behind the backstop and at the eastern corner of the former firing shed.

13.4 Bulb Slope AOPC

Physical and Chemical Characteristics

Placement of debris at the Bulb Slope AOPC has resulted in the contamination of soil with lead, mercury, and PCBs. The lateral extent of contamination is well constrained by the visible presence of debris in the soil and the underlying siltstone bedrock defines the vertical extent of contamination. Groundwater is not present. Soils may potentially be transported to the adjacent Columbia River by mass wasting.

Human Health Risk Screening

Due to the lack of COPCs for the exposure pathways identified in the CEM, the Bulb Slope AOPC is not considered to pose a threat to human health and no further consideration of human health is warranted.

Ecological Risk Screening

Lead and mercury in soil were identified as CPECs for the Bulb Slope AOPC. In addition, CPECs in Bulb Slope soils identified through the evaluation of potential transport to the River OU via mass wasting or erosion are also recommended for risk management.

13.5 River OU

Physical and Chemical Characteristics

Historical disposal of electrical debris into the Columbia River along the north side of Bradford Island has resulted in the contamination of the surrounding sediment with PCBs and potentially other compounds. The electrical equipment and debris were removed in 2000 and 2002 and the majority of the associated PCB-contaminated sediment was removed in 2007. Residual contaminated sediment, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination.

Historical sampling, supported by hydrologic modeling, demonstrated that sediment from the Forebay is not transported upstream beyond Goose Island. Sediment samples collected downstream of the dam demonstrated that contaminated sediment is not being transported beyond the Forebay. Therefore, the boundaries of the River OU include the Bonneville Dam and Spillway, the two powerhouses, the riverbanks of the Columbia River, and the northern end of Goose Island.

The nature of the contamination in the Forebay has been characterized by both random and targeted sampling of surface water, sediment, and various tissues. The targeted sampling included sediments at the mouth of Eagle Creek, as well as sediments and tissue from Goose

Island Slough. To characterize conditions upstream of the site, random sampling of surface water, sediment, and tissues was also conducted in the River Reference Area. This allows the distinction between potential risks that may be associated with the Forebay from potential risks that are due to other sources.

Population-to-population statistical comparisons showed that for all metals, concentrations observed in the 19 random Forebay sediment samples were not significantly higher than the concentrations observed in the 18 random Reference Area samples. Statistical comparisons also showed that concentrations of organic compounds were not significantly higher in Forebay sediment than in the Reference Area sediment, with the exception of RRO and PCBs.

Tissue samples collected in the Forebay were found to have elevated concentrations of some metals, B2EHP, and various HPAHs. However, no clear spatial pattern was observed for any of these COIs. And, since the COIs were not found at concentrations of concern in Forebay sediments, the source(s) of these COIs are unclear.

PCBs have impacted biota in the Forebay. The clams, crayfish, and sculpin with the highest total PCB concentrations were all located along the north shore of Bradford Island. The spatial distribution of total PCB concentrations in bass was much more variable. Some of the bass with the highest concentrations were caught adjacent to bass with the lowest concentrations. This lack of a spatial pattern is consistent with bass migrating into the Goose Island Slough to spawn, bringing with them a wide range of PCB body burdens picked up from various locations in the Forebay. Targeted sampling of sediment, clams, sculpin, and crayfish from the Goose Island Slough did not find any difference between the slough and the remainder of the Forebay (excluding the north shore and tip of Bradford Island.) It is also important to remember that the Forebay bass were collected in 2006, before the 2007 sediment removal. Some of the older bass were estimated to have been up to 10 years old in 2006, meaning that they were exposed to conditions before the electrical debris and contaminated sediments were removed.

Human Health Risk Screening

In the River OU, sediments, surface water, crayfish tissue and smallmouth bass tissue were evaluated for exposure via the shellfish and fish consumption pathway for subsistence and recreational fishers. Surface water was also evaluated for use as a potable water supply. Sediments in the area of Eagle Creek were evaluated for direct contact exposures by waders. Sediments and tissue from Goose Island Slough were also included in the evaluation.

The COPCs that are recommended for risk management in the River OU include the following:

- Sediment – PCBs, mercury
- Surface Water – Arsenic, PCBs
- Crayfish tissue – Arsenic, PCBs
- Smallmouth Bass tissue – Mercury, cPAHs, PCBs
- Eagle Creek Sediments – PCBs, cPAHs, TPH
- Goose Island Sediments – PCBs
- Goose Island Crayfish – PCBs

An expanded list of COPCs that were identified through DEQ’s selection process but are not expected to contribute significantly to risk is provided in Table 11-3.

In general, PCBs contributed the most to health risk for sediment (bioaccumulation) and crayfish and smallmouth bass tissue consumption for both subsistence and recreational fish consumers. Arsenic was also consistently selected as a COPC and to a lesser extent, cPAHs and mercury (only in bass tissue and sediments). Aroclor 1248 was the primary COPC in Eagle Creek sediments. Goose Island is recommended for management at the request of DEQ although its contribution to human health risk is likely to be low. The observed concentrations in tissues are likely the result of historical body burden and may not represent current exposure conditions.

Ecological Risk Screening

The CPECs in sediment and tissue of the Forebay that are recommended for risk management to protect ecological receptors include the following:

- benthic community – PCBs in sediment
- fish and shellfish – cadmium, lead, mercury, and PCBs in sediment and tissue
- aquatic-dependent birds and mammals – mercury and PCBs in sediment and tissue.

These four CPECs for the Forebay were identified through an evaluation of the random and targeted Forebay datasets. All CPECs recommended for risk management based on the evaluation of clam, crayfish, sculpin, and smallmouth bass tissue are also recommended for risk management in sediment even though measured concentrations in Forebay sediment do not likely account for all of the elevated tissue levels. For example, the results of the population to population statistical background comparisons demonstrated that metals concentrations in Forebay sediment are below Reference Area sediment concentrations. In addition, the observed concentrations of PCBs in fish tissue (especially smallmouth bass) are likely the result of historical body burden and may not represent current exposure conditions.

Given the low risk levels estimated for targeted Goose Island sediments samples relative to the risk levels estimated for the random Forebay for PCBs, and the absence of elevated PCB concentrations in Goose Island tissues, PCB concentrations in the targeted Goose Island samples are likely to have contributed minimally to the elevated concentrations of PCBs measured in smallmouth bass tissue from the Forebay. Although the Aroclor data for Goose Island demonstrated elevated risk estimates for sediment, the available congener data, which are expected to provide a more accurate measure of total PCB concentrations, demonstrate acceptable risk levels. Although CPEC concentrations in media collected from the targeted Goose Island samples indicate acceptable risk levels, Goose Island will be maintained as part of the Forebay evaluation in the forthcoming FS in response to DEQ’s request.

PCBs were identified as a concern in sediment at three locations within the Forebay: stations P04 on the north shore of Bradford Island, P09 on the south side of the island (for birds only), and P43 at the mouth of Eagle Creek. Elevated concentrations of PCBs in sculpin and bass tissue were more widespread, although the observed concentrations are likely the result of historical body burden. PCB concentrations in crayfish tissue were notably lower than the concentrations detected in the other tissues (clams, sculpin, and bass). PCBs are the only CPEC in crayfish that were recommended for further consideration, which is based on slightly elevated risk levels for aquatic-dependent birds. This recommendation stems from the known presence of protected bird species in the vicinity of Bradford Island. However, crayfish are not a driver species for birds due to the much higher concentrations detected in sculpin and bass tissue.

13.6 Limitations of Screening Level Risk Assessments

The HHRA problem formulation (Chapter 11) relies on conservative assumptions regarding highly-uncertain parameters, such as duration of contact with soils and sediment, fish/shellfish consumption rates, quantity of untreated groundwater or surface water consumed, etc. If a BHHRA is performed for one or more OUs or AOPCs, site specific factors can be considered. Examples include:

1. Actual site use and reasonably-likely duration of work activities at each Upland AOPC.
2. Actual drinking water sources in use at the site.
3. Actual human consumption rates for Forebay bass for both subsistence and recreational fishers.
4. Actual human consumption rates for Forebay crayfish for both subsistence and recreational fishers, if such consumption even occurs.
5. Use of whole-body crayfish and fish tissue data instead of edible portions only.
6. Actual occurrence of different forms of compounds such as arsenic, chromium, mercury, PAHs and phthalates which have different levels of bioavailability and toxicity based on chemical species and exposure media, different degrees of accumulation in edible tissue, and variations in, metabolic pathways that affect their persistence.

Similarly, the Level II ERA (Chapter 12) also used conservative SLVs which generally assume worst-case exposure scenarios. If a Level III BERA is performed at one or more OUs or AOPCs to better understand the potential for adverse effects to ecological receptors, the following site-specific factors would be considered:

Plants

The studies upon which terrestrial plant SLVs were derived typically use crops as the test species, and sensitivity levels of undomesticated plant species are likely to be different than crop species. Effects to the plant community are likely to be overestimated due to the assumption that these organisms are exposed to the maximum concentration of each CPEC throughout their life span. No sensitive plant species are known to be present at the Upland OU.

Soil Invertebrates

Potential effects to the soil invertebrate community are likely to be overestimated by the SLVs due to the assumption that these organisms are exposed to the maximum concentration of each CPEC throughout their life span. In addition, studies used to develop SLVs for invertebrates commonly use earthworms as the test organism and, hence, earthworms are used to represent the entire soil invertebrate community. No sensitive invertebrate species are known to be present at the Upland OU.

Birds

1. The approach for the Level II Screening Assessment focused on protection of birds at the individual level to account for the bald eagle, and possible transient juvenile spotted owls, but these special-status species are not likely to forage at the AOPCs. The disturbed nature of some of the Upland AOPCs, (e.g., Landfill and Sandblast Area) which have

been graded and continuously subjected to vegetation control activities, precludes high quality habitat and species diversity. Furthermore, no state- or federally listed threatened and endangered terrestrial species are known to occur on the island, with the exception of the bald eagle (which is evaluated for the River OU). For these reasons, protection of terrestrial bird species at the population-level would be emphasized in the BERA for the Upland OU.

2. The site-specific Reference UPLs were greater than the risk-based soil SLVs (EcoSSL for lead and Avian PRG for mercury) and, therefore, the SLVs were replaced by the UPLs in the screening evaluation. In addition to evaluating specific bird target species and using literature-based BAFs to estimate dose, the contribution of background levels of metals would also be considered to better understand site-related dose contribution.
3. The size of the each AOPC or OU relative to the size of a birds’ home range would be factored into the daily dose estimation.

Mammals

1. Site-specific mammal target species would be evaluated.
2. Literature-based BAFs would be used to estimate dose.
3. The contribution of background levels of metals would also be considered to better understand site-related dose contribution.
4. The size of each OU or AOPC relative to the size of a mammal’s home range would be factored into the daily dose estimation.

13.7 Recommendations

Landfill AOPC

Based on the screening level risk assessments at the Landfill AOPC, implementation of one of two options is recommended:

1. Perform a FS to identify targeted soil removal or other remedial actions which will decrease residual concentrations to acceptable risk levels or
2. Perform a site-specific BHHRA and a Level III BERA to determine if risks to human and ecological receptors are unacceptable.

Sandblast Area AOPC

Further site-specific evaluation of human exposures to lead in soil using the size fraction-specific data is not necessary. However, based on the screening level risk assessment for soil gas at the Sandblast Area AOPC, an evaluation of the feasibility of a using a vapor extraction system or other remedial techniques to achieve acceptable soil gas VOC concentrations is recommended.

In addition, implementation of one of two options is recommended for addressing soil contamination:

1. Perform a FS to identify targeted soil removal or other remedial actions which will decrease residual concentrations to acceptable risk levels or

2. Perform a site-specific BHHRA and a Level III BERA to determine if risks to human and ecological receptors are unacceptable.

Pistol Range AOPC

No additional evaluation of this AOPC is warranted for potential human health risk. However, further action addressing the potential for risk to ecological receptors from exposure to lead is recommended - either in the form of a Level III BERA or remediation of the soils with elevated CPEC concentrations (primarily behind the backstop). If a Level III BERA is performed for lead in soil to better understand the potential for adverse effects to terrestrial plants, soil invertebrates, birds, and mammals, site-specific factors would be considered (i.e., absence of special-status species, AOPC size [0.26 acres], contribution of background levels of lead, *etc*.).

Bulb Slope AOPC

No additional evaluation of this AOPC is warranted for potential human health risk. However, further action addressing the potential for risk to ecological receptors from exposure to lead and mercury is recommended - either in the form of a Level III BERA or remediation of the soils with elevated CPEC concentrations. If a Level III BERA is performed for lead and mercury in soil to better understand the potential for adverse effects to terrestrial plants, soil invertebrates, birds, and mammals, site-specific factors would be considered (i.e., absence of special-status species, AOPC size [0.05 acres], contribution of background levels of lead and mercury, *etc*.).

River OU

Neither a Level III BERA nor a BHHRA is recommended for the River OU. Instead, progression to a FS is recommended. PCBs (through the consumption pathway) were identified as the primary risk drivers for both humans and wildlife, and secondarily cadmium, lead, and mercury for fish and wildlife (through the consumption pathway). All COPCs recommended for risk management based on the evaluation of site-specific tissue data are also recommended for risk management in sediment even though measured concentrations in Forebay sediment do not likely account for all of the elevated tissue levels. For example, the results of the population to population statistical background comparisons demonstrated that concentrations of cadmium, lead, and mercury in Forebay sediment are below Reference Area sediment concentrations.

The PCB concentrations remaining in Forebay sediment (after the 2002 and 2007 removal actions) are inconsistent with PCB concentrations measured in Forebay tissue (most notably in smallmouth bass). This is attributed to the fact that the bass were collected in 2006, prior to the sediment removal action, and are therefore not representative of current Forebay conditions. Similarly, the lifespan of crayfish and sculpin is also long enough that the concentrations measured in these samples probably also incorporate exposure to pre-sediment removal conditions. Monitoring of PCB concentrations in Forebay tissue may be recommended to confirm that tissue concentrations are decreasing with time and that residual sediment concentrations are at acceptable levels.

13.8 Post-RI Activity

As part of the pre-FS work for the River OU, additional bass, clam, and sediment samples were collected. In order to meet project goals of nineteen bass samples from the Forebay and Reference Area from a wide range of ages, twenty-three bass samples were collected from the Reference Area in August 2011 and twenty-three bass samples were collected from the Forebay in September 2011. In the Forebay, bass were collected north of Bradford Island, north of Goose Island, and south of Cascade Island. Of the twenty-three samples collected from each area, four samples from the Reference Area and three samples from the Forebay were not analyzed because they comprised very young bass and were not needed to meet the project goals.

The sediment and clam samples were collected from seven locations along the north-shore of Bradford Island in October 2011. The co-located sediment and clam samples were collected in the areas suggested by DEQ as most likely to be influenced by Upland sources. Sediment samples were successfully collected at all seven proposed sample locations. While clams were located and collected at all seven proposed sample locations, only six of the locations yielded enough clam tissue for the planned analysis.

Sediment and tissue samples were analyzed for PCBs (Aroclors and 209 congeners), metals, PAHs, pesticides, butyltins, and SVOCs. This data will be presented in a subsequent document and will be used to verify the COPCs identified in the RI/RA for the River OU, as well as the COPCs originating from erosion or mass wasting evaluation of soils from the Upland OU. If the results indicate a potential source of contamination was overlooked, the list of sediment and tissue COPCs may be modified to reflect the new information. A more thorough evaluation of the potential for erosion and mass wasting of Upland soils will be conducted during the FS phase to support conclusions made regarding the likelihood and magnitude of the overland transport pathway.

14.0 REFERENCES

Adams, C.M, C.P. Schneider, and J.H. Johnson. 1999. Predicting the Size and Age of Smallmouth Bass (Micropterus dolomieu) Consumed by Double-Crested Cormorants (Phalacrocorax auritus) in Eastern Lake Ontario, 1993-1994. NYSDEC Special Report.

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Public Health Assessment for Portland Harbor. Accessed at http://www.atsdr.cdc.gov/hac/pha/PortlandHarbor/PortlandHarborPHA032206.pdf

Basu, I., K.A. Arnold, M Venier, and R.A. Hites. 2009. “Partial Pressures of PCB-11 in Air from Several Great Lakes Sites.” *Environ. Sci. Technol.* 43, 6488-6492.

Beam, J.D. 1990. Daily and Seasonal Movement, as Related to Habitat Use, of Smallmouth Bass in Huron River, Michigan. Mich. Dept. of Nat. Res. And Fisheries Div. Fisheries Research Report #1971.

Beeson, M. H. and T. L. Tolan. 1987. Columbia River Gorge: The Geologic Evolution of the Columbia River in Northwestern Oregon and Southwestern Washington. Cordilleran Section of the Geological Society of America. Centennial Field Guide.

Choi, S.D., S.Y. Baek, Y.S. Chang, F. Wania, M.G. Ikonomou, Y.J. Yoon, B.K. Park, and S. Hong. 2008. “Passive Air Sampling of Polychlorinated Biphenyls and Organochlorine Pesticides at the Koren Arctic and Antarctic Research Stations: Implication for Long-Range Transport and Local Pollution.” *Environ. Sci. Technol.* 42, 7125-7131.

Columbia River Inter-Tribal Fish Commission (CRITFC). 1994. A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin. Technical Report 94-3. October.

Department of Defense Environmental Data Quality Workgroup (DoD EDQW). 2009. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories Version 4.1,Based on NELAC Voted Revision, 5 June 2003. April 22, 2009.

Du, S., S.J. Wall, D. Cacia, and L.A. Rodenburg. 2009. “Passive Air Sampling for Polychlorinated Biphenyls in the Philadelphia Metropolian Area.” *Environ. Sci. Technol.* 43, 1287-1292.

Eisler, R. 1987. Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildlife Service Biological Report 85(1.11).

Efroymson, R.A., M.E Will, and G.W. Suter II. 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge TN. ES/ER/TM-126/R2

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85/R3

Fraser, B. 2010. “Researchers Fine Little-Known PCB ‘Pretty Much Everywhere’.” *Environ. Sci. Technol.* 44, 2753-2754.

Hellou, J. 1996. Polycyclic aromatic hydrocarbons in marine mammals, finfish, and molluscs. Pages 229-250, in: Beyer, W.N., G.H. Heinz, and A.W. Redmon-Norwood (Eds.). *Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations.* CRC Press, Inc., Boca Raton, Florida. 494 pp.

Helsel, D.R. and R. M. Hirsch. 2002. Statistical Methods in Water Resources Techniques of Water Resources Investigations, Book 4, chapter A3. U.S. Geological Survey. 522 pages.

Henderson, C. and R.F. Foster. 1956. Studies of Smallmouth Black Bass (Micropterus dolomieu) in the Columbia River near Richland, Washington. Transactions of the American Fisheries Society 86:112-127.

Hibbs, Don. 2001. USACE. Personal communication.

Holdredge, C. P. 1937. Final Geologic Report on the Bonneville Project, U.S. Army Corps of Engineers, Portland District, Oregon.

Hope, B. 2007. "Atmospheric Deposition as a Source of PCBs to the Willamette Basin." *Environ. Sci. Technol.* 41, 4655–4661.

Hope, B. 2008. "A Model for the Presence of Polychlorinated Biphenyls (PCBs) in the Willamette River Basin (Oregon)." *Envir. Sci. Technol.* 42(16), 2008: 5998-6006.

Hu, D., A. Martinez, and K.C. Hornbuckle. 2008. "Discovery of Non-Aroclor PCB (3,3'-dichlorobiphenyl) in Chicago Air." *Environ. Sci. Technol.* 42, 7873-7877.

Hu, D and K.C. Hornbuckle. 2010. "Inadvertent Polychlorinated Biphenyls in Comercial Paint Pigments." *Environ. Sci. Technol.* 44, 2822-2827.

Huang and Associates, Inc. (HAI). 2007. Project Closure Report, Bradford Island Contaminated Sediment Removal, Bonneville Dam, Cascade Locks, Prepared by HAI. December.

Johnson, Barry L., Heraline E. Hicks, William Cibulas, Obaid Faroon, Annette E. Ashizawa, Christopher T. De Rosa, Vincent J. Cogliano, and Milton Clark 2000. Public Health Implications of Exposure to PCBs. ATSDR. Online: http://www.atsdr.cdc.gov/DT/pcb007.html

Jones and Stokes. 2006. Stakeholder Interview Summary. Bradford Island Community Involvement Program. Prepared for USACE. May.

Langsley, Michael. 1999. U.S. Army Corps of Engineers Fishery Biologist, Portland, OR. Telephone conversation with Lynn Sharp, URS, October 25, 1999.

Lawrence J.F., and D.F. Weber. 1984. Determination of polycyclic aromatic hydrocarbons in some Canadian commercial fish, shellfish, and meat products by liquid chromatography with confirmation by capillary gas chromatography-mass spectrometry. J. Agric. Food Chem. 32:789-794 (as cited in Eisler 1987).

Leland, Dave. 2001. Manager, Oregon Department of Health Services. Phone conversation with Brian McNamara, Staff Geologist, URS.

Lorenzana, R.M., Yeow, A.Y., Colman, J.T., Chappell, L.L and Choudhury, H. 2009. Arsenic in Seafood: Speciation Issues for Human Health Risk Assessment. Human and Ecological Risk Assessment. Vol 15 (1). pp:185-200.

Lower Columbia Fish Recovery Board (LCFRB). 2004. Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. December 15.

Lower Willamette Group (LWG). 2004. Portland Harbor RI/FS Programmatic Work Plan. Appendix C: Human Health Risk Assessment Approach. April 23.

McCavitt, B. 2001. Environmental Site Manager, USACE. Phone call with Brian McNamara, Staff Geologist, URS.

McCavitt, B. 2006. Environmental Site Manager, USACE. Phone call with Chris Moody, URS.

Meador, J.P. 2000. An analysis in support of tissue and sediment based threshold concentrations of polychlorinated biphenyls (PCBs) to protect juvenile salmonids listed by the Endangered Species Act. National Oceanic and Atmospheric Administration, Seattle, WA.

Montgomery, J.C., D.H. Fickeisen, and C.D. Becker. 1980. Factors Influencing Smallmouth Bass Production in the Hanford Area, Columbia River. Northwest Science 54(4): 296-305.

Munther, G.L. 1970. Movement and Distribution of Smallmouth Bass in the Middle Snake River. Transactions of the American Fisheries Society 99:44-53.

National Marine Fisheries Service. 2000. Letter dated January 10, 2000, to Jeff Wallace, URS Greiner Woodward Clyde.

Northwest Power and Conservation Council (NPCC). 2004. Mainstem Lower Columbia River and Columbia River Estuary Subbasin Plan. May.

Oregon Bass and Panfish Club. 2006. Letter from Information Officer about fishing in Bradford Island Area. August 16.

Oregon Department of Environmental Quality (DEQ). 1998a. Guidance for Conducting Beneficial Water Use Determinations at Environmental Cleanup Sites. July. Accessed March 23, 2006 at http://www.deq.state.or.us/wmc/documents/wateruse.pdf.

DEQ. 1998b. Final Guidance, Consideration of Land Use in Environmental Remedial Actions. July. Accessed March 23, 2006 at http://www.deq.state.or.us/wmc/documents/lduse798.pdf.

DEQ. 2000. Guidance for Conduct of Deterministic Human Health Risk Assessments. Final. Updated May 2000. Accessed March 14, 2006 at http://www.deq.state.or.us/wmc/documents/hh-guide.pdf.

DEQ. 2001. Guidance for Ecological Risk Assessment: Levels I, II, III, IV. Waste Management and Cleanup Division. Final. April 1998. Updated December 2001.

DEQ. 2003. Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites. Waste Management and Cleanup Division, Cleanup Policy and Program Development Section. Updated version, September 2009.

DEQ. 2004. Comments on Revised Draft level II Ecological Risk Assessment and Baseline Human Health Risk Assessment, Bonneville Lock and Dam Project. November 4.

DEQ. 2007. Guidance for Evaluation of Bioaccumulative Chemicals of Concern in Sediment. Final. January 31, updated April.

DEQ. 2009a. Oregon Administrative Rule (OAR) 340-041. Chapter 340, Division 41: Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon. Tables 33A, 33B, and 33C. November.

DEQ. 2009b. Personal communication between Paul Seidel of DEQ and Usha Vedagiri of URS in regards to updated screening procedures for human health risk assessment. March 26, 2009.

DEQ. 2010a. Maximum Contaminant Level (MCL). Accessed online in January 2010 at: http://www.oregon.gov/DHS/ph/dwp/docs/pwsrules/61-0030.pdf.

DEQ. 2010b. Human Health Risk Assessment Guidance. Public Review Draft. May 12.

DEQ. 2012a. Personal communication between Paul Seidel of DEQ and Dan Kim of URS in regards to clarifying multi-media exposure for COPC selection for human health risk assessment. May 21, 2012.

DEQ. 2012b. Personal communication between Paul Seidel of DEQ and Dan Kim of URS in regards to clarification that cPAH were retained as a group, rather than individual cPAH COPCs, for the human health risk assessment. June 7, 2012.

Oregon Department of Fish and Wildlife (ODFW). 2007. Personal communication with Michelle Weaver by Kitia Chambers, USACE. April 13

Oregon Bass and Panfish Club. 2006. Letter from Information Officer about fishing in Bradford Island Area. August 16..

Oregon Natural Heritage Program. 1999. Letter and attachments dated August 3, 1999, to URS Greiner Woodward Clyde.

Oregon Natural Heritage Information Program. 2007. Rare, Threatened, and Endangered Species of Oregon: Species Ranking. Oregon Natural Heritage Information Center. Accessed on December 7, 2009 at http://oregonstate.edu/ornhic/ranking.html.

Orr, E.L. and W.N. Orr. 1999. Geology of Oregon. Fifth Edition. Iowa: Kendall/Hunt.

Perletti, K. 2010. Mechanical Engineer, USACE. Email to Mike Gross, USACE dated February 8.

Rodenburg, L.A., J. Guo, S. Du, and G.J. Cavallo. 2010. “Evidence for Unique and Ubiquitous Environmental Sources of 3,3’-Dichlorobiphenyl (PCB 11).” *Environ. Sci. Technol.* 44: 2816-2821.

Sager, J. W. 1989. Bonneville Dam. In Engineering Geology in Washington, Washington Division of Geology and Earth Resources Bulletin 78.

Schoof, R.A and Yager, J.W. 2007. Variation of Total and Speciated Arsenic in Commonly Consumed Fish and Seafood. Human and Ecological Risk Assessment. Vol 13 (5). pp:945-965.

Scofield, David. 1998. Bonneville Fish Hatchery Well Field, Columbia River Gorge, A Case Study of River-Groundwater Interaction. In Burns, S., ed., Environmental Groundwater and Engineering Geology, Applications from Oregon, Star Publishing Company, Belmont, California, pp. 567-578.

Sediment Phthalates Work Group. 2007. Technical Committee Meeting Notes. Accessed at http://www.ecy.wa.gov/programs/tcp/smu/phthalates/Risk%20and%20Receptors.pdf

Singh, A., N. Armbya, and A.K. Singh. 2010. ProUCL Version 4.1 Technical Guide. Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R-07/041.

Southwest Division (SWDIV) and EFA West. 1998. Prodcudural Guidance for Statistically Analyzing Environmental Background Data. Southwest Division Naval Facilities Engineering Command. September.

Suter, G. 1993. Ecological Risk Assessment. Boca Raton, FL. Lewis Publishers.

Suter, G.W. II, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening of Potential Contaminants of Concern for Effects on Aquatic Biota on Oak Ridge Reservation: 1996 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. 104 pp, ES/ER/TM-96/R2

Tetra Tech. 1998. Final Site Investigation Report, Bradford Island Landfill, Cascade Locks, Oregon. Prepared for U.S. Army Corps of Engineers, Portland District. Contract No. DACW57-96-D-0009. Task Order No. 0010. December.

Troffe, P. 1999. Freshwater Fishes of the Columbia Basin in British Columbia. Living Landscapes, Royal British Columbia Museum. http://livinglandscapes.bc.ca/peter_nyles/pdf/fish1e.pdf.

United States Army Corps of Engineers (USACE). 1991. Bonneville Navigation Lock Sediment Evaluation. CENPP-PE-HR, Jim Britton. September 6.

USACE. 1997a. Columbia River Basin Oregon – Washington Bonneville Lock & Dam, Bonneville Master Plan, Final March 1997.

USACE. 1997b. Bonneville Second Powerhouse Forebay Sediment Evaluation. CENPP-PE-HR. October.

USACE. 1998. Navigation Conditions at Bonneville Locks and Dam, Columbia River. Ronald T. Wooley. February.

USACE. 2000. First Powerhouse, Bonneville Dam, Columbia River, Oregon, Report 2, Tracking Velocities Hydraulic Model Investigation. Robert Davidson. April.

USACE. 2001. Environmental Review Guide for Operations, External Compliance Audit, Bonneville Lock and Dam.

USACE. 2005. Seattle District, Water Resources Division, Mid-Columbia River Basin. Accessed December 27, 2005, at http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=waterres&pagename=midcolumbia.

USACE. 2007. Biological Assessment for Anadromous Fish Species and Steller Sea Lion Essential Fish Habitat, Removal of Contaminated Sediment Bradford Island, Columbia River Multnomah County, OR. January.

USACE and URS Corporation (URS). 2006. Surface Water and Sediment Sampling for Non-Time-Critical Sediment Removal Action, Bradford Island Remedial Investigation/Feasibility Study, Bonneville Dam, Cascade Locks, OR. March.

United States Environmental Protection Agency (USEPA). 1989. Superfund Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (Part A), Interim Final. EPA/540/1-89/002. December.

USEPA. 1991. Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual. Part B, Development of Risk-Based Preliminary Remediation Goals. Interim.

USEPA. 1992. Guidance for Data Usability in Risk Assessment. PB92-963356. April 1992.

USEPA. 1997a. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. Interim final. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1997b. EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund. EPA 910-R-97-005. June.

USEPA. 1997c. Health Effects Assessment Summary Tables (HEAST). Office of Emergency and Remedial Response. EPA-540-R-97-036. July.

USEPA. 1998. Guidelines for Ecological Risk Assessment. Final. EPA/630/R-95/002F. Risk Assessment Forum, Washington, DC. April.

USEPA. 1999a. Hazardous Waste Identification Rule, Finite Source, Multimedia, Multipathway, Multireceptor Risk Assessment (3MRA) Technical Background Document for HWIR99. Draft. Office of Solid Waste, Washington DC. June 22.

USEPA. 2000. Technical Review Workgroup for Lead (TRW). TRW Recommendations for Sampling and Analysis of Soil at Lead Sites. Revision 0, March 2000. www.epa.gov/superfund/lead/products/sssiev.pdf

USEPA. 2002a Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. EPA-540-R-01-003; OSWER Directive 9285.7-41. September.

USEPA. 2002b Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER Directive 9285.6-10. December.

USEPA. 2002c. Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), Draft.

USEPA. 2003a. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5, 2003.

USEPA. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Draft. Prepared by Environmental Quality Management, Inc., March 14.

USEPA. 2005a. Guidance for Developing Ecological Soil Screening Levels – Revised Draft. OSWER Directive 9285.7-55, USEPA, OSWER, February.

USEPA. 2005-2008. Ecological Soil Screening Levels. USEPA OSWER. Last Updated April 2008: http://www.epa.gov/ecotox/ecossl/

USEPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. Washington, D.C.: USEPA Office of Environmental Information, EPA QA/G-4. EPA/240/B-05/001, February.

USEPA. 2009. National Recommended Water Quality Criteria.. United States Office of Water, Environmental Protection Agency, Office of Science and Technology.

USEPA. 2010. Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. RSL Table Update. May.

USEPA. 2011. ProUCL Version 4.1.01 (Software). Retrieved from http://www.epa.gov/osp/hstl/tsc/software.htm. July.

United States Fish and Wildlife Service (USFWS). 1999. Letter dated October 12, 1999, to URS Greiner Woodward Clyde.

USFWS. 2009. Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon. Oregon Fish and Wildlife Office. Accessed on December 6, 2009 at http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_list.asp.

United States Geological Survey (USGS). 1996. Water Quality of the Lower Columbia River Basin: Analysis of Current and Historical Water-Quality Data through 1994. Water-Resources Investigations Report 95-4294.

University of Washington. 2003. Information obtained from the Center for Quantitative Science’s Columbia River Data Access in Real Time (DART) website. Online: http://www.cqs.washington.edu/dart/river/html.

URS Corporation (URS). 2000. Draft Supplemental Site Inspection, Bradford Island Landfill. Cascade Locks, Oregon. June.

URS. 2001. Draft Geotechnical Design Report, North Slope Regrade and Stabilization, Bradford Island Landfill. Cascade Locks, Oregon. May 2001.

URS. 2002a. In Water Investigation Report, Bradford Island Landfill. March.

URS. 2002b. In Water Removal Work, Bradford Island Landfill, Cascade Locks, Oregon. Technical memorandum.

URS. 2002c. Preliminary Assessment/Site Inspection. Sandblast Area, Transformer Release Area, and Former Drum Storage Area. Bonneville Lock and Dam Project, Cascade Locks, Oregon. September.

URS. 2002d. Draft Level I Ecological Scoping Assessment and Human Health Problem Formulation, Bradford Island Landfill. Bonneville Dam, Cascade Locks, Oregon. April.

URS. 2002e. Storm Water Drain Cleaning Summary. Technical memorandum.

URS. 2002f. Trashboom Structure Foundation Anchor Sediment Sampling Report, Bonneville Dam Project. March.

URS. 2003a. Draft Preliminary Assessment and Site Inspection, Former Pistol Range. Bonneville Lock and Dam Project, Cascade Locks, Oregon. May.

URS. 2003b. Draft Bulb Slope Reconnaissance Investigation and Evaluation of Potential Remedial Options. Bradford Island. Bonneville Lock and Dam Project, Cascade Locks, Oregon. February.

URS. 2003c. Post-Removal Sediment Investigation, Stage 1 Data Report, Bonneville Dam Forebay, Cascade Locks, Oregon. November.

URS. 2004a. Site Characterization Report, Bradford Island Landfill, Bonneville Lock and Dam Project, Cascade Locks, Oregon. Prepared for the USACE (Portland District). April.

URS. 2004b. Level II Screening Ecological Risk Assessment and Baseline Human Health Risk Assessment, Bradford Island Landfill. Revised Draft Report. Bonneville Dam, Cascade Locks, Oregon. May.

URS. 2004c. Draft Post Removal Sediment Investigation Stage 2 Data Report. Bonneville Dam Forebay. Cascade Locks, Oregon. December.

URS. 2005. Draft Engineering Evaluation and Cost Analysis, Bradford Island Disposal Site, Bonneville Dam Forebay, Cascade Locks, Oregon. December.

URS. 2006a. Supplemental Site Investigation, Sandblast Area, Bonneville Lock and Dam Project. Cascade Locks, Oregon. January.

URS. 2006b. Technical Memorandum - Removal Design Data Gaps Surface Water and Sediment Sampling, Bradford Island and Bonneville Lock and Dam Forebay, Cascade Locks, Oregon. June.

URS. 2007a. Remedial Investigation/Feasibility Study (RI/FS) Management Plan (MP), Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September.

URS. 2007b. Quality Assurance Project Plan (QAPP*)*, River Operable Unit Remedial Investigation, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September.

URS. 2007c. Technical Memorandum - Upland Source Evaluation – Bradford Island Landfill, Bulb Slope, and Site 7, Bradford Island and Bonneville Dam Forebay, Cascade Locks, Oregon. and Bonneville Lock and Dam Forebay, Cascade Locks, Oregon. January. Draft.

URS. 2007d. Technical Memorandum - Upland Source Evaluation – Bradford Island Landfill, Bradford Island and Bonneville Lock and Dam Forebay, Cascade Locks, Oregon. August.

URS. 2007e. Quality Assurance Project Plan (QAPP), Water Quality Monitoring for the In-Water Removal Action, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. July 2007.

URS. 2008a. QAPP, Upland Operable Unit Remedial Investigation, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. October.

URS. 2008b. Proposal – Monitoring Wells Installation and Initiation of Groundwater/Seep/ Surface Water Monitoring Prior to Completion of the Upland QAPP, Bradford Island and Bonneville Dam Forebay, Cascade Locks, Oregon. January.

URS. 2008c. Forebay and Reference Area Smallmouth Bass Collected June 2006 through May 2008 Summary Report, Bradford Island Remedial Investigation Bonneville Dam Forebay, Cascade Locks, Oregon. October 27.

URS. 2008d. Pre-Removal Action Sediment and Clam Sample Analysis Report, Bradford Island Remedial Investigation, Bonneville Dam Forebay, Cascade Locks, Oregon. March 10.

URS. 2008e. Water Quality Monitoring Report In-Water Removal Action, Bradford Island Disposal Site, Bonneville Lock Forebay, Cascade Locks, Oregon. June.

URS. 2008f. Technical Memorandum: Post-Removal Sample Collection, Bradford Island Disposal Site, Bonneville Dam Forebay, Cascade Locks, Oregon. May 12.

URS. 2008g. River Operable Unit Remedial Investigation Data Summary Report, Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. July 29.

URS. 2009a. Upland QAPP Addendum, Bradford Island Upland Operable Unit Remedial Investigation, Cascade Locks Oregon. February 6

URS. 2009b. Revised Sculpin Analysis Strategy, Bradford Island In-Water Operable Unit, Remedial Investigation Bonneville Dam Forebay, Cascade Locks, Oregon. February 2.

URS. 2009c. In Water QAPP Addendum, River Operable Unit Remedial Investigation, Bradford Island, Cascade Locks, Oregon. February 20.

URS. 2009d. River Operable Unit Data Sufficiency Report, Bradford Island Remedial Investigation, Cascade Locks, Oregon. October.

URS. 2009e. Upland Operable Unit Data Sufficiency Report, Bradford Island Remedial Investigation, Cascade Locks, Oregon. November.

URS. 2009f. Upland Operable Unit Data Gap Sampling January-March 2009, Bradford Island Remedial Investigation, Cascade Locks, Oregon. June.

URS. 2009g. Fourth Quarter Groundwater, Seep, and Surface Water Sampling Results, Bradford Island Upland Operable Unit Remedial Investigation, Cascade Locks, Oregon. March 31.

URS. 2009h. Sculpin Analysis Strategy, Bradford Island In-Water Operable Unit, Remedial Investigation Bonneville Dam Forebay, Cascade Locks, Oregon. January 21.

URS. 2009i. Sculpin and PCB Congeners for Downstream Sediment Summary Report, Bradford Island Remedial Investigation, Bonneville Dam, Cascade Locks, Oregon. June 16.

URS. 2009j. PCB Congener Results for Sediment, Clams and Crayfish collected from Forebay and Reference Area February/March 2008, Bradford Island Remedial Investigation Bonneville Dam Forebay, Cascade Locks, Oregon. January 21.

URS. 2009k. Goose Island Data Gap Sampling April 2009, Bradford Island Remedial Investigation, Cascade Locks, Oregon. September.

URS. 2010a. Bradford Island Upland and River OU's DSR DEQ Comments and USACE/URS Responses Discussion Meeting Minutes, 12 Jan 2010. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. January.

URS. 2010b. Bradford Island – Response to Comments – State of Oregon Departmant of Environmental Quality (DEQ) Review of River Operable Unit Data Sufficiency Report. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. February.

URS. 2010c. Bradford Island – Response to Comments – State of Oregon Department of Environmental Quality (DEQ) Review of Upland Operable Unit Data Sufficiency Report. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. February.

URS. 2010d. Bradford Island River Operable Unit – Strategy for Calculating Area-Weighted EPC for Forebay Incorporating 2007 Pre-removal Samples. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. February.

Washington Department of Fisheries, Lead, Washington Department of Wildlife and Oregon Department of Fish and Wildlife, Co-authors (WDF et al.). 1990. Lower Columbia River Subbasin, Salmon and Steelhead Production Plan. September 1.

West, W.R., P.A. Smith, P.W. Stoker, G.M. Booth, T. Smith-Oliver, B.E. Butterworth, and M.L. Lee. 1984. Analysis and genotoxicity of a PAC-polluted river sediment. Paces 1395-1411 in M. Cooke and A.J. Dennis (eds.). Polynuclear aromatic hydrocarbons: mechanisms, methods and metabolism. Battelle Press, Columbus, Ohio. (as cited in Eisler, 1987).

Western Regional Climate Center. 2002. Desert Research Institute. Historical Climate Information Database website http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?orbonn. Accessed on December 29, 2005.

Wise, W. S. 1970. Cenozoic Volcanism in the Cascade Mountains of Southern Washington. Washington Division of Mines and Geology Bulletin 60. Olympia.

FIGURES

Source: Bonneville Dam (45121f8) 7.5 Minute USGS Topographic Map, 1994.

0 1,000 2,000 Feet

VICINITY MAP

BRADFORD ISLAND
CASCADE LOCKS, OREGON

25696528

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FIGURE 1-1

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BRADFORD ISLAND

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BONNEVILLE DAM COMPLEX

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FIGURE 1-2

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FIG 1-2

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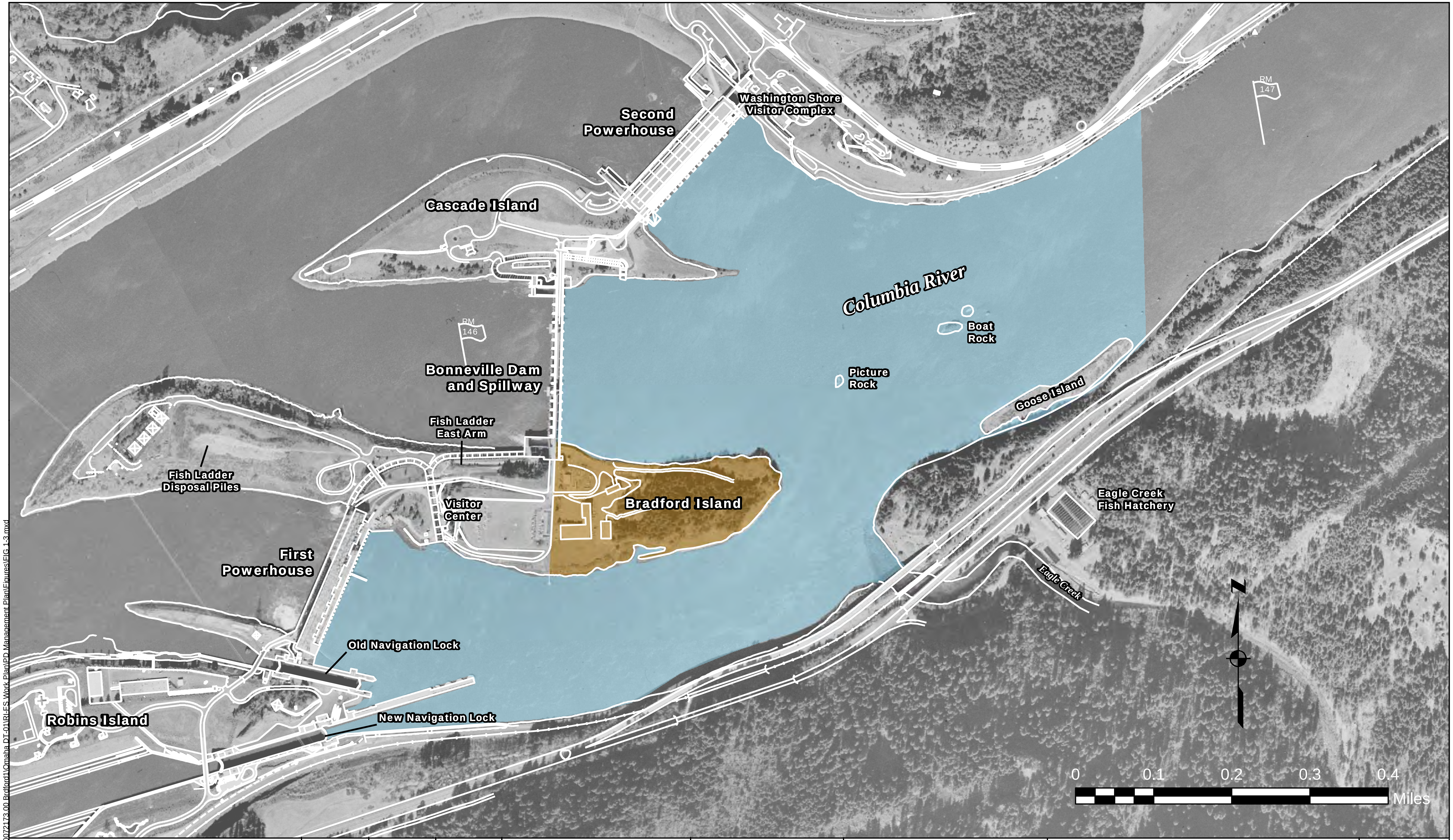

Legend

🟫 Upland OU

🟦 River OU

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LOCATION OF OPERABLE UNITS

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FIGURE 1-3

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FIG 1-3

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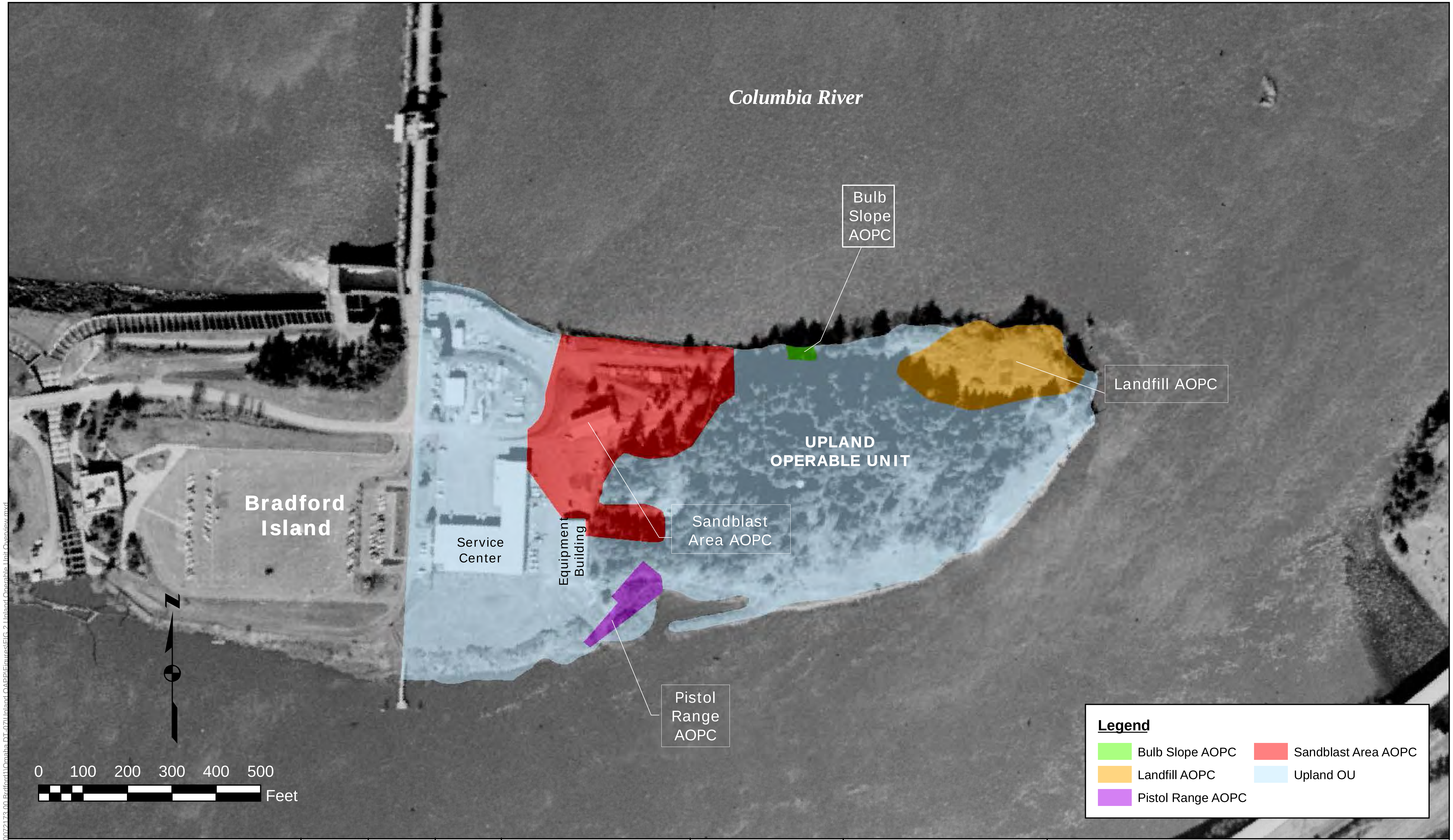
Q:\25692709 USACE\53-F0072173.00 Brdford\1Omaha DT-01\RI-FS Work Plan\PD Management Plan\Figures\FIG 1-3.mxd



Legend

🟩 Bulb Slope AOPC	🟥 Sandblast Area AOPC
🟧 Landfill AOPC	⬜ Upland OU
🟪 Pistol Range AOPC	

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UPLAND OPERABLE UNIT OVERVIEW

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FIGURE 1-4

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FIG 1-4

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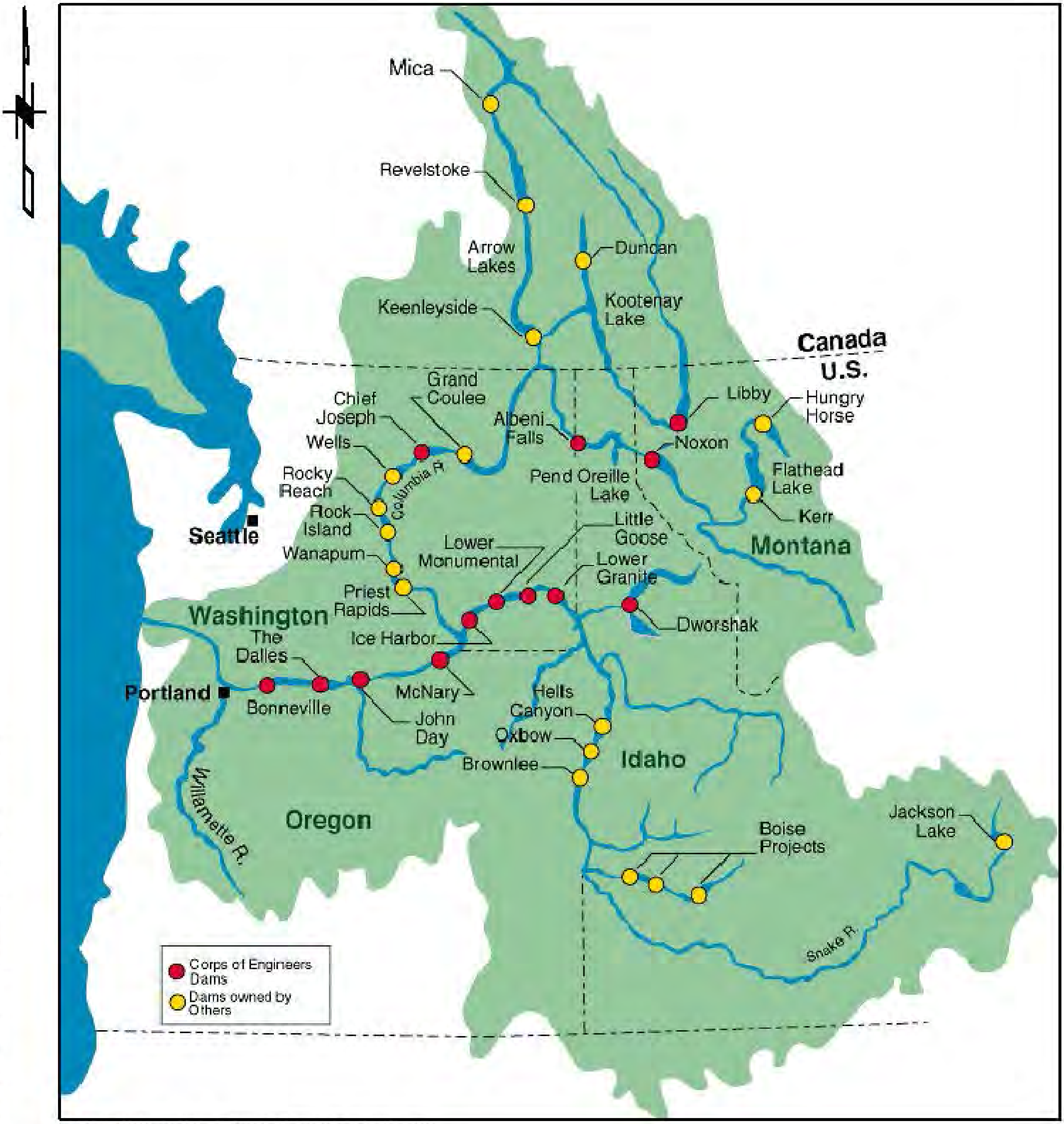
O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\Figures\FIG 2 Upland Operable Unit Overview.mxd



MAP SOURCE: U.S. ARMY CORPS OF ENGINEERS
NOT TO SCALE

BONNEVILLE DAM IN RELATIONSHIP TO OTHER DAMS

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FIGURE 3-1

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WATER SUPPLY WELL LOCATIONS

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FIGURE 3-2

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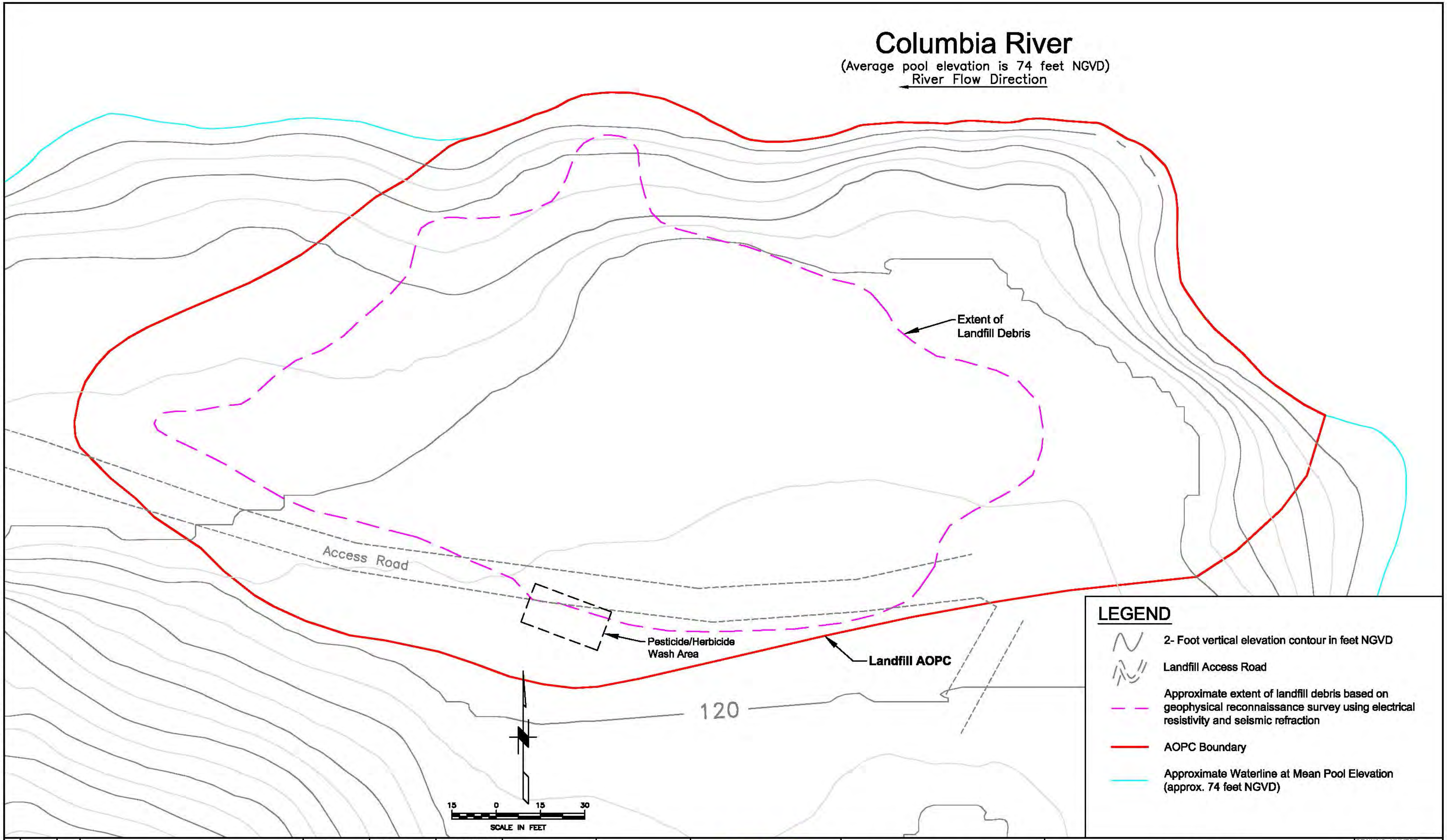

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 3-3 Landfill AOPC Operational Areas.dwg Jul 30, 2010 - 3:04pm

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

LANDFILL AOPC

OPERATIONAL AREAS

DRAWING NUMBER: FIGURE 3-3
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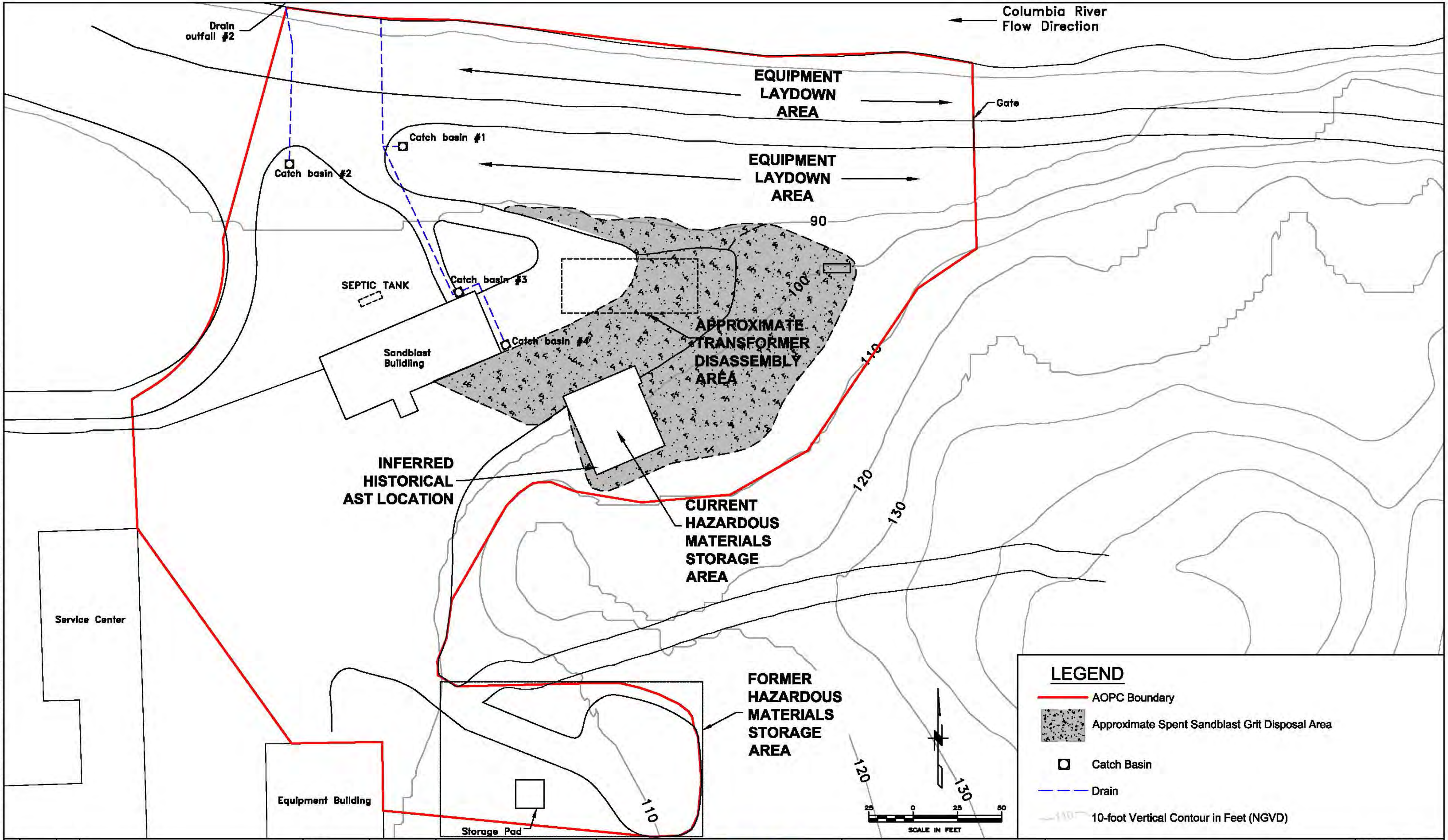

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BRADFORD ISLAND
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SANDBLAST AREA AOPC
OPERATIONAL AREAS

DRAWING NUMBER: FIGURE 3-4
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BRADFORD ISLAND

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RIVER OPERABLE UNIT

RIVER OU DEBRIS PILES

DRAWING NUMBER:
FIGURE 3-5
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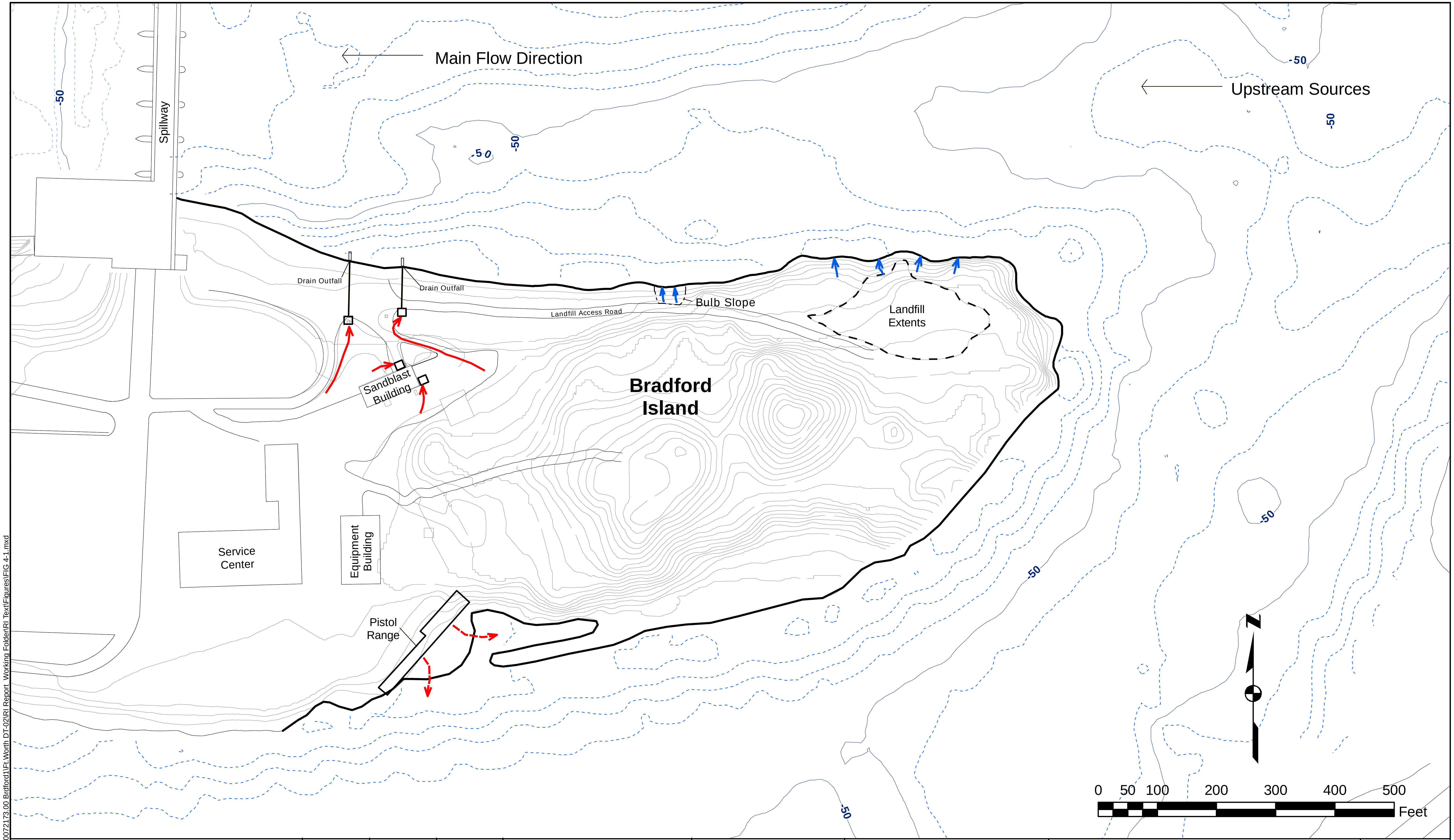

LEGEND

- Surface Water Drainage
- Mass Wasting (Sloughing)
- Historical Surface Water Drainage
- ☐ Catch Basin

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BRADFORD ISLAND

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UPLAND OU TO RIVER OU POTENTIAL CONTANIMATION TRANSPORT PATHWAYS

DRAWING NUMBER: FIGURE 4-1
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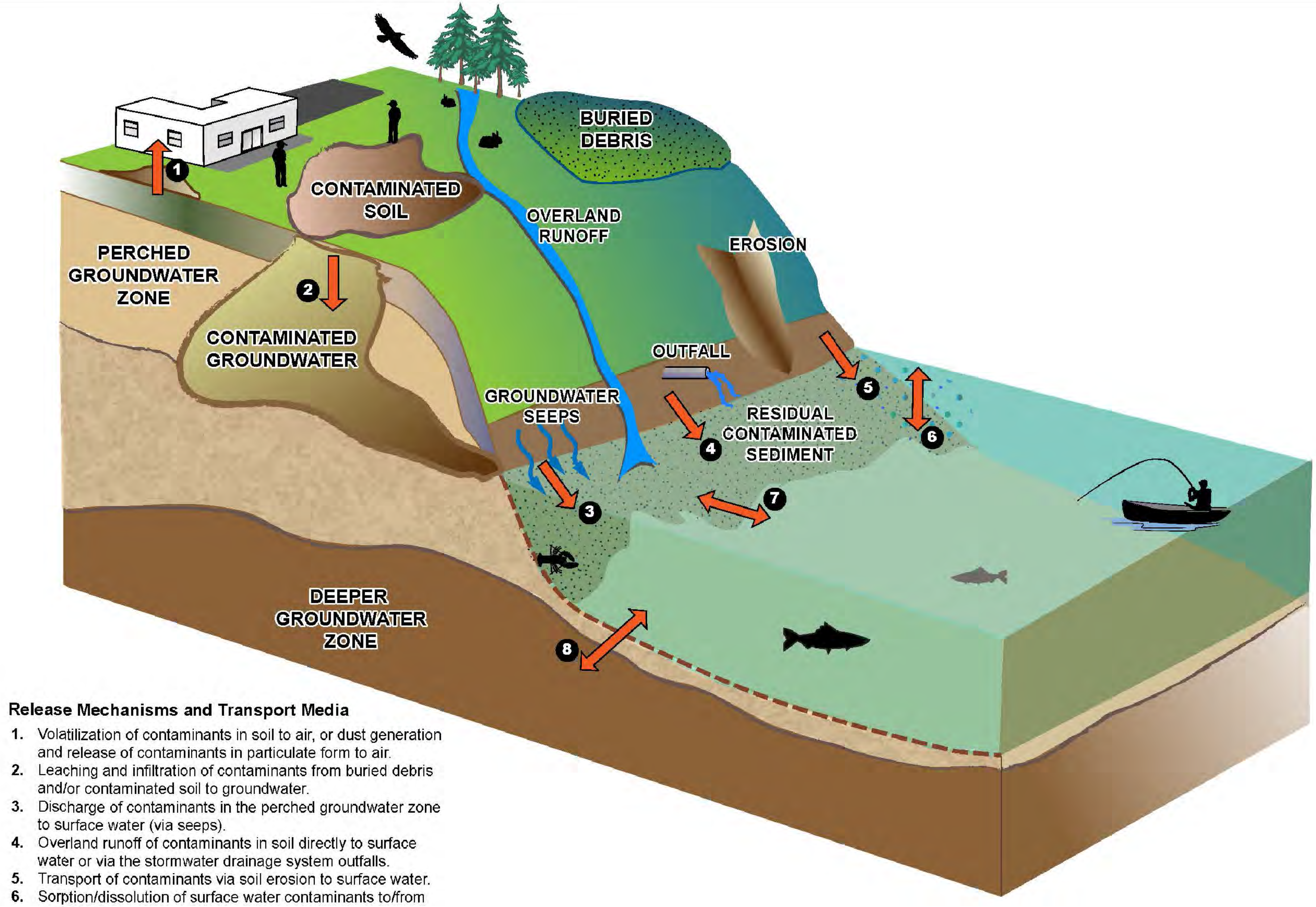

Release Mechanisms and Transport Media

1. Volatilization of contaminants in soil to air, or dust generation and release of contaminants in particulate form to air.
2. Leaching and infiltration of contaminants from buried debris and/or contaminated soil to groundwater.
3. Discharge of contaminants in the perched groundwater zone to surface water (via seeps).
4. Overland runoff of contaminants in soil directly to surface water or via the stormwater drainage system outfalls.
5. Transport of contaminants via soil erosion to surface water.
6. Sorption/dissolution of surface water contaminants to/from sediments.
7. Contaminated sediment transport within the river.
8. Potential surface water communication to the deeper groundwater zone.

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

CONCEPTUAL SITE MODEL

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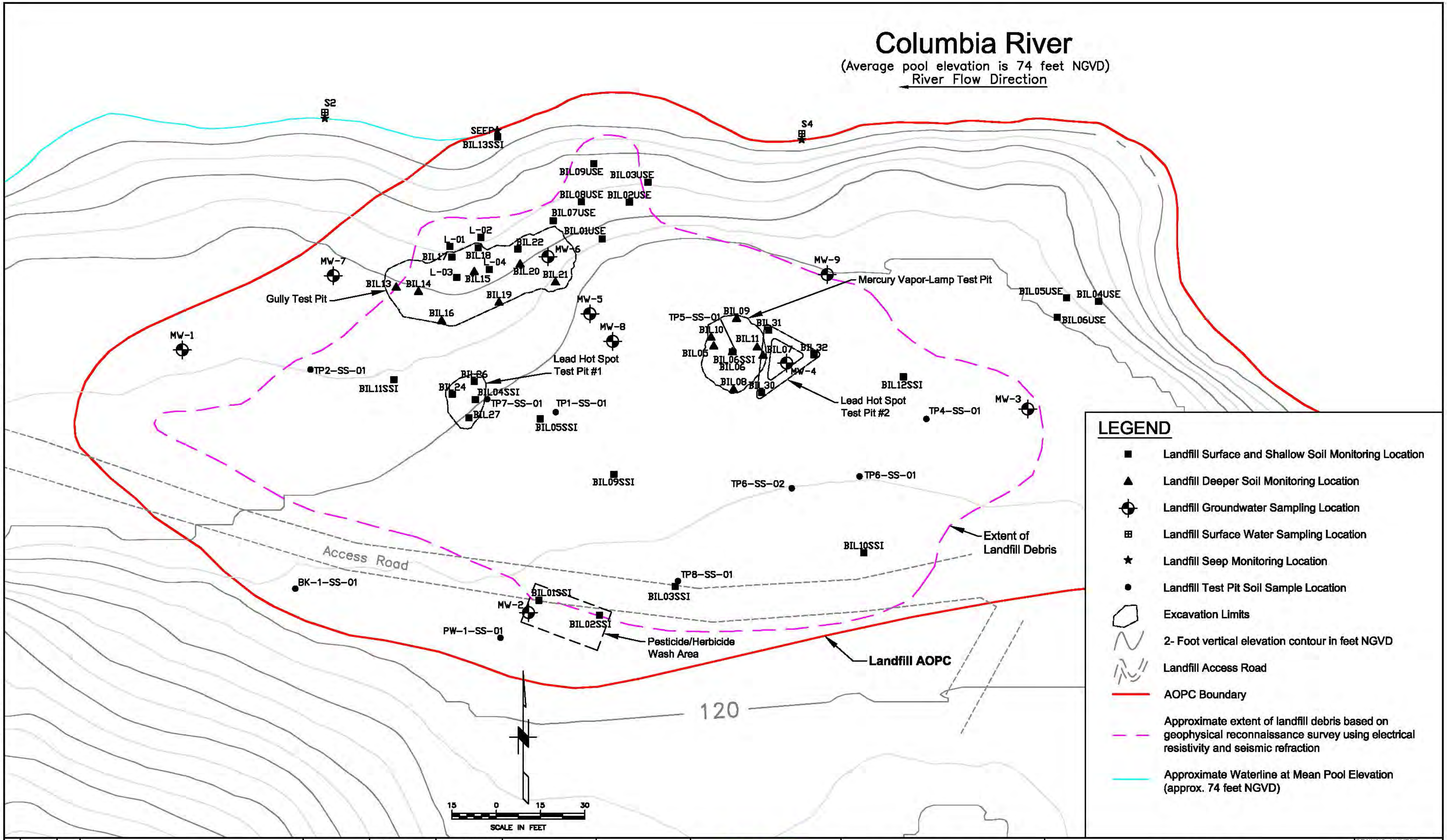

G:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 5-1 Landfill Area Sampling Locations.dwg Jul 30, 2010 - 3:20pm

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LANDFILL AOPC

SAMPLING LOCATIONS

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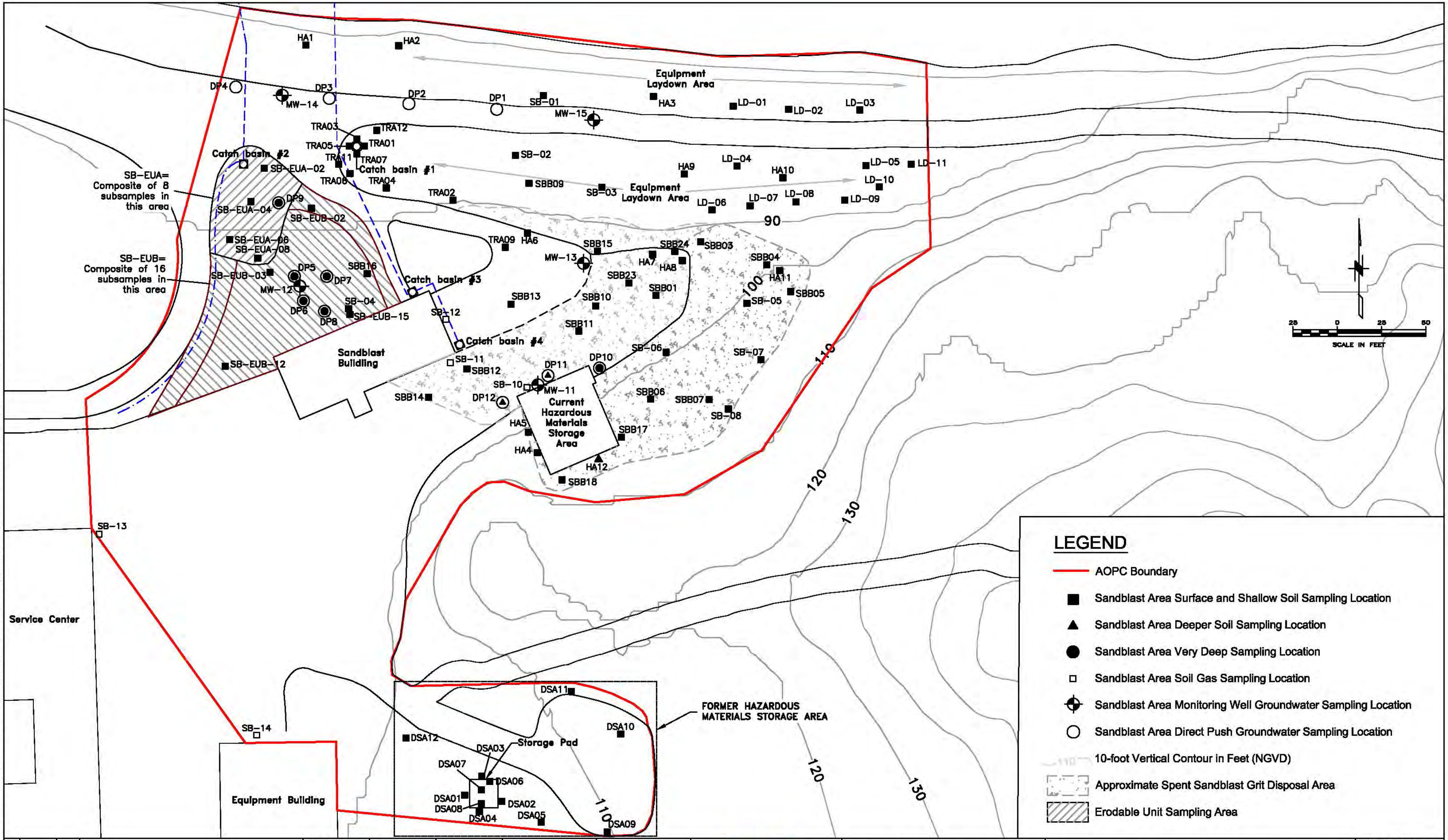

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SANDBLAST AREA AOPC

SAMPLING LOCATIONS

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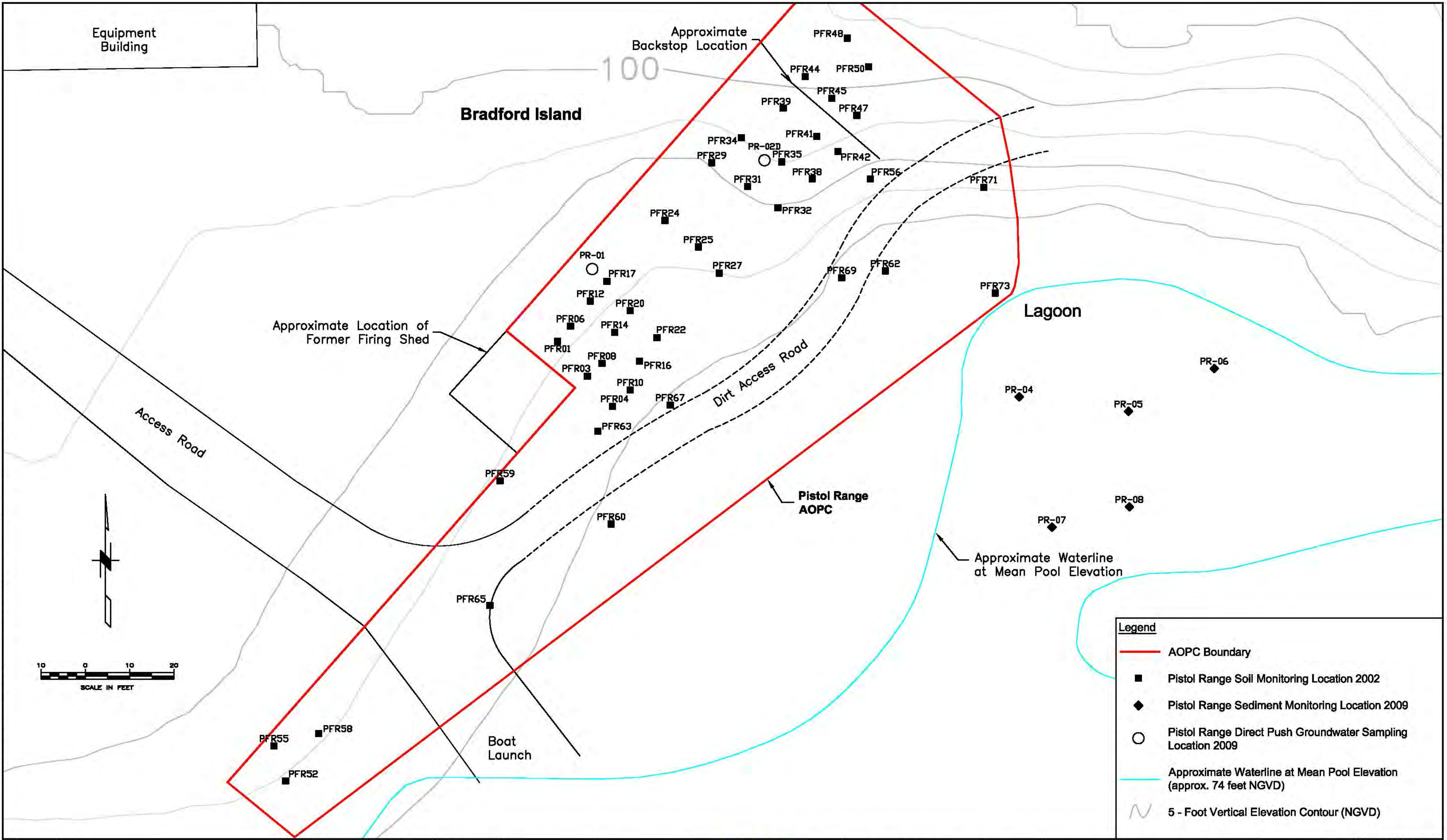

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

PISTOL RANGE AOPC

PISTOL RANGE AOPC
SAMPLING LOCATIONS

DRAWING NUMBER: FIGURE 5-3
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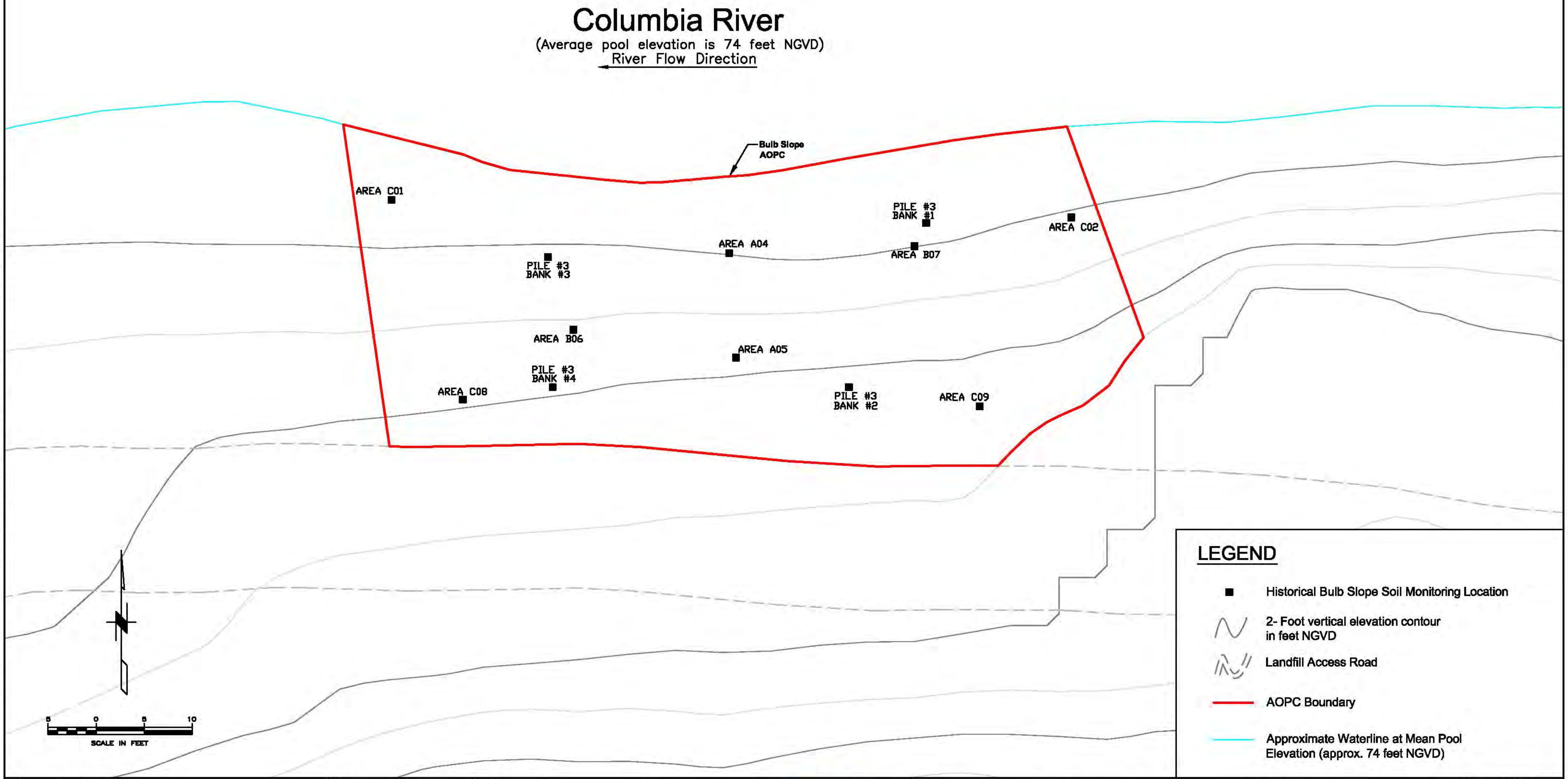
c:\25692709 USACE\33-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 5-3 Pistol Range Area Sampling Locations.dwg Jul 30, 2010 - 3:26pm



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BULB SLOPE AOPC

SAMPLING LOCATIONS

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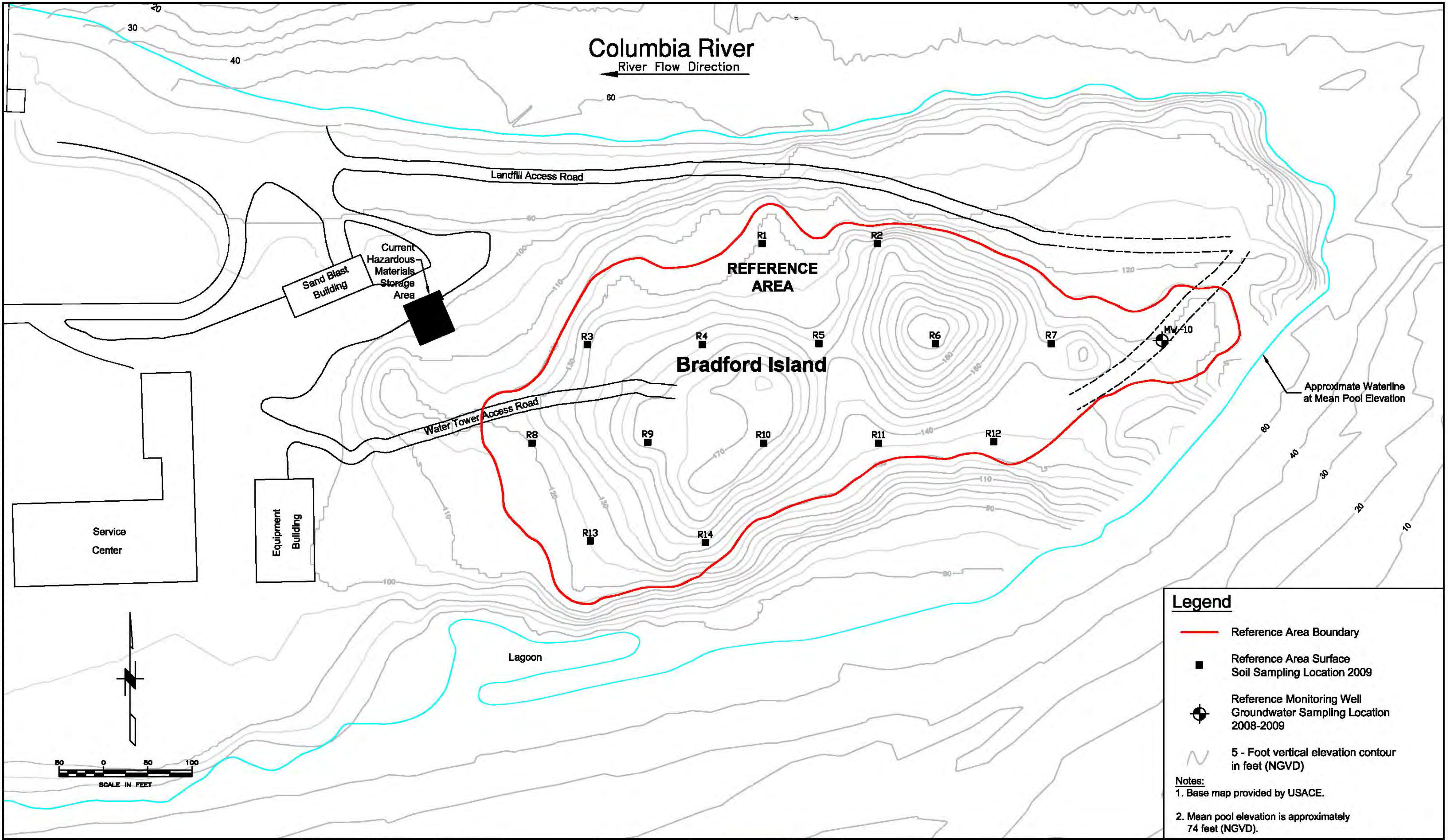

Notes:
1. Base map provided by USACE.

2. Mean pool elevation is approximately 74 feet (NGVD).

No.	DATE	BY	REVISION

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SCALE:	DRAWN BY: SPB	APPROVED BY: LSM
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BRADFORD ISLAND

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UPLAND OPERABLE UNIT

REFERENCE AREA
SAMPLING LOCATIONS

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CAD FILE NUMBER: FIG 6-1

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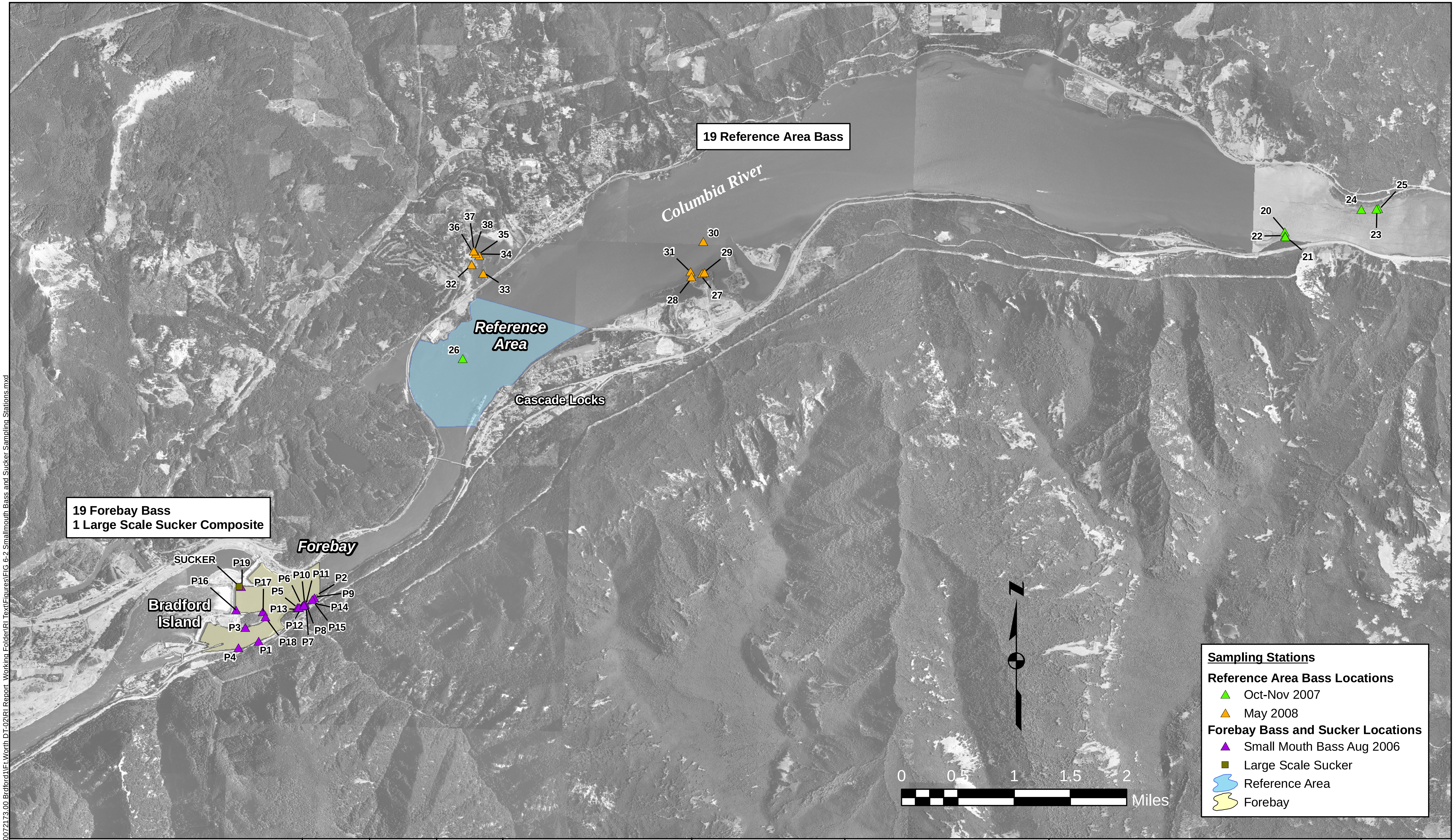

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report Working Folder\RI Text\Figures\FIG 6-2 Smallmouth Bass and Sucker Sampling Stations.mxd

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

RIVER OPERABLE UNIT

SMALLMOUTH BASS AND
LARGE SCALE SUCKER
SAMPLING STATIONS

DRAWING NUMBER: FIGURE 6-2
GIS FILE NUMBER: FIG 6-2
SHEET:
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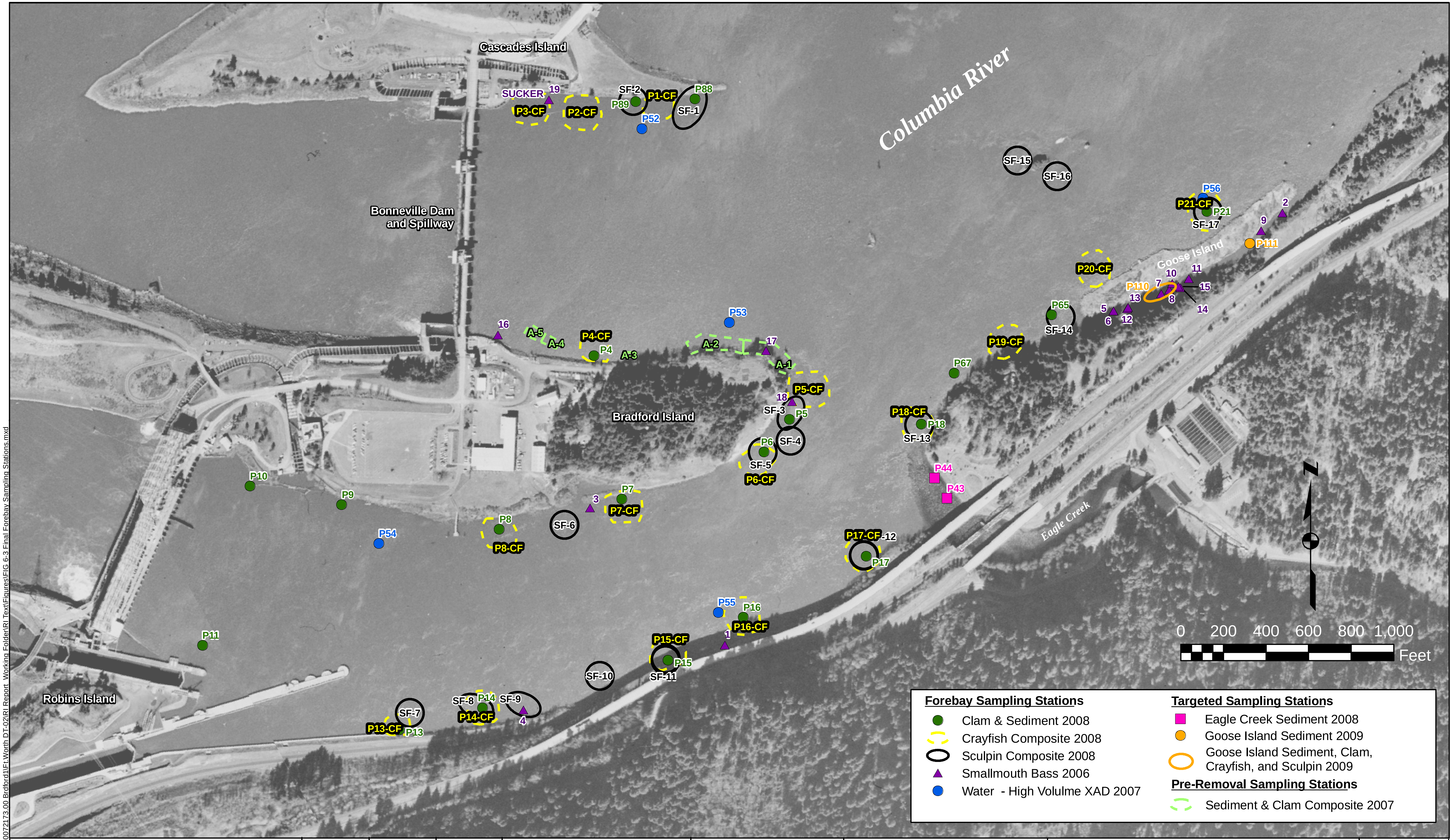

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 6-3 Final Forebay Sampling Stations.mxd

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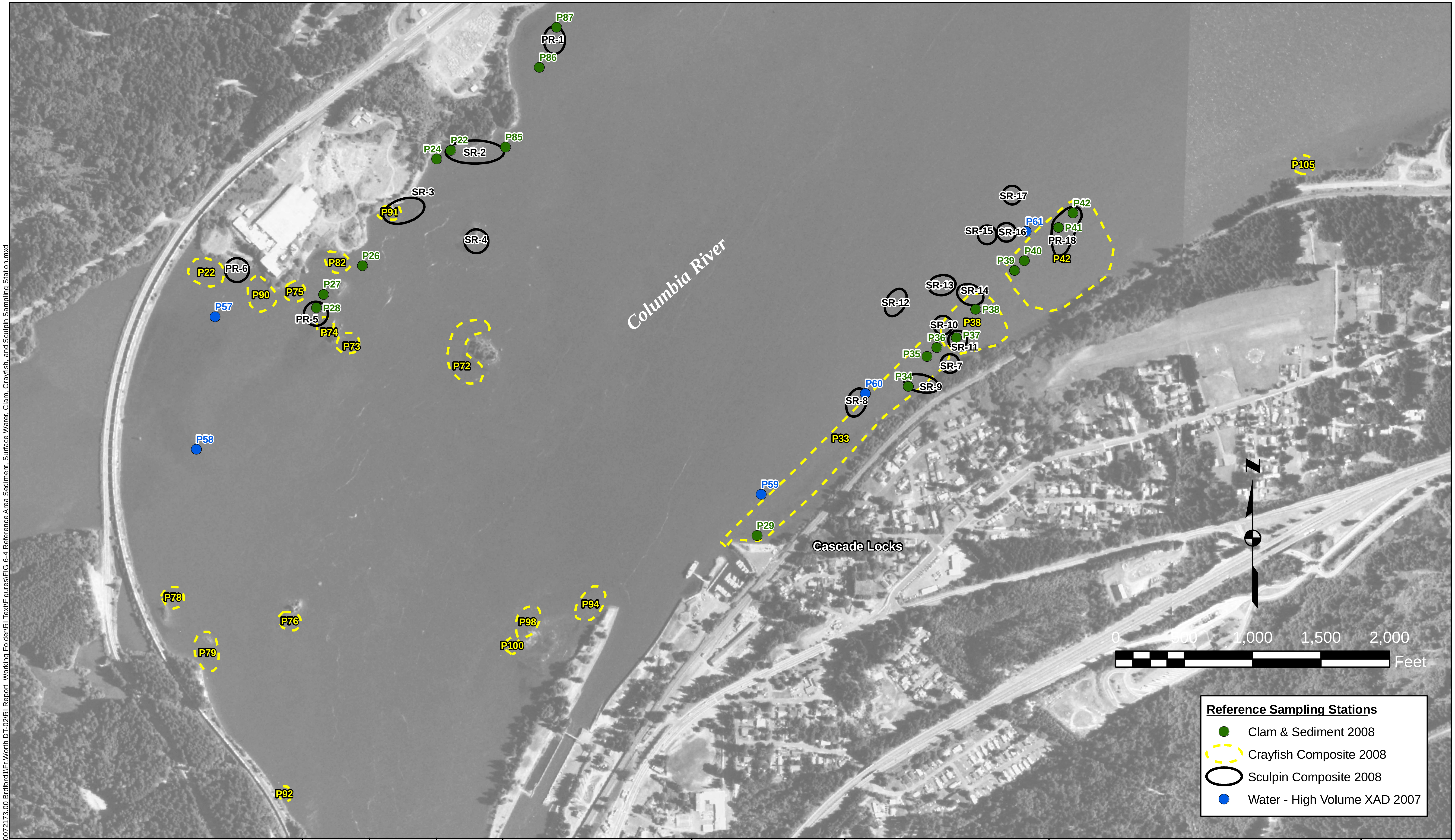
	DRAWN BY: SB	APPROVED BY: MP	111 S.W. Columbia, Suite 1500 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	CASCADE LOCKS, OREGON	FOREBAY SAMPLING STATIONS	GIS FILE NUMBER: FIG 6-3
	CHECKED BY: SB	DATE: JULY 2010				SHEET: REV.



O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report Working Folder\RI Text\Figures\FIG 6-4 Reference Area Sediment, Surface Water, Clam, Crayfish, and Sculpin Sampling Station.mxd

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

RIVER OPERABLE UNIT

REFERENCE AREA
SAMPLING STATIONS

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FIGURE 6-4
GIS FILE NUMBER:
FIG 6-4
SHEET:
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Downstream Sampling Stations

● Sediment 2008

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FIGURE 6-5
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FIG 6-5
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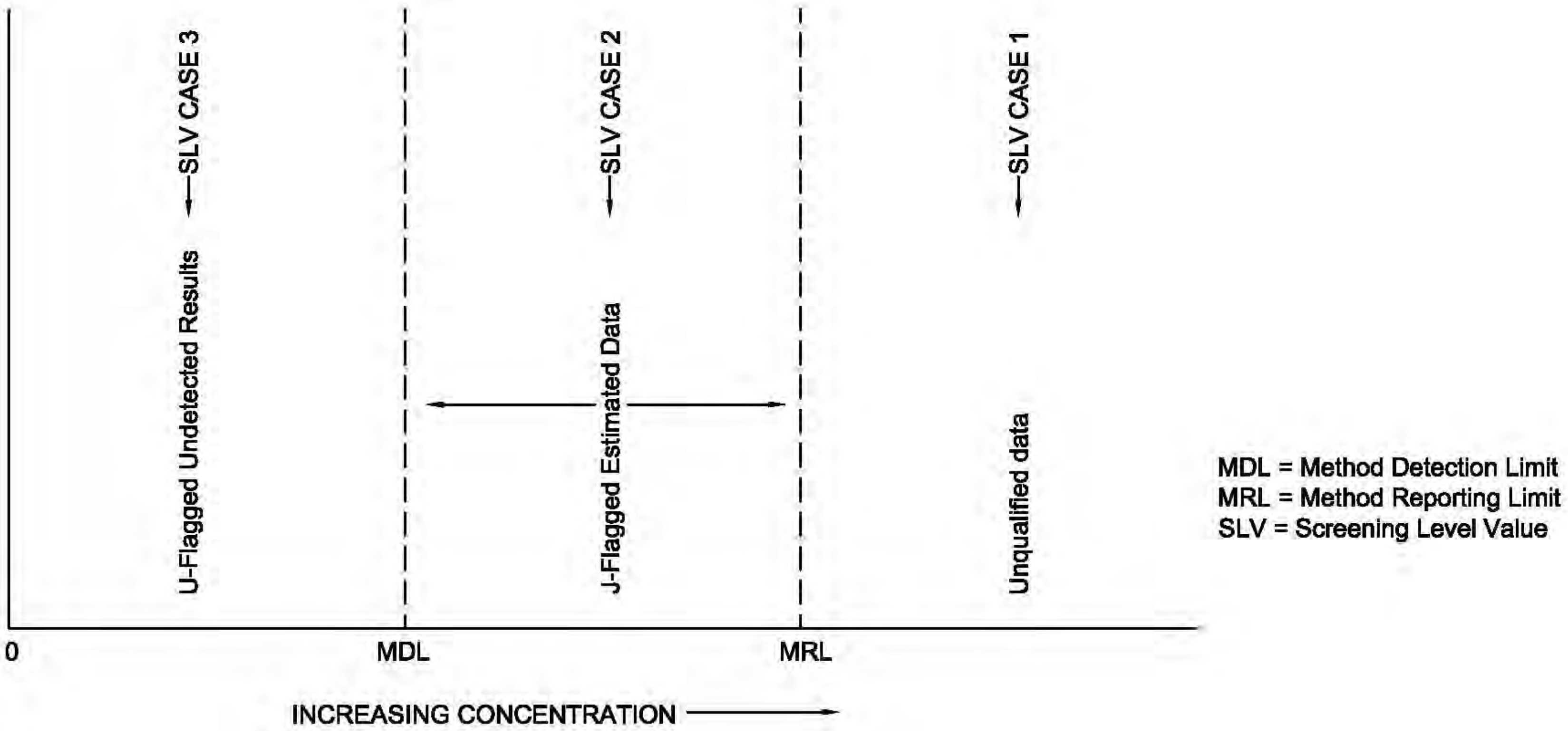
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 6-5 Downstream Sampling Stations.mxd



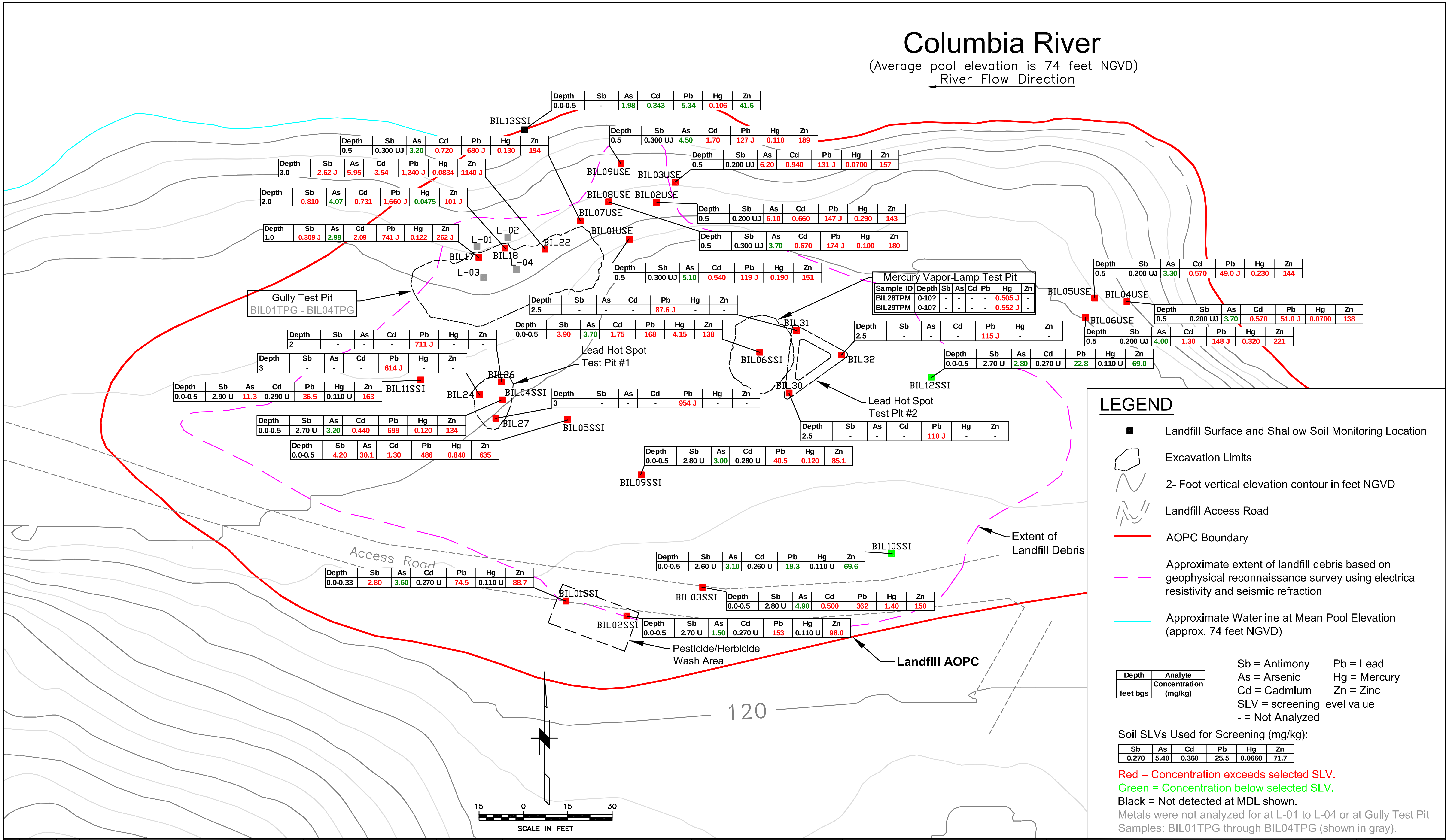
RELATIONSHIP BETWEEN MDL, MRL, AND J-FLAGGED DATA

NOVEMBER 2010
25696528

BRADFORD ISLAND
CASCADE LOCKS, OREGON

FIGURE 7-1

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1a – Metals in Surface and Shallow Soil at Landfill AOPC.dwg Nov 18, 2010 – 9:27am



BIL13SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	-	1.98	0.343	5.34	0.106	41.6

BIL07USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.300 UJ	3.20	0.720	680 J	0.130	194

BIL22

Depth	Sb	As	Cd	Pb	Hg	Zn
3.0	2.62 J	5.95	3.54	1,240 J	0.0834	1140 J

BIL18

Depth	Sb	As	Cd	Pb	Hg	Zn
2.0	0.810	4.07	0.731	1,660 J	0.0475	101 J

BIL17

Depth	Sb	As	Cd	Pb	Hg	Zn
1.0	0.309 J	2.98	2.09	741 J	0.122	262 J

BIL09USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.300 UJ	4.50	1.70	127 J	0.110	189

BIL03USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.200 UJ	6.20	0.940	131 J	0.0700	157

BIL02USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.200 UJ	6.10	0.660	147 J	0.290	143

BIL08USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.300 UJ	3.70	0.670	174 J	0.100	180

BIL01USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.300 UJ	5.10	0.540	119 J	0.190	151

Mercury Vapor-Lamp Test Pit

Sample ID	Depth	Sb	As	Cd	Pb	Hg	Zn
BIL28TPM	0-10?	-	-	-	-	0.505 J	-
BIL29TPM	0-10?	-	-	-	-	0.552 J	-

BIL05USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.200 UJ	3.30	0.570	49.0 J	0.230	144

BIL04USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.200 UJ	3.70	0.570	51.0 J	0.0700	138

BIL06USE

Depth	Sb	As	Cd	Pb	Hg	Zn
0.5	0.200 UJ	4.00	1.30	148 J	0.320	221

BIL31

Depth	Sb	As	Cd	Pb	Hg	Zn
2.5	-	-	-	87.6 J	-	-

BIL06SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	3.90	3.70	1.75	168	4.15	138

BIL32

Depth	Sb	As	Cd	Pb	Hg	Zn
2.5	-	-	-	115 J	-	-

BIL12SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.70 U	2.80	0.270 U	22.8	0.110 U	69.0

BIL30

Depth	Sb	As	Cd	Pb	Hg	Zn
2.5	-	-	-	110 J	-	-

BIL26

Depth	Sb	As	Cd	Pb	Hg	Zn
2	-	-	-	711 J	-	-

BIL24

Depth	Sb	As	Cd	Pb	Hg	Zn
3	-	-	-	614 J	-	-

BIL11SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.90 U	11.3	0.290 U	36.5	0.110 U	163

BIL04SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.70 U	3.20	0.440	699	0.120	134

BIL05SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	4.20	30.1	1.30	486	0.840	635

BIL27

Depth	Sb	As	Cd	Pb	Hg	Zn
3	-	-	-	954 J	-	-

BIL09SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.80 U	3.00	0.280 U	40.5	0.120	85.1

BIL10SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.60 U	3.10	0.260 U	19.3	0.110 U	69.6

BIL01SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.33	2.80	3.60	0.270 U	74.5	0.110 U	88.7

BIL03SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.80 U	4.90	0.500	362	1.40	150

BIL02SSI

Depth	Sb	As	Cd	Pb	Hg	Zn
0.0-0.5	2.70 U	1.50	0.270 U	153	0.110 U	98.0

LEGEND

- ■ Landfill Surface and Shallow Soil Monitoring Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

Sb = Antimony
As = Arsenic
Cd = Cadmium
Pb = Lead
Hg = Mercury
Zn = Zinc
SLV = screening level value
- = Not Analyzed

Soil SLVs Used for Screening (mg/kg):

Sb	As	Cd	Pb	Hg	Zn
0.270	5.40	0.360	25.5	0.0660	71.7

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.
Metals were not analyzed for at L-01 to L-04 or at Gully Test Pit Samples: BIL01TPG through BIL04TPG (shown in gray).

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BRADFORD ISLAND
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LANDFILL AOPC
METALS IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-1a
CAD FILE NUMBER: FIG 9-1a
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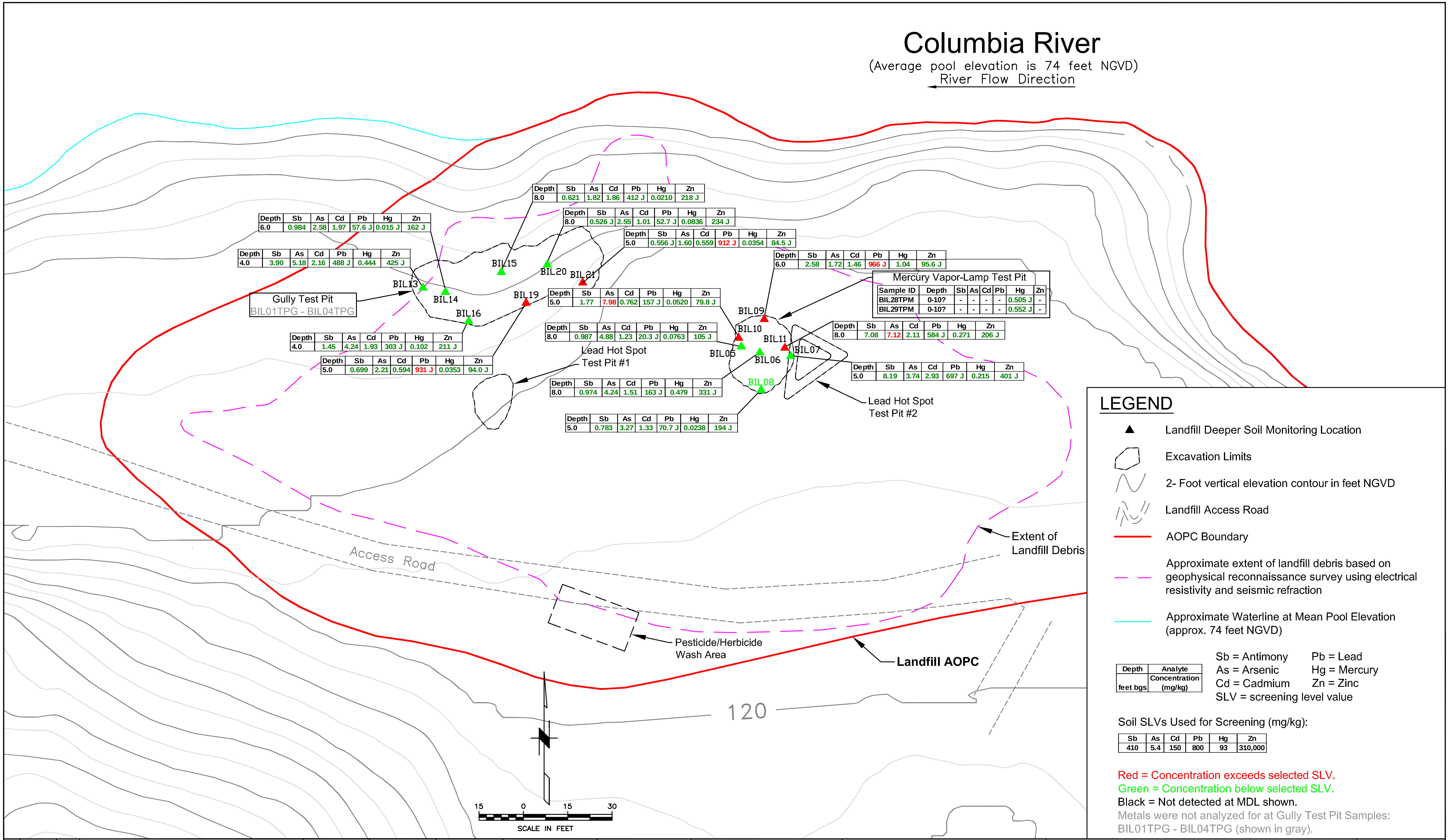
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1b – Metals in Deeper Soil at Landfill AOPC.dwg Nov 18, 2010 – 9:28am



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BRADFORD ISLAND
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LANDFILL AOPC
METALS IN DEEPER SOIL

DRAWING NUMBER: FIGURE 9-1b
CAD FILE NUMBER: FIG 9-1b
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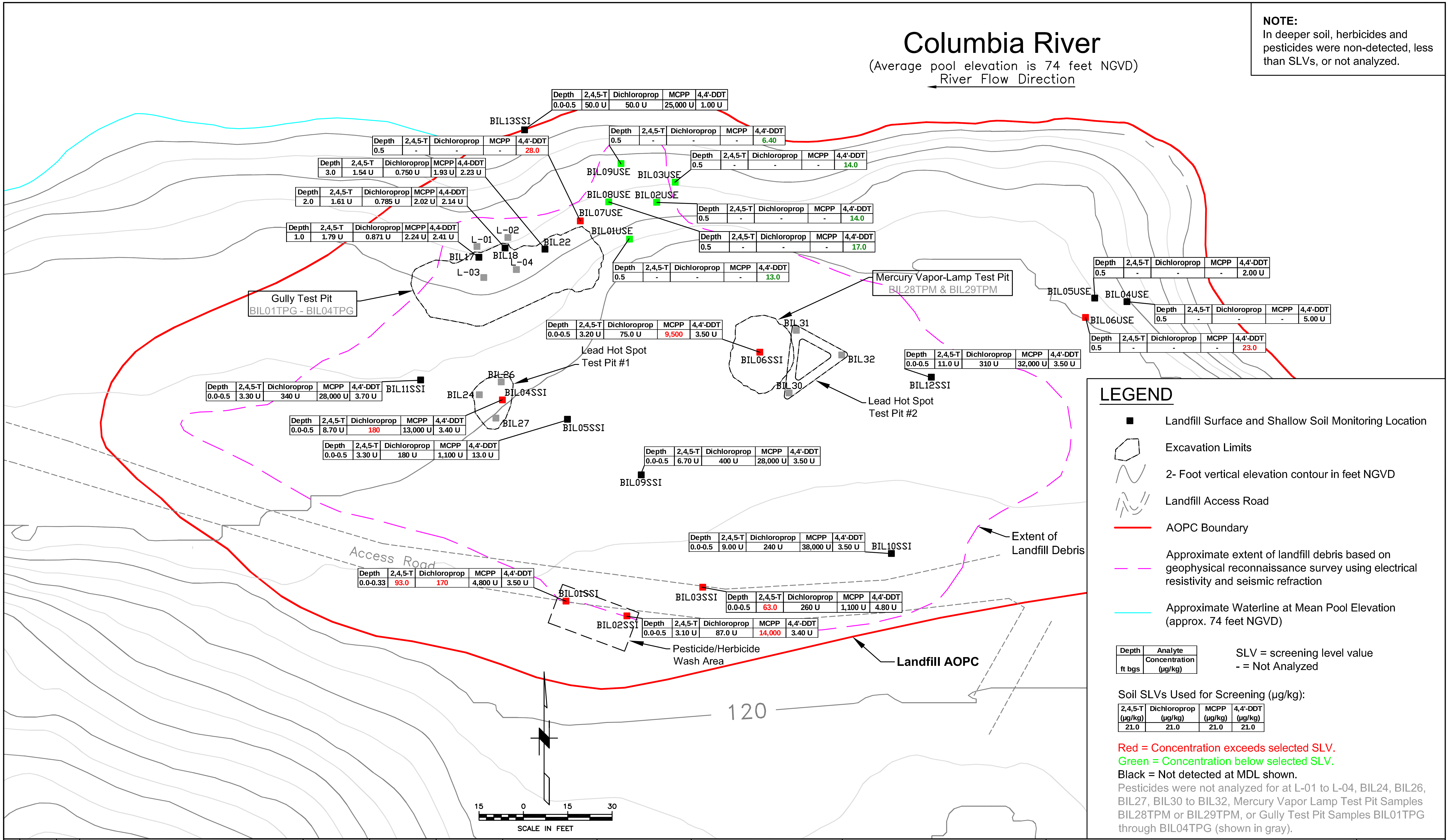
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1c – Herbicides and Pesticides in Surface and Shallow Soil at Landfill AOPC.dwg Nov 18, 2010 – 9:29am

NOTE:
In deeper soil, herbicides and pesticides were non-detected, less than SLVs, or not analyzed.



LEGEND

■ Landfill Surface and Shallow Soil Monitoring Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth ft bgs	Analyte Concentration (µg/kg)

SLV = screening level value
- = Not Analyzed

Soil SLVs Used for Screening (µg/kg):

2,4,5-T (µg/kg)	Dichloroprop (µg/kg)	MCPP (µg/kg)	4,4'-DDT (µg/kg)
21.0	21.0	21.0	21.0

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.
Pesticides were not analyzed for at L-01 to L-04, BIL24, BIL26, BIL27, BIL30 to BIL32, Mercury Vapor Lamp Test Pit Samples BIL28TPM or BIL29TPM, or Gully Test Pit Samples BIL01TPG through BIL04TPG (shown in gray).

No.	DATE	BY	REVISION

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BRADFORD ISLAND
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LANDFILL AOPC

HERBICIDES AND PESTICIDES
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9–1c
CAD FILE NUMBER: FIG 9–1c
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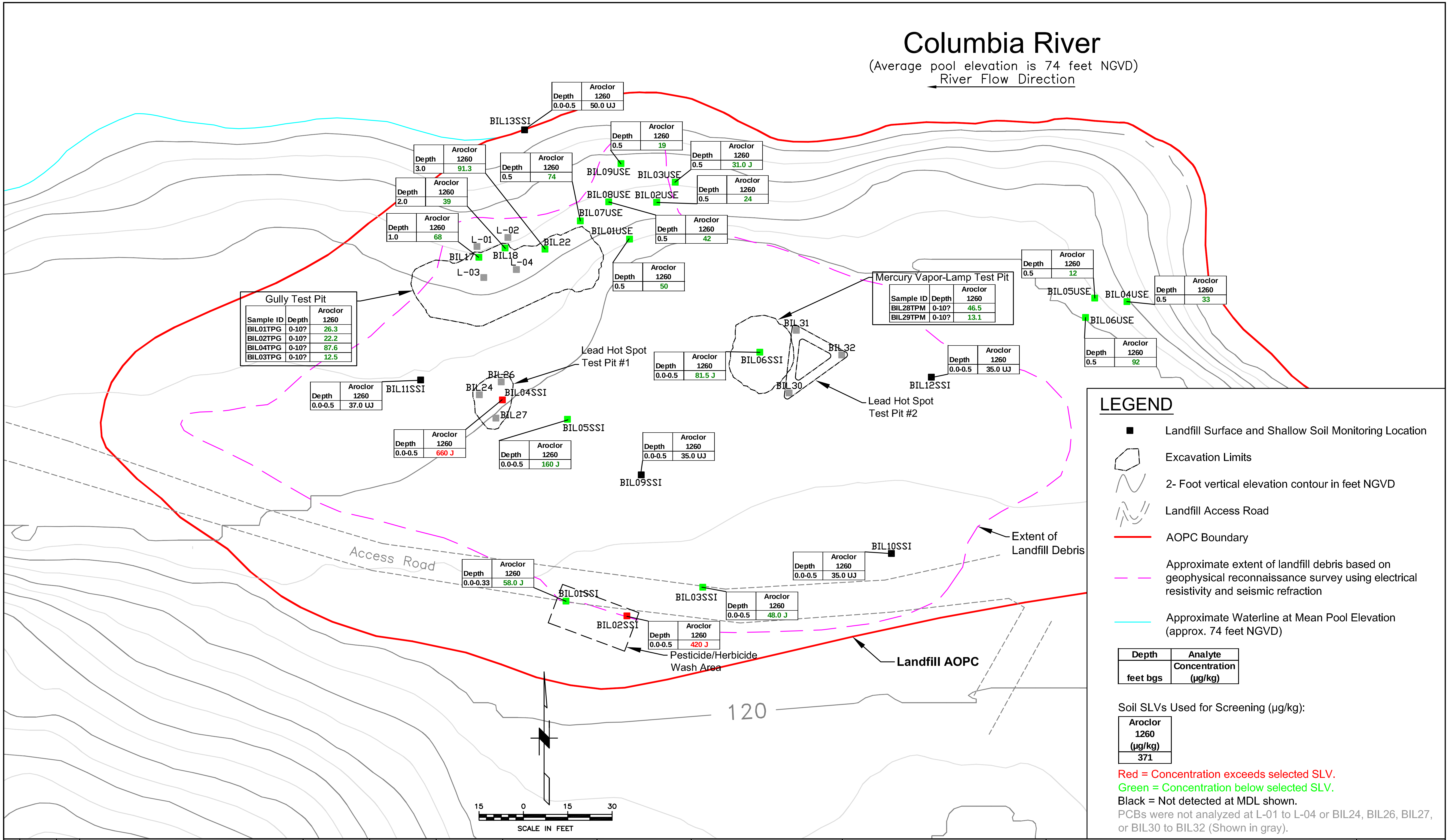

LEGEND

- ■ Landfill Surface and Shallow Soil Monitoring Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth feet bgs	Analyte Concentration (µg/kg)

Soil SLVs Used for Screening (µg/kg):

Aroclor 1260 (µg/kg)
371

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.
PCBs were not analyzed at L-01 to L-04 or BIL24, BIL26, BIL27, or BIL30 to BIL32 (Shown in gray).

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BRADFORD ISLAND
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LANDFILL AOPC
PCBs IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-1d
CAD FILE NUMBER: FIG 9-1d
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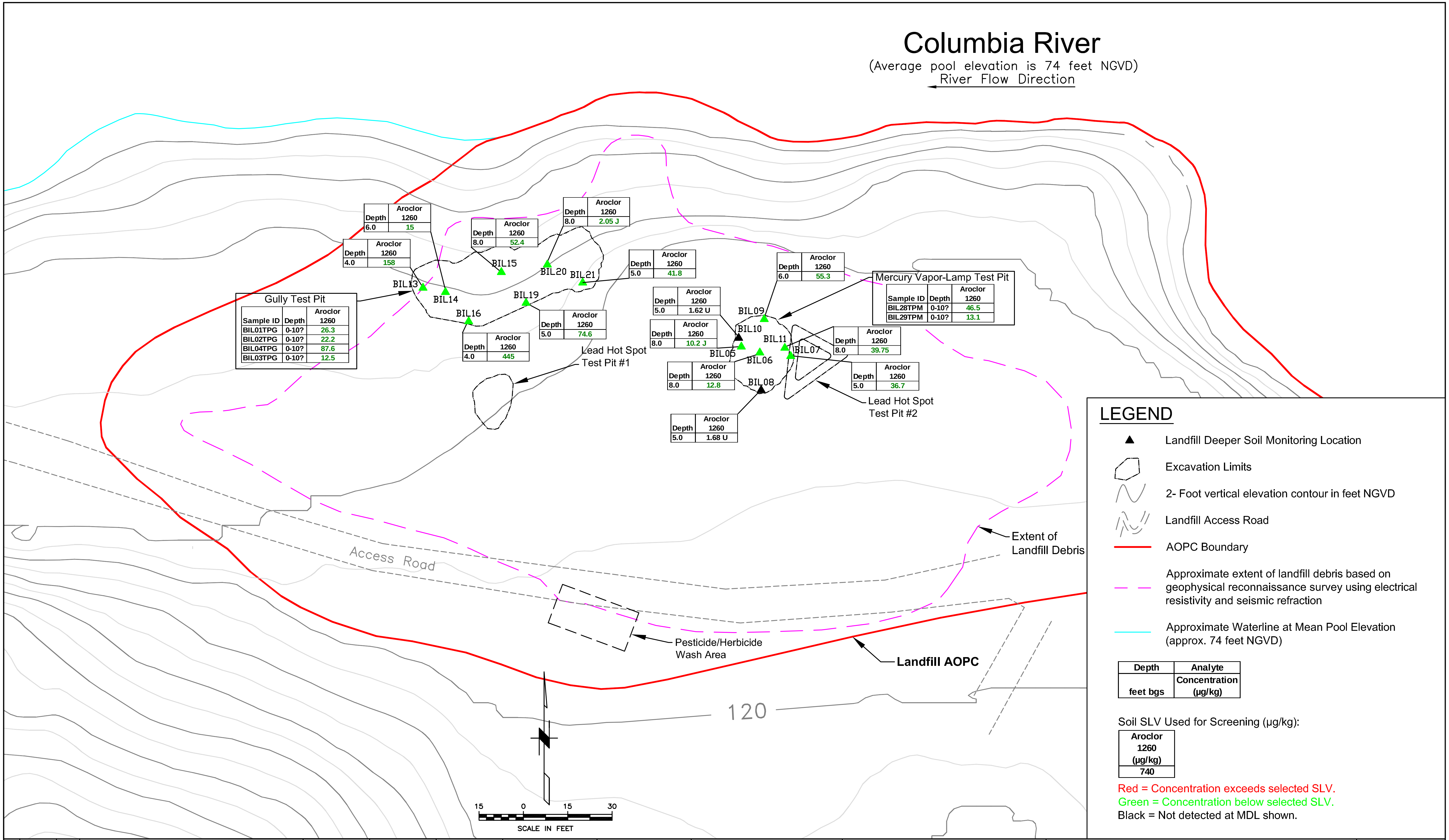

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BRADFORD ISLAND
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LANDFILL AOPC
PCBs IN DEEPER SOIL

DRAWING NUMBER: FIGURE 9-1e
CAD FILE NUMBER: FIG 9-1e
SHEET: OF
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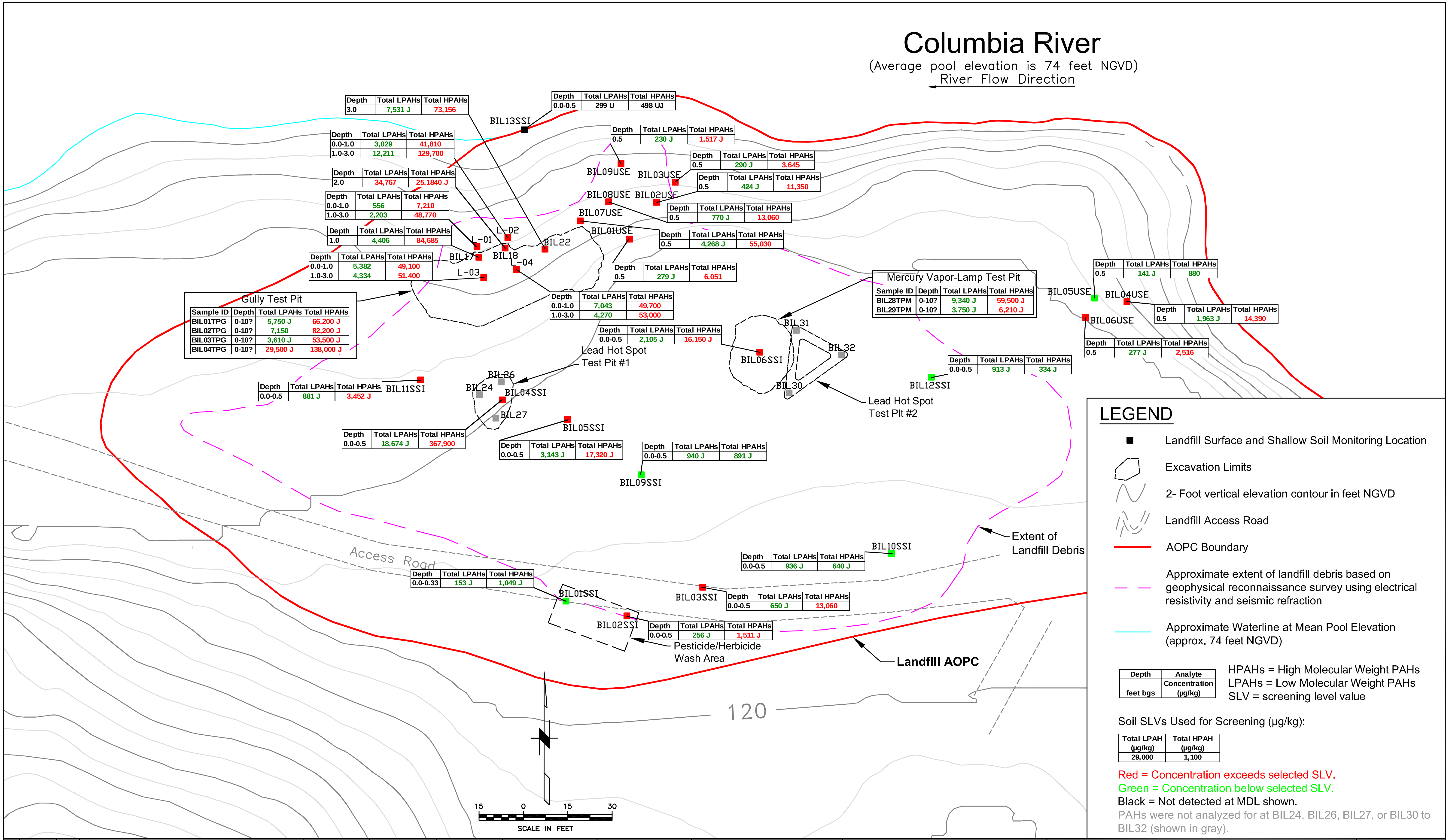
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1f – PAHs in Surface and Shallow Soil at Landfill AOPC.dwg Nov 18, 2010 – 9:33am



Gully Test Pit

Sample ID	Depth	Total LPAHs	Total HPAHs
BIL01TPG	0-10?	5,750 J	66,200 J
BIL02TPG	0-10?	7,150	82,200 J
BIL03TPG	0-10?	3,610 J	53,500 J
BIL04TPG	0-10?	29,500 J	138,000 J

Mercury Vapor-Lamp Test Pit

Sample ID	Depth	Total LPAHs	Total HPAHs
BIL28TPM	0-10?	9,340 J	59,500 J
BIL29TPM	0-10?	3,750 J	6,210 J

LEGEND

■ Landfill Surface and Shallow Soil Monitoring Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

HPAHs = High Molecular Weight PAHs
LPAHs = Low Molecular Weight PAHs
SLV = screening level value

Soil SLVs Used for Screening (µg/kg):

Total LPAH (µg/kg)	Total HPAH (µg/kg)
29,000	1,100

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.
PAHs were not analyzed for at BIL24, BIL26, BIL27, or BIL30 to BIL32 (shown in gray).

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

LANDFILL AOPC

PAHs IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-1f
CAD FILE NUMBER: FIG 9-1f
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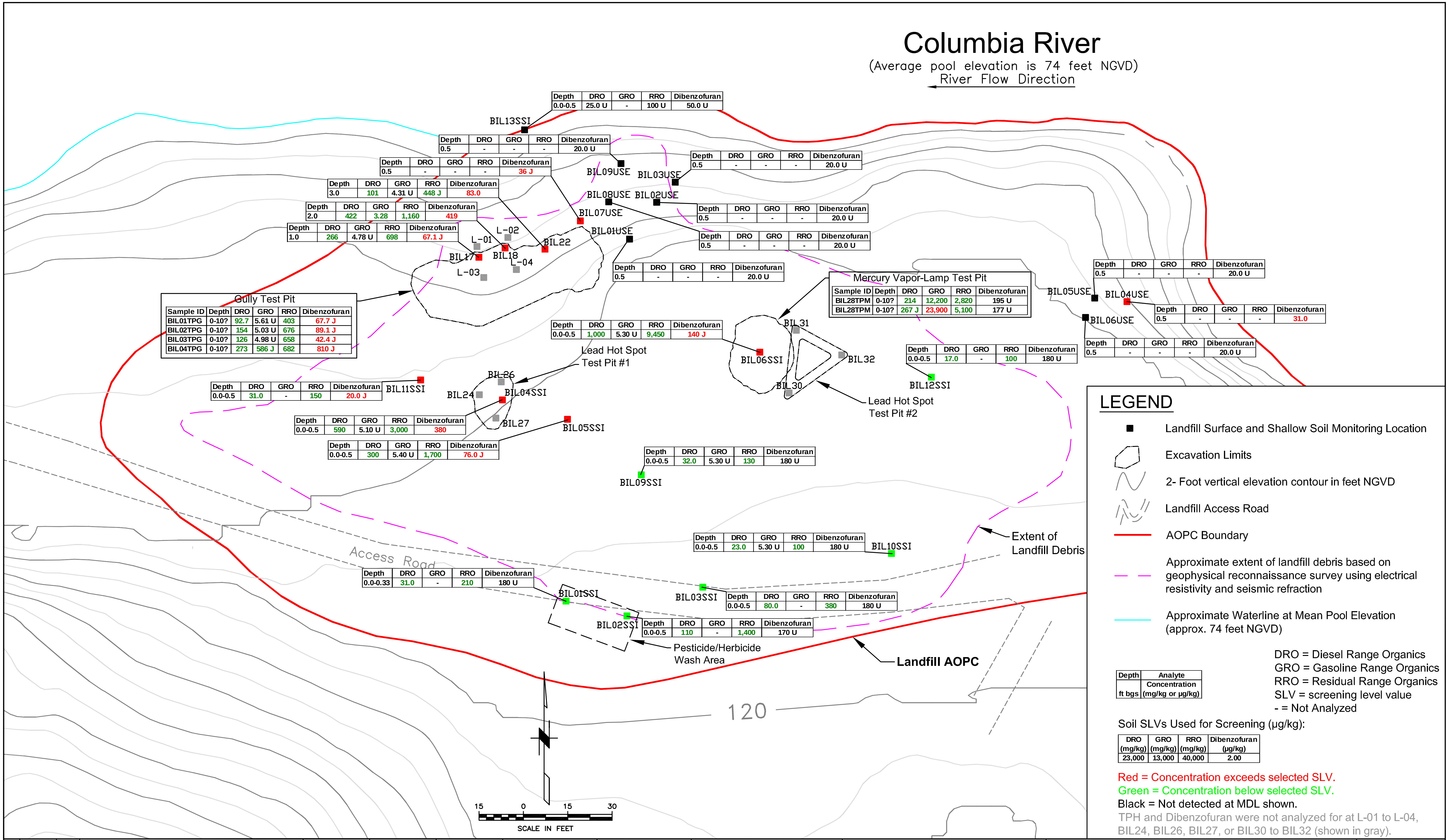
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1g – TPH and Dibenzofuran in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:34am



BIL13SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	25.0 U	-	100 U	50.0 U

BIL09USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL07USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	36 J

BIL22

Depth	DRO	GRO	RRO	Dibenzofuran
3.0	101	4.31 U	448 J	83.0

BIL18

Depth	DRO	GRO	RRO	Dibenzofuran
2.0	422	3.28	1,160	419

BIL17

Depth	DRO	GRO	RRO	Dibenzofuran
1.0	266	4.78 U	698	67.1 J

BIL03USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL02USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL08USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL01USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

Gully Test Pit

Sample ID	Depth	DRO	GRO	RRO	Dibenzofuran
BIL01TPG	0-10?	92.7	5.61 U	403	67.7 J
BIL02TPG	0-10?	154	5.03 U	676	89.1 J
BIL03TPG	0-10?	126	4.98 U	658	42.4 J
BIL04TPG	0-10?	273	586 J	682	810 J

Mercury Vapor-Lamp Test Pit

Sample ID	Depth	DRO	GRO	RRO	Dibenzofuran
BIL28TPM	0-10?	214	12,200	2,820	195 U
BIL28TPM	0-10?	267 J	23,900	5,100	177 U

BIL05USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL04USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	31.0

BIL06USE

Depth	DRO	GRO	RRO	Dibenzofuran
0.5	-	-	-	20.0 U

BIL11SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	31.0	-	150	20.0 J

BIL04SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	590	5.10 U	3,000	380

BIL05SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	300	5.40 U	1,700	76.0 J

BIL06SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	1,000	5.30 U	9,450	140 J

BIL12SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	17.0	-	100	180 U

BIL09SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	32.0	5.30 U	130	180 U

BIL10SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	23.0	5.30 U	100	180 U

BIL01SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.33	31.0	-	210	180 U

BIL03SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	80.0	-	380	180 U

BIL02SSI

Depth	DRO	GRO	RRO	Dibenzofuran
0.0-0.5	110	-	1,400	170 U

DRO = Diesel Range Organics
GRO = Gasoline Range Organics
RRO = Residual Range Organics
SLV = screening level value
- = Not Analyzed

Soil SLVs Used for Screening (µg/kg):

DRO (mg/kg)	GRO (mg/kg)	RRO (mg/kg)	Dibenzofuran (µg/kg)
23,000	13,000	40,000	2.00

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.
TPH and Dibenzofuran were not analyzed for at L-01 to L-04, BIL24, BIL26, BIL27, or BIL30 to BIL32 (shown in gray).

No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
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BRADFORD ISLAND

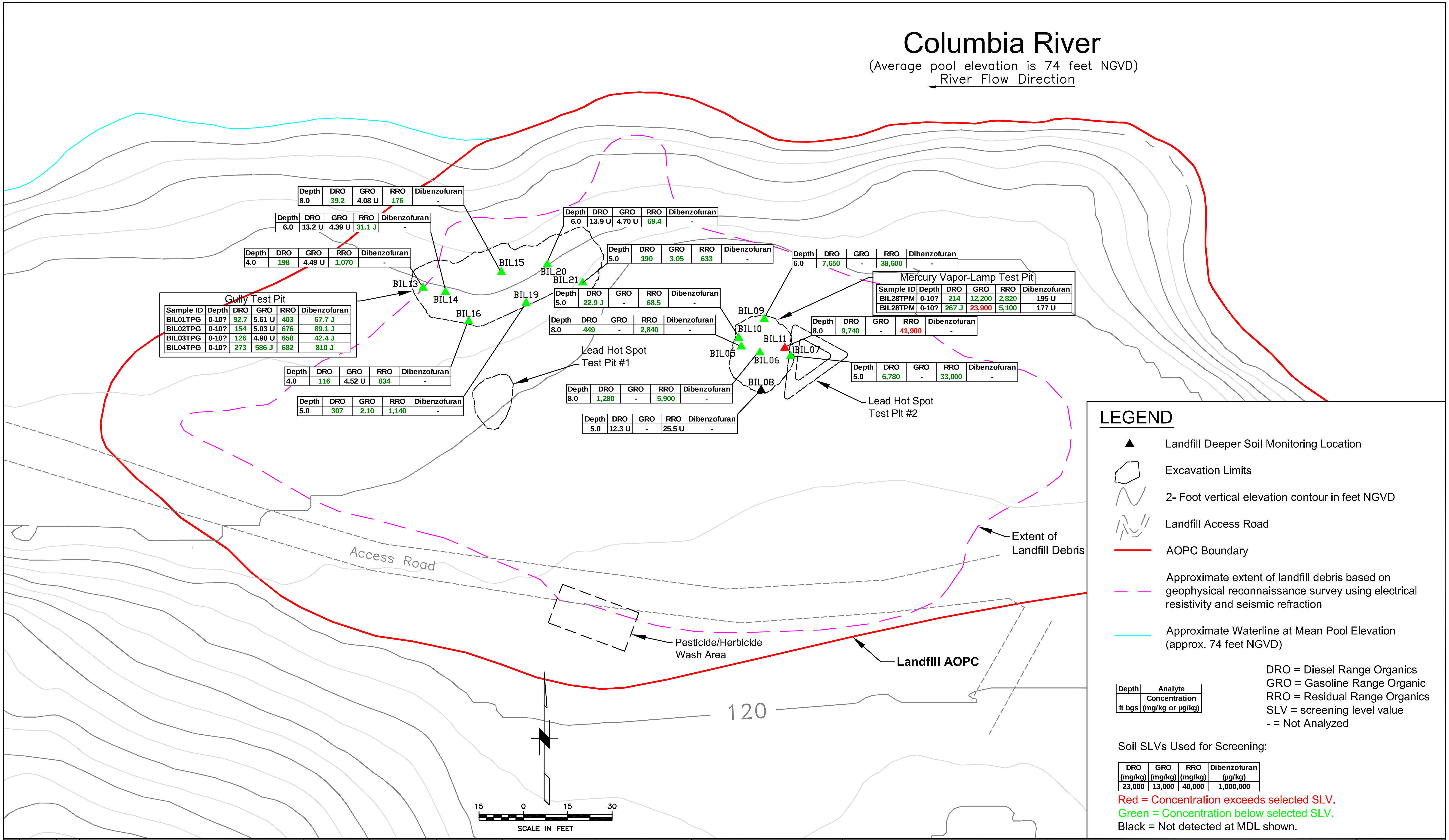
CASCADE LOCKS, OREGON

LANDFILL AOPC

TPH AND DIBENZOFURAN
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-1g
CAD FILE NUMBER: FIG 9-1g
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-1h – TPH and Dibenzofuran in Deeper Soil at Landfill AOPC.dwg Nov 18, 2010 – 9:36am



No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
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BRADFORD ISLAND

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LANDFILL AOPC

TPH AND DIBENZOFURAN IN DEEPER SOIL

DRAWING NUMBER: FIGURE 9-1h
CAD FILE NUMBER: FIG 9-1h
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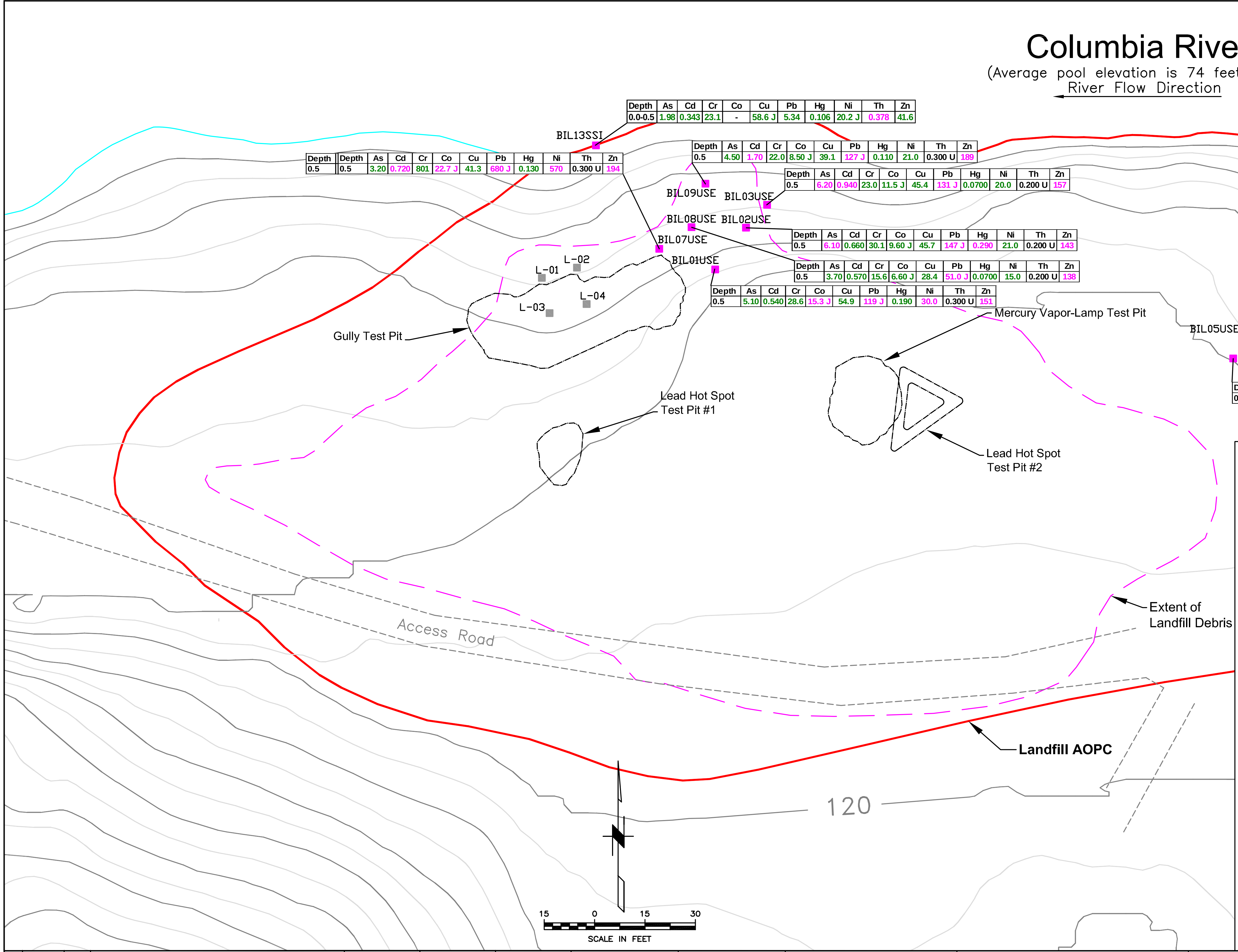
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-2a- Metals in Surface Soil for Mass Wasting Evaluation.dwg Nov 18, 2010 - 9:37am



Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.0-0.5	1.98	0.343	23.1	-	58.6 J	5.34	0.106	20.2 J	0.378	41.6

Depth	Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	0.5	3.20	0.720	801	22.7 J	41.3	680 J	0.130	570	0.300 U	194

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	4.50	1.70	22.0	8.50 J	39.1	127 J	0.110	21.0	0.300 U	189

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	6.20	0.940	23.0	11.5 J	45.4	131 J	0.0700	20.0	0.200 U	157

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	6.10	0.660	30.1	9.60 J	45.7	147 J	0.290	21.0	0.200 U	143

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	3.70	0.570	15.6	6.60 J	28.4	51.0 J	0.0700	15.0	0.200 U	138

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	5.10	0.540	28.6	15.3 J	54.9	119 J	0.190	30.0	0.300 U	151

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	3.30	0.570	16.1	6.40 J	24.4	49.0 J	0.230	15.0	0.200 U	144

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	3.70	0.670	117	10.7 J	52.1	174 J	0.100	72.0	0.300 U	180

Depth	As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
0.5	4.00	1.30	16.9	8.30 J	60.5	148 J	0.320	15.0	0.200 U	221

LEGEND

- ■ Landfill Surface and Shallow Soil Monitoring Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

As = Arsenic
Cd = Cadmium
Cr = Chromium
Co = Cobalt
Cu =Copper
SLV = screening level value
- = Not Analyzed

Pb = Lead
Hg = Mercury
Ni = Nickel
Se = Selenium
Th = Thallium
Zn = Zinc

Sediment SLVs Used for Screening (mg/kg):

As	Cd	Cr	Co	Cu	Pb	Hg	Ni	Th	Zn
6.00	0.674	37.0	15.2	55.6	35.0	0.214	21.2	0.354	123

Pink = Soil Concentration exceeds Sediment SLV.
Green = Soil Concentration below Seiment SLV.
Black = Not detected at MDL shown.
Metals were not analyzed for at L-01 to L-04 (shown in gray).

No.	DATE	BY	REVISION

JOB No.: 25696946
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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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BRADFORD ISLAND
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LANDFILL AOPC
METALS IN SURFACE SOIL
FOR MASS WASTING EVALUATION

DRAWING NUMBER: FIGURE 9-2a
CAD FILE NUMBER: FIG 9-2a
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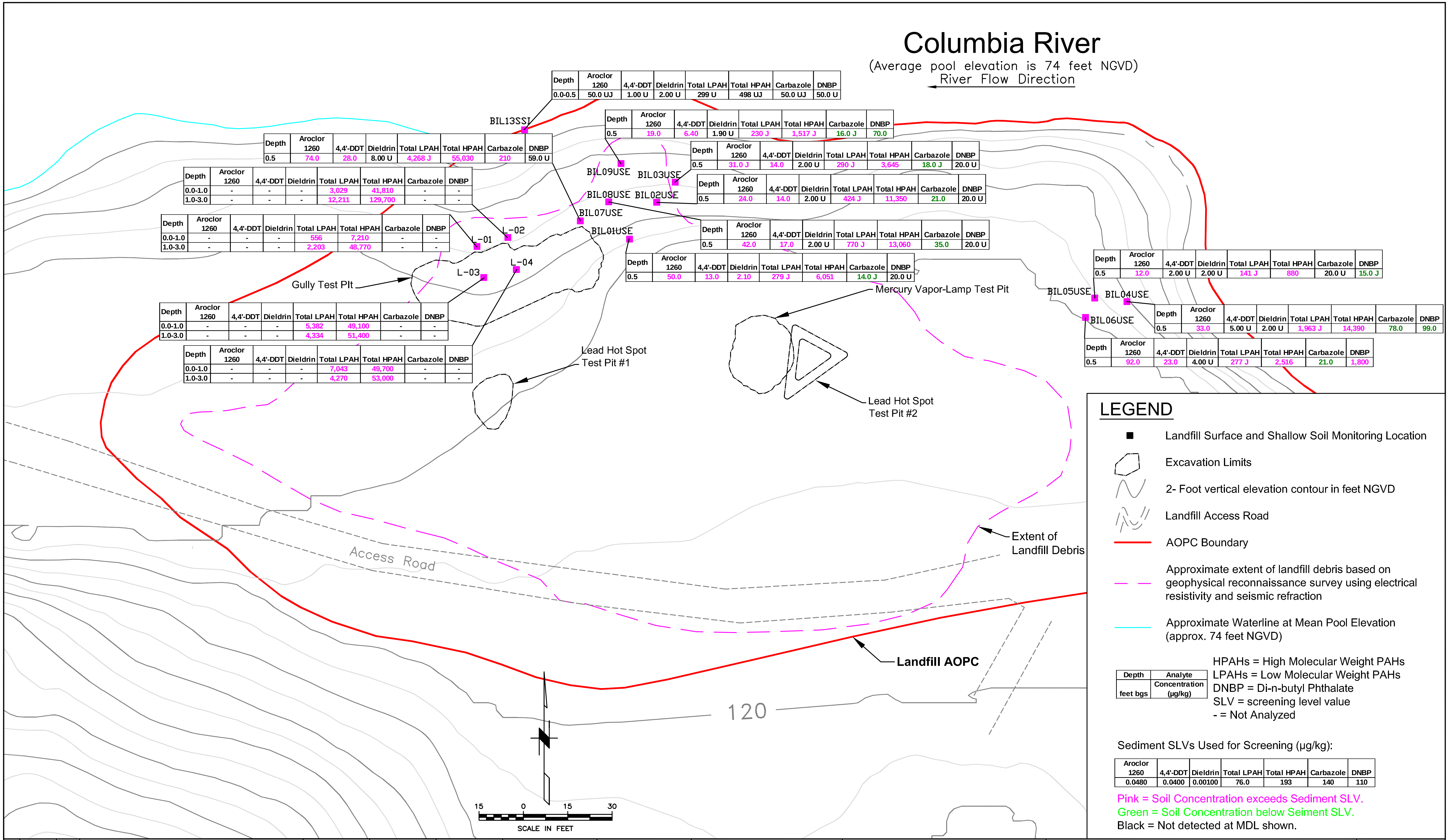
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-2b- PCBs, Pesticides, PAHs, and SVOCs in Surface Soil for Mass Wasting Evaluation..dwg Nov 18, 2010 - 9:38am



BIL13SSI

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0-0.5	50.0 UJ	1.00 U	2.00 U	299 U	498 UJ	50.0 UJ	50.0 U

BIL09USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	19.0	6.40	1.90 U	230 J	1,517 J	16.0 J	70.0

BIL03USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	31.0 J	14.0	2.00 U	290 J	3,645	18.0 J	20.0 U

BIL02USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	24.0	14.0	2.00 U	424 J	11,350	21.0	20.0 U

BIL08USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	42.0	17.0	2.00 U	770 J	13,060	35.0	20.0 U

BIL01USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	50.0	13.0	2.10	279 J	6,051	14.0 J	20.0 U

BIL07USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	74.0	28.0	8.00 U	4,268 J	55,030	210	59.0 U

L-02

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0-1.0	-	-	-	3,029	41,810	-	-
1.0-3.0	-	-	-	12,211	129,700	-	-

L-01

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0-1.0	-	-	-	556	7,210	-	-
1.0-3.0	-	-	-	2,203	48,770	-	-

L-03

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0-1.0	-	-	-	5,382	49,100	-	-
1.0-3.0	-	-	-	4,334	51,400	-	-

L-04

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0-1.0	-	-	-	7,043	49,700	-	-
1.0-3.0	-	-	-	4,270	53,000	-	-

BIL05USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	12.0	2.00 U	2.00 U	141 J	880	20.0 U	15.0 J

BIL04USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	33.0	5.00 U	2.00 U	1,963 J	14,390	78.0	99.0

BIL06USE

Depth	Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.5	92.0	23.0	4.00 U	277 J	2,516	21.0	1,800

LEGEND

- ■ Landfill Surface and Shallow Soil Monitoring Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
feet bgs	Concentration (μg/kg)

HPAHs = High Molecular Weight PAHs
LPAHs = Low Molecular Weight PAHs
DNBP = Di-n-butyl Phthalate
SLV = screening level value
- = Not Analyzed

Sediment SLVs Used for Screening (μg/kg):

Aroclor 1260	4,4'-DDT	Dieldrin	Total LPAH	Total HPAH	Carbazole	DNBP
0.0480	0.0400	0.00100	76.0	193	140	110

Pink = Soil Concentration exceeds Sediment SLV.
Green = Soil Concentration below Seiment SLV.
Black = Not detected at MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
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PROJ. MANAGER: MP
APPROVED BY: LSM
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URS
111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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LANDFILL AOPC

PCBs, PESTICIDES, PAHs, AND SVOCs IN
SURFACE SOILS FOR MASS WASTING EVALUATION

DRAWING NUMBER: FIGURE 9-2b
CAD FILE NUMBER: FIG 9-2b
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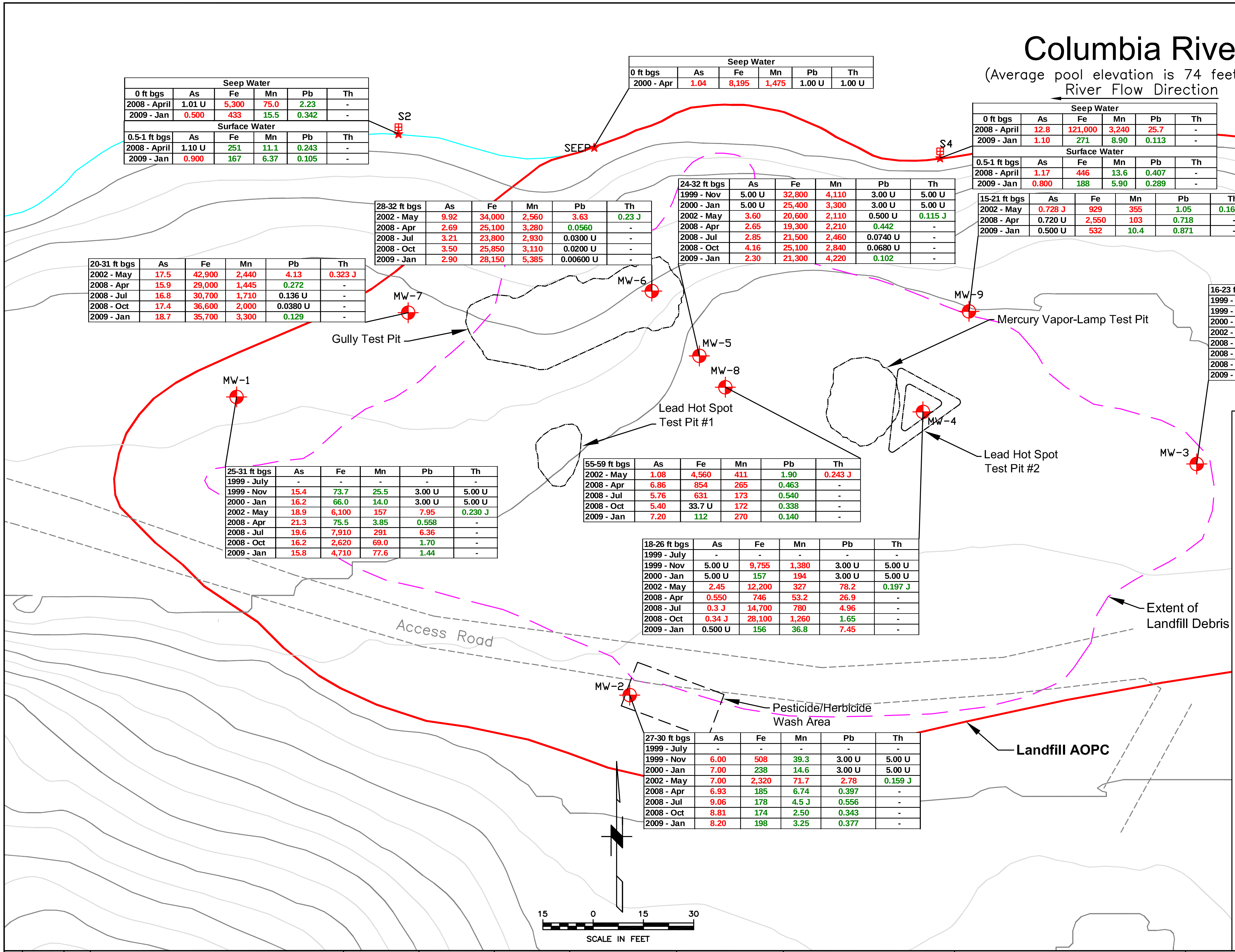
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-3a – Total Metals in Groundwater, Seep Water, and Surface Water.dwg Nov 18, 2010 – 9:39am



Seep Water

0 ft bgs	As	Fe	Mn	Pb	Th
2008 - April	1.01 U	5,300	75.0	2.23	-
2009 - Jan	0.500	433	15.5	0.342	-

Surface Water

0.5-1 ft bgs	As	Fe	Mn	Pb	Th
2008 - April	1.10 U	251	11.1	0.243	-
2009 - Jan	0.900	167	6.37	0.105	-

Seep Water

0 ft bgs	As	Fe	Mn	Pb	Th
2000 - Apr	1.04	8,195	1,475	1.00 U	1.00 U

Seep Water

0 ft bgs	As	Fe	Mn	Pb	Th
2008 - April	12.8	121,000	3,240	25.7	-
2009 - Jan	1.10	271	8.90	0.113	-

Surface Water

0.5-1 ft bgs	As	Fe	Mn	Pb	Th
2008 - April	1.17	446	13.6	0.407	-
2009 - Jan	0.800	188	5.90	0.289	-

20-31 ft bgs	As	Fe	Mn	Pb	Th
2002 - May	17.5	42,900	2,440	4.13	0.323 J
2008 - Apr	15.9	29,000	1,445	0.272	-
2008 - Jul	16.8	30,700	1,710	0.136 U	-
2008 - Oct	17.4	36,600	2,000	0.0380 U	-
2009 - Jan	18.7	35,700	3,300	0.129	-

28-32 ft bgs	As	Fe	Mn	Pb	Th
2002 - May	9.92	34,000	2,560	3.63	0.23 J
2008 - Apr	2.69	25,100	3,280	0.0560	-
2008 - Jul	3.21	23,800	2,930	0.0300 U	-
2008 - Oct	3.50	25,850	3,110	0.0200 U	-
2009 - Jan	2.90	28,150	5,385	0.00600 U	-

24-32 ft bgs	As	Fe	Mn	Pb	Th
1999 - Nov	5.00 U	32,800	4,110	3.00 U	5.00 U
2000 - Jan	5.00 U	25,400	3,300	3.00 U	5.00 U
2002 - May	3.60	20,600	2,110	0.500 U	0.115 J
2008 - Apr	2.65	19,300	2,210	0.442	-
2008 - Jul	2.85	21,500	2,460	0.0740 U	-
2008 - Oct	4.16	25,100	2,840	0.0680 U	-
2009 - Jan	2.30	21,300	4,220	0.102	-

15-21 ft bgs	As	Fe	Mn	Pb	Th
2002 - May	0.728 J	929	355	1.05	0.166 J
2008 - Apr	0.720 U	2,550	103	0.718	-
2009 - Jan	0.500 U	532	10.4	0.871	-

16-23 ft bgs	As	Fe	Mn	Pb	Th
1999 - July	-	-	-	-	-
1999 - Nov	5.00 U	119	23.2	3.00 U	5.00 U
2000 - Jan	5.00 U	53.1	10.0 U	3.00 U	5.00 U
2002 - May	0.138 J	33.1 J	3.17	0.500 U	0.159 J
2008 - Apr	0.35 J	112	6.25	0.154	-
2008 - Jul	0.400 J	57.8 U	4.2 J	0.0560 U	-
2008 - Oct	0.520	9.4 J	0.810	0.0200 U	-
2009 - Jan	0.500 U	60.6 U	2.07	0.0400	-

25-31 ft bgs	As	Fe	Mn	Pb	Th
1999 - July	-	-	-	-	-
1999 - Nov	15.4	73.7	25.5	3.00 U	5.00 U
2000 - Jan	16.2	66.0	14.0	3.00 U	5.00 U
2002 - May	18.9	6,100	157	7.95	0.230 J
2008 - Apr	21.3	75.5	3.85	0.558	-
2008 - Jul	19.6	7,910	291	6.36	-
2008 - Oct	16.2	2,620	69.0	1.70	-
2009 - Jan	15.8	4,710	77.6	1.44	-

55-59 ft bgs	As	Fe	Mn	Pb	Th
2002 - May	1.08	4,560	411	1.90	0.243 J
2008 - Apr	6.86	854	265	0.463	-
2008 - Jul	5.76	631	173	0.540	-
2008 - Oct	5.40	33.7 U	172	0.338	-
2009 - Jan	7.20	112	270	0.140	-

18-26 ft bgs	As	Fe	Mn	Pb	Th
1999 - July	-	-	-	-	-
1999 - Nov	5.00 U	9,755	1,380	3.00 U	5.00 U
2000 - Jan	5.00 U	157	194	3.00 U	5.00 U
2002 - May	2.45	12,200	327	78.2	0.197 J
2008 - Apr	0.550	746	53.2	26.9	-
2008 - Jul	0.3 J	14,700	780	4.96	-
2008 - Oct	0.34 J	28,100	1,260	1.65	-
2009 - Jan	0.500 U	156	36.8	7.45	-

27-30 ft bgs	As	Fe	Mn	Pb	Th
1999 - July	-	-	-	-	-
1999 - Nov	6.00	508	39.3	3.00 U	5.00 U
2000 - Jan	7.00	238	14.6	3.00 U	5.00 U
2002 - May	7.00	2,320	71.7	2.78	0.159 J
2008 - Apr	6.93	185	6.74	0.397	-
2008 - Jul	9.06	178	4.5 J	0.556	-
2008 - Oct	8.81	174	2.50	0.343	-
2009 - Jan	8.20	198	3.25	0.377	-

LEGEND

⊕	Landfill Groundwater Sampling Location
⊞	Landfill Surface Water Sampling Location
★	Landfill Seep Monitoring Location
⬠	Excavation Limits
∿	2- Foot vertical elevation contour in feet NGVD
∿	Landfill Access Road
—	AOPC Boundary
– –	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
—	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
Date	Concentration (µg/L)

As = Arsenic
Fe = Iron
Mn = Manganese
SLV = screening level value
- = Not Analyzed
Pb = Lead
Th = Thallium

Water SLVs Used for Screening (µg/L):

As	Fe	Mn	Pb	Th
0.0180	300	50.0	2.50	0.240

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946
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PROJ. MANAGER: MP
APPROVED BY: LSM
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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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BRADFORD ISLAND

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LANDFILL AOPC

TOTAL METALS IN GROUNDWATER, SEEP WATER, AND SURFACE WATER

DRAWING NUMBER: FIGURE 9-3a
CAD FILE NUMBER: FIG 9-3a
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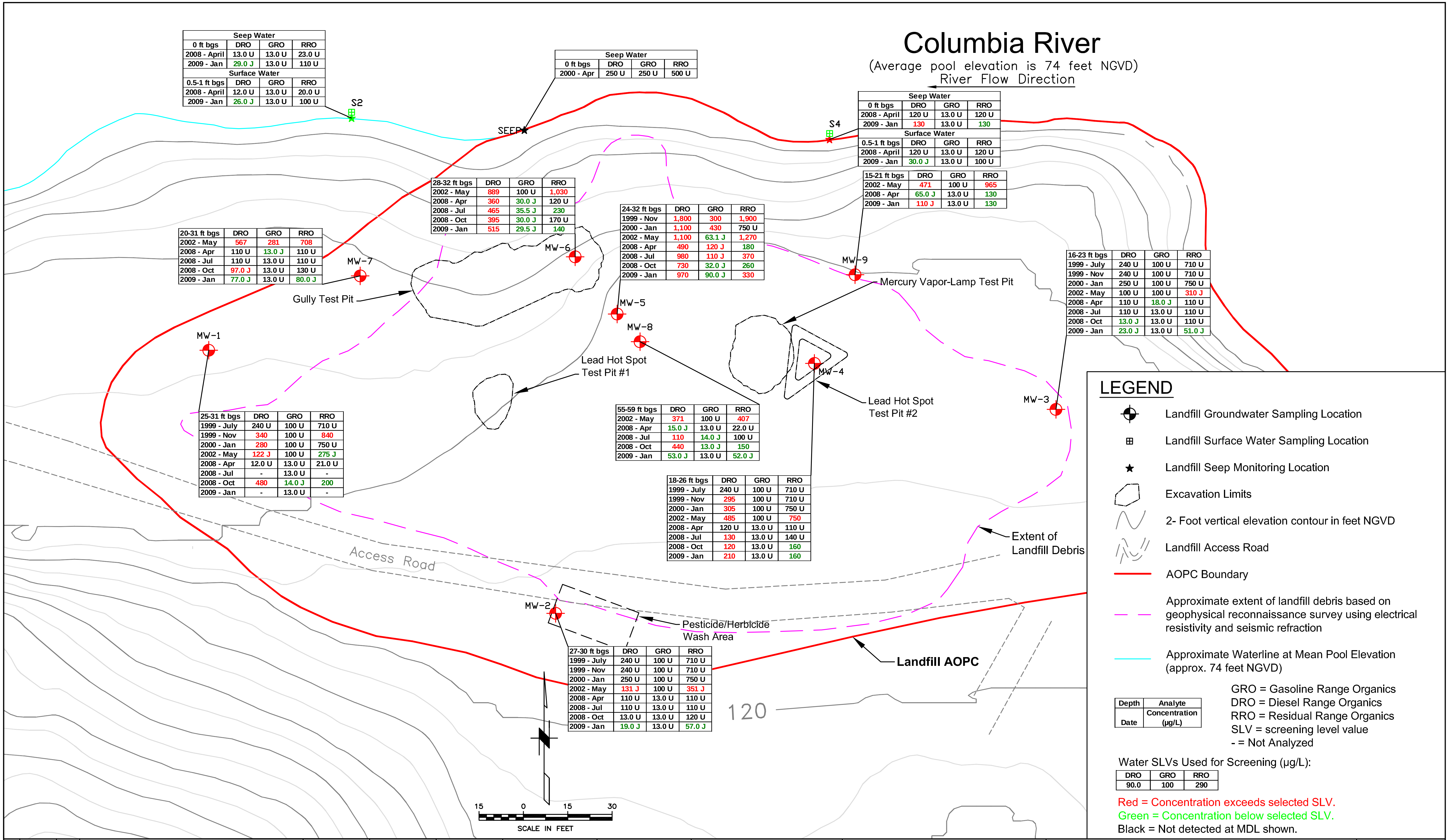

Seep Water			
0 ft bgs	DRO	GRO	RRO
2008 - April	13.0 U	13.0 U	23.0 U
2009 - Jan	29.0 J	13.0 U	110 U
Surface Water			
0.5-1 ft bgs	DRO	GRO	RRO
2008 - April	12.0 U	13.0 U	20.0 U
2009 - Jan	26.0 J	13.0 U	100 U

Seep Water			
0 ft bgs	DRO	GRO	RRO
2000 - Apr	250 U	250 U	500 U

Seep Water			
0 ft bgs	DRO	GRO	RRO
2008 - April	120 U	13.0 U	120 U
2009 - Jan	130	13.0 U	130
Surface Water			
0.5-1 ft bgs	DRO	GRO	RRO
2008 - April	120 U	13.0 U	120 U
2009 - Jan	30.0 J	13.0 U	100 U

28-32 ft bgs	DRO	GRO	RRO
2002 - May	889	100 U	1,030
2008 - Apr	360	30.0 J	120 U
2008 - Jul	465	35.5 J	230
2008 - Oct	395	30.0 J	170 U
2009 - Jan	515	29.5 J	140

15-21 ft bgs	DRO	GRO	RRO
2002 - May	471	100 U	965
2008 - Apr	65.0 J	13.0 U	130
2009 - Jan	110 J	13.0 U	130

24-32 ft bgs	DRO	GRO	RRO
1999 - Nov	1,800	300	1,900
2000 - Jan	1,100	430	750 U
2002 - May	1,100	63.1 J	1,270
2008 - Apr	490	120 J	180
2008 - Jul	980	110 J	370
2008 - Oct	730	32.0 J	260
2009 - Jan	970	90.0 J	330

20-31 ft bgs	DRO	GRO	RRO
2002 - May	567	281	708
2008 - Apr	110 U	13.0 J	110 U
2008 - Jul	110 U	13.0 U	110 U
2008 - Oct	97.0 J	13.0 U	130 U
2009 - Jan	77.0 J	13.0 U	80.0 J

16-23 ft bgs	DRO	GRO	RRO
1999 - July	240 U	100 U	710 U
1999 - Nov	240 U	100 U	710 U
2000 - Jan	250 U	100 U	750 U
2002 - May	100 U	100 U	310 J
2008 - Apr	110 U	18.0 J	110 U
2008 - Jul	110 U	13.0 U	110 U
2008 - Oct	13.0 J	13.0 U	110 U
2009 - Jan	23.0 J	13.0 U	51.0 J

55-59 ft bgs	DRO	GRO	RRO
2002 - May	371	100 U	407
2008 - Apr	15.0 J	13.0 U	22.0 U
2008 - Jul	110	14.0 J	100 U
2008 - Oct	440	13.0 J	150
2009 - Jan	53.0 J	13.0 U	52.0 J

25-31 ft bgs	DRO	GRO	RRO
1999 - July	240 U	100 U	710 U
1999 - Nov	340	100 U	840
2000 - Jan	280	100 U	750 U
2002 - May	122 J	100 U	275 J
2008 - Apr	12.0 U	13.0 U	21.0 U
2008 - Jul	-	13.0 U	-
2008 - Oct	480	14.0 J	200
2009 - Jan	-	13.0 U	-

18-26 ft bgs	DRO	GRO	RRO
1999 - July	240 U	100 U	710 U
1999 - Nov	295	100 U	710 U
2000 - Jan	305	100 U	750 U
2002 - May	485	100 U	750
2008 - Apr	120 U	13.0 U	110 U
2008 - Jul	130	13.0 U	140 U
2008 - Oct	120	13.0 U	160
2009 - Jan	210	13.0 U	160

27-30 ft bgs	DRO	GRO	RRO
1999 - July	240 U	100 U	710 U
1999 - Nov	240 U	100 U	710 U
2000 - Jan	250 U	100 U	750 U
2002 - May	131 J	100 U	351 J
2008 - Apr	110 U	13.0 U	110 U
2008 - Jul	110 U	13.0 U	110 U
2008 - Oct	13.0 U	13.0 U	120 U
2009 - Jan	19.0 J	13.0 U	57.0 J

LEGEND

⌖	Landfill Groundwater Sampling Location
⊞	Landfill Surface Water Sampling Location
★	Landfill Seep Monitoring Location
	Excavation Limits
	2- Foot vertical elevation contour in feet NGVD
	Landfill Access Road
	AOPC Boundary
	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
Date	Concentration (µg/L)

GRO = Gasoline Range Organics
DRO = Diesel Range Organics
RRO = Residual Range Organics
SLV = screening level value
- = Not Analyzed

Water SLVs Used for Screening (µg/L):

DRO	GRO	RRO
90.0	100	290

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
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URS
111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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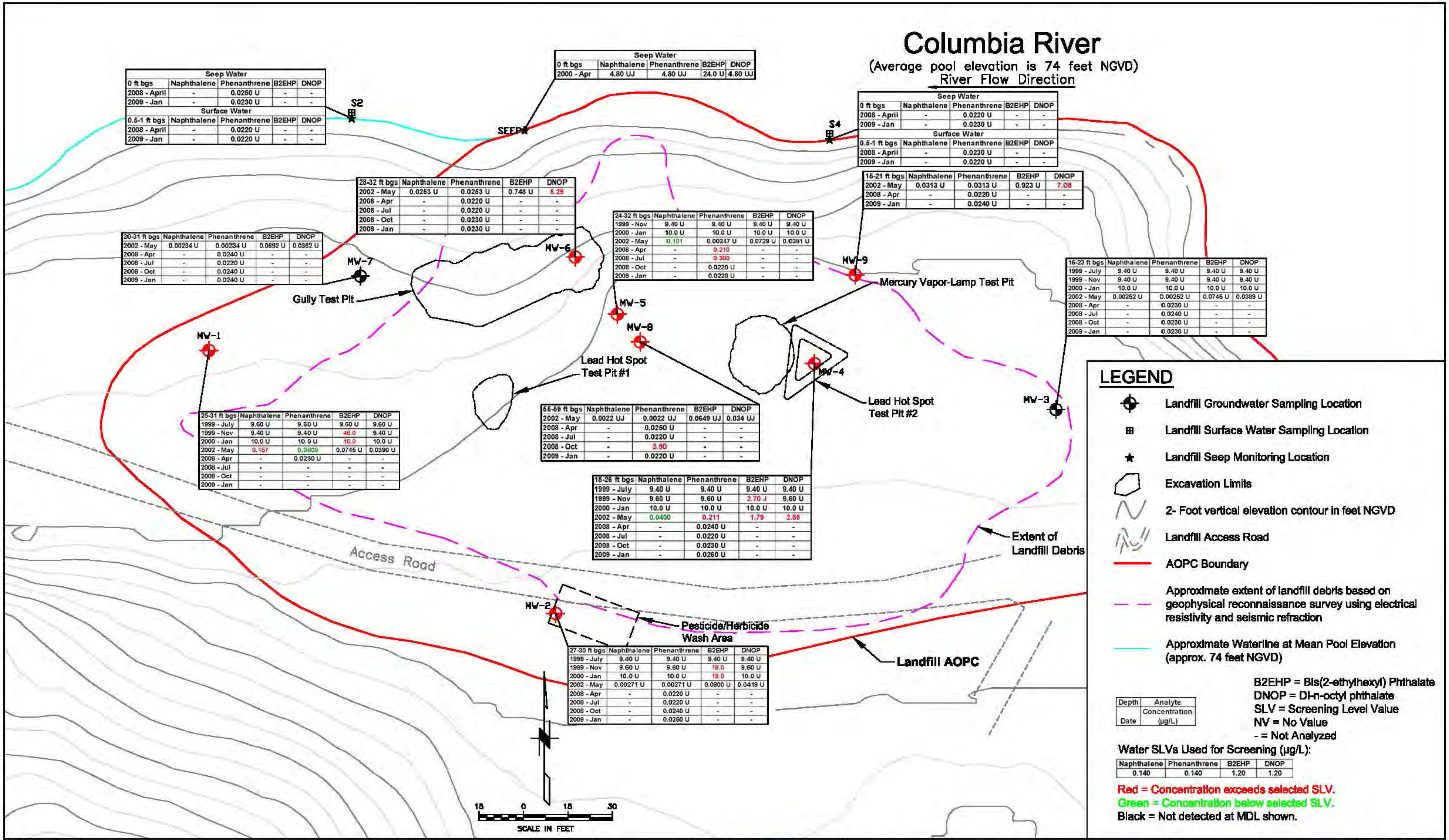
BRADFORD ISLAND
CASCADE LOCKS, OREGON

LANDFILL AOPC
TPH IN GROUNDWATER, SEEP WATER, AND SURFACE WATER

DRAWING NUMBER: FIGURE 9-3b
CAD FILE NUMBER: FIG 9-3b
SHEET: OF
REV.



Seep Water

0 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2008 - April	-	0.0250 U	-	-
2009 - Jan	-	0.0230 U	-	-

Surface Water

0.5-1 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2008 - April	-	0.0220 U	-	-
2009 - Jan	-	0.0220 U	-	-

Seep Water

0 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2000 - Apr	4.80 UJ	4.80 UJ	24.0 U	4.80 UJ

Seep Water

0 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2008 - April	-	0.0220 U	-	-
2009 - Jan	-	0.0230 U	-	-

Surface Water

0.5-1 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2008 - April	-	0.0230 U	-	-
2009 - Jan	-	0.0220 U	-	-

28-32 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2002 - May	0.0253 U	0.0253 U	0.748 U	5.29
2008 - Apr	-	0.0220 U	-	-
2008 - Jul	-	0.0220 U	-	-
2008 - Oct	-	0.0230 U	-	-
2009 - Jan	-	0.0230 U	-	-

15-21 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2002 - May	0.0313 U	0.0313 U	0.923 U	7.08
2008 - Apr	-	0.0220 U	-	-
2009 - Jan	-	0.0240 U	-	-

20-31 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2002 - May	0.00234 U	0.00234 U	0.0692 U	0.0362 U
2008 - Apr	-	0.0240 U	-	-
2008 - Jul	-	0.0220 U	-	-
2008 - Oct	-	0.0240 U	-	-
2009 - Jan	-	0.0240 U	-	-

24-32 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
1999 - Nov	9.40 U	9.40 U	9.40 U	9.40 U
2000 - Jan	10.0 U	10.0 U	10.0 U	10.0 U
2002 - May	0.101	0.00247 U	0.0729 U	0.0381 U
2008 - Apr	-	0.210	-	-
2008 - Jul	-	0.300	-	-
2008 - Oct	-	0.0220 U	-	-
2009 - Jan	-	0.0220 U	-	-

16-23 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
1999 - July	9.40 U	9.40 U	9.40 U	9.40 U
1999 - Nov	9.40 U	9.40 U	9.40 U	9.40 U
2000 - Jan	10.0 U	10.0 U	10.0 U	10.0 U
2002 - May	0.00252 U	0.00252 U	0.0745 U	0.0389 U
2008 - Apr	-	0.0230 U	-	-
2008 - Jul	-	0.0240 U	-	-
2008 - Oct	-	0.0230 U	-	-
2009 - Jan	-	0.0230 U	-	-

25-31 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
1999 - July	9.60 U	9.60 U	9.60 U	9.60 U
1999 - Nov	9.40 U	9.40 U	48.0	9.40 U
2000 - Jan	10.0 U	10.0 U	10.0	10.0 U
2002 - May	0.157	0.0800	0.0745 U	0.0390 U
2008 - Apr	-	0.0230 U	-	-
2008 - Jul	-	-	-	-
2008 - Oct	-	-	-	-
2009 - Jan	-	-	-	-

55-59 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
2002 - May	0.0022 UJ	0.0022 UJ	0.0649 UJ	0.034 UJ
2008 - Apr	-	0.0250 U	-	-
2008 - Jul	-	0.0220 U	-	-
2008 - Oct	-	3.90	-	-
2009 - Jan	-	0.0220 U	-	-

18-26 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
1999 - July	9.40 U	9.40 U	9.40 U	9.40 U
1999 - Nov	9.60 U	9.60 U	2.70 J	9.60 U
2000 - Jan	10.0 U	10.0 U	10.0 U	10.0 U
2002 - May	0.0400	0.211	1.79	2.86
2008 - Apr	-	0.0240 U	-	-
2008 - Jul	-	0.0220 U	-	-
2008 - Oct	-	0.0230 U	-	-
2009 - Jan	-	0.0260 U	-	-

27-30 ft bgs	Naphthalene	Phenanthrene	B2EHP	DNOP
1999 - July	9.40 U	9.40 U	9.40 U	9.40 U
1999 - Nov	9.60 U	9.60 U	19.0	9.60 U
2000 - Jan	10.0 U	10.0 U	19.0	10.0 U
2002 - May	0.00271 U	0.00271 U	0.0800 U	0.0419 U
2008 - Apr	-	0.0220 U	-	-
2008 - Jul	-	0.0220 U	-	-
2008 - Oct	-	0.0240 U	-	-
2009 - Jan	-	0.0250 U	-	-

LEGEND

⌖	Landfill Groundwater Sampling Location
⊞	Landfill Surface Water Sampling Location
★	Landfill Seep Monitoring Location
⬡	Excavation Limits
∿	2- Foot vertical elevation contour in feet NGVD
∿	Landfill Access Road
—	AOPC Boundary
– –	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
—	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
Date	Concentration (µg/L)

B2EHP = Bis(2-ethylhexyl) Phthalate
DNOP = Di-n-octyl phthalate
SLV = Screening Level Value
NV = No Value
- = Not Analyzed

Water SLVs Used for Screening (µg/L):

Naphthalene	Phenanthrene	B2EHP	DNOP
0.140	0.140	1.20	1.20

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: NOV 2010

URS
111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
www.urscorp.com

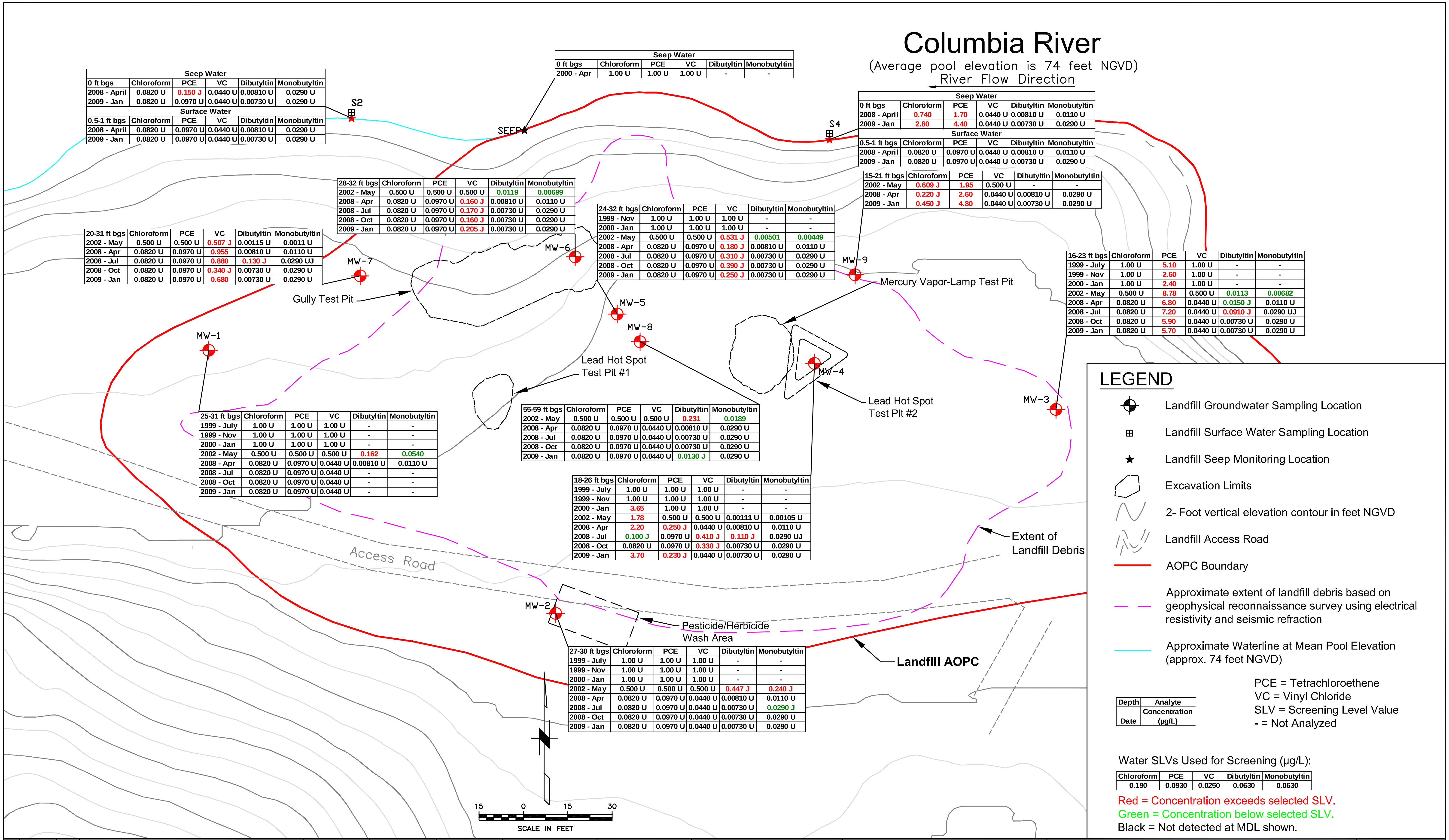
BRADFORD ISLAND
CASCADE LOCKS, OREGON

LANDFILL AOPC
PAHs AND SVOCs IN GROUNDWATER, SEEP WATER, AND SURFACE WATER

DRAWING NUMBER: FIGURE 9-3c
CAD FILE NUMBER: FIG 9-3c
SHEET: OF
REV.

c:\25692709 USACE\53-F0072173.00 Bradford\1 F\North DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-3c - PAHs and SVOCs in Groundwater, Seep Water, and Surface Water.dwg Feb 13, 2012 - 2:16pm

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-3d – VOCs and Butyltins in Groundwater, Seep Water, and Surface Water.dwg Nov 22, 2010 – 7:59am



Seep Water					
0 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2008 - April	0.0820 U	0.150 J	0.0440 U	0.00810 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U
Surface Water					
0.5-1 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2008 - April	0.0820 U	0.0970 U	0.0440 U	0.00810 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U

Seep Water					
0 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2000 - Apr	1.00 U	1.00 U	1.00 U	-	-

Seep Water					
0 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2008 - April	0.740	1.70	0.0440 U	0.00810 U	0.0110 U
2009 - Jan	2.80	4.40	0.0440 U	0.00730 U	0.0290 U
Surface Water					
0.5-1 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2008 - April	0.0820 U	0.0970 U	0.0440 U	0.00810 U	0.0110 U
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U

28-32 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2002 - May	0.500 U	0.500 U	0.500 U	0.0119	0.00699
2008 - Apr	0.0820 U	0.0970 U	0.160 J	0.00810 U	0.0110 U
2008 - Jul	0.0820 U	0.0970 U	0.170 J	0.00730 U	0.0290 U
2008 - Oct	0.0820 U	0.0970 U	0.160 J	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.205 J	0.00730 U	0.0290 U

15-21 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2002 - May	0.609 J	1.95	0.500 U	-	-
2008 - Apr	0.220 J	2.60	0.0440 U	0.00810 U	0.0290 U
2009 - Jan	0.450 J	4.80	0.0440 U	0.00730 U	0.0290 U

20-31 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2002 - May	0.500 U	0.500 U	0.507 J	0.00115 U	0.0011 U
2008 - Apr	0.0820 U	0.0970 U	0.955	0.00810 U	0.0110 U
2008 - Jul	0.0820 U	0.0970 U	0.880	0.130 J	0.0290 UJ
2008 - Oct	0.0820 U	0.0970 U	0.340 J	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.680	0.00730 U	0.0290 U

24-32 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
1999 - Nov	1.00 U	1.00 U	1.00 U	-	-
2000 - Jan	1.00 U	1.00 U	1.00 U	-	-
2002 - May	0.500 U	0.500 U	0.531 J	0.00501	0.00449
2008 - Apr	0.0820 U	0.0970 U	0.180 J	0.00810 U	0.0110 U
2008 - Jul	0.0820 U	0.0970 U	0.310 J	0.00730 U	0.0290 U
2008 - Oct	0.0820 U	0.0970 U	0.390 J	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.250 J	0.00730 U	0.0290 U

16-23 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
1999 - July	1.00 U	5.10	1.00 U	-	-
1999 - Nov	1.00 U	2.60	1.00 U	-	-
2000 - Jan	1.00 U	2.40	1.00 U	-	-
2002 - May	0.500 U	8.78	0.500 U	0.0113	0.00682
2008 - Apr	0.0820 U	6.80	0.0440 U	0.0150 J	0.0110 U
2008 - Jul	0.0820 U	7.20	0.0440 U	0.0910 J	0.0290 UJ
2008 - Oct	0.0820 U	5.90	0.0440 U	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	5.70	0.0440 U	0.00730 U	0.0290 U

25-31 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
1999 - July	1.00 U	1.00 U	1.00 U	-	-
1999 - Nov	1.00 U	1.00 U	1.00 U	-	-
2000 - Jan	1.00 U	1.00 U	1.00 U	-	-
2002 - May	0.500 U	0.500 U	0.500 U	0.162	0.0540
2008 - Apr	0.0820 U	0.0970 U	0.0440 U	0.00810 U	0.0110 U
2008 - Jul	0.0820 U	0.0970 U	0.0440 U	-	-
2008 - Oct	0.0820 U	0.0970 U	0.0440 U	-	-
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	-	-

55-59 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
2002 - May	0.500 U	0.500 U	0.500 U	0.231	0.0189
2008 - Apr	0.0820 U	0.0970 U	0.0440 U	0.00810 U	0.0290 U
2008 - Jul	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U
2008 - Oct	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	0.0130 J	0.0290 U

18-26 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
1999 - July	1.00 U	1.00 U	1.00 U	-	-
1999 - Nov	1.00 U	1.00 U	1.00 U	-	-
2000 - Jan	3.65	1.00 U	1.00 U	-	-
2002 - May	1.78	0.500 U	0.500 U	0.00111 U	0.00105 U
2008 - Apr	2.20	0.250 J	0.0440 U	0.00810 U	0.0110 U
2008 - Jul	0.100 J	0.0970 U	0.410 J	0.110 J	0.0290 UJ
2008 - Oct	0.0820 U	0.0970 U	0.330 J	0.00730 U	0.0290 U
2009 - Jan	3.70	0.230 J	0.0440 U	0.00730 U	0.0290 U

27-30 ft bgs	Chloroform	PCE	VC	Dibutyltin	Monobutyltin
1999 - July	1.00 U	1.00 U	1.00 U	-	-
1999 - Nov	1.00 U	1.00 U	1.00 U	-	-
2000 - Jan	1.00 U	1.00 U	1.00 U	-	-
2002 - May	0.500 U	0.500 U	0.500 U	0.447 J	0.240 J
2008 - Apr	0.0820 U	0.0970 U	0.0440 U	0.00810 U	0.0110 U
2008 - Jul	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 J
2008 - Oct	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U
2009 - Jan	0.0820 U	0.0970 U	0.0440 U	0.00730 U	0.0290 U

LEGEND

⊕	Landfill Groundwater Sampling Location
⊞	Landfill Surface Water Sampling Location
★	Landfill Seep Monitoring Location
⬠	Excavation Limits
∿	2- Foot vertical elevation contour in feet NGVD
⋰	Landfill Access Road
—	AOPC Boundary
– –	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
—	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Depth	Analyte
Date	Concentration (µg/L)

PCE = Tetrachloroethene
VC = Vinyl Chloride
SLV = Screening Level Value
- = Not Analyzed

Water SLVs Used for Screening (µg/L):

Chloroform	PCE	VC	Dibutyltin	Monobutyltin
0.190	0.0930	0.0250	0.0630	0.0630

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL shown.

No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: NOV 2010

URS
111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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BRADFORD ISLAND
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LANDFILL AOPC
VOCs AND BUTYLTINS IN GROUNDWATER,
SEEP WATER, AND SURFACE WATER

DRAWING NUMBER: FIGURE 9-3d
CAD FILE NUMBER: FIG 9-3d
SHEET: OF
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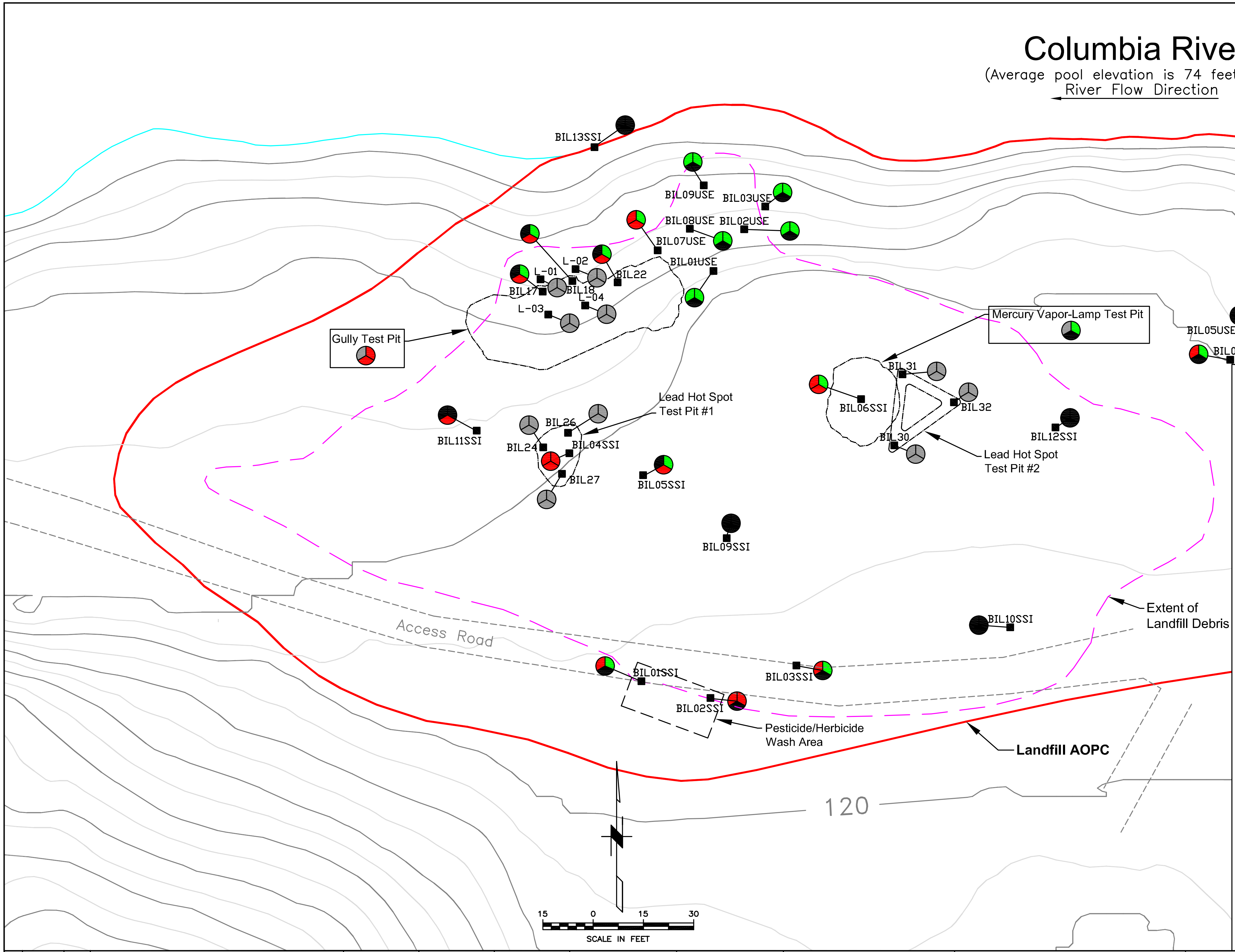
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-4a Summary of Herbicides, Pesticides, PCBs, and Dibenzofurans in Surface and Shallow Soil.dwg Nov 18, 2010 - 9:41am



LEGEND

■	Landfill Surface and Shallow Soil Monitoring Location
	Excavation Limits
	2- Foot vertical elevation contour in feet NGVD
	Landfill Access Road
	AOPC Boundary
	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Soil SLVs used for Screening (µg/kg):

2,4,5-T	Dichloroprop	MCPP	4,4'-DDT	Total PCBs (Aroclors)	Dibenzofuran
21.0	21.0	21.0	21.0	371	2

SLV = Screening Level Value

Summary of Herbicides, Pesticides, PCBs, and Dibenzofurans in Surface and Shallow Soil

- Herbicides/Pesticides Concentration
- PCBs Concentration
- Dibenzofuran Concentration

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL.
Gray = Not Analyzed.

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: JULY 2010

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Portland, Oregon 97201-5814
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(fax) 503-222-4292
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LANDFILL AOPC

SUMMARY OF HERBICIDES, PESTICIDES, PCBs,
AND DIBENZOFURAN IN SURFACE
AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-4a
CAD FILE NUMBER: FIG 9-4a
SHEET: OF
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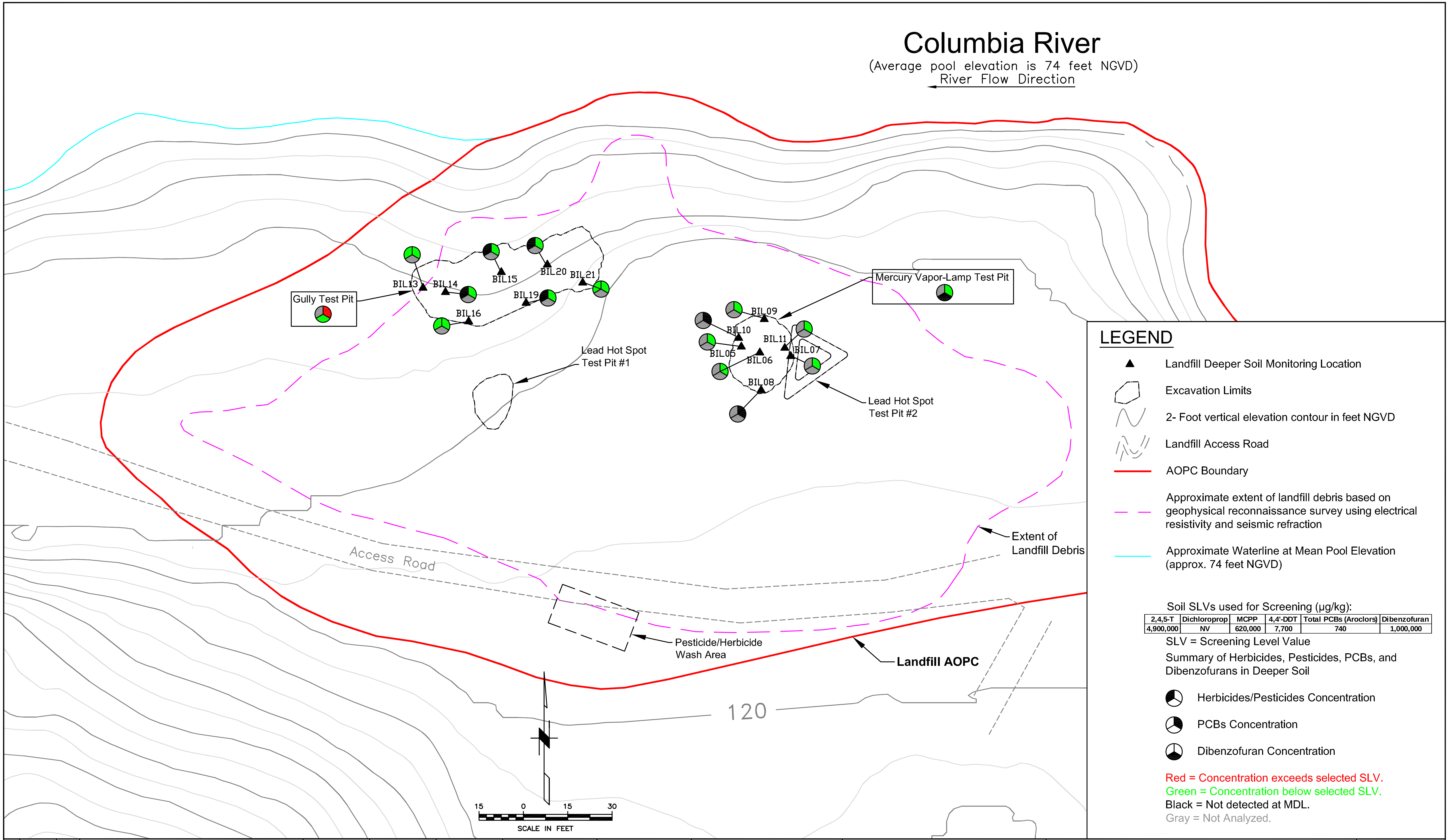

LEGEND

- ▲ Landfill Deeper Soil Monitoring Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Soil SLVs used for Screening (µg/kg):

2,4,5-T	Dichloroprop	MCPP	4,4'-DDT	Total PCBs (Aroclors)	Dibenzofuran
4,900,000	NV	620,000	7,700	740	1,000,000

SLV = Screening Level Value

Summary of Herbicides, Pesticides, PCBs, and Dibenzofurans in Deeper Soil

- Herbicides/Pesticides Concentration
- PCBs Concentration
- Dibenzofuran Concentration

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL.
Gray = Not Analyzed.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
www.urscorp.com

BRADFORD ISLAND

CASCADE LOCKS, OREGON

LANDFILL AOPC

SUMMARY OF HERBICIDES, PESTICIDES, PCBs,
AND DIBENZOFURAN IN DEEPER SOIL

DRAWING NUMBER: FIGURE 9-4b
CAD FILE NUMBER: FIG 9-4b
SHEET: OF
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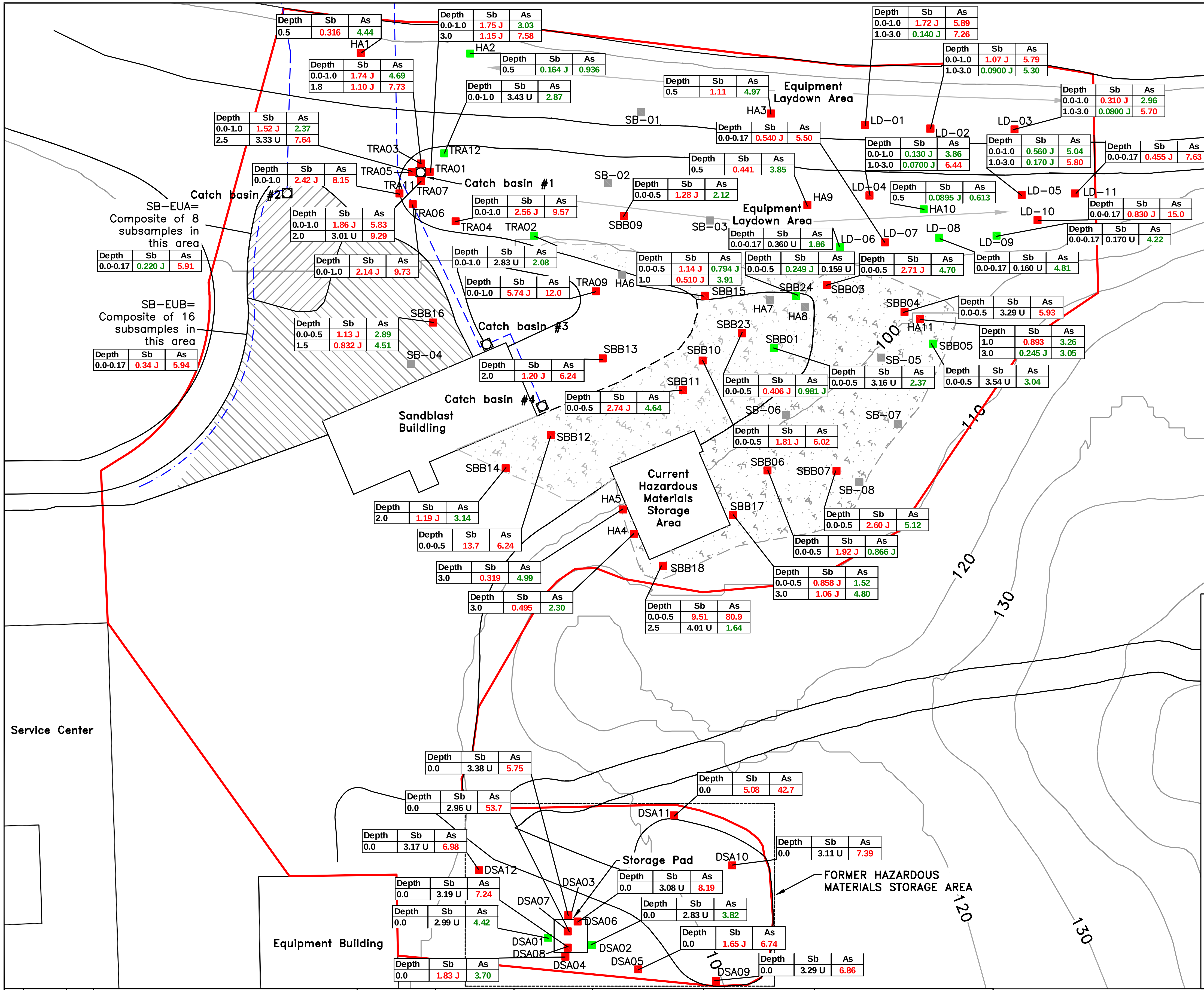

LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area

Depth	Analyte
feet bgs	Concentration (mg/kg)

Sb = Antimony
As = Arsenic
SLV = Screening Level Value

Soil SLVs used for screening (mg/kg):

Sb	As
0.270	5.40

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
Antimony and arsenic were not analyzed for at HA6 through HA8 or SB01 through SB08 (shown in gray).

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: NOV 2010

No.	DATE	BY	REVISION

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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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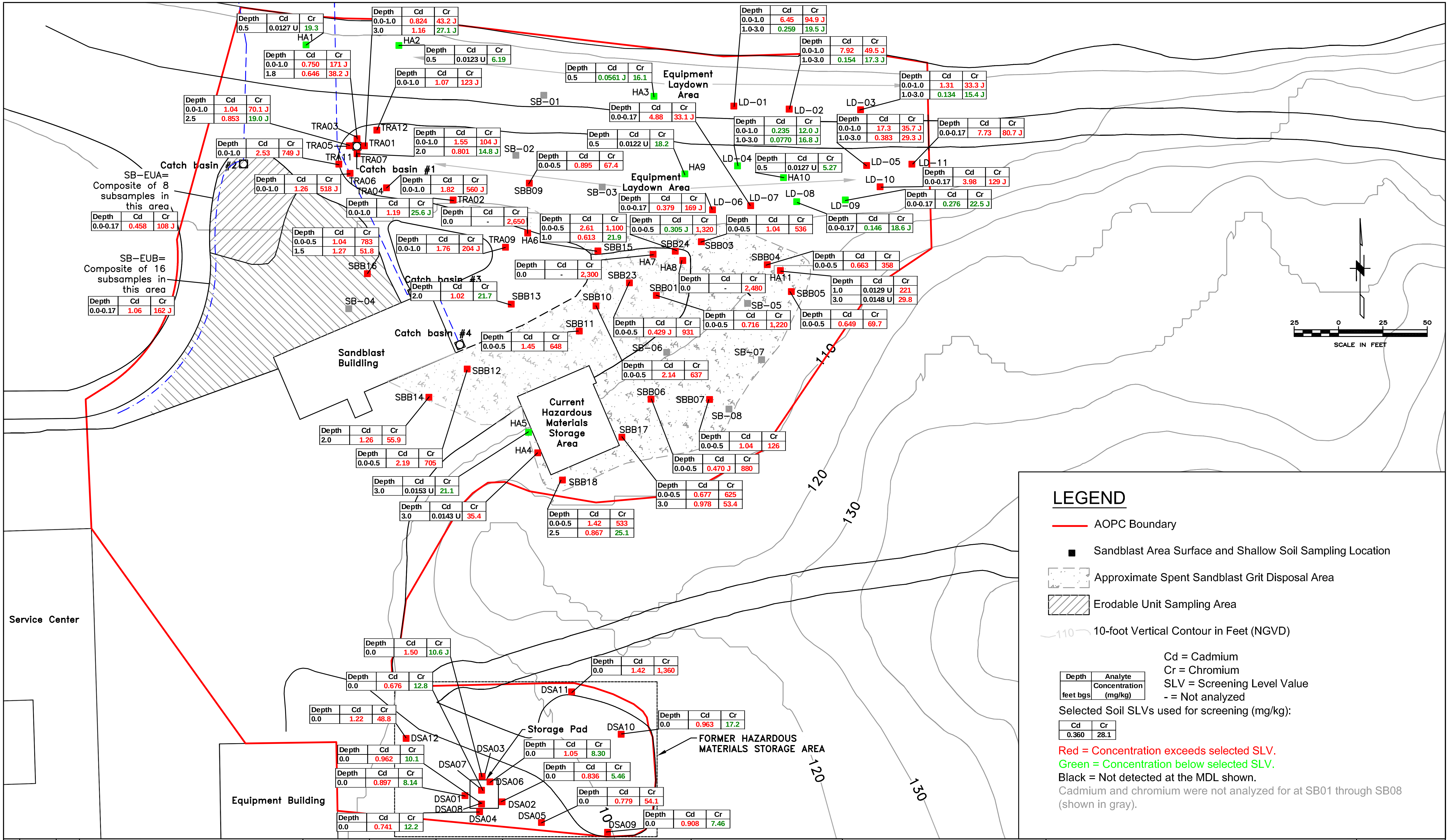
BRADFORD ISLAND
CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

ANTIMONY AND ARSENIC
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5a
CAD FILE NUMBER: FIG 9-5a
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5b – Cadmium and Chromium in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:43am



LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

Cd = Cadmium
Cr = Chromium
SLV = Screening Level Value
- = Not analyzed

Selected Soil SLVs used for screening (mg/kg):

Cd	Cr
0.360	28.1

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
Cadmium and chromium were not analyzed for at SB01 through SB08 (shown in gray).

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: JULY 2010

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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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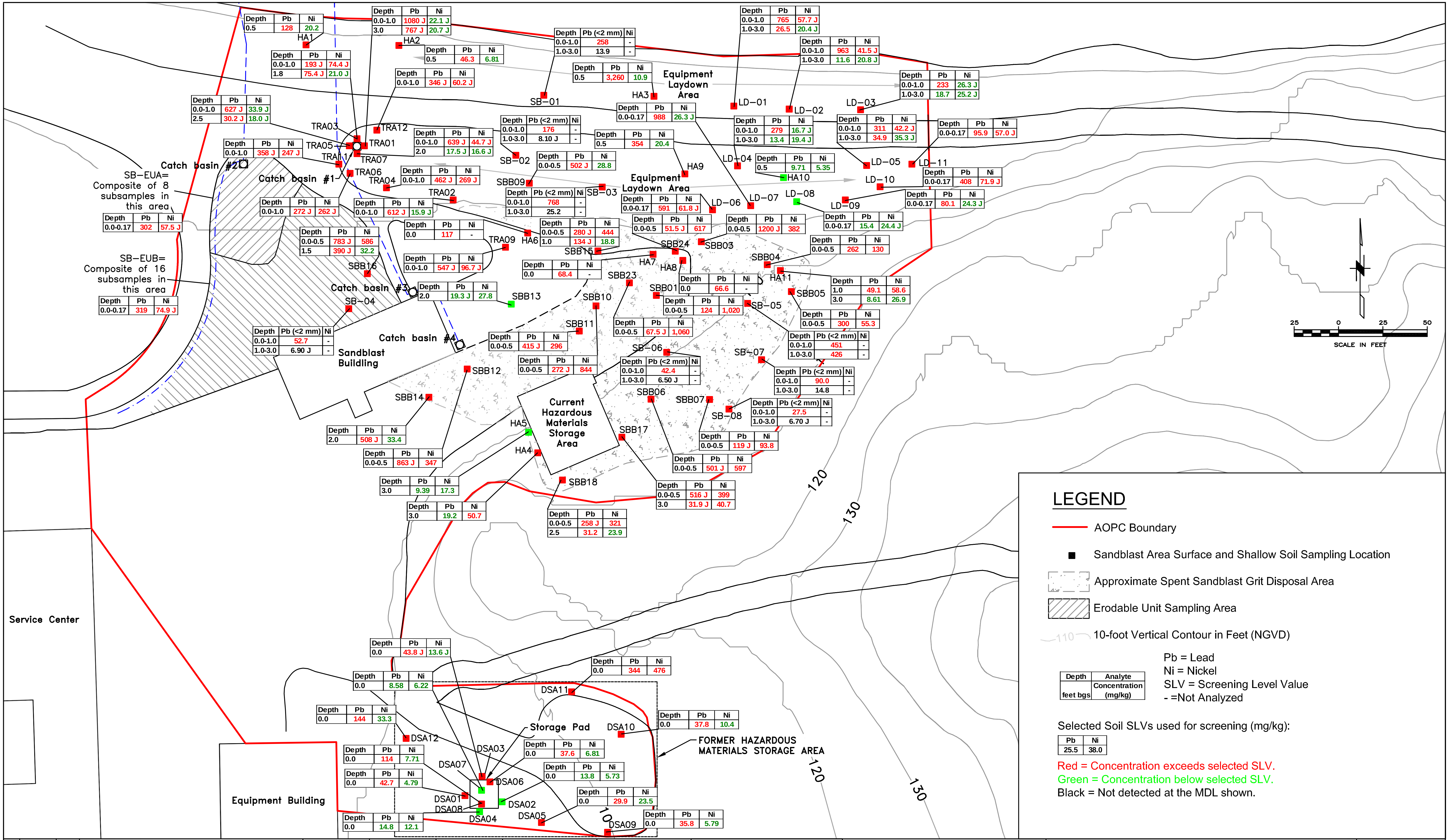
BRADFORD ISLAND
CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC
CADMIUM AND CHROMIUM
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5b
CAD FILE NUMBER: FIG 9-5b
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5c - Lead and Nickel in Surface and Shallow Soil.dwg Nov 18, 2010 - 9:44am



LEGEND

—	AOPC Boundary
■	Sandblast Area Surface and Shallow Soil Sampling Location
▨	Approximate Spent Sandblast Grit Disposal Area
▨	Erodable Unit Sampling Area
110	10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

Pb = Lead
Ni = Nickel
SLV = Screening Level Value
- =Not Analyzed

Selected Soil SLVs used for screening (mg/kg):

Pb	Ni
25.5	38.0

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
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SANDBLAST AREA AOPC
LEAD AND NICKEL
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5c
CAD FILE NUMBER: FIG 9-5c
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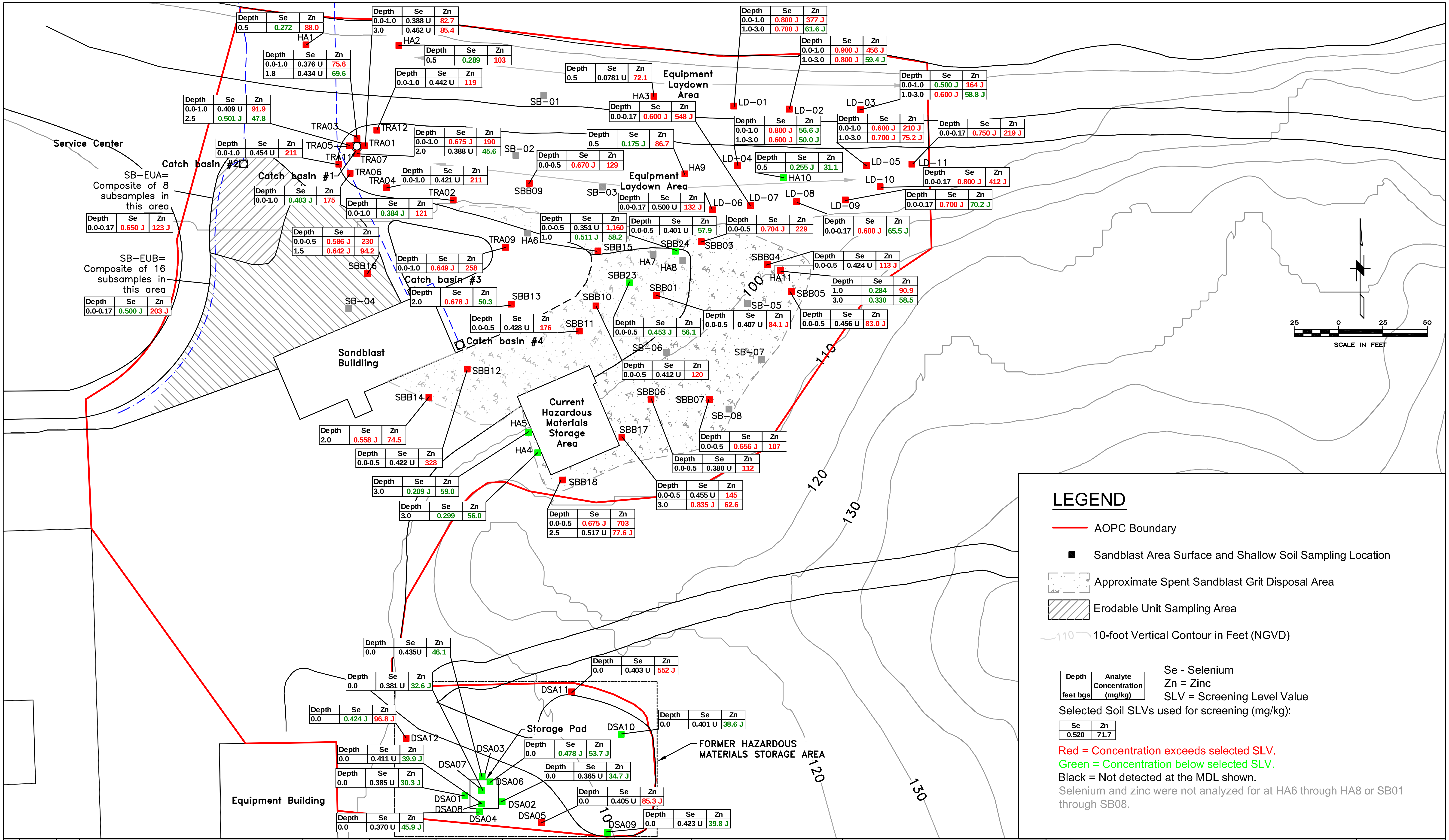
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5d - Selenium and Zinc in Surface and Shallow Soil.dwg Nov 18, 2010 - 9:44am



LEGEND

🟥 AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

▨ Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

Se - Selenium
Zn = Zinc
SLV = Screening Level Value

Selected Soil SLVs used for screening (mg/kg):

Se	Zn
0.520	71.7

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
Selenium and zinc were not analyzed for at HA6 through HA8 or SB01 through SB08.

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DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
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SANDBLAST AREA AOPC

SELENIUM AND ZINC
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5d
CAD FILE NUMBER: FIG 9-5d
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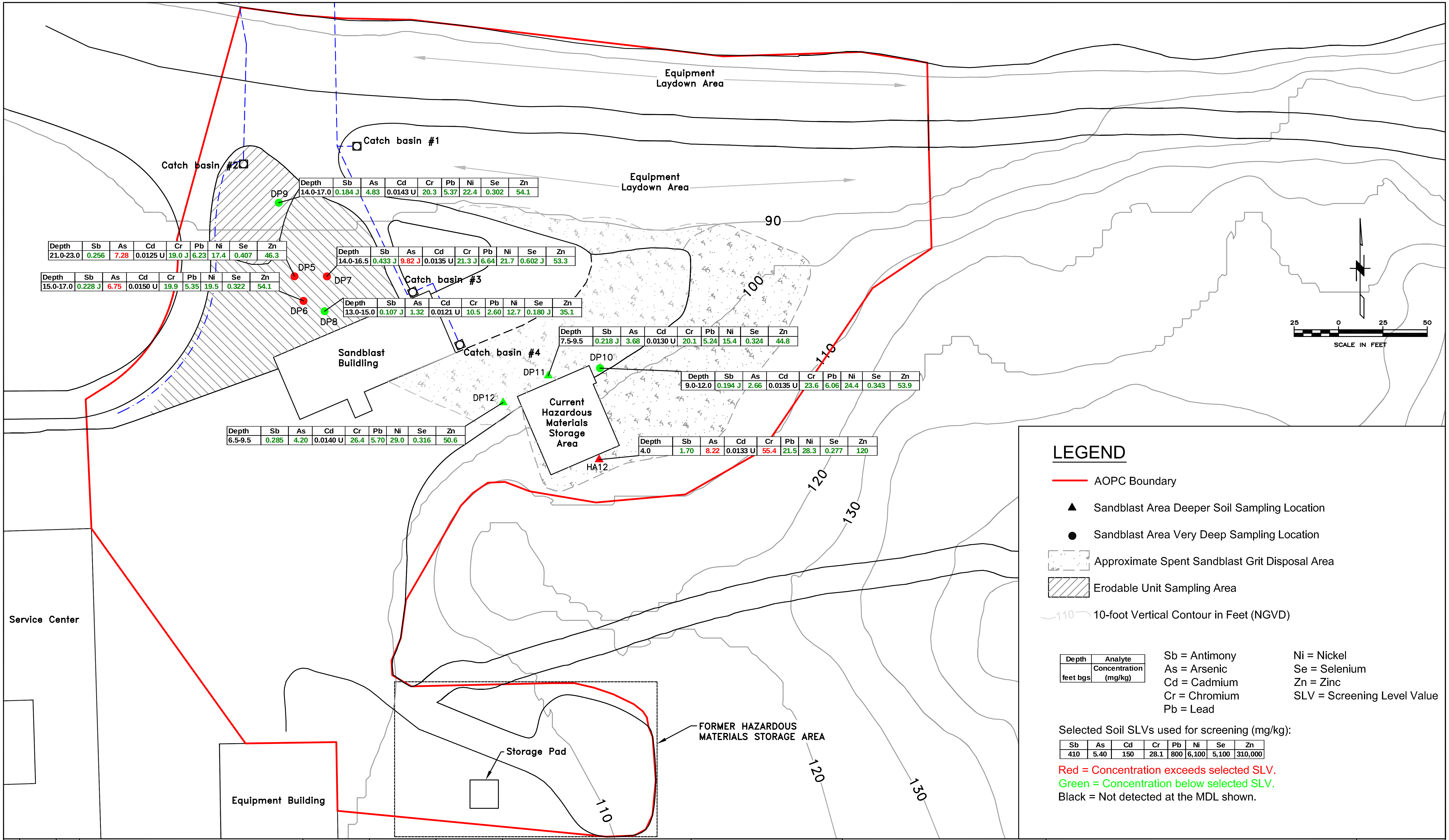
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5e - Metals in Deeper Soil and Very Deep Soil (g10 ft bgs).dwg Nov 18, 2010 - 9:45am



DP9

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
14.0-17.0	0.184 J	4.83	0.0143 U	20.3	5.37	22.4	0.302	54.1

DP5

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
21.0-23.0	0.256	7.28	0.0125 U	19.0 J	6.23	17.4	0.407	46.3

DP7

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
14.0-16.5	0.433 J	9.82 J	0.0135 U	21.3 J	6.64	21.7	0.602 J	53.3

DP6

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
15.0-17.0	0.228 J	6.75	0.0150 U	19.9	5.35	19.5	0.322	54.1

DP8

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
13.0-15.0	0.107 J	1.32	0.0121 U	10.5	2.60	12.7	0.180 J	35.1

DP11

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
7.5-9.5	0.218 J	3.68	0.0130 U	20.1	5.24	15.4	0.324	44.8

DP10

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
9.0-12.0	0.194 J	2.66	0.0135 U	23.6	6.06	24.4	0.343	53.9

DP12

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
6.5-9.5	0.285	4.20	0.0140 U	26.4	5.70	29.0	0.316	50.6

HA12

Depth	Sb	As	Cd	Cr	Pb	Ni	Se	Zn
4.0	1.70	8.22	0.0133 U	55.4	21.5	28.3	0.277	120

LEGEND

- AOPC Boundary
- ▲ Sandblast Area Deeper Soil Sampling Location
- ● Sandblast Area Very Deep Sampling Location
- ⬚ Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg)

Sb = Antimony
As = Arsenic
Cd = Cadmium
Cr = Chromium
Pb = Lead
Ni = Nickel
Se = Selenium
Zn = Zinc
SLV = Screening Level Value

Selected Soil SLVs used for screening (mg/kg):

Sb	As	Cd	Cr	Pb	Ni	Se	Zn
410	5.40	150	28.1	800	6,100	5,100	310,000

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

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SANDBLAST AREA AOPC

METALS IN DEEPER SOIL
AND VERY DEEP SOIL (> 10 ft bgs)

DRAWING NUMBER: FIGURE 9-5e
CAD FILE NUMBER: FIG 9-5e
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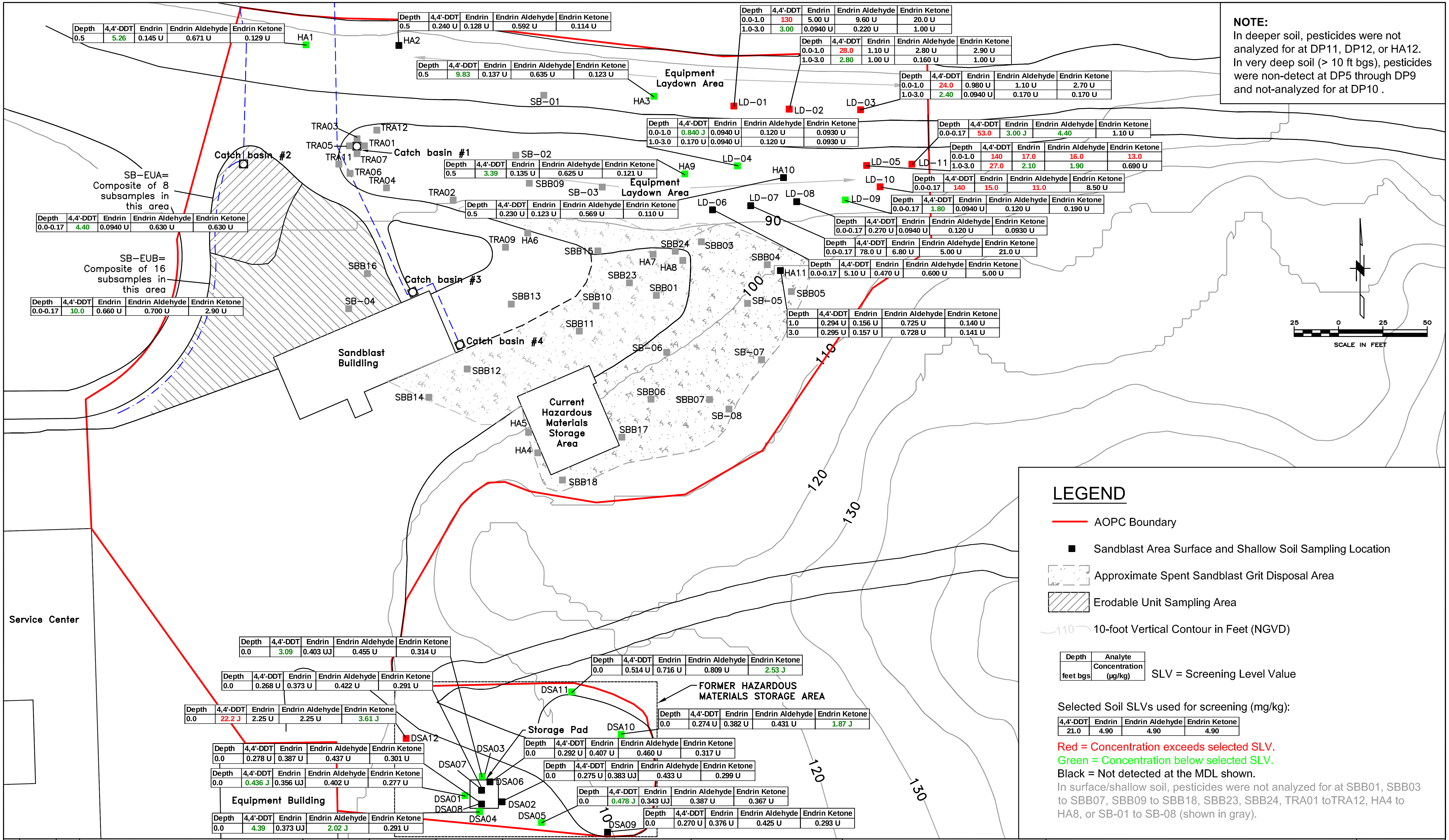
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5f – Pesticides in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:45am



Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.5	5.26	0.145 U	0.671 U	0.129 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.5	0.240 U	0.128 U	0.592 U	0.114 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.5	9.83	0.137 U	0.635 U	0.123 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-1.0	130	5.00 U	9.60 U	20.0 U
1.0-3.0	3.00	0.0940 U	0.220 U	1.00 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-1.0	28.0	1.10 U	2.80 U	2.90 U
1.0-3.0	2.80	1.00 U	0.160 U	1.00 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-1.0	24.0	0.980 U	1.10 U	2.70 U
1.0-3.0	2.40	0.0940 U	0.170 U	0.170 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	4.40	0.0940 U	0.630 U	0.630 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	10.0	0.660 U	0.700 U	2.90 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.5	3.39	0.135 U	0.625 U	0.121 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-1.0	0.840 J	0.0940 U	0.120 U	0.0930 U
1.0-3.0	0.170 U	0.0940 U	0.120 U	0.0930 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	53.0	3.00 J	4.40	1.10 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-1.0	140	17.0	16.0	13.0
1.0-3.0	27.0	2.10	1.90	0.690 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.5	0.230 U	0.123 U	0.569 U	0.110 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	140	15.0	11.0	8.50 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	1.80	0.0940 U	0.120 U	0.190 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	0.270 U	0.0940 U	0.120 U	0.0930 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	78.0 U	6.80 U	5.00 U	21.0 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0-0.17	5.10 U	0.470 U	0.600 U	5.00 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
1.0	0.294 U	0.156 U	0.725 U	0.140 U
3.0	0.295 U	0.157 U	0.728 U	0.141 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	3.09	0.403 UJ	0.455 U	0.314 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.514 U	0.716 U	0.809 U	2.53 J

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.268 U	0.373 U	0.422 U	0.291 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	22.2 J	2.25 U	2.25 U	3.61 J

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.274 U	0.382 U	0.431 U	1.87 J

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.292 U	0.407 U	0.460 U	0.317 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.278 U	0.387 U	0.437 U	0.301 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.275 U	0.383 UJ	0.433 U	0.299 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.436 J	0.356 UJ	0.402 U	0.277 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.478 J	0.343 UJ	0.387 U	0.367 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	4.39	0.373 UJ	2.02 J	0.291 U

Depth	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
0.0	0.270 U	0.376 U	0.425 U	0.293 U

NOTE:
In deeper soil, pesticides were not analyzed for at DP11, DP12, or HA12. In very deep soil (> 10 ft bgs), pesticides were non-detect at DP5 through DP9 and not-analyzed for at DP10 .

LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

SLV = Screening Level Value

Selected Soil SLVs used for screening (mg/kg):

4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
21.0	4.90	4.90	4.90

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
In surface/shallow soil, pesticides were not analyzed for at SBB01, SBB03 to SBB07, SBB09 to SBB18, SBB23, SBB24, TRA01 toTRA12, HA4 to HA8, or SB-01 to SB-08 (shown in gray).

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
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	CHECKED BY: LSM	DATE: NOV 2010

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SANDBLAST AREA AOPC

PESTICIDES IN SURFACE
AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5f
CAD FILE NUMBER: FIG 9-5f
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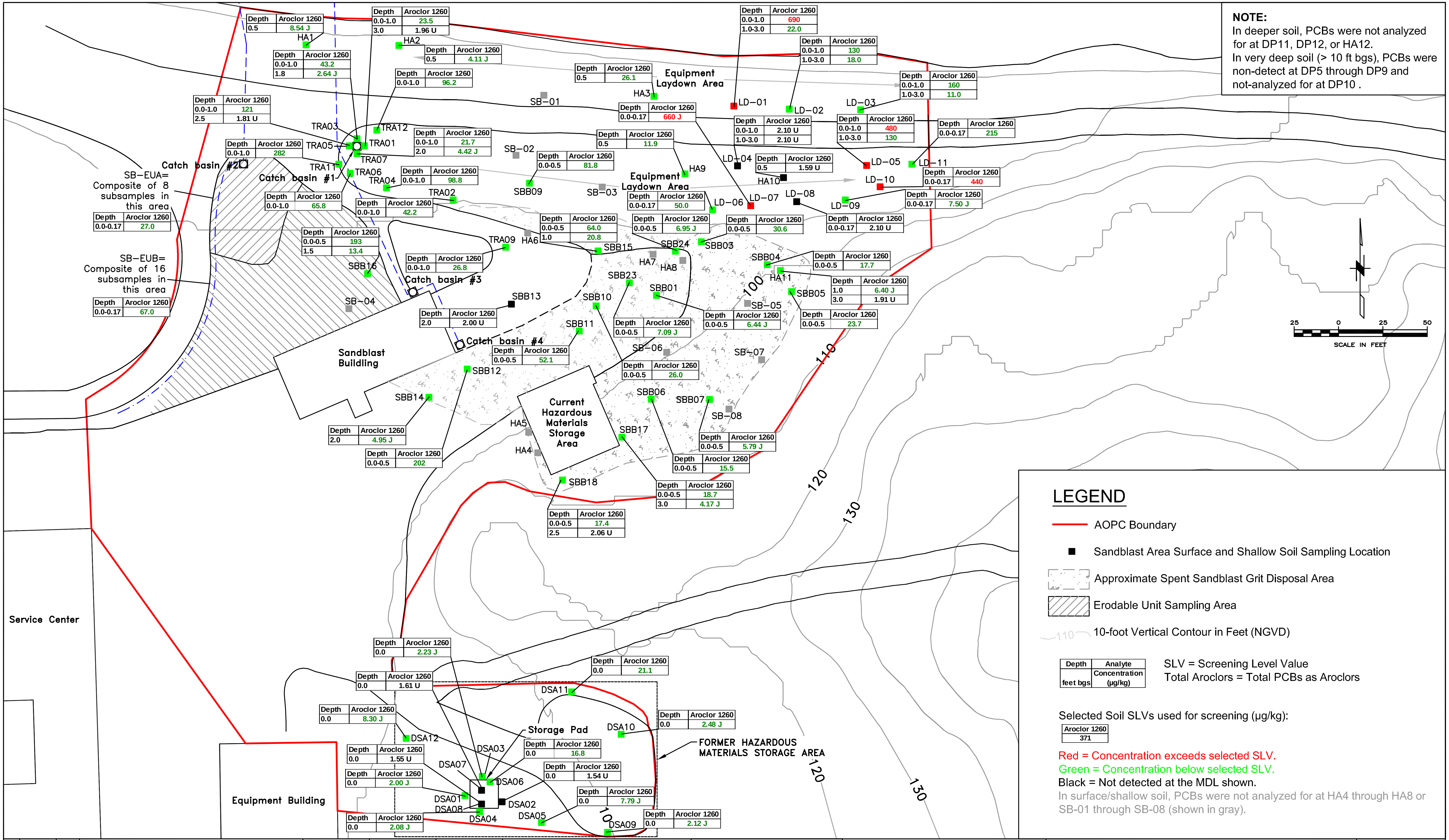
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5g – PCBs in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:46am



NOTE:
In deeper soil, PCBs were not analyzed for at DP11, DP12, or HA12.
In very deep soil (> 10 ft bgs), PCBs were non-detect at DP5 through DP9 and not-analyzed for at DP10 .

LEGEND

🟥 AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

SLV = Screening Level Value
Total Aroclors = Total PCBs as Aroclors

Selected Soil SLVs used for screening (µg/kg):

Aroclor 1260
371

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
In surface/shallow soil, PCBs were not analyzed for at HA4 through HA8 or SB-01 through SB-08 (shown in gray).

No.	DATE	BY	REVISION

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SANDBLAST AREA AOPC
PCBs IN SURFRACE
AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5g
CAD FILE NUMBER: FIG 9-5g
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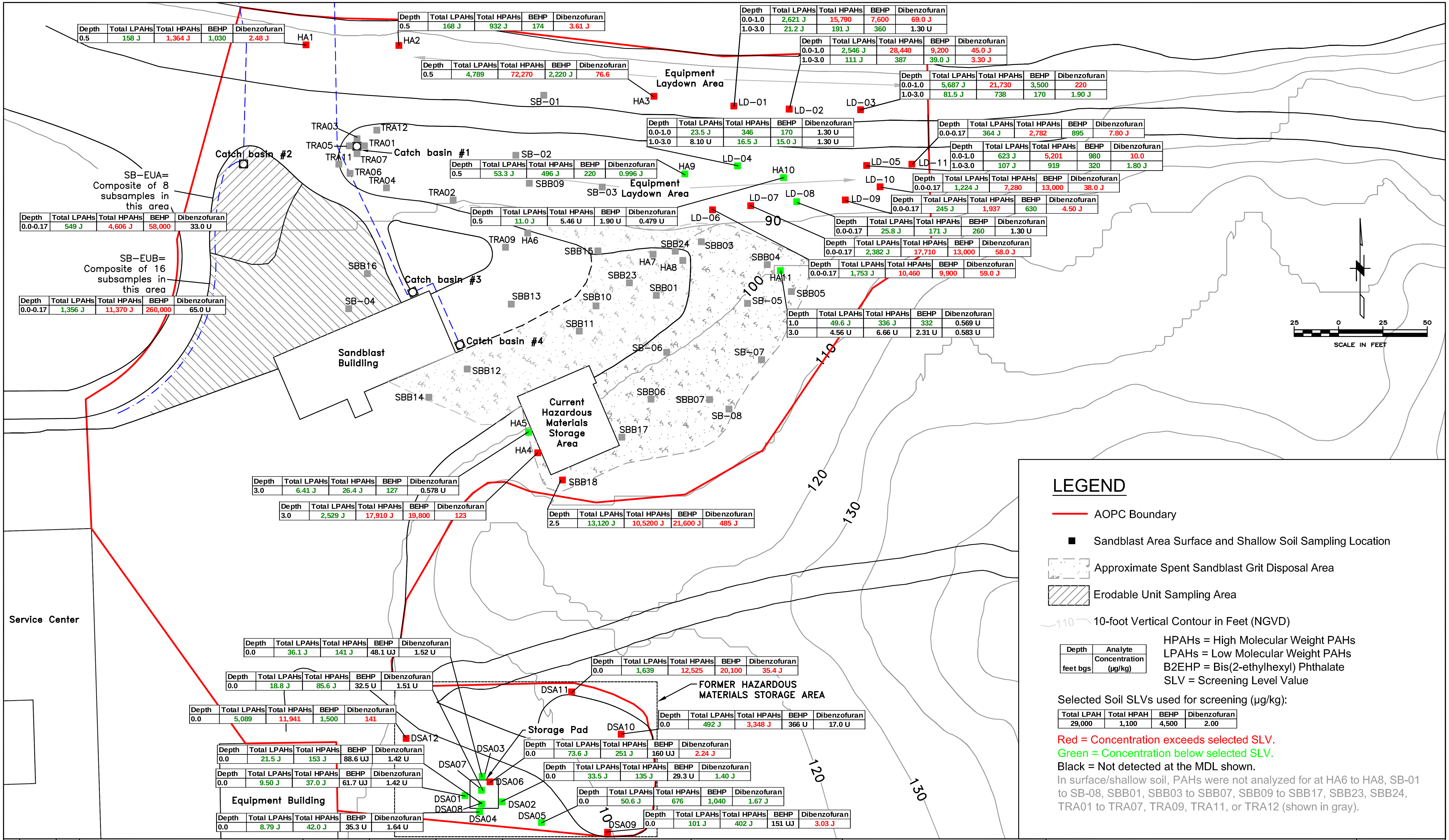
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5h – PAHs in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:46am



LEGEND

🟥 AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

▨ Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

HPAHs = High Molecular Weight PAHs
LPAHs = Low Molecular Weight PAHs
B2EHP = Bis(2-ethylhexyl) Phthalate
SLV = Screening Level Value

Selected Soil SLVs used for screening (µg/kg):

Total LPAH	Total HPAH	BEHP	Dibenzofuran
29,000	1,100	4,500	2.00

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
In surface/shallow soil, PAHs were not analyzed for at HA6 to HA8, SB-01 to SB-08, SBB01, SBB03 to SBB07, SBB09 to SBB17, SBB23, SBB24, TRA01 to TRA07, TRA09, TRA11, or TRA12 (shown in gray).

No.	DATE	BY	REVISION

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SANDBLAST AREA AOPC
PAHs, B2EHP, AND DIBENZOFURAN IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5h
CAD FILE NUMBER: FIG 9-5h
SHEET: OF
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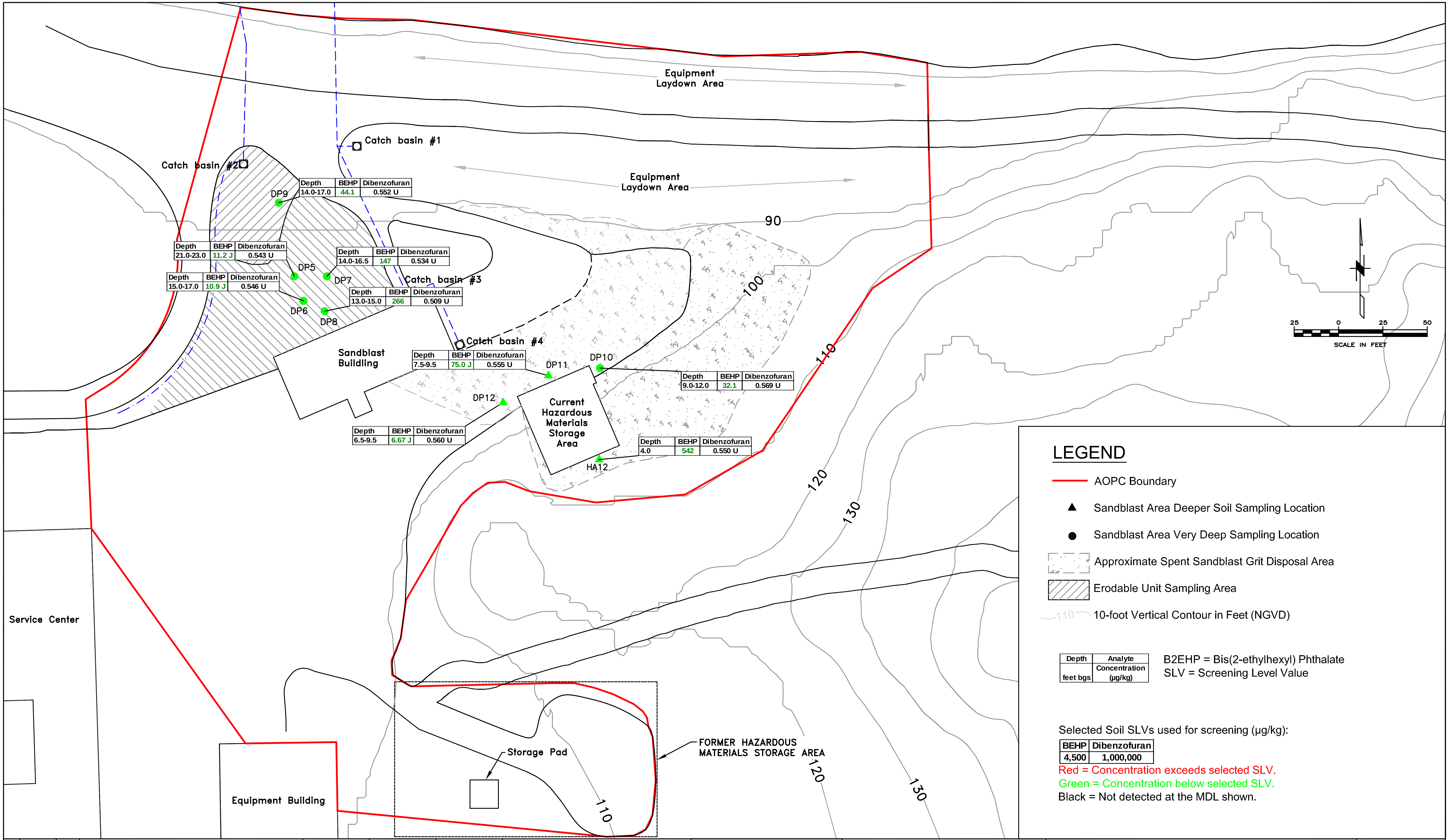
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5i- SVOCs in Deeper Soil and Very Deep Soil (g10 ft bgs).dwg Nov 18, 2010 - 9:47am



LEGEND

- AOPC Boundary
- ▲ Sandblast Area Deeper Soil Sampling Location
- ● Sandblast Area Very Deep Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

B2EHP = Bis(2-ethylhexyl) Phthalate
SLV = Screening Level Value

Selected Soil SLVs used for screening (µg/kg):

BEHP	Dibenzofuran
4,500	1,000,000

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
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SANDBLAST AREA AOPC
B2EHP AND DIBENZOFURAN IN DEEPER SOIL
AND VERY DEEP SOIL (> 10 ft bgs)

DRAWING NUMBER: FIGURE 9-5i
CAD FILE NUMBER: FIG 9-5i
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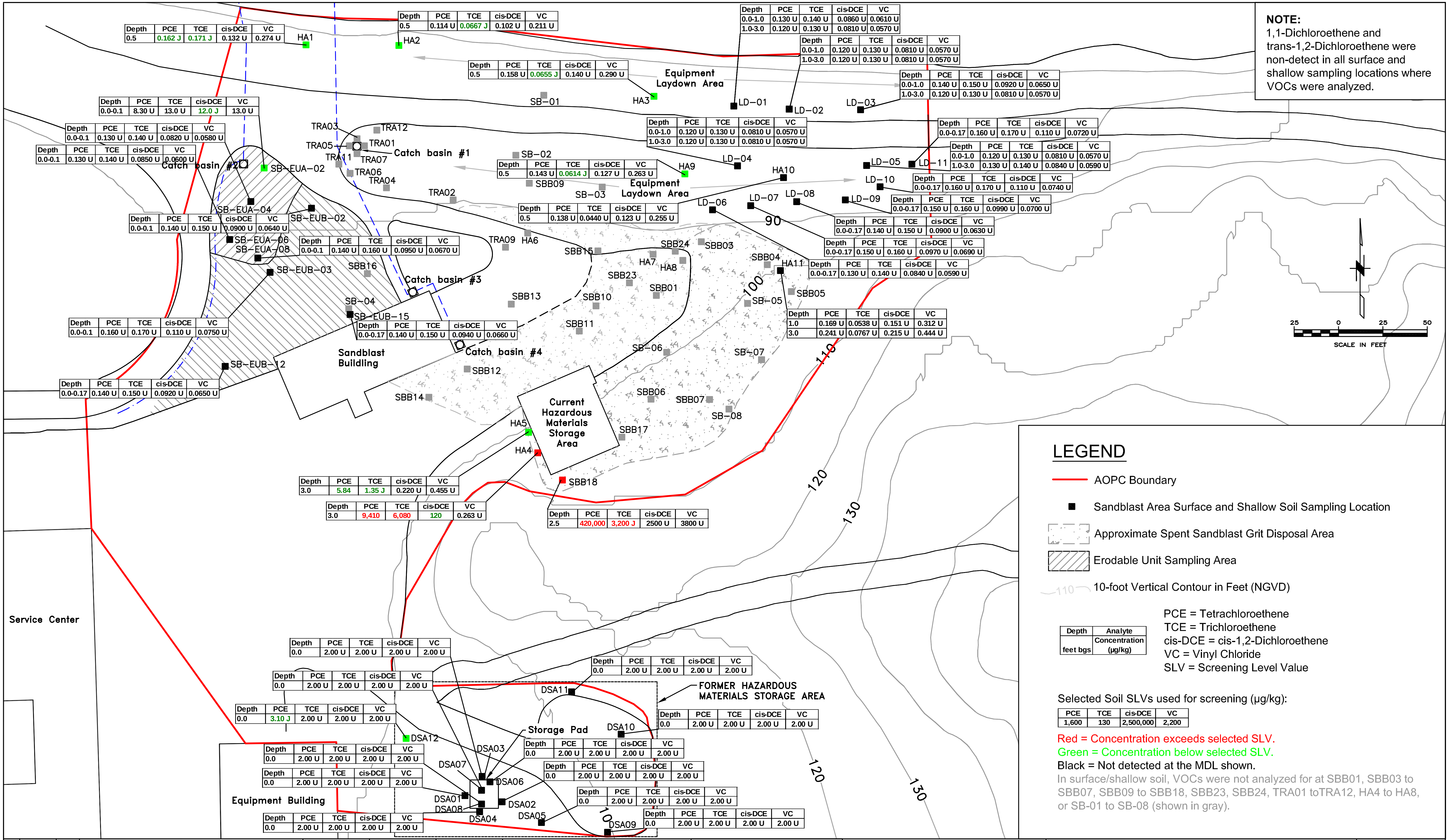
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-5j – VOCs in Surface and Shallow Soil.dwg Nov 18, 2010 – 9:48am



NOTE:
1,1-Dichloroethene and trans-1,2-Dichloroethene were non-detect in all surface and shallow sampling locations where VOCs were analyzed.

LEGEND

- 🟥 AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- ▨ Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

PCE = Tetrachloroethene
TCE = Trichloroethene
cis-DCE = cis-1,2-Dichloroethene
VC = Vinyl Chloride
SLV = Screening Level Value

Selected Soil SLVs used for screening (µg/kg):

PCE	TCE	cis-DCE	VC
1,600	130	2,500,000	2,200

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
In surface/shallow soil, VOCs were not analyzed for at SBB01, SBB03 to SBB07, SBB09 to SBB18, SBB23, SBB24, TRA01 toTRA12, HA4 to HA8, or SB-01 to SB-08 (shown in gray).

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SANDBLAST AREA AOPC

VOCs IN SURFACE
AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-5j
CAD FILE NUMBER: FIG 9-5j
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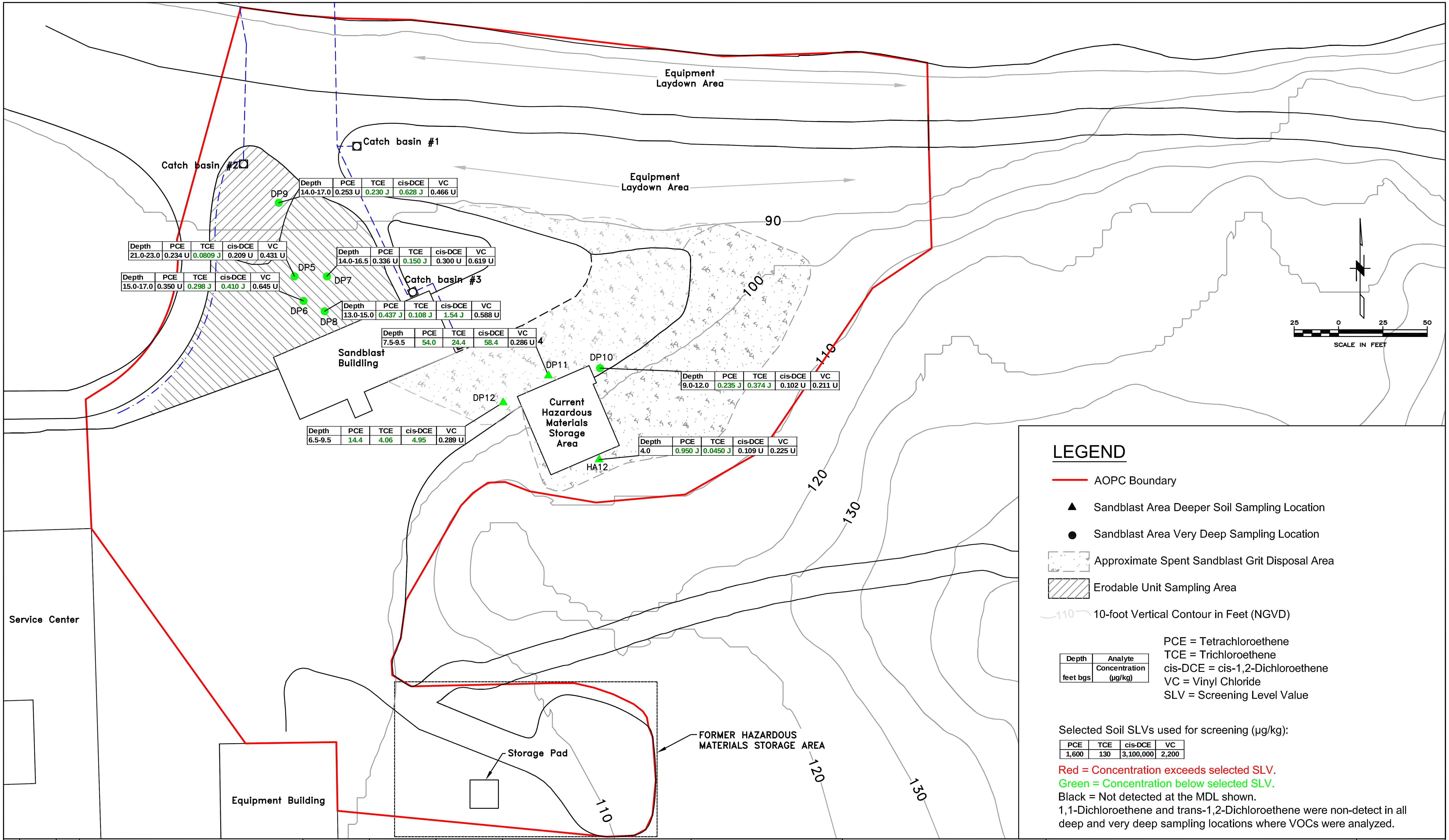

DP9

Depth	PCE	TCE	cis-DCE	VC
14.0-17.0	0.253 U	0.230 J	0.628 J	0.466 U

DP5

Depth	PCE	TCE	cis-DCE	VC
21.0-23.0	0.234 U	0.0809 J	0.209 U	0.431 U

DP7

Depth	PCE	TCE	cis-DCE	VC
14.0-16.5	0.336 U	0.150 J	0.300 U	0.619 U

DP6

Depth	PCE	TCE	cis-DCE	VC
15.0-17.0	0.350 U	0.298 J	0.410 J	0.645 U

DP8

Depth	PCE	TCE	cis-DCE	VC
13.0-15.0	0.437 J	0.108 J	1.54 J	0.588 U

DP11

Depth	PCE	TCE	cis-DCE	VC
7.5-9.5	54.0	24.4	58.4	0.286 U

DP10

Depth	PCE	TCE	cis-DCE	VC
9.0-12.0	0.235 J	0.374 J	0.102 U	0.211 U

DP12

Depth	PCE	TCE	cis-DCE	VC
6.5-9.5	14.4	4.06	4.95	0.289 U

HA12

Depth	PCE	TCE	cis-DCE	VC
4.0	0.950 J	0.0450 J	0.109 U	0.225 U

LEGEND

- AOPC Boundary
- ▲ Sandblast Area Deeper Soil Sampling Location
- ● Sandblast Area Very Deep Sampling Location
- ⬚ Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (µg/kg)

PCE = Tetrachloroethene
TCE = Trichloroethene
cis-DCE = cis-1,2-Dichloroethene
VC = Vinyl Chloride
SLV = Screening Level Value

Selected Soil SLVs used for screening (µg/kg):

PCE	TCE	cis-DCE	VC
1,600	130	3,100,000	2,200

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.
1,1-Dichloroethene and trans-1,2-Dichloroethene were non-detect in all deep and very deep sampling locations where VOCs were analyzed.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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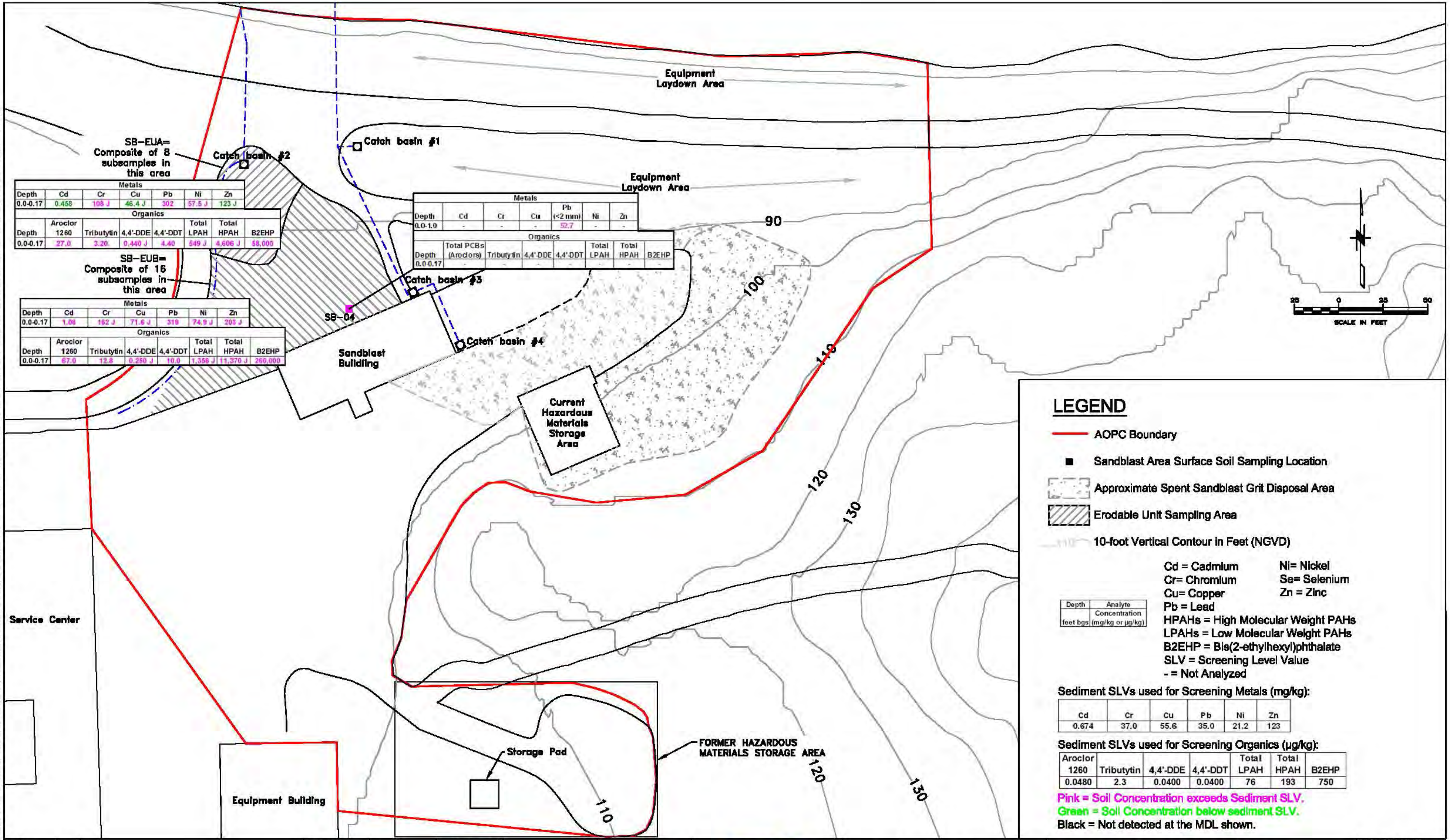
SANDBLAST AREA AOPC
VOCs IN DEEPER SOIL
AND VERY DEEP SOIL (> 10 ft bgs)

DRAWING NUMBER: FIGURE 9-5k
CAD FILE NUMBER: FIG 9-5k
SHEET: OF
REV.



SB-EUA= Composite of 8 subsamples in this area

Metals						
Depth	Cd	Cr	Cu	Pb	Ni	Zn
0.0-0.17	0.458	108 J	46.4 J	302	57.5 J	123 J

Organics							
Depth	Aroclor 1260	Tributytin	4,4'-DDE	4,4'-DDT	Total LPAH	Total HPAH	B2EHP
0.0-0.17	27.0	3.20	0.440 J	4.40	549 J	4,606 J	58,000

SB-EUB= Composite of 16 subsamples in this area

Metals						
Depth	Cd	Cr	Cu	Pb	Ni	Zn
0.0-0.17	1.08	162 J	71.6 J	319	74.9 J	203 J

Organics							
Depth	Aroclor 1260	Tributytin	4,4'-DDE	4,4'-DDT	Total LPAH	Total HPAH	B2EHP
0.0-0.17	67.0	12.8	0.250 J	10.0	1,356 J	11,370 J	260,000

SB-04

Metals						
Depth	Cd	Cr	Cu	Pb (<2 mm)	Ni	Zn
0.0-1.0	-	-	-	52.7	-	-

Organics							
Depth	Total PCBs (Aroclors)	Tributytin	4,4'-DDE	4,4'-DDT	Total LPAH	Total HPAH	B2EHP
0.0-0.17	-	-	-	-	-	-	-

LEGEND

🟥	AOPC Boundary
■	Sandblast Area Surface Soil Sampling Location
▨	Approximate Spent Sandblast Grit Disposal Area
▨	Erodable Unit Sampling Area
110	10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
feet bgs	Concentration (mg/kg or µg/kg)

Cd = Cadmium
Cr= Chromium
Cu= Copper
Pb = Lead
HPAHs = High Molecular Weight PAHs
LPAHs = Low Molecular Weight PAHs
B2EHP = Bis(2-ethylhexyl)phthalate
SLV = Screening Level Value
- = Not Analyzed
Ni= Nickel
Se= Selenium
Zn = Zinc

Sediment SLVs used for Screening Metals (mg/kg):

Cd	Cr	Cu	Pb	Ni	Zn
0.674	37.0	55.6	35.0	21.2	123

Sediment SLVs used for Screening Organics (µg/kg):

Aroclor 1260	Tributytin	4,4'-DDE	4,4'-DDT	Total LPAH	Total HPAH	B2EHP
0.0480	2.3	0.0400	0.0400	76	193	750

Pink = Soil Concentration exceeds Sediment SLV.
Green = Soil Concentration below sediment SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No. 25695946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: NOV 2010

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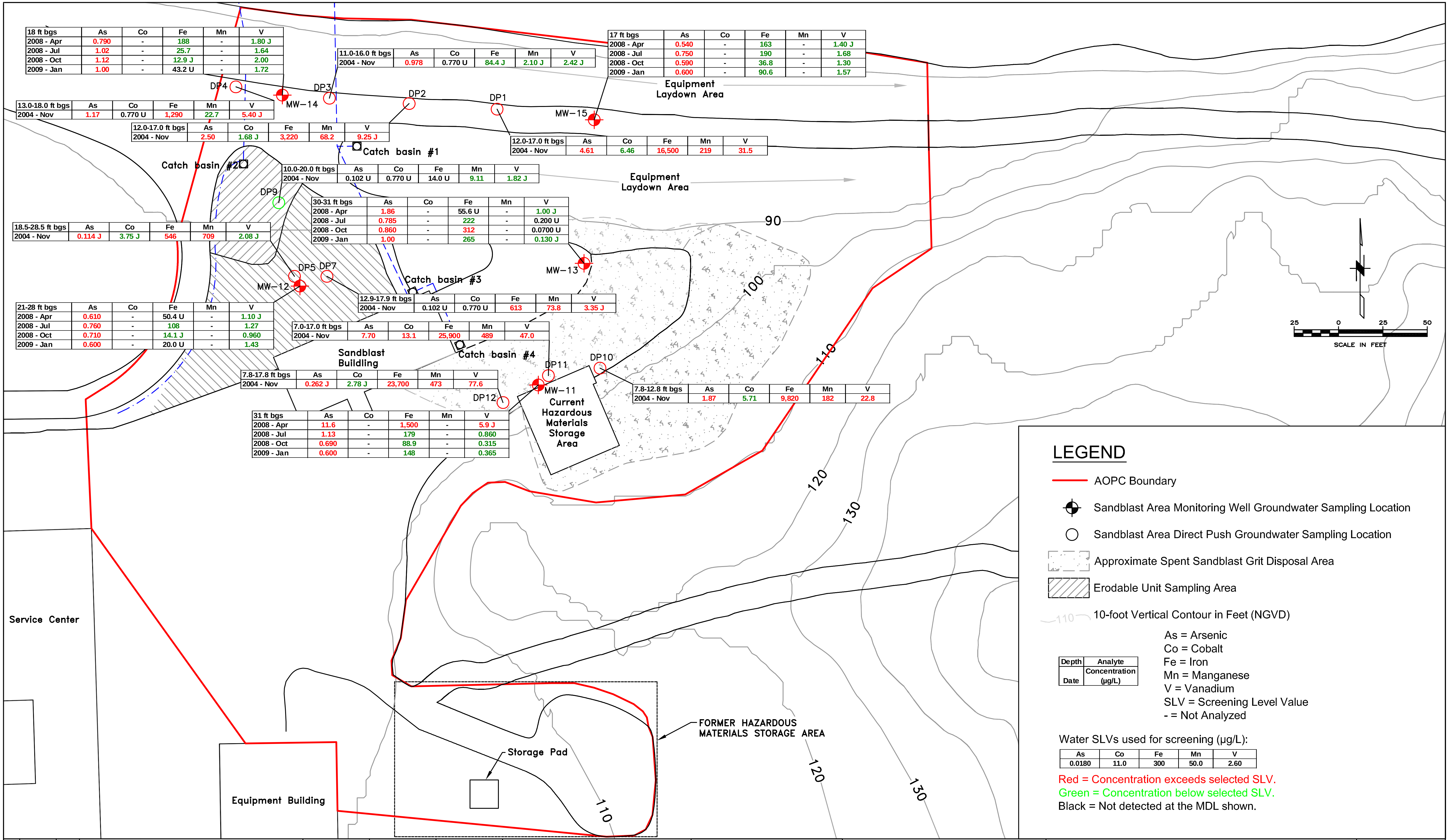
SANDBLAST AREA AOPC

COIs IN SURFACE SOIL
FOR ERODABILITY EVALUATION

DRAWING NUMBER: FIGURE 9-6
CAD FILE NUMBER: FIG 9-6
SHEET: OF
REV.

G:\25692708 USACE\33-FD072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-6 - Metals, PCBs, Pesticides, PAHs, and SVOCs in Surface Soil for Erodibility Evaluation.dwg Feb 13, 2012 - 2:01pm

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-7a - Total Metals in Groundwater.dwg Nov 18, 2010 - 10:14am



18 ft bgs	As	Co	Fe	Mn	V
2008 - Apr	0.790	-	188	-	1.80 J
2008 - Jul	1.02	-	25.7	-	1.64
2008 - Oct	1.12	-	12.9 J	-	2.00
2009 - Jan	1.00	-	43.2 U	-	1.72

11.0-16.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	0.978	0.770 U	84.4 J	2.10 J	2.42 J

17 ft bgs	As	Co	Fe	Mn	V
2008 - Apr	0.540	-	163	-	1.40 J
2008 - Jul	0.750	-	190	-	1.68
2008 - Oct	0.590	-	36.8	-	1.30
2009 - Jan	0.600	-	90.6	-	1.57

13.0-18.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	1.17	0.770 U	1,290	22.7	5.40 J

12.0-17.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	2.50	1.68 J	3,220	68.2	9.25 J

12.0-17.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	4.61	6.46	16,500	219	31.5

10.0-20.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	0.102 U	0.770 U	14.0 U	9.11	1.82 J

30-31 ft bgs	As	Co	Fe	Mn	V
2008 - Apr	1.86	-	55.6 U	-	1.00 J
2008 - Jul	0.785	-	222	-	0.200 U
2008 - Oct	0.860	-	312	-	0.0700 U
2009 - Jan	1.00	-	265	-	0.130 J

18.5-28.5 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	0.114 J	3.75 J	546	709	2.08 J

12.9-17.9 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	0.102 U	0.770 U	613	73.8	3.35 J

21-28 ft bgs	As	Co	Fe	Mn	V
2008 - Apr	0.610	-	50.4 U	-	1.10 J
2008 - Jul	0.760	-	108	-	1.27
2008 - Oct	0.710	-	14.1 J	-	0.960
2009 - Jan	0.600	-	20.0 U	-	1.43

7.0-17.0 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	7.70	13.1	25,900	489	47.0

7.8-17.8 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	0.262 J	2.78 J	23,700	473	77.6

7.8-12.8 ft bgs	As	Co	Fe	Mn	V
2004 - Nov	1.87	5.71	9,820	182	22.8

31 ft bgs	As	Co	Fe	Mn	V
2008 - Apr	11.6	-	1,500	-	5.9 J
2008 - Jul	1.13	-	179	-	0.860
2008 - Oct	0.690	-	88.9	-	0.315
2009 - Jan	0.600	-	148	-	0.365

LEGEND

🟥 AOPC Boundary

⊕ Sandblast Area Monitoring Well Groundwater Sampling Location

○ Sandblast Area Direct Push Groundwater Sampling Location

⬚ Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

110 10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
Date	Concentration (µg/L)

As = Arsenic
Co = Cobalt
Fe = Iron
Mn = Manganese
V = Vanadium
SLV = Screening Level Value
- = Not Analyzed

Water SLVs used for screening (µg/L):

As	Co	Fe	Mn	V
0.0180	11.0	300	50.0	2.60

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No.: 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: NOV 2010

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(tel) 503-222-7200
(fax) 503-222-4292
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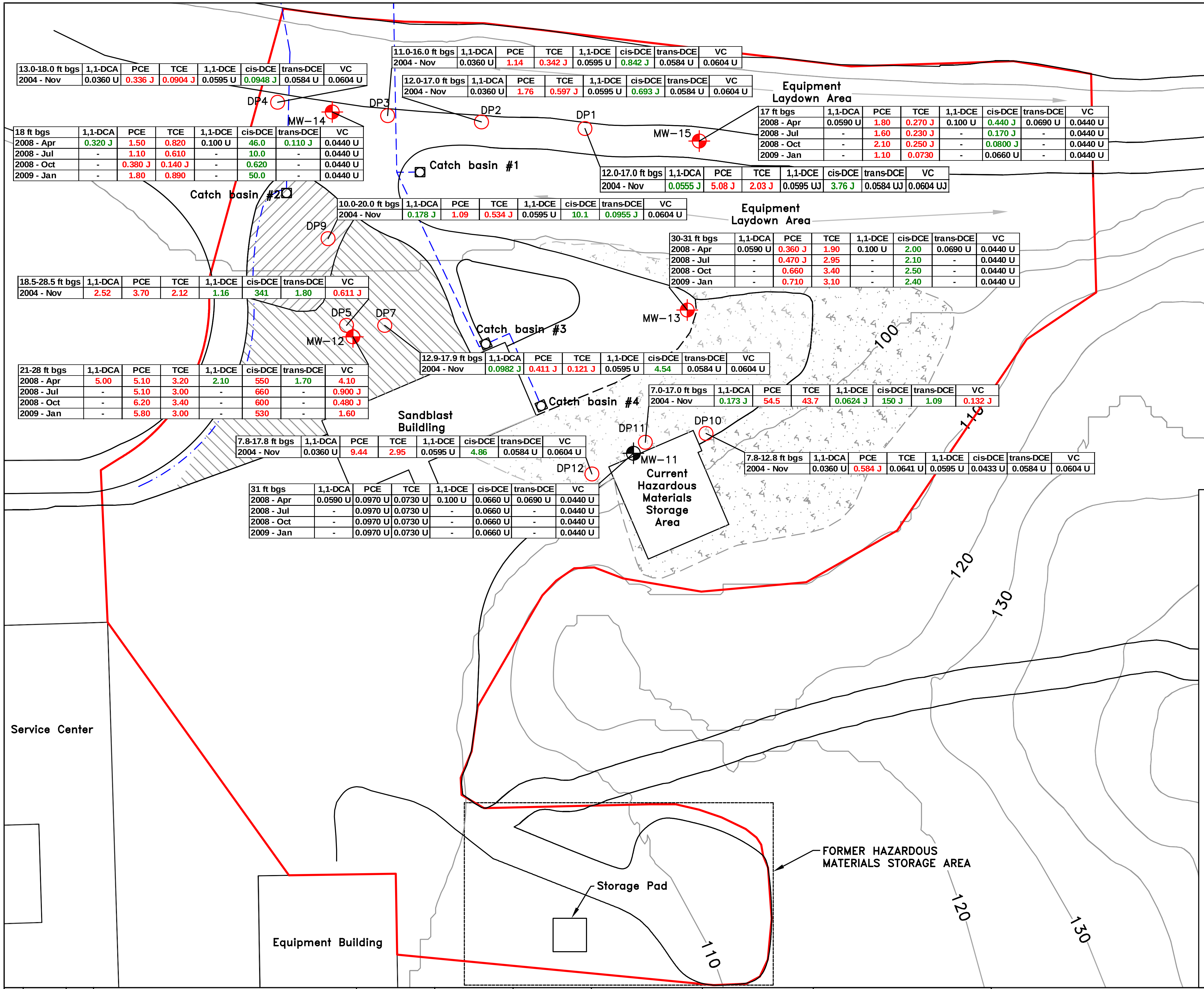
SANDBLAST AREA AOPC

TOTAL METALS
IN GROUNDWATER

DRAWING NUMBER: FIGURE 9-7a
CAD FILE NUMBER: FIG 9-7a
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-7b – VOCs in Groundwater.dwg Nov 18, 2010 – 10:15am



13.0-18.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0360 U	0.336 J	0.0904 J	0.0595 U	0.0948 J	0.0584 U	0.0604 U

11.0-16.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0360 U	1.14	0.342 J	0.0595 U	0.842 J	0.0584 U	0.0604 U

12.0-17.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0360 U	1.76	0.597 J	0.0595 U	0.693 J	0.0584 U	0.0604 U

18 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2008 - Apr	0.320 J	1.50	0.820	0.100 U	46.0	0.110 J	0.0440 U
2008 - Jul	-	1.10	0.610	-	10.0	-	0.0440 U
2008 - Oct	-	0.380 J	0.140 J	-	0.620	-	0.0440 U
2009 - Jan	-	1.80	0.890	-	50.0	-	0.0440 U

17 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2008 - Apr	0.0590 U	1.80	0.270 J	0.100 U	0.440 J	0.0690 U	0.0440 U
2008 - Jul	-	1.60	0.230 J	-	0.170 J	-	0.0440 U
2008 - Oct	-	2.10	0.250 J	-	0.0800 J	-	0.0440 U
2009 - Jan	-	1.10	0.0730	-	0.0660 U	-	0.0440 U

12.0-17.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0555 J	5.08 J	2.03 J	0.0595 UJ	3.76 J	0.0584 UJ	0.0604 UJ

10.0-20.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.178 J	1.09	0.534 J	0.0595 U	10.1	0.0955 J	0.0604 U

30-31 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2008 - Apr	0.0590 U	0.360 J	1.90	0.100 U	2.00	0.0690 U	0.0440 U
2008 - Jul	-	0.470 J	2.95	-	2.10	-	0.0440 U
2008 - Oct	-	0.660	3.40	-	2.50	-	0.0440 U
2009 - Jan	-	0.710	3.10	-	2.40	-	0.0440 U

18.5-28.5 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	2.52	3.70	2.12	1.16	341	1.80	0.611 J

12.9-17.9 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0982 J	0.411 J	0.121 J	0.0595 U	4.54	0.0584 U	0.0604 U

21-28 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2008 - Apr	5.00	5.10	3.20	2.10	550	1.70	4.10
2008 - Jul	-	5.10	3.00	-	660	-	0.900 J
2008 - Oct	-	6.20	3.40	-	600	-	0.480 J
2009 - Jan	-	5.80	3.00	-	530	-	1.60

7.0-17.0 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.173 J	54.5	43.7	0.0624 J	150 J	1.09	0.132 J

7.8-17.8 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0360 U	9.44	2.95	0.0595 U	4.86	0.0584 U	0.0604 U

7.8-12.8 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2004 - Nov	0.0360 U	0.584 J	0.0641 U	0.0595 U	0.0433 U	0.0584 U	0.0604 U

31 ft bgs	1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2008 - Apr	0.0590 U	0.0970 U	0.0730 U	0.100 U	0.0660 U	0.0690 U	0.0440 U
2008 - Jul	-	0.0970 U	0.0730 U	-	0.0660 U	-	0.0440 U
2008 - Oct	-	0.0970 U	0.0730 U	-	0.0660 U	-	0.0440 U
2009 - Jan	-	0.0970 U	0.0730 U	-	0.0660 U	-	0.0440 U

LEGEND

🟥	AOPC Boundary
⊕	Sandblast Area Monitoring Well Groundwater Sampling Location
○	Sandblast Area Direct Push Groundwater Sampling Location
110	Approximate Spent Sandblast Grit Disposal Area
⬚	Erodable Unit Sampling Area
▨	10-foot Vertical Contour in Feet (NGVD)

Depth	Analyte
Date	Concentration (µg/L)

1,1-DCA = 1,1-Dichloroethane
PCE = Tetrachloroethene
TCE = Trichloroethene
1,1-DCE = 1,1-Dichloroethene
cis-DCE = cis-1,2-Dichloroethene
trans-DCE = trans-1,2-Dichloroethene
VC = Vinyl Chloride
SLV = Screening Level Value
- = Not Analyzed

Water SLVs used for screening (µg/L):

1,1-DCA	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2.3	0.0930	0.0390	25.00	360	110	0.0250

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: JULY 2010

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Portland, Oregon 97201-5814
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BRADFORD ISLAND
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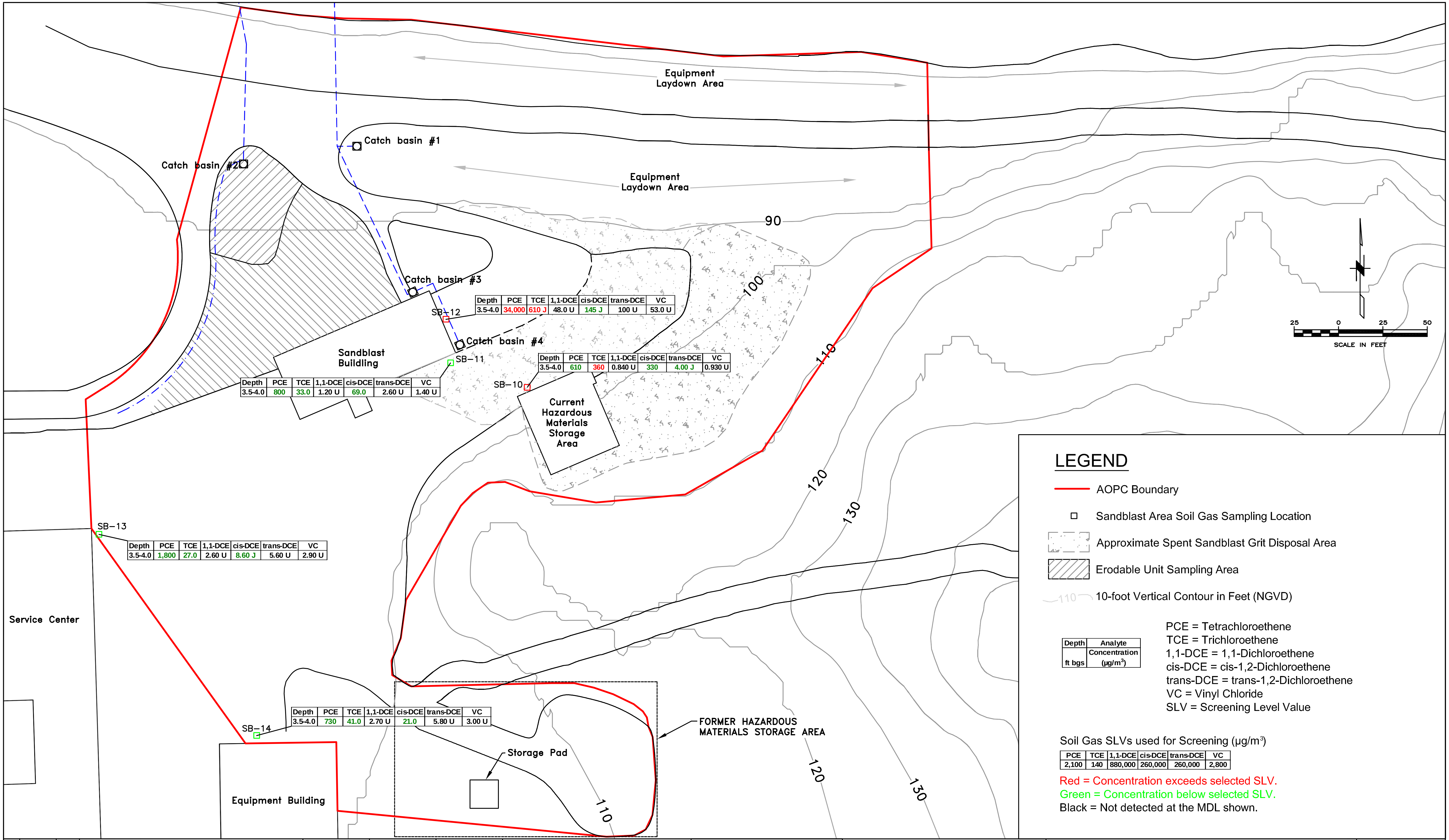
SANDBLAST AREA AOPC
VOCs IN GROUNDWATER

DRAWING NUMBER: FIGURE 9-7b
CAD FILE NUMBER: FIG 9-7b
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-8 - Soil Gas.dwg Nov 18, 2010 - 10:15am



SB-12

Depth	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
3.5-4.0	34,000	610 J	48.0 U	145 J	100 U	53.0 U

SB-11

Depth	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
3.5-4.0	800	33.0	1.20 U	69.0	2.60 U	1.40 U

SB-10

Depth	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
3.5-4.0	610	360	0.840 U	330	4.00 J	0.930 U

SB-13

Depth	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
3.5-4.0	1,800	27.0	2.60 U	8.60 J	5.60 U	2.90 U

SB-14

Depth	PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
3.5-4.0	730	41.0	2.70 U	21.0	5.80 U	3.00 U

Depth	Analyte
ft bgs	Concentration ($\mu g/m^3$)

PCE = Tetrachloroethene
TCE = Trichloroethene
1,1-DCE = 1,1-Dichloroethene
cis-DCE = cis-1,2-Dichloroethene
trans-DCE = trans-1,2-Dichloroethene
VC = Vinyl Chloride
SLV = Screening Level Value

Soil Gas SLVs used for Screening ($\mu g/m^3$)

PCE	TCE	1,1-DCE	cis-DCE	trans-DCE	VC
2,100	140	880,000	260,000	260,000	2,800

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at the MDL shown.

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP	
SCALE:	DRAWN BY: SB	APPROVED BY: LSM	
	CHECKED BY: LSM	DATE: NOV 2010	

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BRADFORD ISLAND

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SANDBLAST AREA AOPC

VOCs IN SOIL GAS

DRAWING NUMBER:
FIGURE 9-8

CAD FILE NUMBER:
FIG 9-8

SHEET:
OF

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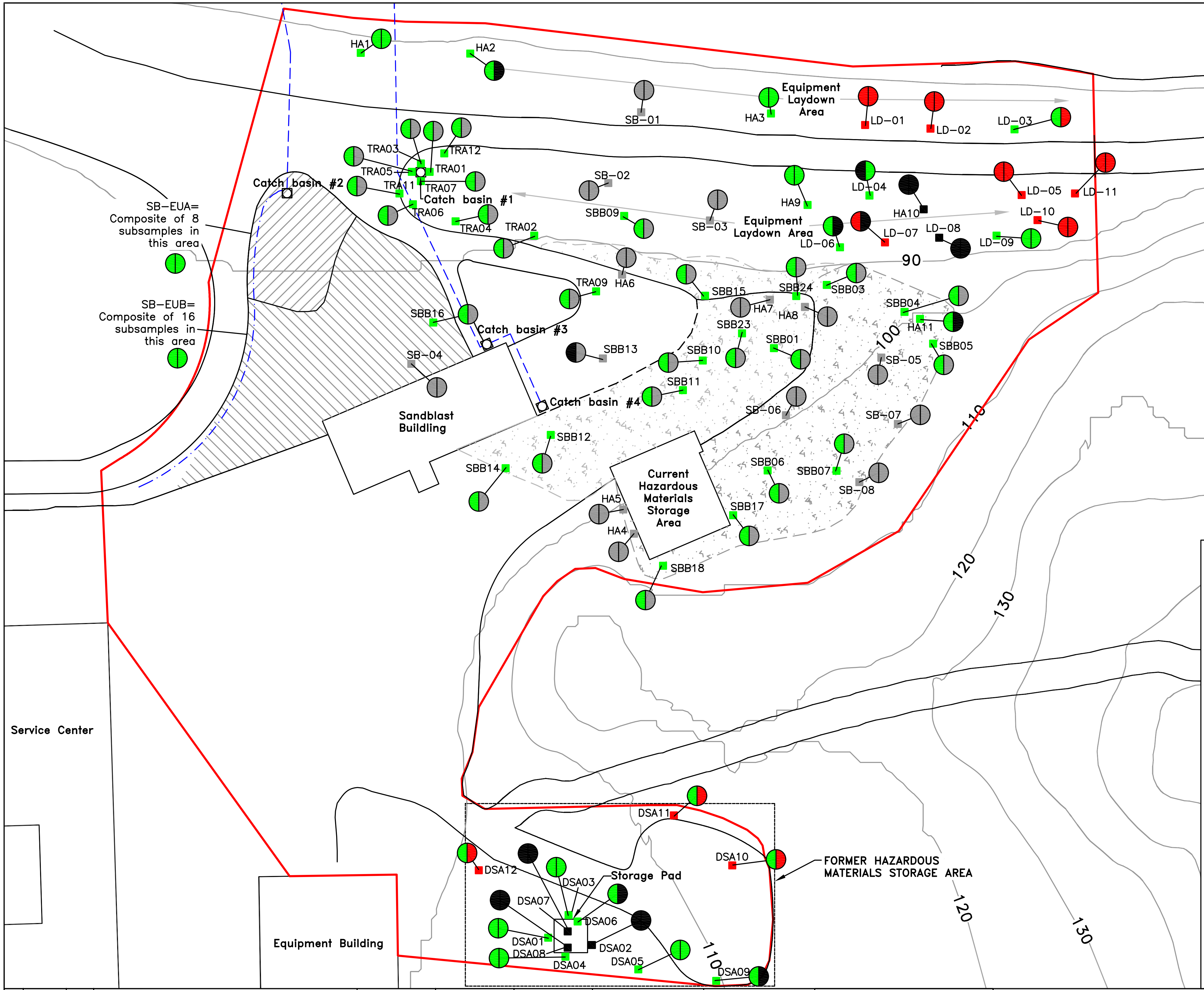

NOTE:
In deeper soil, PCBs were not analyzed for at DP11, DP12, or HA12.
In very deep soil (> 10 ft bgs), PCBs were non-detect at DP5 through DP9 and not-analyzed for at DP10 .

LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

Soil SLVs used for Screening (µg/kg):

Total Aroclors	4,4'-DDT	Endrin	Endrin Aldehyde	Endrin Ketone
371	21.0	4.90	4.90	4.90

SLV = Screening Level Value

Summary of PCBs and Pesticides in Surface and Shallow Soil

◐ PCBs Concentration

◑ Pesticides Concentration

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL.
Gray = Not Analyzed.

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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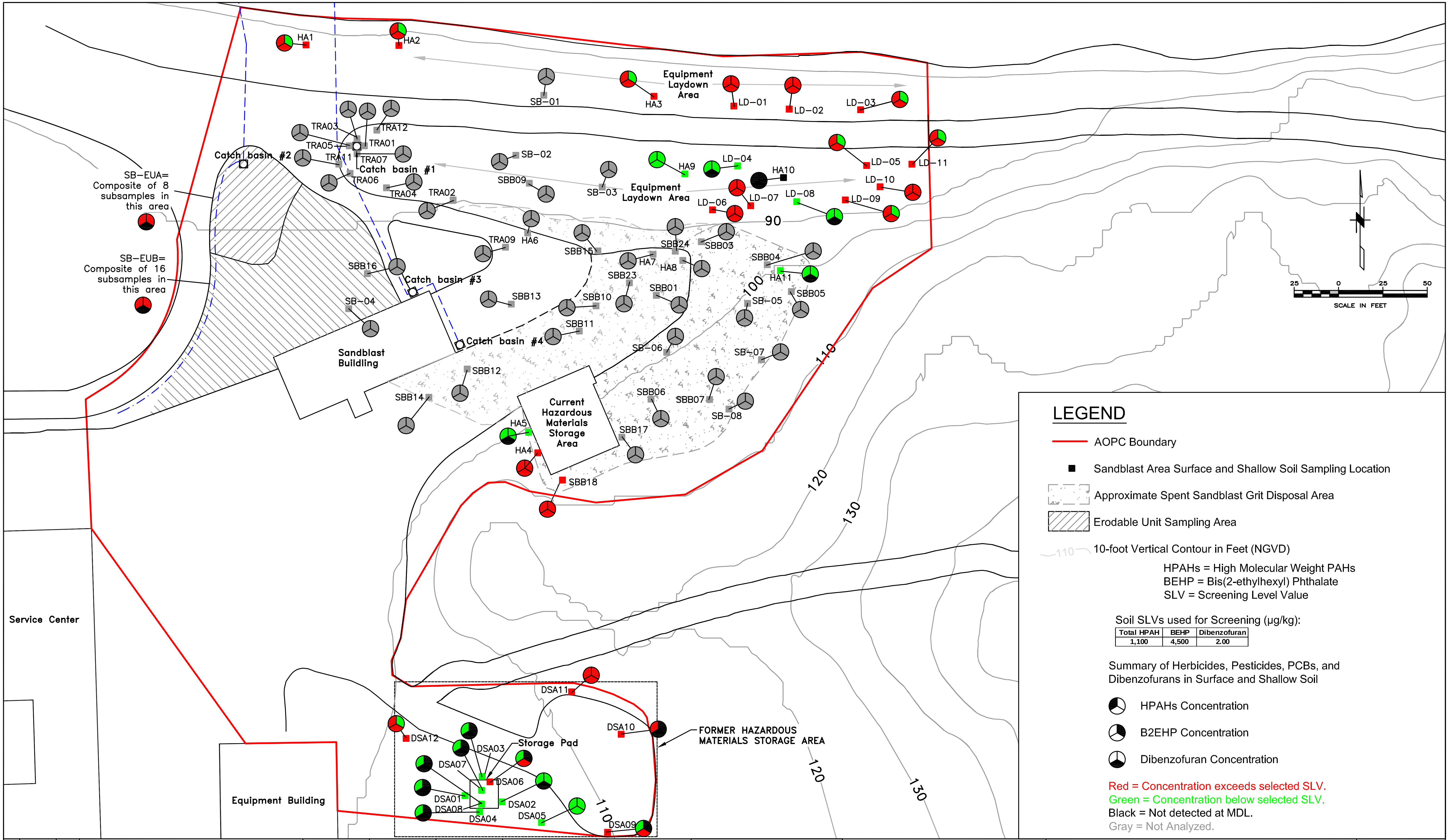
BRADFORD ISLAND
CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC
SUMMARY OF PCBs AND PESTICIES
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-9a
CAD FILE NUMBER: FIG 9-9a
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-9b - Summary of HPAHs in Surface and Shallow Soil.dwg Nov 18, 2010 - 10:17am



LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 110 10-foot Vertical Contour in Feet (NGVD)

HPAHs = High Molecular Weight PAHs
BEHP = Bis(2-ethylhexyl) Phthalate
SLV = Screening Level Value

Soil SLVs used for Screening (µg/kg):

Total HPAH	BEHP	Dibenzofuran
1,100	4,500	2.00

Summary of Herbicides, Pesticides, PCBs, and Dibenzofurans in Surface and Shallow Soil

- HPAHs Concentration
- B2EHP Concentration
- Dibenzofuran Concentration

Red = Concentration exceeds selected SLV.
Green = Concentration below selected SLV.
Black = Not detected at MDL.
Gray = Not Analyzed.

No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
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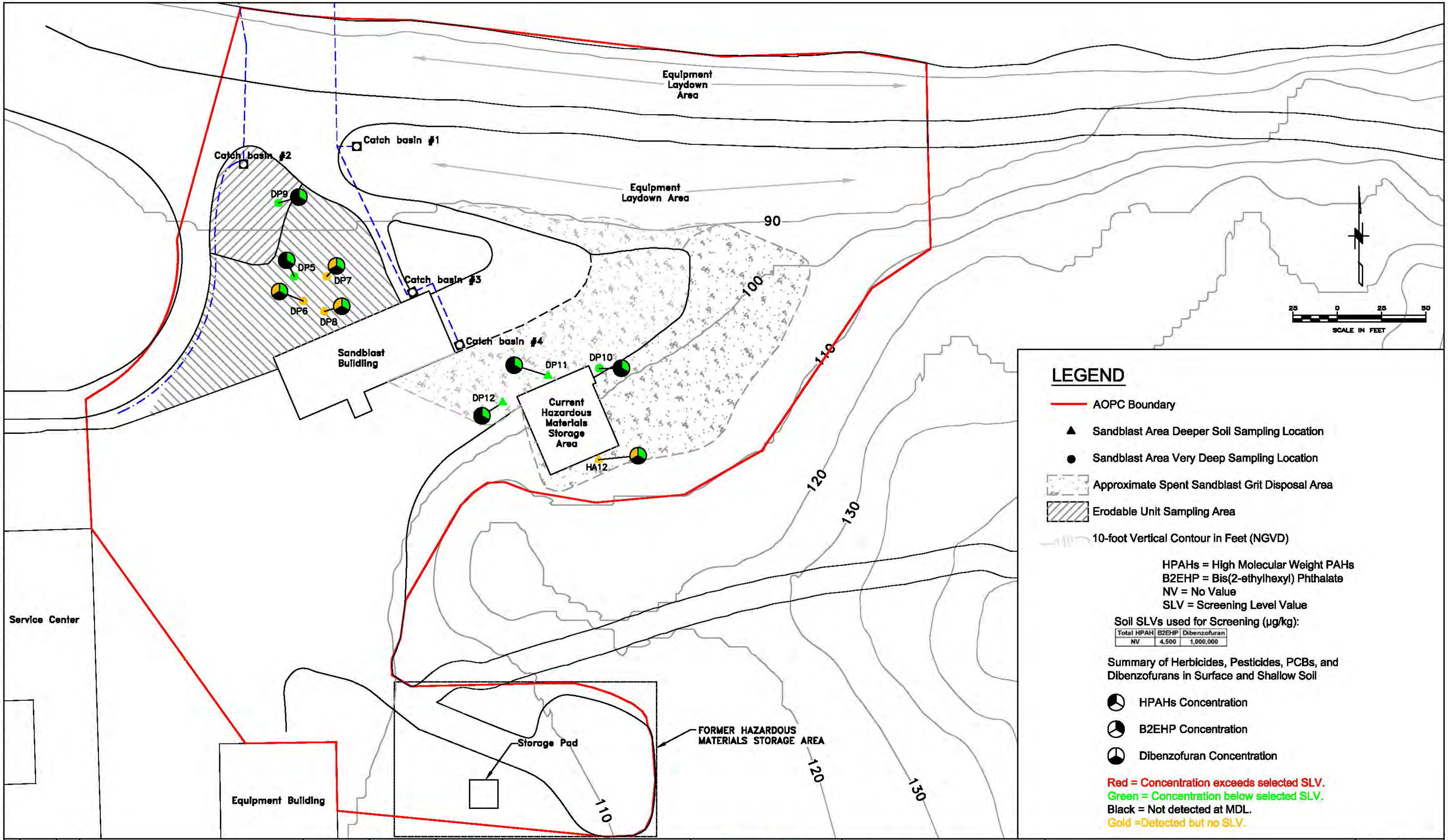
BRADFORD ISLAND
CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

SUMMARY OF HPAHs, B2EHP, AND DIBENZOFURAN
IN SURFACE AND SHALLOW SOIL

DRAWING NUMBER: FIGURE 9-9b
CAD FILE NUMBER: FIG 9-9b
SHEET:
OF
REV.

c:\25692709 USACE\53-F0072173.00 Bradford\F.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-9c- Summary of HPAHs, BEHP, and Dibenzofuran in Deeper Soil and Very Deep Soil (≥10 ft bgs).dwg Feb 13, 2012 - 2:03pm



Total HPAH	B2EHP	Dibenzofuran
NV	4,500	1,000,000

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SANDBLAST AREA AOPC

SUMMARY OF HPAHs, B2EHP, AND DIBENZOFURAN IN DEEPER SOIL AND VERY DEEP SOIL (> 10 ft bgs)

DRAWING NUMBER: FIGURE 9-9c

CAD FILE NUMBER: FIG 9-9c

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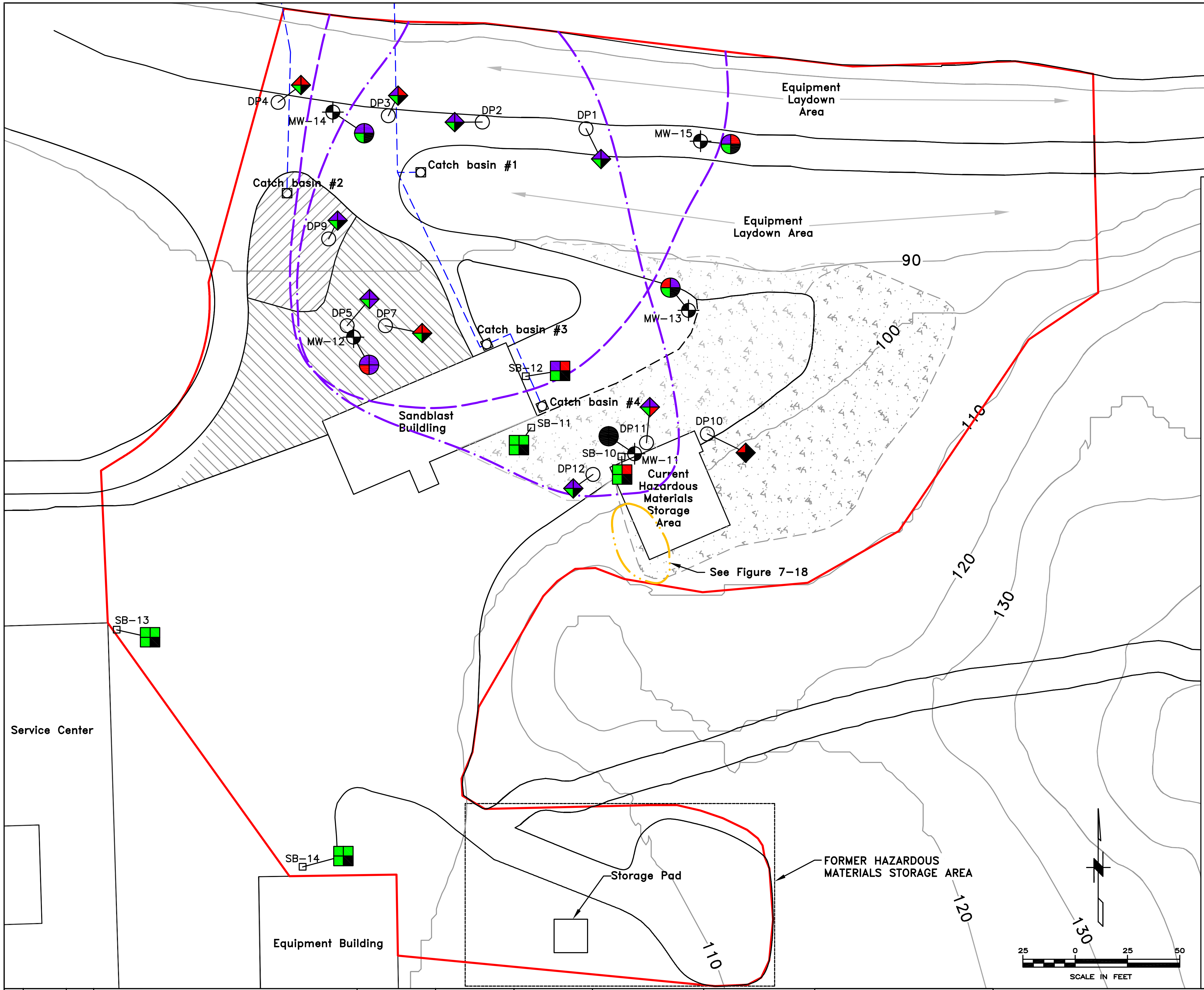
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-10 – Summary of VOCs in Groundwater.dwg Nov 18, 2010 – 10:18am



LEGEND

- AOPC Boundary
- 2004 Area where PCE Concentration Exceeds 10x the SLV
- 2008 Area where PCE Concentration Exceeds 10x the SLV
- Area of Surface/Shallow Soil PCE and TCE Contamination
- Sandblast Area Monitoring Well Groundwater Sampling Location
- ○ Sandblast Area Direct Push Groundwater Sampling Location
- □ Sandblast Area Soil Gas Sampling Location
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area
- 10-foot Vertical Contour in Feet (NGVD)

PCE = Tetrachloroethene
TCE = Trichloroethene
cis-DCE = cis-1,2-Dichloroethene
VC = Vinyl Chloride

- ◆ 2004 Summary of PCE, TCE, cis-DCE, and VC in Groundwater
- ● 2008 Summary of PCE, TCE, cis-DCE, and VC in Groundwater
- ■ 2009 Summary of PCE, TCE, cis-DCE, and VC in Soil Gas
- PCE Concentration
- TCE Concentration
- cis-DCE Concentration
- VC Concentration

Water SLVs used for Screening (µg/L):

PCE	TCE	cis-DCE	VC
0.0930	0.0390	360	0.0250

Soil Gas SLVs used for Screening (µg/m³):

PCE	TCE	cis-DCE	VC
2,100	140	260,000	2,800

Purple = Concentration exceeds selected SLV (>10x).
Red = Concentration exceeds selected SLV (<10x).
Green = Concentration below selected SLV.
Black = Not detected at MDL.

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SANDBLAST AREA AOPC
SUMMARY OF VOCs
IN GROUNDWATER AND SOIL GAS

DRAWING NUMBER: FIGURE 9-10
CAD FILE NUMBER: FIG 9-10
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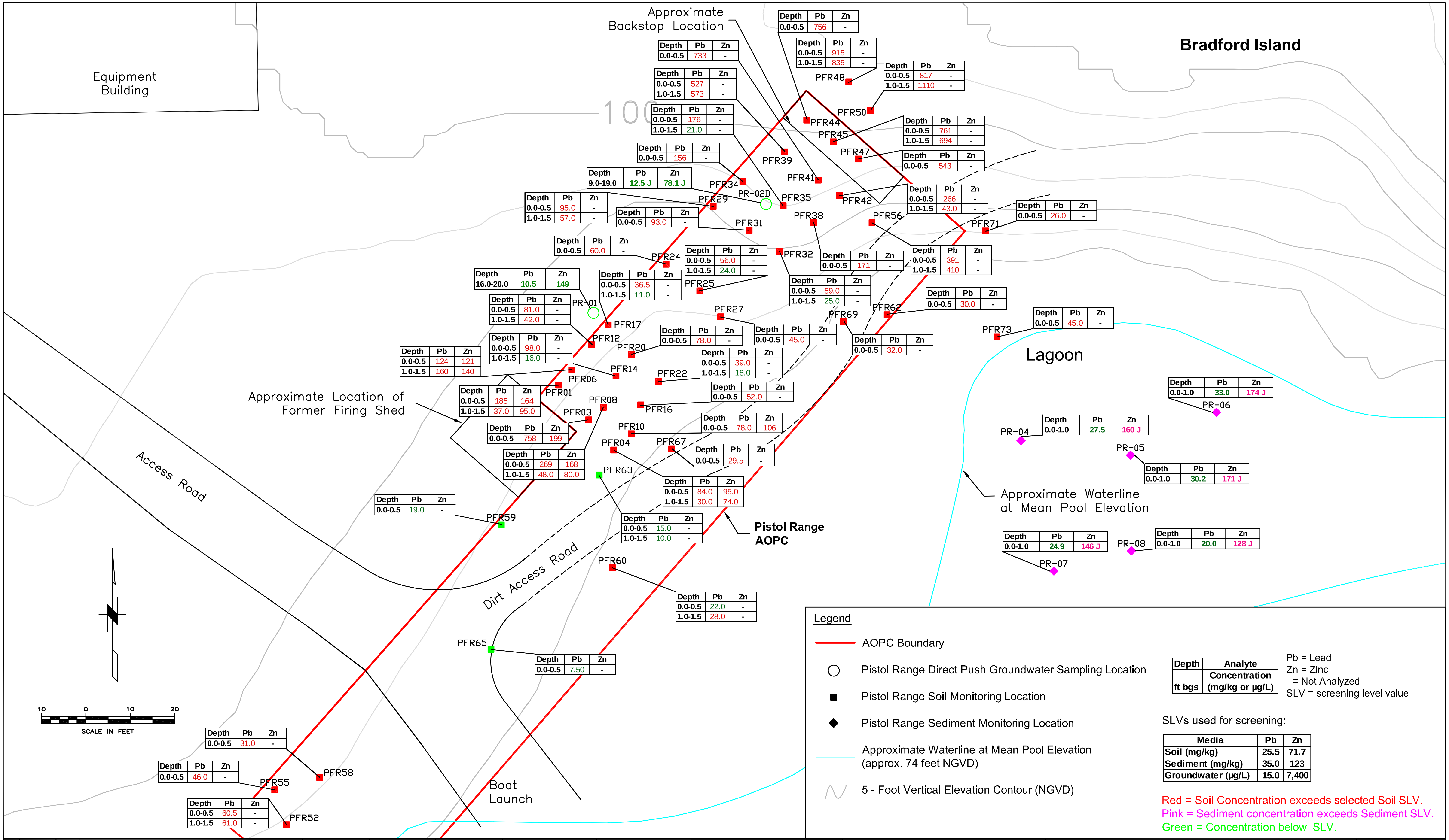
O:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-11 – Metals in Surface Soil, Groundwater, and Lagoon Sediment at Pistol Range AOPC.dwg Nov 18, 2010 – 10:18am



Legend

- 🟥 AOPC Boundary
- ○ Pistol Range Direct Push Groundwater Sampling Location
- ■ Pistol Range Soil Monitoring Location
- ◆ Pistol Range Sediment Monitoring Location
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)
- ∿ 5 - Foot Vertical Elevation Contour (NGVD)

Depth	Analyte
ft bgs	Concentration (mg/kg or µg/L)

Pb = Lead
Zn = Zinc
- = Not Analyzed
SLV = screening level value

SLVs used for screening:

Media	Pb	Zn
Soil (mg/kg)	25.5	71.7
Sediment (mg/kg)	35.0	123
Groundwater (µg/L)	15.0	7,400

Red = Soil Concentration exceeds selected Soil SLV.
Pink = Sediment concentration exceeds Sediment SLV.
Green = Concentration below SLV.

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PISTOL RANGE AOPC

METALS IN SURFACE SOIL, GROUNDWATER,
AND LAGOON SEDIMENT

DRAWING NUMBER: FIGURE 9-11
CAD FILE NUMBER: FIG 9-11
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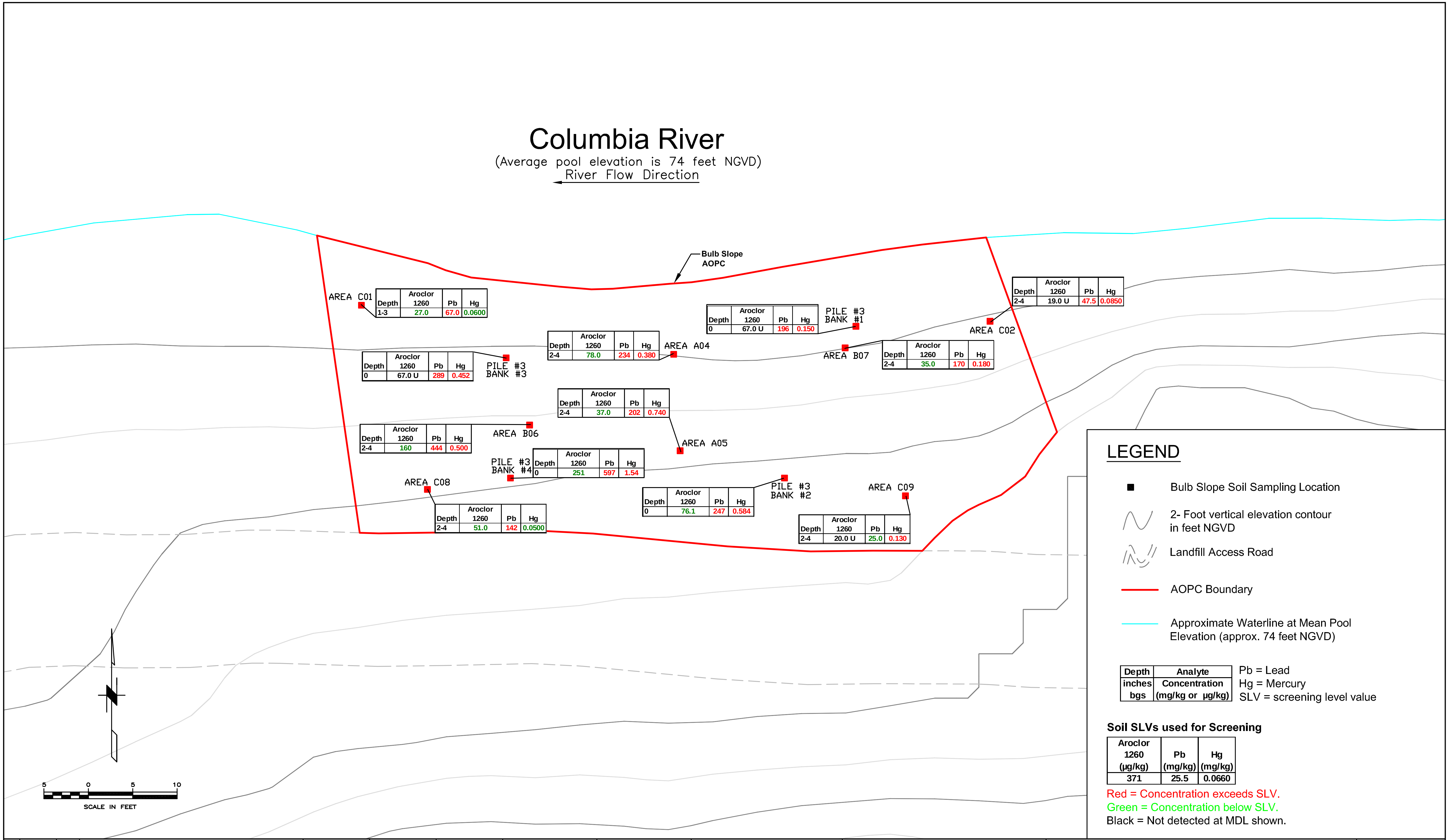
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-12 – Metals and PCBs in Surface Soil at Bulb Slope AOPC.dwg Nov 18, 2010 – 10:19am



Soil SLVs used for Screening

Aroclor 1260 (µg/kg)	Pb (mg/kg)	Hg (mg/kg)
371	25.5	0.0660

Red = Concentration exceeds SLV.
Green = Concentration below SLV.
Black = Not detected at MDL shown.

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BULB SLOPE AOPC

METALS AND PCBs IN SURFACE SOIL

DRAWING NUMBER: FIGURE 9-12
CAD FILE NUMBER: FIG 9-12
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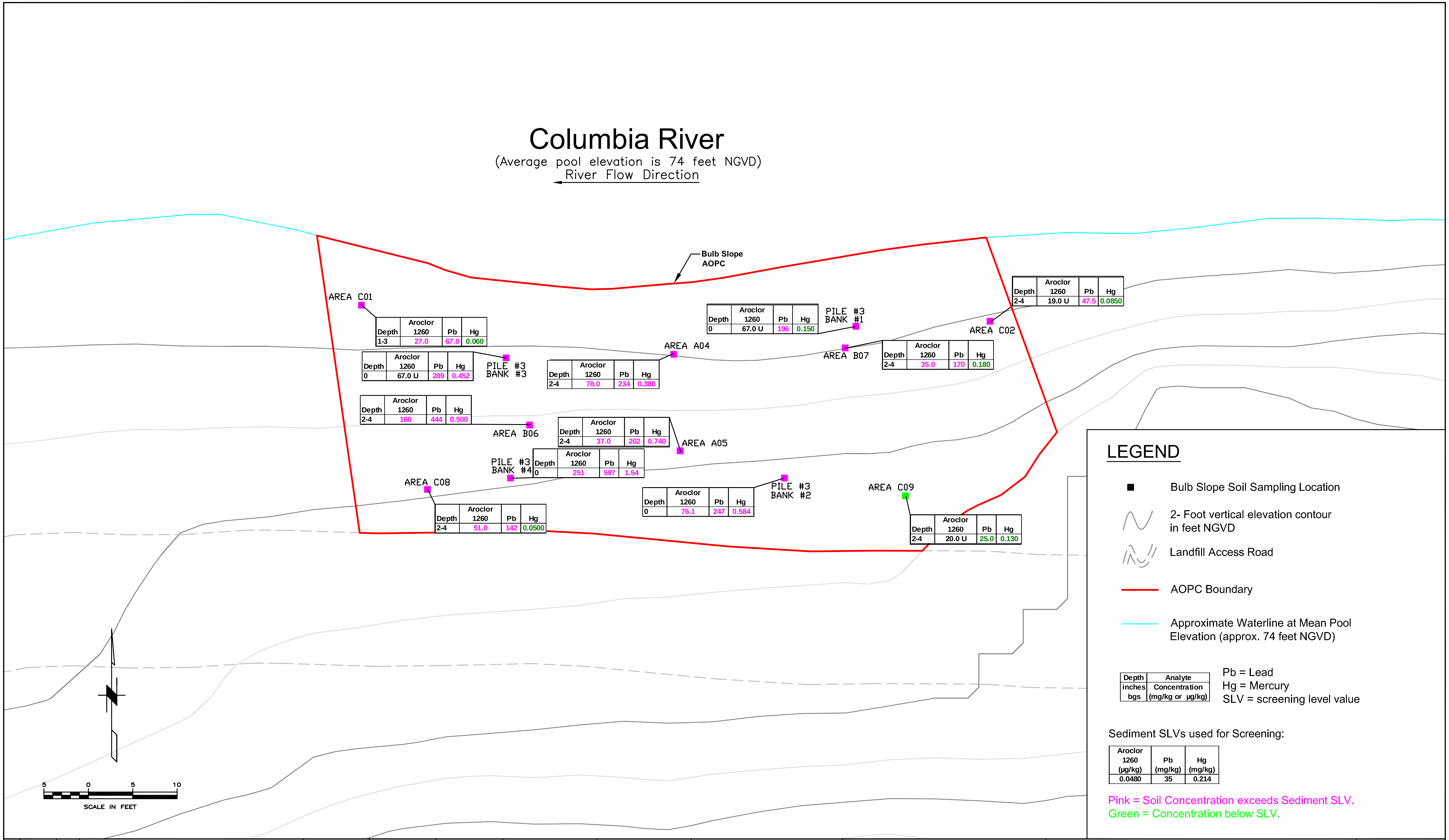
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-13 – Metals and PCBs in Surface Soil at Bulb Slope AOPC for Mass Wasting Evaluation.dwg Nov 18, 2010 – 10:20am



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BULB SLOPE AOPC

METALS AND PCBs IN SURFACE SOIL
FOR MASS WASTING EVALUATION

DRAWING NUMBER: FIGURE 9-13
CAD FILE NUMBER: FIG 9-13
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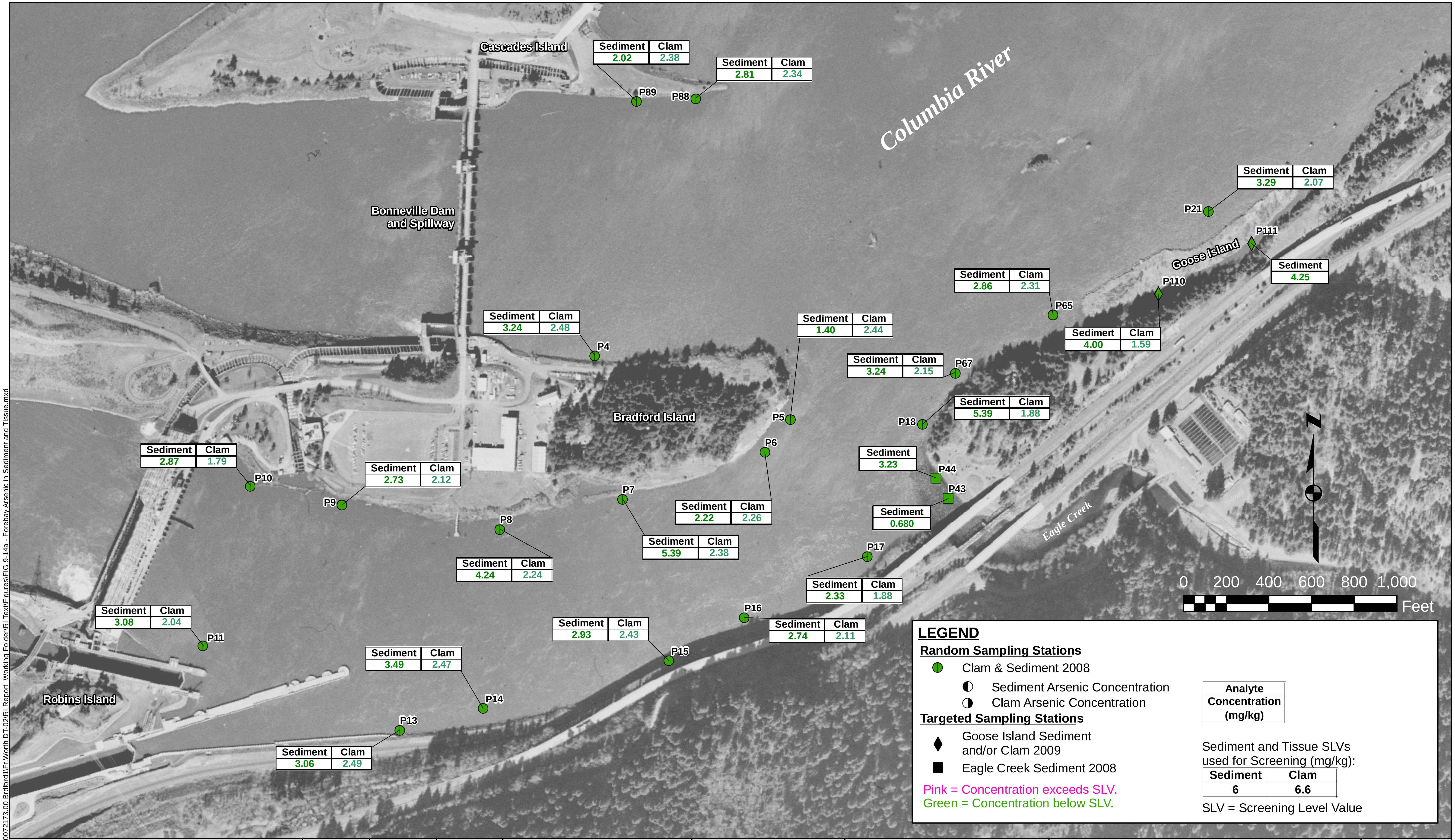

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report Working Folder\RI Text\Figures\FIG 9-14a - Forebay Arsenic in Sediment and Tissue.mxd

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CASCADE LOCKS, OREGON

RIVER OPERABLE UNIT

FOREBAY ARSENIC IN SEDIMENT AND CLAM TISSUE

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FIGURE 9-14a

GIS FILE NUMBER:
FIG 9-14a

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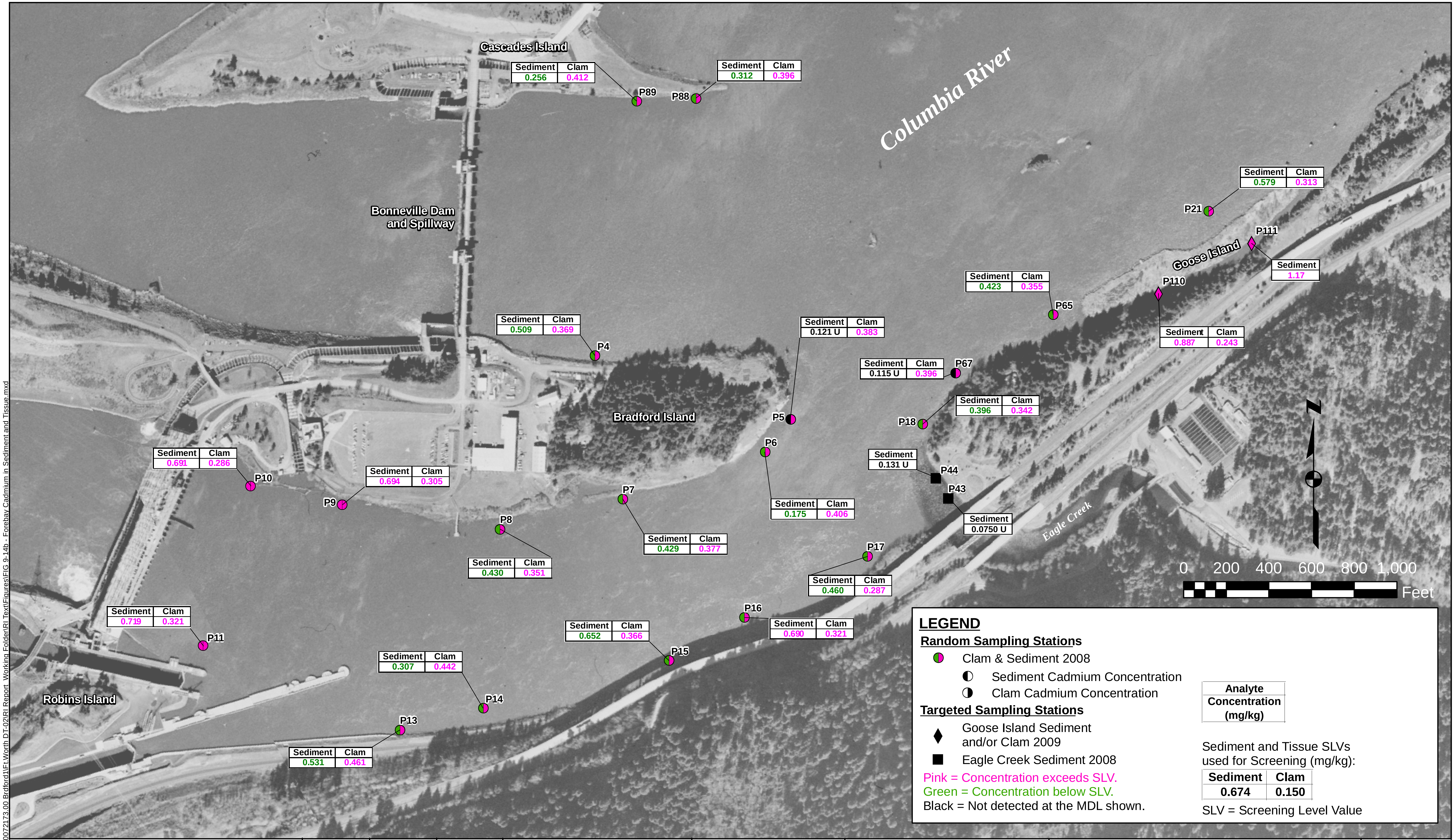

LEGEND

Random Sampling Stations

- ◐ Clam & Sediment 2008
  - ◐ Sediment Cadmium Concentration
  - ◑ Clam Cadmium Concentration

Targeted Sampling Stations

- ♦ Goose Island Sediment and/or Clam 2009
- ■ Eagle Creek Sediment 2008

Pink = Concentration exceeds SLV.
Green = Concentration below SLV.
Black = Not detected at the MDL shown.

Analyte
Concentration (mg/kg)

Sediment and Tissue SLVs used for Screening (mg/kg):

Sediment	Clam
0.674	0.150

SLV = Screening Level Value

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RIVER OPERABLE UNIT

FOREBAY CADMIUM IN SEDIMENT AND CLAM TISSUE

DRAWING NUMBER: FIGURE 9-14b
GIS FILE NUMBER: FIG 9-14b
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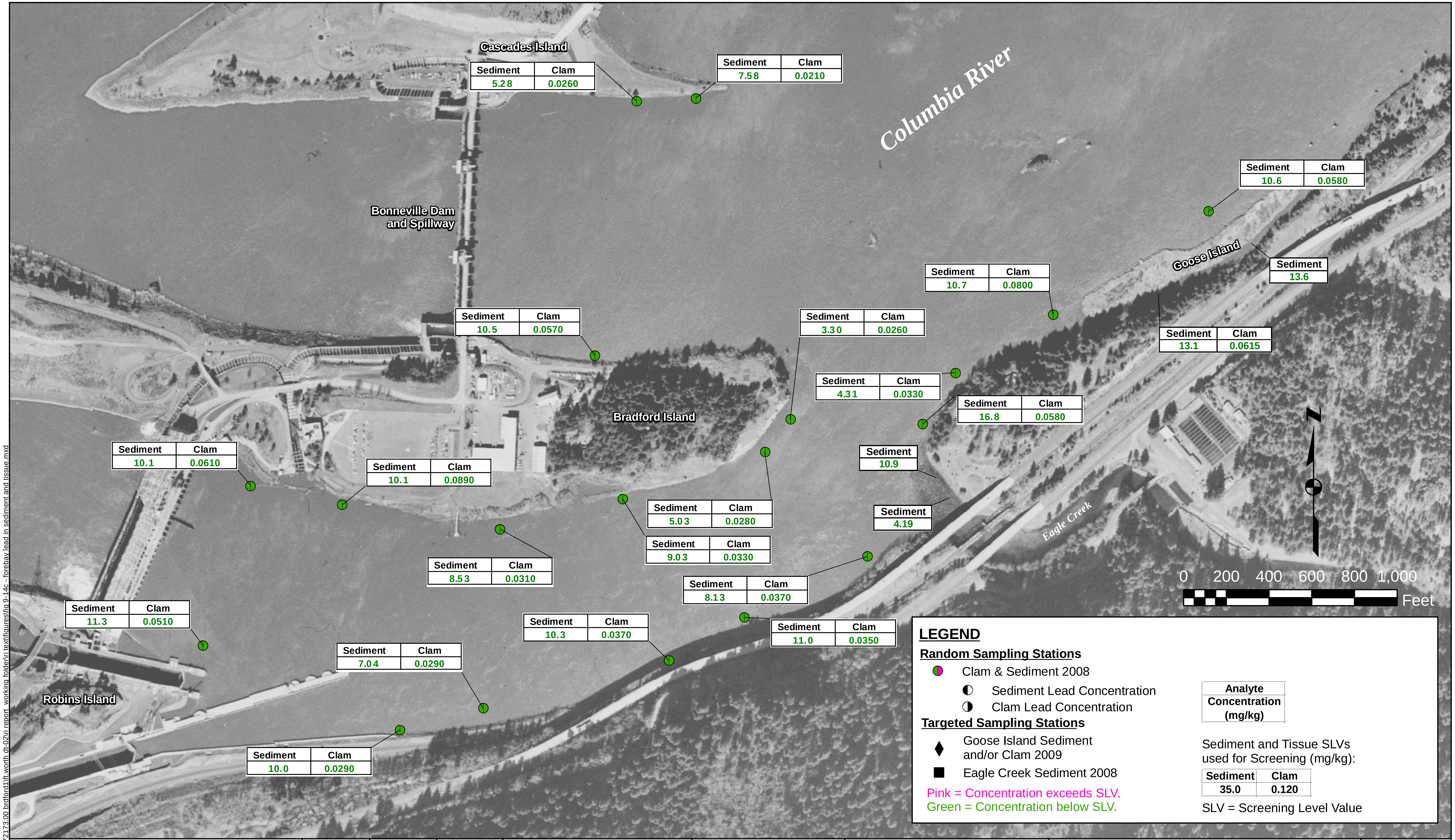

LEGEND

Random Sampling Stations

● Clam & Sediment 2008

◐ Sediment Lead Concentration

◑ Clam Lead Concentration

Targeted Sampling Stations

◆ Goose Island Sediment and/or Clam 2009

■ Eagle Creek Sediment 2008

Pink = Concentration exceeds SLV.

Green = Concentration below SLV.

Analyte
Concentration (mg/kg)

Sediment and Tissue SLVs used for Screening (mg/kg):

Sediment	Clam
35.0	0.120

SLV = Screening Level Value

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RIVER OPERABLE UNIT

FOREBAY LEAD IN SEDIMENT AND CLAM TISSUE

DRAWING NUMBER: FIGURE 9-14c

GIS FILE NUMBER: FIG 9-14c

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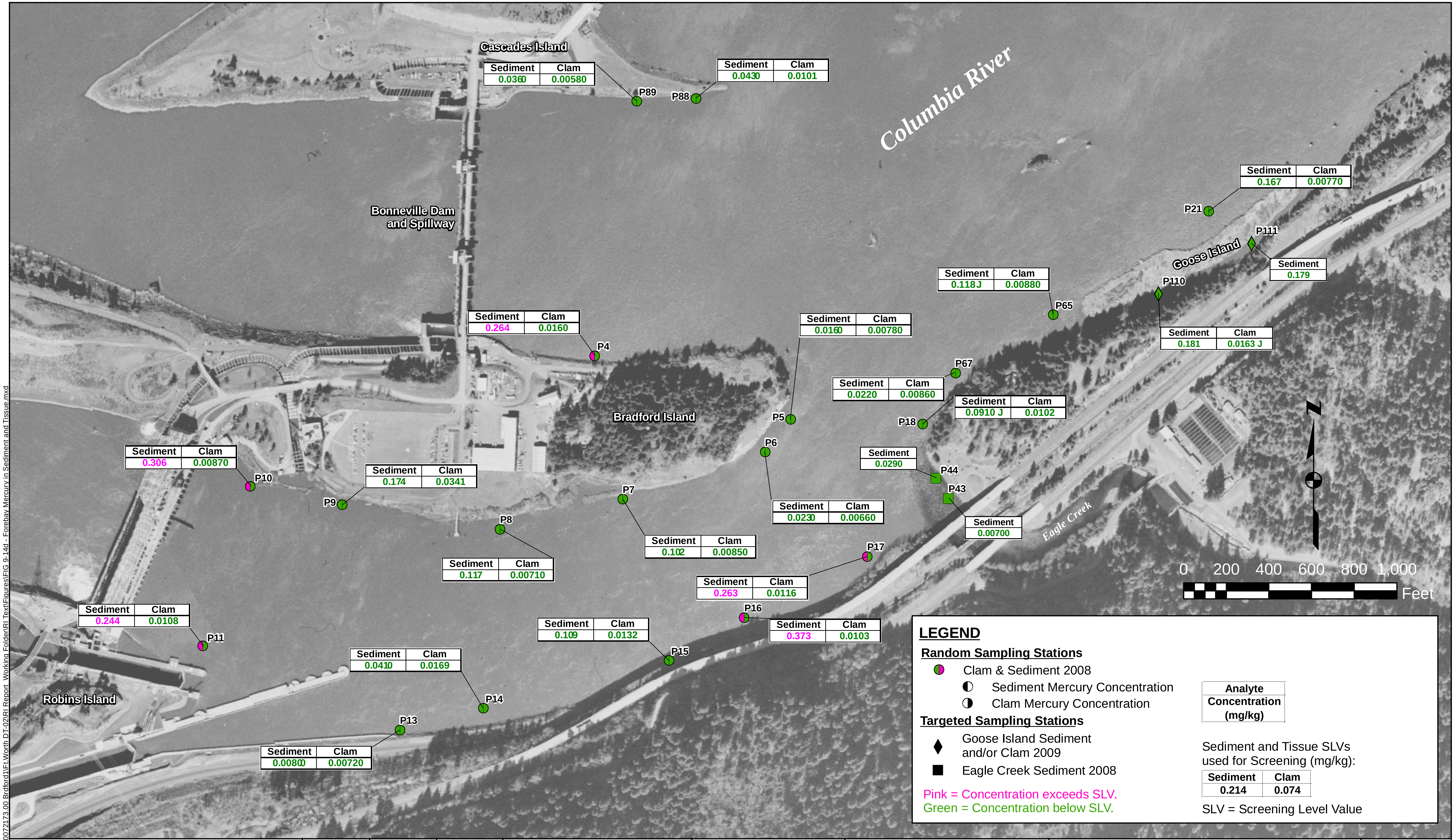

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-14d - Forebay Mercury in Sediment and Tissue.mxd

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RIVER OPERABLE UNIT

FOREBAY MERCURY IN SEDIMENT AND CLAM TISSUE

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FIGURE 9-14d
GIS FILE NUMBER:
FIG 9-14d
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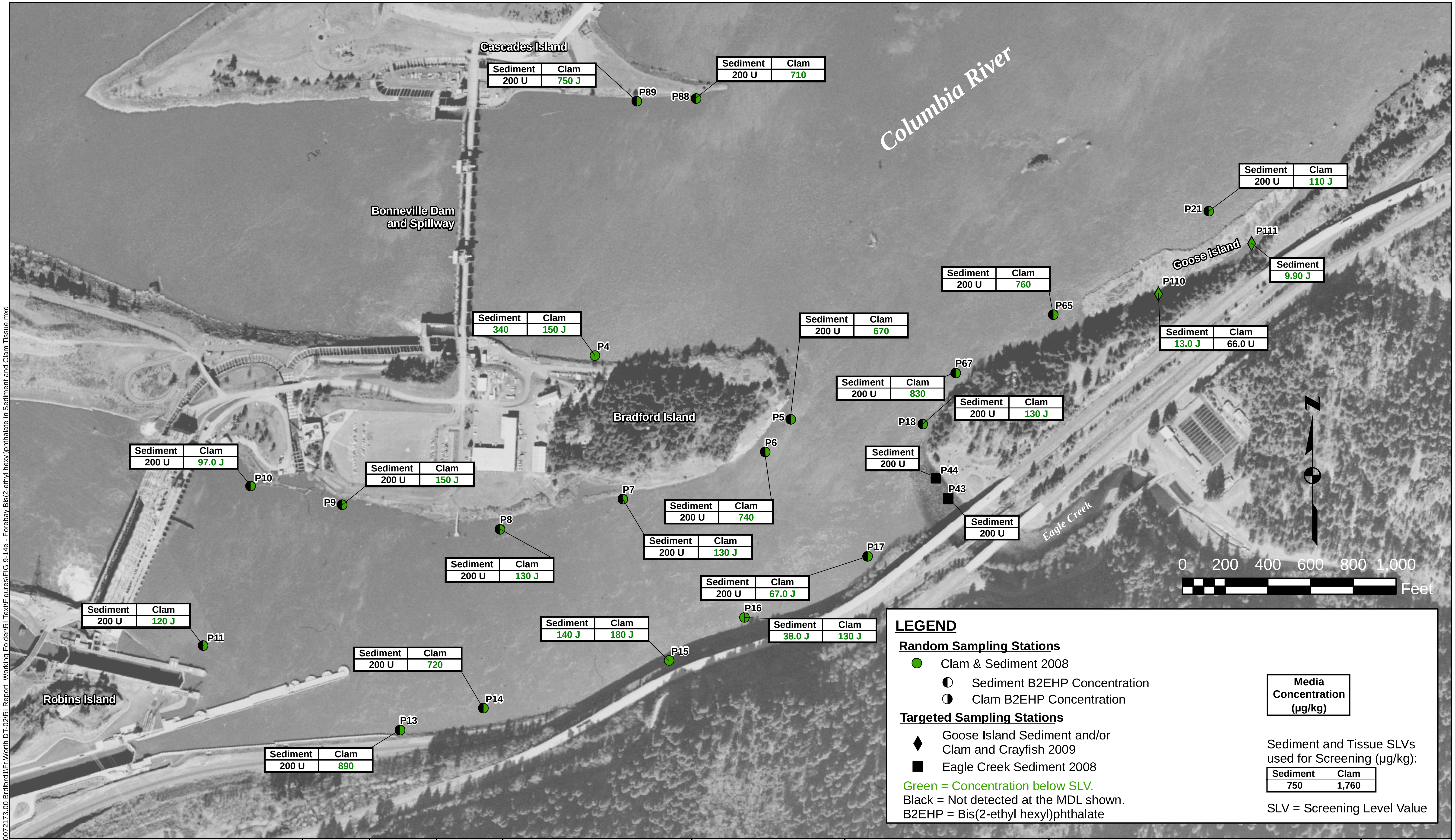

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-14e - Forebay Bis(2-ethyl hexyl)phthalate in Sediment and Clam Tissue.mxd

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RIVER OPERABLE UNIT

FOREBAY B2EHP IN SEDIMENT AND CLAM TISSUE

DRAWING NUMBER: FIGURE 9-14e
GIS FILE NUMBER: FIG 9-14e
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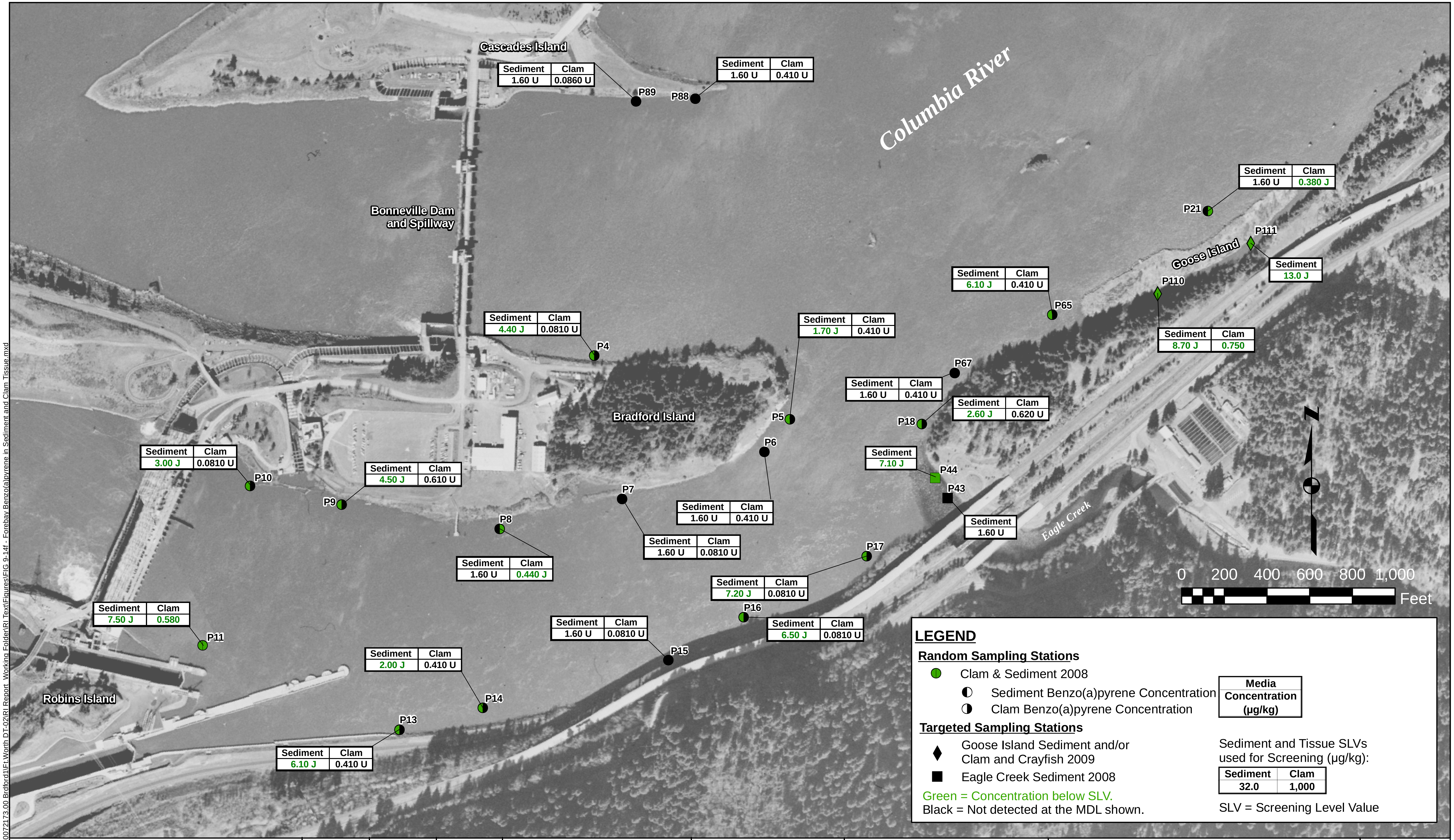

LEGEND

Random Sampling Stations

● Clam & Sediment 2008

◐ Sediment Benzo(a)pyrene Concentration

◑ Clam Benzo(a)pyrene Concentration

Media
Concentration (µg/kg)

Targeted Sampling Stations

◆ Goose Island Sediment and/or Clam and Crayfish 2009

■ Eagle Creek Sediment 2008

Green = Concentration below SLV.
Black = Not detected at the MDL shown.

Sediment and Tissue SLVs used for Screening (µg/kg):

Sediment	Clam
32.0	1,000

SLV = Screening Level Value

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RIVER OPERABLE UNIT

FOREBAY BENZO(A)PYRENE IN SEDIMENT AND CLAM TISSUE

DRAWING NUMBER: FIGURE 9-14f
GIS FILE NUMBER: FIG 9-14f
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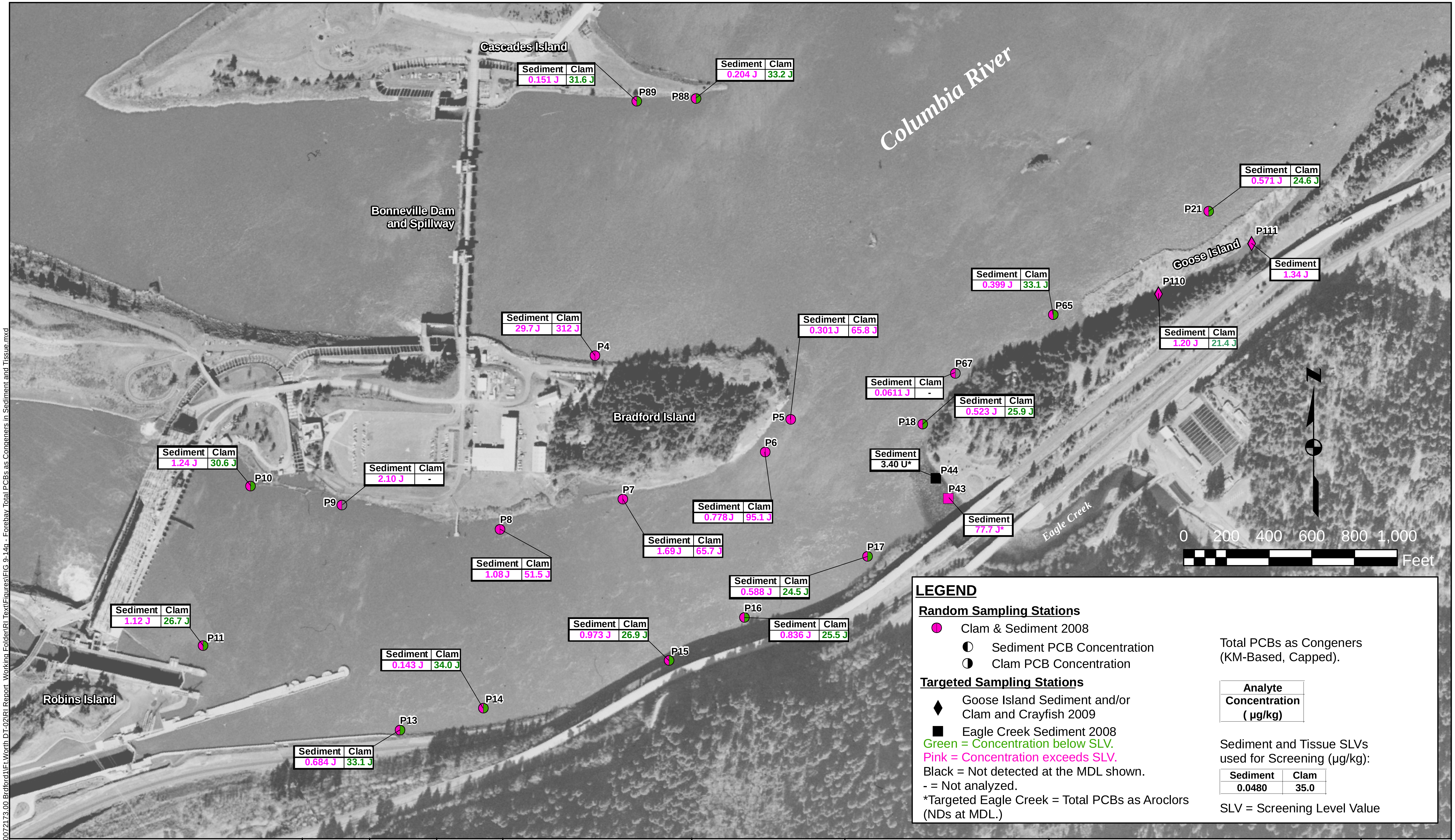

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	DRAWN BY: SB	APPROVED BY: MP		CASCADE LOCKS, OREGON	FOREBAY TOTAL PCBs AS CONGENERS IN SEDIMENT AND CLAM TISSUE	GIS FILE NUMBER: FIG 9-14g
	CHECKED BY: SB	DATE: OCTOBER 2010				SHEET: REV.

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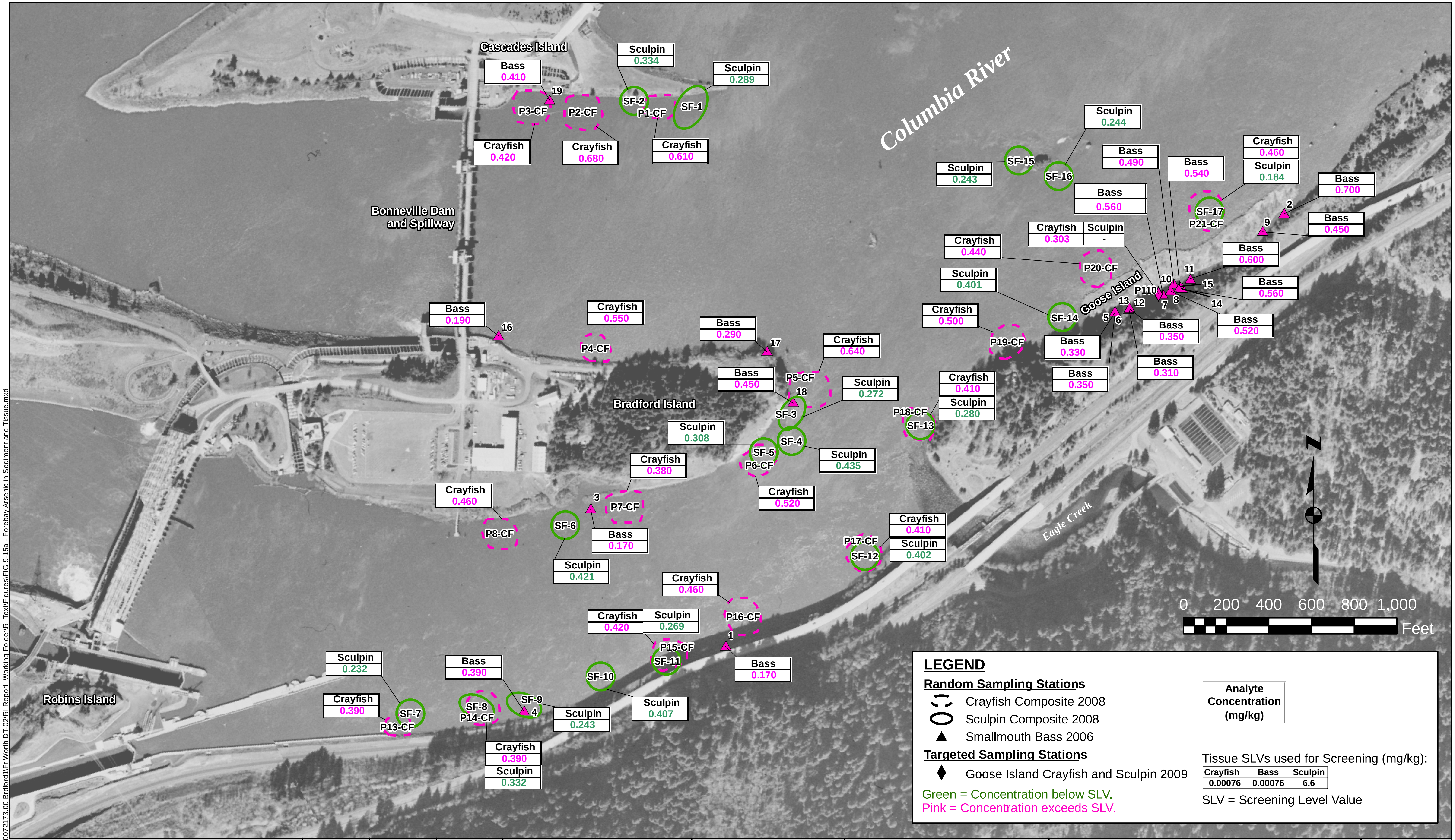

Tissue SLVs used for Screening (mg/kg):

Crayfish	Bass	Sculpin
0.00076	0.00076	6.6

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RIVER OPERABLE UNIT

FOREBAY ARSENIC IN CRAYFISH, SCULPIN, AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER:
FIGURE 9-15a

GIS FILE NUMBER:
FIG 9-15a

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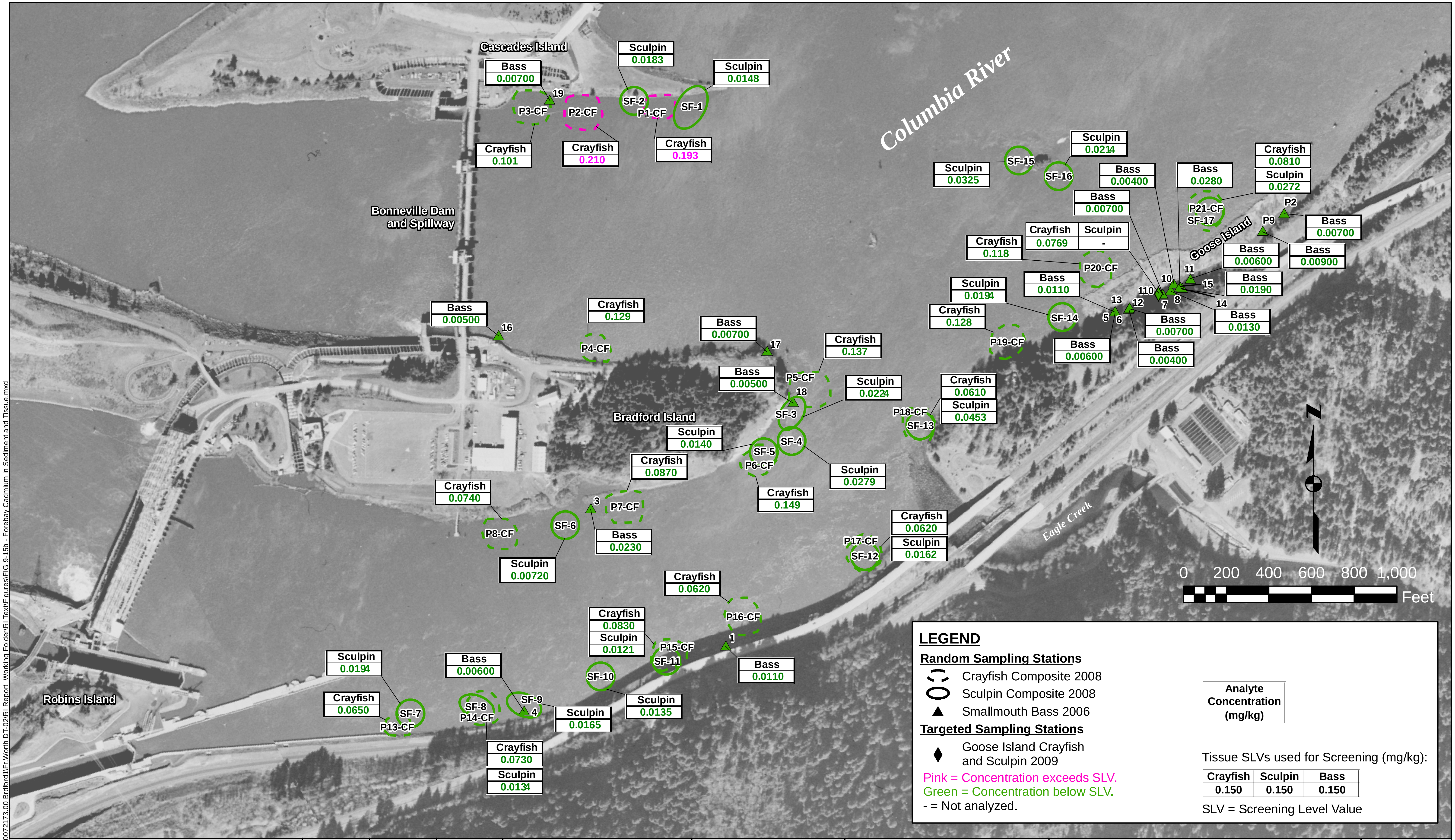

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RIVER OPERABLE UNIT

FOREBAY CADMIUM IN CRAYFISH, SCULPIN AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER:
FIGURE 9-15b

GIS FILE NUMBER:
FIG 9-15b

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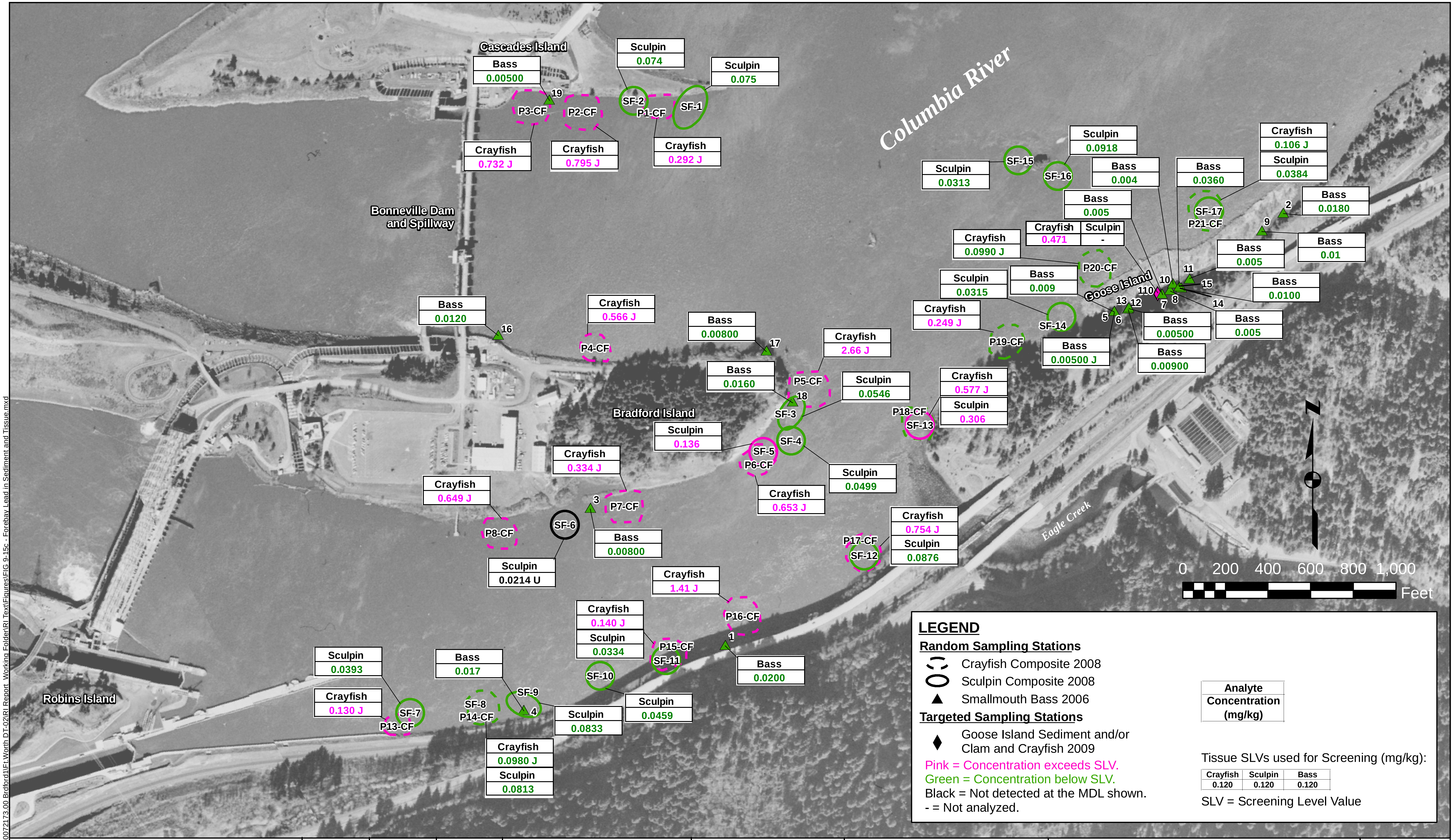

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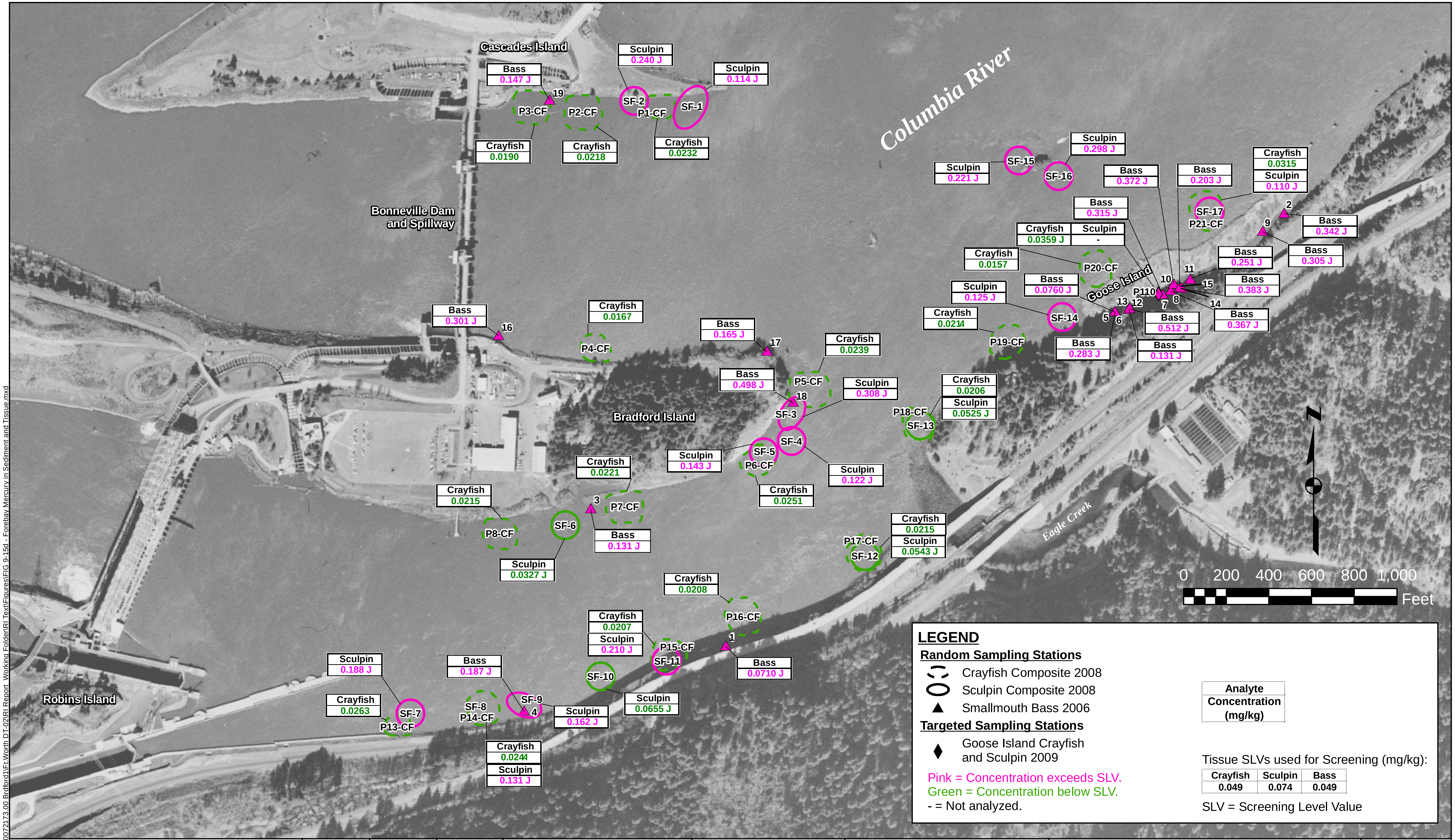
	DRAWN BY: SB	APPROVED BY: MP		CASCADE LOCKS, OREGON	**FOREBAY LEAD IN CRAYFISH, SCULPIN, AND SMALLMOUTH BASS TISSUE**	GIS FILE NUMBER: FIG 9-15c
	CHECKED BY: SB	DATE: JULY 2010				SHEET: REV.



LEGEND

Random Sampling Stations

- Crayfish Composite 2008
- Sculpin Composite 2008
- ▲ Smallmouth Bass 2006

Targeted Sampling Stations

- ♦ Goose Island Crayfish and Sculpin 2009

Pink = Concentration exceeds SLV.
Green = Concentration below SLV.
- = Not analyzed.

Analyte
Concentration (mg/kg)

Tissue SLVs used for Screening (mg/kg):

Crayfish	Sculpin	Bass
0.049	0.074	0.049

SLV = Screening Level Value

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RIVER OPERABLE UNIT

FOREBAY MERCURY IN CRAYFISH, SCULPIN, AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER: FIGURE 9-15d
GIS FILE NUMBER: FIG 9-15d
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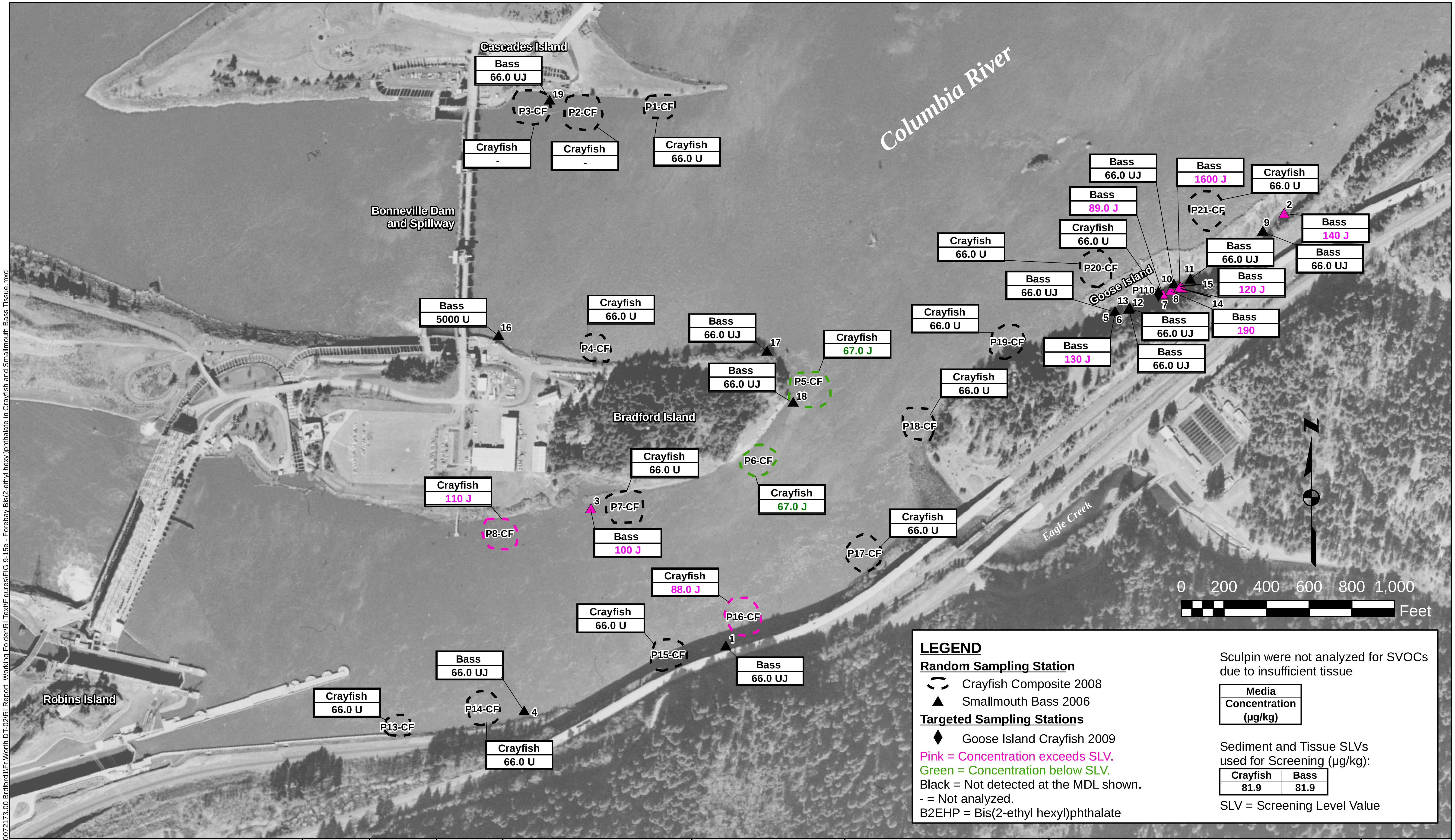

LEGEND

Random Sampling Station

◌ Crayfish Composite 2008

▲ Smallmouth Bass 2006

Targeted Sampling Stations

◆ Goose Island Crayfish 2009

Pink = Concentration exceeds SLV.

Green = Concentration below SLV.

Black = Not detected at the MDL shown.

- = Not analyzed.

B2EHP = Bis(2-ethyl hexyl)phthalate

Sculpin were not analyzed for SVOCs due to insufficient tissue

Media
Concentration (µg/kg)

Sediment and Tissue SLVs used for Screening (µg/kg):

Crayfish	Bass
81.9	81.9

SLV = Screening Level Value

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RIVER OPERABLE UNIT

FOREBAY B2EHP IN CRAYFISH AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER: FIGURE 9-15e

GIS FILE NUMBER: FIG 9-15e

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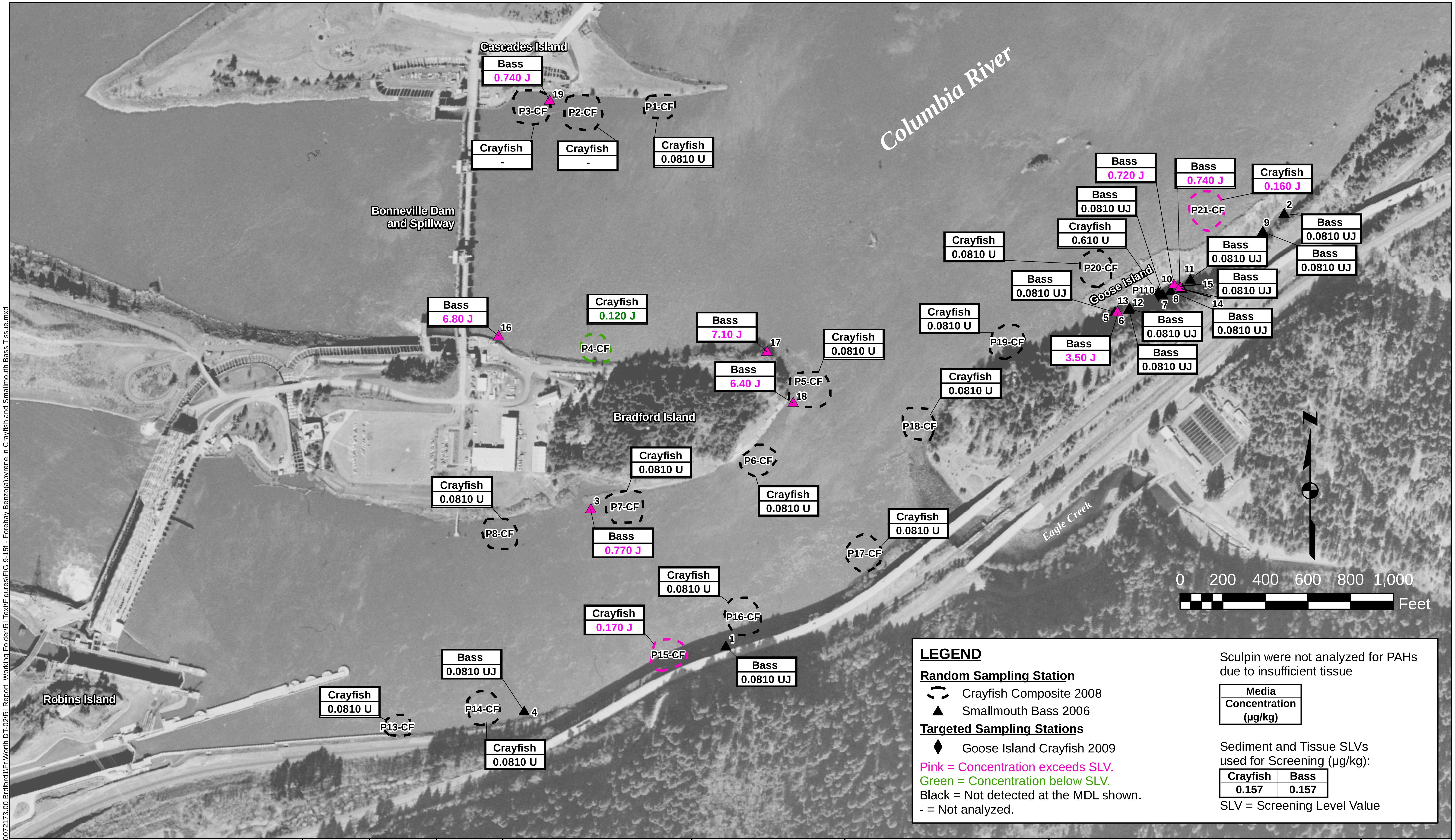
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-15e - Forebay Bis(2-ethyl hexyl)phthalate in Crayfish and Smallmouth Bass Tissue.mxd



LEGEND

Random Sampling Station

- Crayfish Composite 2008
- ▲ Smallmouth Bass 2006

Targeted Sampling Stations

- ◆ Goose Island Crayfish 2009

Pink = Concentration exceeds SLV.
Green = Concentration below SLV.
Black = Not detected at the MDL shown.
- = Not analyzed.

Sculpin were not analyzed for PAHs due to insufficient tissue

Media
Concentration (µg/kg)

Sediment and Tissue SLVs used for Screening (µg/kg):

Crayfish	Bass
0.157	0.157

SLV = Screening Level Value

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	DRAWN BY: SB	APPROVED BY: MP
	CHECKED BY: SB	DATE: JULY 2010

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RIVER OPERABLE UNIT

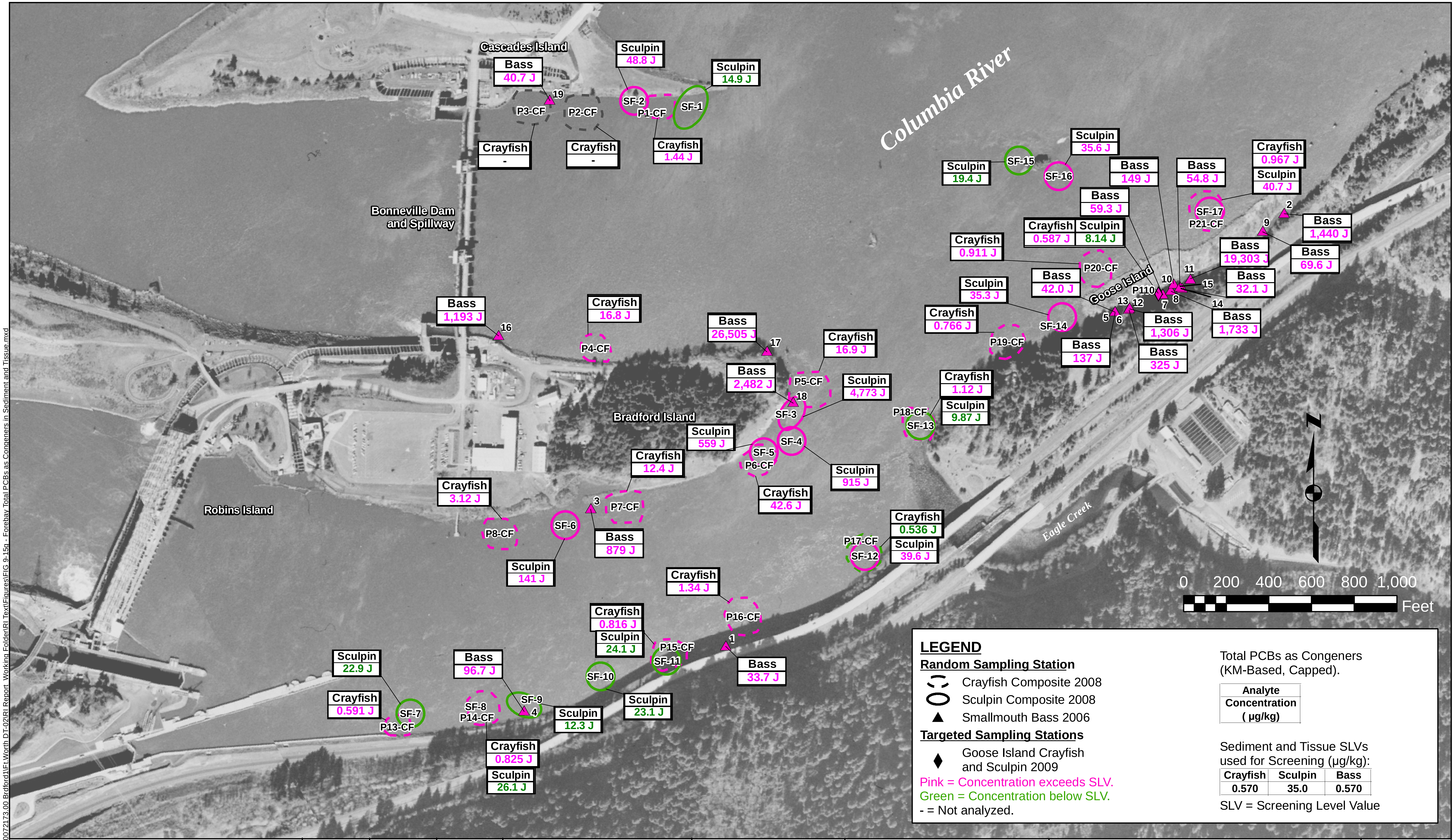
FOREBAY BENZO(A)PYRENE IN CRAYFISH AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER:
FIGURE 9-15f

GIS FILE NUMBER:
FIG 9-15f

SHEET:
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-15f - Forebay Benzo(a)pyrene in Crayfish and Smallmouth Bass Tissue.mxd



LEGEND

Random Sampling Station

- ◌ Crayfish Composite 2008
- ○ Sculpin Composite 2008
- ▲ Smallmouth Bass 2006

Targeted Sampling Stations

- ◆ Goose Island Crayfish and Sculpin 2009

Pink = Concentration exceeds SLV.
Green = Concentration below SLV.
- = Not analyzed.

Total PCBs as Congeners (KM-Based, Capped).

Analyte
Concentration (µg/kg)

Sediment and Tissue SLVs used for Screening (µg/kg):

Crayfish	Sculpin	Bass
0.570	35.0	0.570

SLV = Screening Level Value

JOB No. 25696528	DESIGNED: LSM	PROJ. ENGINEER: LSM
	DRAWN BY: SB	APPROVED BY: MP
	CHECKED BY: SB	DATE: OCTOBER 2010

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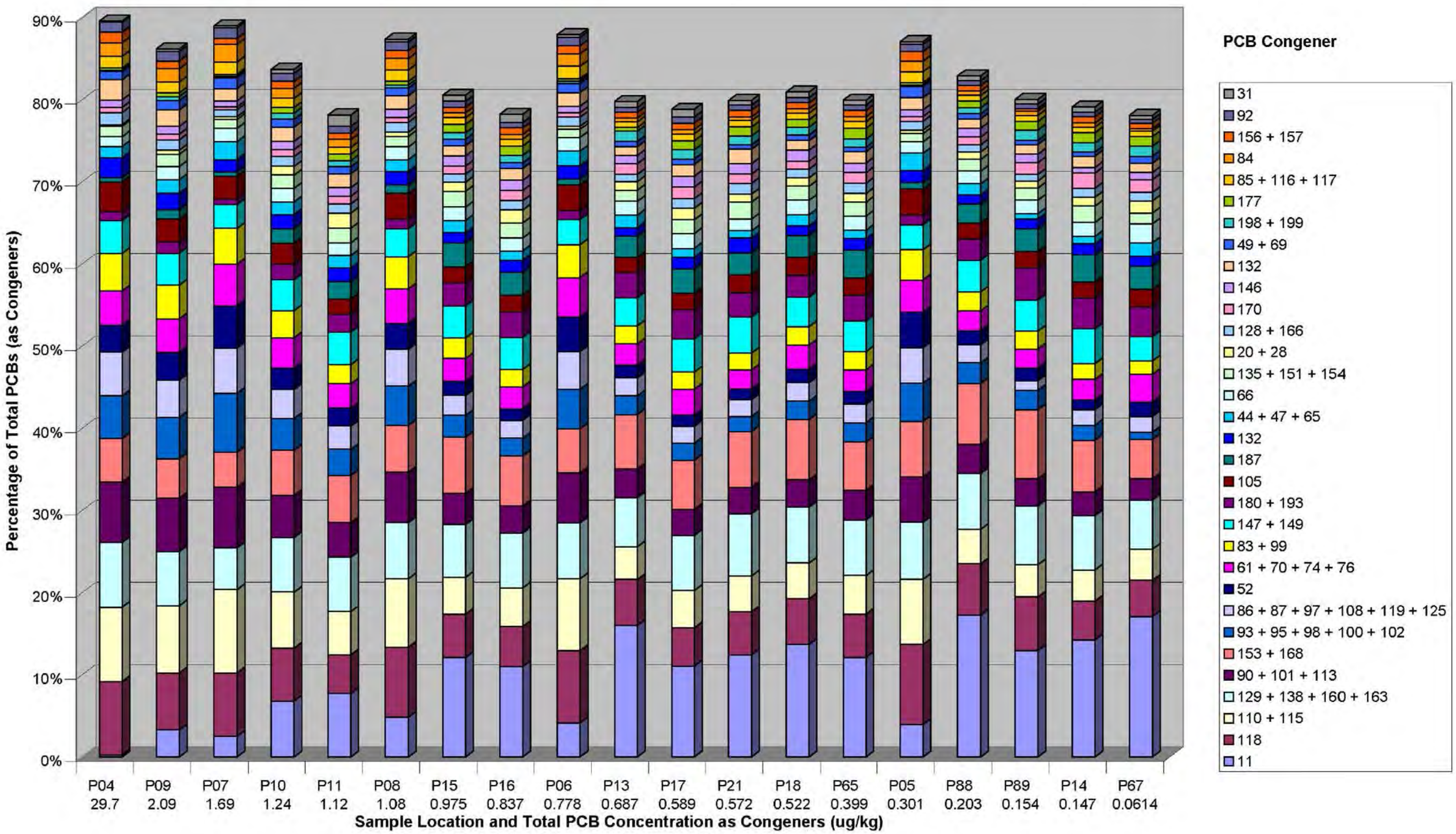
RIVER OPERABLE UNIT

FOREBAY TOTAL PCBs AS CONGENERS IN CRAYFISH, SCULPIN, AND SMALLMOUTH BASS TISSUE

DRAWING NUMBER: FIGURE 9-15g
GIS FILE NUMBER: FIG 9-15g
SHEET:
REV.

O:\25692709 USACE\53-F0072173.00 Brdford\1Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-15g - Forebay Total PCBs as Congeners in Sediment and Tissue.mxd



No.	DATE	BY	REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: HP
APPROVED BY: LSM
CHECKED BY: LSM
DATE: JULY 2010

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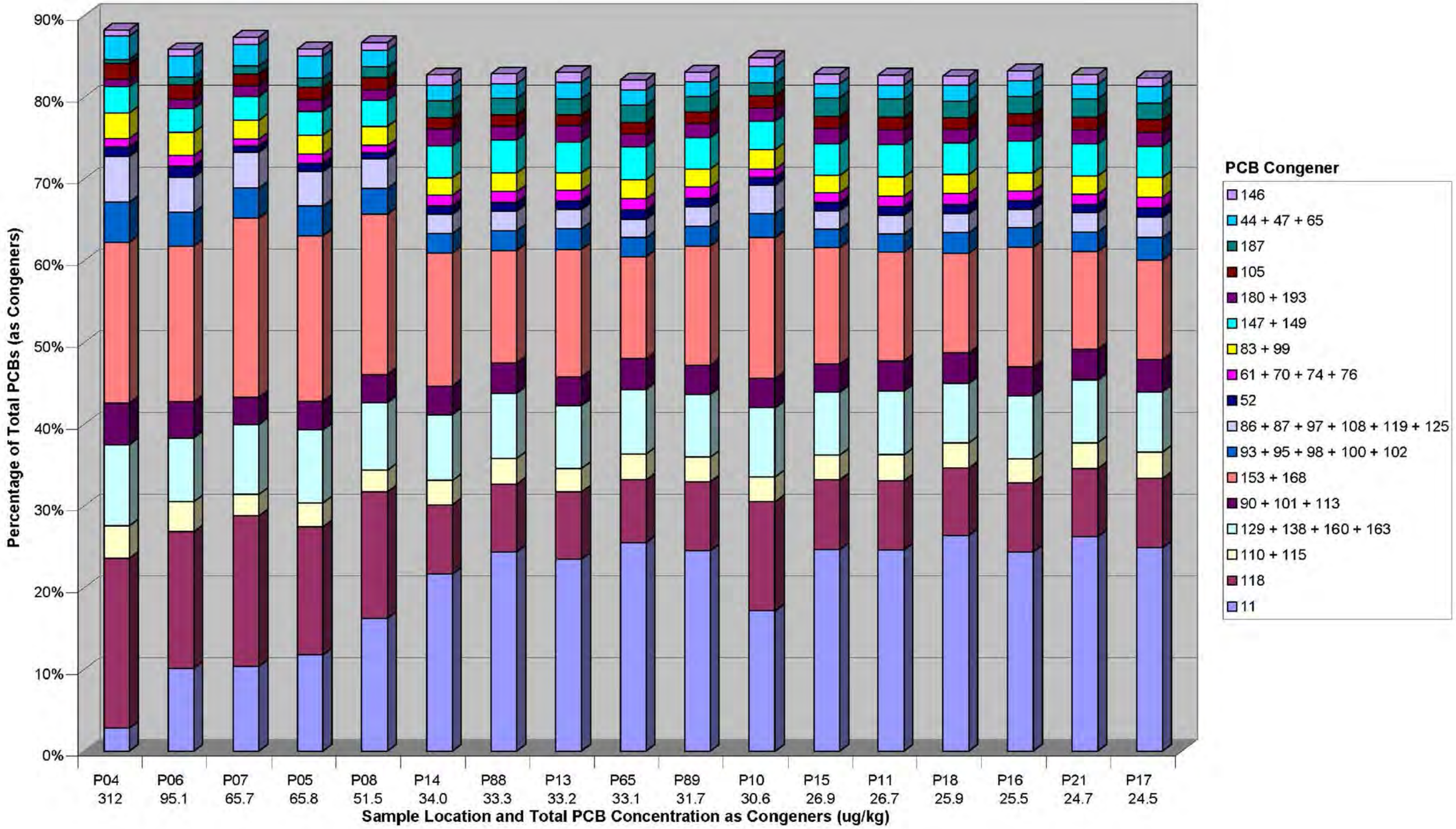
FOREBAY PCB CONGENER
DISTRIBUTION IN SEDIMENT

DRAWING NUMBER: FIG 9-16a
CAD FILE NUMBER: FIG 9-16a
SHEET: OF
REV.

c:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-16a – Forebay PCB Congener Distribution In Sediment.dwg Nov 18, 2010 – 10:20am



c:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-16b - Forebay PCB Congener Distribution In Clam Tissue.dwg Nov 18, 2010 - 10:21am

No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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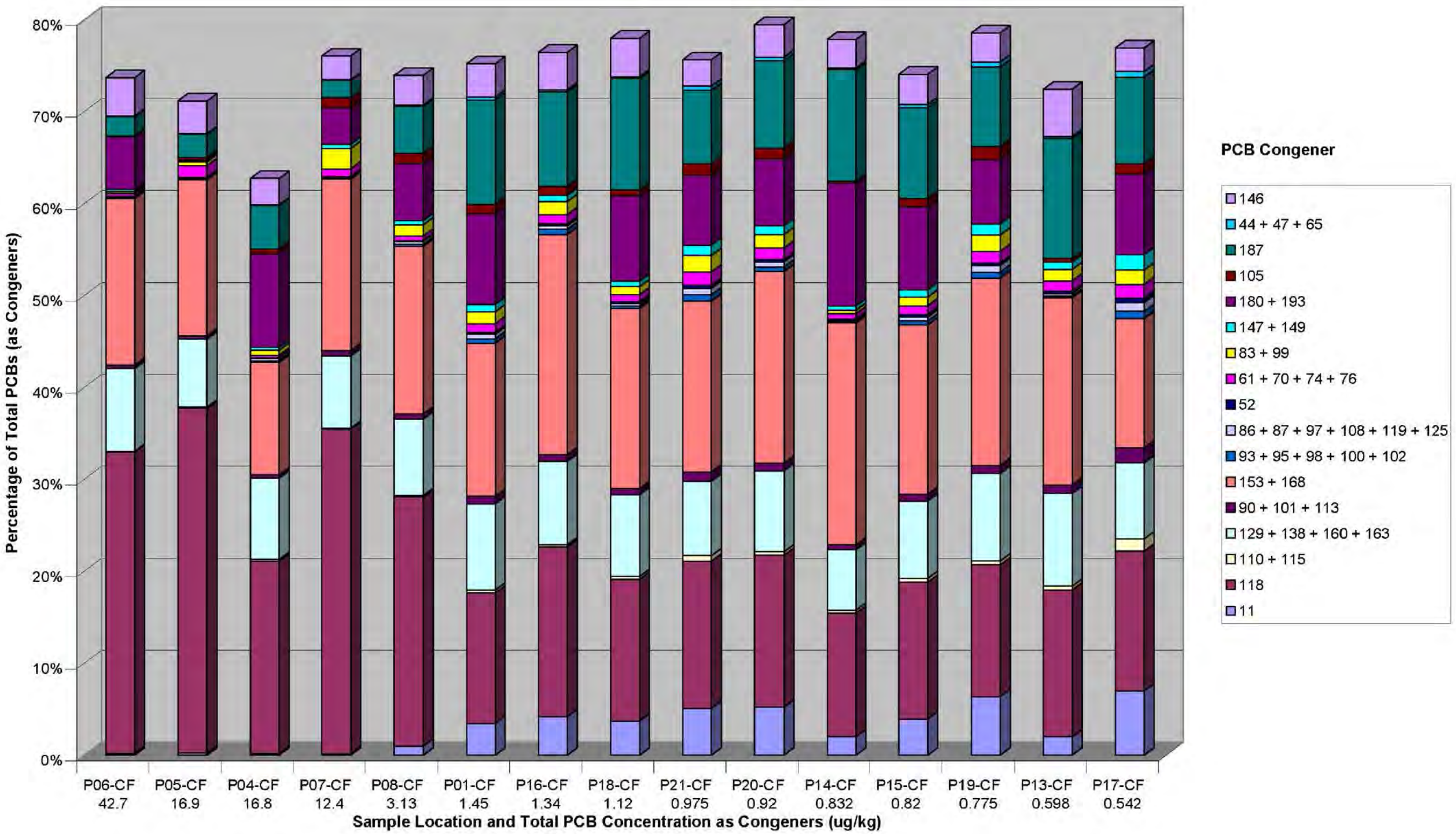
FOREBAY PCB CONGENER
DISTRIBUTION IN CLAM TISSUE

DRAWING NUMBER: FIG 9-16b
CAD FILE NUMBER: FIG 9-16b
SHEET: OF
REV.



c:\25692709 USACE\53-F0072173.00 Bradford\1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-16c – Forebay PCB Congener Distribution in Crayfish Tissue.dwg Nov 18, 2010 – 10:21am

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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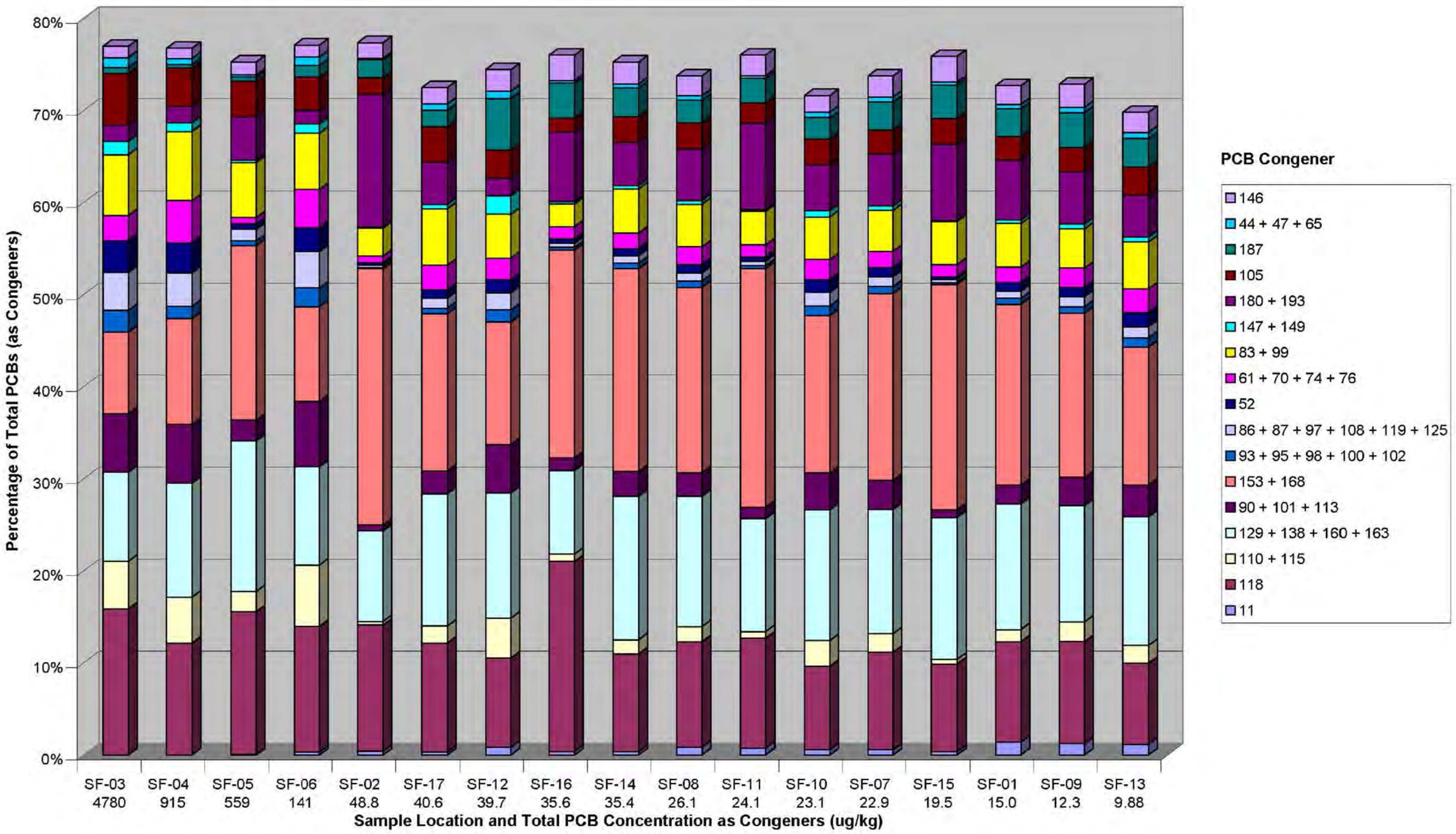
CASCADE LOCKS, OREGON

FOREBAY PCB CONGENER
DISTRIBUTION IN CRAYFISH TISSUE

DRAWING NUMBER: FIG 9-16c
CAD FILE NUMBER: FIG 9-16c
SHEET: OF
REV.



No. DATE BY REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: HP
APPROVED BY: LSM
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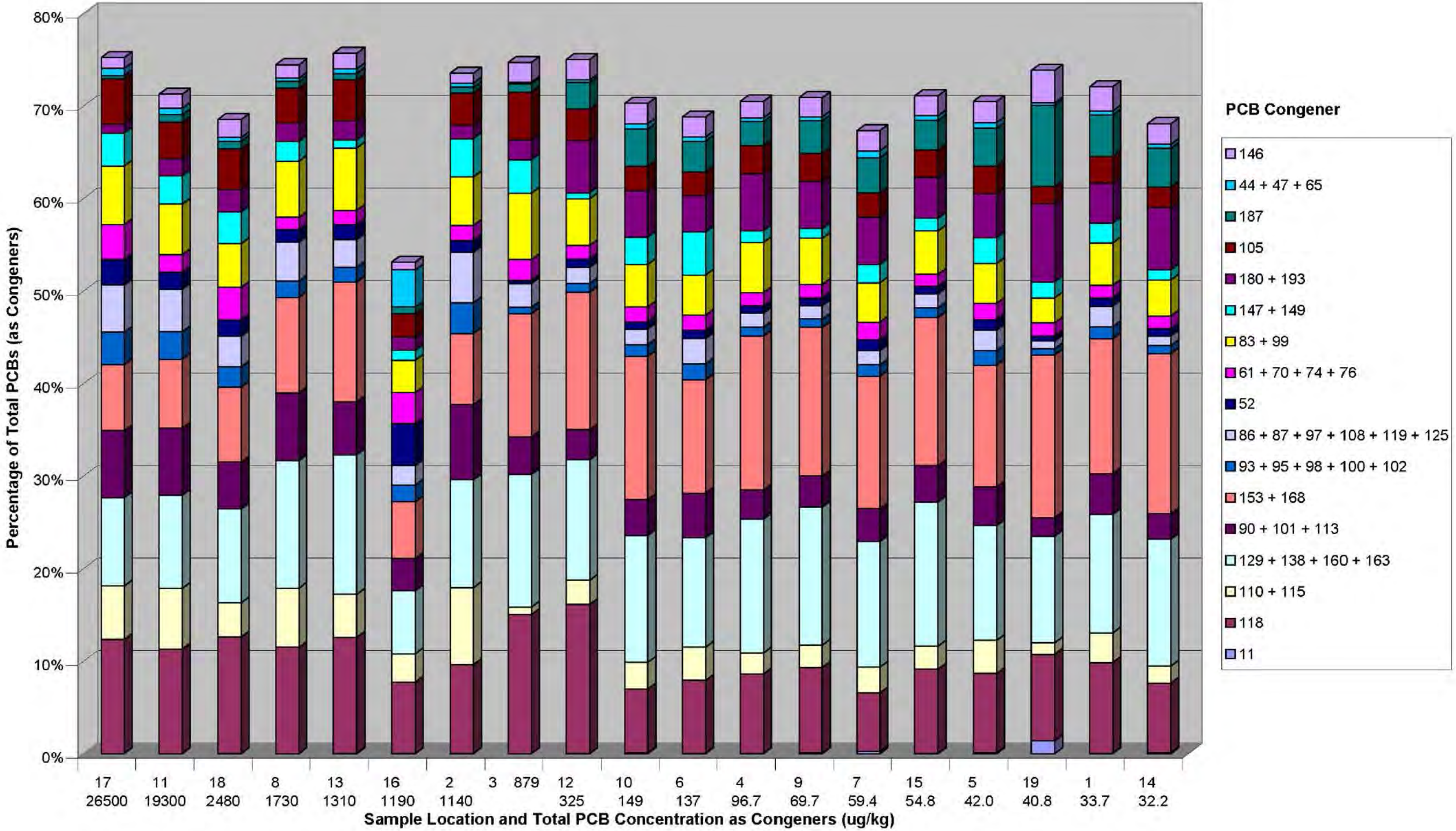
FOREBAY PCB CONGENER
DISTRIBUTION IN SCULPIN TISSUE

DRAWING NUMBER: FIG 9-16d
CAD FILE NUMBER: FIG 9-16d
SHEET: OF
REV.

c:\25692709 USACE\53-F0072173.00 Braford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-16d - Forebay PCB Congener Distribution In Sculpin Tissue.dwg Nov 18, 2010 - 10:22am



O:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-16e - Forebay PCB Congener Distribution in Smallmouth Bass Tissue.dwg Nov 18, 2010 - 10:23am

No.	DATE	BY	REVISION

JOB No.: 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: HP
APPROVED BY: LSM
CHECKED BY: LSM
DATE: JULY 2010

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FOREBAY PCB CONGENER
DISTRIBUTION IN SMALLMOUTH BASS TISSUE

DRAWING NUMBER: FIG 9-16e
CAD FILE NUMBER: FIG 9-16e
SHEET: OF
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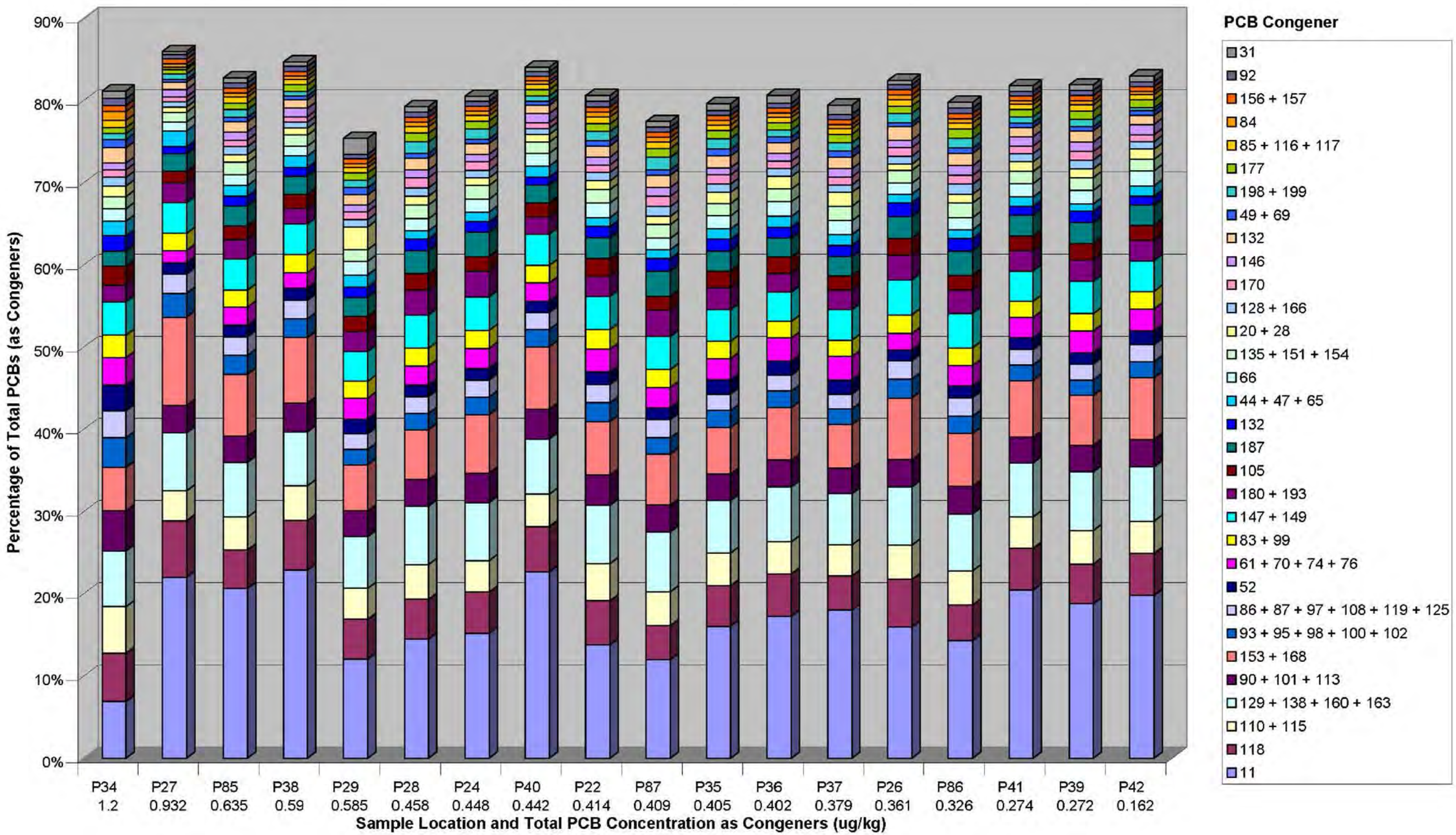

No. DATE BY REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: HP
APPROVED BY: LSM
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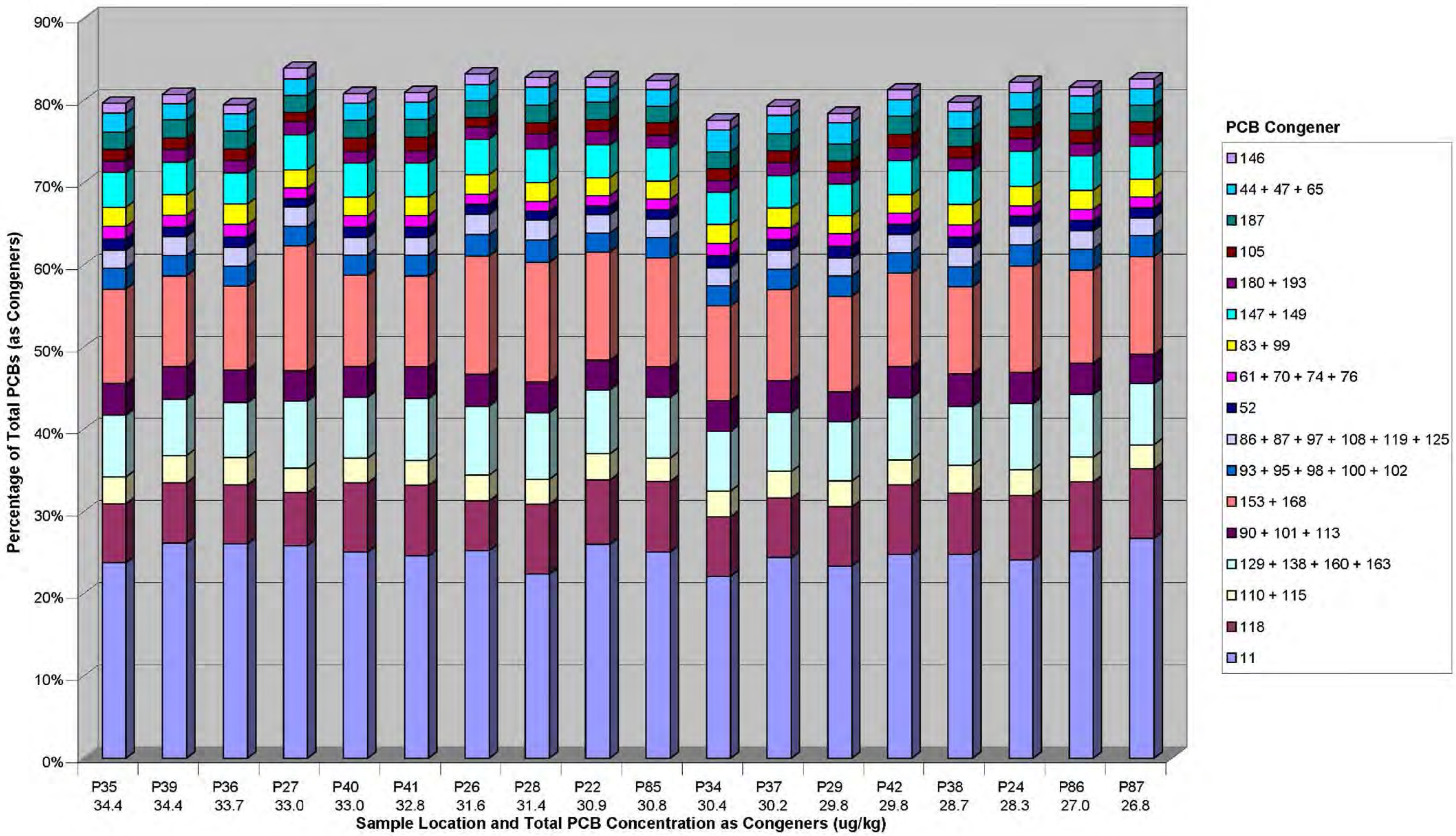
REFERENCE AREA PCB CONGENER DISTRIBUTION IN SEDIMENT

DRAWING NUMBER: FIG 9-17a
CAD FILE NUMBER: FIG 9-17a
SHEET: OF
REV.

c:\25692709 USACE\53-F0072173.00 Bradford\1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-17a - Reference Area PCB Congener Distribution in Sediment.dwg Nov 18, 2010 - 10:23am

O:\25692709 USACE\53-F0072173.00 Bradford\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-17b – Reference Area PCB Congener Distribution in Clam Tissue.dwg Nov 18, 2010 – 10:24am



No.	DATE	BY	REVISION

JOB No.: 25696946
SCALE:
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DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
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REFERENCE AREA PCB CONGENER
DISTRIBUTION IN CLAM TISSUE

DRAWING NUMBER: FIG 9-17b
CAD FILE NUMBER: FIG 9-17b
SHEET: OF
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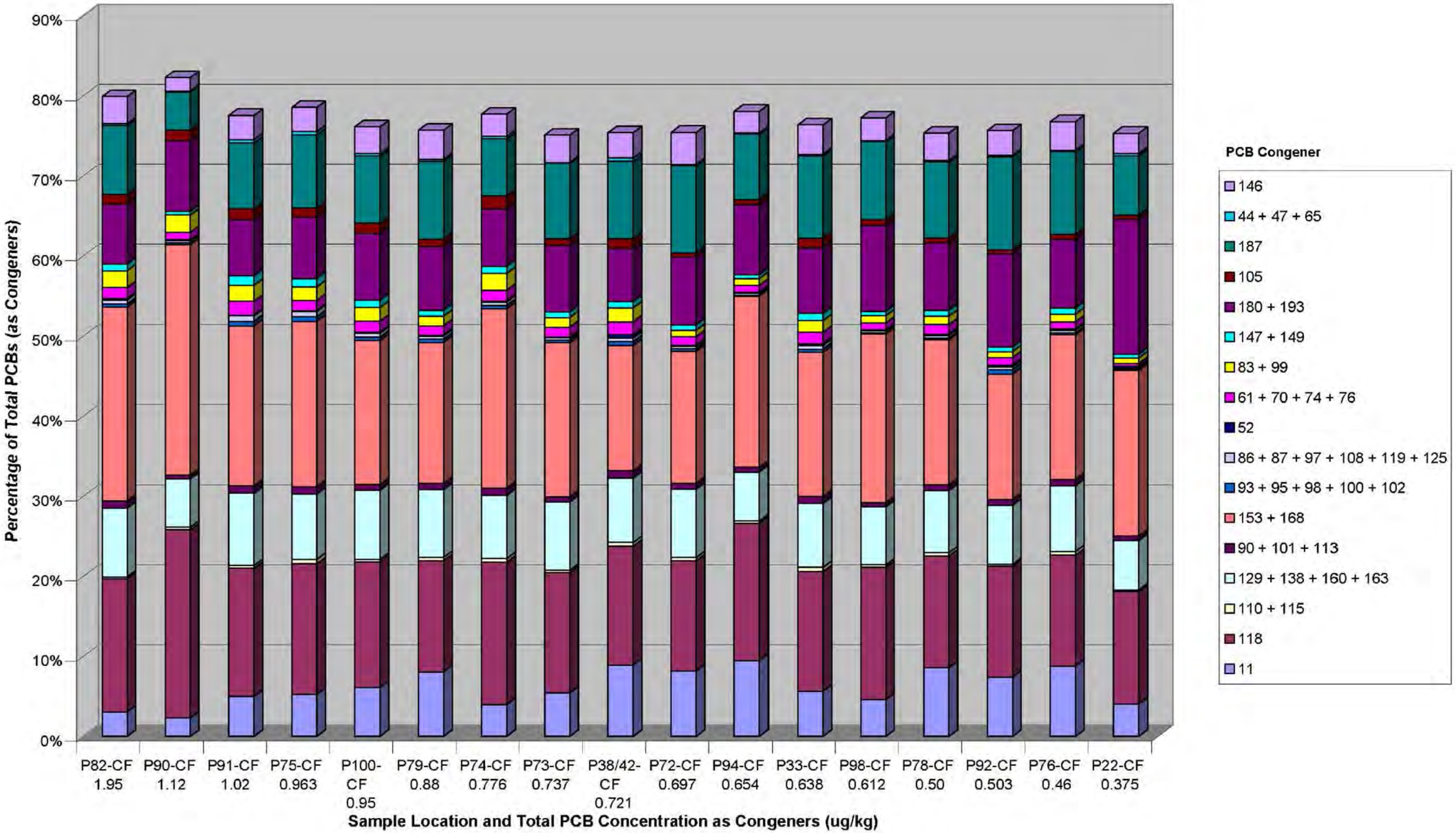

c:\25692709 USACE\53-F0072173.00 Bradford\1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-17c - Reference Area PCB Congener Distribution in Crayfish Tissue.dwg Nov 18, 2010 - 10:24am

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
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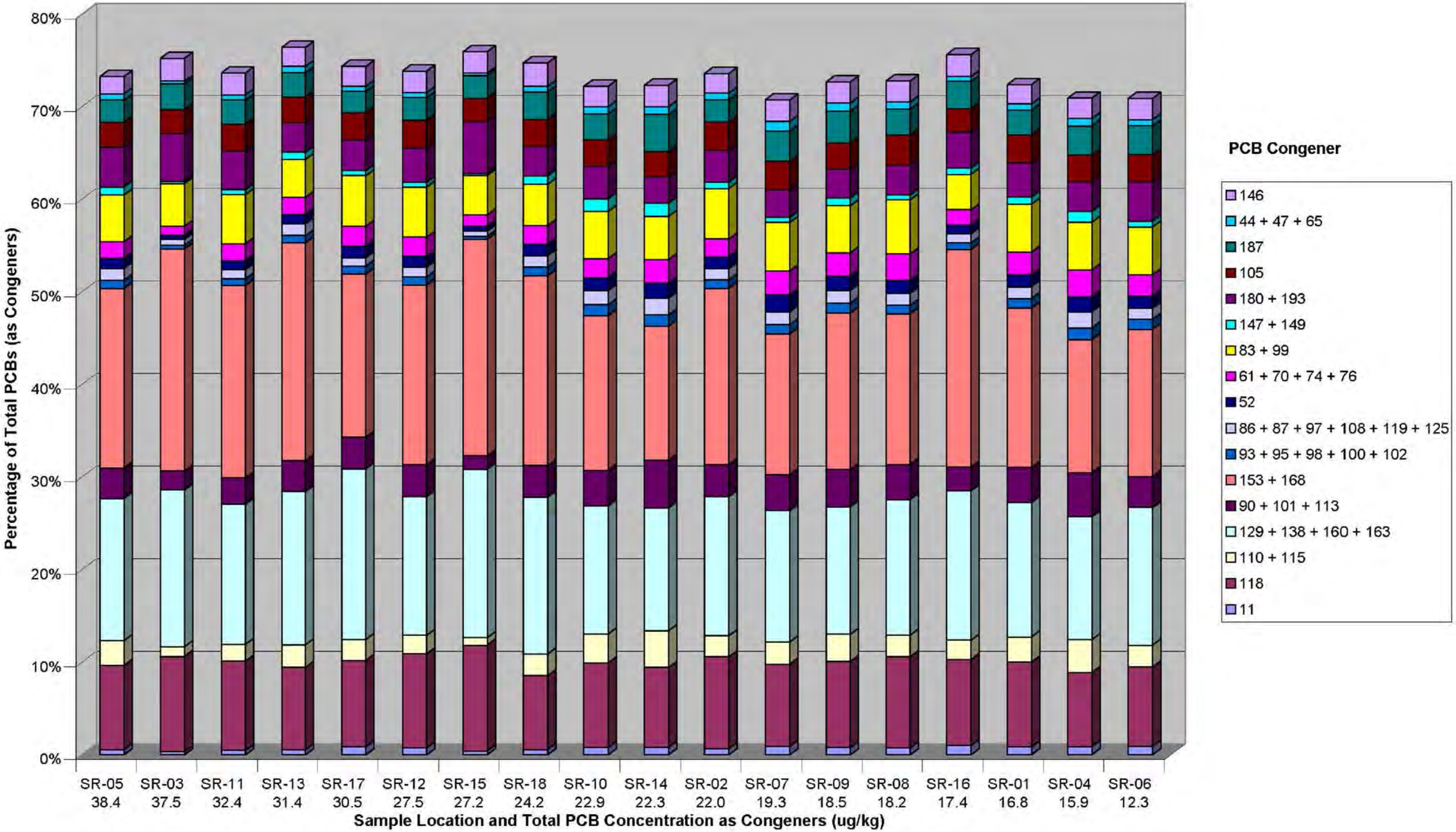
REFERENCE AREA PCB CONGENER
DISTRIBUTION IN CRAYFISH TISSUE

DRAWING NUMBER: FIG 9-17c
CAD FILE NUMBER: FIG 9-17c
SHEET: OF
REV.



O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-17d - Reference Area PCB Congener Distribution in Sculpin Tissue.dwg Nov 18, 2010 - 10:25am

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
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DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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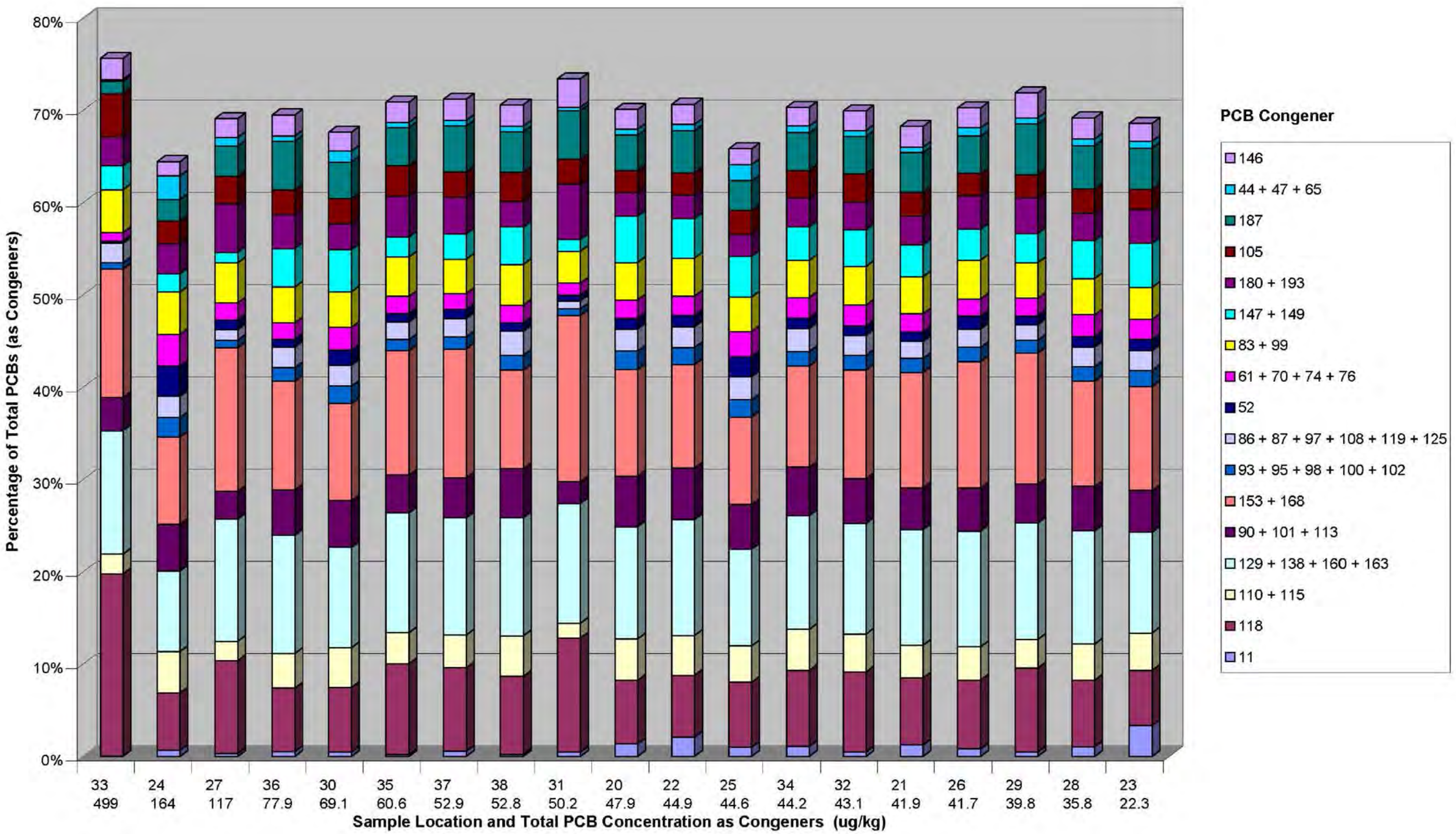
REFERENCE AREA PCB CONGENER DISTRIBUTION IN SCULPIN TISSUE

DRAWING NUMBER: FIG 9-17d
CAD FILE NUMBER: FIG 9-17d
SHEET: OF
REV.



No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: HP
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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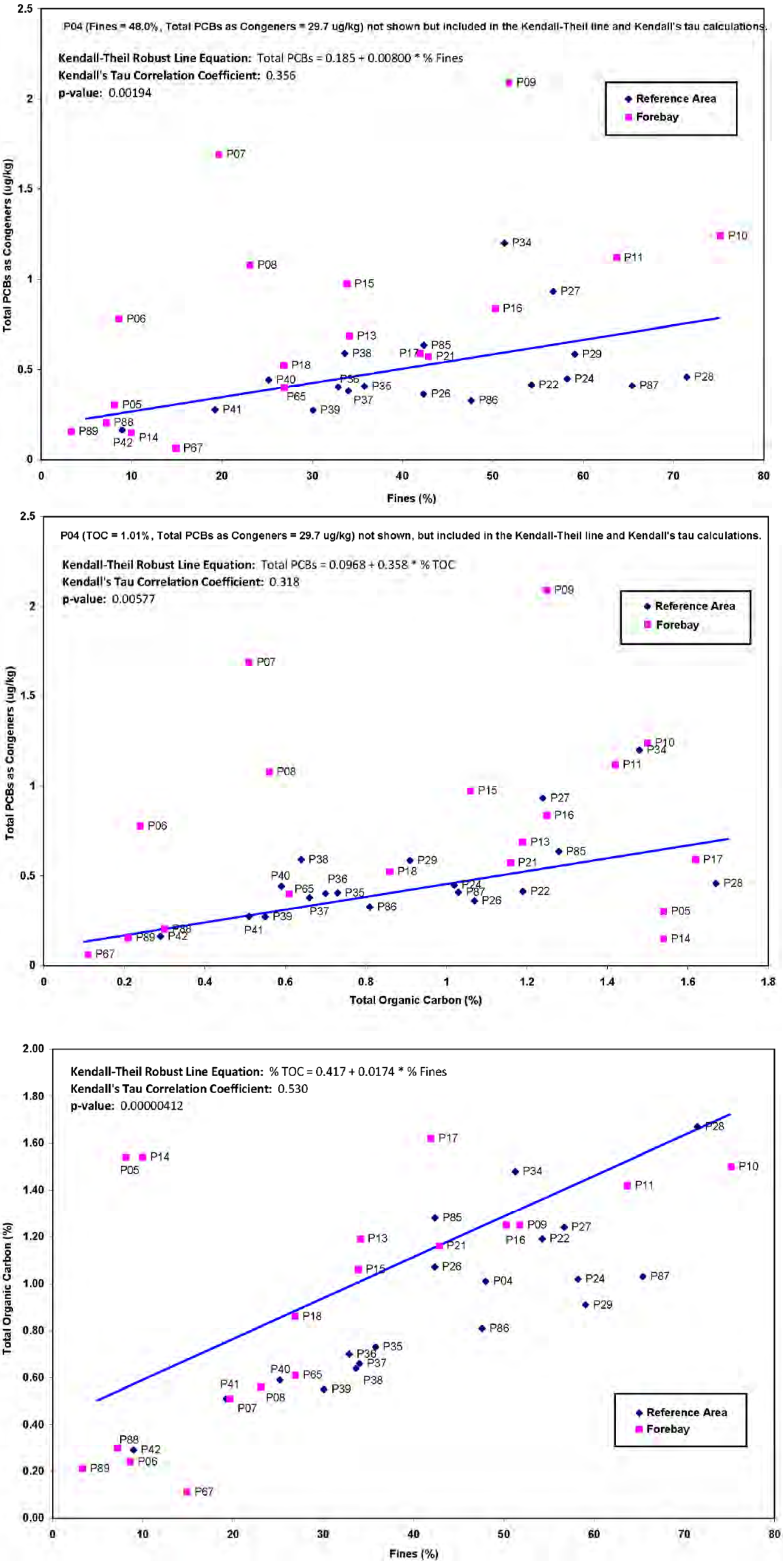
REFERENCE AREA PCB CONGENER
DISTRIBUTION IN SMALLMOUTH BASS TISSUE

DRAWING NUMBER: FIG 9-17e
CAD FILE NUMBER: FIG 9-17e
SHEET: OF
REV.

O:\25692709 USACE\63-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-17e - Reference Area PCB Congener Distribution in Smallmouth Bass Tissue.dwg Nov 18, 2010 - 10:28am



P04 (Fines = 48.0%, Total PCBs as Congeners = 29.7 ug/kg) not shown but included in the Kendall-Theil line and Kendall's tau calculations.

Kendall-Theil Robust Line Equation: Total PCBs = 0.185 + 0.00800 * % Fines
Kendall's Tau Correlation Coefficient: 0.356
p-value: 0.00194

P04 (TOC = 1.01%, Total PCBs as Congeners = 29.7 ug/kg) not shown, but included in the Kendall-Theil line and Kendall's tau calculations.

Kendall-Theil Robust Line Equation: Total PCBs = 0.0968 + 0.358 * % TOC
Kendall's Tau Correlation Coefficient: 0.318
p-value: 0.00577

Kendall-Theil Robust Line Equation: % TOC = 0.417 + 0.0174 * % Fines
Kendall's Tau Correlation Coefficient: 0.530
p-value: 0.00000412

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 9-18 - Correlation Between Grainsize, TOC, and Total PCBs in Sediment.dwg Nov 18, 2010 - 10:26am

CORRELATION BETWEEN GRAINSIZE, TOC, AND TOTAL PCBs IN SEDIMENT

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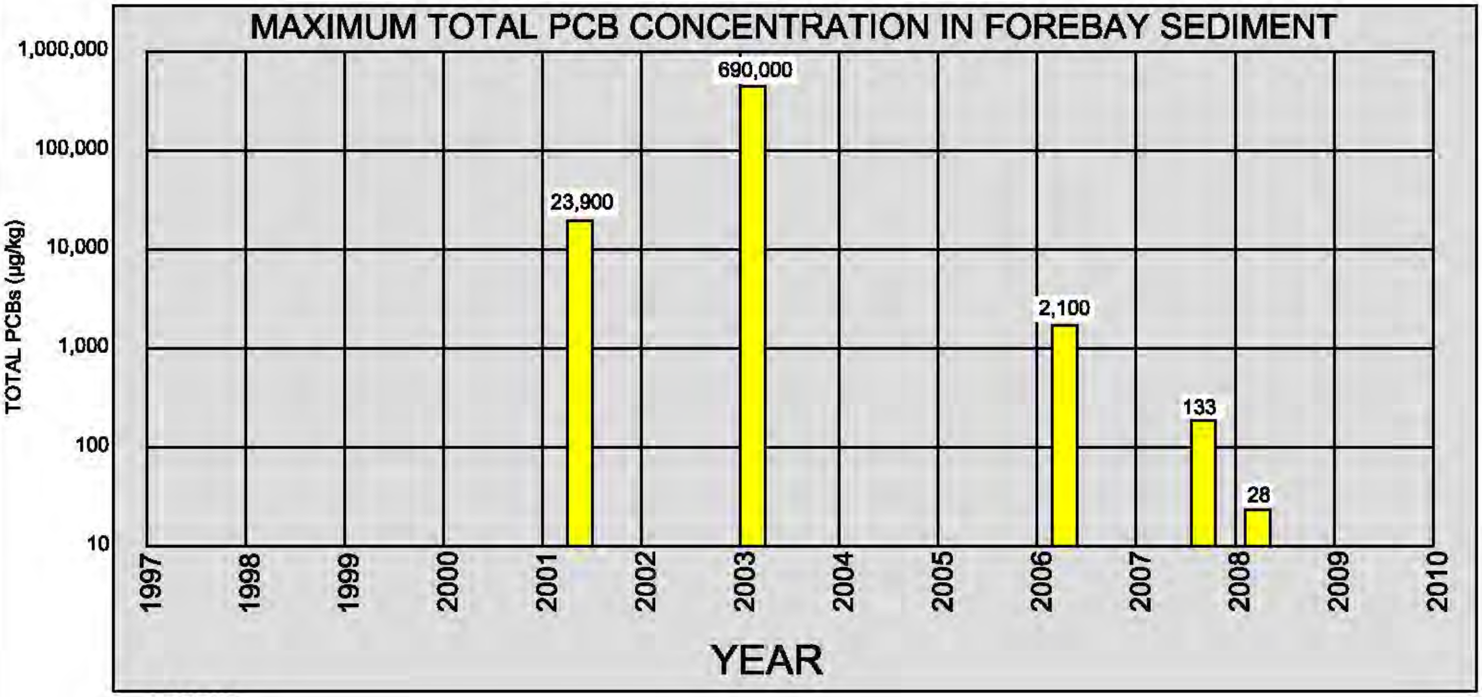
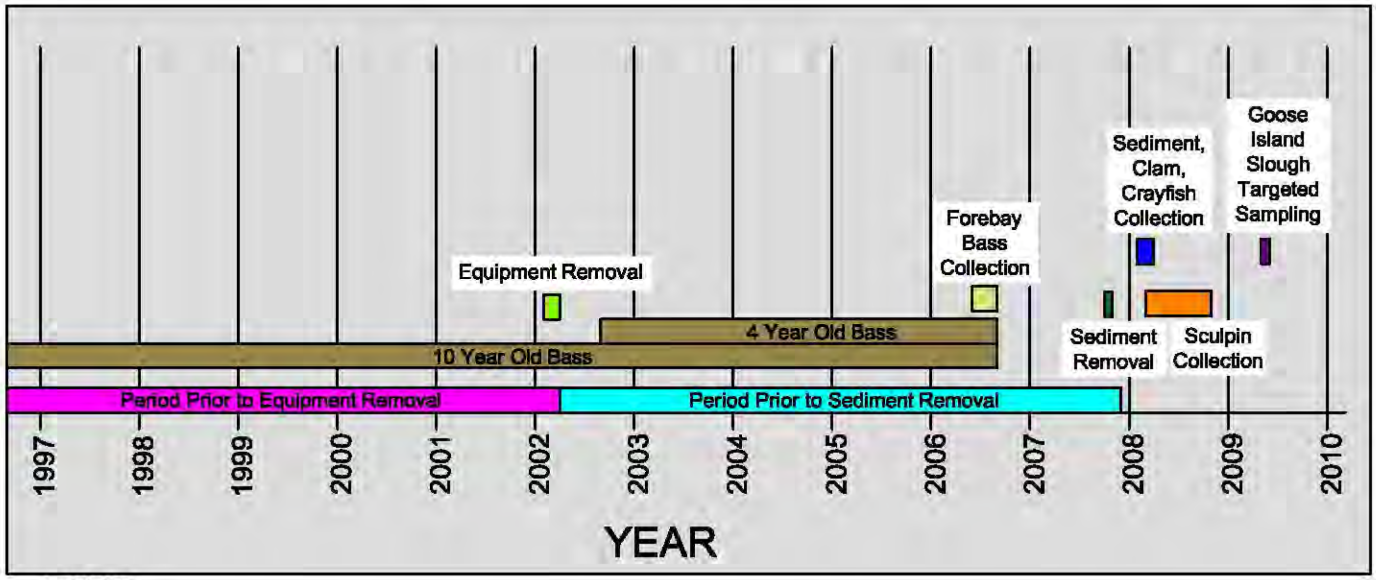
CASCADE LOCKS, OREGON

FIGURE 9-18



LEGEND

🟨 Maximum Measured PCB Concentration in Forebay Sediment



LEGEND

🟩 Feb/Mar 2002 Electrical Equipment & Sediment Removal

🟩 Oct 2007 Sediment Removal

🟨 June/Aug 2006 Forebay Smallmouth Bass Collection

🟦 Feb/Mar 2008 Forebay Sediment, Clam, Crayfish Collection

🟧 Mar-Oct 2008 Forebay Sculpin Collection

🟪 April 2009 Goose Island Slough Targeted Sampling

🟫 Smallmouth Bass Lifespan

TIMELINE OF REMEDIAL ACTIONS
AND SAMPLE COLLECTION ACTIVITIES

NOVEMBER 2010
25696528

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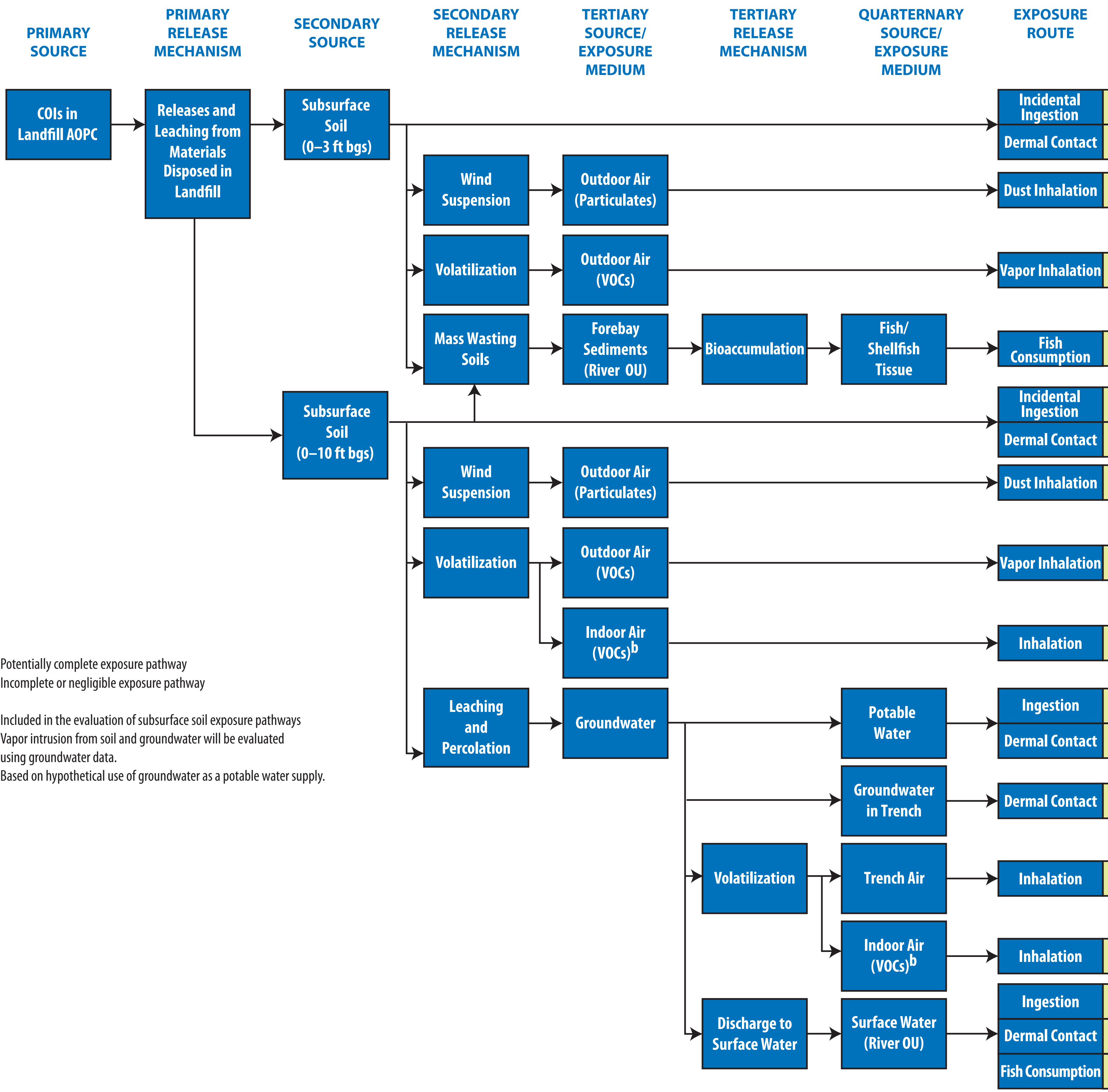
CASCADE LOCKS, OREGON

FIGURE 9-19



EXPOSURE ROUTE	UPLAND OU RECEPTORS OUTDOOR WORKER	 CONSTRUCTION/ EXCAVATION WORKER	 INDOOR OFFICE WORKER	RIVER OU RECEPTORS SUBSISTENCE FISHER	 RECREATIONAL FISHER/WADER	 DOWNSTREAM POTABLE WATER USER
Incidental Ingestion	●	● (a)	I	I	I	I
Dermal Contact	●	● (a)	I	I	I	I
Dust Inhalation	●	● (a)	I	I	I	I
Vapor Inhalation	●	● (a)	I	I	I	I
Fish Consumption	I	I	I	●	●	I
Incidental Ingestion	I	●	I	I	I	I
Dermal Contact	I	●	I	I	I	I
Dust Inhalation	I	●	I	I	I	I
Vapor Inhalation	I	●	I	I	I	I
Inhalation	I	I	●	I	I	I
Ingestion	● (c)	I	● (c)	I	I	I
Dermal Contact	● (c)	I	● (c)	I	I	I
Dermal Contact	I	●	I	I	I	I
Inhalation	I	●	I	I	I	I
Inhalation	I	I	●	I	I	I
Ingestion	I	I	I	I	I	●
Dermal Contact	I	I	I	●	●	●
Fish Consumption	I	I	I	●	●	I

LEGEND

●	Potentially complete exposure pathway
I	Incomplete or negligible exposure pathway
a	Included in the evaluation of subsurface soil exposure pathways
b	Vapor intrusion from soil and groundwater will be evaluated using groundwater data.
c	Based on hypothetical use of groundwater as a potable water supply.

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CASCADE LOCKS, OREGON

LANDFILL AOPC

HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER: FIGURE 11-1
GIS FILE NUMBER: FIG 11-1
SHEET:
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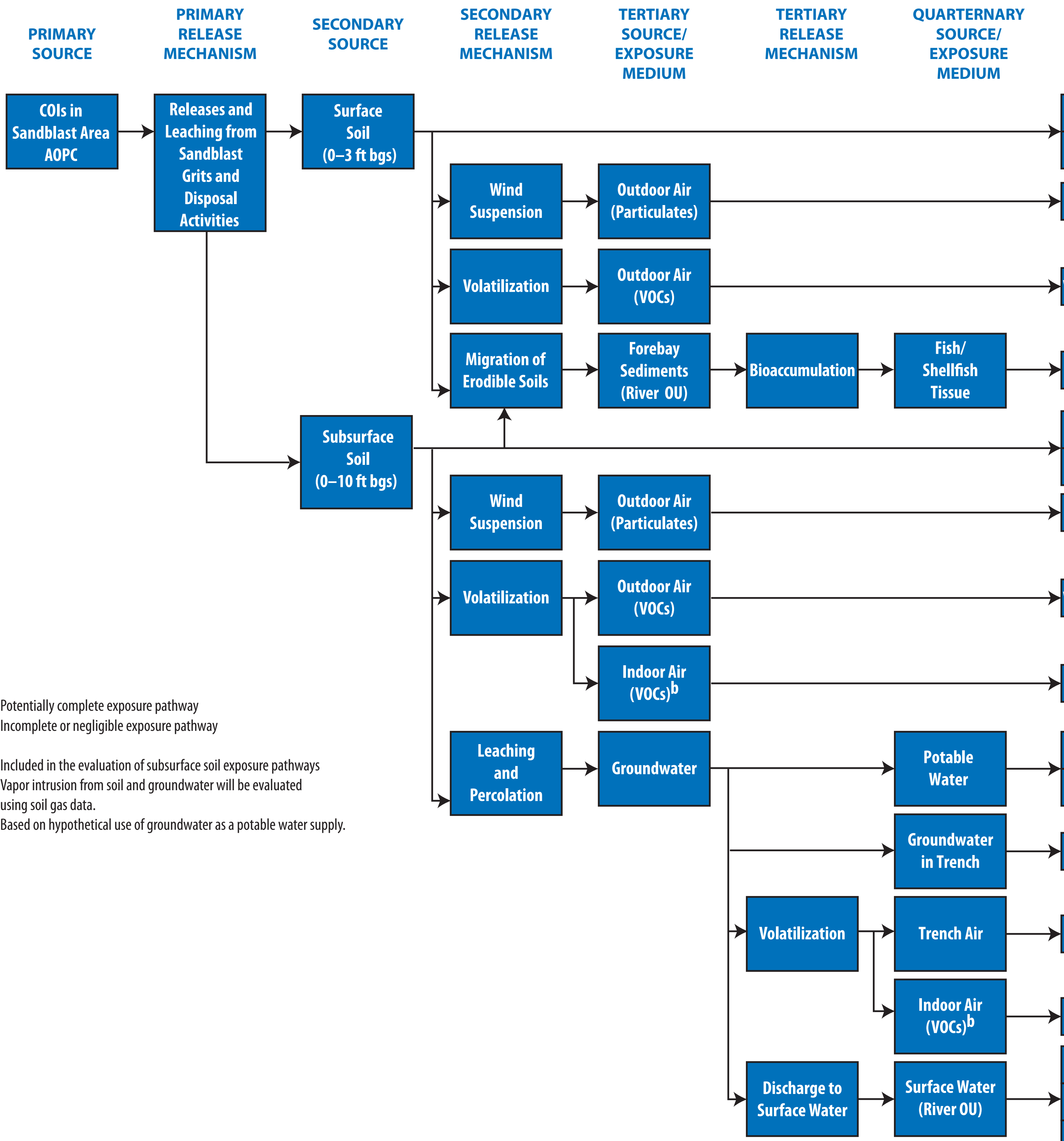

EXPOSURE ROUTE	UPLAND OU RECEPTORS: OUTDOOR WORKER	UPLAND OU RECEPTORS: CONSTRUCTION/ EXCAVATION WORKER	UPLAND OU RECEPTORS: INDOOR OFFICE WORKER	RIVER OU RECEPTORS: SUBSISTENCE FISHER	RIVER OU RECEPTORS: RECREATIONAL FISHER/WADER	RIVER OU RECEPTORS: DOWNSTREAM POTABLE WATER USER
Incidental Ingestion	●	● (a)	I	I	I	I
Dermal Contact	●	● (a)	I	I	I	I
Dust Inhalation	●	● (a)	I	I	I	I
Vapor Inhalation	●	● (a)	I	I	I	I
Fish Consumption	I	I	I	●	●	I
Incidental Ingestion	I	●	I	I	I	I
Dermal Contact	I	●	I	I	I	I
Dust Inhalation	I	●	I	I	I	I
Vapor Inhalation	I	●	I	I	I	I
Inhalation	I	I	●	I	I	I
Ingestion	● (c)	I	● (c)	I	I	I
Dermal Contact	● (c)	I	● (c)	I	I	I
Dermal Contact	I	●	I	I	I	I
Inhalation	I	●	I	I	I	I
Inhalation	I	I	●	I	I	I
Ingestion	I	I	I	I	I	●
Dermal Contact	I	I	I	●	●	●
Fish Consumption	I	I	I	●	●	I

LEGEND

●	Potentially complete exposure pathway
I	Incomplete or negligible exposure pathway
a	Included in the evaluation of subsurface soil exposure pathways
b	Vapor intrusion from soil and groundwater will be evaluated using soil gas data.
c	Based on hypothetical use of groundwater as a potable water supply.

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CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER: FIGURE 11-2
GIS FILE NUMBER: FIG 11-2
SHEET:
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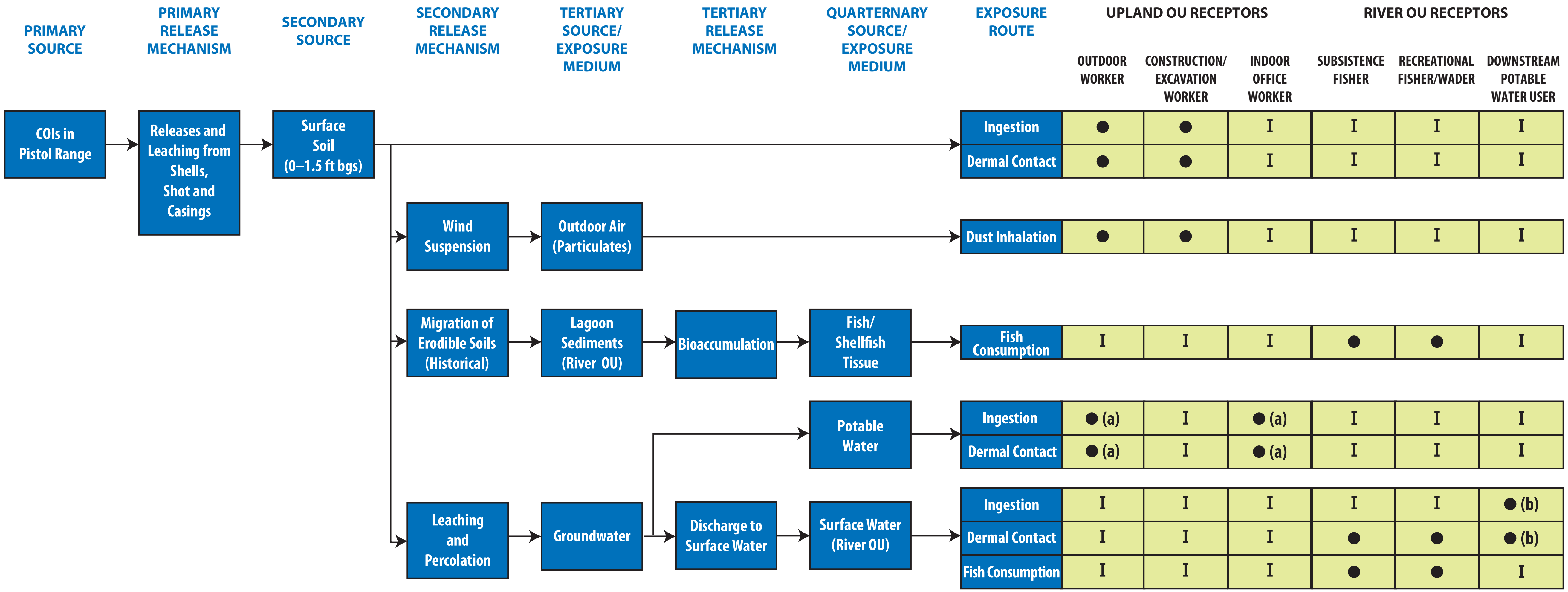
O:\25692709 USACE\53-F0072173.00 Bradford\1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-2.ai



EXPOSURE ROUTE	OUTDOOR WORKER	CONSTRUCTION/ EXCAVATION WORKER	INDOOR OFFICE WORKER	SUBSISTENCE FISHER	RECREATIONAL FISHER/WADER	DOWNSTREAM POTABLE WATER USER
Ingestion	●	●	I	I	I	I
Dermal Contact	●	●	I	I	I	I
Dust Inhalation	●	●	I	I	I	I
Fish Consumption	I	I	I	●	●	I
Ingestion	● (a)	I	● (a)	I	I	I
Dermal Contact	● (a)	I	● (a)	I	I	I
Ingestion	I	I	I	I	I	● (b)
Dermal Contact	I	I	I	●	●	● (b)
Fish Consumption	I	I	I	●	●	I

LEGEND

●	Potentially complete exposure pathway
I	Incomplete or negligible exposure pathway
a	Based on hypothetical use of groundwater as a potable water supply
b	Based on use of downstream river water as a potable water supply

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-3.ai

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PISTOL RANGE AOPC

HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER:
FIGURE 11-3
GIS FILE NUMBER:
FIG 11-3
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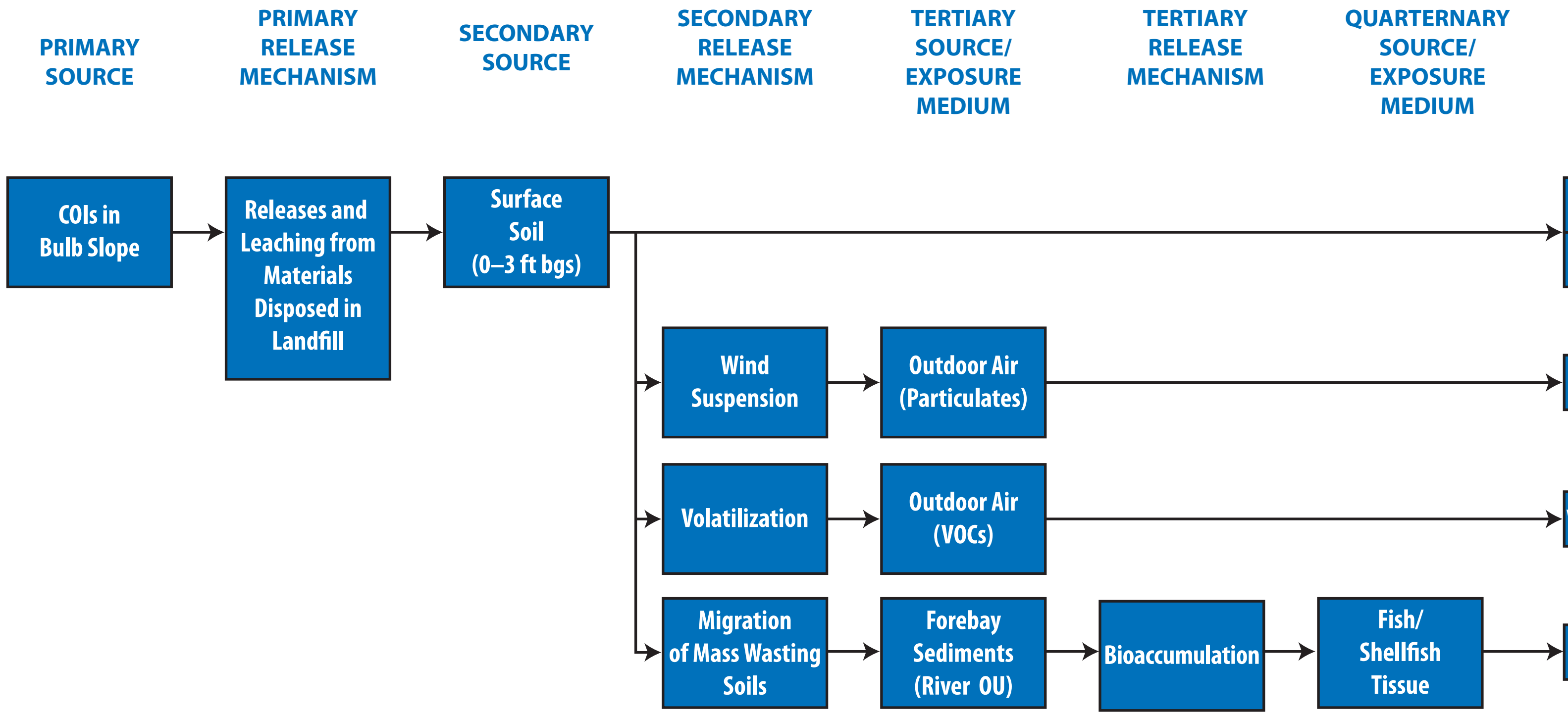

	UPLAND OU RECEPTORS			RIVER OU RECEPTORS		
EXPOSURE ROUTE	OUTDOOR INDUSTRIAL WORKER	CONSTRUCTION WORKER (a)	INDOOR OFFICE WORKER	SUBSISTENCE FISHER	RECREATIONAL FISHER/WADER	DOWNSTREAM POTABLE WATER USER
Ingestion	●	I	I	I	I	I
Dermal Contact	●	I	I	I	I	I
Dust Inhalation	●	I	I	I	I	I
Vapor Inhalation	●	I	I	I	I	I
Fish Consumption	I	I	I	●	●	I

LEGEND

●	Potentially complete exposure pathway
I	Incomplete or negligible exposure pathway
(a)	No construction or excavation activities are feasible or likely at the Bulb Slope AOPC

JOB No.
25696528

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PROJ. ENGINEER:
LSM

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BULB SLOPE AOPC

HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER:
FIGURE 11-4

GIS FILE NUMBER:
FIG 11-4

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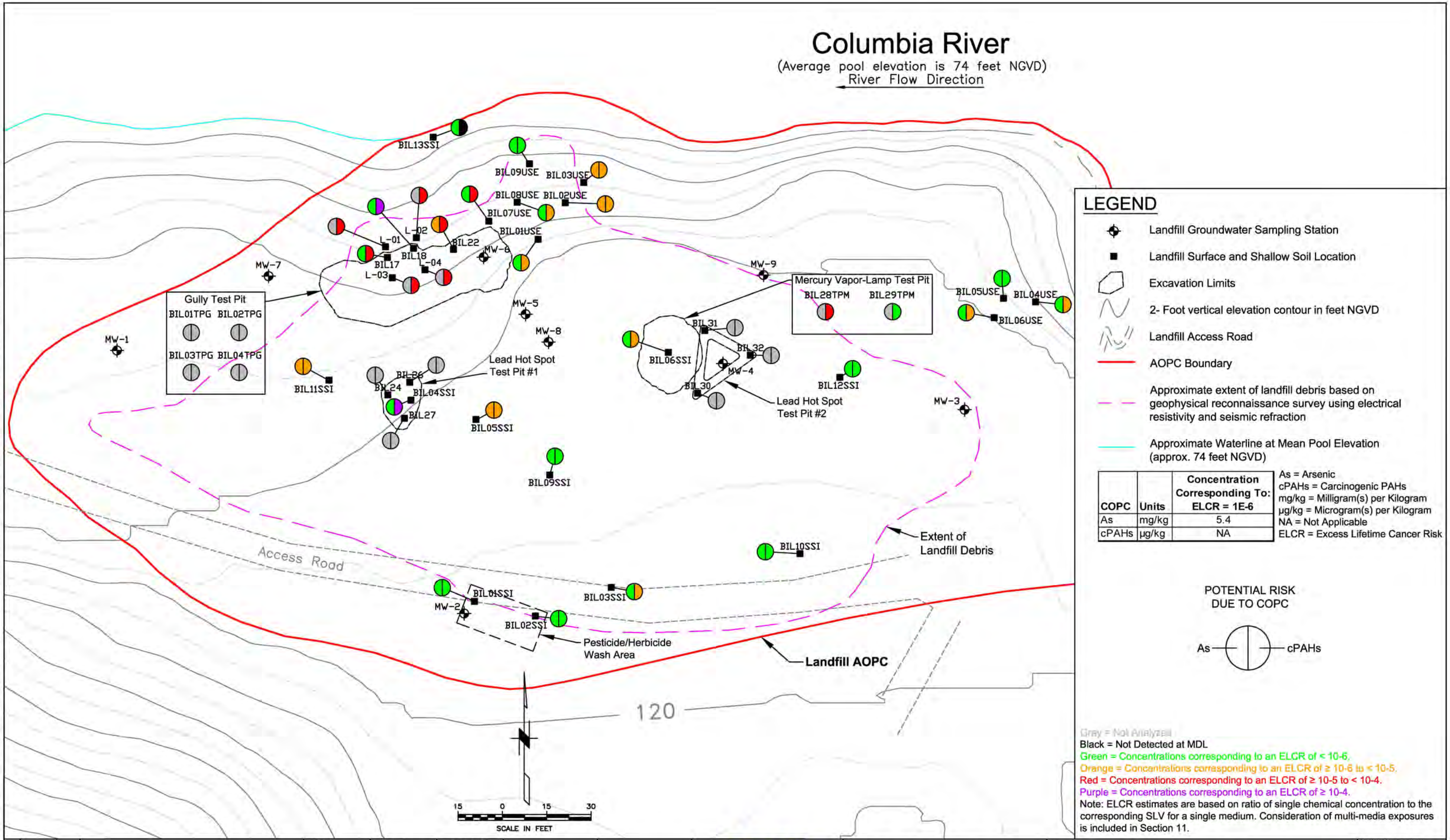
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report Working Folder\RI Text\Figures\FIG 11-3.ai



LEGEND

⊕ Landfill Groundwater Sampling Station

■ Landfill Surface and Shallow Soil Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

COPC	Units	Concentration Corresponding To: ELCR = 1E-6
As	mg/kg	5.4
cPAHs	µg/kg	NA

As = Arsenic
cPAHs = Carcinogenic PAHs
mg/kg = Milligram(s) per Kilogram
µg/kg = Microgram(s) per Kilogram
NA = Not Applicable
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

As – cPAHs

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.

Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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LANDFILL AOPC

MAGNITUDE OF POTENTIAL RISK IN SOIL
OUTDOOR WORKER (0-3 ft bgs)

DRAWING NUMBER: FIGURE 11-5
CAD FILE NUMBER: FIG 11-5
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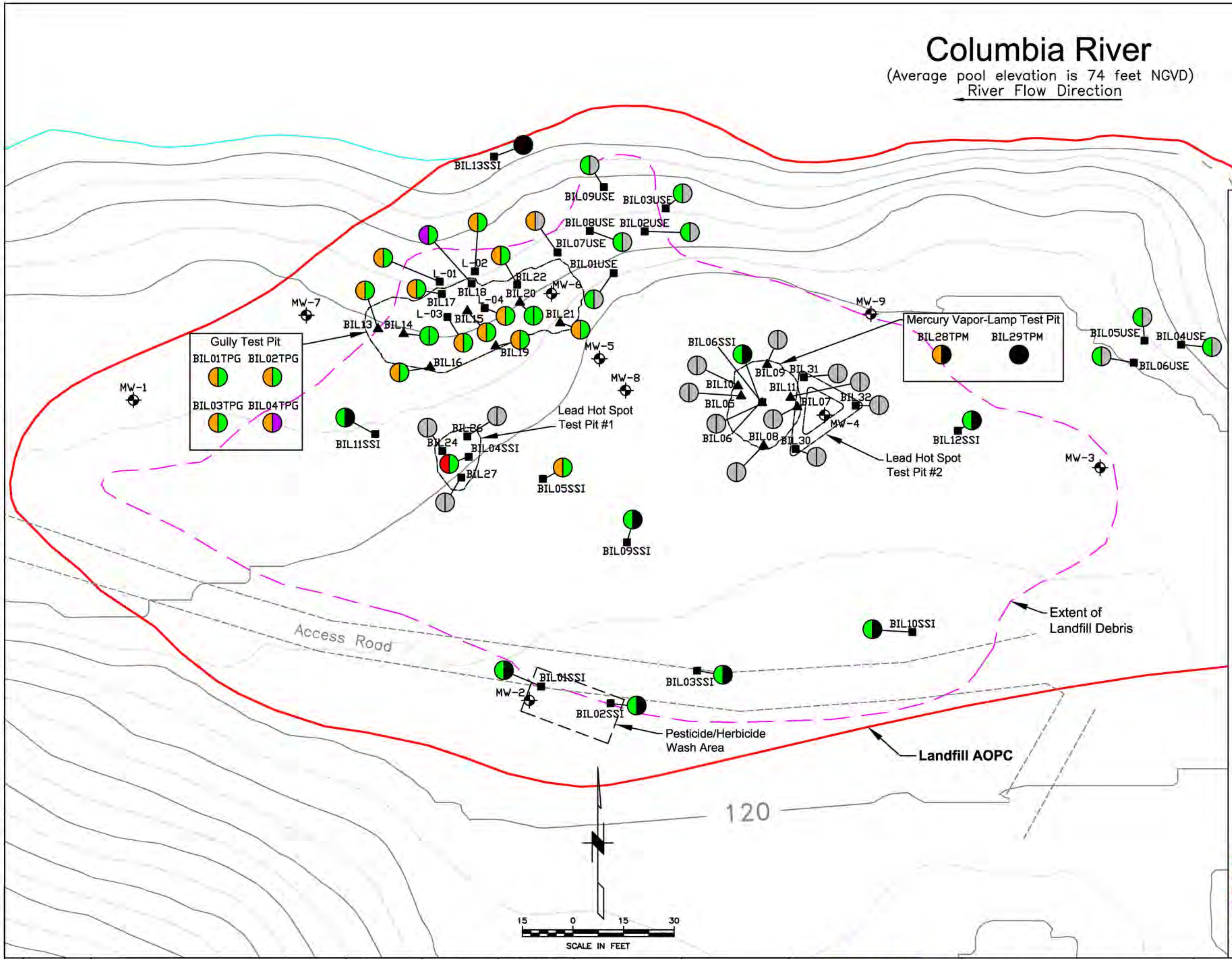

LEGEND

⌖ Landfill Groundwater Sampling Station

■ Landfill Surface and Shallow Soil Location

▲ Landfill Deeper Soil Sampling Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

COPC	Units	Concentration Corresponding To: ELCR = 1E-6
PCE	µg/kg	40,000
BAP	µg/kg	2,100

PCE = Tetrachloroethene
BAP = Benzo(a)pyrene
µg/kg = Microgram(s) per Kilogram
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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LANDFILL AOPC

MAGNITUDE OF POTENTIAL RISK IN SOIL
CONSTRUCTION WORKER (0-10 ft bgs)

DRAWING NUMBER: FIGURE 11-6
CAD FILE NUMBER: FIG 11-6
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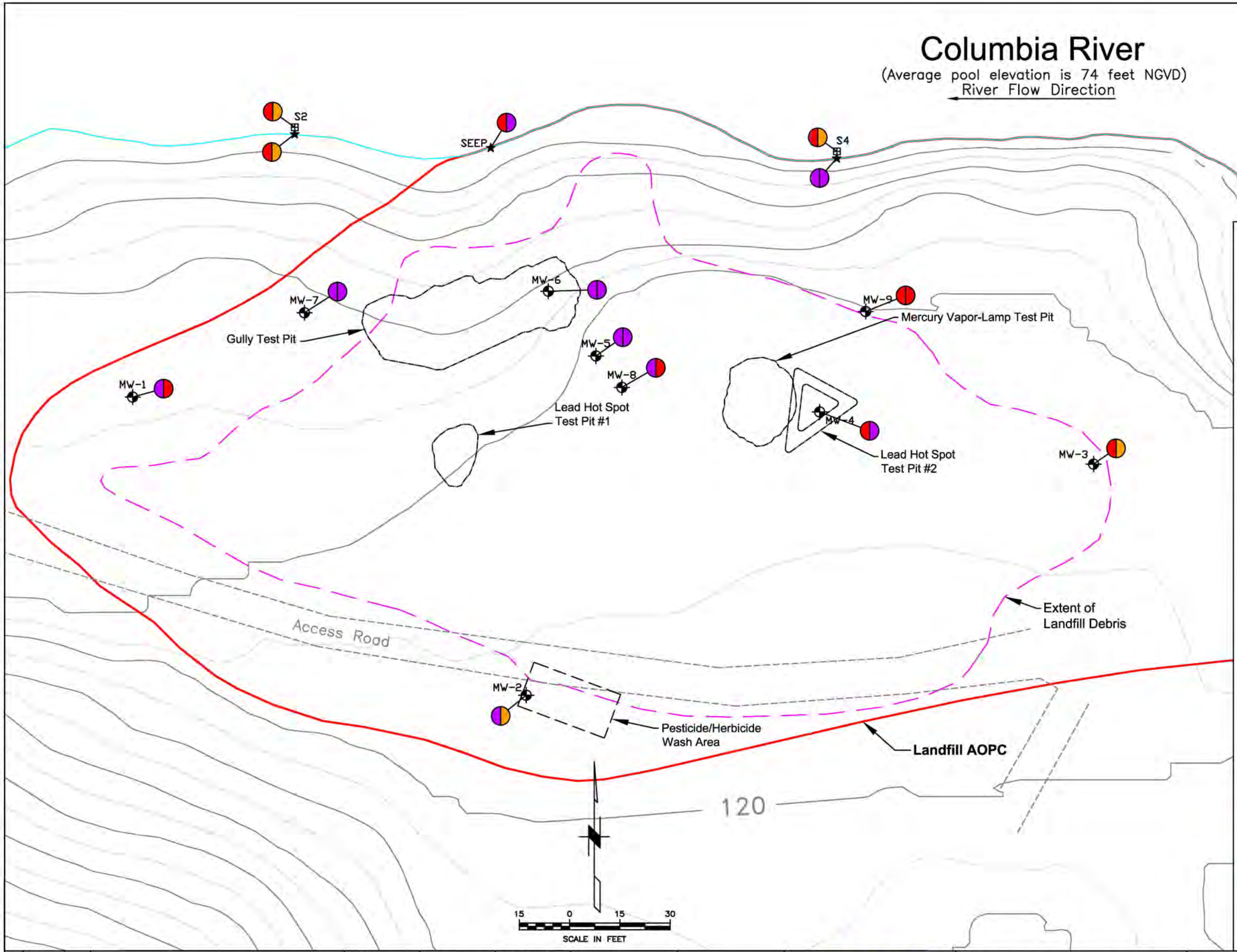
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-7 Magnitude of Potential Risk in Groundwater in Landfill Area AOPC.dwg Jun 05, 2012 – 11:10am



LEGEND

- ⌖ Landfill Groundwater Sampling Station
- ⊞ Landfill Surface Water Sampling Location
- ★ Landfill Seep Location
- ⬠ Excavation Limits
- ∿ 2- Foot vertical elevation contour in feet NGVD
- ∿ Landfill Access Road
- — AOPC Boundary
- – – Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- — Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

COPC	Units	Concentration	
		ELCR = 1E-06	NC HQ = 1
As	µg/L	0.038	-
Mn	µg/L	-	88

As = Arsenic
Mn = Manganese
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk
NC HQ = Non-carcinogenic Hazard Quotient

POTENTIAL RISK
DUE TO COPC

As ◐ Mn

Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6 or a NC HQ of < 0.1.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5 or a NC HQ of ≥ 0.1 to < 1.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4 or a NC HQ of ≥ 1 to < 10.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4 or a NC HQ of ≥ 10.
Note: ELCR and HQ estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

No.	DATE	BY	REVISION

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LANDFILL AOPC

MAGNITUDE OF POTENTIAL RISK (INORGANICS)
IN GROUNDWATER
POTABLE WATER USER

DRAWING NUMBER: FIGURE 11-7
CAD FILE NUMBER: FIG 11-7
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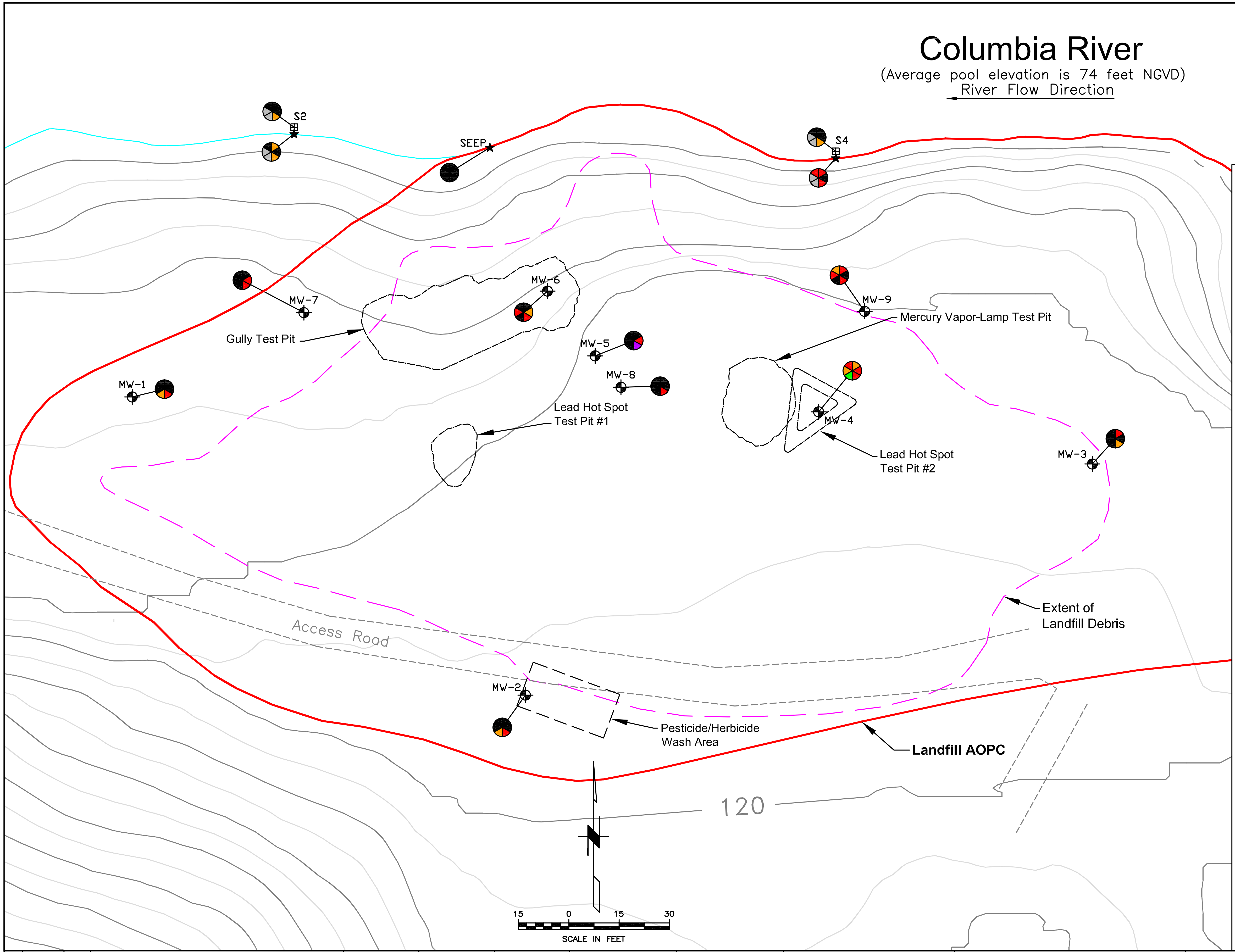
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-8 Magnitude of Potential Risk in Groundwater in Landfill Area AOPC - Potable Water User.dwg Nov 18, 2010 - 8:20am



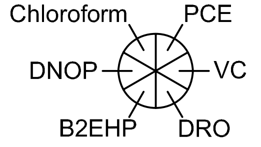
LEGEND

⌖	Landfill Groundwater Sampling Station
⊞	Landfill Surface Water Sampling Location
★	Landfill Seep Location
	Excavation Limits
	2- Foot vertical elevation contour in feet NGVD
	Landfill Access Road
	AOPC Boundary
	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
	Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

COPC	Units	Concentration ELCR = 1E-06	NC HQ = 1
Chloroform	µg/L	0.19	-
PCE	µg/L	0.093	-
VC	µg/L	0.025	-
DRO	µg/L	-	90
B2EHP	µg/L	4.1	-
DNOP	µg/L	-	4.1

DRO = Diesel Range Organics
DNOP = Di-n-octyl Phthalate
B2EHP = Bis(2-ethylhexyl) Phthalate
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl Chloride
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk
NC HQ = Non-carcinogenic Hazard Quotient

POTENTIAL RISK
DUE TO COPC



Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6 or a NC HQ of < 0.1.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5 or a NC HQ of ≥ 0.1 to < 1.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4 or a NC HQ of ≥ 1 to < 10.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4 or a NC HQ of ≥ 10.

Note: ELCR and HQ estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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LANDFILL AOPC
MAGNITUDE OF POTENTIAL RISK (ORGANICS)
IN GROUNDWATER
POTABLE WATER USER

DRAWING NUMBER: FIGURE 11-8
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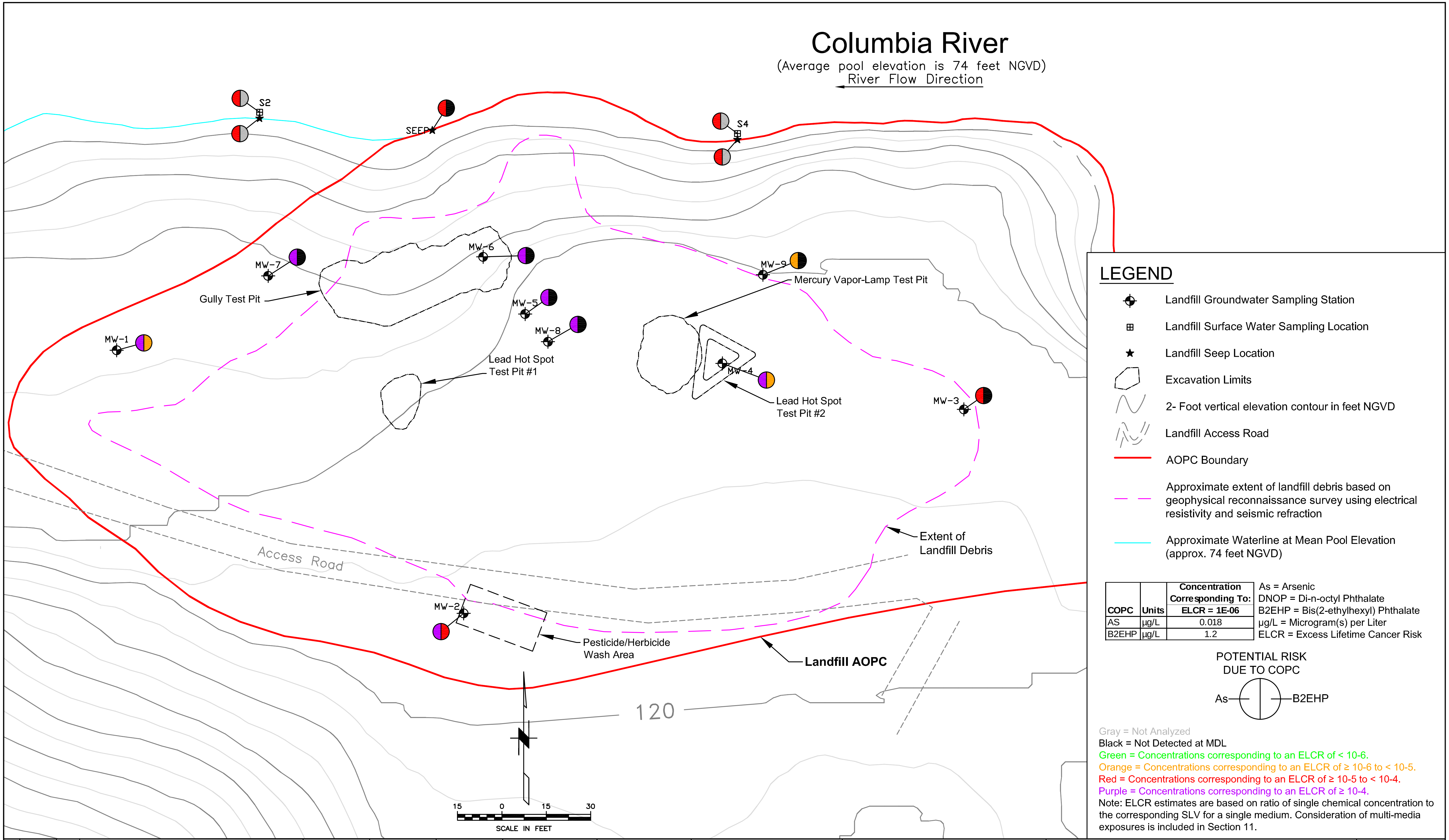
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-9 Magnitude of Potential Risk in Groundwater in Landfill Area AOPC - Groundwater Discharge.dwg Nov 16, 2010 - 3:32pm



LEGEND

- ⊕ Landfill Groundwater Sampling Station
- ⊞ Landfill Surface Water Sampling Location
- ★ Landfill Seep Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

COPC	Units	Concentration Corresponding To: ELCR = 1E-06
AS	µg/L	0.018
B2EHP	µg/L	1.2

As = Arsenic
DNOP = Di-n-octyl Phthalate
B2EHP = Bis(2-ethylhexyl) Phthalate
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

As—⊖—B2EHP

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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LANDFILL AOPC

MAGNITUDE OF POTENTIAL RISK IN
GROUNDWATER DISCHARGE AND
SUBSEQUENT BIOACCUMULATION

DRAWING NUMBER: FIGURE 11-9
CAD FILE NUMBER: FIG 11-9
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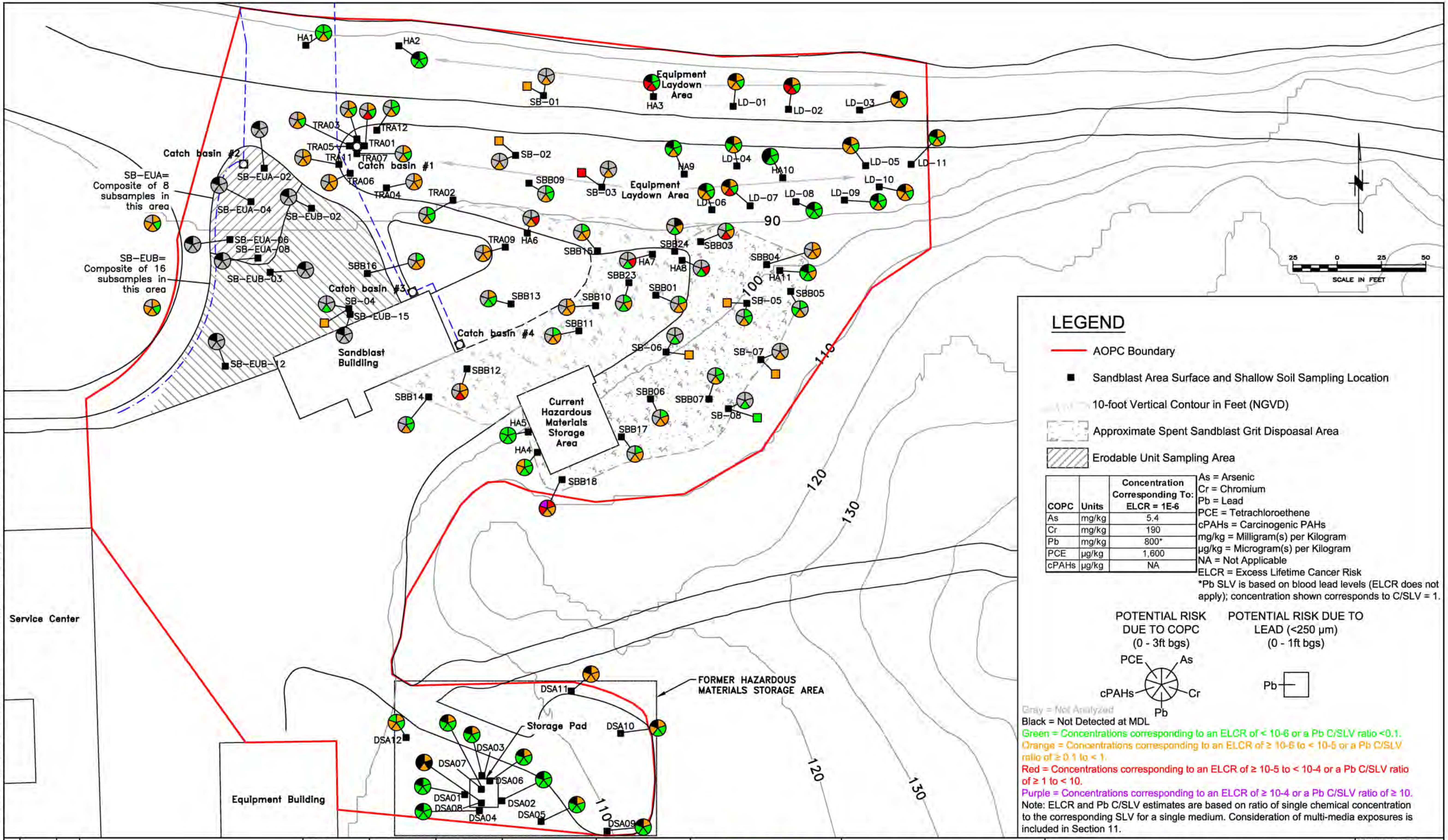

LEGEND

AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

10-foot Vertical Contour in Feet (NGVD)

Approximate Spent Sandblast Grit Dispoasal Area

▨ Erodable Unit Sampling Area

COPC	Units	Concentration Corresponding To: ELCR = 1E-6
As	mg/kg	5.4
Cr	mg/kg	190
Pb	mg/kg	800*
PCE	µg/kg	1,600
cPAHs	µg/kg	NA

As = Arsenic
Cr = Chromium
Pb = Lead
PCE = Tetrachloroethene
cPAHs = Carcinogenic PAHs
mg/kg = Milligram(s) per Kilogram
µg/kg = Microgram(s) per Kilogram
NA = Not Applicable
ELCR = Excess Lifetime Cancer Risk
*Pb SLV is based on blood lead levels (ELCR does not apply); concentration shown corresponds to C/SLV = 1.

POTENTIAL RISK DUE TO COPC (0 - 3ft bgs)

PCE, As, cPAHs, Cr, Pb

POTENTIAL RISK DUE TO LEAD (<250 µm) (0 - 1ft bgs)

Pb

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6 or a Pb C/SLV ratio <0.1.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5 or a Pb C/SLV ratio of ≥ 0.1 to < 1.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4 or a Pb C/SLV ratio of ≥ 1 to < 10.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4 or a Pb C/SLV ratio of ≥ 10.
Note: ELCR and Pb C/SLV estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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SANDBLAST AREA AOPC

MAGNITUDE OF POTENTIAL RISK IN SOIL
OUTDOOR WORKER (0-3 ft bgs)

DRAWING NUMBER: FIGURE 11-10
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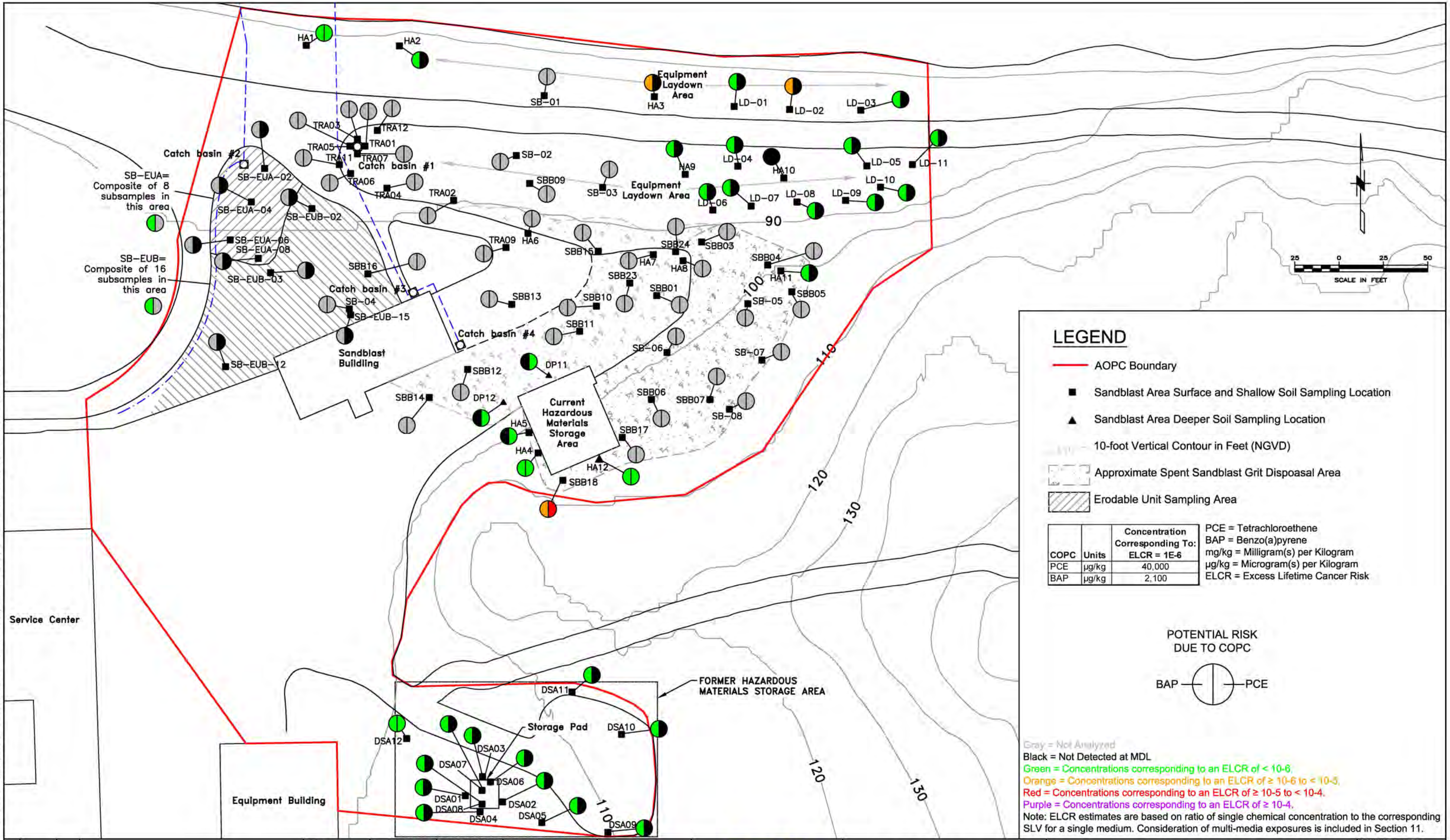
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-10 Magnitude of Potential Risk in Soil in Sandblast Area AOPC - Outdoor Worker.dwg Jun 06, 2012 - 10:58am

O:\25692709 USACE\53-F0072173.00 Bradford\FLWorth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-11 Magnitude of Potential Risk in Soil in Sandblast Area AOPC - Excavation Worker.dwg Jun 06, 2012 - 10:59am



LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- ▲ Sandblast Area Deeper Soil Sampling Location
- 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Dispoasal Area
- ▨ Erodable Unit Sampling Area

COPC	Units	Concentration Corresponding To: ELCR = 1E-6
PCE	µg/kg	40,000
BAP	µg/kg	2,100

PCE = Tetrachloroethene
BAP = Benzo(a)pyrene
mg/kg = Milligram(s) per Kilogram
µg/kg = Microgram(s) per Kilogram
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK DUE TO COPC

BAP — ◐ — PCE

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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SANDBLAST AREA AOPC
MAGNITUDE OF POTENTIAL RISK IN SOIL
CONSTRUCTION WORKER (0-10 ft bgs)

DRAWING NUMBER: FIGURE 11-11
CAD FILE NUMBER: FIG 11-11
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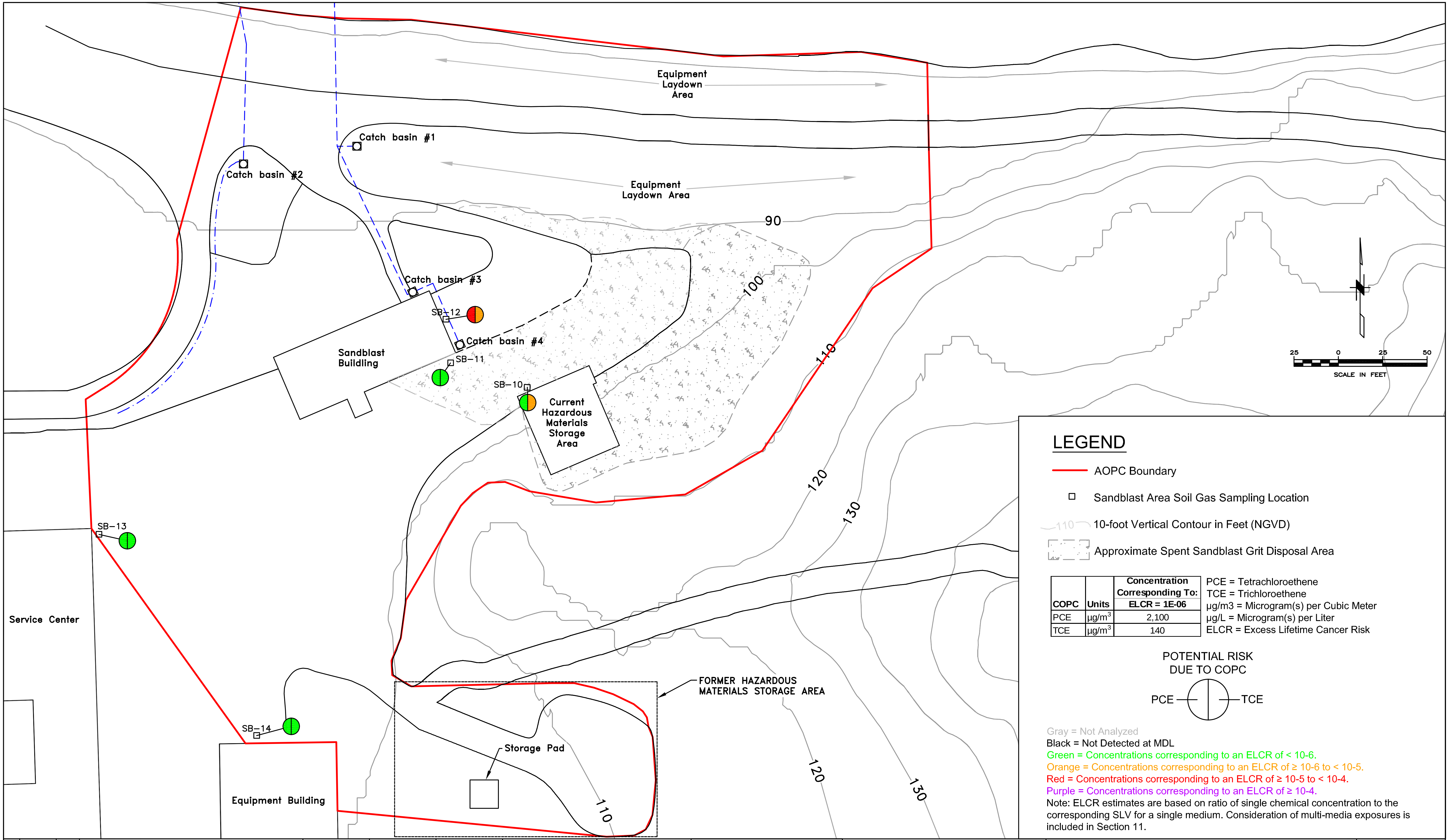
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-12 Magnitude of Potential Risk in Soil Gas in Sandblast Area AOPC - Indoor Office Worker.dwg Nov 16, 2010 - 3:49pm



LEGEND

- AOPC Boundary
- ☐ Sandblast Area Soil Gas Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area

COPC	Units	Concentration Corresponding To: ELCR = 1E-06
PCE	µg/m^3	2,100
TCE	µg/m^3	140

PCE = Tetrachloroethene
TCE = Trichloroethene
µg/m3 = Microgram(s) per Cubic Meter
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

PCE — TCE

Gray = Not Analyzed
Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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(fax) 503-222-4292
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SANDBLAST AREA AOPC
MAGNITUDE OF POTENTIAL RISK IN SOIL GAS
INDOOR OFFICE WORKER

DRAWING NUMBER: FIGURE 11-12
CAD FILE NUMBER: FIG 11-12
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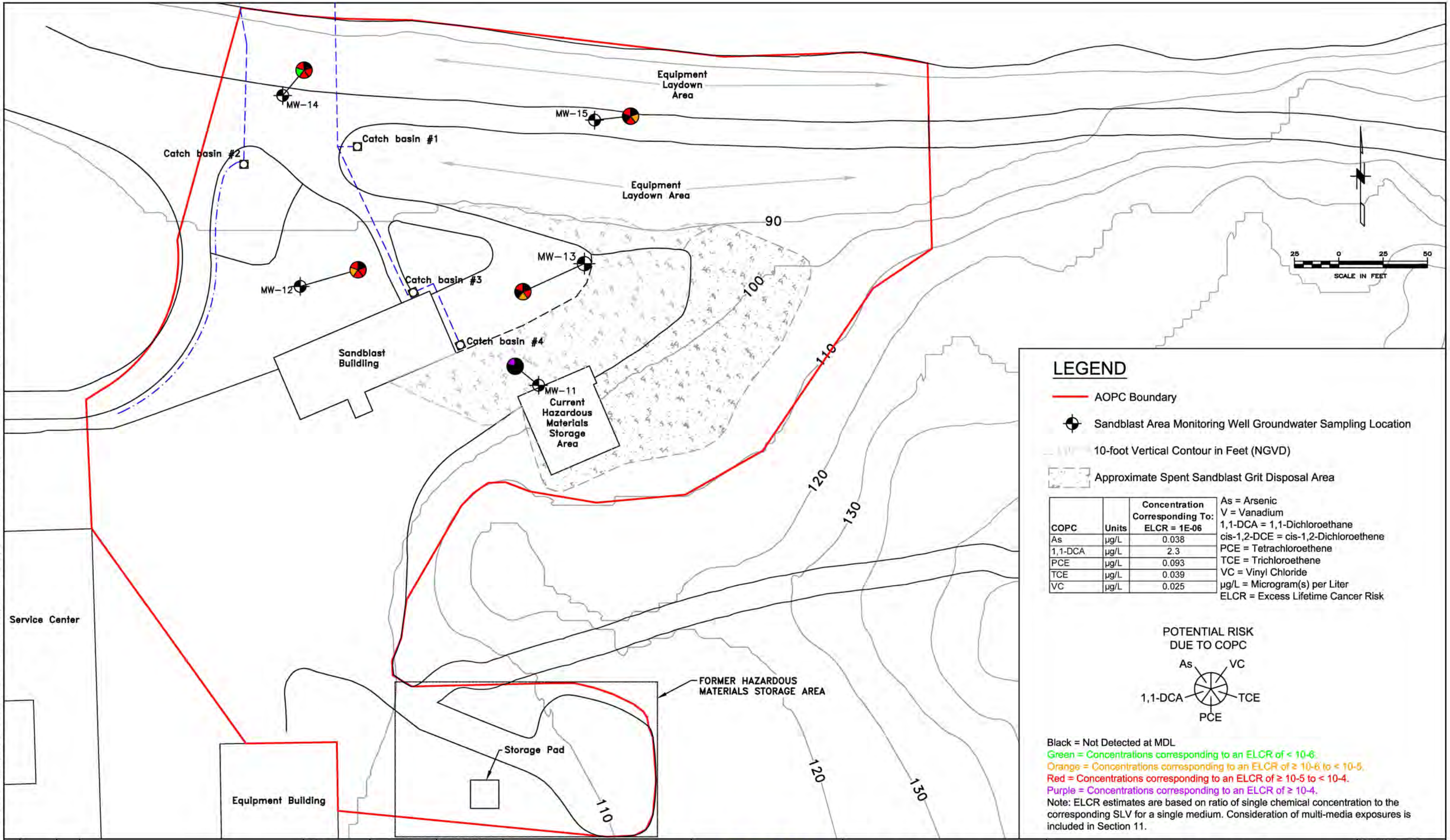

LEGEND

AOPC Boundary

Sandblast Area Monitoring Well Groundwater Sampling Location

10-foot Vertical Contour in Feet (NGVD)

Approximate Spent Sandblast Grit Disposal Area

COPC	Units	Concentration Corresponding To: ELCR = 1E-06
As	µg/L	0.038
1,1-DCA	µg/L	2.3
PCE	µg/L	0.093
TCE	µg/L	0.039
VC	µg/L	0.025

As = Arsenic
V = Vanadium
1,1-DCA = 1,1-Dichloroethane
cis-1,2-DCE = cis-1,2-Dichloroethene
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl Chloride
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

Black = Not Detected at MDL
Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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SANDBLAST AREA AOPC

MAGNITUDE OF POTENTIAL RISK IN GROUNDWATER
POTABLE WATER USER

DRAWING NUMBER: FIGURE 11-13
CAD FILE NUMBER: FIG 11-13
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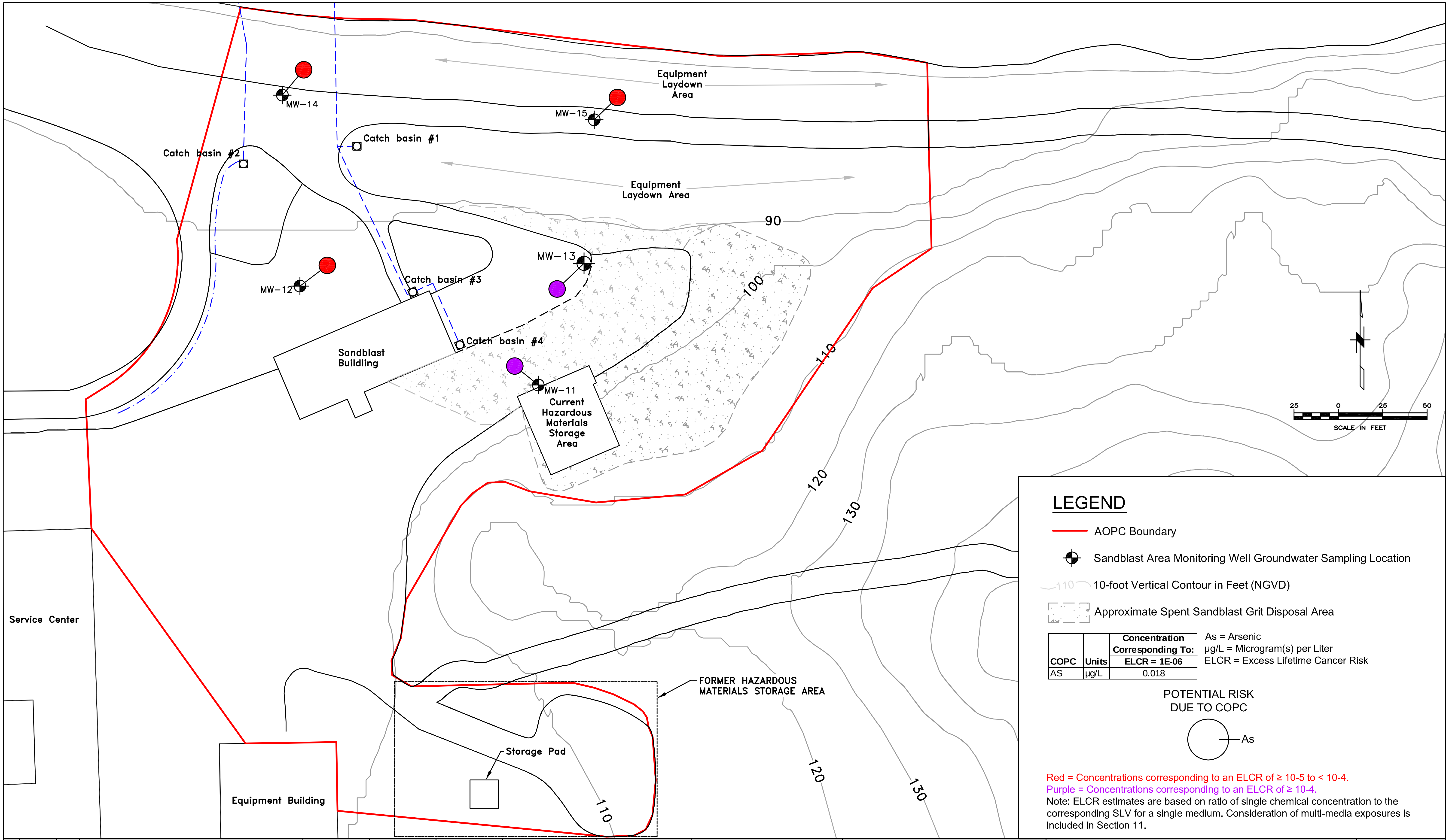
O:\25692709 USACE\53-F0072173.00 Bradford\1\FL Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-13 Magnitude of Potential Risk in Groundwater in Sandblast Area AOPC - Potable Water User.dwg Jun 06, 2012 - 9:01am

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 11-14 Magnitude of Potential Risk in Groundwater in Sandblast Area AOPC -Groundwater Discharge.dwg Nov 16, 2010 - 3:55pm



LEGEND

- AOPC Boundary
- Sandblast Area Monitoring Well Groundwater Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area

COPC	Units	Concentration Corresponding To: ELCR = 1E-06
AS	µg/L	0.018

As = Arsenic
µg/L = Microgram(s) per Liter
ELCR = Excess Lifetime Cancer Risk

POTENTIAL RISK
DUE TO COPC

As

Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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SANDBLAST AREA AOPC

MAGNITUDE OF POTENTIAL RISK IN
GROUNDWATER DISCHARGE AND
SUBSEQUENT BIOACCUMULATION

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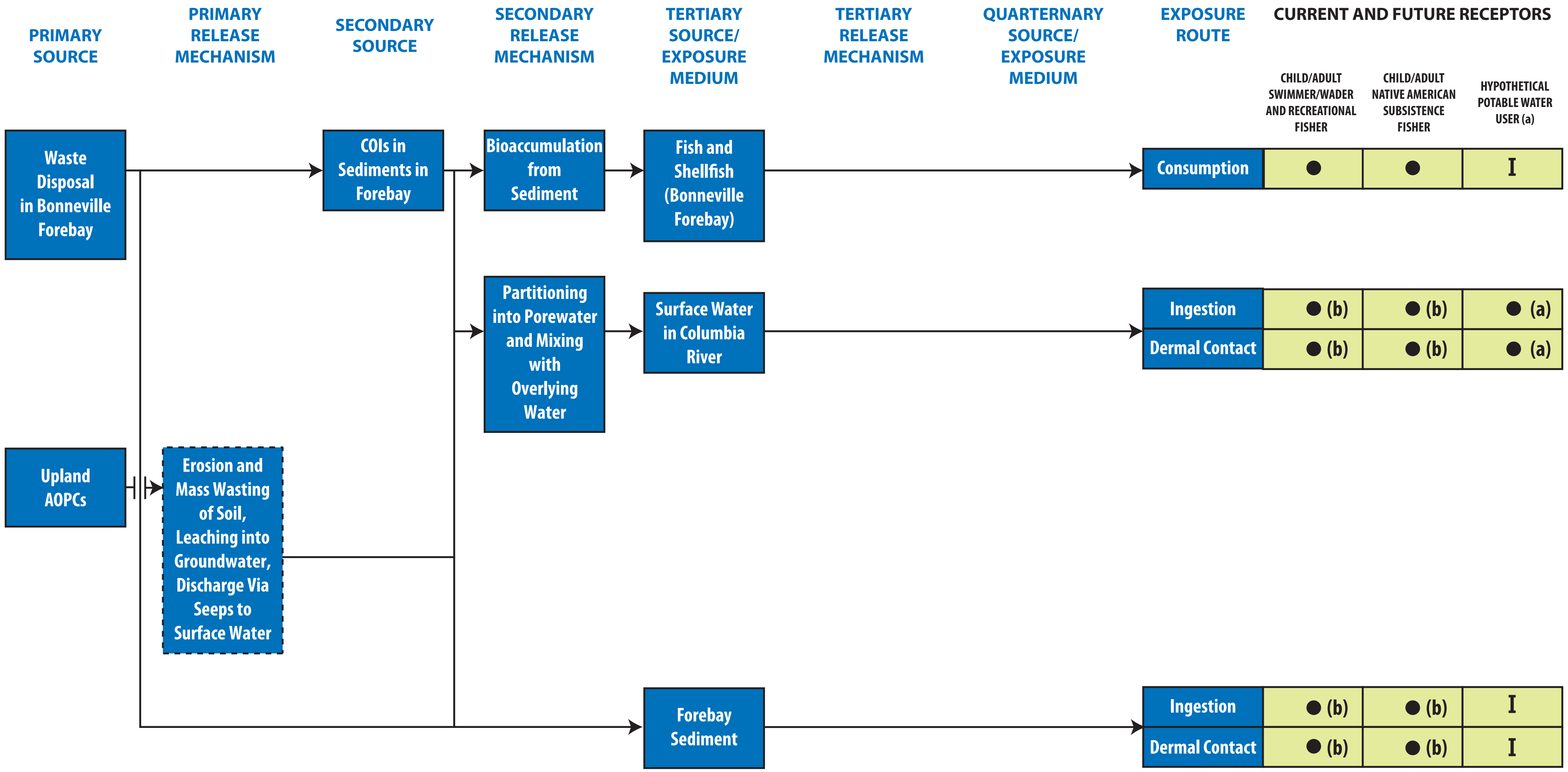

Exposure Medium	Exposure Route	CHILD/ADULT SWIMMER/WADER AND RECREATIONAL FISHER	CHILD/ADULT NATIVE AMERICAN SUBSISTENCE FISHER	HYPOTHETICAL POTABLE WATER USER (a)
Fish and Shellfish (Bonneville Forebay)	Consumption	●	●	I
Surface Water in Columbia River	Ingestion	● (b)	● (b)	● (a)
	Dermal Contact	● (b)	● (b)	● (a)
Forebay Sediment	Ingestion	● (b)	● (b)	I
	Dermal Contact	● (b)	● (b)	I

LEGEND

● Potentially complete exposure pathway

I Incomplete exposure pathway

a Based on hypothetical use of riverwater as a potable water supply.

b Direct contact while fishing from boats or wading in shallow sediments.
(inclusive of Goose Island and the mouth of Eagle Creek).

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RIVER OPERABLE UNIT

HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL

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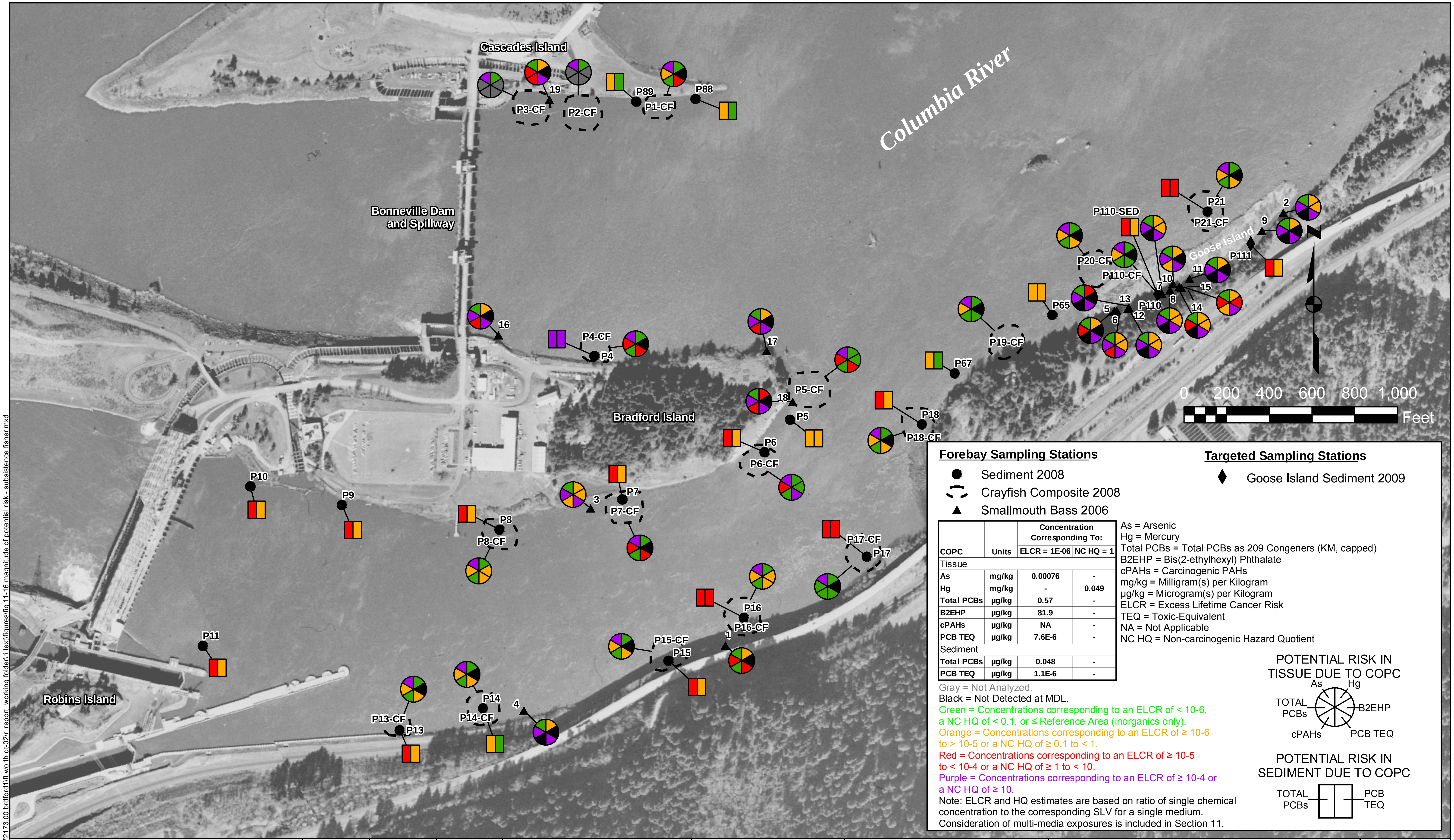

Forebay Sampling Stations

● Sediment 2008

◌ Crayfish Composite 2008

▲ Smallmouth Bass 2006

Targeted Sampling Stations

◆ Goose Island Sediment 2009

COPC	Units	Concentration Corresponding To: ELCR = 1E-06	Concentration Corresponding To: NC HQ = 1
Tissue			
As	mg/kg	0.00076	-
Hg	mg/kg	-	0.049
Total PCBs	µg/kg	0.57	-
B2EHP	µg/kg	81.9	-
cPAHs	µg/kg	NA	-
PCB TEQ	µg/kg	7.6E-6	-
Sediment			
Total PCBs	µg/kg	0.048	-
PCB TEQ	µg/kg	1.1E-6	-

As = Arsenic
Hg = Mercury
Total PCBs = Total PCBs as 209 Congeners (KM, capped)
B2EHP = Bis(2-ethylhexyl) Phthalate
cPAHs = Carcinogenic PAHs
mg/kg = Milligram(s) per Kilogram
µg/kg = Microgram(s) per Kilogram
ELCR = Excess Lifetime Cancer Risk
TEQ = Toxic-Equivalent
NA = Not Applicable
NC HQ = Non-carcinogenic Hazard Quotient

Gray = Not Analyzed.
Black = Not Detected at MDL.
Green = Concentrations corresponding to an ELCR of < 10-6, a NC HQ of < 0.1, or ≤ Reference Area (inorganics only).
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to > 10-5 or a NC HQ of ≥ 0.1 to < 1.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4 or a NC HQ of ≥ 1 to < 10.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4 or a NC HQ of ≥ 10.

Note: ELCR and HQ estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

POTENTIAL RISK IN TISSUE DUE TO COPC

As
Hg
TOTAL PCBs
B2EHP
cPAHs
PCB TEQ

POTENTIAL RISK IN SEDIMENT DUE TO COPC

TOTAL PCBs
PCB TEQ

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RIVER OPERABLE UNIT

MAGNITUDE OF POTENTIAL RISK SUBSISTENCE FISHER

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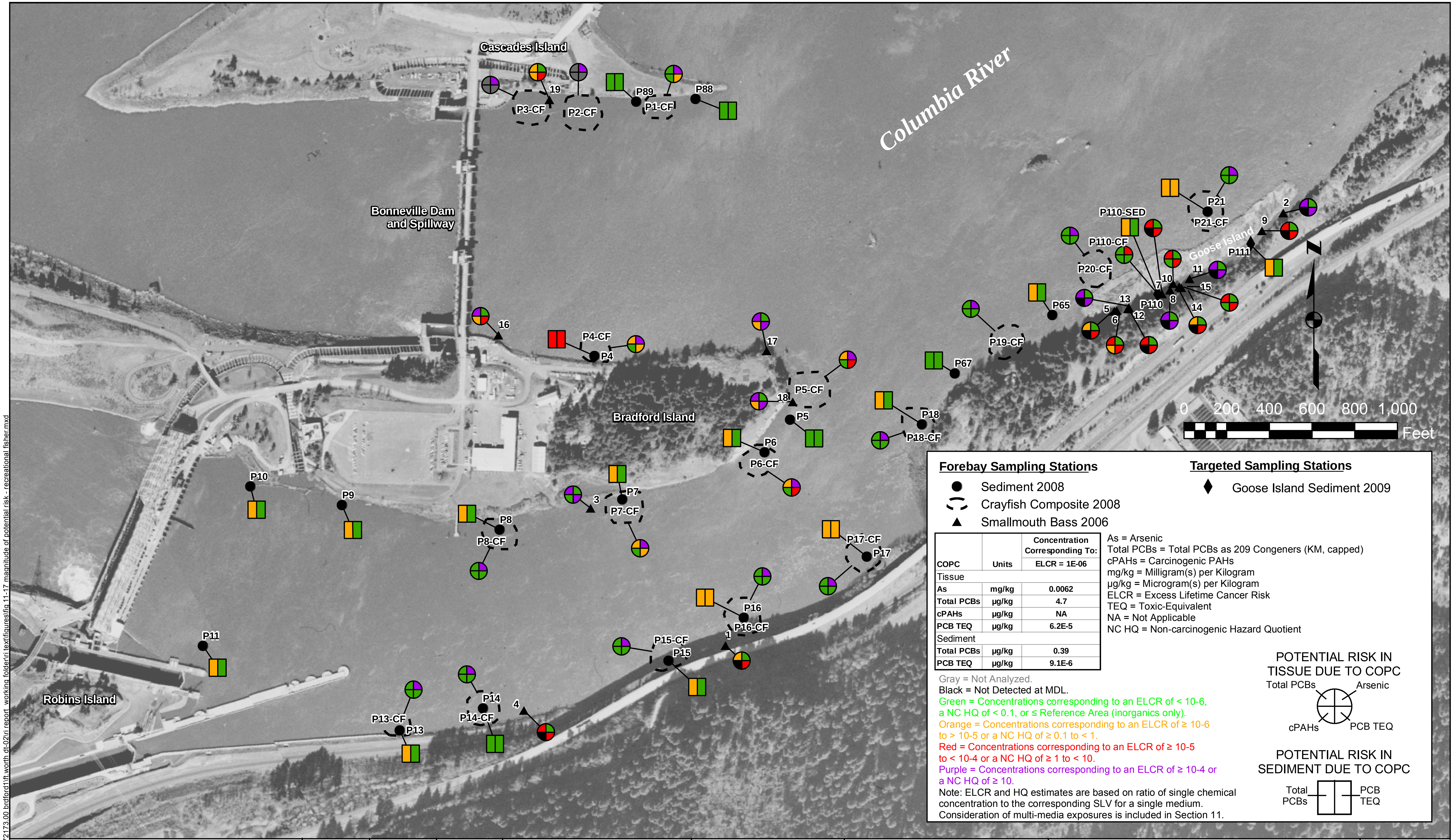

Forebay Sampling Stations

● Sediment 2008

◌ Crayfish Composite 2008

▲ Smallmouth Bass 2006

Targeted Sampling Stations

◆ Goose Island Sediment 2009

COPC	Units	Concentration Corresponding To: ELCR = 1E-06
Tissue		
As	mg/kg	0.0062
Total PCBs	µg/kg	4.7
cPAHs	µg/kg	NA
PCB TEQ	µg/kg	6.2E-5
Sediment		
Total PCBs	µg/kg	0.39
PCB TEQ	µg/kg	9.1E-6

As = Arsenic
Total PCBs = Total PCBs as 209 Congeners (KM, capped)
cPAHs = Carcinogenic PAHs
mg/kg = Milligram(s) per Kilogram
µg/kg = Microgram(s) per Kilogram
ELCR = Excess Lifetime Cancer Risk
TEQ = Toxic-Equivalent
NA = Not Applicable
NC HQ = Non-carcinogenic Hazard Quotient

Gray = Not Analyzed.
Black = Not Detected at MDL.
Green = Concentrations corresponding to an ELCR of < 10-6, a NC HQ of < 0.1, or ≤ Reference Area (inorganics only).
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to > 10-5 or a NC HQ of ≥ 0.1 to < 1.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4 or a NC HQ of ≥ 1 to < 10.
Purple = Concentrations corresponding to an ELCR of ≥ 10-4 or a NC HQ of ≥ 10.

Note: ELCR and HQ estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

POTENTIAL RISK IN TISSUE DUE TO COPC

Total PCBs
Arsenic
cPAHs
PCB TEQ

POTENTIAL RISK IN SEDIMENT DUE TO COPC

Total PCBs
PCB TEQ

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RIVER OPERABLE UNIT

MAGNITUDE OF POTENTIAL RISK
RECREATIONAL FISHER

DRAWING NUMBER: FIGURE 11-17
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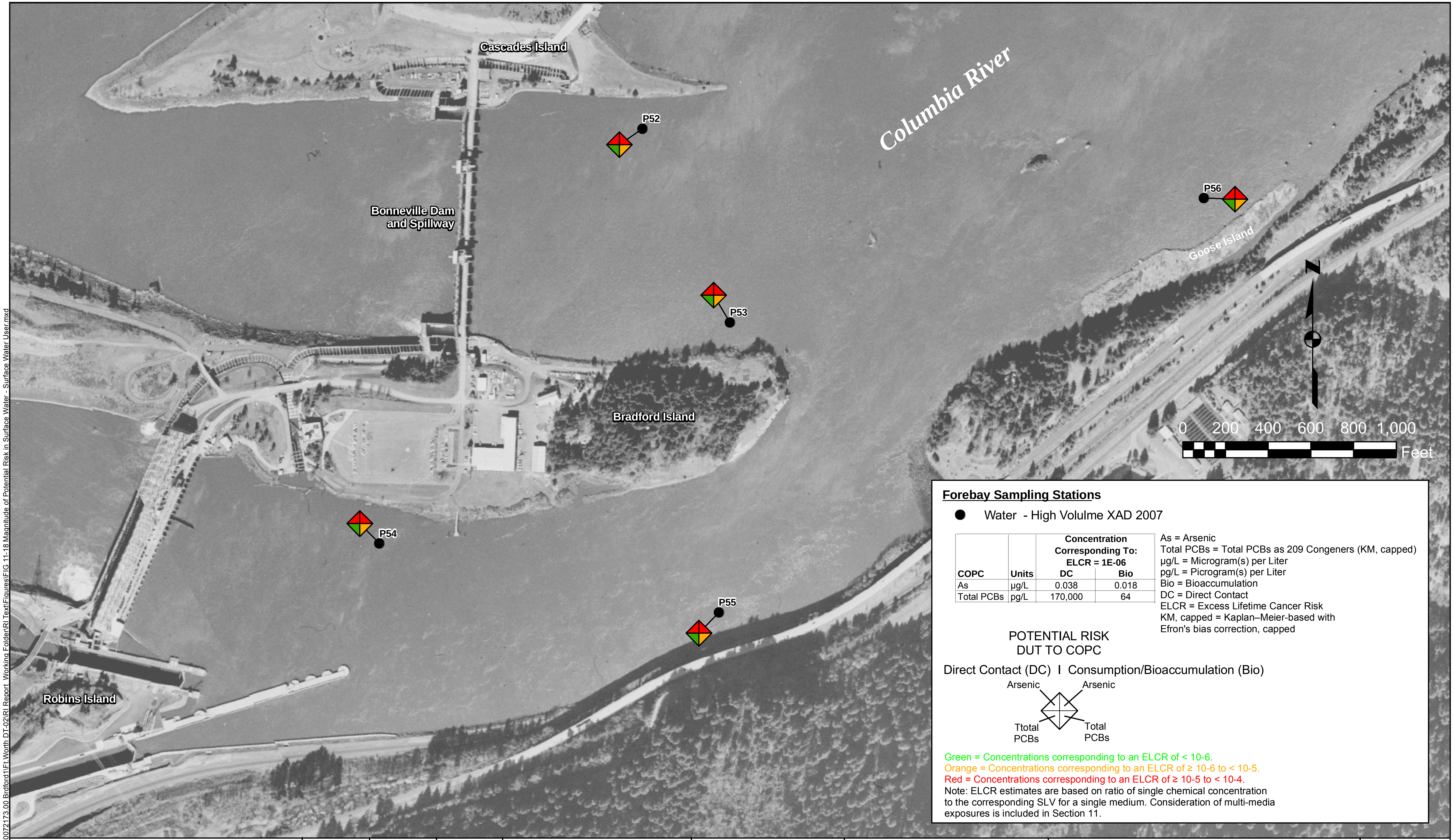
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report Working Folder\RI Text\Figures\FIG 11-18 Magnitude of Potential Risk in Surface Water - Surface Water User.mxd



Forebay Sampling Stations

● Water - High Volulme XAD 2007

COPC	Units	Concentration Corresponding To: ELCR = 1E-06 DC	Bio
As	µg/L	0.038	0.018
Total PCBs	pg/L	170,000	64

As = Arsenic
Total PCBs = Total PCBs as 209 Congeners (KM, capped)
µg/L = Microgram(s) per Liter
pg/L = Picogram(s) per Liter
Bio = Bioaccumulation
DC = Direct Contact
ELCR = Excess Lifetime Cancer Risk
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped

POTENTIAL RISK
DUT TO COPC

Direct Contact (DC) I Consumption/Bioaccumulation (Bio)

Green = Concentrations corresponding to an ELCR of < 10-6.
Orange = Concentrations corresponding to an ELCR of ≥ 10-6 to < 10-5.
Red = Concentrations corresponding to an ELCR of ≥ 10-5 to < 10-4.
Note: ELCR estimates are based on ratio of single chemical concentration to the corresponding SLV for a single medium. Consideration of multi-media exposures is included in Section 11.

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DRAWING NUMBER: FIGURE 11-18
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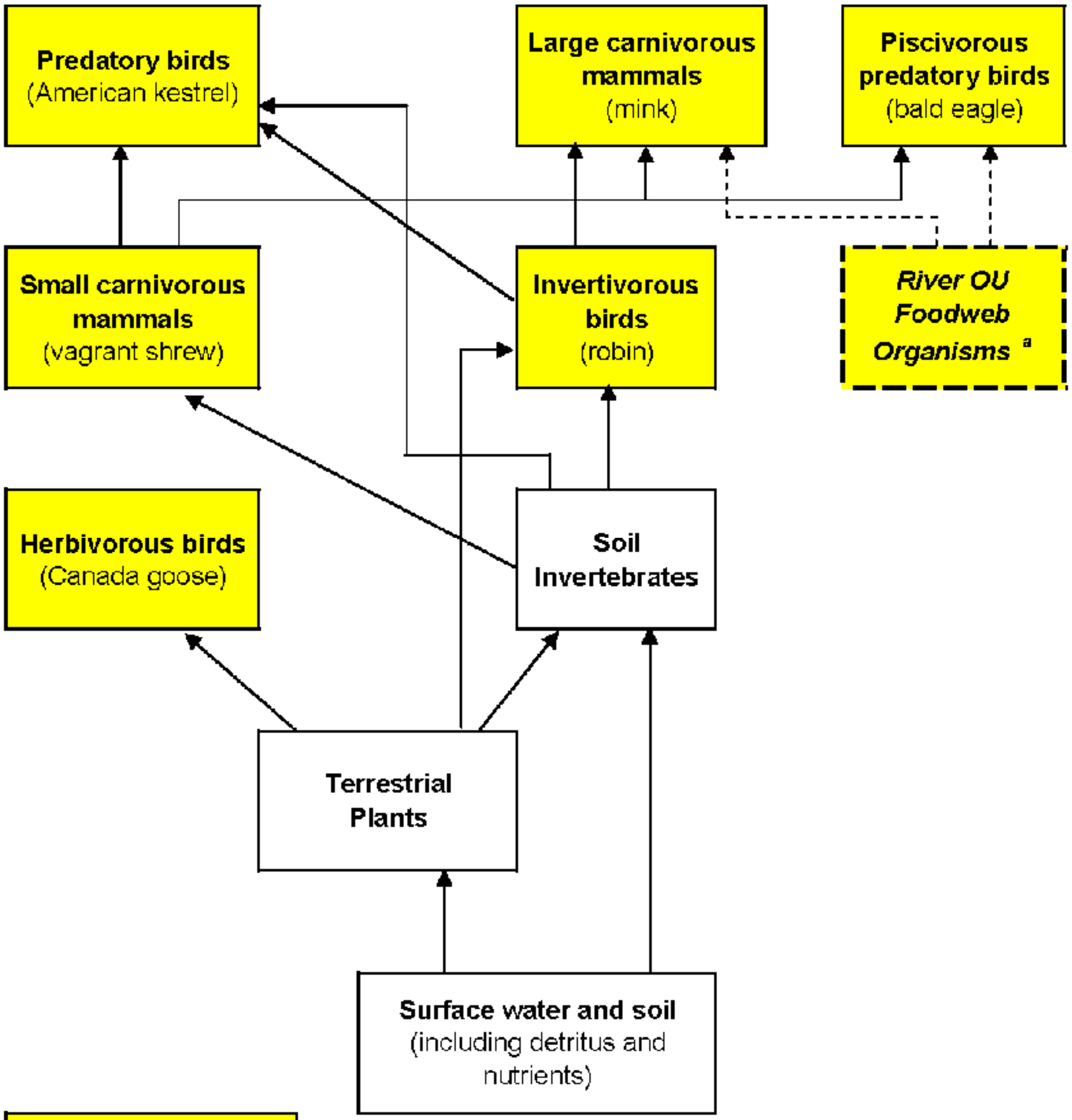

Organisms in the shaded boxes will be evaluated for risk using the representative species shown.

[a] Risk assessment performed for terrestrial wildlife receptors (100% use of Upland OU) assumed to be protective of aquatic-dependent wildlife receptors.

UPLAND OPERABLE UNIT FOOD WEB

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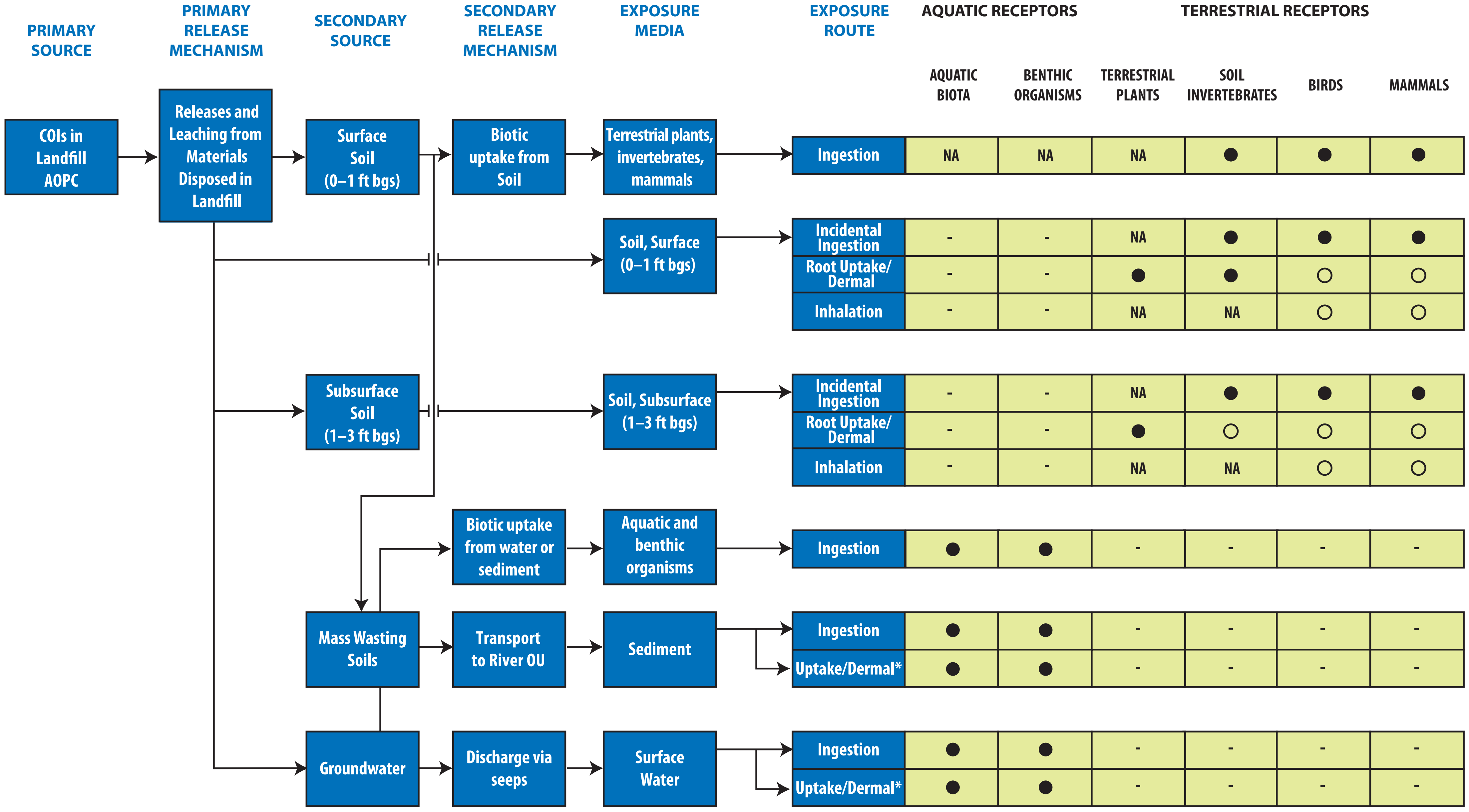
FIGURE 12-1

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folden\RI Text\Figures\FIG 12-1 Upland OU Food Web.mxd



EXPOSURE MEDIA	EXPOSURE ROUTE	AQUATIC BIOTA	BENTHIC ORGANISMS	TERRESTRIAL PLANTS	SOIL INVERTEBRATES	BIRDS	MAMMALS
Terrestrial plants, invertebrates, mammals	Ingestion	NA	NA	NA	●	●	●
Soil, Surface (0–1 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/ Dermal	-	-	●	●	○	○
	Inhalation	-	-	NA	NA	○	○
Soil, Subsurface (1–3 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/ Dermal	-	-	●	○	○	○
	Inhalation	-	-	NA	NA	○	○
Aquatic and benthic organisms	Ingestion	●	●	-	-	-	-
Sediment	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-
Surface Water	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-

LEGEND

●	Complete and potentially significant pathway
○	Complete but likely minor pathway
-	Incomplete pathway
NA	Pathway not applicable to receptor

Aquatic Biota defined as aquatic plants, plankton, invertebrates, fish and aquatic-dependent wildlife.

*The dermal exposure pathway for aquatic-dependent wildlife is expected to be minor due to the barrier offered by fur and feathers.

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BRADFORD ISLAND
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LANDFILL AOPC
ECOLOGICAL CONCEPTUAL EXPOSURE MODEL

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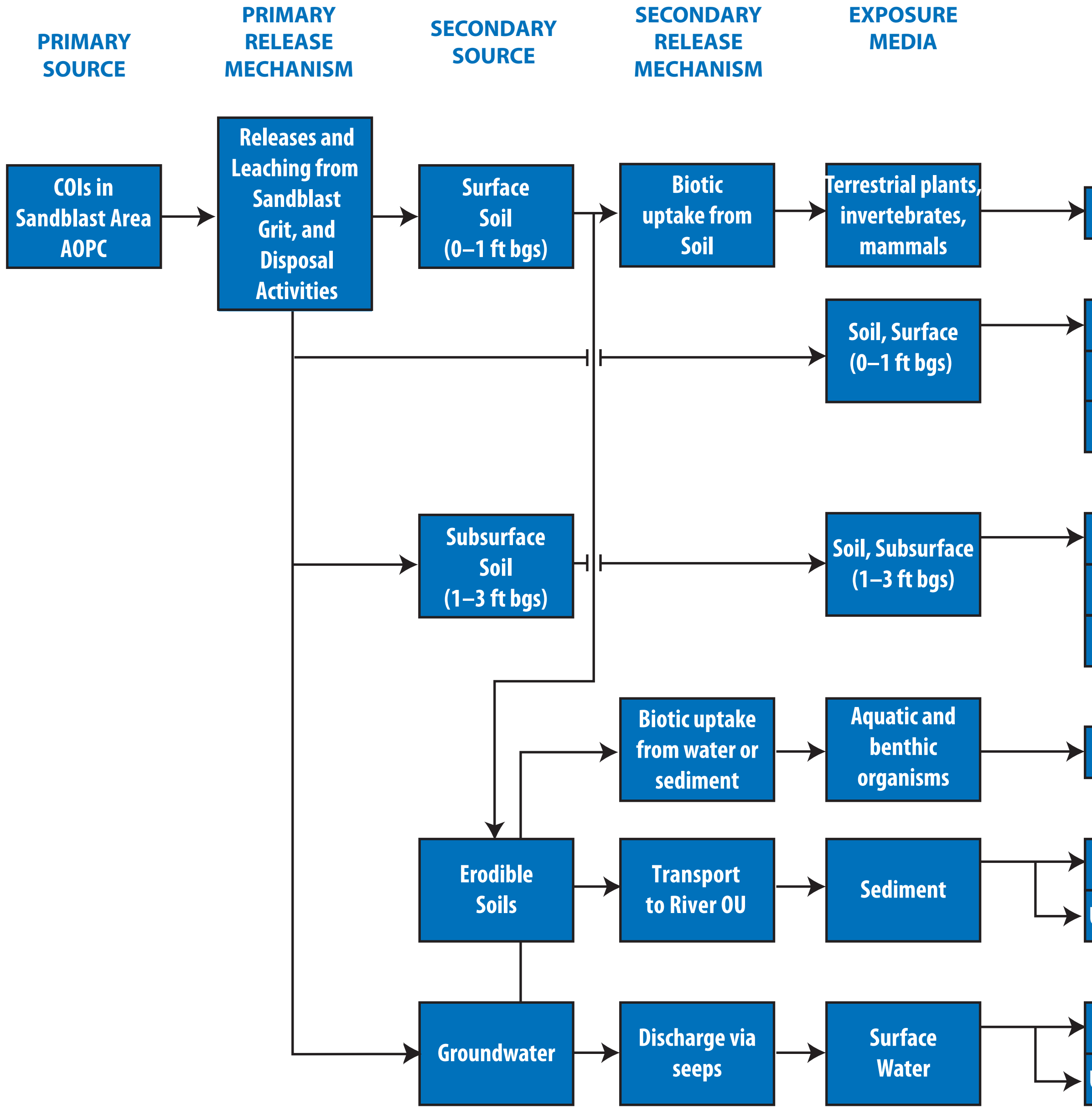

EXPOSURE MEDIA	EXPOSURE ROUTE	AQUATIC RECEPTORS: AQUATIC BIOTA	AQUATIC RECEPTORS: BENTHIC ORGANISMS	TERRESTRIAL RECEPTORS: TERRESTRIAL PLANTS	TERRESTRIAL RECEPTORS: SOIL INVERTEBRATES	TERRESTRIAL RECEPTORS: BIRDS	TERRESTRIAL RECEPTORS: MAMMALS
Terrestrial plants, invertebrates, mammals	Ingestion	NA	NA	NA	●	●	●
Soil, Surface (0–1 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/ Dermal	-	-	●	●	○	○
	Inhalation	-	-	NA	NA	○	○
Soil, Subsurface (1–3 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/ Dermal	-	-	●	○	○	○
	Inhalation	-	-	NA	NA	○	○
Aquatic and benthic organisms	Ingestion	●	●	-	-	-	-
Sediment	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-
Surface Water	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-

LEGEND

●	Complete and potentially significant pathway
○	Complete but likely minor pathway
-	Incomplete pathway
NA	Pathway not applicable to receptor

Aquatic Biota defined as aquatic plants, plankton, invertebrates, fish and aquatic-dependent wildlife.

*The dermal exposure pathway for aquatic-dependent wildlife is expected to be minor due to the barrier offered by fur and feathers.

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

ECOLOGICAL CONCEPTUAL EXPOSURE MODEL

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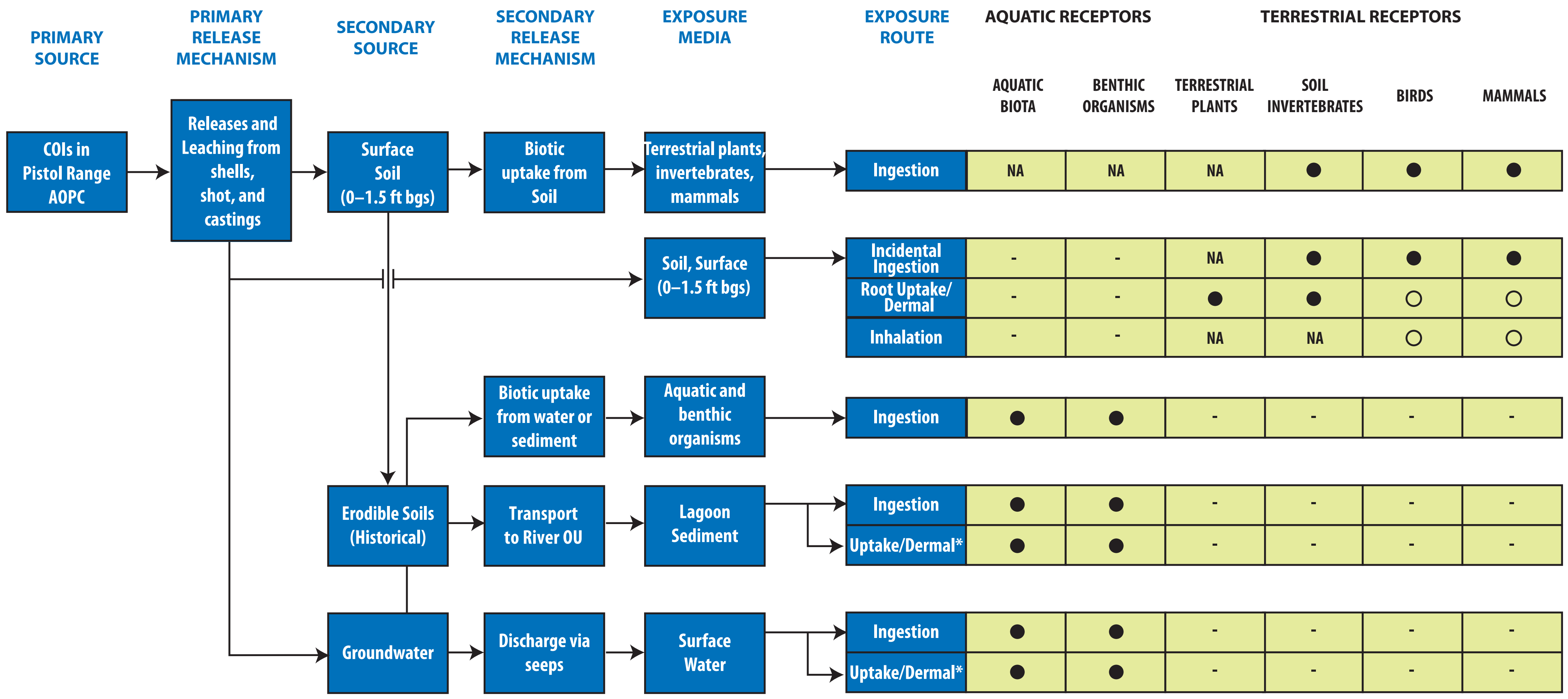

EXPOSURE MEDIA	EXPOSURE ROUTE	AQUATIC BIOTA	BENTHIC ORGANISMS	TERRESTRIAL PLANTS	SOIL INVERTEBRATES	BIRDS	MAMMALS
Terrestrial plants, invertebrates, mammals	Ingestion	NA	NA	NA	●	●	●
Soil, Surface (0–1.5 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/Dermal	-	-	●	●	○	○
	Inhalation	-	-	NA	NA	○	○
Aquatic and benthic organisms	Ingestion	●	●	-	-	-	-
Lagoon Sediment	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-
Surface Water	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-

LEGEND

● Complete and potentially significant pathway
○ Complete but likely minor pathway
- Incomplete pathway
NA Pathway not applicable to receptor

Aquatic Biota defined as aquatic plants, plankton, invertebrates, fish and aquatic-dependent wildlife.
*The dermal exposure pathway for aquatic-dependent wildlife is expected to be minor due to the barrier offered by fur and feathers.

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BRADFORD ISLAND
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PISTOL RANGE AOPC
ECOLOGICAL CONCEPTUAL EXPOSURE MODEL

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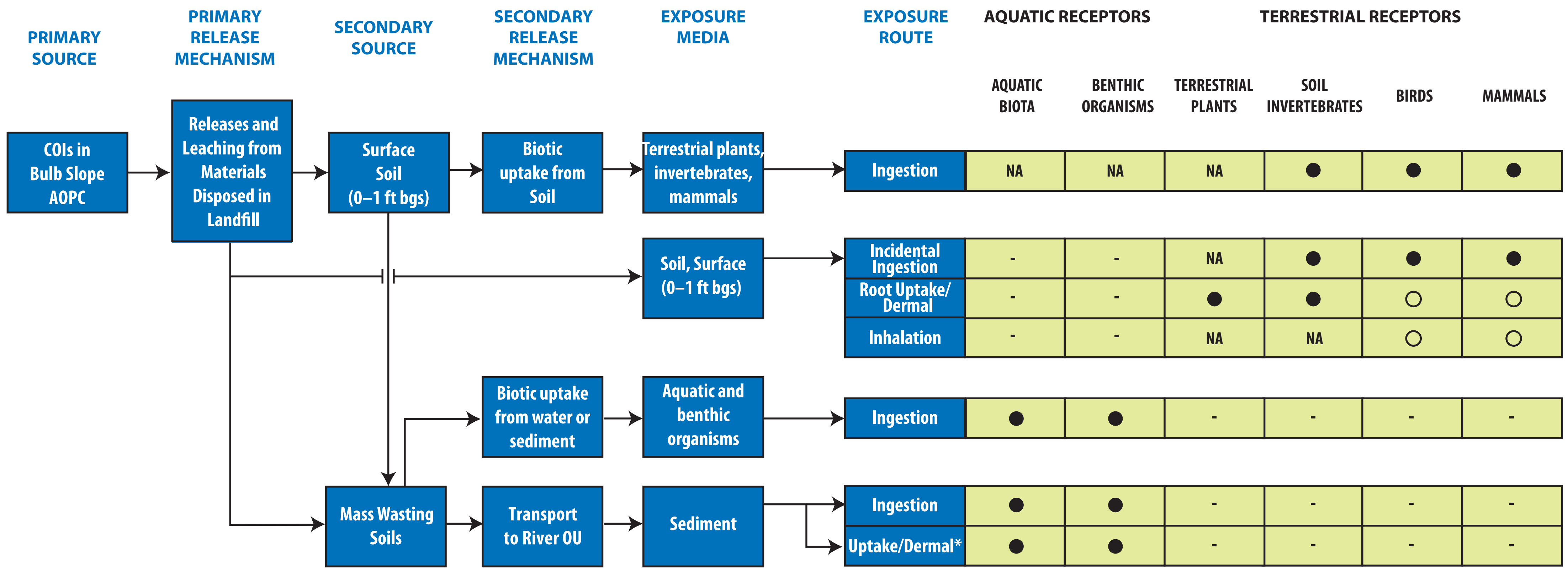

EXPOSURE MEDIA	EXPOSURE ROUTE	AQUATIC RECEPTORS		TERRESTRIAL RECEPTORS			
		AQUATIC BIOTA	BENTHIC ORGANISMS	TERRESTRIAL PLANTS	SOIL INVERTEBRATES	BIRDS	MAMMALS
Terrestrial plants, invertebrates, mammals	Ingestion	NA	NA	NA	●	●	●
Soil, Surface (0–1 ft bgs)	Incidental Ingestion	-	-	NA	●	●	●
	Root Uptake/ Dermal	-	-	●	●	○	○
	Inhalation	-	-	NA	NA	○	○
Aquatic and benthic organisms	Ingestion	●	●	-	-	-	-
Sediment	Ingestion	●	●	-	-	-	-
	Uptake/Dermal*	●	●	-	-	-	-

LEGEND

●	Complete and potentially significant pathway
○	Complete but likely minor pathway
-	Incomplete pathway
NA	Pathway not applicable to receptor

Aquatic Biota defined as aquatic plants, plankton, invertebrates, fish and aquatic-dependent wildlife.

*The dermal exposure pathway for aquatic-dependent wildlife is expected to be minor due to the barrier offered by fur and feathers.

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

BULB SLOPE AOPC

ECOLOGICAL CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER: FIGURE 12-5
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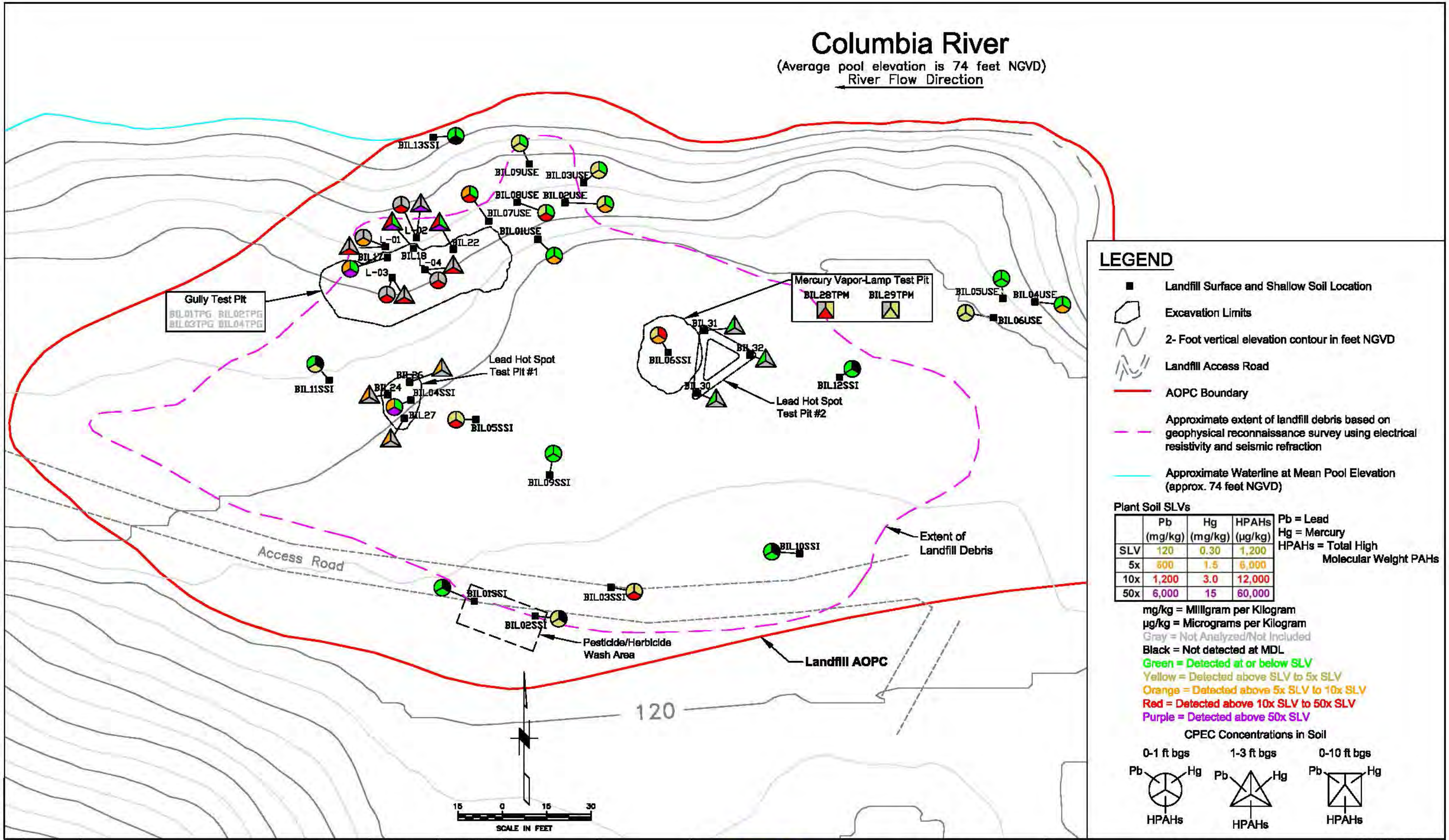

LEGEND

■ Landfill Surface and Shallow Soil Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Plant Soil SLVs

	Pb (mg/kg)	Hg (mg/kg)	HPAHs (µg/kg)
SLV	120	0.30	1,200
5x	600	1.5	6,000
10x	1,200	3.0	12,000
50x	6,000	15	60,000

Pb = Lead
Hg = Mercury
HPAHs = Total High Molecular Weight PAHs

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed/Not Included
Black = Not detected at MDL
Green = Detected at or below SLV
Yellow = Detected above SLV to 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil

0-1 ft bgs	1-3 ft bgs	0-10 ft bgs
Pb Hg HPAHs	Pb Hg HPAHs	Pb Hg HPAHs

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LANDFILL AOPC

PLANT CPECs IN SOIL

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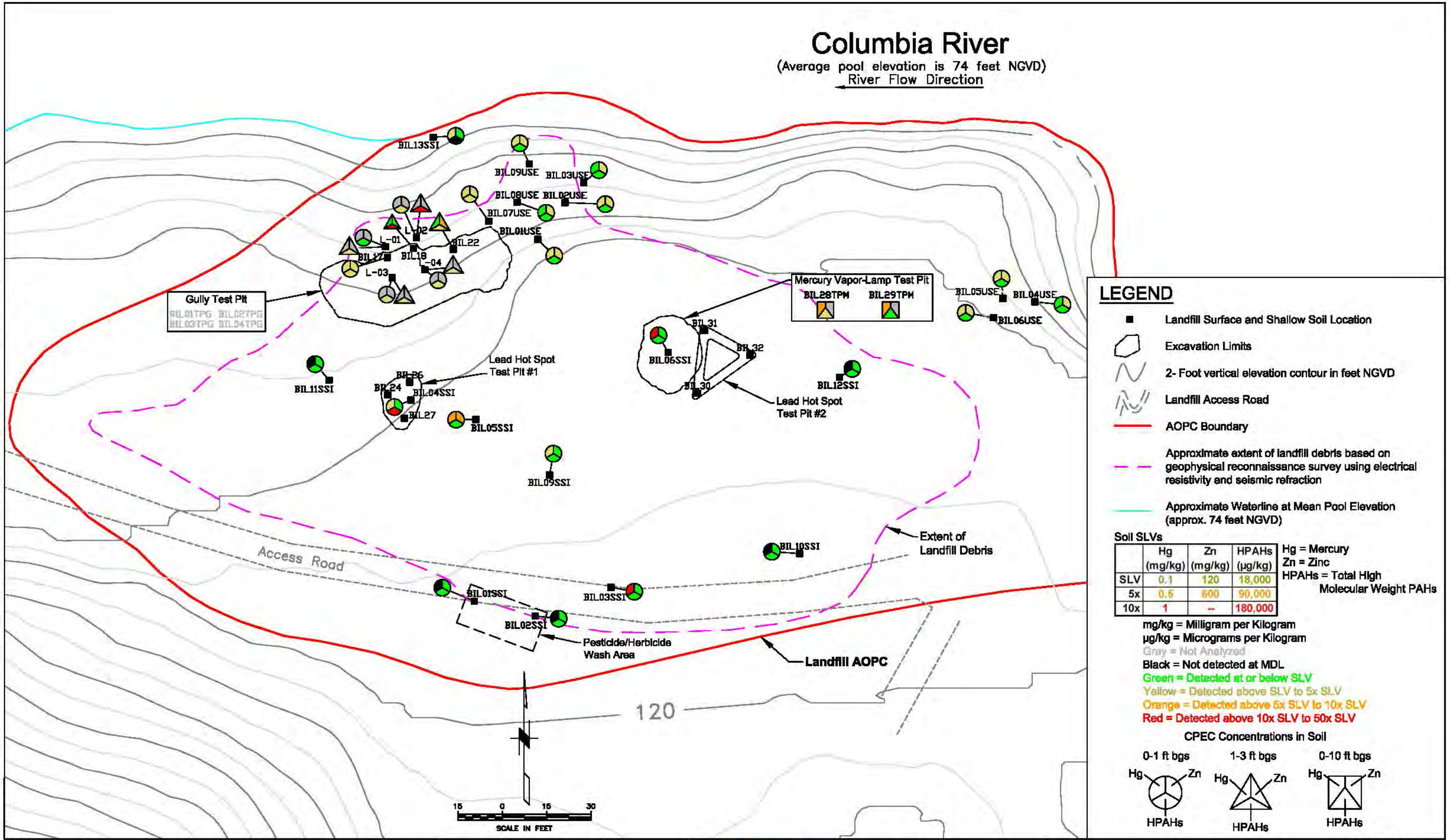

Soil SLVs

	Hg (mg/kg)	Zn (mg/kg)	HPAHs (µg/kg)
SLV	0.1	120	18,000
5x	0.5	600	90,000
10x	1	--	180,000

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CASCADE LOCKS, OREGON

LANDFILL AOPC

SOIL INVERTEBRATE CPECs IN SOIL

DRAWING NUMBER: FIG12-7
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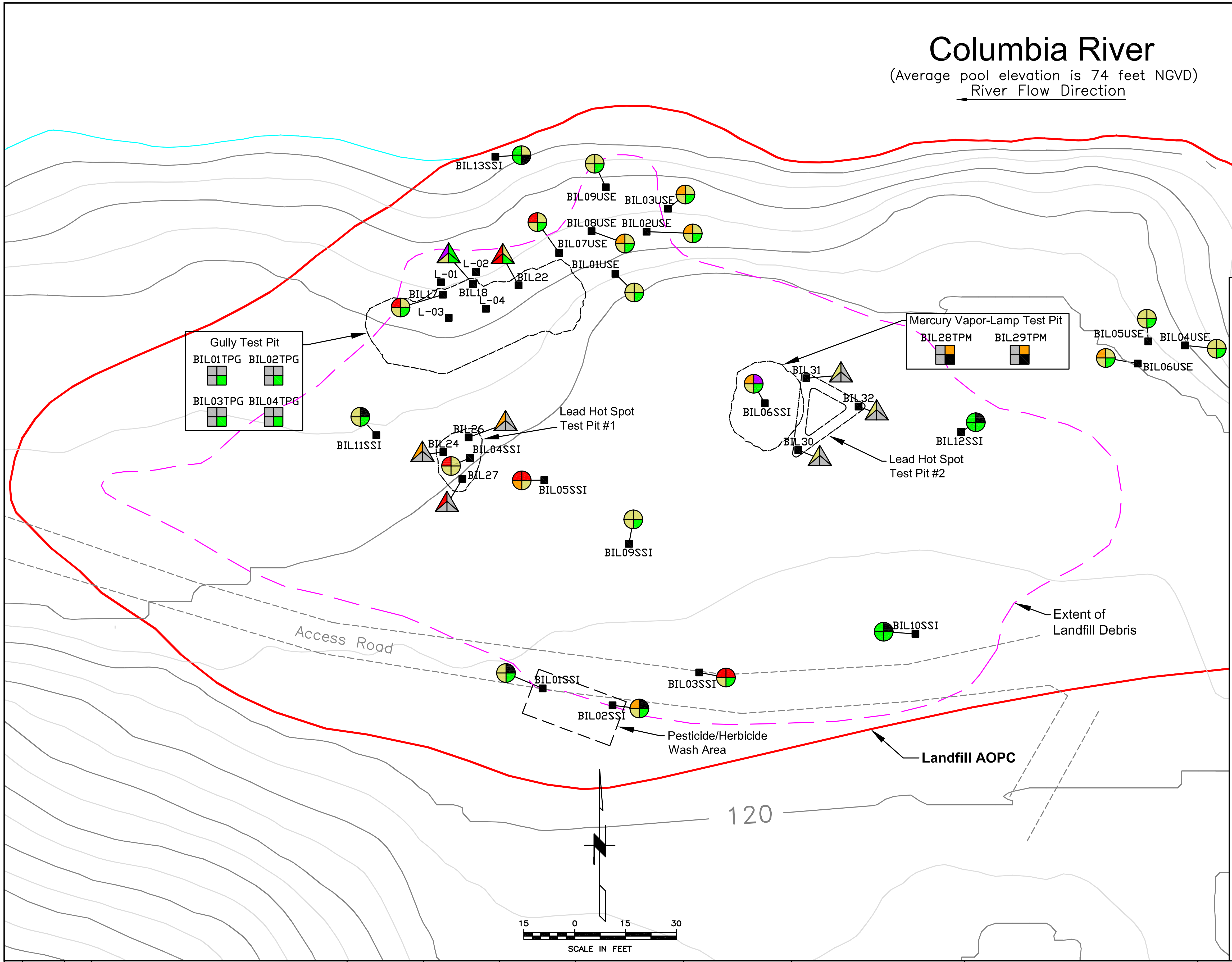
c:\25692709 USACE\53-FD072173.00 Bradford\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-7 Soil Invertebrate CPECs in Soil at the Landfill AOPC.dwg Apr 13, 2012 - 11:32am



LEGEND

■ Landfill Surface and Shallow Soil Location

Excavation Limits

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

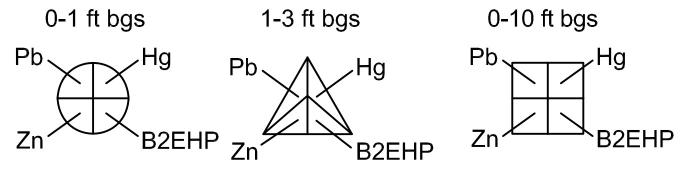
Avian Soil SLVs

	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)	B2EHP (µg/kg)
SLV	25.5	0.066	72	4,500
5x	127.5	0.330	359	22,500
10x	255	0.66	717	--
50x	1,275	3.3	--	--

Pb = Lead
Hg = Mercury
Zn = Zinc
B2EHP = Bis(2-ethylhexyl)phthalate

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Yellow = Detected above SLV to 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil



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LANDFILL AOPC

BIRD CPECs IN SOIL

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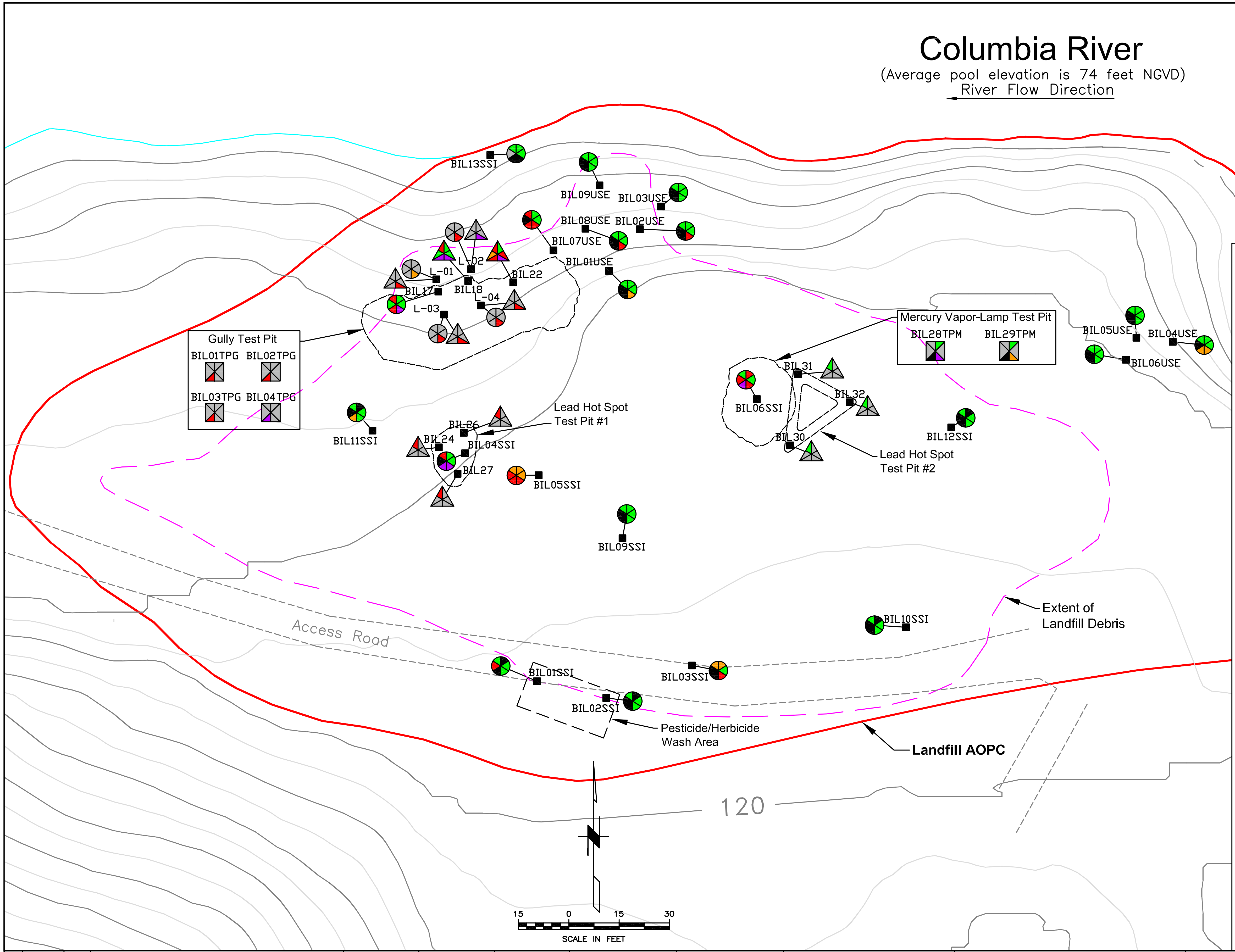


LEGEND

- ■ Landfill Surface and Shallow Soil Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

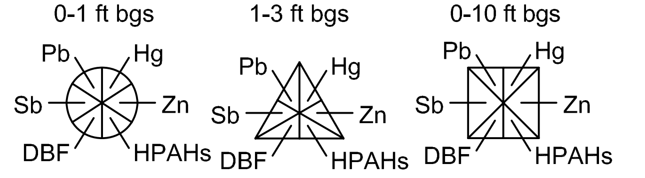
Mammal SLVs

	Sb (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)	DBF (µg/kg)	HPAHs (µg/kg)
SLV	0.27	56	0.15	79	2.0	1,100
5x	1.35	280	0.73	395	10	5,500
10x	2.7	560	1.5	790	20	11,000
50x	--	--	--	--	100	55,000

Sb = Antimony
Pb = Lead
Hg = Mercury
Zn = Zinc
DBF = Dibenzofuran
HPAHs = Total High Molecular Weight PAHs

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil



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MAMMAL CPECs IN SOIL

DRAWING NUMBER: FIG 12-9
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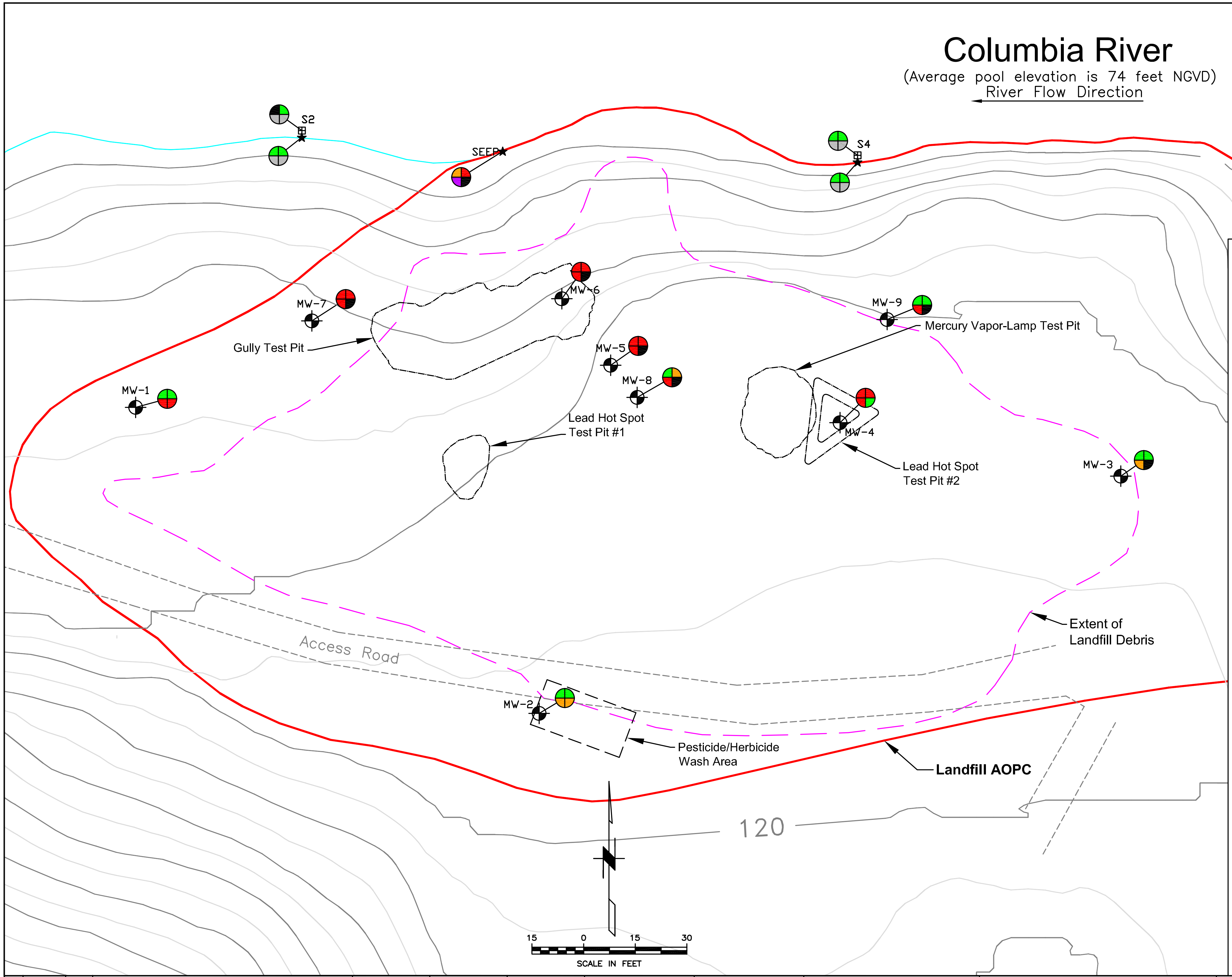
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-10 Aquatic Organism CPECs in GW, Seep Water, and Surface Water at the Landfill AOPC.dwg Nov 18, 2010 - 9:07am



LEGEND

- ⊕ Landfill Groundwater Sampling Location
- ⊞ Landfill Surface Water Sampling Location
- ★ Landfill Seep Location
- Excavation Limits
- 2- Foot vertical elevation contour in feet NGVD
- Landfill Access Road
- AOPC Boundary
- Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
- Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

Aquatic Organism SLVs

	Ba (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	B2EHP (µg/kg)
SLV	0.004	1.0	0.12	3.0
10x	0.04	10	1.2	30
50x	0.2	--	--	--

Ba = Barium
Fe = Iron
Mn = Manganese
B2EHP = Bis(2-ethylhexyl)phthalate

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Orange = Detected above SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Water

Fe Mn
Ba B2EHP

Note: Barium and zinc concentrations at MW-1 & MW-5 through MW-9 are totals because they were not analyzed for dissolved barium and zinc at these locations.

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LANDFILL AOPC
AQUATIC ORGANISM CPECs IN GROUNDWATER,
SEEP WATER, AND SURFACE WATER

DRAWING NUMBER: FIG 12-10
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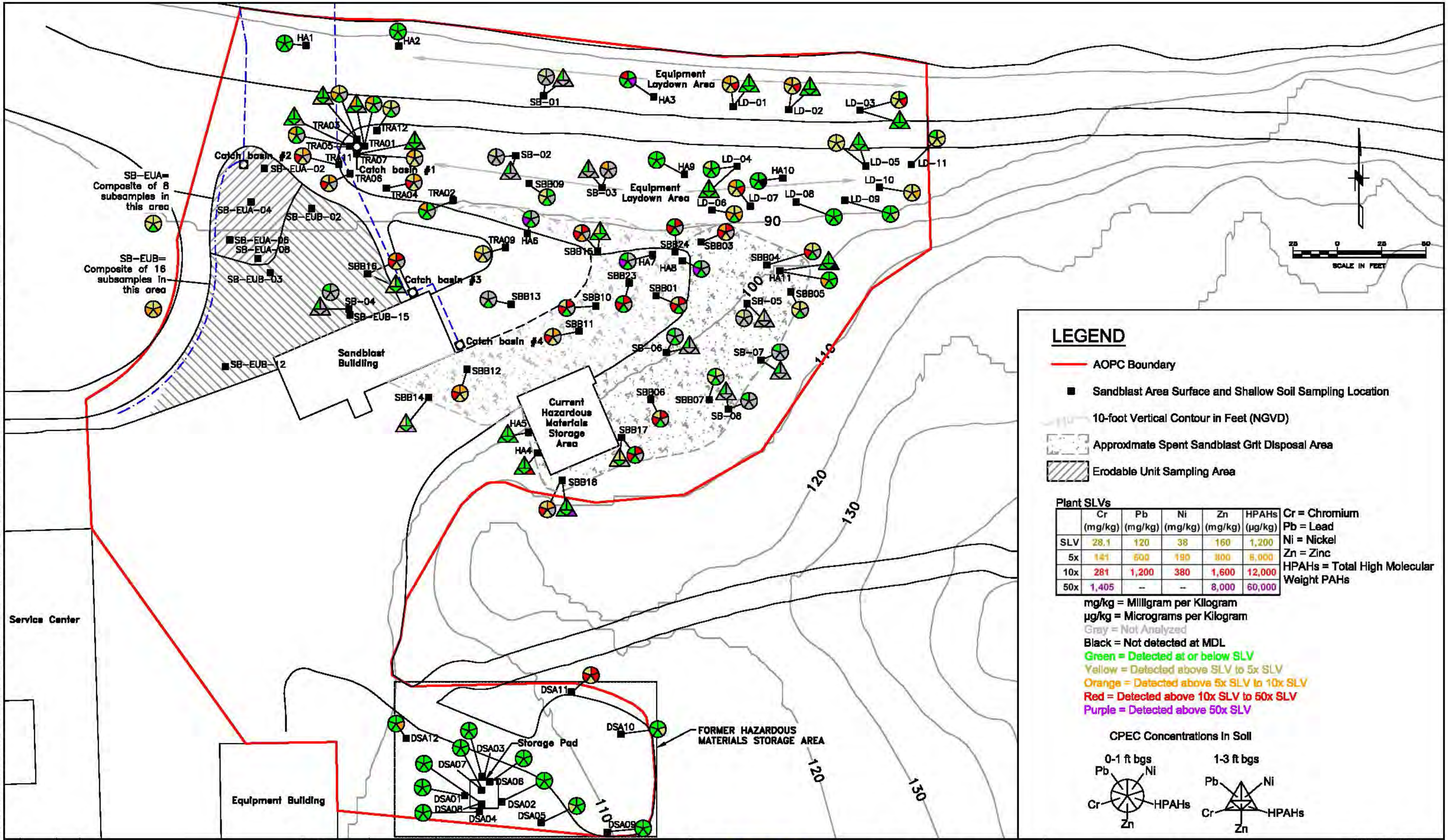

LEGEND

AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

10-foot Vertical Contour in Feet (NGVD)

Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

Plant SLVs

	Cr (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Zn (mg/kg)	HPAHs (µg/kg)
SLV	28.1	120	38	160	1,200
5x	141	600	190	800	6,000
10x	281	1,200	380	1,600	12,000
50x	1,405	--	--	8,000	60,000

Cr = Chromium
Pb = Lead
Ni = Nickel
Zn = Zinc
HPAHs = Total High Molecular Weight PAHs

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Yellow = Detected above SLV to 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil

0-1 ft bgs: Pb, Ni, Cr, HPAHs, Zn

1-3 ft bgs: Pb, Ni, Cr, HPAHs, Zn

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SANDBLAST AREA AOPC

PLANT CPECs IN SOIL

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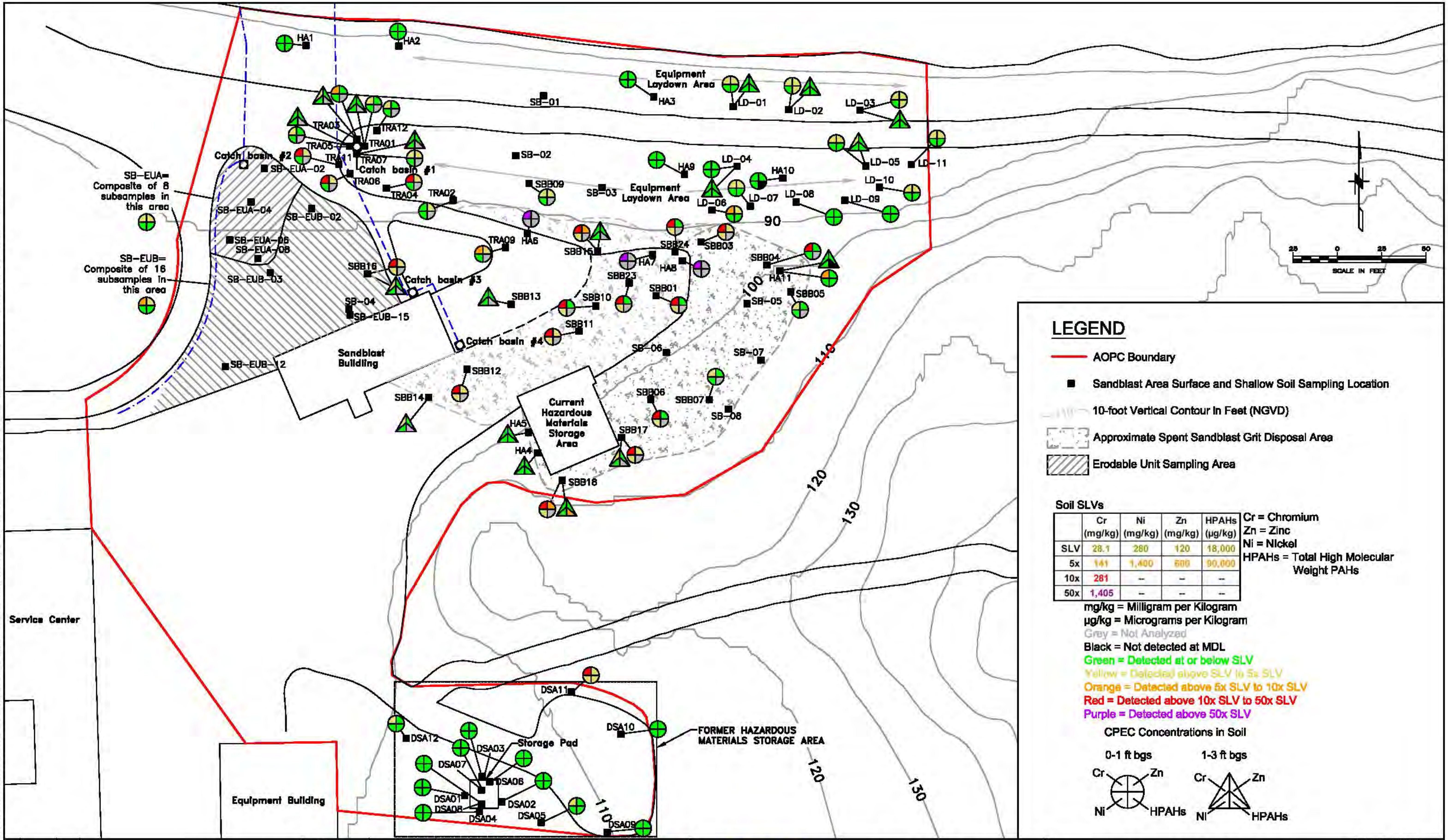
c:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-11 Plant CPECs in Soil at the Sandblast Area AOPC.dwg Apr 16, 2012 - 10:31am



LEGEND

AOPC Boundary

■ Sandblast Area Surface and Shallow Soil Sampling Location

10-foot Vertical Contour in Feet (NGVD)

Approximate Spent Sandblast Grit Disposal Area

▨ Erodable Unit Sampling Area

Soil SLVs

	Cr (mg/kg)	Ni (mg/kg)	Zn (mg/kg)	HPAHs (µg/kg)
SLV	28.1	280	120	18,000
5x	141	1,400	600	90,000
10x	281	--	--	--
50x	1,405	--	--	--

Cr = Chromium
Zn = Zinc
Ni = Nickel
HPAHs = Total High Molecular Weight PAHs

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Grey = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Yellow = Detected above SLV to 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil

0-1 ft bgs: Cr, Zn, Ni, HPAHs

1-3 ft bgs: Cr, Zn, Ni, HPAHs

c:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-12 Soil Invertebrate CPECs in Soil at the Sandblast Area AOPC.dwg Apr 16, 2012 - 10:30am

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SANDBLAST AREA AOPC

SOIL INVERTEBRATE CPECs IN SOIL

DRAWING NUMBER: FIG 12-12
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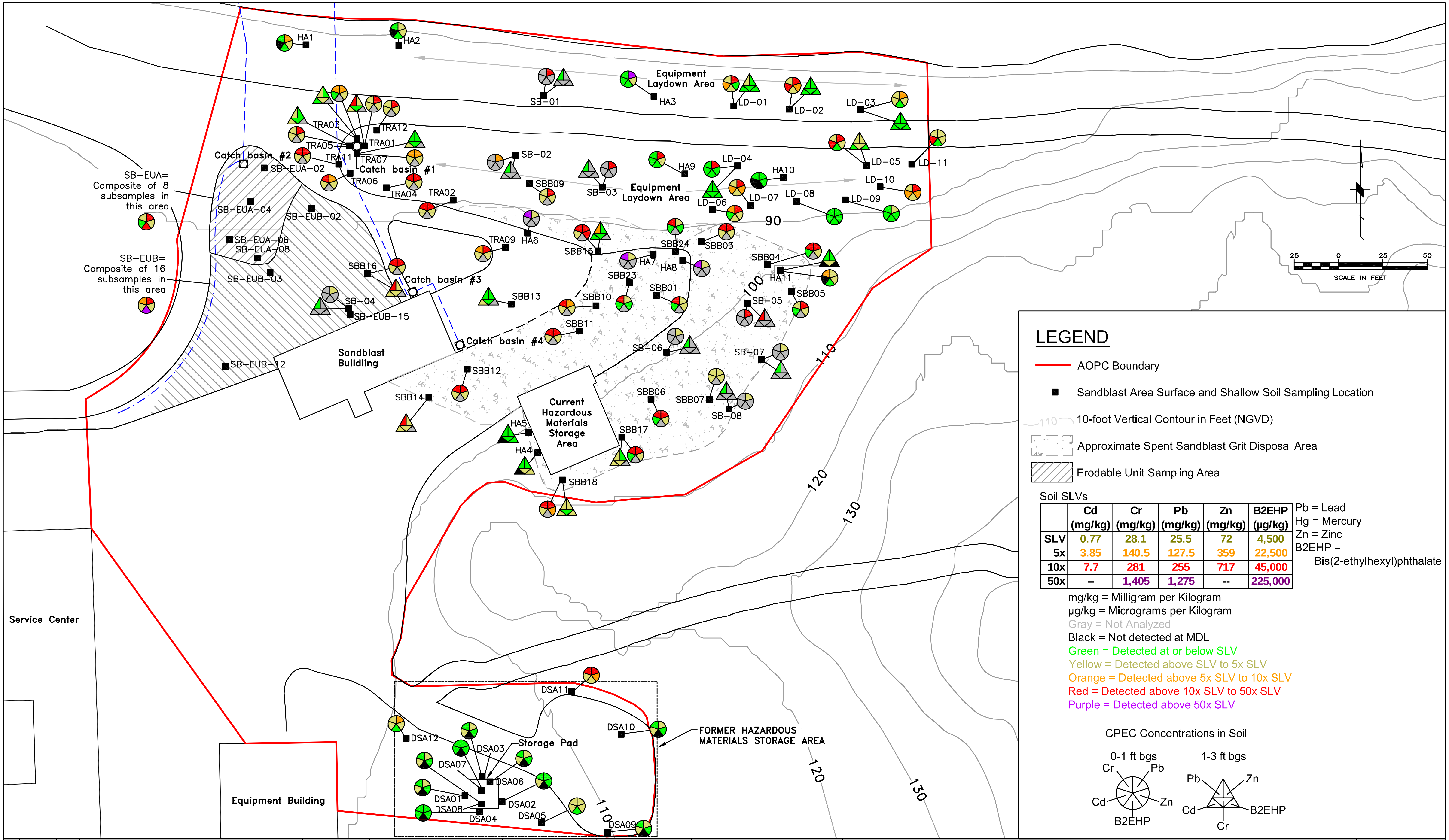
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-13 Bird CPECs in Soil at the Sandblast Area AOPC.dwg Nov 18, 2010 - 9:08am



LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area

Soil SLVs

	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	B2EHP (µg/kg)
SLV	0.77	28.1	25.5	72	4,500
5x	3.85	140.5	127.5	359	22,500
10x	7.7	281	255	717	45,000
50x	--	1,405	1,275	--	225,000

Pb = Lead
Hg = Mercury
Zn = Zinc
B2EHP = Bis(2-ethylhexyl)phthalate

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Yellow = Detected above SLV to 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

CPEC Concentrations in Soil

0-1 ft bgs: Cr, Pb, Cd, Zn, B2EHP
1-3 ft bgs: Pb, Zn, Cd, B2EHP, Cr

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SANDBLAST AREA AOPC
BIRD CPECs IN SOIL

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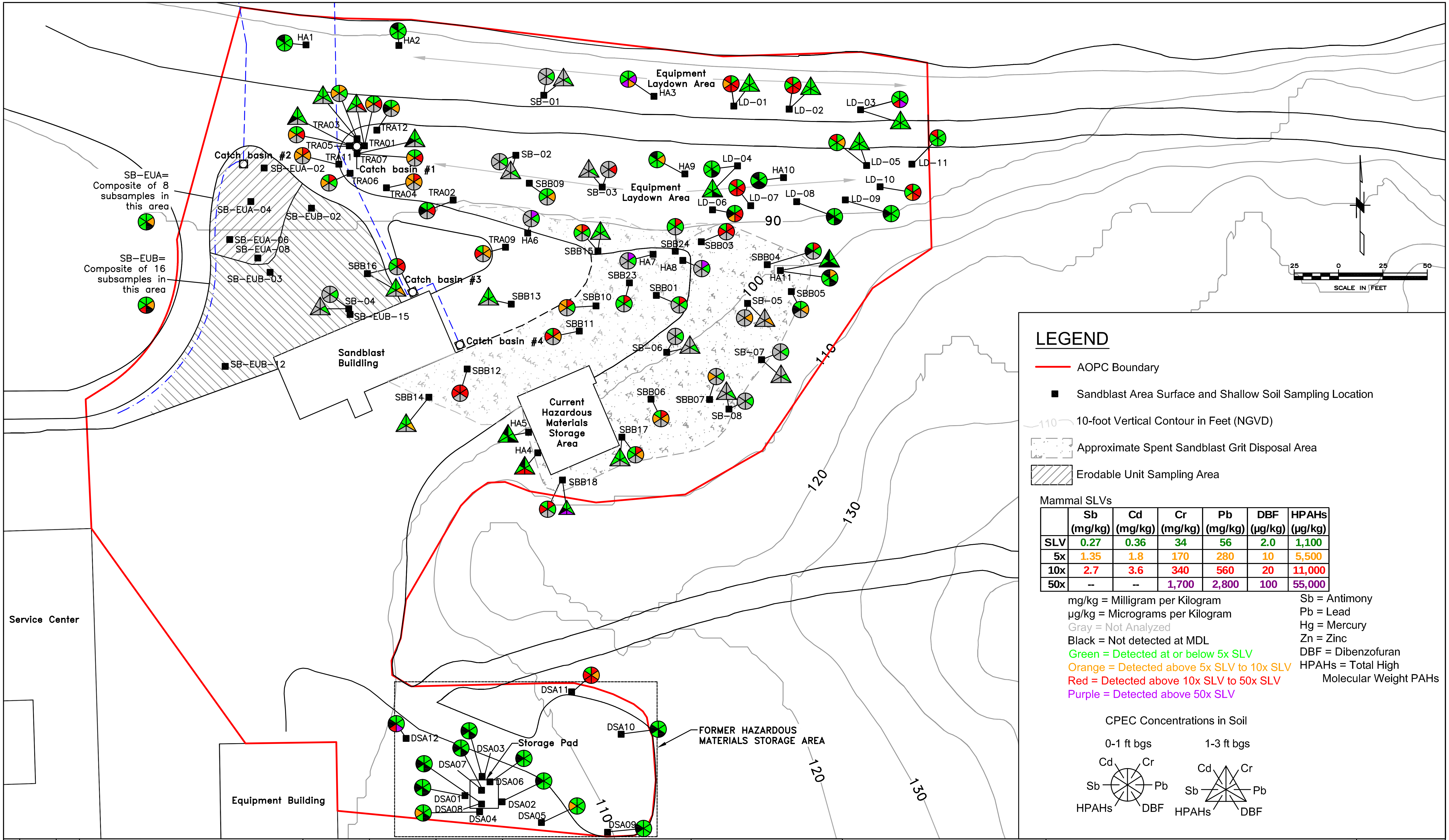
O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-14 Mammal CPECs in Soil at the Sandblast Area AOPC.dwg Nov 18, 2010 - 9:09am



LEGEND

- AOPC Boundary
- ■ Sandblast Area Surface and Shallow Soil Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area
- ▨ Erodable Unit Sampling Area

Mammal SLVs

	Sb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	DBF (µg/kg)	HPAHs (µg/kg)
SLV	0.27	0.36	34	56	2.0	1,100
5x	1.35	1.8	170	280	10	5,500
10x	2.7	3.6	340	560	20	11,000
50x	--	--	1,700	2,800	100	55,000

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below 5x SLV
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV
Purple = Detected above 50x SLV

Sb = Antimony
Pb = Lead
Hg = Mercury
Zn = Zinc
DBF = Dibenzofuran
HPAHs = Total High Molecular Weight PAHs

CPEC Concentrations in Soil

0-1 ft bgs: Cd, Cr, Sb, Pb, HPAHs, DBF

1-3 ft bgs: Cd, Cr, Sb, Pb, HPAHs, DBF

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SANDBLAST AREA AOPC

MAMMAL CPECs IN SOIL

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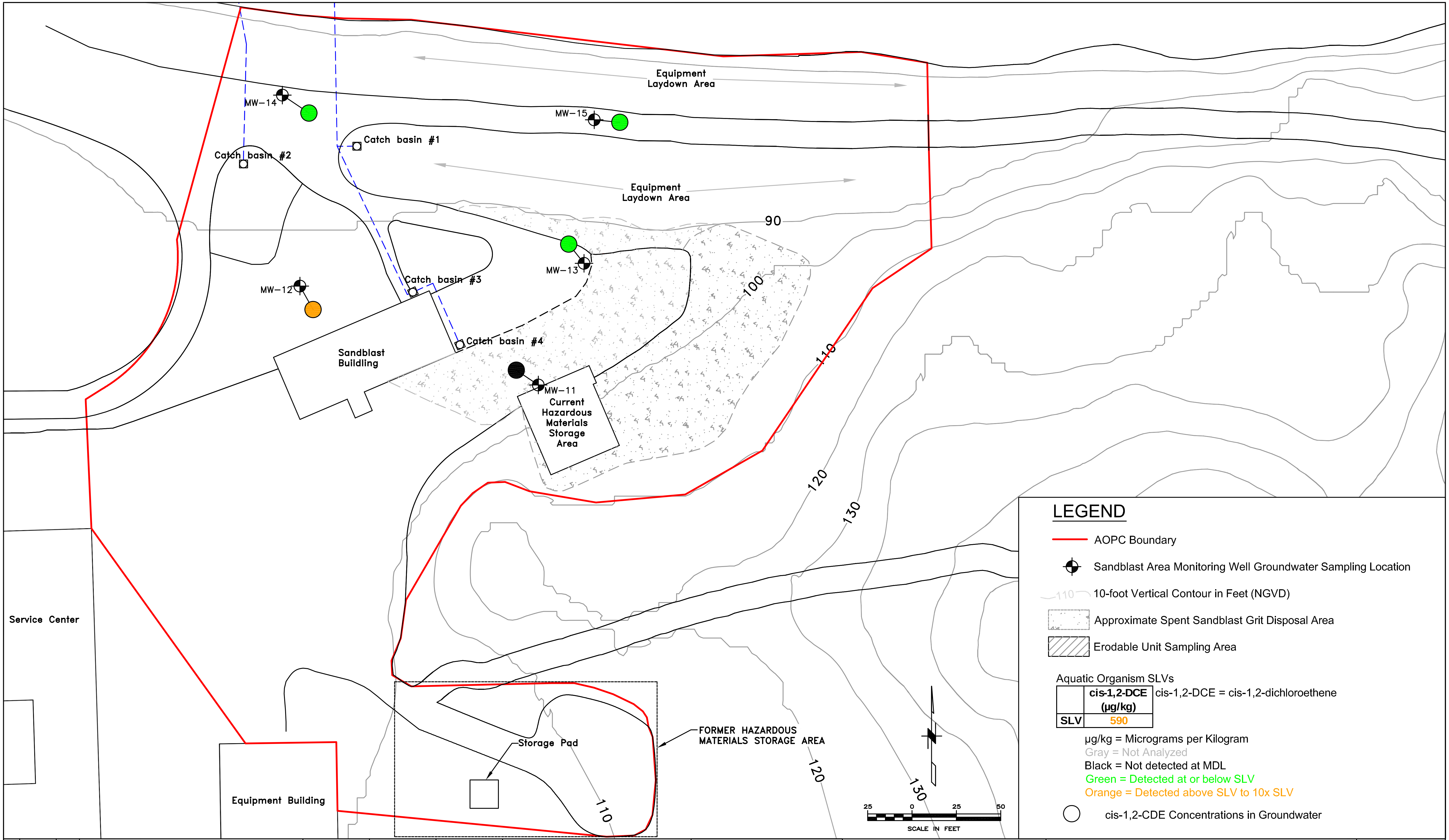

LEGEND

- AOPC Boundary
- Sandblast Area Monitoring Well Groundwater Sampling Location
- 110 10-foot Vertical Contour in Feet (NGVD)
- Approximate Spent Sandblast Grit Disposal Area
- Erodable Unit Sampling Area

Aquatic Organism SLVs

	cis-1,2-DCE (µg/kg)
SLV	590

cis-1,2-DCE = cis-1,2-dichloroethene

µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV
Orange = Detected above SLV to 10x SLV

○ cis-1,2-CDE Concentrations in Groundwater

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SANDBLAST AREA AOPC

AQUATIC ORGANISM CPECs IN GROUNDWATER

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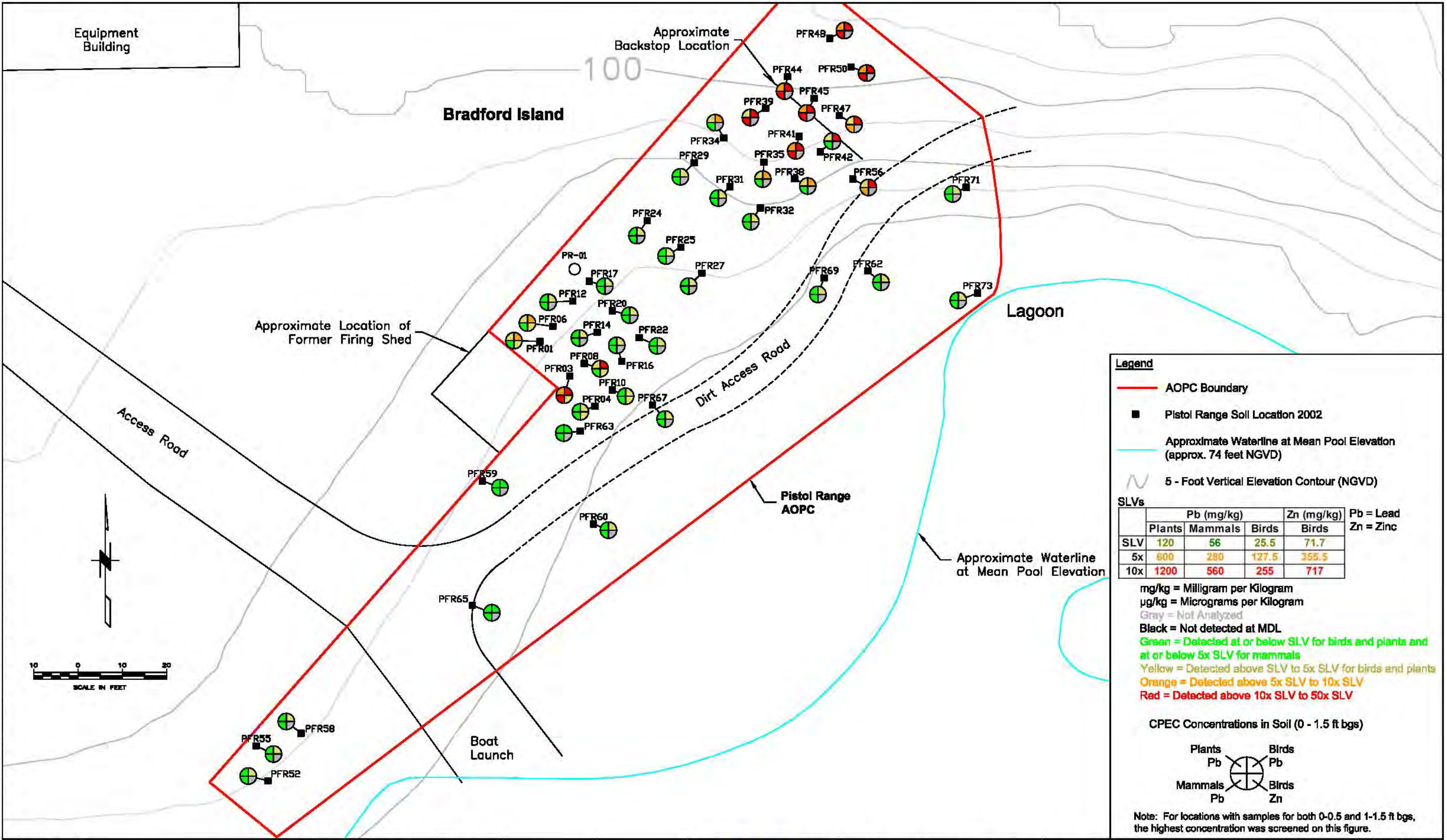

Legend

AOPC Boundary

■ Pistol Range Soil Location 2002

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

5 - Foot Vertical Elevation Contour (NGVD)

SLVs

	Pb (mg/kg)			Zn (mg/kg)
	Plants	Mammals	Birds	Birds
SLV	120	56	25.5	71.7
5x	600	280	127.5	355.5
10x	1200	560	255	717

Pb = Lead
Zn = Zinc

mg/kg = Milligram per Kilogram
µg/kg = Micrograms per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV for birds and plants and at or below 5x SLV for mammals
Yellow = Detected above SLV to 5x SLV for birds and plants
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV

CPEC Concentrations in Soil (0 - 1.5 ft bgs)

Plants Pb
Birds Pb
Mammals Pb
Birds Zn

Note: For locations with samples for both 0-0.5 and 1-1.5 ft bgs, the highest concentration was screened on this figure.

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PISTOL RANGE AOPC

ECOLOGICAL CPECs IN SOIL

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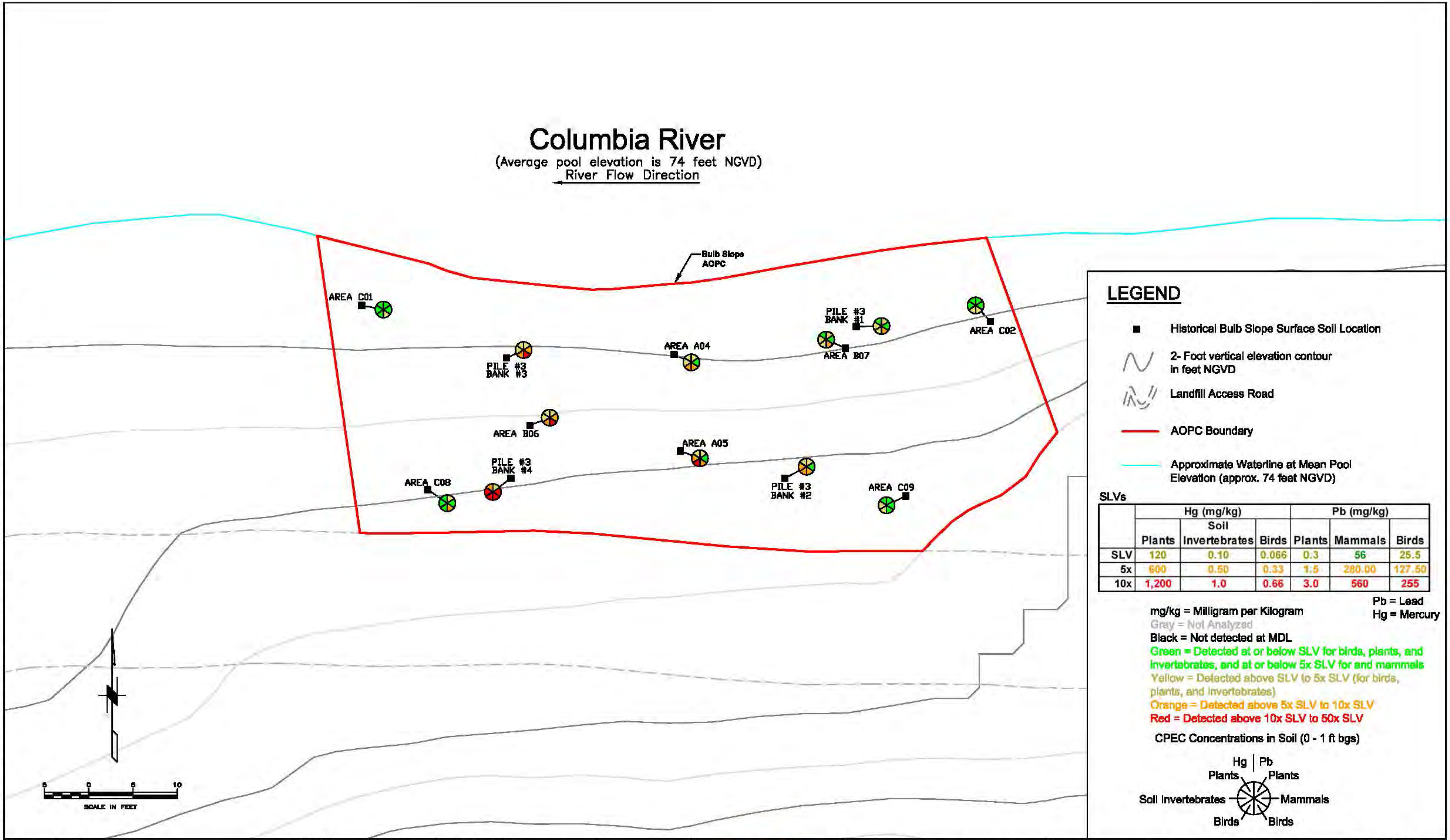

LEGEND

■ Historical Bulb Slope Surface Soil Location

2- Foot vertical elevation contour in feet NGVD

Landfill Access Road

AOPC Boundary

Approximate Waterline at Mean Pool Elevation (approx. 74 feet NGVD)

SLVs

	Hg (mg/kg)			Pb (mg/kg)		
	Plants	Soil Invertebrates	Birds	Plants	Mammals	Birds
SLV	120	0.10	0.066	0.3	56	25.5
5x	600	0.50	0.33	1.5	280.00	127.50
10x	1,200	1.0	0.66	3.0	560	255

Pb = Lead
Hg = Mercury

mg/kg = Milligram per Kilogram
Gray = Not Analyzed
Black = Not detected at MDL
Green = Detected at or below SLV for birds, plants, and invertebrates, and at or below 5x SLV for and mammals
Yellow = Detected above SLV to 5x SLV (for birds, plants, and invertebrates)
Orange = Detected above 5x SLV to 10x SLV
Red = Detected above 10x SLV to 50x SLV

CPEC Concentrations in Soil (0 - 1 ft bgs)

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BULB SLOPE AOPC
ECOLOGICAL CPECs IN SOIL

DRAWING NUMBER: FIG 12-17
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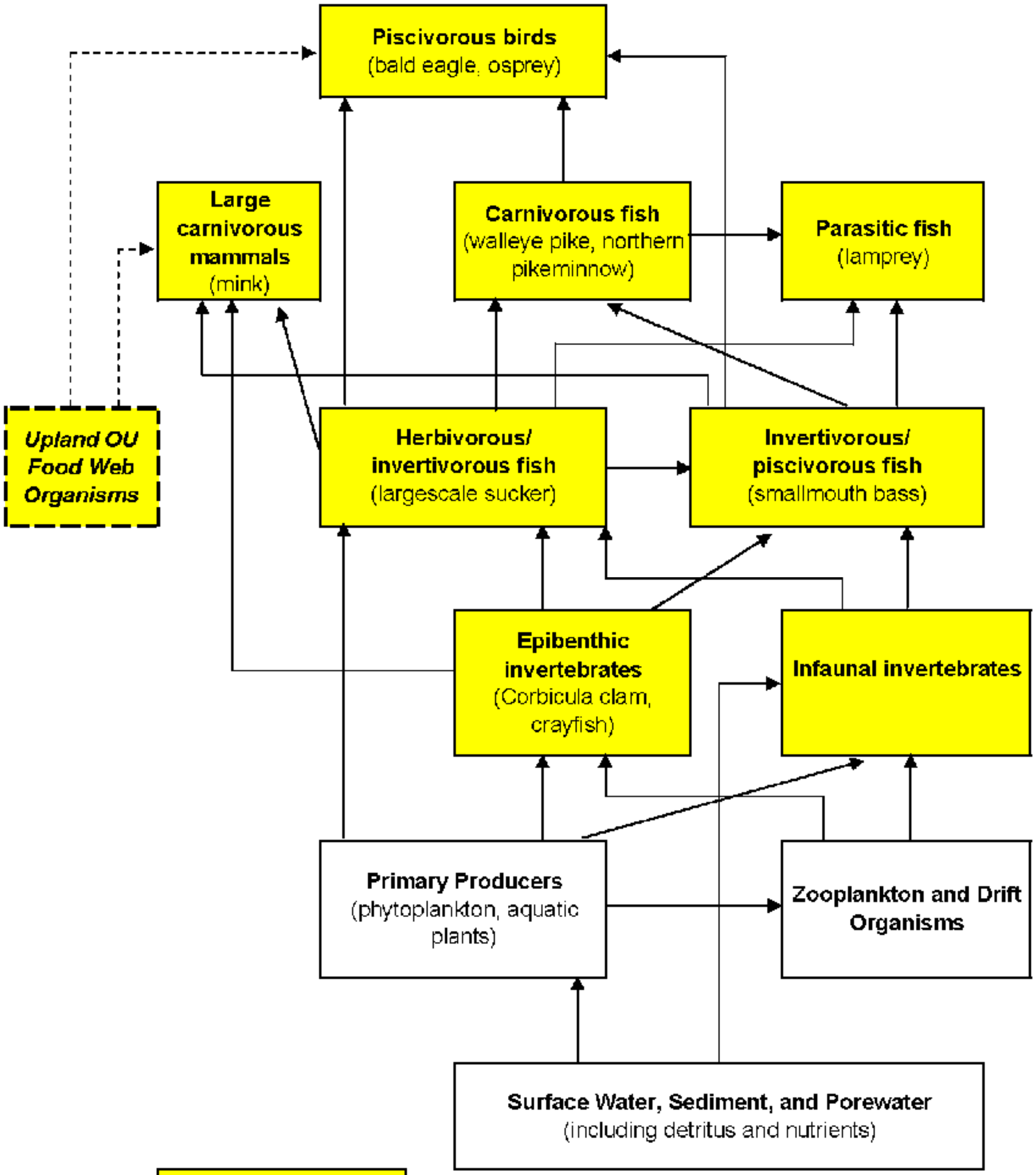

Organisms in the shaded boxes will be evaluated for risk using the representative species shown.

RIVER OPERABLE UNIT FOOD WEB

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FIGURE 12-18

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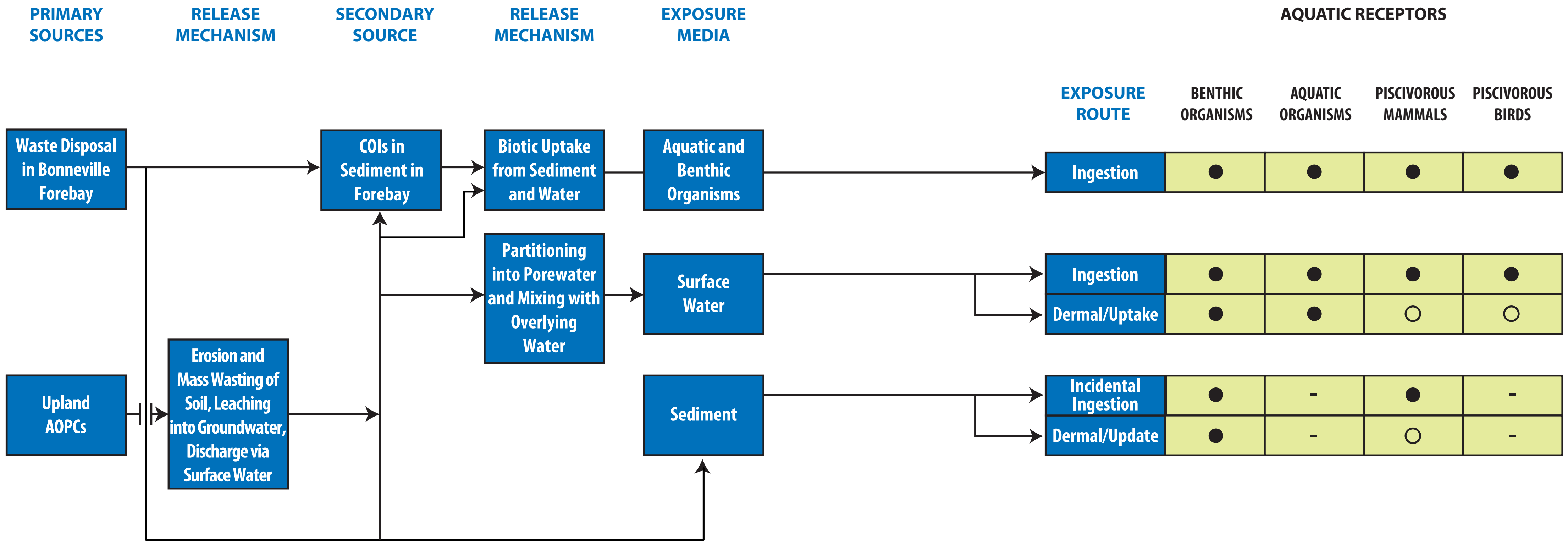

AQUATIC RECEPTORS

EXPOSURE MEDIA	EXPOSURE ROUTE	BENTHIC ORGANISMS	AQUATIC ORGANISMS	PISCIVOROUS MAMMALS	PISCIVOROUS BIRDS
Aquatic and Benthic Organisms	Ingestion	●	●	●	●
Surface Water	Ingestion	●	●	●	●
	Dermal/Uptake	●	●	○	○
Sediment	Incidental Ingestion	●	-	●	-
	Dermal/Update	●	-	○	-

LEGEND

●	Complete and potentially significant pathway
○	Complete but likely minor pathway
-	Incomplete pathway

Aquatic Organisms defined as aquatic plants, plankton, invertebrates, fish (resident species: smallmouth bass; anadromous species: salmon, sturgeon)
Benthic Organisms defined as benthic invertebrates (infaunal invertebrates, clams, crayfish) and demersal fish (sculpin)
Piscivorous Mammals and Birds defined as those aquatic-dependent species that consume fish or shellfish from the river (bald eagle, osprey, mink)

JOB No. 25696528	DESIGNED: LSM	PROJ. ENGINEER: LSM
	DRAWN BY: MS	APPROVED BY: MP
	CHECKED BY: HP	DATE: JULY 2010

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201
(tel) 503-222-7200
(fax) 503-222-4292
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BRADFORD ISLAND
CASCADE LOCKS, OREGON

RIVER OPERABLE UNIT
ECOLOGICAL CONCEPTUAL EXPOSURE MODEL

DRAWING NUMBER: FIGURE 12-19
GIS FILE NUMBER: FIG 12-19
SHEET:
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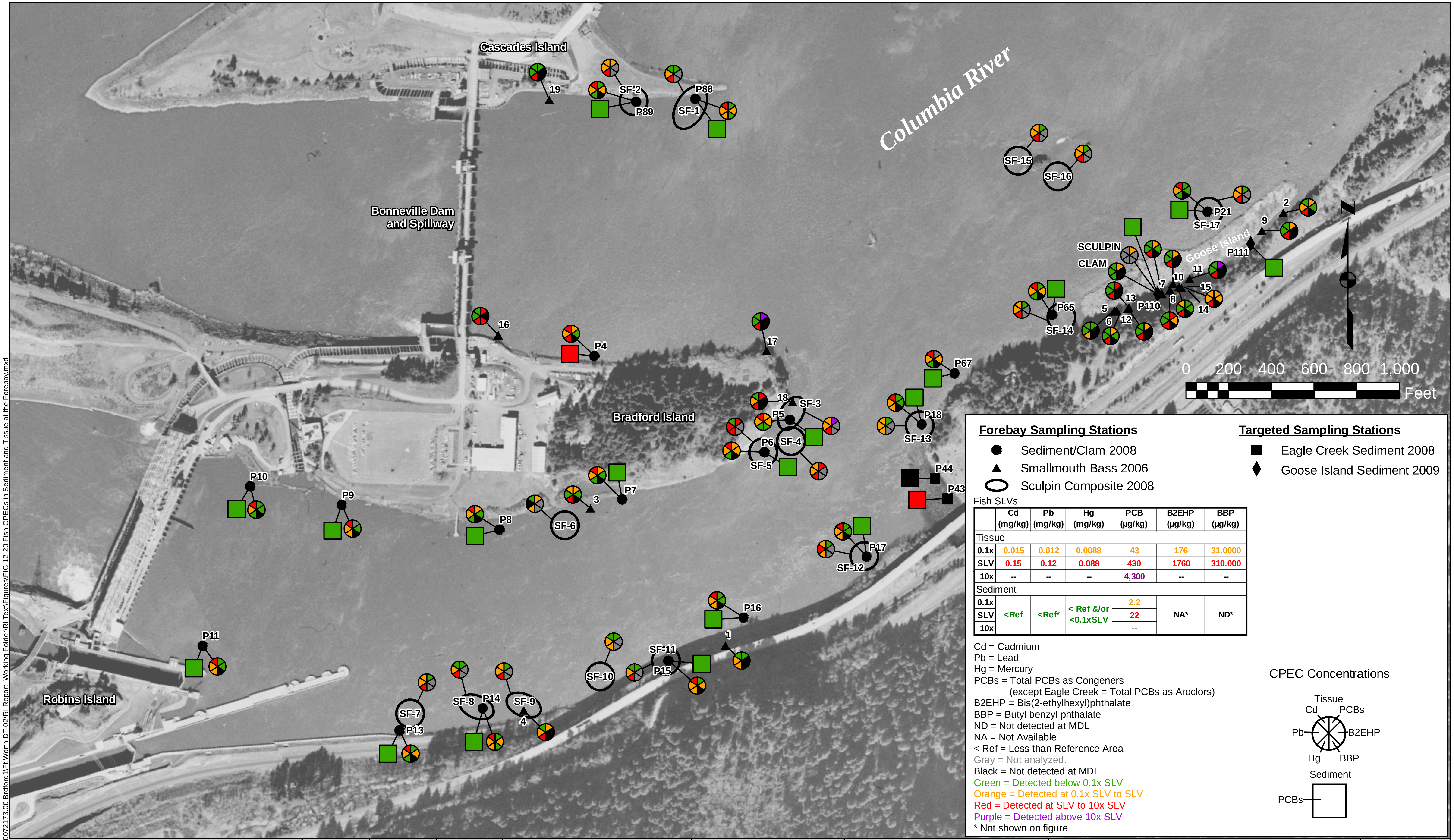

Forebay Sampling Stations

- ● Sediment/Clam 2008
- ▲ Smallmouth Bass 2006
- ○ Sculpin Composite 2008

Targeted Sampling Stations

- ■ Eagle Creek Sediment 2008
- ◆ Goose Island Sediment 2009

Fish SLVs

	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	PCB (µg/kg)	B2EHP (µg/kg)	BBP (µg/kg)
Tissue						
0.1x	0.015	0.012	0.0088	43	176	31.0000
SLV	0.15	0.12	0.088	430	1760	310.000
10x	--	--	--	4,300	--	--
Sediment						
0.1x	<Ref	<Ref*	< Ref &/or <0.1xSLV	2.2	NA*	ND*
SLV				22		
10x				--		

Cd = Cadmium
Pb = Lead
Hg = Mercury
PCBs = Total PCBs as Congeners
(except Eagle Creek = Total PCBs as Aroclors)
B2EHP = Bis(2-ethylhexyl)phthalate
BBP = Butyl benzyl phthalate
ND = Not detected at MDL
NA = Not Available
< Ref = Less than Reference Area
Gray = Not analyzed.
Black = Not detected at MDL
Green = Detected below 0.1x SLV
Orange = Detected at 0.1x SLV to SLV
Red = Detected at SLV to 10x SLV
Purple = Detected above 10x SLV
* Not shown on figure

JOB No. 25696528	DESIGNED: LSM	PROJ. ENGINEER: LSM		
	DRAWN BY: SB	APPROVED BY: MP		
	CHECKED BY: SB	DATE: MAY 2012		

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111 S.W. Columbia, Suite 1500
Portland, Oregon 97201
(tel) 503-222-7200
(fax) 503-222-4292
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BRADFORD ISLAND

CASCADE LOCKS, OREGON

RIVER OPERABLE UNIT

FISH CPECs IN SEDIMENT AND TISSUE

DRAWING NUMBER:
FIGURE 12-20

GIS FILE NUMBER:
Fig 12-20

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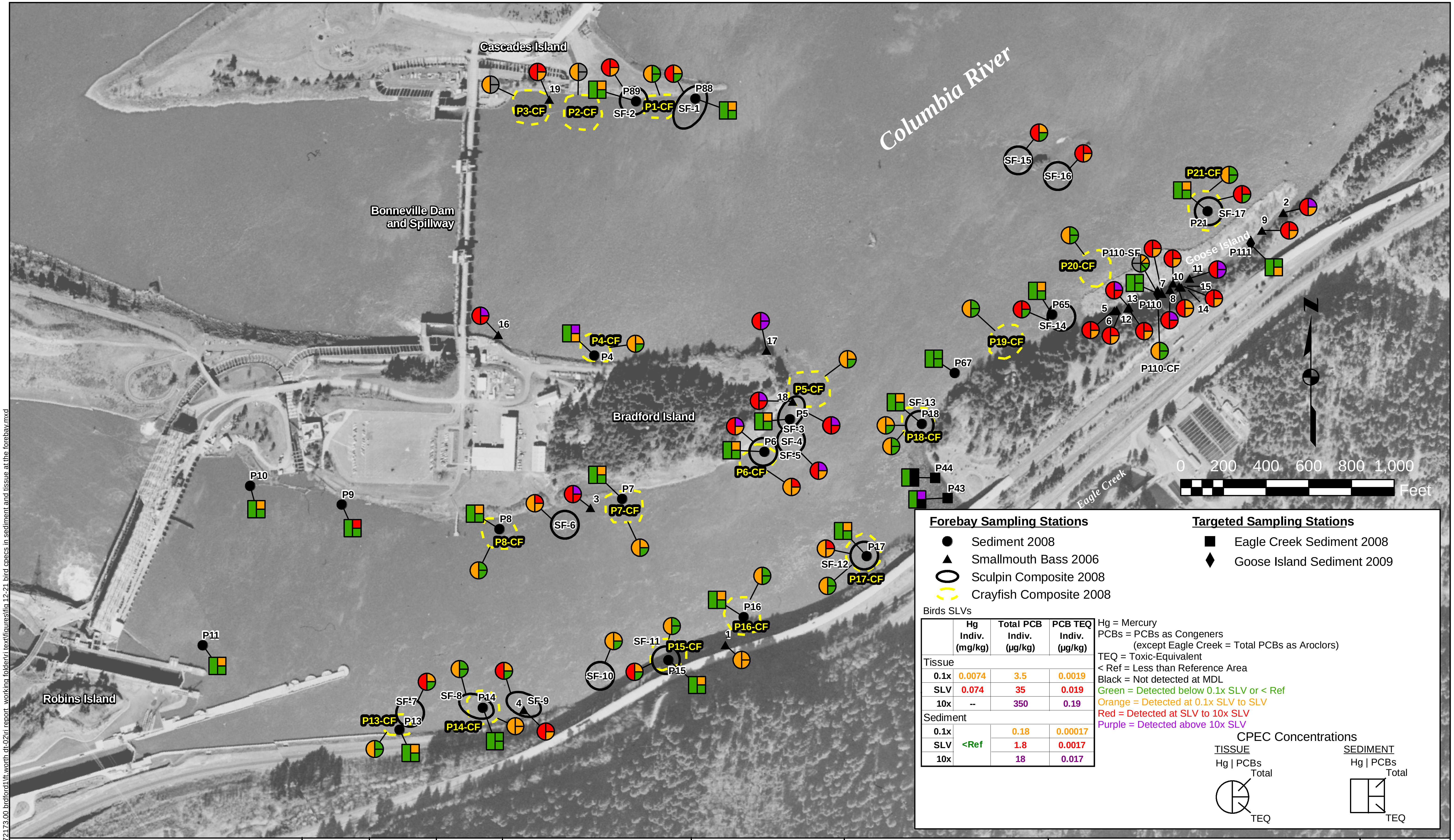
O:\25692709 USACE\53-F0072173.00 Bradford\1Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\FIG 12-20 Fish CPECs in Sediment and Tissue at the Forebay.mxd



Forebay Sampling Stations

- ● Sediment 2008
- ▲ Smallmouth Bass 2006
- ⬭ Sculpin Composite 2008
- ◌ Crayfish Composite 2008

Targeted Sampling Stations

- ■ Eagle Creek Sediment 2008
- ◆ Goose Island Sediment 2009

Birds SLVs

	Hg Indiv. (mg/kg)	Total PCB Indiv. (µg/kg)	PCB TEQ Indiv. (µg/kg)
Tissue			
0.1x	0.0074	3.5	0.0019
SLV	0.074	35	0.019
10x	--	350	0.19
Sediment			
0.1x	<Ref	0.18	0.00017
SLV		1.8	0.0017
10x		18	0.017

Hg = Mercury
PCBs = PCBs as Congeners
(except Eagle Creek = Total PCBs as Aroclors)
TEQ = Toxic-Equivalent
< Ref = Less than Reference Area
Black = Not detected at MDL
Green = Detected below 0.1x SLV or < Ref
Orange = Detected at 0.1x SLV to SLV
Red = Detected at SLV to 10x SLV
Purple = Detected above 10x SLV

CPEC Concentrations

TISSUE
Hg | PCBs
Total
TEQ

SEDIMENT
Hg | PCBs
Total
TEQ

JOB No. 25696528	DESIGNED: LSM	PROJ. ENGINEER: LSM	URS	BRADFORD ISLAND	RIVER OPERABLE UNIT
	DRAWN BY: SB	APPROVED BY: MP	111 S.W. Columbia, Suite 1500 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	CASCADE LOCKS, OREGON	BIRD CPECs IN SEDIMENT AND TISSUE
	CHECKED BY: SB	DATE: APRIL 2012			

DRAWING NUMBER:
FIGURE 12-21
GIS FILE NUMBER:
Fig 12-21
SHEET:
REV.

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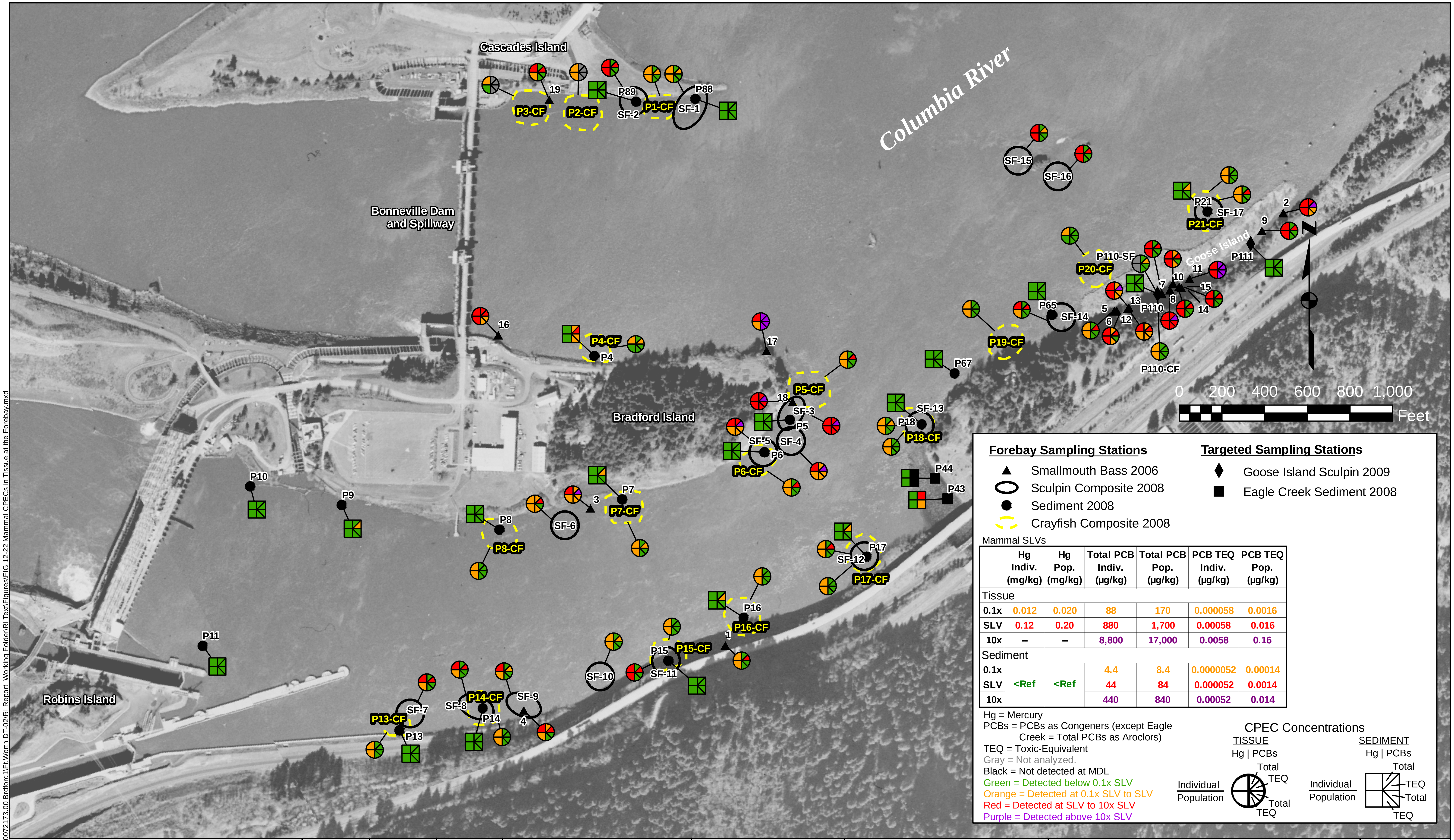

Forebay Sampling Stations

- ▲ Smallmouth Bass 2006
- ⬭ Sculpin Composite 2008
- ● Sediment 2008
- ◌ Crayfish Composite 2008

Targeted Sampling Stations

- ◆ Goose Island Sculpin 2009
- ■ Eagle Creek Sediment 2008

Mammal SLVs

	Hg Indiv. (mg/kg)	Hg Pop. (mg/kg)	Total PCB Indiv. (µg/kg)	Total PCB Pop. (µg/kg)	PCB TEQ Indiv. (µg/kg)	PCB TEQ Pop. (µg/kg)
Tissue						
0.1x	0.012	0.020	88	170	0.000058	0.0016
SLV	0.12	0.20	880	1,700	0.00058	0.016
10x	--	--	8,800	17,000	0.0058	0.16
Sediment						
0.1x			4.4	8.4	0.0000052	0.00014
SLV	<Ref	<Ref	44	84	0.000052	0.0014
10x			440	840	0.00052	0.014

Hg = Mercury
PCBs = PCBs as Congeners (except Eagle Creek = Total PCBs as Aroclors)
TEQ = Toxic-Equivalent
Gray = Not analyzed.
Black = Not detected at MDL
Green = Detected below 0.1x SLV
Orange = Detected at 0.1x SLV to SLV
Red = Detected at SLV to 10x SLV
Purple = Detected above 10x SLV

CPEC Concentrations

TISSUE
Hg | PCBs
Individual
Population
Total
TEQ
Total
TEQ

SEDIMENT
Hg | PCBs
Individual
Population
Total
TEQ
Total
TEQ

JOB No. 25696528	DESIGNED: LSM	PROJ. ENGINEER: LSM	URS	BRADFORD ISLAND	RIVER OPERABLE UNIT	DRAWING NUMBER: FIGURE 12-22	
	DRAWN BY: SB	APPROVED BY: MP	111 S.W. Columbia, Suite 1500 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292 www.urscorp.com	CASCADE LOCKS, OREGON	MAMMAL CPECs IN TISSUE	GIS FILE NUMBER: Fig 12-22	
	CHECKED BY: SB	DATE: APRIL 2012				SHEET:	REV.

TABLES

Table 3-1
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Plants					
Golden indian-paintbrush *(Castilleja levisecta)*	LT	LE	1-ex	G1, SH	Very unlikely, no suitable habitat, not seen in Oregon for 40 years, not observed.
Howellia (*Howellia aquatilus*)	LT	LT	1	G3, S1	Very unlikely, no suitable habitat, not observed.
Howell's daisy *(Erigeron howellii)*	SoC	C	1	G2, S2	Very unlikely, known from higher elevations in the Gorge, potentially suitable habitat on Bradford Island in forested areas, not project site, not observed.
Oregon daisy *(Erigeron oreganus)*	SoC	C	1	G3, S3	Very unlikely, last seen in early 1900s in Bonneville Dam area, unlikely to occur, not observed.
Tall bugbane *(Cimicifuga elata)*		C	1	G3, S3	Very unlikely, not observed, no suitable habitat.
Barrett's penstemon *(Penstemon barrettiae)*	SoC	C	1	G2, S2	Very unlikely, not observed in potentially suitable habitat, and would be identifiable if it had been present.
Howell's bentgrass *(Agrostis howellii)*	SoC	C	1	G2, S2	Very unlikely, not observed, should have been identifiable if present.
Cold-water corydalis *(Corydalis aquae-gelidae)*	SoC	C	1	G5T3, S3	Very unlikely, not observed, no habitat present.
Liverwort *(Scapania gymnostomophila)*			2	G4, S1	Very unlikely, not observed, potentially suitable habitat present on side of island north of project area.
Strickland's tauschia *(Tauschia stricklandii)*			2	G4, S1	Very unlikely, no suitable habitat, not observed.
Long-bearded hawkweed *(Hieracium longiberbe)*			4	G4G5, S3	Very unlikely, not observed, potential cliff habitat not within project area.
Sicklepod rockcress *(Arabis sparsiflora* var. *atrorubens)*			2	G5T3, S2	Very unlikely, not observed, probably no suitable habitat present.
Columbia lewisia (Lewisia columbiana var. columbiana)			2	G4T4, S2	Very unlikely, not observed, rocky slope habitat present outside of project area.
Oregon bolandra (Bolandra oregana)		SC	4	G3, S3	Very unlikely, not observed, no wet cliff/talus habitat present on Bradford Island.
Invertebrates					
Pristine springsnail (Pristinicola hempilli)			3	G3, S2	Very unlikely, no suitable habitat (springs) present in project area.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Fish					
Sockeye salmon *(Oncorhynchus nerka)* Salmon River tributary to Snake River, Idaho ESU	LE		1-ex	G5T1Q, SXB, S1M	Any surviving fish of this extremely rare species would pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migration. No spawning or rearing.
Chum salmon *(Oncorhynchus keta)* Lower Columbia River ESU	LT	SC	1	G5T2Q, S2	Unlikely, current range restricted to below Bonneville Dam. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Lower Columbia ESU	LT	SC	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Snake River Basin ESU	LT	SV	1	G5T2T3Q, S2S3	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Middle Columbia ESU	LT	SV	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Snake River ESU	LT	LT	1	G5T1Q, S1	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Lower Columbia ESU	LT	SC	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Coastal cutthroat trout *(Oncorhynchus clarki clarki)*	SoC	SC	1	G4T3Q, S2	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Coho salmon *(Oncorhynchus kisutch)* Lower Columbia ESU	LT	LE	1	G4T2Q, S2	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Pacific lamprey *(Lampropelta tridentata)*	SoC	SV	4	G5, S3	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Bull Trout *(Salvelinus confluentus)*	LT				Adults and juveniles pass thorugh Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Amphibians					
Larch mountain salamander *(Plethodon larselli)*	SoC	SV	2	G3, S2	Very unlikely, suitable small-sized talus slope habitat not present.
Oregon spotted frog *(Rana pretiosa)*	C	SC	1	G2, S2	Very unlikely, no suitable warm, shallow marsh habitat present.
Reptiles					
Western painted turtle *(Chrysemys picta)*		SC	2	G5, S2	Very unlikely, observed in ponds near Cascade Locks, no suitable habitat in project area.
Birds					
Northern spotted owl *(Strix occidentalis caurina)*	LT	LT	1	G3T3, S3	Very unlikely to occur, only as transients passing through, area too small and disturbed to provide habitat.
Bald eagle *(Haliaeetus leucocephalus)*		LT	4	G5,S4B, S4N	Summer breeding and wintering resident of the vicinity.
Mammals					
Columbia white-tailed deer *(Odocoileus virginianus lecurus)*	PS:LE	SV	1	G5T2Q, S2	Very unlikely, no suitable habitat, current range below RM 50.
Northern (Stellar) Sea Lion *(Eumetopias jubatus)*	LT	SV	2	G3, S2	Sea lions have been observed foraging in the Bonneville pool, but they are not known to occur in the Bonneville forebay (above the dam).

State and Federal Status Definitions

LE – Listed Endangered. Taxa listed by the U.S. Fish and Wildlife Service or National Marine Fisheries Service as Endangered under the Endangered Species Act, or by the Oregon Departments of Agriculture (ODA) and Fish and Wildlife (ODFW) under the Oregon Endangered Species Act of 1987. Endangered taxa are those that are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

LT – Listed Threatened. Taxa listed by the above agencies as Threatened; defined as those taxa likely to become endangered within the foreseeable future.

PS – Partial Status. Taxa listed by the above agencies in part of its range.

C – Candidate. Candidate taxa for which National Marine Fisheries Service or U.S. Fish and Wildlife Service have sufficient information to support a proposal to list under the Endangered Species Act, or which is a candidate for listing by the ODA under the Oregon Endangered Species Act.

SoC – Species of Concern. Former Category 2 candidates for which additional information is needed to propose as threatened or endangered under the Endangered Species Act; these species are under review for consideration as Candidates for listing under the Endangered Species Act.

SC – **State Critical**. Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation activities are not taken. Also considered critical are some peripheral species that are at risk throughout their range, and some disjunct populations.

SV – State Vulnerable. Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.

Oregon Natural Heritage Program (ONHP) Definitions

List 1 - taxa that are threatened with extinction or presumed to be extinct (-ex) throughout their entire range.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

List 2 – taxa threatened with extirpation or presumed extirpated from Oregon; often peripheral or disjunct species that are of concern considering species diversity within Oregon; can be very significant in protecting the genetic diversity of the taxon; ONHP regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.

List 3 – taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

List 4 – taxa that are of conservation concern but not currently threatened or endangered, including taxa that are very rare but considered secure as well as those declining in numbers or habitat but still too common to be proposed as threatened or endangered; these taxa require continued monitoring.

The Nature Conservancy's (TNC) Natural Heritage Network Ranks

The Natural Heritage Network ranks are part of a national system of ranking species throughout the world and is used throughout the U.S., Canada, and 13 Latin American countries. Both global and state ranks are provided in ONHP (2007), abbreviated as "G" and "S", respectively.

1 – Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.

2 – Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.

3 – Rare, uncommon, or threatened, but not immediately imperiled, typically with 21-100 occurrences.

4 – Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences.

5 – Demonstrably widespread, abundant, and secure.

B – Breeding. Conservation status refers to the breeding population of the species in the nation or state/province.

H – Possibly extirpated or extinct. Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty.

M – Migrant. Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

N – Nonbreeding. Conservation status refers to the non-breeding population of the species in the nation or state/province.

T – Infraspecific Taxon (trinomial). The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. A vertebrate animal population, (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

Q – Questionable taxonomy that may reduce conservation priority. Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

X – Presumed extirpated or extinct.

Table 3-2
State and Federally Listed Anadromous Salmonid Species

Evolutionarily Significant Unit (ESU)	State Status	Federal Status	Life History Type	Federal Register (FR) Citation
Chinook Salmon (*Oncorhynchus tshawytscha*)				
Snake River	Threatened	Threatened	Ocean	57 FR 14653; April 22, 1992
Lower Columbia River		Threatened	Stream	64 FR 14308; March 24, 1999
Upper Columbia River		Endangered	Stream	64 FR 14308; March 24, 1999
Upper Willamette River		Threatened	Ocean	64 FR 14308; March 24, 1999
Chum Salmon (*Oncorhynchus keta*)				
Columbia River		Threatened	Ocean	64 FR 14508; March 25, 1999
Sockeye Salmon (*Oncorhynchus nerka*)				
Snake River		Endangered	Stream	56 FR 58619; November 20, 1991
Steelhead Trout (*Oncorhynchus mykiss*)				
Snake River Basin		Threatened	Stream	62 FR 43937; August 18, 1997
Lower Columbia River		Threatened	Stream	63 FR 13347; March 19, 1998
Middle Columbia River		Threatened	Stream	64 FR 14517; March 25, 1999
Upper Columbia River		Endangered	Stream	62 FR 43937; August 18, 1997
Upper Willamette River		Threatened	Stream	64 FR 14517; March 25, 1999
Coho Salmon *(Oncorhynchus kisutch)*				
Lower Columbia River	Endangered	Threatened	Stream	60 FR 38011; July 25, 1995

Table 3-3
Designated Beneficial Uses – Mainstem Columbia River

Beneficial Uses	Columbia River Mouth to RM 86	Columbia River RM 86 to 309
Public Domestic Water Supply[1]	X	X
Private Domestic Water Supply[1]	X	X
Industrial Water Supply	X	X
Irrigation	X	X
Livestock Watering	X	X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	X

Source: OAR 340-41-0101, November 2003

[1] With adequate pretreatment and natural quality that meets drinking water standards.

[2] See also Table 3-3 for fish use designations for this river.

Table 3-4
Beneficial Use Designations – Fish Uses, Mainstem Columbia River

Geographic Extent of Use	Salmon and Steelhead Migration Corridors (20°C)	Salmon and Steelhead Spawning through Fry Emergence	Shad and Sturgeon Spawning and Rearing
Mainstem Columbia River			
Beacon Rock to Upstream of Ives Island (RM 141.5 to RM 143.5)		October 15 – March 31	
Columbia River, mouth to Washington border (RM309)	X		
Columbia River (RM 147 to RM 203)			X

Source: OAR 340-41-0101, November 2003
RM = River mile

Table 5-1a
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
(Page 1 of 2)

Site ID	BIL01SSI	BIL02SSI	BIL03SSI	BIL04SSI	BIL05SSI	BIL06SSI*	BIL09SSI	BIL10SSI	BIL11SSI	BIL12SSI	BIL13SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL01SS	990920BIL02SS	990920BIL03SS	990920BIL04SS	990920BIL05SS	990920BIL06SS	990920BIL09SS	990920BIL10SS	990921BIL11SS	990921BIL12SS	000413BIL13SS		
Sample Date	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/21/1999	9/21/1999	4/13/2000		
Sample Depth (Feet bgs)	0.0-0.33	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
PCB Aroclors (µg/kg dry)													
Aroclor 1016	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1221	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1232	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1242	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1248	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1254	35.0 UJ	34.0 UJ	35.0 UJ	34.0 UJ	36.0 UJ	35.0 UJ	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Aroclor 1260	**58.0 J**	**420 J**	**48.0 J**	**660 J**	**160 J**	**81.5 J**	35.0 UJ	35.0 UJ	37.0 UJ	35.0 UJ	50.0 UJ	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**128 J**	**488 J**	**118 J**	**728 J**	**232 J**	**152 J**	105 UJ	105 UJ	111 UJ	105 UJ	150 UJ	371	Eco
Metals (mg/kg dry)													
Antimony	**2.80**	2.70 U	2.80 U	2.70 U	**4.20**	**3.90**	2.80 U	2.60 U	2.90 U	2.70 U	-	0.270	Eco
Arsenic	**3.60**	**1.50**	**4.90**	**3.20**	**30.1**	**3.70**	**3.00**	**3.10**	**11.3**	**2.80**	**1.98**	5.40	UPL
Barium	**83.4**	**71.1**	**77.9**	**58.9**	**204**	**111**	**119**	**108**	**108**	**115**	**243**	330	Eco
Beryllium	**0.300**	0.270 U	0.280 U	0.270 U	**0.460**	**0.350**	**0.400**	**0.440**	**0.540**	**0.370**	**0.576**	21.0	Eco
Cadmium	0.270 U	0.270 U	**0.500**	**0.440**	**1.30**	**1.75**	0.280 U	0.260 U	0.290 U	0.270 U	**0.343**	0.360	Eco
Chromium	**25.2**	**15.8**	**14.7**	**33.8**	**237**	**21.9**	**18.8**	**16.3**	**50.0**	**17.3**	**23.1**	28.1	UPL
Copper	**43.8**	**39.3**	**74.8**	**56.2**	**494**	**143**	**26.6**	**25.5**	**131**	**23.5**	**58.7 J**	56.7	UPL
Iron	**26,700**	**22,900**	**16,500**	**14,100**	**37,000**	**21,600**	**20,700**	**22,200**	**31,400**	**19,700**	**45,900**	36,900	UPL
Lead	**74.5**	**153**	**362**	**699**	**486**	**168**	**40.5**	**19.3**	**36.5**	**22.8**	**5.34**	25.5	UPL
Manganese	**372**	**270**	**244**	**196**	**714**	**333**	**312**	**327**	**720**	**300**	**415**	885	UPL
Mercury	0.110 U	0.110 U	**1.40**	**0.120**	**0.840**	**4.15**	**0.120**	0.110 U	0.110 U	0.100 U	**0.106**	0.0660	UPL
Nickel	**40.0**	**18.0**	**13.4**	**15.4**	**170**	**19.2**	**14.9**	**14.9**	**42.4**	**13.6**	**20.3 J**	38.0	Eco
Selenium	0.260 U	0.270 U	0.270 U	0.270 U	1.40 U	0.280 U	0.550 U	0.520 U	1.50 U	0.510 U	**0.848 J**	0.520	Eco
Silver	0.540 U	0.530 U	0.560 U	0.530 U	**1.50**	0.510 U	0.560 U	0.510 U	0.570 U	0.540 U	0.262 U	4.20	Eco
Thallium	0.260 U	0.270 U	0.270 U	0.270 U	0.280 U	0.270 U	0.280 U	0.260 U	0.290 U	0.250 U	**0.378**	1.00	Eco
Zinc	**88.7**	**98.0**	**150**	**134**	**635**	**138**	**85.1**	**69.6**	**163**	**69.0**	**41.6**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)													
Diesel Range Organics	**31.0**	**110**	**80.0**	**590**	**300**	**1,000**	**32.0**	**23.0**	**31.0**	**17.0**	25.0 U	23,000	HH
Residual Range Organics	**210**	**1,400**	**380**	**3,000**	**1,700**	**9,450**	**130**	**100**	**150**	**100**	100 U	40,000	HH
Gasoline Range Organics	-	-	-	5.10 U	5.40 U	5.30 U	5.30 U	5.30 U	-	-	20.0 U	13,000	HH
Herbicides (µg/kg dry)													
2,4,5-T	**93.0**	3.10 U	**63.0**	8.70 U	3.30 U	3.20 U	6.70 U	9.00 U	3.30 U	11.0 U	50.0 U	21.0	Eco
2,4,5-TP (Silvex)	4.00 U	2.90 U	5.00 U	3.60 U	2.50 U	4.50 U	10.0 U	5.50 U	9.60 U	13.0 U	50.0 U	21.0	Eco
2,4-D	21.0 U	21.0 U	21.0 U	20.0 U	22.0 U	21.0 U	21.0 U	21.0 U	30.0 U	30.0 U	50.0 U	21.0	Eco
2,4-DB	10.0 U	10.0 U	5.00 U	10.0 U	11.0 U	10.0 U	34.0 U	11.0 U	11.0 U	10.0 U	50.0 U	21.0	Eco
Dalapon	42.0 U	41.0 U	42.0 U	41.0 U	43.0 U	42.0 U	42.0 U	42.0 U	44.0 U	42.0 U	50.0 U	18,000,000	HH
Dicamba	2.10 U	2.10 U	2.10 U	4.80 U	5.70 U	2.10 U	12.0 U	2.10 U	2.20 U	2.10 U	50.0 U	18,000,000	HH
Dichloroprop	**170**	87.0 U	260 U	**180**	180 U	75.0 U	400 U	240 U	340 U	310 U	50.0 U	21.0	Eco
Dinoseb	13.0 U	10.0 U	15.0 U	10.0 U	16.0 U	10.0 U	15.0 U	16.0 U	11.0 U	10.0 U	50.0 U	620,000	HH
MCPA	1,000 U	1,400 U	16,000 U	1,000 U	1,100 U	1,900 U	1,100 U	1,100 U	1,100 U	2,500 U	25,000 U	21.0	Eco
MCPP	4,800 U	**14,000**	1,100 U	13,000 U	1,100 U	**9,500**	28,000 U	38,000 U	28,000 U	32,000 U	25,000 U	21.0	Eco

Table 5-1a
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
(Page 2 of 2)

Site ID	BIL01SSI	BIL02SSI	BIL03SSI	BIL04SSI	BIL05SSI	BIL06SSI*	BIL09SSI	BIL10SSI	BIL11SSI	BIL12SSI	BIL13SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL01SS	990920BIL02SS	990920BIL03SS	990920BIL04SS	990920BIL05SS	990920BIL06SS	990920BIL09SS	990920BIL10SS	990921BIL11SS	990921BIL12SS	000413BIL13SS		
Sample Date	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/21/1999	9/21/1999	4/13/2000		
Sample Depth (Feet bgs)	0.0-0.33	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
Pesticides (µg/kg dry)													
4,4'-DDD	3.50 U	3.40 U	6.10 U	3.40 U	5.10 U	7.40 U	18.0 U	13.0 U	3.70 U	25.0 U	1.00 U	21.0	Eco
4,4'-DDE	3.50 U	9.40 U	3.50 U	**17.0**	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	1.00 U	21.0	Eco
4,4'-DDT	3.50 U	3.40 U	4.80 U	3.40 U	13.0 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	1.00 U	21.0	Eco
Aldrin	1.80 U	1.70 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.00 U	4.90	Eco
BHC (alpha)	1.80 U	1.70 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	0.500 U	340	HH
BHC (beta)	1.80 U	1.70 U	1.80 U	2.10 U	1.80 U	1.80 U	1.80 U	1.80 U	**2.60**	1.80 U	0.900 U	960	HH
BHC (delta)	1.80 U	1.70 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	0.600 U	340	HH
BHC (gamma) Lindane	1.80 U	1.70 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.00 U	2,000	HH
Chlordane (alpha)	1.80 U	1.70 U	2.10 U	19.0 U	**4.00**	4.10 U	8.80 U	3.50 U	1.80 U	8.00 U	0.800 U	7,200	HH
Chlordane (gamma)	1.80 U	11.0 U	1.80 U	13.0 U	2.40 U	1.80 U	2.60 U	1.80 U	1.80 U	2.70 U	0.700 U	7,200	HH
Dieldrin	3.50 U	3.40 U	3.50 U	3.40 U	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	2.00 U	4.90	Eco
Endosulfan I	1.80 U	3.50 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.00 U	20,000	Eco
Endosulfan II	3.50 U	4.90 U	3.50 U	3.60 U	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	2.00 U	20,000	Eco
Endosulfan Sulfate	3.50 U	3.40 U	3.50 U	3.40 U	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	1.00 U	20,000	Eco
Endrin	3.50 U	3.40 U	3.50 U	3.40 U	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	2.00 U	4.90	Eco
Endrin Aldehyde	3.50 U	13.0 U	3.50 U	3.40 U	3.60 U	4.00 U	3.50 U	3.50 U	3.70 U	3.50 U	2.00 U	4.90	Eco
Endrin Ketone	3.50 U	3.40 U	3.50 U	3.40 U	3.60 U	3.50 U	3.50 U	3.50 U	3.70 U	3.50 U	-	4.90	Eco
Heptachlor	1.80 U	1.70 U	1.80 U	1.70 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.00 U	480	HH
Heptachlor Epoxide	1.80 U	3.20 U	1.80 U	7.10 U	2.00 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.00 U	240	HH
Methoxychlor	18.0 U	17.0 U	18.0 U	17.0 U	18.0 U	18.0 U	18.0 U	18.0 U	18.0 U	18.0 U	4.00 U	500,000	Eco
Toxaphene	35.0 U	34.0 U	35.0 U	34.0 U	36.0 U	35.0 U	35.0 U	35.0 U	37.0 U	35.0 U	50.0 U	2,000	HH

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1248, 1254, and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Landfill AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1b
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
Volatile Organic Compounds
(Page 1 of 2)

Site ID	BIL01SSI	BIL02SSI	BIL03SSI	BIL04SSI	BIL05SSI	BIL06SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL01SS	990920BIL02SS	990920BIL03SS	990920BIL04SS	990920BIL05SS	990920BIL06SS		
Sample Date	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999		
Sample Depth (Feet bgs)	0.0-0.33	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
Volatile Organic Compounds (µg/kg dry)							--	--
1,1,1,2-Tetrachloroethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	9,300	HH
1,1,1-Trichloroethane (TCA)	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	38,000,000	HH
1,1,2,2-Tetrachloroethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,800	HH
1,1,2-Trichloroethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,700	HH
1,1-Dichloroethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	5,900	HH
1,1-Dichloroethene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	680,000	HH
1,1-Dichloropropene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	8,100	HH
1,2,3-Trichlorobenzene	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	20,000	Eco
1,2,3-Trichloropropane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	95.0	HH
1,2,4-Trichlorobenzene	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	20,000	Eco
1,2,4-Trimethylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	200,000	Eco
1,2-Dibromo-3-chloropropane	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	69.0	HH
1,2-Dibromoethane (EDB)	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	140	HH
1,2-Dichlorobenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
1,2-Dichloroethane (EDC)	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	590	HH
1,2-Dichloropropane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	4,500	HH
1,3,5-Trimethylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	150,000	HH
1,3-Dichlorobenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
1,3-Dichloropropane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	20,000,000	HH
1,4-Dichlorobenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	17,000	HH
2,2-Dichloropropane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	4,500	HH
2-Butanone (MEK)	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	200,000,000	HH
2-Chlorotoluene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	20,000,000	HH
2-Hexanone	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	1,250,000	Eco
4-Chlorotoluene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	72,000,000	HH
4-Isopropyltoluene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	200,000	Eco
4-Methyl-2-pentanone (MIBK)	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	1,250,000	Eco
Acetone	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	1,250,000	Eco
Benzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	1,200	HH
Bromobenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	1,800,000	HH
Bromochloromethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	1,900	HH
Bromodichloromethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	1,900	HH
Bromoform	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	360,000	HH
Bromomethane	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	17,000	HH
Carbon Disulfide	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	1,000,000	Eco
Carbon Tetrachloride	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	630	HH
Chlorobenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	40,000	Eco
Chloroethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	61,000,000	HH
Chloroform	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	410	HH
Chloromethane	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	300,000	HH
cis-1,2-Dichloroethene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,500,000	Eco
cis-1,3-Dichloropropene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	8,100	HH
Dibromochloromethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	34,000	HH
Dibromomethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	110,000	HH
Dichlorodifluoromethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	730,000	Eco
Dichloromethane (Methylene Chloride)	10.0 U	10.0 U	11.0 U	**12.0**	11.0 U	10.0 U	20,000	HH
Ethylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
Hexachlorobutadiene	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	22,000	HH
Isopropylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
m,p-Xylenes	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	120,000	Eco
Naphthalene	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	23,000	HH
n-Butylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	-	-
n-Propylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
o-Xylene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	1,000	Eco
sec-Butylbenzene	5.30 U	5.20 U	5.30 U	5.10 U	5.40 U	5.30 U	2,260	Eco
Styrene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	300,000	Eco
tert-Butylbenzene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,260	Eco
Tetrachloroethene (PCE)	2.10 U	2.10 U	**15.0**	**23.0**	**65.0**	2.10 U	1,600	HH
Toluene	2.10 U	2.10 U	2.10 U	2.00 U	**5.30**	2.10 U	200,000	Eco
trans-1,2-Dichloroethene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	200,000	HH
trans-1,3-Dichloropropene	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	8,100	HH
Trichloroethene (TCE)	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	130	HH
Trichlorofluoromethane	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	730,000	Eco
Vinyl Acetate	10.0 U	10.0 U	11.0 U	10.0 U	11.0 U	10.0 U	4,100,000	HH
Vinyl Chloride	2.10 U	2.10 U	2.10 U	2.00 U	2.20 U	2.10 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1b
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
Volatile Organic Compounds
(Page 2 of 2)

Site ID	BIL09SSI	BIL10SSI	BIL11SSI	BIL12SSI	BIL13SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL09SS	990920BIL10SS	990921BIL11SS	990921BIL12SS	000413BIL13SS		
Sample Date	9/20/1999	9/20/1999	9/21/1999	9/21/1999	4/13/2000		
Sample Depth (Feet bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
Volatile Organic Compounds (µg/kg dry)						--	--
1,1,1,2-Tetrachloroethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	9,300	HH
1,1,1-Trichloroethane (TCA)	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	38,000,000	HH
1,1,2,2-Tetrachloroethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,800	HH
1,1,2-Trichloroethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,700	HH
1,1-Dichloroethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	5,900	HH
1,1-Dichloroethene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	680,000	HH
1,1-Dichloropropene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	8,100	HH
1,2,3-Trichlorobenzene	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	20,000	Eco
1,2,3-Trichloropropane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	95.0	HH
1,2,4-Trichlorobenzene	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	20,000	Eco
1,2,4-Trimethylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	200,000	Eco
1,2-Dibromo-3-chloropropane	5.30 U	5.30 U	5.60 U	5.30 U	500 UJ	69.0	HH
1,2-Dibromoethane (EDB)	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	140	HH
1,2-Dichlorobenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
1,2-Dichloroethane (EDC)	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	590	HH
1,2-Dichloropropane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	4,500	HH
1,3,5-Trimethylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	150,000	HH
1,3-Dichlorobenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
1,3-Dichloropropane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	20,000,000	HH
1,4-Dichlorobenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	17,000	HH
2,2-Dichloropropane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	4,500	HH
2-Butanone (MEK)	11.0 U	11.0 U	11.0 U	10.0 U	1,000 UJ	200,000,000	HH
2-Chlorotoluene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	20,000,000	HH
2-Hexanone	11.0 U	11.0 U	11.0 U	10.0 U	1,000 UJ	1,250,000	Eco
4-Chlorotoluene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	72,000,000	HH
4-Isopropyltoluene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	200,000	Eco
4-Methyl-2-pentanone (MIBK)	11.0 U	11.0 U	11.0 U	10.0 U	1,000 UJ	1,250,000	Eco
Acetone	11.0 U	11.0 U	11.0 U	10.0 U	1,000 UJ	1,250,000	Eco
Benzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,200	HH
Bromobenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,800,000	HH
Bromochloromethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,900	HH
Bromodichloromethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,900	HH
Bromoform	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	360,000	HH
Bromomethane	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	17,000	HH
Carbon Disulfide	11.0 U	11.0 U	11.0 U	10.0 U	100 UJ	1,000,000	Eco
Carbon Tetrachloride	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	630	HH
Chlorobenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	40,000	Eco
Chloroethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	61,000,000	HH
Chloroform	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	410	HH
Chloromethane	5.30 U	5.30 U	5.60 U	5.30 U	500 UJ	300,000	HH
cis-1,2-Dichloroethene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,500,000	Eco
cis-1,3-Dichloropropene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	8,100	HH
Dibromochloromethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	34,000	HH
Dibromomethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	110,000	HH
Dichlorodifluoromethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	730,000	Eco
Dichloromethane (Methylene Chloride)	11.0 U	11.0 U	11.0 U	10.0 U	1,000 UJ	20,000	HH
Ethylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
Hexachlorobutadiene	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	22,000	HH
Isopropylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
m,p-Xylenes	2.10 U	2.10 U	2.20 U	2.10 U	200 UJ	120,000	Eco
Naphthalene	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	23,000	HH
n-Butylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	-	-
n-Propylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
o-Xylene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,000	Eco
sec-Butylbenzene	5.30 U	5.30 U	5.60 U	5.30 U	100 UJ	2,260	Eco
Styrene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	300,000	Eco
tert-Butylbenzene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,260	Eco
Tetrachloroethene (PCE)	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	1,600	HH
Toluene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	200,000	Eco
trans-1,2-Dichloroethene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	200,000	HH
trans-1,3-Dichloropropene	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	8,100	HH
Trichloroethene (TCE)	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	130	HH
Trichlorofluoromethane	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	730,000	Eco
Vinyl Acetate	11.0 U	11.0 U	11.0 U	10.0 U	-	4,100,000	HH
Vinyl Chloride	2.10 U	2.10 U	2.20 U	2.10 U	100 UJ	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1c
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
Semivolatile Organic Compounds
(Page 1 of 2)

Site ID	BIL01SSI	BIL02SSI	BIL03SSI	BIL04SSI	BIL05SSI	BIL06SSI*	BIL09SSI	BIL10SSI	BIL11SSI	BIL12SSI	BIL13SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL01SS	990920BIL02SS	990920BIL03SS	990920BIL04SS	990920BIL05SS	990920BIL06SS	990920BIL09SS	990920BIL10SS	990921BIL11SS	990921BIL12SS	000413BIL13SS		
Sample Date	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/21/1999	9/21/1999	4/13/2000		
Sample Depth (Feet bgs)	0.0-0.33	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
Semivolatile Organic Compounds (µg/kg dry)													
1,2,4-Trichlorobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	20,000	Eco
1,2-Dichlorobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	2,260	Eco
1,3-Dichlorobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	2,260	Eco
1,4-Dichlorobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	17,000	HH
2,4,5-Trichlorophenol	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	49.8 U	4,000	Eco
2,4,6-Trichlorophenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	10,000	Eco
2,4-Dichlorophenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	20,000	Eco
2,4-Dimethylphenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	99.7 U	20,000	Eco
2,4-Dinitrophenol	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 UJ	20,000	Eco
2,4-Dinitrotoluene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	249 UJ	5,500	HH
2,6-Dinitrotoluene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	249 U	240,000	HH
2-Chloronaphthalene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	82,000,000	HH
2-Chlorophenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	60,000	Eco
2-Methylphenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	50,000	Eco
2-Nitroaniline	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 U	6,000,000	HH
2-Nitrophenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 UJ	180,000,000	HH
3,3'-Dichlorobenzidine	350 U	340 U	350 U	680 U	350 U	350 U	350 U	350 U	370 U	350 U	2,490 UJ	4,800	HH
3-Nitroaniline	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 U	70,000	Eco
4,6-Dinitro-2-methylphenol	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 UJ	49,000	HH
4-Bromophenyl Phenyl Ether	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	-	-
4-Chloro-3-methylphenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	62,000,000	HH
4-Chloroaniline	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	249 UJ	8,600	HH
4-Chlorophenyl Phenyl Ether	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	-	-
4-Nitroaniline	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 U	40,000	Eco
4-Nitrophenol	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	930 U	880 U	249 U	7,000	Eco
Aniline	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	200,000	Eco
Benzidine	1,800 U	1,700 U	1,800 U	1,700 U	1,800 U	1,800 U	1,800 U	1,800 U	1,800 U	1,800 U	-	55,000	HH
Benzoic Acid	880 U	860 U	880 U	**34.0 J**	900 U	**32.0 J**	**20.0 J**	880 U	930 U	880 U	**300**	200,000	Eco
Benzyl Alcohol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	2,260	Eco
Bis(2-chloroethoxy)methane	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	730,000	Eco
Bis(2-chloroethyl) Ether	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	1,000	HH
Bis(2-chloroisopropyl) Ether	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	1,000	HH
Bis(2-ethylhexyl) Phthalate	**150 J**	**430**	**330**	**21,000**	**5,100**	**825 J**	**180**	**770**	**760**	**1,900**	50.0 U	4,500	Eco
Butyl Benzyl Phthalate	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	**22.0 J**	180 U	49.8 U	450	Eco
Carbazole	180 U	170 U	**56.0 J**	**1,300**	**220**	**144 J**	180 U	180 U	**27.0 J**	180 U	49.8 UJ	2,260	Eco
Dibenzofuran	180 U	170 U	180 U	**380**	**76.0 J**	**140 J**	180 U	180 U	**20.0 J**	180 U	49.8 U	2.00	Eco
Diethyl Phthalate	180 U	170 U	180 U	**50.0 J**	**44.0 J**	180 U	180 U	180 U	190 U	180 U	49.8 U	100,000	Eco
Dimethyl Phthalate	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	150,000	HH
Di-n-butyl Phthalate	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	450	Eco
Di-n-octyl Phthalate	180 U	170 U	180 U	170 U	730 U	180 U	180 U	180 U	190 U	180 U	49.8 U	450	Eco
Hexachlorobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	1,800	HH
Hexachlorobutadiene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	22,000	HH
Hexachlorocyclopentadiene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	249 UJ	10,000	Eco
Hexachloroethane	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	150,000	HH
Isophorone	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	1,800,000	HH
Nitrobenzene	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	8,000	Eco
N-Nitrosodimethylamine	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	-	34.0	HH
N-Nitrosodi-n-propylamine	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	250	HH
N-Nitrosodiphenylamine	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	20,000	Eco
p-cresol (4-Methylphenol)	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	50,000	Eco
Pentachlorophenol	880 U	860 U	880 U	860 U	900 U	880 U	880 U	880 U	**72.0 J**	880 U	249 U	2,100	Eco
Phenol	180 U	170 U	180 U	170 U	180 U	180 U	180 U	180 U	190 U	180 U	49.8 U	30,000	Eco

Table 5-1c
1999/2000 Landfill Supplemental Site Inspection Soil Analytical Results
Semivolatile Organic Compounds
(Page 2 of 2)

Site ID	BIL01SSI	BIL02SSI	BIL03SSI	BIL04SSI	BIL05SSI	BIL06SSI*	BIL09SSI	BIL10SSI	BIL11SSI	BIL12SSI	BIL13SSI*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	990920BIL01SS	990920BIL02SS	990920BIL03SS	990920BIL04SS	990920BIL05SS	990920BIL06SS	990920BIL09SS	990920BIL10SS	990921BIL11SS	990921BIL12SS	000413BIL13SS		
Sample Date	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/20/1999	9/21/1999	9/21/1999	4/13/2000		
Sample Depth (Feet bgs)	0.0-0.33	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5		
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)													
2-Methylnaphthalene	180 U	170 U	180 U	**57.0 J**	180 U	**76.0 J**	180 U	180 U	190 U	180 U	49.8 U	4,100,000	HH
Acenaphthene	180 U	**42.0 J**	**53.0 J**	**2,600 J**	**500**	**171 J**	180 U	180 U	**140 J**	180 U	49.8 U	19,000,000	HH
Acenaphthylene	180 U	170 U	180 U	**74.0 J**	180 U	**22.0 J**	180 U	180 U	190 U	180 U	49.8 U	23,000	HH
Anthracene	**12.0 J**	**18.0 J**	**110 J**	**2,700**	**460**	**177 J**	180 U	180 U	**100 J**	180 U	49.8 U	93,000,000	HH
Fluorene	180 U	170 U	**47.0 J**	**1,200**	**170 J**	**145 J**	180 U	180 U	**67.0 J**	180 U	49.8 U	12,000,000	HH
Naphthalene	180 U	170 U	180 U	**100 J**	**19.0 J**	**360**	180 U	180 U	190 U	180 U	49.8 U	23,000	HH
Phenanthrene	**39.0 J**	**68.0 J**	**300**	**12,000**	**1,900**	**1,230**	**40.0 J**	**36.0 J**	**370**	**13.0 J**	49.8 U	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**153 J**	**256 J**	**650 J**	**18,674 J**	**3,143 J**	**2,105 J**	**940 J**	**936 J**	**881 J**	**913 J**	299 U	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)													
Benzo(a)anthracene	**98.0 J**	**130 J**	**1,600**	**32,000**	**2,200**	**1,400 J**	**82.0 J**	**60.0 J**	**400**	**29.0 J**	49.8 U	2,700	HH
Benzo(a)pyrene	**140 J**	**160 J**	**1,800**	**33,000**	**2,200**	**1,400 J**	**100 J**	**70.0 J**	**420**	**28.0 J**	49.8 U	270	HH
Benzo(b)fluoranthene	**110 J**	**170 J**	**2,000**	**65,000**	**340 J**	**2,350**	**82.0 J**	**58.0 J**	**66.0 J**	**34.0 J**	49.8 U	2,700	HH
Benzo(g,h,i)perylene	**71.0 J**	**150 J**	**790**	**18,000**	**1,800**	**1,250 J**	**82.0 J**	**51.0 J**	**290**	**20.0 J**	49.8 U	27,000	HH
Benzo(k)fluoranthene	**110 J**	**100 J**	**1,000**	**65,000**	**340 J**	**2,350**	**89.0 J**	**64.0 J**	**66.0 J**	**40.0 J**	49.8 U	27,000	HH
Chrysene	**120 J**	**160 J**	**1,600**	**32,000**	**1,700**	**1,650 J**	**100 J**	**79.0 J**	**420**	**62.0 J**	49.8 U	270,000	HH
Dibenz(a,h)anthracene	**37.0 J**	170 U	**450**	**9,900**	**540 J**	1,800 U	**32.0 J**	**24.0 J**	**150 J**	**18.0 J**	49.8 U	270	HH
Fluoranthene	**130 J**	**160 J**	**1,600**	**54,000**	**3,300**	**795**	**120 J**	**88.0 J**	**700**	**42.0 J**	49.8 U	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**73.0 J**	**130 J**	**820**	**19,000**	**1,700**	**1,175 J**	**74.0 J**	**48.0 J**	**300**	**18.0 J**	49.8 U	2,700	HH
Pyrene	**160 J**	**210**	**1,400**	**40,000**	**3,200**	**2,500 J**	**130 J**	**98.0 J**	**640**	**43.0 J**	49.8 UJ	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**1,049 J**	**1,511 J**	**13,060**	**367,900**	**17,320 J**	**16,150 J**	**891 J**	**640 J**	**3,452 J**	**334 J**	498 UJ	1,100	Eco

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped

Table 5-1d
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
(Page 1 of 4)

Site ID	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990713BIL08GW	991108BIL14GW	000110BIL20GW	990712BIL07GW	991108BIL12GW	000110BIL15GW				
Sample Date	7/13/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000				
Sample Depth (Feet btc)	27.5	27.5	27.5	29.56	29.56	29.56				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater				
Total PCB Aroclors (µg/L)										
Aroclor 1016	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.0140	Eco
Aroclor 1221	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.00680	HH
Aroclor 1232	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.00680	HH
Aroclor 1242	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.0140	Eco
Aroclor 1248	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.0140	Eco
Aroclor 1254	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.0140	Eco
Aroclor 1260	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.0000640	HH	0.0140	Eco
Total Metals (µg/L)										
Antimony	-	50.0 U	50.0 U	-	50.0 U	50.0 U	5.60	HH	15.0	HH
Arsenic	-	**15.4**	**16.2**	-	**6.00**	**7.00**	0.0180	HH	0.0380	HH
Barium	-	**33.5**	**33.1**	-	**45.7**	**42.6**	1,000	HH	7,300	HH
Beryllium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	--	--	73.0	HH
Cadmium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	--	--	18.0	HH
Chromium	-	10.0 U	10.0 U	-	10.0 U	10.0 U	--	--	55,000	HH
Copper	-	10.0 U	10.0 U	-	10.0 U	10.0 U	1,300	HH	1,500	HH
Iron	-	**73.7**	**66.0**	-	**508**	**238**	300	HH	26,000	HH
Lead	-	3.00 U	3.00 U	-	3.00 U	3.00 U	--	--	15.0	HH
Manganese	-	**25.5**	**14.0**	-	**39.3**	**14.6**	50.0	HH	880	HH
Mercury	-	0.200 U	**0.330**	-	0.200 U	0.200 U	--	--	11.0	HH
Nickel	-	10.0 U	10.0 U	-	10.0 U	10.0 U	610	HH	730	HH
Selenium	-	**32.9**	**28.6**	-	5.00 U	5.00 U	170	HH	180	HH
Silver	-	10.0 U	10.0 U	-	10.0 U	10.0 U	--	--	180	HH
Thallium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	0.240	HH	2.00	HH
Zinc	-	**16.8**	**19.5**	-	10.0 U	10.0 U	7,400	HH	11,000	HH
Dissolved Metals (µg/L)										
Antimony	-	-	-	50.0 U	-	-	5.60	HH	15.0	HH
Arsenic	-	-	-	**6.80**	-	-	0.0180	HH	0.0380	HH
Barium	-	-	-	**37.5**	-	-	4.00	Eco	4.00	Eco
Beryllium	-	-	-	5.00 U	-	-	5.30	Eco	5.30	Eco
Cadmium	-	-	-	5.00 U	-	-	0.250	Eco	0.250	Eco
Chromium	-	-	-	10.0 U	-	-	74.0	Eco	74.0	Eco
Copper	-	-	-	10.0 U	-	-	9.00	Eco	9.00	Eco
Iron	-	-	-	**188**	-	-	300	HH	1,000	Eco
Lead	-	-	-	3.00 U	-	-	2.50	Eco	2.50	Eco
Manganese	-	-	-	**14.2**	-	-	50.0	HH	120	Eco
Mercury	-	-	-	0.200 U	-	-	0.770	Eco	0.770	Eco
Nickel	-	-	-	10.0 U	-	-	52.0	Eco	52.0	Eco
Selenium	-	-	-	5.00 U	-	-	5.00	Eco	5.00	Eco
Silver	-	-	-	10.0 U	-	-	0.120	Eco	0.120	Eco
Thallium	-	-	-	5.00 U	-	-	0.240	HH	2.00	HH
Zinc	-	-	-	10.0 U	-	-	120	Eco	120	Eco

Table 5-1d
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
(Page 2 of 4)

Site ID	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990713BIL08GW	991108BIL14GW	000110BIL20GW	990712BIL07GW	991108BIL12GW	000110BIL15GW				
Sample Date	7/13/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000				
Sample Depth (Feet btc)	27.5	27.5	27.5	29.56	29.56	29.56				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater				
Total Petroleum Hydrocarbons (µg/L)										
Diesel Range Organics	240 U	**340**	**280**	240 U	240 U	250 U	--	--	90.0	HH
Residual Range Organics	710 U	**840**	750 U	710 U	710 U	750 U	--	--	290	HH
Gasoline Range Organics	100 U	100 U	100 U	100 U	100 U	100 U	--	--	100	HH
Total Herbicides (µg/L)										
2,4,5-T	-	0.100 U	0.150 U	0.150 U	0.100 U	0.150 U	36.0	Eco	36.0	Eco
2,4,5-TP (Silvex)	-	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	--	--	290	HH
2,4-D	-	0.250 U	1.00 U	1.00 U	0.250 U	1.00 U	4.00	Eco	4.00	Eco
2,4-DB	-	0.500 U	0.500 U	1.00 U	0.500 U	0.500 U	--	--	290	HH
Dalapon	-	0.500 U	2.00 U	2.00 U	0.500 U	2.00 U	--	--	1,100	HH
Dicamba	-	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	10.0	Eco	10.0	Eco
Dichloroprop	-	0.250 U	0.250 U	1.00 U	0.250 U	0.250 U	4.00	Eco	4.00	Eco
Dinoseb	-	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.0500	Eco	0.0500	Eco
MCPA	-	10.0 U	50.0 U	50.0 U	10.0 U	50.0 U	2.60	Eco	2.60	Eco
MCPP	-	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	--	--	37.0	HH
Total Pesticides (µg/L)										
4,4'-DDD	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.000310	HH	0.00100	Eco
4,4'-DDE	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.000220	HH	0.00100	Eco
4,4'-DDT	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.000220	HH	0.00100	Eco
Aldrin	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0000490	HH	0.00330	HH
BHC (alpha)	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.00260	HH	0.00900	HH
BHC (beta)	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.00910	HH	0.0370	HH
BHC (delta)	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.00260	HH	0.00900	HH
BHC (gamma) Lindane	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0800	Eco	0.0520	HH
Chlordane (alpha)	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.000800	HH	0.00430	Eco
Chlordane (gamma)	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.000800	HH	0.00430	Eco
Dieldrin	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0000520	HH	0.00350	HH
Endosulfan I	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0560	Eco	0.0560	Eco
Endosulfan II	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0560	Eco	0.0560	Eco
Endosulfan Sulfate	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0510	Eco	0.0510	Eco
Endrin	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0360	Eco	0.0360	Eco
Endrin Aldehyde	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.150	Eco	0.150	Eco
Endrin Ketone	0.0960 U	0.0960 U	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0590	HH	11.0	HH
Heptachlor	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0000790	HH	0.00380	Eco
Heptachlor Epoxide	0.0480 U	0.0480 U	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0000390	HH	0.00380	Eco
Methoxychlor	0.480 U	0.480 U	0.500 U	0.470 U	0.480 UJ	0.500 U	0.0300	Eco	0.0300	Eco
Toxaphene	0.960 U	0.960 U	1.00 U	0.940 U	0.950 UJ	1.00 U	0.000280	HH	0.00200	Eco

Notes:

µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1d
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
(Page 3 of 4)

Site ID	MW-03	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990712BIL06GW	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	18.21	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Total PCB Aroclors (µg/L)													
Aroclor 1016	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.0140	Eco
Aroclor 1221	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.00680	HH
Aroclor 1232	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.00680	HH
Aroclor 1242	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.0140	Eco
Aroclor 1248	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.0140	Eco
Aroclor 1254	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.0140	Eco
Aroclor 1260	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 U	1.00 U	0.940 U	1.00 UJ	0.100 U	0.0000640	HH	0.0140	Eco
Total Metals (µg/L)													
Antimony	-	50.0 U	50.0 U	-	50.0 U	50.0 U	50.0 U	50.0 U	1.00 U	5.60	HH	15.0	HH
Arsenic	-	5.00 U	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	**1.04**	0.0180	HH	0.0380	HH
Barium	-	**15.7**	**10.8**	-	**290**	**238**	**164**	**126**	**74.2**	1,000	HH	7,300	HH
Beryllium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	--	--	73.0	HH
Cadmium	-	5.00 U	5.00 U	-	**5.60**	5.00 U	5.00 U	5.00 U	1.00 U	--	--	18.0	HH
Chromium	-	10.0 U	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	**1.05**	--	--	55,000	HH
Copper	-	10.0 U	10.0 U	-	**17.6**	**45.2**	10.0 U	10.0 U	**2.72**	1,300	HH	1,500	HH
Iron	-	**119**	**53.1**	-	**9,755**	**157**	**32,800**	**25,400**	**8,195**	300	HH	26,000	HH
Lead	-	3.00 U	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	--	--	15.0	HH
Manganese	-	**23.2**	10.0 U	-	**1,380**	**194**	**4,110**	**3,300**	**1,475**	50.0	HH	880	HH
Mercury	-	0.200 U	**0.200**	-	0.200 U	0.200 U	0.200 U	0.200 U	1.00 U	--	--	11.0	HH
Nickel	-	10.0 U	10.0 U	-	**110**	**112**	10.0 U	10.0 U	**2.32**	610	HH	730	HH
Selenium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	**1.11**	170	HH	180	HH
Silver	-	10.0 U	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	1.00 U	--	--	180	HH
Thallium	-	5.00 U	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	0.240	HH	2.00	HH
Zinc	-	10.0 U	10.0 U	-	**2,655**	**1,500**	**18.7**	**15.8**	10.0 U	7,400	HH	11,000	HH
Dissolved Metals (µg/L)													
Antimony	50.0 U	-	-	50.0 U	-	-	-	-	**2.28**	5.60	HH	15.0	HH
Arsenic	5.00 U	-	-	5.00 U	-	-	-	-	1.00 U	0.0180	HH	0.0380	HH
Barium	**21.2**	-	-	**134**	-	-	-	-	**277**	4.00	Eco	4.00	Eco
Beryllium	5.00 U	-	-	5.00 U	-	-	-	-	1.00 U	5.30	Eco	5.30	Eco
Cadmium	5.00 U	-	-	5.00 U	-	-	-	-	1.00 U	0.250	Eco	0.250	Eco
Chromium	10.0 U	-	-	10.0 U	-	-	-	-	1.00 U	74.0	Eco	74.0	Eco
Copper	10.0 U	-	-	10.0 U	-	-	-	-	**1.09**	9.00	Eco	9.00	Eco
Iron	50.0 U	-	-	**3,615**	-	-	-	-	**3,210**	300	HH	1,000	Eco
Lead	3.00 U	-	-	3.00 U	-	-	-	-	1.00 U	2.50	Eco	2.50	Eco
Manganese	**12.0**	-	-	**1,325**	-	-	-	-	**1,480 J**	50.0	HH	120	Eco
Mercury	0.200 U	-	-	0.200 U	-	-	-	-	1.00 U	0.770	Eco	0.770	Eco
Nickel	10.0 U	-	-	**18.7**	-	-	-	-	**2.22**	52.0	Eco	52.0	Eco
Selenium	5.00 U	-	-	5.00 U	-	-	-	-	1.00 U	5.00	Eco	5.00	Eco
Silver	10.0 U	-	-	10.0 U	-	-	-	-	1.00 U	0.120	Eco	0.120	Eco
Thallium	5.00 U	-	-	5.00 U	-	-	-	-	1.00 U	0.240	HH	2.00	HH
Zinc	10.0 U	-	-	**197**	-	-	-	-	**85.6**	120	Eco	120	Eco

Table 5-1d
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Herbicides, and Pesticides
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Site ID	MW-03	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990712BIL06GW	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	18.21	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Total Petroleum Hydrocarbons (µg/L)													
Diesel Range Organics	240 U	240 U	250 U	240 U	**295**	**305**	**1,800**	**1,100**	250 U	--	--	90.0	HH
Residual Range Organics	710 U	710 U	750 U	710 U	710 U	750 U	**1,900**	750 U	500 U	--	--	290	HH
Gasoline Range Organics	100 U	100 U	100 U	100 U	100 U	100 U	**300**	**430**	250 U	--	--	100	HH
Total Herbicides (µg/L)													
2,4,5-T	0.150 U	0.100 U	0.150 U	0.150 U	0.100 U	0.150 U	0.100 U	0.150 U	0.400 U	36.0	Eco	36.0	Eco
2,4,5-TP (Silvex)	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.400 U	--	--	290	HH
2,4-D	1.00 U	0.250 U	1.00 U	1.00 U	0.250 U	1.00 U	0.250 U	1.00 U	0.400 U	4.00	Eco	4.00	Eco
2,4-DB	1.00 U	0.500 U	0.500 U	1.00 U	0.500 U	0.500 U	0.500 U	0.500 U	0.400 U	--	--	290	HH
Dalapon	2.00 U	0.500 U	2.00 U	2.00 U	0.500 U	2.00 U	0.500 U	2.00 U	0.400 U	--	--	1,100	HH
Dicamba	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.400 U	10.0	Eco	10.0	Eco
Dichloroprop	1.00 U	0.250 U	0.250 U	1.00 U	0.250 U	0.250 U	**1.10**	0.250 U	0.400 U	4.00	Eco	4.00	Eco
Dinoseb	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.400 U	0.0500	Eco	0.0500	Eco
MCPA	50.0 U	10.0 U	50.0 U	50.0 U	10.0 U	50.0 U	10.0 U	50.0 U	100 U	2.60	Eco	2.60	Eco
MCPP	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	100 U	--	--	37.0	HH
Total Pesticides (µg/L)													
4,4'-DDD	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0400 U	0.000310	HH	0.00100	Eco
4,4'-DDE	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0300 U	0.000220	HH	0.00100	Eco
4,4'-DDT	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0900 U	0.000220	HH	0.00100	Eco
Aldrin	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0400 U	0.0000490	HH	0.00330	HH
BHC (alpha)	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0200 U	0.00260	HH	0.00900	HH
BHC (beta)	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.100 U	0.00910	HH	0.0370	HH
BHC (delta)	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0500 U	0.00260	HH	0.00900	HH
BHC (gamma) Lindane	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0300 U	0.0800	Eco	0.0520	HH
Chlordane (alpha)	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0500 U	0.000800	HH	0.00430	Eco
Chlordane (gamma)	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0200 U	0.000800	HH	0.00430	Eco
Dieldrin	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0700 U	0.0000520	HH	0.00350	HH
Endosulfan I	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0300 U	0.0560	Eco	0.0560	Eco
Endosulfan II	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0500 U	0.0560	Eco	0.0560	Eco
Endosulfan Sulfate	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0700 U	0.0510	Eco	0.0510	Eco
Endrin	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.0800 U	0.0360	Eco	0.0360	Eco
Endrin Aldehyde	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	0.100 U	0.150	Eco	0.150	Eco
Endrin Ketone	0.0940 U	0.0940 UJ	0.100 U	0.0940 U	0.0950 UJ	0.100 U	0.0940 U	0.100 UJ	-	0.0590	HH	11.0	HH
Heptachlor	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0300 U	0.0000790	HH	0.00380	Eco
Heptachlor Epoxide	0.0470 U	0.0470 UJ	0.0500 U	0.0470 U	0.0480 UJ	0.0500 U	0.0470 U	0.0500 UJ	0.0300 U	0.0000390	HH	0.00380	Eco
Methoxychlor	0.470 U	0.470 UJ	0.500 U	0.470 U	0.480 UJ	0.500 U	0.470 U	0.500 UJ	0.500 U	0.0300	Eco	0.0300	Eco
Toxaphene	0.940 U	0.940 UJ	1.00 U	0.940 U	0.950 UJ	1.00 U	0.940 U	1.00 UJ	1.50 U	0.000280	HH	0.00200	Eco

Notes:

µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1e
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
Volatile Organic Compounds
(Page 1 of 2)

Site ID	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990713BIL08GW	991108BIL14GW	000110BIL20GW	990712BIL07GW	991108BIL12GW	000110BIL15GW	990712BIL06GW	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	7/13/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	27.5	27.5	27.5	29.56	29.56	29.56	18.21	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Total Volatile Organic Compounds (µg/L)																			
1,1,1,2-Tetrachloroethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.590	HH	0.230	HH
1,1-Dichloroethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	47.0	Eco	2.30	HH
1,1-Dichloroethene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.430	HH
1,2,3-Trichlorobenzene	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.000720	HH
1,2,4-Trichlorobenzene	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	5.00 U	1.00 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**5.20**	**1.00**	1.00 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	5.00 U	--	--	0.000320	HH
1,2-Dibromoethane (EDB)	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.00630	HH
1,2-Dichlorobenzene	2.00 U	-	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.380	HH	0.140	HH
1,2-Dichloropropane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	2.00 U	-	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	2.00 U	-	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.500	HH	0.390	HH
2-Butanone (MEK)	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	14,000	Eco	7,100	HH
2-Chloroethylvinylethe	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	-	4,760	Eco	4,760	Eco
2-Chlorotoluene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	730	HH
2-Hexanone	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	99.0	Eco	47.0	HH
4-Chlorotoluene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	2,600	HH
4-Isopropyltoluene	2.00 U	-	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	--	--	--	--
4-Methyl-2-pentanone (MIBK	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	170	Eco	170	Eco
Acetone	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 UJ	1,500	Eco	1,500	Eco
Benzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.20	HH	0.390	HH
Bromobenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	88.0	HH
Bromochloromethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.550	HH	0.120	HH
Bromodichloromethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.550	HH	0.120	HH
Bromoform	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	4.30	HH	7.20	HH
Bromomethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1.00 U	0.920	Eco	0.920	Eco
Carbon Tetrachloride	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**1.40**	1.00 U	1.00 U	1.00 U	0.230	HH	0.190	HH
Chlorobenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50.0	Eco	50.0	Eco
Chloroethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	21,000	HH
Chloroform	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**3.65**	1.00 U	1.00 U	1.00 U	5.70	HH	0.190	HH
Chloromethane	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--	--	190	HH
cis-1,2-Dichloroethene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	590	Eco	360	HH
cis-1,3-Dichloropropene	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	2.00 U	-	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	0.400	HH	0.680	HH
Dibromomethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	8.20	HH
Dichlorodifluoromethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	390	HH
Dichloromethane (Methylene Chloride	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	4.60	HH	4.40	HH
Ethylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**1.00**	1.00 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.440	HH	0.860	HH
Isopropylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**4.60**	**3.20**	1.00 U	7.30	Eco	7.30	Eco
m,p-Xylenes	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.00 U	13.0	Eco	13.0	Eco
Naphthalene	5.00 U	-	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	620	Eco	0.140	HH
n-Butylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
n-Propylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**2.00**	**1.20**	1.00 U	7.30	Eco	7.30	Eco
o-Xylene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	350	Eco	350	Eco
sec-Butylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
Styrene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
Tetrachloroethene (PCE)	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	**5.10**	**2.60**	**2.40**	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.690	HH	0.0930	HH
Toluene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	140	HH	110	HH
trans-1,3-Dichloropropene	3.00 U	-	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.50	HH	0.0390	HH
Trichlorofluoromethane	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	1,300	HH
Vinyl Acetate	10.0 U	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	-	16.0	Eco	16.0	Eco
Vinyl Chloride	1.00 U	-	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
btc = below top of well casing	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1e
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
Volatile Organic Compounds
(Page 2 of 2)

Site ID	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Total Volatile Organic Compounds (µg/L)												
1,1,1,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.590	HH	0.230	HH
1,1-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	47.0	Eco	2.30	HH
1,1-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.430	HH
1,2,3-Trichlorobenzene	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.000720	HH
1,2,4-Trichlorobenzene	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**5.20**	**1.00**	1.00 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	5.00 U	--	--	0.000320	HH
1,2-Dibromoethane (EDB)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	0.00630	HH
1,2-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.380	HH	0.140	HH
1,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.500	HH	0.390	HH
2-Butanone (MEK)	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	14,000	Eco	7,100	HH
2-Chloroethylvinylether	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	-	4,760	Eco	4,760	Eco
2-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	730	HH
2-Hexanone	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	99.0	Eco	47.0	HH
4-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	2,600	HH
4-Isopropyltoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	--	--	--	--
4-Methyl-2-pentanone (MIBK)	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	170	Eco	170	Eco
Acetone	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 UJ	1,500	Eco	1,500	Eco
Benzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.20	HH	0.390	HH
Bromobenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	88.0	HH
Bromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.550	HH	0.120	HH
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.550	HH	0.120	HH
Bromoform	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	4.30	HH	7.20	HH
Bromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1.00 U	0.920	Eco	0.920	Eco
Carbon Tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	**1.40**	1.00 U	1.00 U	1.00 U	0.230	HH	0.190	HH
Chlorobenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50.0	Eco	50.0	Eco
Chloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	21,000	HH
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	**3.65**	1.00 U	1.00 U	1.00 U	5.70	HH	0.190	HH
Chloromethane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--	--	190	HH
cis-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	590	Eco	360	HH
cis-1,3-Dichloropropene	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1.00 U	0.400	HH	0.680	HH
Dibromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	8.20	HH
Dichlorodifluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	390	HH
Dichloromethane (Methylene Chloride)	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	4.60	HH	4.40	HH
Ethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**1.00**	1.00 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.440	HH	0.860	HH
Isopropylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**4.60**	**3.20**	1.00 U	7.30	Eco	7.30	Eco
m,p-Xylenes	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.00 U	13.0	Eco	13.0	Eco
Naphthalene	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 U	620	Eco	0.140	HH
n-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
n-Propylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**2.00**	**1.20**	1.00 U	7.30	Eco	7.30	Eco
o-Xylene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	350	Eco	350	Eco
sec-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
Styrene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	--	--
Tetrachloroethene (PCE)	**2.60**	**2.40**	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.690	HH	0.0930	HH
Toluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	140	HH	110	HH
trans-1,3-Dichloropropene	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1.00 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.50	HH	0.0390	HH
Trichlorofluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--	--	1,300	HH
Vinyl Acetate	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	-	16.0	Eco	16.0	Eco
Vinyl Chloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-1f
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
Semivolatile Organic Compounds
(Page 1 of 2)

Site ID	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990713BIL08GW	991108BIL14GW	000110BIL20GW	990712BIL07GW	991108BIL12GW	000110BIL15GW	990712BIL06GW	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	7/13/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	27.5	27.5	27.5	29.56	29.56	29.56	18.21	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Semivolatile Organic Compounds (µg/L)																			
1,2,4-Trichlorobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	35.0	HH	2.30	HH
1,2-Dichlorobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	14.0	Eco	14.0	Eco
1,3-Dichlorobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	71.0	Eco	0.420	HH
1,4-Dichlorobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	15.0	Eco	0.420	HH
2,4,5-Trichlorophenol	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	4.76 U	18.0	Eco	18.0	Eco
2,4,6-Trichlorophenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	1.40	HH	5.20	HH
2,4-Dichlorophenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	77.0	HH	110	HH
2,4-Dimethylphenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	42.0	Eco	42.0	Eco
2,4-Dinitrophenol	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	9.52 U	19.0	Eco	19.0	Eco
2,4-Dinitrotoluene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.110	HH	0.220	HH
2,6-Dinitrotoluene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	230	Eco	37.0	HH
2-Chloronaphthalene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	32.0	Eco	32.0	Eco
2-Chlorophenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	81.0	HH	180	HH
2-Methylphenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	**76.0**	10.0 U	4.76 U	13.0	Eco	13.0	Eco
2-Nitroaniline	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	4.76 UJ	--	--	370	HH
2-Nitrophenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	10,000	HH	11,000	HH
3,3'-Dichlorobenzidine	19.0 U	19.0 U	10.0 U	19.0 U	19.0 U	10.0 U	19.0 U	19.0 U	10.0 U	19.0 U	19.0 U	10.0 U	19.0 U	10.0 U	4.76 UJ	0.0210	HH	0.130	HH
3-Nitroaniline	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	4.76 UJ	--	--	3.40	HH
4,6-Dinitro-2-methylphenol	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	4.76 U	13.0	HH	2.90	HH
4-Bromophenyl Phenyl Ether	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	1.50	Eco	1.50	Eco
4-Chloro-3-methylphenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	--	--	3700	HH
4-Chloroaniline	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	50.0	Eco	0.340	HH
4-Chlorophenyl Phenyl Ether	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	--	--	--	--
4-Nitroaniline	48.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	47.0 U	25.0 U	47.0 U	48.0 U	25.0 U	47.0 U	25.0 U	4.76 UJ	--	--	3.40	HH
4-Nitrophenol	48.0 U	47.0 U	10.0 U	47.0 U	48.0 U	10.0 U	47.0 U	47.0 U	10.0 U	47.0 U	48.0 U	10.0 U	47.0 U	10.0 U	4.76 U	150	Eco	150	Eco
Aniline	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	2.20	Eco	2.20	Eco
Benzidine	96.0 U	94.0 U	10.0 U	94.0 U	96.0 U	10.0 U	94.0 U	94.0 U	10.0 U	94.0 U	96.0 U	100 U	94.0 U	100 U	4.76 UJ	0.0000860	HH	0.720	HH
Benzoic Acid	48.0 U	47.0 U	10.0 U	47.0 U	48.0 U	10.0 U	47.0 U	47.0 U	10.0 U	47.0 U	48.0 U	10.0 U	**11.0 J**	10.0 U	**5.89**	42.0	Eco	42.0	Eco
Benzyl Alcohol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	8.60	Eco	8.60	Eco
Bis(2-chloroethoxy)methane	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	--	--	110	HH
Bis(2-chloroethyl) Ether	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.0300	HH	0.0120	HH
Bis(2-chloroisopropyl) Ether	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	1,400	HH	--	--
Bis(2-ethylhexyl) Phthalate	9.60 U	48.0 U	**10.0**	9.40 U	19.0 U	**19.0**	9.40 U	9.40 U	10.0 U	9.40 U	**2.70 J**	10.0 U	9.40 U	10.0 U	23.8 UJ	1.20	HH	3.00	Eco
Butyl Benzyl Phthalate	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	19.0	Eco	19.0	Eco
Carbazole	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	--	--	--	--
Dibenzofuran	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	3.70	Eco	3.70	Eco
Diethyl Phthalate	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	210	Eco	210	Eco
Dimethyl Phthalate	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	3.00	Eco	3.00	Eco
Di-n-butyl Phthalate	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	35.0	Eco	35.0	Eco
Di-n-octyl Phthalate	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	1.20	HH	4.10	HH
Hexachlorobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.000280	HH	0.000300	Eco
Hexachlorobutadiene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.440	HH	0.860	HH
Hexachlorocyclopentadiene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	5.20	Eco	5.20	Eco
Hexachloroethane	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	1.40	HH	4.10	HH
Isophorone	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	35.0	HH	71.0	HH
Nitrobenzene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	17.0	HH	0.120	HH
N-Nitrosodimethylamine	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.000690	HH	0.000420	HH
N-Nitrosodi-n-propylamine	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00500	HH	0.00960	HH
N-Nitrosodiphenylamine	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	3.30	HH	14.0	HH
p-cresol (4-Methylphenol)	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	**29.0**	4.76 U	13.0	Eco	13.0	Eco
Pentachlorophenol	9.60 U	9.40 U	25.0 U	9.40 U	9.60 U	25.0 U	9.40 U	9.40 U	25.0 U	9.40 U	9.60 U	25.0 U	9.40 U	25.0 U	4.76 U	0.270	HH	0.470	HH
Phenol	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 U	110	Eco	110	Eco

Table 5-1f
1999/2000 Landfill Supplemental Site Inspection Groundwater Analytical Results
Semivolatile Organic Compounds
(Page 2 of 2)

Site ID	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-04*	MW-04*	MW-04*	MW-05	MW-05	SEEP*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	990713BIL08GW	991108BIL14GW	000110BIL20GW	990712BIL07GW	991108BIL12GW	000110BIL15GW	990712BIL06GW	991108BIL11GW	000110BIL18GW	990712BIL01GW	991108BIL09GW	000110BIL16GW	991108BIL13GW	000110BIL19GW	000413BIL21GW				
Sample Date	7/13/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	7/12/1999	11/8/1999	1/10/2000	11/8/1999	1/10/2000	4/13/2000				
Sample Depth (Feet btc)	27.5	27.5	27.5	29.56	29.56	29.56	18.21	18.21	18.21	20.29	20.29	20.29	24.87	24.87	0.0				
Medium	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Seep Water				
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)																			
2-Methylnaphthalene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	72.2	Eco	72.2	Eco
Acenaphthene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	520	Eco	520	Eco
Acenaphthylene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	307	Eco	0.140	HH
Anthracene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	13.0	Eco	13.0	Eco
Fluorene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	3.90	Eco	3.90	Eco
Naphthalene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	620	Eco	0.140	HH
Phenanthrene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)																			
Benzo(a)anthracene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	0.0270	Eco
Benzo(a)pyrene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	0.00290	HH
Benzo(b)fluoranthene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	0.0290	HH
Benzo(g,h,i)perylene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.380	HH	0.290	HH
Benzo(k)fluoranthene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	0.290	HH
Chrysene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	2.04	Eco
Dibenz(a,h)anthracene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.0180	HH	0.00290	HH
Fluoranthene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	6.16	Eco	6.16	Eco
Indeno(1,2,3-cd)pyrene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	0.00380	HH	0.0290	HH
Pyrene	9.60 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	9.40 U	10.0 U	9.40 U	9.60 U	10.0 U	9.40 U	10.0 U	4.76 UJ	10.1	Eco	10.1	Eco

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
btc = below top of well casing	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-2a
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 1 of 4)

Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL05	BIL06	BIL07	BIL08	BIL09	BIL10	BIL11*	**Selected SLV[1] (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV[1] (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL05SS	011016BIL06SS	011016BIL07SS	011016BIL08SS	011016BIL09SS	011016BIL10SS	011016BIL11SS				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001				
Sample Depth or Interval (Feet bgs)	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0	8.0	8.0	5.0	5.0	6.0	5.0	8.0				
PCB Aroclors (µg/kg dry)															
Aroclor 1016	1.49 U	1.30 U	1.35 U	1.25 U	1.23 U	1.18 U	1.17 U	1.18 U	1.27 U	1.14 U	1.32 U	371	Eco	21,000	HH
Aroclor 1221	6.39 U	5.55 U	5.78 U	5.34 U	5.28 U	5.07 U	5.02 U	5.06 U	5.43 U	4.88 U	5.66 U	371	Eco	540	HH
Aroclor 1232	5.10 U	4.43 U	4.61 U	4.26 U	4.21 U	4.04 U	4.00 U	4.04 U	4.33 U	3.90 U	4.51 U	371	Eco	540	HH
Aroclor 1242	2.73 U	2.37 U	2.47 U	2.28 U	2.25 U	2.16 U	2.14 U	2.16 U	2.32 U	2.08 U	2.41 U	371	Eco	740	HH
Aroclor 1248	**968**	5.89 U	**61.5**	5.66 U	5.60 U	5.38 U	5.32 U	5.37 U	5.76 U	5.18 U	6.00 U	371	Eco	740	HH
Aroclor 1254	2.12 U	1.84 U	1.91 U	1.77 U	1.75 U	**26.7**	1.66 U	1.68 U	1.80 U	1.62 U	**55.3**	371	Eco	740	HH
Aroclor 1260	**26.3**	**22.2**	**87.6**	**12.5**	**10.2 J**	**12.8**	**36.7**	1.68 U	**55.3**	1.62 U	**39.8**	371	Eco	740	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**996 J**	**29.9 J**	**151 J**	**19.9 J**	**17.6 J**	**44.9 J**	**43.7 J**	8.73 U	**62.9 J**	8.42 U	**101 J**	371	Eco	740	HH
Metals (mg/kg dry)															
Aluminum	-	-	-	-	**6,480**	**6,080**	**6,890**	**4,710**	**2,380**	**7,360**	**7,390**	31,400	UPL	990,000	HH
Antimony	-	-	-	-	**0.987**	**0.974**	**8.19**	**0.783**	**2.58**	**1.77**	**7.08**	0.270	Eco	410	HH
Arsenic	-	-	-	-	**4.88**	**4.24**	**3.74**	**3.27**	**1.72**	**7.98**	**7.13**	5.40	UPL	5.40	UPL
Barium	-	-	-	-	**87.4 J**	**116 J**	**110 J**	**99.6 J**	**45.3 J**	**68.4 J**	**154 J**	330	Eco	60,000	HH
Beryllium	-	-	-	-	**0.297 J**	**0.288 J**	**0.222 J**	**0.186 J**	0.182 U	**0.227 J**	**0.296 J**	21.0	Eco	610	HH
Cadmium	-	-	-	-	**1.23**	**1.51**	**2.93**	**1.33**	**1.46**	**0.762**	**2.11**	0.360	Eco	150	HH
Calcium	-	-	-	-	**5,410**	**5,420**	**4,960**	**3,170**	**1,760**	**5,320**	**4,835**	10,400	UPL	10,400	UPL
Chromium	-	-	-	-	**13.7**	**17.6**	**27.0**	**14.0**	**11.0**	**15.5**	**50.1**	28.1	UPL	190	HH
Cobalt	-	-	-	-	**10.1**	**8.81**	**9.81**	**8.85**	**3.99**	**12.4**	**13.3**	19.9	UPL	300	HH
Copper	-	-	-	-	**27.9 J**	**57.9 J**	**120 J**	**17.9 J**	**36.0 J**	**32.5 J**	**98.8 J**	56.7	UPL	12,000	HH
Iron	-	-	-	-	**21,900**	**22,900**	**20,600**	**16,500**	**10,300**	**21,400**	**19,600**	36,900	UPL	720,000	HH
Lead	-	-	-	-	**20.3 J**	**163 J**	**697 J**	**70.7 J**	**966 J**	**157 J**	**584 J**	25.5	UPL	800	HH
Magnesium	-	-	-	-	**5,310**	**4,630**	**4,550**	**3,360**	**1,190**	**6,850**	**4,035**	12,400	UPL	12,400	UPL
Manganese	-	-	-	-	**304 J**	**296 J**	**317 J**	**323 J**	**146 J**	**387 J**	**336 J**	885	UPL	7,200	HH
Mercury	-	-	-	-	**0.0763**	**0.479**	**0.215**	**0.0238**	**1.04**	**0.0520**	**0.271**	0.0660	UPL	93.0	HH
Nickel	-	-	-	-	**14.4 J**	**14.1 J**	**20.3 J**	**13.0 J**	**7.85 J**	**23.3 J**	**26.0 J**	38.0	Eco	6,100	HH
Potassium	-	-	-	-	**367 J**	**456**	**600**	**822**	**336 J**	**493**	**1,145**	2,050	UPL	2,050	UPL
Selenium	-	-	-	-	**0.106 J**	**0.273 J**	0.085 U	0.083 U	0.087 U	**0.300 J**	**0.178 J**	0.520	Eco	5,100	HH
Silver	-	-	-	-	**0.140 J**	**0.220 J**	**1.51**	**0.110 J**	**0.205 J**	**0.169 J**	**0.393 J**	4.20	Eco	1,500	HH
Sodium	-	-	-	-	161 U	156 U	159 U	155 U	163 U	158 U	172 U	341	UPL	341	UPL
Thallium	-	-	-	-	**0.148**	**0.118**	**0.0830 J**	**0.152**	**0.0835 J**	**0.116**	**0.209**	1.00	Eco	0.203	UPL
Vanadium	-	-	-	-	**40.2**	**37.9**	**46.2**	**38.0**	**15.9**	**42.7**	**48.2**	104	UPL	104	UPL
Zinc	-	-	-	-	**105 J**	**331 J**	**401 J**	**194 J**	**95.6 J**	**79.8 J**	**206 J**	71.7	UPL	310,000	HH
Total Petroleum Hydrocarbons (mg/kg dry)															
Diesel Range Organics	**92.7**	**154**	**126**	**273**	**449**	**1,280**	**6,780**	12.3 U	**7,650**	**22.9 J**	**9,735**	23,000	HH	23,000	HH
Residual Range Organics	**403**	**676**	**658**	**682**	**2,840**	**5,900**	**33,000**	25.5 U	**38,600**	**68.5**	**41,900**	40,000	HH	40,000	HH
Gasoline Range Organics	5.61 U	5.03 U	4.98 U	**586 J**	-	-	-	-	-	-	-	13,000	HH	13,000	HH

Table 5-2a
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 2 of 4)

Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL05	BIL06	BIL07	BIL08	BIL09	BIL10	BIL11*	**Selected SLV^1 (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV^1 (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL05SS	011016BIL06SS	011016BIL07SS	011016BIL08SS	011016BIL09SS	011016BIL10SS	011016BIL11SS				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001				
Sample Depth (Feet bgs)	5.0	5.0	5.0	5.0	8.0	8.0	5.0	5.0	6.0	5.0	8.0				
Sample Depth or Interval (Feet bgs)	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0	8.0	8.0	5.0	5.0	6.0	5.0	8.0				
Butyltins (µg/kg dry)															
Dibutyltin	0.899 U	0.730 U	0.788 U	**20.0**	0.711 U	0.716 U	-	0.653 U	6.44 U	0.657 U	7.62 U	28,000	Eco	180,000	HH
Monobutyltin	1.98 U	1.61 U	1.74 U	**38.0**	1.57 U	1.58 U	-	1.44 U	14.2 U	1.45 U	16.8 U	28,000	Eco	180,000	HH
Tetrabutyltin	0.694 U	0.564 U	0.609 U	0.579 U	0.549 U	0.553 U	-	0.505 U	4.98 U	0.507 U	5.89 U	28,000	Eco	180,000	HH
Tributyltin	1.43 U	**5.12**	1.25 U	**165**	1.13 U	1.14 U	-	1.04 U	10.3 U	1.05 U	12.1 U	28,000	Eco	180,000	HH
Herbicides (µg/kg dry)															
2,4,5-T	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	6,200,000	HH
2,4,5-TP (Silvex)	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	4,900,000	HH
2,4-D	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	2,400,000	HH
2,4-DB	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	4,900,000	HH
4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	7,000	Eco	180,000,000	HH
Dalapon	-	-	-	-	-	-	-	-	-	-	-	18,000,000	HH	18,000,000	HH
Dicamba	-	-	-	-	-	-	-	-	-	-	-	18,000,000	HH	18,000,000	HH
Dichloroprop	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	4,900,000	HH
Dinoseb	-	-	-	-	-	-	-	-	-	-	-	620,000	HH	620,000	HH
MCPA	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	120,000	HH
MCPP	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	620,000	HH
Pentachlorophenol	-	-	-	-	-	-	-	-	-	-	-	2,100	Eco	13,000	HH
Pesticides (µg/kg dry)															
4,4'-DDD	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	11,000	HH
4,4'-DDE	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	7,700	HH
4,4'-DDT	-	-	-	-	-	-	-	-	-	-	-	21.0	Eco	7,700	HH
Aldrin	-	-	-	-	-	-	-	-	-	-	-	4.90	Eco	130	HH
BHC (alpha)	-	-	-	-	-	-	-	-	-	-	-	340	HH	340	HH
BHC (beta)	-	-	-	-	-	-	-	-	-	-	-	960	HH	960	HH
BHC (delta)	-	-	-	-	-	-	-	-	-	-	-	340	HH	340	HH
BHC (gamma) Lindane	-	-	-	-	-	-	-	-	-	-	-	2,000	HH	2,000	HH
Chlordane (technical)	-	-	-	-	-	-	-	-	-	-	-	7,200	HH	7,200	HH
Dieldrin	-	-	-	-	-	-	-	-	-	-	-	4.90	Eco	130	HH
Endosulfan I	-	-	-	-	-	-	-	-	-	-	-	20,000	Eco	1,400,000	HH
Endosulfan II	-	-	-	-	-	-	-	-	-	-	-	20,000	Eco	1,400,000	HH
Endosulfan Sulfate	-	-	-	-	-	-	-	-	-	-	-	20,000	Eco	1,400,000	HH
Endrin	-	-	-	-	-	-	-	-	-	-	-	4.90	Eco	71,000	HH
Endrin Aldehyde	-	-	-	-	-	-	-	-	-	-	-	4.90	Eco	71,000	HH
Endrin Ketone	-	-	-	-	-	-	-	-	-	-	-	4.90	Eco	71,000	HH
Heptachlor	-	-	-	-	-	-	-	-	-	-	-	480	HH	480	HH
Heptachlor Epoxide	-	-	-	-	-	-	-	-	-	-	-	240	HH	240	HH
Methoxychlor	-	-	-	-	-	-	-	-	-	-	-	500,000	Eco	3,100,000	HH
Toxaphene	-	-	-	-	-	-	-	-	-	-	-	2,000	HH	2,000	HH

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

[1] Only Aroclors 1248, 1254, and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Landfill AOPC soil samples.
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.
[1] = Screening based on depth of sample with the exception of Gully Test pit samples (Site ID suffix = "TPG") and Mercury Vapor Lamp Test Pit samples (Site ID suffix = "TPM"), which used the minimum SLV for the two depth ranges.

Table 5-2a
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 3 of 4)

Site ID	BIL13	BIL14	BIL15	BIL16	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV^1 (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV^1 (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Sample Depth or Interval (Feet bgs)	4.0	6.0	8.0	4.0	1.0	2.0	5.0	8.0	5.0	3.0	0.0-10.0	0.0-10.0				
PCB Aroclors (µg/kg dry)																
Aroclor 1016	1.23 U	1.20 U	1.21 U	1.16 U	1.36 U	1.16 U	1.16 U	1.31 U	1.10 U	1.14 U	1.39 U	1.29 U	371	Eco	21,000	HH
Aroclor 1221	5.27 U	5.13 U	5.16 U	4.97 U	5.83 U	4.96 U	4.98 U	5.62 U	4.72 U	4.89 U	5.96 U	5.53 U	371	Eco	540	HH
Aroclor 1232	4.21 U	4.10 U	4.12 U	3.97 U	4.65 U	3.96 U	3.97 U	4.49 U	3.77 U	3.90 U	4.76 U	4.42 U	371	Eco	540	HH
Aroclor 1242	2.25 U	2.19 U	2.20 U	2.12 U	2.49 U	2.12 U	2.12 U	2.40 U	2.01 U	2.09 U	2.54 U	2.36 U	371	Eco	740	HH
Aroclor 1248	5.60 U	5.45 U	5.48 U	5.27 U	6.19 U	5.27 U	5.28 U	5.97 U	5.01 U	5.19 U	6.33 U	5.87 U	371	Eco	740	HH
Aroclor 1254	**499**	1.70 U	1.71 U	1.65 U	**78.6**	**48.4**	**54.9**	1.86 U	**37.2**	**104**	1.98 U	**23.4**	371	Eco	740	HH
Aroclor 1260	**158**	**15.0**	**52.4**	**445**	**68.0**	**39.0**	**74.6**	**2.05 J**	**41.8**	**91.3**	**46.5**	**13.1**	371	Eco	740	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**663 J**	**22.2 J**	**59.6 J**	**452 J**	**153 J**	**92.7 J**	**135 J**	**9.88 J**	**84.0 J**	**200 J**	**54.8 J**	**54.8 J**	371	Eco	740	HH
Metals (mg/kg dry)																
Aluminum	**11,300**	**13,200**	**11,000**	**13,200**	**7,560**	**6,000**	**4,720**	**23,100**	**5,090**	**9,840**	-	-	31,400	UPL	990,000	HH
Antimony	**3.90**	**0.984**	**0.621**	**1.45**	**0.309 J**	**0.810**	**0.699**	**0.526 J**	**0.556 J**	**2.63 J**	-	-	0.270	Eco	410	HH
Arsenic	**5.18**	**2.58**	**1.82**	**4.24**	**2.98**	**4.07**	**2.21**	**2.55**	**1.60**	**5.95**	-	-	5.40	UPL	5.40	UPL
Barium	**113 J**	**77.8 J**	**85.4 J**	**102 J**	**132 J**	**42.6 J**	**36.5 J**	**110 J**	**34.0 J**	**129 J**	-	-	330	Eco	60,000	HH
Beryllium	**0.193 J**	0.167 U	0.162 U	**0.237 J**	0.189 U	0.157 U	0.158 U	**0.254 J**	0.155 U	0.164 U	-	-	21.0	Eco	610	HH
Cadmium	**2.16**	**1.97**	**1.86**	**1.93**	**2.09**	**0.731**	**0.594**	**1.01**	**0.559**	**3.54**	-	-	0.360	Eco	150	HH
Calcium	**6,520**	**4,240**	**4,700**	**5,660**	**4,810**	**6,100**	**3,390**	**6,220**	**4,470**	**10,485**	-	-	10,400	UPL	10,400	UPL
Chromium	**57.2**	**28.1**	**28.2**	**46.0**	**77.6**	**1,950**	**1,920**	**57.0**	**2,300**	**800**	-	-	28.1	UPL	190	HH
Cobalt	**14.1**	**15.3**	**18.9**	**14.9**	**11.3**	**41.0**	**42.3**	**17.5**	**32.4**	**22.3**	-	-	19.9	UPL	300	HH
Copper	**312 J**	**27.4 J**	**28.7 J**	**97.5 J**	**37.1 J**	**37.5 J**	**31.9 J**	**43.2 J**	**29.8 J**	**378 J**	-	-	56.7	UPL	12,000	HH
Iron	**31,100**	**29,800**	**33,000**	**28,100**	**19,200**	**51,000**	**47,300**	**32,200**	**50,700**	**40,150**	-	-	36,900	UPL	720,000	HH
Lead	**488 J**	**57.6 J**	**412 J**	**303 J**	**741 J**	**1,660 J**	**931 J**	**52.7 J**	**912 J**	**1,235 J**	-	-	25.5	UPL	800	HH
Magnesium	**6,410**	**6,010**	**5,260**	**7,340**	**6,070**	**77,700**	**73,000**	**12,000**	**88,300**	**27,250**	-	-	12,400	UPL	12,400	UPL
Manganese	**489 J**	**388 J**	**635 J**	**525 J**	**367 J**	**895 J**	**821 J**	**592 J**	**944 J**	**1,713 J**	-	-	885	UPL	7,200	HH
Mercury	**0.444**	**0.0150 J**	**0.0210**	**0.102**	**0.122**	**0.0475**	**0.0353**	**0.0836**	**0.0354**	**0.0835**	**0.505 J**	**0.552 J**	0.0660	UPL	93.0	HH
Nickel	**32.4 J**	**34.4 J**	**38.3 J**	**27.3 J**	**65.0 J**	**1,610 J**	**1,760 J**	**43.0 J**	**684 J**	**578 J**	-	-	38.0	Eco	6,100	HH
Potassium	**843**	**703**	**441**	**839**	**797**	**322 J**	**214 J**	**830**	**279 J**	**722**	-	-	2,050	UPL	2,050	UPL
Selenium	0.081 U	0.080 U	0.077 U	0.086 U	**0.205 J**	**0.226 J**	**0.184 J**	0.082 U	**0.154 J**	**0.879 J**	-	-	0.520	Eco	5,100	HH
Silver	**1.52**	**0.353 J**	**0.545**	**1.28**	**0.634**	**0.126 J**	**0.119 J**	**0.192 J**	**0.101 J**	**0.743 J**	-	-	4.20	Eco	1,500	HH
Sodium	151 U	150 U	145 U	162 U	169 U	141 U	142 U	**165 J**	139 U	147 U	-	-	341	UPL	341	UPL
Thallium	**0.120**	**0.0994 J**	**0.0892 J**	**0.123**	**0.0953 J**	**0.0578 J**	**0.0361 J**	**0.0930 J**	**0.0442 J**	**0.0829 J**	-	-	1.00	Eco	0.203	UPL
Vanadium	**67.0**	**84.0**	**93.4**	**70.1**	**34.3**	**39.5**	**35.8**	**77.4**	**34.0**	**56.1**	-	-	104	UPL	104	UPL
Zinc	**425 J**	**162 J**	**218 J**	**211 J**	**262 J**	**101 J**	**94.0 J**	**234 J**	**84.5 J**	**1,140 J**	-	-	71.7	UPL	310,000	HH
Total Petroleum Hydrocarbons (mg/kg dry)																
Diesel Range Organics	**198**	13.2 U	**39.2**	**116**	**266**	**422**	**307**	13.9 U	**190**	**101**	**2820**	**5100 J**	23,000	HH	23,000	HH
Residual Range Organics	**1,070**	**31.1 J**	**176**	**834**	**698**	**1,160**	**1,140**	**69.4**	**633**	**448 J**	**12,200**	**23,900**	40,000	HH	40,000	HH
Gasoline Range Organics	4.49 U	4.39 U	4.08 U	4.52 U	4.78 U	**3.28 J**	**2.10 J**	4.70 U	**3.05 J**	4.31 U	**214**	**267**	13,000	HH	13,000	HH
Butyltins (µg/kg dry)																
Dibutyltin	0.720 U	0.657 U	0.691 U	0.685 U	**20.2**	0.741 U	0.653 U	0.758 U	0.567 U	0.685 U	0.790 U	0.754 U	28,000	Eco	180,000	HH
Monobutyltin	1.59 U	1.45 U	1.52 U	1.51 U	**9.08**	1.63 U	1.44 U	1.67 U	1.25 U	1.51 U	1.74 U	1.66 U	28,000	Eco	180,000	HH
Tetrabutyltin	0.556 U	0.507 U	0.534 U	0.529 U	0.600 U	0.573 U	0.505 U	0.585 U	0.438 U	0.529 U	0.611 U	0.582 U	28,000	Eco	180,000	HH
Tributyltin	1.15 U	1.05 U	1.10 U	1.09 U	**9.01**	1.18 U	1.04 U	1.21 U	0.903 U	**15.4**	1.26 U	1.20 U	28,000	Eco	180,000	HH

Table 5-2a
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
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Site ID	BIL13	BIL14	BIL15	BIL16	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV[1] (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV[1] (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Sample Depth (Feet bgs)	4.0	6.0	8.0	4.0	1.0	2.0	5.0	8.0	5.0	3.0	5.0	5.0				
Sample Depth or Interval (Feet bgs)	4.0	6.0	8.0	4.0	1.0	2.0	5.0	8.0	5.0	3.0	0.0-10.0	0.0-10.0				
Herbicides (µg/kg dry)																
2,4,5-T	1.74 U	1.63 U	1.55 U	1.66 U	1.79 U	1.61 U	1.46 U	1.74 U	1.48 U	1.54 U	-	-	21.0	Eco	6,200,000	HH
2,4,5-TP (Silvex)	2.55 U	2.38 U	2.27 U	2.43 U	2.61 U	2.35 U	2.14 U	2.55 U	2.17 U	2.25 U	-	-	21.0	Eco	4,900,000	HH
2,4-D	0.659 U	0.614 U	0.585 U	0.627 U	0.675 U	0.608 U	0.520 U	0.658 U	0.560 U	0.581 U	-	-	21.0	Eco	2,400,000	HH
2,4-DB	1.12 U	1.04 U	0.994 U	1.07 U	1.15 U	1.03 U	0.939 U	1.12 U	0.951 U	0.988 U	-	-	21.0	Eco	4,900,000	HH
4-Nitrophenol	1.77 U	1.65 U	1.57 U	1.68 U	1.81 U	1.63 U	1.48 U	1.76 U	1.50 U	1.56 U	-	-	7,000	Eco	180,000,000	HH
Dalapon	2.44 U	2.27 U	2.16 U	2.32 U	2.50 U	2.25 U	2.04 U	2.43 U	2.07 U	2.15 U	-	-	18,000,000	HH	18,000,000	HH
Dicamba	1.94 U	1.81 U	1.72 U	1.85 U	1.99 U	1.79 U	1.63 U	1.94 U	1.65 U	1.71 U	-	-	18,000,000	HH	18,000,000	HH
Dichloroprop	0.851 U	0.793 U	0.755 U	0.810 U	0.871 U	0.785 U	0.713 U	0.849 U	0.722 U	0.750 U	-	-	21.0	Eco	4,900,000	HH
Dinoseb	0.659 U	0.614 U	0.585 U	0.627 U	0.675 U	0.608 U	0.552 U	0.658 U	0.560 U	0.581 U	-	-	620,000	HH	620,000	HH
MCPA	1.20 U	1.12 U	1.07 U	1.15 U	1.23 U	1.11 U	1.01 U	1.20 U	1.02 U	1.06 U	-	-	21.0	Eco	120,000	HH
MCPP	2.19 U	2.04 U	1.94 U	2.08 U	2.24 U	2.02 U	1.83 U	2.18 U	1.86 U	1.93 U	-	-	21.0	Eco	620,000	HH
Pentachlorophenol	0.933 U	0.869 U	0.827 U	0.887 U	0.955 U	0.859 U	0.781 U	0.930 U	0.791 U	0.822 U	-	-	2,100	Eco	13,000	HH
Pesticides (µg/kg dry)																
4,4'-DDD	2.23 U	0.214 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	21.0	Eco	11,000	HH
4,4'-DDE	2.23 U	0.253 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	21.0	Eco	7,700	HH
4,4'-DDT	2.23 U	0.285 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	21.0	Eco	7,700	HH
Aldrin	1.12 U	0.474 U	1.09 U	1.14 U	1.20 U	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	4.90	Eco	130	HH
BHC (alpha)	1.12 U	0.341 U	1.09 U	1.14 U	1.20 U	**2.02**	0.994 U	1.18 U	0.978 U	1.11 U	-	-	340	HH	340	HH
BHC (beta)	1.12 U	0.465 U	1.09 U	1.14 U	1.20 U	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	960	HH	960	HH
BHC (delta)	1.12 U	0.422 U	1.09 U	1.14 U	1.20 U	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	340	HH	340	HH
BHC (gamma) Lindane	1.12 U	0.420 U	1.09 U	1.14 U	1.20 U	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	2,000	HH	2,000	HH
Chlordane (technical)	**409**	1.55 U	10.9 U	**53.6 J**	**1,560**	**65.6 J**	9.94 U	11.8 U	**49.4 J**	**92.7 J**	-	-	7,200	HH	7,200	HH
Dieldrin	2.23 U	0.360 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	4.90	Eco	130	HH
Endosulfan I	1.12 U	0.468 U	1.09 U	1.14 U	1.20 U	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	20,000	Eco	1,400,000	HH
Endosulfan II	2.23 U	0.425 U	2.17 U	2.29 U	**8.84 J**	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	20,000	Eco	1,400,000	HH
Endosulfan Sulfate	2.23 U	0.400 U	2.17 U	2.29 U	**5.97 J**	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	20,000	Eco	1,400,000	HH
Endrin	2.23 U	0.397 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	4.90	Eco	71,000	HH
Endrin Aldehyde	2.23 U	0.448 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	4.90	Eco	71,000	HH
Endrin Ketone	2.23 U	0.309 U	2.17 U	2.29 U	2.41 U	2.14 U	1.99 U	2.35 U	1.96 U	2.23 U	-	-	4.90	Eco	71,000	HH
Heptachlor	1.12 U	0.378 U	1.09 U	1.14 U	**2.83**	1.07 U	0.994 U	1.18 U	0.978 U	**3.07**	-	-	480	HH	480	HH
Heptachlor Epoxide	1.12 U	0.401 U	1.09 U	1.14 U	**14.4**	1.07 U	0.994 U	1.18 U	0.978 U	1.11 U	-	-	240	HH	240	HH
Methoxychlor	11.2 U	1.51 U	10.9 U	11.4 U	12.0 U	10.7 U	9.94 U	11.8 U	9.78 U	11.1 U	-	-	500,000	Eco	3,100,000	HH
Toxaphene	112 U	6.89 U	109 U	114 U	120 U	107 U	99.4 U	118 U	97.8 U	111 U	-	-	2,000	HH	2,000	HH

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed

[1] Only Aroclors 1248, 1254, and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Landfill AOPC soil samples.
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.
[1] = Screening based on depth of sample with the exception of Gully Test pit samples (Site ID suffix = "TPG") and Mercury Vapor Lamp Test Pit samples (Site ID suffix = "TPM"), which used the minimum SLV for the two depth ranges.

Table 5-2b
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
Volatile Organic Compounds
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Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL13	BIL14	BIL15	BIL16	Selected SLV^1 (0-3 ft bgs)	SLV Source (0-3 ft bgs)	Selected SLV^1 (>3 ft bgs)	SLV Source (>3 ft bgs)
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001				
Sample Depth or Interval (Feet bgs)	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0	4.0	6.0	8.0	4.0				
Volatile Organic Compounds (µg/kg dry)												
1,1,1,2-Tetrachloroethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	9,300	HH	9,300	HH
1,1,1-Trichloroethane (TCA)	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	38,000,000	HH	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,800	HH	2,800	HH
1,1,2-Trichloroethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,700	HH	2,700	HH
1,1-Dichloroethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	5,900	HH	5,900	HH
1,1-Dichloroethene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	680,000	HH	680,000	HH
1,1-Dichloropropene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	8,100	HH	8,100	HH
1,2,3-Trichlorobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	20,000	Eco	490,000	HH
1,2,3-Trichloropropane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	95.0	HH	95.0	HH
1,2,4-Trichlorobenzene	0.247 UJ	0.226 UJ	0.231 UJ	2,300 U	0.242 UJ	0.212 UJ	0.192 UJ	0.208 UJ	20,000	Eco	99,000	HH
1,2,4-Trimethylbenzene	0.247 U	0.226 U	0.231 U	**14,300**	0.242 U	0.212 U	0.192 U	0.208 U	200,000	Eco	980,000	HH
1,2-Dibromo-3-chloropropane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	69.0	HH	69.0	HH
1,2-Dibromoethane (EDB)	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	140	HH	140	HH
1,2-Dichlorobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	19,000,000	HH
1,2-Dichloroethane (EDC)	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	590	HH	590	HH
1,2-Dichloropropane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	4,500	HH	4,500	HH
1,3,5-Trimethylbenzene	0.247 U	0.226 U	0.231 U	**5,410**	0.242 U	0.212 U	0.192 U	0.208 U	150,000	HH	150,000	HH
1,3-Dichlorobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	17,000	HH
1,3-Dichloropropane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	20,000,000	HH	20,000,000	HH
1,4-Dichlorobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	17,000	HH	17,000	HH
2,2-Dichloropropane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	4,500	HH	4,500	HH
2-Butanone (MEK)	1,230 U	1.13 U	1.15 U	11,500 U	1.21 U	1.06 U	0.958 U	1.04 U	200,000,000	HH	200,000,000	HH
2-Chlorotoluene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	20,000,000	HH	20,000,000	HH
2-Hexanone	1.24 U	1.13 U	1.15 U	11,500 U	1.21 U	1.06 U	0.958 U	1.04 U	1,250,000	Eco	1,400,000	HH
4-Chlorotoluene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	72,000,000	HH	72,000,000	HH
4-Isopropyltoluene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	**0.457**	200,000	Eco	24,000,000	HH
4-Methyl-2-pentanone (MIBK)	1.24 U	1.13 U	1.15 U	11,500 U	1.21 U	1.06 U	0.958 U	1.04 U	1,250,000	Eco	53,000,000	HH
Acetone	1.24 UJ	1.13 UJ	1.15 UJ	11,500 U	1.21 UJ	1.06 UJ	0.958 UJ	1.04 UJ	1,250,000	Eco	630,000,000	HH
Benzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	1,200	HH	1,200	HH
Bromobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	1,800,000	HH	1,800,000	HH
Bromochloromethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	1,900	HH	1,900	HH
Bromodichloromethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	1,900	HH	1,900	HH
Bromoform	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	360,000	HH	360,000	HH
Bromomethane	0.247 UJ	0.226 UJ	0.231 UJ	2,300 UJ	0.242 UJ	0.212 UJ	0.192 UJ	0.208 UJ	17,000	HH	17,000	HH
Carbon Disulfide	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	1,000,000	Eco	3,700,000	HH
Carbon Tetrachloride	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	630	HH	630	HH
Chlorobenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	40,000	Eco	4,300,000	HH
Chloroethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	61,000,000	HH	61,000,000	HH
Chloroform	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	410	HH	410	HH
Chloromethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	300,000	HH	300,000	HH
cis-1,2-Dichloroethene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,500,000	Eco	3,100,000	HH
cis-1,3-Dichloropropene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	8,100	HH	8,100	HH
Dibromochloromethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	34,000	HH	34,000	HH
Dibromomethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	110,000	HH	110,000	HH
Dichlorodifluoromethane	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	**0.221 J**	0.208 U	730,000	Eco	780,000	HH
Dichloromethane (Methylene Chloride)	3.70 U	2.48 U	3.39 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	20,000	HH	20,000	HH
Ethylbenzene	0.247 U	0.226 U	0.231 U	**2,700 J**	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	12,000	HH
Hexachlorobutadiene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	22,000	HH	22,000	HH
Isopropylbenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	24,000,000	HH
m,p-Xylenes	0.495 U	0.452 U	0.461 U	**9,800**	0.242 U	0.424 U	**0.552 J**	0.416 U	120,000	Eco	2,700,000	HH
Naphthalene	0.247 UJ	0.226 UJ	0.231 UJ	**8,360**	0.242 UJ	0.212 UJ	0.192 UJ	0.208 UJ	23,000	HH	23,000	HH
n-Butylbenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	-	-	-	-
n-Propylbenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	21,000,000	HH
o-Xylene	0.247 U	0.226 U	0.231 U	**4,260 J**	0.242 U	0.212 U	**0.368 J**	0.208 U	1,000	Eco	19,000,000	HH
sec-Butylbenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	-	-
Styrene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	300,000	Eco	51,000,000	HH
tert-Butylbenzene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,260	Eco	-	-
Tetrachloroethene (PCE)	**11.0**	**3.73**	**8.88**	**403,000**	**8.12**	**0.605**	**0.668**	**5.19**	1,600	HH	1,600	HH
Toluene	**3.69**	**0.760**	**1.65**	**133,000**	0.242 U	**0.269 J**	**0.352 J**	0.208 U	200,000	Eco	24,000,000	HH
trans-1,2-Dichloroethene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	200,000	HH	200,000	HH
trans-1,3-Dichloropropene	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	8,100	HH	8,100	HH
Trichloroethene (TCE)	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	130	HH	130	HH
Trichlorofluoromethane	0.247 U	0.226 U	0.231 U	2,300 U	**0.325 J**	0.212 U	0.192 U	0.208 U	730,000	Eco	63,000,000	HH
Vinyl Acetate	1.24 UJ	1.13 UJ	1.15 UJ	11,500 U	1.21 UJ	1.06 UJ	0.958 UJ	1.04 UJ	4,100,000	HH	4,100,000	HH
Vinyl Chloride	0.247 U	0.226 U	0.231 U	2,300 U	0.242 U	0.212 U	0.192 U	0.208 U	2,200	HH	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.

UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.

[1] = Screening based on depth of sample with the exception of Gully Test Pit samples (Site ID suffix = "TPG") and Mercury Vapor Lamp Test Pit samples (Site ID suffix = "TPM"). The Mercury Vapor Lamp Test Pit samples were screened against the the minimum SLV for the two depth ranges. The Gully Test Pit COCs were screened against the minimum SLV for the two depth ranges, except for o-xylene, toluene, and PCE which were compared only to >3 ft SLVs due to more recent (2009) surface and subsurface samples that analyzed for a subset of analytes and superceed the Gully Test it data for these analytes.

Table 5-2b
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
Volatile Organic Compounds
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Site ID	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV[1] (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV[1] (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Sample Depth or Interval (Feet bgs)	1.0	2.0	5.0	8.0	5.0	3.0	0.0-10.0	0.0-10.0				
Volatile Organic Compounds (µg/kg dry)												
1,1,1,2-Tetrachloroethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	9,300	HH	9,300	HH
1,1,1-Trichloroethane (TCA)	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	38,000,000	HH	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,800	HH	2,800	HH
1,1,2-Trichloroethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,700	HH	2,700	HH
1,1-Dichloroethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	5,900	HH	5,900	HH
1,1-Dichloroethene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	680,000	HH	680,000	HH
1,1-Dichloropropene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	8,100	HH	8,100	HH
1,2,3-Trichlorobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	20,000	Eco	490,000	HH
1,2,3-Trichloropropane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	95.0	HH	95.0	HH
1,2,4-Trichlorobenzene	0.218 UJ	0.220 UJ	0.174 U	0.229 UJ	0.200 UJ	0.212 UJ	255 U	230 U	20,000	Eco	99,000	HH
1,2,4-Trimethylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	**0.230 J**	0.212 U	**1,280**	**672**	200,000	Eco	980,000	HH
1,2-Dibromo-3-chloropropane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	69.0	HH	69.0	HH
1,2-Dibromoethane (EDB)	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	140	HH	140	HH
1,2-Dichlorobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	19,000,000	HH
1,2-Dichloroethane (EDC)	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	590	HH	590	HH
1,2-Dichloropropane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	4,500	HH	4,500	HH
1,3,5-Trimethylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	**493 J**	**326 J**	150,000	HH	150,000	HH
1,3-Dichlorobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	17,000	HH
1,3-Dichloropropane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	20,000,000	HH	20,000,000	HH
1,4-Dichlorobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	17,000	HH	17,000	HH
2,2-Dichloropropane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	4,500	HH	4,500	HH
2-Butanone (MEK)	1.09 U	1.10 U	0.872 U	1.15 U	1.00 U	1.06 U	1,270 U	1,150 U	200,000,000	HH	200,000,000	HH
2-Chlorotoluene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	20,000,000	HH	20,000,000	HH
2-Hexanone	1.09 U	1.10 U	0.872 UJ	1.15 U	1.00 U	1.06 U	1,270 U	1,150 U	1,250,000	Eco	1,400,000	HH
4-Chlorotoluene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	72,000,000	HH	72,000,000	HH
4-Isopropyltoluene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	200,000	Eco	24,000,000	HH
4-Methyl-2-pentanone (MIBK)	1.09 U	1.10 U	0.872 U	1.15 U	1.00 U	1.06 U	1,270 U	1,150 U	1,250,000	Eco	53,000,000	HH
Acetone	1.09 UJ	1.10 UJ	0.872 U	1.15 UJ	1.00 UJ	1.06 UJ	1,270 U	1,150 U	1,250,000	Eco	630,000,000	HH
Benzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	1,200	HH	1,200	HH
Bromobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	1,800,000	HH	1,800,000	HH
Bromochloromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	1,900	HH	1,900	HH
Bromodichloromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	1,900	HH	1,900	HH
Bromoform	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	360,000	HH	360,000	HH
Bromomethane	0.218 UJ	0.220 UJ	0.174 UJ	0.229 UJ	0.200 UJ	0.212 UJ	255 UJ	230 UJ	17,000	HH	17,000	HH
Carbon Disulfide	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	1,000,000	Eco	3,700,000	HH
Carbon Tetrachloride	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	630	HH	630	HH
Chlorobenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	40,000	Eco	4,300,000	HH
Chloroethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	61,000,000	HH	61,000,000	HH
Chloroform	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	410	HH	410	HH
Chloromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	300,000	HH	300,000	HH
cis-1,2-Dichloroethene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,500,000	Eco	3,100,000	HH
cis-1,3-Dichloropropene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	8,100	HH	8,100	HH
Dibromochloromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	34,000	HH	34,000	HH
Dibromomethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	110,000	HH	110,000	HH
Dichlorodifluoromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	730,000	Eco	780,000	HH
Dichloromethane (Methylene Chloride)	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	20,000	HH	20,000	HH
Ethylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	**0.282 J**	0.212 U	255 U	230 U	2,260	Eco	12,000	HH
Hexachlorobutadiene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	22,000	HH	22,000	HH
Isopropylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	24,000,000	HH
m,p-Xylenes	0.437 U	0.440 U	0.349 U	0.458 U	0.400 U	0.424 U	509 U	460 U	120,000	Eco	2,700,000	HH
Naphthalene	0.218 UJ	0.220 UJ	0.735 UJ	0.229 UJ	0.200 UJ	0.212 UJ	**542**	**504**	23,000	HH	23,000	HH
n-Butylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	-	-	-	-
n-Propylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	21,000,000	HH
o-Xylene	0.218 U	0.220 U	0.174 U	0.229 U	**0.735**	0.212 U	255 U	230 U	1,000	Eco	19,000,000	HH
sec-Butylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	-	-
Styrene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	300,000	Eco	51,000,000	HH
tert-Butylbenzene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,260	Eco	-	-
Tetrachloroethene (PCE)	**1.07**	**0.734**	**1.13**	**3.42**	**0.707**	**3.29**	255 U	230 U	1,600	HH	1,600	HH
Toluene	0.218 U	**0.225 J**	**0.312 J**	**0.984**	**0.376 J**	0.212 U	255 U	230 U	200,000	Eco	24,000,000	HH
trans-1,2-Dichloroethene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	200,000	HH	200,000	HH
trans-1,3-Dichloropropene	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	8,100	HH	8,100	HH
Trichloroethene (TCE)	0.218 U	0.220 U	0.174 UJ	0.229 U	0.200 U	0.212 U	255 U	230 U	130	HH	130	HH
Trichlorofluoromethane	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	730,000	Eco	63,000,000	HH
Vinyl Acetate	1.09 UJ	1.10 UJ	0.872 U	1.15 UJ	1.00 UJ	1.06 UJ	1,270 U	1,150 U	4,100,000	HH	4,100,000	HH
Vinyl Chloride	0.218 U	0.220 U	0.174 U	0.229 U	0.200 U	0.212 U	255 U	230 U	2,200	HH	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.
[1] = Screening based on depth of sample with the exception of Gully Test Pit samples (Site ID suffix = "TPG") and Mercury Vapor Lamp Test Pit samples (Site I
The Gully Test Pit COCs were screened against the minimum SLV for the two depth ranges, except for o-xylene, toluene, and PCE which were compared only
Test it data for these analytes.

Table 5-2c
2001/2002 Phase II Supplimental Landfill Site InspectionSoil Analytical Results
Semivolatile Organic Compounds
(Page 1 of 2)

Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL13	BIL14	BIL15	BIL16	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV[1] (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV[1] (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Sample Depth or Interval (Feet bgs)	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0	4.0	6.0	8.0	4.0	1.0	2.0	5.0	8.0	5.0	3.0	0.0-10.0	0.0-10.0				
Semivolatile Organic Compounds (µg/kg)																				
1,2,4-Trichlorobenzene	15.2 U	13.0 U	13.0 U	-	12.9 U	11.2 U	12.0 U	12.4 U	13.0 U	12.0 U	11.4 U	12.2 U	11.0 U	11.8 U	140 U	126 U	20,000	Eco	99,000	HH
1,2-Dichlorobenzene	18.9 U	16.1 U	16.2 U	-	16.0 U	13.9 U	14.9 U	15.3 U	16.1 U	14.9 U	14.2 U	15.1 U	13.6 U	14.6 U	173 U	157 U	2,260	Eco	19,000,000	HH
1,3-Dichlorobenzene	25.6 U	21.9 U	22.0 U	-	21.8 U	19.0 U	20.3 U	20.9 U	21.9 U	20.2 U	19.2 U	20.6 U	18.5 U	19.9 U	236 U	213 U	2,260	Eco	17,000	HH
1,4-Dichlorobenzene	29.3 U	25.0 U	25.1 U	-	24.9 U	21.7 U	23.1 U	23.8 U	25.0 U	23.1 U	22.0 U	23.5 U	21.1 U	22.7 U	269 U	244 U	17,000	HH	17,000	HH
2,4,5-Trichlorophenol	32.9 U	28.1 U	28.3 U	28.3 U	28.0 U	24.4 U	26.0 U	26.8 U	28.1 U	26.0 U	24.7 U	26.4 U	23.8 U	19.5 U	303 U	274 U	4,000	Eco	62,000,000	HH
2,4,6-Trichlorophenol	24.3 U	20.8 U	20.9 U	20.9 U	20.7 U	18.0 U	19.2 U	19.8 U	20.8 U	19.2 U	18.3 U	19.5 U	17.6 U	18.9 U	224 U	203 U	10,000	Eco	200,000	HH
2,4-Dichlorophenol	20.1 U	17.2 U	17.3 U	17.3 U	37.4 U	14.9 U	15.9 U	16.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	198 U	20,000	Eco	1,800,000	HH
2,4-Dimethylphenol	20.1 U	17.2 U	17.3 U	17.3 U	17.1 U	14.9 U	15.9 U	16.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	168 U	20,000	Eco	12,000,000	HH
2,4-Dinitrophenol	-	-	-	-	17.1 UJ	32.5 UJ	34.7 UJ	35.8 UJ	37.5 UJ	34.7 UJ	33.0 UJ	35.2 UJ	31.7 UJ	34.1 UJ	404 U	168 U	20,000	Eco	1,200,000	HH
2,4-Dinitrotoluene	23.8 U	20.3 U	20.4 U	-	20.2 U	17.6 U	18.8 U	19.4 U	20.3 U	18.8 U	17.9 U	19.1 U	17.2 U	18.5 U	219 U	366 U	5,500	HH	5,500	HH
2,6-Dinitrotoluene	32.9 U	28.1 U	28.3 U	-	28.0 UJ	24.4 UJ	26.0 UJ	26.8 UJ	28.1 UJ	26.0 U	24.7 UJ	26.4 UJ	23.8 UJ	25.6 UJ	303 U	259 U	240,000	HH	240,000	HH
2-Chloronaphthalene	5.49 U	4.69 U	4.71 U	-	4.67 U	4.60 U	4.34 U	4.47 U	4.68 U	4.34 U	4.12 U	4.40 U	3.97 U	4.27 U	50.5 U	45.7 U	82,000,000	HH	82,000,000	HH
2-Chlorophenol	27.5 U	23.4 U	23.6 U	23.6 U	23.3 U	20.3 U	21.7 U	22.3 U	23.4 U	21.7 U	20.6 U	22.0 U	19.8 U	21.3 U	252 U	228 U	60,000	Eco	5,100,000	HH
2-Methylphenol	22.0 U	18.8 U	18.9 U	18.9 U	18.7 U	16.2 U	17.4 U	17.9 U	18.7 U	17.4 U	16.5 U	17.6 U	15.9 U	17.1 U	202 U	183 U	50,000	Eco	31,000,000	HH
2-Nitroaniline	23.8 U	20.3 U	20.4 U	-	17.1 U	17.6 U	18.8 U	19.4 U	20.3 U	18.8 U	17.9 U	19.1 U	17.2 U	18.5 U	219 U	198 U	6,000,000	HH	6,000,000	HH
2-Nitrophenol	25.6 U	21.9 U	22.0 U	22.0 U	21.8 U	19.0 U	20.3 U	20.9 U	21.9 U	20.2 U	19.2 U	20.6 U	18.5 U	19.9 U	236 U	213 U	180,000,000	HH	180,000,000	HH
3,3'-Dichlorobenzidine	20.1 U	17.2 U	17.3 U	-	17.1 UJ	14.9 UJ	15.9 UJ	16.4 UJ	17.2 UJ	15.9 UJ	15.1 UJ	16.1 UJ	14.5 UJ	15.6 UJ	185 U	168 U	4,800	HH	4,800	HH
3-Nitroaniline	31.1 U	26.6 U	26.7 U	-	26.5 UJ	23.0 UJ	24.6 UJ	25.3 UJ	26.5 UJ	24.6 UJ	23.4 UJ	25.0 UJ	22.5 UJ	24.2 UJ	286 U	259 U	70,000	Eco	6,000,000	HH
4,6-Dinitro-2-methylphenol	-	-	-	-	57.6 UJ	50.1 UJ	24.6 UJ	55.1 UJ	57.8 UJ	53.5 UJ	50.9 UJ	54.3 UJ	48.9 UJ	52.6 UJ	623 U	564 U	49,000	HH	49,000	HH
4-Bromophenyl Phenyl Ether	24.3 U	20.8 U	20.9 U	-	20.7 U	18.0 U	19.2 U	19.8 U	20.8 U	19.2 U	18.3 U	19.5 U	17.6 U	18.9 U	224 U	203 U	-	-	-	-
4-Chloro-3-methylphenol	20.1 U	17.2 U	17.3 U	17.3 U	17.1 U	14.9 U	15.9 U	16.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	168 U	62,000,000	HH	62,000,000	HH
4-Chloroaniline	17.0 U	14.5 U	14.6 U	-	14.5 U	12.6 U	13.5 U	13.9 U	14.5 U	13.4 U	12.8 U	13.7 U	12.3 U	13.2 U	157 U	142 U	8,600	HH	8,600	HH
4-Chlorophenyl Phenyl Ether	30.8 U	26.3 U	26.4 U	-	26.1 U	22.7 U	24.3 U	25.0 U	26.2 U	24.3 U	23.1 U	24.7 U	22.2 U	23.9 U	283 U	256 U	-	-	-	-
4-Nitroaniline	31.1 U	26.6 U	26.7 U	-	26.5 UJ	23.0 UJ	24.6 UJ	25.3 UJ	26.5 UJ	24.6 UJ	23.4 UJ	25.0 UJ	22.5 UJ	24.2 UJ	286 U	259 U	40,000	Eco	86,000	HH
4-Nitrophenol	34.8 UJ	29.7 UJ	29.9 UJ	29.9 UJ	29.6 UJ	25.7 UJ	27.5 UJ	28.3 UJ	29.7 UJ	27.5 UJ	26.1 UJ	27.9 UJ	25.1 UJ	27.0 UJ	320 U	289 U	7,000	Eco	180,000,000	HH
Aniline	49.4 UJ	156 U	157 U	-	42.0 U	36.6 U	39.1 U	40.2 U	42.2 U	39.0 U	37.1 U	39.6 U	35.7 U	38.4 U	454 U	411 U	200,000	Eco	300,000	HH
Benzidine	34.6 UJ	29.5 UJ	29.7 UJ	-	29.4 UJ	25.6 UJ	27.3 UJ	28.2 UJ	29.5 UJ	27.3 UJ	26.0 UJ	27.7 UJ	25.0 UJ	26.9 UJ	318 U	288 U	55,000	HH	55,000	HH
Benzoic Acid	-	-	-	-	52.9 U	46.0 U	49.2 U	50.6 U	**553**	**191 J**	**301 J**	49.9 U	44.9 U	**300 J**	572 U	518 U	200,000	Eco	2,500,000,000	HH
Benzyl Alcohol	38.4 U	32.5 U	33.0 U	33.0 U	32.7 UJ	28.4 UJ	30.4 UJ	31.3 UJ	32.8 UJ	30.4 UJ	28.9 UJ	30.8 UJ	27.8 UJ	29.9 UJ	353 UJ	320 UJ	2,260	Eco	62,000,000	HH
Bis(2-chloroethoxy)methane	22.0 U	18.8 U	18.9 U	-	18.7 U	16.2 U	17.4 U	17.9 U	18.7 U	17.4 U	16.5 U	17.6 U	15.9 U	17.1 U	202 U	183 U	730,000	Eco	1,800,000	HH
Bis(2-chloroethyl) Ether	35.0 U	29.9 U	30.0 U	-	29.7 U	25.9 U	27.6 U	28.5 U	29.8 U	27.6 U	26.3 U	28.0 U	25.2 U	27.2 U	321 U	291 U	1,000	HH	1,000	HH
Bis(2-chloroisopropyl) Ether	47.6 U	40.6 U	40.9 U	-	40.5 U	35.2 U	37.6 U	38.7 U	40.6 U	37.6 U	35.7 U	38.2 U	34.4 U	37.0 U	438 U	396 U	1,000	HH	1,000	HH
Bis(2-ethylhexyl) Phthalate	**2,670 J**	**3,240 J**	**995 J**	**4,280 J**	**2,370**	**237 J**	**1,170**	**1,160**	**3,960**	**2,030**	**1,720**	**188 J**	**1,510**	**888**	690 UJ	625 UJ	4,500	Eco	150,000	HH
Butyl Benzyl Phthalate	34.8 U	**67.2 J**	29.9 U	-	29.6 U	25.7 U	27.5 U	**152**	**68.7 J**	27.5 U	26.1 U	**35.2 J**	25.1 U	27.0 U	320 U	289 U	450	Eco	910,000	HH
Carbazole	**425 J**	**577 J**	**281 J**	**2,650 J**	**448**	5.28 U	**205**	**128**	**490**	**2,840**	**1,630**	5.73 U	**1,070**	**592**	**707**	59.4 U	2,260	Eco	1,000,000	HH
Dibenzofuran	**67.7 J**	**89.1 J**	**42.4 J**	**810 J**	**94.9 J**	15.7 U	**21.7 J**	**20.9 J**	**67.1 J**	**419**	**214**	17.0 U	**161**	**83.0 J**	195 U	177 U	2.00	Eco	1,000,000	HH
Diethyl Phthalate	31.1 U	26.6 U	26.7 U	-	26.5 U	23.0 U	24.3 U	25.3 U	**73.4 J**	**28.9 J**	23.4 U	25.0 U	**30.4 J**	**31.8 J**	286 U	259 U	100,000	Eco	490,000,000	HH
Dimethyl Phthalate	20.1 U	17.2 U	17.3 U	-	17.1 U	14.9 U	15.9 U	16.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	168 U	150,000	HH	150,000	HH
Di-n-butyl Phthalate	159 U	136 U	137 U	-	135 UJ	118 UJ	126 UJ	130 UJ	136 UJ	126 UJ	120 UJ	128 UJ	115 UJ	124 UJ	1,460 U	1,330 U	450	Eco	62,000,000	HH
Di-n-octyl Phthalate	47.6 UJ	40.6 UJ	40.9 UJ	-	40.5 UJ	35.2 UJ	37.6 UJ	38.7 UJ	40.6 UJ	37.6 UJ	35.7 UJ	38.2 UJ	34.4 UJ	37.0 UJ	438 U	396 U	450	Eco	150,000	HH
Hexachlorobenzene	20.1 U	17.2 U	17.3 U	-	17.1 U	14.9 U	15.9 U	13.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	168 U	1,800	HH	1,800	HH
Hexachlorobutadiene	16.5 U	14.1 U	14.1 U	-	14.0 U	12.2 U	13.0 U	28.3 U	14.1 U	13.0 U	12.4 U	13.2 U	11.9 U	12.8 U	151 U	137 U	22,000	HH	22,000	HH
Hexachlorocyclopentadiene	25.8 U	22.0 U	22.2 U	-	21.9 U	19.1 U	20.4 U	21.0 U	22.0 U	20.4 U	19.4 U	20.7 U	16.6 U	20.0 U	237 UJ	215 UJ	10,000	Eco	3,700,000	HH
Hexachloroethane	34.8 U	29.7 U	29.9 U	-	29.6 U	25.7 U	27.5 U	16.4 U	29.7 U	27.5 U	26.1 U	27.9 U	25.1 U	27.0 U	320 U	289 U	150,000	HH	150,000	HH
Isophorone	25.6 U	21.9 U	22.0 U	-	21.8 U	19.0 U	20.3 U	20.9 U	21.4 U	20.2 U	19.2 U	20.6 U	18.5 U	19.9 U	236 U	213 U	1,800,000	HH	1,800,000	HH
Nitrobenzene	25.1 U	21.4 U	21.5 U	-	21.3 U	18.5 U	19.8 U	20.4 U	21.4 U	19.8 U	18.8 U	20.1 U	18.1 U	19.5 U	231 U	209 U	8,000	Eco	24,000	HH
N-Nitrosodimethylamine	-	-	-	-	17.1 UJ	10.8 UJ	15.9 UJ	16.4 UJ	17.2 UJ	15.9 UJ	15.1 UJ	16.1 UJ	14.5 UJ	15.6 UJ	135 UJ	168 UJ	34.0	HH	34.0	HH
N-Nitrosodi-n-propylamine	20.1 U	17.2 U	17.3 U	-	17.1 U	14.9 U	15.9 U	16.4 U	17.2 U	15.9 U	15.1 U	16.1 U	14.5 U	15.6 U	185 U	168 U	250	HH	250	HH
N-Nitrosodiphenylamine	-	-	-	-	12.5 U	14.9 U	11.6 U	11.9 U	12.5 U	11.6 U	11.0 U	11.7 U	10.6 U	11.4 U	185 U	122 U	20,000	Eco	350,000	HH
p-cresol (4-Methylphenol)	27.1 U	23.1 U	23.3 U	23.3 U	23.0 U	20.0 U	21.4 U	22.0 U	**64.0 J**	21.4 U	20.3 U	21.7 U	19.6 U	21.0 U	249 UJ	225 UJ	-	-	-	-
Pentachlorophenol	38.4 U	32.8 U	33.0 U	33.0 U	32.7 U	28.4 U	30.4 U	31.3 U	**201**	30.4 U	28.9 U	30.8 U	27.8 U	29.9 U	353 U	320 U	2,100	Eco	13,000	HH
Phenol	36.6 U	31.3 U	31.4 U	31.5 U	31.1 U	27.1 U	28.9 U	29.8 U	31.2 U	28.9 U	27.5 U	29.4 U	26.4 U	28.4 U	337 U	305 U	30,000	Eco	180,000,000	HH

Table 5-2c
2001/2002 Phase II Supplimental Landfill Site InspectionSoil Analytical Results
Semivolatile Organic Compounds
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Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL13	BIL14	BIL15	BIL16	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV^1**	**SLV Source**	**Selected SLV^1**	**SLV Source**
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Site ID	BIL01TPG	BIL02TPG	BIL03TPG	BIL04TPG	BIL13	BIL14	BIL15	BIL16	BIL17	BIL18	BIL19	BIL20	BIL21	BIL22*	BIL28TPM	BIL29TPM	**Selected SLV^1 (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV^1 (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	011015BIL01TPG	011015BIL02TPG	011015BIL03TPG	011015BIL04TPG	011016BIL13SS	011016BIL14SS	011016BIL15SS	011016BIL16SS	011016BIL17SS	011016BIL18SS	011016BIL19SS	011016BIL20SS	011016BIL21SS	011016BIL22SS	011017BIL28TPM	011017BIL29TPM				
Sample Date	10/15/2001	10/15/2001	10/15/2001	10/15/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/16/2001	10/17/2001	10/17/2001				
Sample Depth or Interval (Feet bgs)	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0	4.0	6.0	8.0	4.0	1.0	2.0	5.0	8.0	5.0	3.0	0.0-10.0	0.0-10.0				
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)																				
2-Methylnaphthalene	2.86 U	**20.3**	2.45 U	**206 J**	**42.0**	2.11 U	2.26 U	**28.3**	**37.5**	**43.4**	**17.9**	2.29 U	2.06 U	2.22 U	**1,530**	**625**	4,100,000	HH	4,100,000	HH
Acenaphthene	**461**	**616**	**266**	**3,040 J**	**540**	**23.0**	**113**	**87.9**	**323**	**2,530**	6.80 U	7.27 U	**978**	**576**	83.3 U	**168**	19,000,000	HH	19,000,000	HH
Acenaphthylene	7.98 U	**20.3**	6.85 U	**22.0 J**	**65.4**	5.90 U	**27.5**	**35.8**	**78.1**	**111**	5.99 U	6.40 U	**71.4**	**51.4**	73.4 U	66.4 U	23,000	HH	23,000	HH
Anthracene	**1,450**	**1,810**	**891**	**7,550 J**	**872**	**62.3**	**307**	**295**	**773**	**8,440**	**5,640**	3.70 U	**4,650**	**1,780**	**1,750**	**503**	93,000,000	HH	93,000,000	HH
Fluorene	**223**	**349**	**185**	**1,400 J**	**272**	**17.6**	**89.7**	**71.5**	**244**	**1,610**	**977**	6.86 U	**673**	**371**	78.6 U	71.1 U	12,000,000	HH	12,000,000	HH
Naphthalene	**36.6**	**56.3**	7.35 U	**1,710 J**	**82.5**	6.34 U	6.77 U	**34.3**	**78.1**	**176**	**77.0**	6.87 U	**44.9**	**47.8**	**791**	**823**	23,000	HH	23,000	HH
Phenanthrene	**3,560**	**4,280**	**2,240**	**15,600 J**	**3,110**	**194**	**1,240**	**798**	**2,910**	**21,900**	2.93 U	**23.5**	**9,370**	**4,705**	**5,020**	**1,480**	93,000,000	HH	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	NC	NC	NC	NC	NC	NC	NC	NC	**4,406**	**34,767**	NC	NC	NC	**7,531 J**	**7,782 J**	**3,107 J**	29,000	Eco	-	-
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)																				
Benzo(a)anthracene	**6,460**	**8,750**	**4,540**	**13,500 J**	**10,100**	**418**	**3,020**	**4,590**	**9,620**	**28,200**	**31,200**	**173**	**23,100**	**9,420**	**9,780**	92.9 U	2,700	HH	2,700	HH
Benzo(a)pyrene	**7,030**	**8,130**	**6,070**	**12,700 J**	**9,840**	**533**	**3,160**	**3,310**	**10,500**	**34,000**	**19,200**	**135**	**15,800**	**7,695**	**7,100**	35.5 U	270	HH	270	HH
Benzo(g,h,i)perylene	**3,560**	**4,380**	**3,350**	**5,870 J**	**5,060**	**318**	**1,850**	**1,780**	**6,150**	**17,000**	**9,530**	**41.1**	**7,360**	**3,020**	27.8 U	25.1 U	27,000	HH	27,000	HH
Benzofluoranthenes, Total	**10,300 J**	**11,100 J**	**7,480 J**	**16,500 J**	**14,200**	**839**	**5,370**	**7,940**	**14,700**	**31,300**	**8,430**	**197**	**13,900**	**8,490**	**5,100**	**1,080**	2,700	HH	2,700	HH
Chrysene	**6,900**	**8,190**	**5,170**	**13,200 J**	**8,190**	**437**	**2,990**	**3,380**	**8,430**	**35,300 J**	**24,000**	**191 J**	**19,800**	**8,415**	**8,210**	**2,060**	270,000	HH	270,000	HH
Dibenz(a,h)anthracene	**793**	**760**	**498**	**904 J**	**685**	**52.8**	**324**	**280**	**695**	**1,940**	3.20 U	3.42 U	3.08 U	**573**	39.2 U	35.5 U	270	HH	270	HH
Fluoranthene	**11,800**	**16,700**	**10,600**	**33,500 J**	**19,500**	**1,100**	**6,830**	**9,800**	**19,400**	**48,300**	**30,700**	**169**	**25,800**	**17,850**	**13,600**	71.1 U	8,900,000	HH	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**4,610**	**4,240**	**3,790**	**7,660 J**	**6,260**	**382**	**2,140**	**1,990**	**6,990**	**20,000**	**11,300**	**52.8**	**8,930**	**2,033**	39.2 U	35.5 U	2,700	HH	2,700	HH
Pyrene	**14,700**	**20,000**	**12,000**	**33,700 J**	**23,100**	**1,220**	**7,670**	**11,600**	**22,900**	**67,100**	**37,700**	**214**	**31,600**	**24,150**	**15,500**	**2,540**	6,700,000	HH	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	NC	NC	NC	NC	NC	NC	NC	NC	**84,685**	**251,840**	NC	NC	NC	**73,156**	**54,272 J**	**4,750 J**	1,100	Eco	-	-

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
NC = not calculated
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.
[1] = Screening based on depth of sample with the exception of Gully Test Pit samples (Site ID suffix = "TPG") and Mercury Vapor Lamp Test Pit samples (Site ID suffix = "TPM"). The Mercury Vapor Lamp Test Pit samples were screened against the the minimum SLV for the two depth ranges. The Gully Test Pit COCs were screened against the minimum SLV for the two depth ranges, except for LPAHs and HPAHs (excluding 2-Methylnaphthalene) which were compared only to >3 ft SLVs due to more recent (2009) surface and subsurface samples that analyzed for a subset of analytes and superceed the Gully Test Pit data for these analytes.

Table 5-2d
2001/2002 Phase II Supplimental Landfill Site Inspection Soil Analytical Results
Samples from Lead "Hot Spot" Areas

Site ID	BIL24*	BIL26	BIL27	BIL30	BIL31	BIL32	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011017BIL24SS	011017BIL26SS	011017BIL27SS	011017BIL30SS	011017BIL31SS	011017BIL32SS		
Sample Date	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001		
Sample Depth (Feet bgs)	3	2	3	2.5	2.5	2.5		
Metals (mg/kg)								
Lead	**614 J**	**711 J**	**954 J**	**110 J**	**87.6 J**	**115 J**	25.5	UPL

Notes:

mg/kg = milligram per kilogram
bgs = below ground surface
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available

U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of combining primary and field duplicate results at this sampling location as described in Section 5.1.

Table 5-2e
2001/2002 Phase II Supplimental Landfill Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 1 of 2)

Site ID	MW-01	MW-02	MW-03	MW-04*	MW-05	MW-06	MW-07	MW-08	MW-09	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	020501BIL02GW	020501BIL03GW	020501BIL05GW	020503BIL06GW	020503BIL09GW	020503BIL08GW	020503BIL10GW	020501BIL01GW	020501BIL04GW				
Sample Date	5/1/2002	5/1/2002	5/1/2002	5/3/2002	5/3/2002	5/3/2002	5/3/2002	5/1/2002	5/1/2002				
Sample Depth (Feet btc)	27.5	29.56	18.21	20.29	24.87	31.06	20.44	58.45	21.08				
Total PCB Aroclors (µg/L)													
Aroclor 1016	0.00222 U	0.00199 U	0.00218 U	0.00206 U	0.00218 U	0.00207 U	0.00233 U	0.00360 U	-	0.0000640	HH	0.0140	Eco
Aroclor 1221	0.00552 U	0.00496 U	0.00542 U	0.00513 U	0.00542 U	0.00515 U	0.00579 U	0.00894 U	-	0.0000640	HH	0.00680	HH
Aroclor 1232	0.00263 U	0.00236 U	0.00258 U	0.00244 U	0.00258 U	0.00245 U	0.00275 U	0.00426 U	-	0.0000640	HH	0.00680	HH
Aroclor 1242	0.00364 U	0.00327 U	0.00358 U	0.00338 U	0.00358 U	0.00340 U	0.00382 U	0.00590 U	-	0.0000640	HH	0.0140	Eco
Aroclor 1248	0.00172 U	0.00155 U	0.00169 U	0.00160 U	0.00169 U	0.00161 U	0.00181 U	0.00279 U	-	0.0000640	HH	0.0140	Eco
Aroclor 1254	0.00222 U	0.00199 U	0.00218 U	0.00206 U	0.00218 U	0.00207 U	0.00233 U	0.00360 U	-	0.0000640	HH	0.0140	Eco
Aroclor 1260	0.00121 U	0.00109 U	0.00119 U	0.00113 U	0.00119 U	0.00113 U	0.00127 U	0.00197 U	-	0.0000640	HH	0.0140	Eco
Total Metals (µg/L)													
Antimony	**1.56 J**	**0.879 J**	3.00 U	**3.89**	**0.798 J**	**1.26 J**	**0.586 J**	**2.98 J**	**0.294 J**	5.60	HH	15.0	HH
Arsenic	**18.9**	**7.00**	**0.138 J**	**2.45**	**3.60**	**9.92**	**17.5**	**1.08**	**0.728 J**	0.0180	HH	0.0380	HH
Barium	**140**	**64.9**	**7.15**	**304**	**50.8**	**139**	**174**	**100**	**128**	1,000	HH	7,300	HH
Beryllium	**0.435 J**	**0.396 J**	0.0142 U	**0.268 J**	0.0142 U	**0.222 J**	**0.344 J**	**0.307 J**	**0.324 J**	-	-	73.0	HH
Cadmium	0.00710 U	0.00710 U	**0.0100 J**	**4.68**	**0.110 J**	0.00710 U	**0.0260 J**	0.00710 U	**1.03**	-	-	18.0	HH
Chromium	**18.5**	**7.43**	1.95 U	**6.01**	1.00 U	**8.64**	**7.51**	**3.36**	**4.73**	-	-	55,000	HH
Copper	**14.3**	**5.08**	**2.34**	**201**	**2.33**	**35.9**	**47.0**	**13.2**	**39.7**	1,300	HH	1,500	HH
Iron	**6,100**	**2,320**	**33.1 J**	**12,200**	**20,600**	**34,000**	**42,900**	**4,560**	**929**	300	HH	26,000	HH
Lead	**7.95**	**2.78**	0.500 U	**78.2**	0.500 U	**3.63**	**4.13**	**1.90**	**1.05**	-	-	15.0	HH
Manganese	**157**	**71.7**	**3.17**	**327**	**2,110**	**2,560**	**2,440**	**411**	**355**	50.0	HH	880	HH
Mercury	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	-	-	11.0	HH
Nickel	**7.23**	**2.11**	**0.850 J**	**117**	**4.81**	**12.4**	**14.4**	**7.61**	**7.49**	610	HH	730	HH
Selenium	**2.01 J**	0.385 U	0.385 U	0.385 U	0.385 U	**0.530 J**	**0.539 J**	**8.23**	**5.63**	170	HH	180	HH
Silver	**0.154**	0.100 U	0.100 U	**0.658**	0.100 U	**0.108**	**0.131**	**0.0810 J**	0.100 U	-	-	180	HH
Thallium	**0.230 J**	**0.159 J**	**0.159 J**	**0.197 J**	**0.115 J**	**0.230 J**	**0.323 J**	**0.243 J**	**0.166 J**	0.240	HH	2.00	HH
Zinc	**57.6**	**23.7**	**4.27**	**1,745**	**61.6**	**21.5**	**54.8**	**11.2**	**28.9**	7,400	HH	11,000	HH
Total Petroleum Hydrocarbons (µg/L)													
Diesel Range Organics	**122 J**	**131 J**	100 U	**485**	**1,100**	**889**	**567**	**371**	**471**	-	-	90.0	HH
Residual Range Organics	**275 J**	**351 J**	**310 J**	**750**	**1,270**	**1,030**	**708**	**407**	**965**	-	-	290	HH
Gasoline Range Organics	100 U	100 U	100 U	100 U	**63.1 J**	100 U	**281**	100 U	100 U	-	-	100	HH
Total Butyltins (µg/L)													
Dibutyltin	**0.162**	**0.447 J**	**0.0113**	0.00111 U	**0.00501**	**0.0119**	0.00115 U	**0.231**	-	0.0630	Eco	0.0630	Eco
Monobutyltin	**0.0540**	**0.240 J**	**0.00682**	0.00105 U	**0.00449**	**0.00699**	0.00110 U	**0.0189**	-	0.0630	Eco	0.0630	Eco
Tetrabutyltin	0.00119 U	0.00110 U	0.00116 U	0.00111 U	0.00119 U	0.00116 U	0.00115 U	0.00114 U	-	0.0630	Eco	0.0630	Eco
Tributyltin	**0.0233**	**0.0601 J**	**0.0287 J**	0.00156 U	**0.0171**	**0.0213**	0.00163 U	**0.0284**	-	0.0630	Eco	0.0630	Eco

Table 5-2e
2001/2002 Phase II Supplimental Landfill Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 2 of 2)

Site ID										**Selected Discharge to Surface Water / Bioaccumulation**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID													
Sample Date													
Sample Depth (Feet btc)													
Total Herbicides (µg/L)													
2,4,5-T	0.0566 U	0.0566 U	0.0566 U	0.0566 U	0.0566 U	0.0566 U	0.0566 U	0.0566 U	-	36.0	Eco	36.0	Eco
2,4,5-TP (Silvex)	0.0227 U	0.0227 U	0.0277 U	0.0227 U	0.0227 U	0.0227 U	0.0227 U	0.0227 U	-	-	-	290	HH
2,4-D	0.0296 U	0.0296 U	0.0296 U	0.0296 U	0.0296 U	0.0296 U	0.0296 U	0.0296 U	-	4.00	Eco	4.00	Eco
2,4-DB	0.0557 U	0.0577 U	0.0577 U	0.0577 U	0.0577 U	0.0577 U	0.0577 U	0.0577 U	-	-	-	290	HH
4-Nitrophenol	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	**0.840**	-	150	Eco	150	Eco
Dalapon	0.0124 U	0.0124 U	0.0124 U	0.0124 U	0.0124 U	0.0124 U	0.0124 U	0.0124 U	-	-	-	1,100	HH
Dicamba	0.0221 U	0.0221 U	0.0221 U	0.0221 U	0.0221 U	0.0221 U	0.0221 U	0.0221 U	-	10.0	Eco	10.0	Eco
Dichloroprop	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	-	4.00	Eco	4.00	Eco
Dinoseb	0.0292 U	0.0292 U	0.0292 U	0.0292 U	0.0292 U	0.0292 U	0.0292 U	0.0292 U	-	0.0500	Eco	0.0500	Eco
MCPA	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	0.0114 U	-	2.60	Eco	2.60	Eco
MCPP	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	-	-	-	37.0	HH
Pentachlorophenol	0.0259 U	0.0259 U	0.0259 U	0.0259 U	0.0259 U	0.0259 U	0.0259 U	**0.112**	-	0.270	HH	0.470	HH
Total Pesticides (µg/L)													
4,4'-DDD	0.000513 UJ	0.000458 UJ	0.000531 U	0.000473 UJ	0.00227 UJ	0.000517 UJ	0.00208 U	0.000646 UJ	-	0.000310	HH	0.00100	Eco
4,4'-DDE	0.000425 UJ	0.000380 UJ	**0.00246 J**	0.000391 UJ	0.00227 UJ	0.000428 UJ	0.00208 U	0.000535 UJ	-	0.000220	HH	0.00100	Eco
4,4'-DDT	0.000544 UJ	0.000486 UJ	0.000563 U	0.000501 UJ	0.00227 UJ	0.000548 UJ	0.00208 U	0.000685 UJ	-	0.000220	HH	0.00100	Eco
Aldrin	0.000125 UJ	0.000111 UJ	0.000129 U	0.000115 UJ	0.00114 UJ	0.000126 UJ	0.00104 U	0.000157 UJ	-	0.0000490	HH	0.00330	HH
BHC (alpha)	0.000401 UJ	0.000358 UJ	0.000414 U	0.000369 UJ	0.00114 UJ	0.000403 UJ	0.00104 U	0.000505 UJ	-	0.00260	HH	0.00900	HH
BHC (beta)	0.000465 UJ	0.000415 UJ	0.000481 U	0.000428 UJ	0.00114 UJ	0.000468 UJ	0.00104 U	0.000586 UJ	-	0.00910	HH	0.0370	HH
BHC (delta)	0.000256 UJ	0.000228 UJ	0.000264 U	0.000235 UJ	0.00114 UJ	0.000257 UJ	0.00104 U	0.000322 UJ	-	0.00260	HH	0.00900	HH
BHC (gamma) Lindane	0.000784 UJ	0.000700 UJ	0.000811 U	0.000722 UJ	0.00114 UJ	0.000789 UJ	0.00104 U	0.000987 UJ	-	0.0800	Eco	0.0520	HH
Chlordane (technical)	0.00349 UJ	0.00312 UJ	0.00361 U	0.00321 UJ	0.0114 UJ	0.00351 UJ	0.0104 U	0.00439 UJ	-	0.000800	HH	0.00430	Eco
Dieldrin	0.000329 UJ	0.000294 UJ	**0.000982 J**	0.000303 UJ	0.00227 UJ	0.000331 UJ	0.00208 U	0.000414 UJ	-	0.0000520	HH	0.00350	HH
Endosulfan I	0.000543 UJ	0.000485 UJ	0.000562 U	0.000500 UJ	0.00114 UJ	0.000547 UJ	0.00104 U	0.000684 UJ	-	0.0560	Eco	0.0560	Eco
Endosulfan II	0.000412 UJ	0.000368 UJ	0.000426 U	0.000380 UJ	0.00227 UJ	0.000415 UJ	0.00208 U	0.000519 UJ	-	0.0560	Eco	0.0560	Eco
Endosulfan Sulfate	0.000585 UJ	0.000523 UJ	0.000605 U	0.000539 UJ	0.00227 UJ	0.000589 UJ	0.00208 U	0.000737 UJ	-	0.0510	Eco	0.0510	Eco
Endrin	0.000337 UJ	0.000301 UJ	0.000349 U	0.000311 UJ	0.00227 UJ	0.000340 UJ	0.00208 U	0.000425 UJ	-	0.0360	Eco	0.0360	Eco
Endrin Aldehyde	0.00106 UJ	0.000947 UJ	0.00110 U	0.000976 UJ	0.00227 UJ	0.00107 UJ	0.00208 U	0.00134 UJ	-	0.150	Eco	0.150	Eco
Endrin Ketone	0.000376 UJ	0.000335 UJ	0.000388 U	0.000346 UJ	0.00227 UJ	0.000378 UJ	0.00208 U	0.000473 UJ	-	0.0590	HH	11.0	HH
Heptachlor	0.000821 UJ	0.000733 UJ	0.000848 U	0.000756 UJ	0.00114 UJ	0.000826 UJ	0.00104 U	0.00103 UJ	-	0.0000790	HH	0.00380	Eco
Heptachlor Epoxide	0.000407 UJ	0.000364 UJ	0.000421 U	0.000375 UJ	0.00114 UJ	0.000410 UJ	0.00104 U	0.000513 UJ	-	0.0000390	HH	0.00380	Eco
Methoxychlor	0.000585 UJ	0.000522 UJ	0.000605 U	0.000539 UJ	0.0114 UJ	0.000589 UJ	0.0104 U	0.000737 UJ	-	0.0300	Eco	0.0300	Eco
Toxaphene	0.0127 UJ	0.0113 UJ	0.0131 U	0.0117 UJ	0.114 UJ	0.0128 UJ	0.104 U	0.0160 UJ	-	0.000280	HH	0.00200	Eco

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
mg/L = milligram per liter	J = The reported value is an estimate.
btc = below top of well casing	U = The analyte was not detected at or above the MDL.
Eco = Ecological	UJ = The analyte was not detected. The reported MDL is an estimate.
HH = Human Health	**bold** = analyte detected above MDL.
MDL = method detection limit	🟨 = The reported concentration exceeds the selected SLV
SLV = screening level value	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
- = Not Analyzed	

Table 5-2f
2001/2002 Phase II Supplimental Landfill Site Inspection
Groundwater Analytical Results
Volatile Organic Compounds
(Page 1 of 2)

Site ID	MW-01	MW-02	MW-03	MW-04*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	020501BIL02GW	020501BIL03GW	020501BIL05GW	020503BIL06GW				
Sample Date	5/1/2002	5/1/2002	5/1/2002	5/3/2002				
Sample Depth (Feet btc)	27.5	29.56	18.21	20.29				
Total Volatile Organic Compounds (µg/L)								
1,1,1,2-Tetrachloroethane	0.500 U	0.500 U	0.500 U	0.500 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	0.500 U	0.500 U	0.500 U	0.500 U	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.590	HH	0.230	HH
1,1-Dichloroethane	0.500 U	0.500 U	0.500 U	0.500 U	47.0	Eco	2.30	HH
1,1-Dichloroethene	0.500 U	0.500 U	0.500 U	0.500 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.430	HH
1,2,3-Trichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.000720	HH
1,2,4-Trichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.00630	HH
1,2-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	0.500 U	0.500 U	0.500 U	0.500 U	0.380	HH	0.140	HH
1,2-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500	HH	0.390	HH
2-Butanone (MEK)	-	-	-	-	14,000	Eco	7,100	HH
2-Chlorotoluene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	730	HH
2-Hexanone	2.50 U	2.50 U	2.50 U	2.50 U	99.0	Eco	47.0	HH
4-Chlorotoluene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	2,600	HH
4-Isopropyltoluene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
4-Methyl-2-pentanone (MIBK)	2.50 U	2.50 U	2.50 U	2.50 U	170	Eco	170	Eco
Acetone	2.50 U	2.50 U	2.50 U	2.50 U	1,500	Eco	1,500	Eco
Benzene	0.500 U	0.500 U	0.500 U	0.500 U	2.20	HH	0.390	HH
Bromobenzene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	88.0	HH
Bromochloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.550	HH	0.120	HH
Bromodichloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.550	HH	0.120	HH
Bromoform	0.500 U	0.500 U	0.500 U	0.500 U	4.30	HH	7.20	HH
Bromomethane	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	0.500 U	0.500 U	0.500 U	0.500 U	0.920	Eco	0.920	Eco
Carbon Tetrachloride	0.500 U	0.500 U	0.500 U	0.500 U	0.230	HH	0.190	HH
Chlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	50.0	Eco	50.0	Eco
Chloroethane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	21,000	HH
Chloroform	0.500 U	0.500 U	0.500 U	**1.78**	5.70	HH	0.190	HH
Chloromethane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	190	HH
cis-1,2-Dichloroethene	0.500 U	0.500 U	0.500 U	0.500 U	590	Eco	360	HH
cis-1,3-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.400	HH	0.680	HH
Dibromomethane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	8.20	HH
Dichlorodifluoromethane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	390	HH
Dichloromethane (Methylene Chloride)	0.500 U	0.500 U	0.500 U	0.500 U	4.60	HH	4.40	HH
Ethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	0.500 U	0.500 U	0.500 U	0.500 U	0.440	HH	0.860	HH
Isopropylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
m,p-Xylenes	1.00 U	1.00 U	1.00 U	1.00 U	13.0	Eco	13.0	Eco
Naphthalene	0.500 U	0.500 U	0.500 U	0.500 U	620	Eco	0.140	HH
n-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
n-Propylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
o-Xylene	0.500 U	0.500 U	0.500 U	0.500 U	350	Eco	350	Eco
sec-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
Styrene	0.500 U	0.500 U	0.500 U	0.500 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
Tetrachloroethene (PCE)	0.500 U	0.500 U	**8.78**	0.500 U	0.690	HH	0.0930	HH
Toluene	0.500 U	0.500 U	0.500 U	0.500 U	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	0.500 U	0.500 U	0.500 U	0.500 U	140	HH	110	HH
trans-1,3-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	0.500 U	0.500 U	0.500 U	0.500 U	2.50	HH	0.0390	HH
Trichlorofluoromethane	0.500 U	0.500 U	0.500 U	0.500 U	-	-	1,300	HH
Vinyl Acetate	2.50 U	2.50 U	2.50 U	2.50 U	16.0	Eco	16.0	Eco
Vinyl Chloride	0.500 U	0.500 U	0.500 U	0.500 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-2f
2001/2002 Phase II Supplimental Landfill Site Inspection
Groundwater Analytical Results
Volatile Organic Compounds
(Page 2 of 2)

Site ID	MW-05	MW-06	MW-07	MW-08	MW-09	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	020503BIL09GW	020503BIL08GW	020503BIL10GW	020501BIL01GW	020501BIL04GW				
Sample Date	5/3/2002	5/3/2002	5/3/2002	5/1/2002	5/1/2002				
Sample Depth (Feet btc)	24.87	31.06	20.44	58.45	21.08				
Total Volatile Organic Compounds (µg/L)									
1,1,1,2-Tetrachloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.590	HH	0.230	HH
1,1-Dichloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	47.0	Eco	2.30	HH
1,1-Dichloroethene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.430	HH
1,2,3-Trichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.000720	HH
1,2,4-Trichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	0.00630	HH
1,2-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.380	HH	0.140	HH
1,2-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500	HH	0.390	HH
2-Butanone (MEK)	-	-	2.50 U	-	-	14,000	Eco	7,100	HH
2-Chlorotoluene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	730	HH
2-Hexanone	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	99.0	Eco	47.0	HH
4-Chlorotoluene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	2,600	HH
4-Isopropyltoluene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
4-Methyl-2-pentanone (MIBK)	2.50 U	2.50 U	2.50 U	**3.04 J**	2.50 U	170	Eco	170	Eco
Acetone	**14.7**	2.50 U	**8.39**	**14.4**	**15.4**	1,500	Eco	1,500	Eco
Benzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	2.20	HH	0.390	HH
Bromobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	88.0	HH
Bromochloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.550	HH	0.120	HH
Bromodichloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.550	HH	0.120	HH
Bromoform	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	4.30	HH	7.20	HH
Bromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	0.500 U	0.500 U	0.500 U	0.500 U	**3.95**	0.920	Eco	0.920	Eco
Carbon Tetrachloride	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.230	HH	0.190	HH
Chlorobenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	50.0	Eco	50.0	Eco
Chloroethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	21,000	HH
Chloroform	0.500 U	0.500 U	0.500 U	0.500 U	**0.609 J**	5.70	HH	0.190	HH
Chloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	190	HH
cis-1,2-Dichloroethene	0.500 U	0.500 U	**0.791 J**	0.500 U	0.500 U	590	Eco	360	HH
cis-1,3-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.400	HH	0.680	HH
Dibromomethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	8.20	HH
Dichlorodifluoromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	390	HH
Dichloromethane (Methylene Chloride)	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	4.60	HH	4.40	HH
Ethylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.440	HH	0.860	HH
Isopropylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
m,p-Xylenes	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	13.0	Eco	13.0	Eco
Naphthalene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	620	Eco	0.140	HH
n-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
n-Propylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	7.30	Eco	7.30	Eco
o-Xylene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	350	Eco	350	Eco
sec-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
Styrene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	-	-
Tetrachloroethene (PCE)	0.500 U	0.500 U	0.500 U	0.500 U	**1.95**	0.690	HH	0.0930	HH
Toluene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	140	HH	110	HH
trans-1,3-Dichloropropene	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	2.50	HH	0.0390	HH
Trichlorofluoromethane	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	-	-	1,300	HH
Vinyl Acetate	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	16.0	Eco	16.0	Eco
Vinyl Chloride	**0.531 J**	0.500 U	**0.507 J**	0.500 U	0.500 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-2g
2001/2002 Phase II Supplimental Landfill Site Inspection Groundwater Analytical Results
Semivolatile Organic Compounds
(Page 1 of 2)

Site ID	MW-01	MW-02	MW-03	MW-04*	Selected Discharge to Surface Water / Bioaccumulation SLV	SLV Source	Selected Direct Contact SLV	SLV Source
Sample ID	020501BIL02GW	020501BIL03GW	020501BIL05GW	020503BIL06GW				
Sample Date	5/1/2002	5/1/2002	5/1/2002	5/3/2002				
Sample Depth (Feet btc)	27.5	29.56	18.21	20.29				
Total Semivolatile Organic Compounds (µg/L)								
1,2,4-Trichlorobenzene	0.0183 U	0.0197 U	0.0183 U	0.0100 U	35.0	HH	2.30	HH
1,2-Dichlorobenzene	0.0183 U	0.0197 U	0.0183 U	0.0160 U	14.0	Eco	14.0	Eco
1,3-Dichlorobenzene	0.0195 U	0.0209 U	0.0195 U	0.0170 U	71.0	Eco	0.420	HH
1,4-Dichlorobenzene	0.0172 U	0.0185 U	**0.0601 J**	0.0150 U	15.0	Eco	0.420	HH
2,4,5-Trichlorophenol	0.0126 U	0.0135 U	0.0126 U	0.0110 U	18.0	Eco	18.0	Eco
2,4,6-Trichlorophenol	0.0138 U	0.0148 U	0.0137 U	0.0120 U	1.40	HH	5.20	HH
2,4-Dichlorophenol	0.0172 U	0.0185 U	0.0172 U	0.0150 U	77.0	HH	110	HH
2,4-Dimethylphenol	0.0172 U	0.0185 U	0.0172 U	0.0150 U	42.0	Eco	42.0	Eco
2,4-Dinitrophenol	0.0344 U	0.0369 U	0.0344 U	0.0300 U	19.0	Eco	19.0	Eco
2,4-Dinitrotoluene	0.0149 U	0.0160 U	0.0149 U	0.0130 U	0.110	HH	0.220	HH
2,6-Dinitrotoluene	0.0229 U	0.0246 U	0.0229 U	0.0200 U	230	Eco	37.0	HH
2-Chloronaphthalene	0.00172 U	0.00185 U	0.00172 U	0.00150 U	32.0	Eco	32.0	Eco
2-Chlorophenol	0.0195 U	0.0209 U	0.0195 U	0.0170 U	81.0	HH	180	HH
2-Methylphenol	0.0275 U	0.0296 U	0.0275 U	0.0240 U	13.0	Eco	13.0	Eco
2-Nitroaniline	0.0206 U	0.0222 U	0.0206 U	0.0180 U	-	-	370	HH
2-Nitrophenol	0.0252 U	0.0271 U	0.0252 U	0.0220 U	10,000	HH	11,000	HH
3,3'-Dichlorobenzidine	0.0413 U	0.0443 U	0.0412 U	0.0360 U	0.0210	HH	0.130	HH
3-Nitroaniline	0.0378 U	0.0406 U	0.0378 U	0.0330 U	-	-	3.40	HH
4,6-Dinitro-2-methylphenol	0.0252 U	0.0271 U	0.0252 U	0.0220 U	13.0	HH	2.90	HH
4-Bromophenyl Phenyl Ether	0.0138 U	0.0148 U	0.0137 U	0.0120 U	1.50	Eco	1.50	Eco
4-Chloro-3-methylphenol	0.0619 U	0.0665 U	0.0619 U	0.0540 U	-	-	3700	HH
4-Chloroaniline	0.0447 U	0.0480 U	0.0447 U	0.0390 U	50.0	Eco	0.340	HH
4-Chlorophenyl Phenyl Ether	0.0172 U	0.0185 U	0.0172 U	0.0150 U	-	-	-	-
4-Nitroaniline	0.0241 U	0.0259 U	0.0241 U	0.0210 U	-	-	3.40	HH
4-Nitrophenol	0.0333 U	0.0357 U	0.0332 U	0.0290 U	150	Eco	150	Eco
Aniline	0.0573 U	0.0000616 U	0.0573 U	0.0500 U	2.20	Eco	2.20	Eco
Benzidine	0.0275 U	0.0296 U	0.0275 U	0.0240 U	0.0000860	HH	0.720	HH
Benzoic Acid	0.0229 U	0.0246 U	0.0229 U	0.0200 U	42.0	Eco	42.0	Eco
Benzyl Alcohol	0.0367 U	0.0394 U	0.0367 U	0.0320 U	8.60	Eco	8.60	Eco
Bis(2-chloroethoxy)methane	0.0206 U	0.0222 U	0.0206 U	0.0180 U	-	-	110	HH
Bis(2-chloroethyl) Ether	0.0218 U	0.0234 U	0.0218 U	0.0190 U	0.0300	HH	0.0120	HH
Bis(2-chloroisopropyl) Ether	0.0241 U	0.0259 U	0.0241 U	0.0210 U	1,400	HH	-	-
Bis(2-ethylhexyl) Phthalate	0.0745 U	0.0800 U	0.0745 U	**1.79**	1.20	HH	3.00	Eco
Butyl Benzyl Phthalate	0.214 U	0.230 U	0.214 U	0.187 U	19.0	Eco	19.0	Eco
Carbazole	0.00321 U	0.00345 U	0.00321 U	0.00280 U	-	-	-	-
Dibenzofuran	0.0161 U	0.0172 U	0.0160 U	0.0140 U	3.70	Eco	3.70	Eco
Diethyl Phthalate	0.0665 U	0.0714 U	0.0664 U	**0.192**	210	Eco	210	Eco
Dimethyl Phthalate	0.0183 U	0.0197 U	0.0183 U	0.0160 U	3.00	Eco	3.00	Eco
Di-n-butyl Phthalate	0.265 U	0.284 U	0.265 U	0.231 U	35.0	Eco	35.0	Eco
Di-n-octyl Phthalate	0.0390 U	0.0419 U	0.0389 U	**2.85**	1.20	HH	4.10	HH
Hexachlorobenzene	0.0229 U	0.0248 U	0.0229 U	0.0200 U	0.000280	HH	0.000300	Eco
Hexachlorobutadiene	0.0333 U	0.0357 U	0.0332 U	0.0290 U	0.440	HH	0.860	HH
Hexachlorocyclopentadiene	0.0298 U	0.0320 U	0.0298 U	0.0260 U	5.20	Eco	5.20	Eco
Hexachloroethane	0.0459 U	0.0493 U	0.0458 U	0.0400 U	1.40	HH	4.10	HH
Isophorone	**0.282**	**0.116 J**	0.0206 U	0.0180 U	35.0	HH	71.0	HH
Nitrobenzene	0.0516 U	0.0554 U	0.0515 U	0.0450 U	17.0	HH	0.120	HH
N-Nitrosodimethylamine	0.0378 U	0.0123 U	0.0378 U	0.0330 U	0.000690	HH	0.000420	HH
N-Nitrosodi-n-propylamine	0.0241 U	0.0259 U	0.0241 U	0.0210 U	0.00500	HH	0.00960	HH
N-Nitrosodiphenylamine	0.0115 U	0.0406 U	0.0115 U	0.0100 U	3.30	HH	14.0	HH
p-cresol (4-Methylphenol)	0.0264 U	0.0283 U	0.0263 U	0.0230 U	-	-	-	-
Pentachlorophenol	0.0195 U	0.0209 U	0.0195 U	0.0170 U	0.270	HH	0.470	HH
Phenol	0.0367 U	0.0394 U	0.0367 U	0.0320 U	110	Eco	110	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)								
2-Methylnaphthalene	**0.0385 J**	0.0185 U	0.0172 U	**0.233 J**	72.2	Eco	72.2	Eco
Acenaphthene	0.00183 U	0.00197 U	0.00183 U	0.00160 U	520	Eco	520	Eco
Acenaphthylene	0.00172 U	0.00185 U	0.00172 U	0.00150 U	307	Eco	0.140	HH
Anthracene	**0.0589**	0.00185 U	0.00172 U	0.00150 U	13.0	Eco	13.0	Eco
Fluorene	0.00161 U	0.00172 U	0.00160 U	0.00140 U	3.90	Eco	3.90	Eco
Naphthalene	**0.157**	0.00271 U	0.00252 U	**0.0400**	620	Eco	0.140	HH
Phenanthrene	**0.0800**	0.00271 U	0.00252 U	**0.211**	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)								
Benzo(a)anthracene	0.00505 U	0.00542 U	0.00504 U	0.00440 U	0.00380	HH	0.0270	Eco
Benzo(a)pyrene	0.00539 U	0.00579 U	0.00538 U	0.00470 U	0.00380	HH	0.00290	HH
Benzo(g,h,i)perylene	0.00390 U	0.00419 U	0.00389 U	0.00340 U	0.380	HH	0.290	HH
Benzofluoranthenes, Total	0.00436 U	0.00468 U	0.00435 U	0.00380 U	0.00380	HH	0.01400	Eco
Chrysene	0.00287 U	0.00308 U	0.00286 U	0.00250 U	0.00380	HH	2.04	Eco
Dibenz(a,h)anthracene	0.00310 U	0.00333 U	0.00309 U	0.00270 U	0.0180	HH	0.00290	HH
Fluoranthene	0.00218 U	0.00234 U	0.00218 U	0.00190 U	6.16	Eco	6.16	Eco
Indeno(1,2,3-cd)pyrene	0.00344 U	0.00369 U	0.00344 U	0.00300 U	0.00380	HH	0.0290	HH
Pyrene	0.00161 U	0.00172 U	0.00160 U	0.00140 U	10.1	Eco	10.1	Eco

Notes:

µg/L = microgram per liter	J = The reported value is an estimate.
btc = below top of well casing	U = The analyte was not detected at or above the MDL.
Eco = Ecological	UJ = The analyte was not detected. The reported MDL is an estimate.
HH = Human Health	**bold** = analyte detected above MDL.
MDL = method detection limit	🟨 = The reported concentration exceeds the selected SLV
SLV = screening level value	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
- = Not Analyzed	
-- = SLV for analyte not available	

Table 5-2g
2001/2002 Phase II Supplimental Landfill Site Inspection Groundwater Analytical Results
Semivolatile Organic Compounds
(Page 2 of 2)

Site ID	MW-05	MW-06	MW-07	MW-08	MW-09	Selected Discharge to Surface Water / Bioaccumulation SLV	SLV Source	Selected Direct Contact SLV	SLV Source
Sample ID	020503BIL09GW	020503BIL08GW	020503BIL10GW	020501BIL01GW	020501BIL04GW				
Sample Date	5/3/2002	5/3/2002	5/3/2002	5/1/2002	5/1/2002				
Sample Depth (Feet btc)	24.87	31.06	20.44	58.45	21.08				
Total Semivolatile Organic Compounds (µg/L)									
1,2,4-Trichlorobenzene	0.0179 U	0.184 U	0.0170 U	0.0160 UJ	0.227 U	35.0	HH	2.30	HH
1,2-Dichlorobenzene	0.0179 U	0.184 U	0.0170 U	0.0160 UJ	0.227 U	14.0	Eco	14.0	Eco
1,3-Dichlorobenzene	0.0191 U	0.196 U	0.0181 U	0.0170 UJ	0.241 U	71.0	Eco	0.420	HH
1,4-Dichlorobenzene	**0.0258 J**	0.173 U	0.0160 U	0.0150 UJ	0.213 U	15.0	Eco	0.420	HH
2,4,5-Trichlorophenol	0.0123 U	0.127 U	0.0117 U	0.0110 U	0.156 U	18.0	Eco	18.0	Eco
2,4,6-Trichlorophenol	0.0135 U	0.138 U	0.0128 U	0.0120 U	0.170 U	1.40	HH	5.20	HH
2,4-Dichlorophenol	0.0168 U	0.173 U	0.0160 U	0.0150 U	0.213 U	77.0	HH	110	HH
2,4-Dimethylphenol	0.0168 U	0.173 U	0.0160 U	0.0150 U	0.213 U	42.0	Eco	42.0	Eco
2,4-Dinitrophenol	0.0336 U	0.345 U	0.0319 U	0.0300 U	0.426 U	19.0	Eco	19.0	Eco
2,4-Dinitrotoluene	0.0146 U	0.150 U	0.0138 U	0.0130 UJ	0.185 U	0.110	HH	0.220	HH
2,6-Dinitrotoluene	0.0224 U	0.230 U	0.0213 U	0.0200 UJ	0.284 U	230	Eco	37.0	HH
2-Chloronaphthalene	0.00168 U	0.0173 U	0.00160 U	0.00150 UJ	0.0213 U	32.0	Eco	32.0	Eco
2-Chlorophenol	0.0191 U	0.196 U	0.0181 U	0.0170 U	0.241 U	81.0	HH	180	HH
2-Methylphenol	0.0269 U	0.276 U	0.0256 U	0.0240 U	0.341 U	13.0	Eco	13.0	Eco
2-Nitroaniline	0.0202 U	0.207 U	0.0192 U	0.0180 UJ	0.256 U	-	-	370	HH
2-Nitrophenol	0.0247 U	0.253 U	0.0234 U	0.0220 U	0.313 U	10,000	HH	11,000	HH
3,3'-Dichlorobenzidine	0.0404 U	0.414 U	0.0383 U	0.0360 UJ	0.511 U	0.0210	HH	0.130	HH
3-Nitroaniline	0.0370 U	0.380 U	0.0351 U	0.0330 UJ	0.469 U	-	-	3.40	HH
4,6-Dinitro-2-methylphenol	0.0247 U	0.253 U	0.0234 U	0.0220 U	0.313 U	13.0	HH	2.90	HH
4-Bromophenyl Phenyl Ether	0.0135 U	0.138 U	0.0128 U	0.0120 UJ	0.284 U	1.50	Eco	1.50	Eco
4-Chloro-3-methylphenol	0.0605 U	0.621 U	0.0575 U	0.0539 U	0.767 U	-	-	3700	HH
4-Chloroaniline	0.0437 U	0.449 U	0.0415 U	0.0390 UJ	0.554 U	50.0	Eco	0.340	HH
4-Chlorophenyl Phenyl Ether	0.0168 U	0.173 U	0.0160 U	0.0150 UJ	0.213 U	-	-	-	-
4-Nitroaniline	0.0235 U	0.242 U	0.0224 U	0.0210 UJ	0.298 U	-	-	3.40	HH
4-Nitrophenol	0.0325 U	-	0.0309 U	0.0290 U	0.412 U	150	Eco	150	Eco
Aniline	0.0561 U	0.575 U	0.0532 U	0.0500 UJ	0.710 U	2.20	Eco	2.20	Eco
Benzidine	0.0269 U	0.276 U	0.0252 U	0.0240 UJ	0.341 U	0.0000860	HH	0.720	HH
Benzoic Acid	0.0224 U	0.230 U	0.0213 U	0.0200 UJ	0.284 U	42.0	Eco	42.0	Eco
Benzyl Alcohol	0.0359 U	0.398 U	0.0341 U	0.0320 U	0.455 U	8.60	Eco	8.60	Eco
Bis(2-chloroethoxy)methane	0.0202 U	0.207 U	0.0192 U	0.0180 UJ	0.256 U	-	-	110	HH
Bis(2-chloroethyl) Ether	0.0213 U	0.219 U	0.0202 U	0.0190 UJ	0.270 U	0.0300	HH	0.0120	HH
Bis(2-chloroisopropyl) Ether	0.0235 U	0.242 U	0.0224 U	0.0210 UJ	0.298 U	1,400	HH	-	-
Bis(2-ethylhexyl) Phthalate	0.0729 U	0.748 U	0.0692 U	0.0649 UJ	0.923 U	1.20	HH	3.00	Eco
Butyl Benzyl Phthalate	0.210 U	2.15 U	0.199 U	0.187 UJ	2.66 U	19.0	Eco	19.0	Eco
Carbazole	0.00314 U	0.0322 U	0.00298 U	0.00280 UJ	0.0398 U	-	-	-	-
Dibenzofuran	0.0157 U	0.161 U	0.0149 U	0.0140 UJ	0.199 U	3.70	Eco	3.70	Eco
Diethyl Phthalate	0.0650 U	**1.90**	0.0618 U	0.0579 UJ	**1.03 J**	210	Eco	210	Eco
Dimethyl Phthalate	0.0179 U	0.184 U	0.0170 U	**0.235 J**	0.227 U	3.00	Eco	3.00	Eco
Di-n-butyl Phthalate	0.259 U	2.66 U	0.246 U	0.231 UJ	3.28 U	35.0	Eco	35.0	Eco
Di-n-octyl Phthalate	0.0381 U	**5.29**	0.0362 U	0.0340 UJ	**7.08**	1.20	HH	4.10	HH
Hexachlorobenzene	0.0224 U	0.230 U	0.0213 U	0.0200 UJ	0.284 U	0.000280	HH	0.000300	Eco
Hexachlorobutadiene	0.0325 U	0.334 U	0.0309 U	0.0290 UJ	0.412 U	0.440	HH	0.860	HH
Hexachlorocyclopentadiene	0.0291 U	0.229 U	0.0277 U	0.0260 UJ	0.369 U	5.20	Eco	5.20	Eco
Hexachloroethane	0.0448 U	0.460 U	0.0426 U	0.0400 UJ	0.568 U	1.40	HH	4.10	HH
Isophorone	0.0202 U	0.207 U	0.0192 U	0.0180 UJ	0.256 U	35.0	HH	71.0	HH
Nitrobenzene	0.0504 U	0.518 U	0.0479 U	0.0450 UJ	0.639 U	17.0	HH	0.120	HH
N-Nitrosodimethylamine	0.0370 U	0.380 U	0.0351 U	0.00330 UJ	0.469 U	0.000690	HH	0.000420	HH
N-Nitrosodi-n-propylamine	0.0235 U	0.242 U	0.0224 U	0.0210 UJ	0.298 U	0.00500	HH	0.00960	HH
N-Nitrosodiphenylamine	0.0112 U	0.115 U	0.0106 U	0.00999 UJ	0.142 U	3.30	HH	14.0	HH
p-cresol (4-Methylphenol)	0.0258 U	0.265 U	0.0245 U	0.0230 U	0.327 U	-	-	-	-
Pentachlorophenol	0.0191 U	0.196 U	0.0181 U	0.0170 U	0.241 U	0.270	HH	0.470	HH
Phenol	0.0359 U	**0.382 J**	0.0341 U	0.0320 U	0.455 U	110	Eco	110	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)									
2-Methylnaphthalene	0.0168 U	0.173 U	**0.0939 J**	0.0150 UJ	**0.360 J**	72.2	Eco	72.2	Eco
Acenaphthene	**0.111**	0.0184 U	0.00170 U	0.00160 UJ	**0.239**	520	Eco	520	Eco
Acenaphthylene	0.00168 U	0.0173 U	0.00160 U	0.00150 UJ	0.0213 U	307	Eco	0.140	HH
Anthracene	0.00168 U	0.0173 U	0.00160 U	0.00150 UJ	0.0213 U	13.0	Eco	13.0	Eco
Fluorene	0.00157 U	0.0161 U	0.00149 U	0.00140 UJ	0.0199 U	3.90	Eco	3.90	Eco
Naphthalene	**0.101**	0.0253 U	0.00234 U	0.00220 UJ	0.0313 U	620	Eco	0.140	HH
Phenanthrene	0.00247 U	0.0253 U	0.00234 U	0.00220 UJ	0.0313 U	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)									
Benzo(a)anthracene	*0.00493 U*	*0.0506 U*	*0.00426 U*	*0.00440 UJ*	*0.0625 U*	0.00380	HH	0.0270	Eco
Benzo(a)pyrene	0.00527 U	0.0541 U	0.00501 U	0.00470 UJ	0.0668 U	0.00380	HH	0.00290	HH
Benzo(g,h,i)perylene	*0.00381 U*	*0.0391 U*	*0.00362 U*	*0.00340 UJ*	*0.0483 U*	0.380	HH	0.290	HH
Benzofluoranthenes, Total	0.00426 U	0.0437 U	0.00405 U	0.00380 UJ	0.0540 U	0.00380	HH	0.01400	Eco
Chrysene	*0.00280 U*	*0.0288 U*	*0.00266 U*	*0.00250 UJ*	*0.0355 U*	0.00380	HH	2.04	Eco
Dibenz(a,h)anthracene	0.00303 U	0.0311 U	0.00288 U	0.00270 UJ	0.0384 U	0.0180	HH	0.00290	HH
Fluoranthene	0.00213 U	0.0219 U	0.00202 U	0.00190 UJ	0.0270 U	6.16	Eco	6.16	Eco
Indeno(1,2,3-cd)pyrene	0.00336 U	0.0345 U	0.00319 U	0.00300 UJ	0.0426 U	0.00380	HH	0.0290	HH
Pyrene	0.00157 U	0.0161 U	0.00149 U	0.00140 UJ	0.0199 U	10.1	Eco	10.1	Eco

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-3a
2007 Upland Source Evaluation Soil Analytical Results
PCB Aroclors, Metals, and Pesticides

Site ID	BIL01USE	BIL02USE	BIL03USE	BIL04USE	BIL05USE	BIL06USE	BIL07USE	BIL08USE	BIL09USE	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	070410BIL01SS	070410BIL02SS	070410BIL03SS	070410BIL04SS	070410BIL05SS	070410BIL06SS	070410BIL07SS	070410BIL08SS	070410BIL09SS		
Sample Date	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007		
Sample Depth (Feet bgs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
PCB Aroclors (µg/kg dry)											
Aroclor 1016	*3.90 U*	*3.90 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.80 U*	371	Eco
Aroclor 1221	*3.90 U*	*3.90 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.80 U*	371	Eco
Aroclor 1232	*3.90 U*	*3.90 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.80 U*	371	Eco
Aroclor 1242	*3.90 U*	*3.90 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.90 U*	*3.90 U*	*4.00 U*	*3.80 U*	371	Eco
Aroclor 1248	3.90 U	3.90 U	3.90 U	3.90 U	4.00 U	3.90 U	3.90 U	4.00 U	3.80 U	371	Eco
Aroclor 1254	**26.0**	**27.0**	**19.0**	**8.30**	4.00 U	19.0 U	**49.0**	**24.0**	**5.50**	371	Eco
Aroclor 1260	**50.0**	**24.0**	**31.0 J**	**33.0**	**12.0**	**92.0**	**74.0**	**42.0**	**19.0**	371	Eco
Total PCBs as Aroclors (NDs at MDL)[1]	**79.9 J**	**54.9 J**	**53.9 J**	**45.2 J**	**20.0 J**	**115 J**	**127 J**	**70.0 J**	**28.3 J**	371	Eco
Metals (mg/kg dry)											
Aluminum	**17,400 J**	**19,100 J**	**17,400 J**	**10,500 J**	**10,800 J**	**11,200 J**	**14,800 J**	**15,500 J**	**16,000 J**	31,400	UPL
Antimony	0.300 UJ	0.200 UJ	0.200 UJ	0.200 UJ	0.200 UJ	0.200 UJ	0.300 UJ	0.300 UJ	0.300 UJ	0.270	Eco
Arsenic	**5.10**	**6.10**	**6.20**	**3.70**	**3.30**	**4.00**	**3.20**	**3.70**	**4.50**	5.40	UPL
Barium	**136**	**99.3**	**95.1**	**115**	**120**	**115**	**107**	**97.8**	**130**	330	Eco
Beryllium	**0.400**	**0.400**	**0.500**	**0.300**	**0.300**	**0.300**	**0.300**	**0.400**	**0.400**	21.0	Eco
Cadmium	**0.540**	**0.660**	**0.940**	**0.570**	**0.570**	**1.30**	**0.720**	**0.670**	**1.70**	0.360	Eco
Calcium	**6,920**	**6,680**	**6,710**	**4,770**	**4,500**	**4,380**	**6,060**	**5,840**	**5,410**	10,400	UPL
Chromium	**28.6**	**30.1**	**23.0**	**15.6**	**16.1**	**16.9**	**801**	**117**	**22.0**	28.1	UPL
Cobalt	**15.3 J**	**9.60 J**	**11.5 J**	**6.60 J**	**6.40 J**	**8.30 J**	**22.7 J**	**10.7 J**	**8.50 J**	19.9	UPL
Copper	**54.9**	**45.7**	**45.4**	**28.4**	**24.4**	**60.5**	**41.3**	**52.1**	**39.1**	56.7	UPL
Iron	**28,000 J**	**28,000 J**	**32,100 J**	**19,600 J**	**19,600 J**	**20,500 J**	**38,800 J**	**26,400 J**	**25,100 J**	36,900	UPL
Lead	**119 J**	**147 J**	**131 J**	**51.0 J**	**49.0 J**	**148 J**	**680 J**	**174 J**	**127 J**	25.5	UPL
Magnesium	**6,500**	**6,160**	**6,950**	**4,260**	**4,330**	**4,830**	**35,100**	**9,550**	**5,580**	12,400	UPL
Manganese	**405 J**	**408 J**	**450 J**	**273 J**	**263 J**	**284 J**	**614 J**	**391 J**	**366 J**	885	UPL
Mercury	**0.190**	**0.290**	**0.0700**	**0.0700**	**0.230**	**0.320**	**0.130**	**0.100**	**0.110**	0.0660	UPL
Nickel	**30.0**	**21.0**	**20.0**	**15.0**	**15.0**	**15.0**	**570**	**72.0**	**21.0**	38.0	Eco
Potassium	**1,280**	**1,220**	**1,360**	**1,480**	**1,570**	**1,400**	**1,060**	**1,210**	**1,870**	2,050	UPL
Selenium	**0.300**	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.300 U	0.300 U	0.300 U	0.520	Eco
Silver	**0.300**	**0.300**	**0.200**	0.200 U	**0.400**	**0.500**	0.300 U	0.300 U	0.300 U	4.20	Eco
Sodium	**530**	**570**	**530**	**460**	**480**	**430**	**420**	**550**	**560**	341	UPL
Thallium	0.300 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.300 U	0.300 U	0.300 U	1.00	Eco
Vanadium	**48.6**	**56.3**	**53.3**	**36.3**	**36.0**	**36.0**	**34.8**	**44.8**	**42.6**	104	UPL
Zinc	**151**	**143**	**157**	**138**	**144**	**221**	**194**	**180**	**189**	71.7	UPL
Pesticides (µg/kg dry)											
4,4'-DDD	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.80 U	2.00 U	1.90 U	21.0	Eco
4,4'-DDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.80 U	2.00 U	1.90 U	21.0	Eco
4,4'-DDT	**13.0**	**14.0**	**14.0**	5.00 U	2.00 U	**23.0**	**28.0**	**17.0**	**6.40**	21.0	Eco
Aldrin	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	4.90	Eco
BHC (alpha)	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	340	HH
BHC (beta)	0.990 U	0.980 U	0.980 U	6.80 U	0.990 U	0.980 U	12.0 U	3.50 U	0.970 U	960	HH
BHC (delta)	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	340	HH
BHC (gamma) Lindane	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	2,000	HH
Chlordane (alpha)	5.50 U	2.40 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	3.60 U	0.970 U	7,200	HH
Chlordane (gamma)	5.10 U	0.980 U	0.980 U	3.00 U	0.990 U	0.980 U	14.0 U	4.30 U	0.970 U	7,200	HH
Dieldrin	**2.10**	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U	8.00 U	2.00 U	1.90 U	4.90	Eco
Endosulfan I	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	20,000	Eco
Endosulfan II	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.80 U	2.00 U	1.90 U	20,000	Eco
Endosulfan Sulfate	2.00 U	2.00 U	8.00 U	2.00 U	2.00 U	2.00 U	3.80 U	2.00 U	1.90 U	20,000	Eco
Endrin	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	10.0 U	2.00 U	1.90 U	4.90	Eco
Endrin Aldehyde	2.00 U	2.00 U	10.0 U	5.50 U	2.00 U	5.40 U	5.80 U	5.10 U	1.90 U	4.90	Eco
Endrin Ketone	2.00 U	5.30 U	2.00 U	2.00 U	2.00 U	2.00 U	17.0 U	2.00 U	1.90 U	4.90	Eco
Heptachlor	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	480	HH
Heptachlor Epoxide	0.990 U	0.980 U	0.980 U	0.980 U	0.990 U	0.980 U	1.90 U	0.990 U	0.970 U	240	HH
Methoxychlor	9.90 U	9.80 U	9.80 U	9.80 U	9.90 U	9.80 U	19.0 U	9.90 U	9.70 U	500,000	Eco
Toxaphene	99.0 U	98.0 U	98.0 U	98.0 U	99.0 U	98.0 U	190 U	99.0 U	97.0 U	2,000	HH

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value

[1] Only Aroclors 1248, 1254, and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Landfill AOPC soil samples.
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV

Table 5-3b
2007 Upland Source Evaluation Soil Analytical Results
Semivolatile Organic Compounds

Site ID	BIL01USE	BIL02USE	BIL03USE	BIL04USE	BIL05USE	BIL06USE	BIL07USE	BIL08USE	BIL09USE	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	070410BIL01SS	070410BIL02SS	070410BIL03SS	070410BIL04SS	070410BIL05SS	070410BIL06SS	070410BIL07SS	070410BIL08SS	070410BIL09SS		
Sample Date	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007	4/10/2007		
Sample Depth (Feet bgs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Semivolatile Organic Compounds (µg/kg dry)											
1,2,4-Trichlorobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	20,000	Eco
1,2-Dichlorobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	2,260	Eco
1,3-Dichlorobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	2,260	Eco
1,4-Dichlorobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	17,000	HH
2,4,5-Trichlorophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	4,000	Eco
2,4,6-Trichlorophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	10,000	Eco
2,4-Dichlorophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	20,000	Eco
2,4-Dimethylphenol	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	20,000	Eco
2,4-Dinitrophenol	200 U	200 U	200 U	200 U	200 U	200 U	590 U	200 U	200 U	20,000	Eco
2,4-Dinitrotoluene	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	5,500	HH
2,6-Dinitrotoluene	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	240,000	HH
2-Chloronaphthalene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	82,000,000	HH
2-Chlorophenol	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	60,000	Eco
2-Methylphenol	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	50,000	Eco
2-Nitroaniline	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	6,000,000	HH
2-Nitrophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	180,000,000	HH
3,3'-Dichlorobenzidine	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	4,800	HH
3-Nitroaniline	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	70,000	Eco
4,6-Dinitro-2-methylphenol	200 U	200 U	200 U	200 U	200 U	200 U	590 U	200 U	200 U	49,000	HH
4-Bromophenyl Phenyl Ether	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	-	-
4-Chloro-3-methylphenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	62,000,000	HH
4-Chloroaniline	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	8,600	HH
4-Chlorophenyl Phenyl Ether	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	-	-
4-Nitroaniline	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	40,000	Eco
4-Nitrophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	7,000	Eco
Benzoic Acid	200 U	200 U	200 U	200 U	200 U	**130 J**	590 U	200 U	**140 J**	200,000	Eco
Benzyl Alcohol	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	**14.0 J**	2,260	Eco
Bis(2-chloroethoxy)methane	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	730,000	Eco
Bis(2-chloroethyl) Ether	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	1,000	HH
Bis(2-chloroisopropyl) Ether	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	1,000	HH
Bis(2-ethylhexyl) Phthalate	**140**	**140**	**170**	**97.0**	**92.0**	**150**	**420**	**280**	**140**	4,500	Eco
Butyl Benzyl Phthalate	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	450	Eco
Carbazole	**14.0 J**	**21.0**	**18.0 J**	**78.0**	20.0 U	**21.0**	**210**	**35.0**	**16.0 J**	2,260	Eco
Dibenzofuran	20.0 U	20.0 U	20.0 U	**31.0**	20.0 U	20.0 U	**36.0 J**	20.0 U	20.0 U	2.00	Eco
Diethyl Phthalate	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	100,000	Eco
Dimethyl Phthalate	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	150,000	HH
Di-n-butyl Phthalate	20.0 U	20.0 U	20.0 U	**99.0**	**15.0 J**	**1,800**	59.0 U	20.0 U	**70.0**	450	Eco
Di-n-octyl Phthalate	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	450	Eco
Hexachlorobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	1,800	HH
Hexachlorobutadiene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	22,000	HH
Hexachlorocyclopentadiene	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	10,000	Eco
Hexachloroethane	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	150,000	HH
Isophorone	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	1,800,000	HH
Nitrobenzene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	8,000	Eco
N-Nitrosodimethylamine	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	34.0	HH
N-Nitrosodi-n-propylamine	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	250	HH
N-Nitrosodiphenylamine	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	20,000	Eco
p-cresol (4-Methylphenol)	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	50,000	Eco
Pentachlorophenol	99.0 U	98.0 U	98.0 U	99.0 U	99.0 U	99.0 U	300 U	98.0 U	99.0 U	2,100	Eco
Phenol	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)											
2-Methylnaphthalene	20.0 U	20.0 U	20.0 U	**11.0 J**	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	4,100,000	HH
Acenaphthene	**16.0 J**	**23.0**	**15.0 J**	**170**	20.0 U	**24.0**	**270**	**46.0**	20.0 U	19,000,000	HH
Acenaphthylene	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	23,000	HH
Anthracene	**35.0**	**65.0**	**30.0**	**180**	**15.0 J**	**34.0**	**740**	**110**	**30.0**	93,000,000	HH
Fluorene	20.0 U	**12.0 J**	20.0 U	**73.0**	20.0 U	**13.0 J**	**140**	**24.0**	**10.0 J**	12,000,000	HH
Naphthalene	20.0 U	20.0 U	20.0 U	**20.0**	20.0 U	20.0 U	59.0 U	20.0 U	20.0 U	23,000	HH
Phenanthrene	**180**	**300**	**200**	**1,500**	**66.0**	**180**	**3,000**	**550**	**160**	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**279 J**	**424 J**	**290 J**	**1,963 J**	**141 J**	**277 J**	**4,268 J**	**770 J**	**230 J**	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)											
Benzo(a)anthracene	**530**	**960**	**330**	**1,000**	**78.0**	**250**	**4,500**	**1,000**	**180**	2,700	HH
Benzo(a)pyrene	**600**	**1,200**	**360**	**1,600**	**85.0**	**240**	**6,200**	**1,300**	**140**	270	HH
Benzo(b)fluoranthene	**680**	**1,200**	**420**	**1,600**	**110**	**310**	**8,200**	**1,500**	**170**	2,700	HH
Benzo(g,h,i)perylene	**280**	**530**	**210**	**870**	**67.0**	**160**	**1,800**	**480**	**75.0**	27,000	HH
Benzo(k)fluoranthene	**450**	**1,100**	**310**	**1,200**	**77.0**	**220**	**2,500**	**990**	**130**	27,000	HH
Chrysene	**670**	**1,200**	**450**	**1,300**	**96.0**	**280**	**5,900**	**1,400**	**190**	270,000	HH
Dibenz(a,h)anthracene	**71.0**	**150**	**55.0**	**240**	**29.0**	**76.0**	**730**	**160**	**18.0 J**	270	HH
Fluoranthene	**1,300**	**2,100**	**580**	**2,700**	**150**	**460**	**14,000**	**2,800**	**300**	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**270**	**510**	**200**	**780**	**58.0**	**160**	**2,100**	**530**	**74.0**	2,700	HH
Pyrene	**1,200**	**2,400**	**730**	**3,100**	**130**	**360**	**9,100**	**2,900**	**240 J**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**6,051**	**11,350**	**3,645**	**14,390**	**880.0**	**2,516**	**55,030**	**13,060**	**1,517 J**	1,100	Eco

Notes:

µg/kg = microgram per kilogram	UPL = Reference Area Upper Prediction Limit
mg/kg = milligram per kilogram	- = Not Analyzed
bgs = below ground surface	-- = SLV for analyte not available
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV

Table 5-4a
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage Area
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 1 of 2)

Site ID	DSA01	DSA02	DSA03	DSA04	DSA05	DSA06	DSA07	DSA08	DSA09	DSA10	DSA11*	DSA12*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA01SS	011204DSA02SS	011204DSA03SS	011204DSA04SS	011204DSA05SS	011204DSA06SS	011204DSA07SS	011204DSA08SS	011204DSA09SS	011204DSA10SS	011204DSA11SS	011204DSA12SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PCB Aroclors (µg/kg dry)														
Aroclor 1016	1.20 U	1.09 U	1.22 U	1.24 U	1.08 U	1.22 U	1.14 U	1.09 U	1.22 U	1.19 U	1.21 U	1.25 U	371	Eco
Aroclor 1221	5.13 U	4.66 U	5.23 U	5.29 U	4.63 U	5.22 U	4.87 U	4.68 U	5.21 U	5.10 U	5.19 U	5.51 U	371	Eco
Aroclor 1232	4.09 U	3.72 U	4.18 U	4.22 U	3.69 U	4.17 U	3.89 U	3.73 U	4.16 U	4.07 U	4.15 U	4.28 U	371	Eco
Aroclor 1242	2.19 U	1.99 U	2.23 U	2.26 U	1.97 U	2.23 U	2.08 U	2.00 U	2.22 U	2.17 U	2.22 U	2.29 U	371	Eco
Aroclor 1248	5.44 U	4.94 U	5.55 U	5.62 U	4.91 U	5.54 U	5.17 U	4.96 U	5.53 U	5.41 U	5.51 U	5.70 U	371	Eco
Aroclor 1254	1.70 U	1.54 U	1.73 U	1.75 U	1.53 U	1.73 U	1.61 U	1.55 U	1.73 U	1.69 U	1.72 U	1.78 U	371	Eco
Aroclor 1260	**2.00 J**	1.54 U	**2.23 J**	**2.08 J**	**7.79 J**	**16.8**	1.61 U	1.55 U	**2.12 J**	**2.48 J**	**21.1**	**8.30 J**	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**3.70 J**	3.08 U	**3.96 J**	**3.83 J**	**9.32 J**	**18.5 J**	3.22 U	3.10 U	**3.85 J**	**4.17 J**	**22.7 J**	**10.1 J**	371	Eco
Metals (mg/kg dry)														
Aluminum	**4,160 J**	**5,570 J**	**5,440 J**	**7,310 J**	**5,840 J**	**5,860 J**	**5,180 J**	**6,020 J**	**6,350 J**	**5,550 J**	**4,710 J**	**9,340 J**	31,400	UPL
Antimony	2.99 U	2.83 U	3.38 U	**1.83 J**	**1.65 J**	3.08 U	2.96 U	3.19 U	3.29 U	3.11 U	**5.08**	3.17 U	0.270	Eco
Arsenic	**4.42**	**3.82**	**5.75**	**3.70**	**6.74**	**8.19**	**53.7**	**7.24**	**6.86**	**7.39**	**42.7**	**6.99**	5.40	UPL
Barium	**35.5**	**129**	**89.6**	**67.3**	**27.7**	**63.9**	**73.4**	**49.9**	**49.6**	**65.2**	**61.0**	**82.4**	330	Eco
Beryllium	0.180 U	**0.169 J**	0.182 U	**0.193 J**	0.169 U	**0.179 J**	0.160 U	**0.229 J**	0.177 U	0.168 U	0.169 U	**0.236 J**	21.0	Eco
Cadmium	**0.897**	**0.836**	**1.50**	**0.741**	**0.779**	**1.05**	**0.676**	**0.962**	**0.908**	**0.963**	**1.42**	**1.23**	0.360	Eco
Calcium	**2,980 J**	**4,240 J**	**3,430**	**3,620 J**	**4,180 J**	**4,940 J**	**2,910 J**	**4,550 J**	**4,110 J**	**4,430 J**	**7,315 J**	**4,610 J**	10,400	UPL
Chromium	**8.14**	**5.46**	**10.6 J**	**12.2**	**54.1**	**8.30**	**12.8**	**10.1**	**7.46**	**17.2**	**1,365**	**48.8**	28.1	UPL
Cobalt	**9.99**	**12.1**	**8.75**	**8.45**	**12.7**	**11.1**	**9.09**	**13.5**	**12.1**	**13.6**	**23.7**	**12.6**	19.9	UPL
Copper	**17.0**	**16.1**	**26.8**	**21.9**	**27.4**	**24.9**	**54.9**	**21.6**	**16.0**	**13.2**	**158**	**42.9**	56.7	UPL
Iron	**18,600**	**21,700**	**16,800 J**	**18,100**	**28,600**	**20,600**	**18,500**	**25,300**	**25,200**	**24,100**	**40,450**	**22,150**	36,900	UPL
Lead	**42.7**	**13.8**	**43.8 J**	**14.8**	**29.9**	**37.6**	**8.58**	**114**	**35.8**	**37.8**	**344**	**144**	25.5	UPL
Magnesium	**2,690 J**	**3,510 J**	**4,350 J**	**4,140 J**	**6,150 J**	**2,980 J**	**2,310 J**	**3,790 J**	**4,120 J**	**4,510 J**	**42,250 J**	**5,600 J**	12,400	UPL
Manganese	**270 J**	**385 J**	**234 J**	**235 J**	**289 J**	**367 J**	**259 J**	**484 J**	**313 J**	**324 J**	**711 J**	**464 J**	885	UPL
Mercury	**0.170**	**0.0951**	**0.0325 J**	**0.0313 J**	**0.0525**	0.0306 U	**0.0616**	0.0256 U	**0.294**	**0.393**	**0.0818**	**0.0389 J**	0.0660	UPL
Nickel	**4.79**	**5.73**	**13.6 J**	**12.1**	**23.5**	**6.81**	**6.22**	**7.71**	**5.79**	**10.4**	**477**	**33.3**	38.0	Eco
Potassium	**669**	**716**	**445 J**	**515**	**348 J**	**822**	**751**	**857**	**475**	**722**	**476 J**	**684**	2,050	UPL
Selenium	0.385 U	0.365 U	0.435 U	0.370 U	0.405 U	**0.478 J**	0.381 U	0.411 U	0.423 U	0.401 U	0.403 U	**0.424 J**	0.520	Eco
Silver	**0.149 J**	**0.149 J**	**0.198 J**	**0.162 J**	**0.119 J**	**0.155 J**	**0.103 J**	**0.145 J**	**0.142 J**	**0.165 J**	**0.214 J**	**0.163 J**	4.20	Eco
Sodium	162 U	137 U	163 U	139 U	152 U	149 U	143 U	154 U	159 U	150 U	151 U	153 U	341	UPL
Thallium	**0.239 J**	**0.136 J**	**0.229 J**	**0.105 J**	**0.0691 J**	**0.0913 J**	**0.117 J**	**0.122 J**	**0.102 J**	**0.150 J**	**0.0771 J**	**0.0969 J**	1.00	Eco
Vanadium	**41.6**	**47.9**	**39.4**	**42.9**	**69.0**	**41.6**	**37.9**	**49.4**	**64.2**	**69.7**	**30.5**	**52.6**	104	UPL
Zinc	**30.3 J**	**34.7 J**	**46.1**	**45.9 J**	**85.3 J**	**53.7 J**	**32.6 J**	**39.9 J**	**39.8 J**	**38.6 J**	**552 J**	**96.8 J**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)														
Diesel Range Organics	**34.4**	13.4 U	13.6 U	13.1 U	13.5 U	**21.0 J**	**13.5 J**	12.5 U	**16.0 J**	**22.7 J**	**91.0**	**51.3**	23,000	HH
Residual Range Organics	**191**	26.9 U	**55.6**	**34.7 J**	**28.0 J**	**125**	26.9 U	24.9 U	**38.2 J**	**66.9**	**378**	**115**	40,000	HH
Gasoline Range Organics	4.35 U	4.18 U	4.43 U	4.26 U	4.03 U	4.55 U	4.34 U	4.23 U	4.60 U	**3.49 J**	4.41 U	4.46 U	13,000	HH
Butyltins (µg/kg dry)														
Dibutyltin	-	-	-	-	-	-	-	-	-	-	**74.3**	-	28,000	Eco
Monobutyltin	-	-	-	-	-	-	-	-	-	-	**55.6**	-	28,000	Eco
Tetrabutyltin	-	-	-	-	-	-	-	-	-	-	0.471 U	-	28,000	Eco
Tributyltin	-	-	-	-	-	-	-	-	-	-	**409**	-	28,000	Eco

Table 5-4a
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage Area
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Herbicides, and Pesticides
(Page 2 of 2)

Site ID	DSA01	DSA02	DSA03	DSA04	DSA05	DSA06	DSA07	DSA08	DSA09	DSA10	DSA11*	DSA12*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA01SS	011204DSA02SS	011204DSA03SS	011204DSA04SS	011204DSA05SS	011204DSA06SS	011204DSA07SS	011204DSA08SS	011204DSA09SS	011204DSA10SS	011204DSA11SS	011204DSA12SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Herbicides (µg/kg dry)														
2,4,5-T	1.36 U	1.37 U	1.54 U	1.50 U	1.26 U	1.52 U	1.34 U	1.53 U	1.32 U	1.47 U	1.58 U	1.56 U	21.0	Eco
2,4,5-TP (Silvex)	1.98 U	2.00 U	2.26 U	2.20 U	1.84 U	2.22 U	1.96 U	2.24 U	1.93 U	2.15 U	2.31 U	2.29 U	21.0	Eco
2,4-D	0.512 U	0.516 U	0.582 U	5.68 U	0.476 U	0.573 U	0.506 U	0.579 U	0.499 U	0.556 U	0.596 U	0.591 U	21.0	Eco
2,4-DB	0.871 U	0.878 U	0.990 U	0.568 U	0.809 U	0.974 U	0.860 U	0.985 U	0.849 U	0.946 U	1.01 U	1.00 U	21.0	Eco
4-Nitrophenol	1.37 U	1.38 U	1.56 U	1.52 U	1.27 U	1.53 U	1.35 U	1.55 U	1.34 U	1.49 U	1.60 U	1.58 U	7,000	Eco
Dalapon	1.89 U	1.91 U	2.15 U	2.10 U	1.76 U	2.12 U	1.87 U	2.14 U	1.85 U	2.06 U	2.20 U	2.18 U	18,000,000	HH
Dicamba	1.51 U	1.52 U	1.71 U	1.67 U	1.40 U	1.69 U	1.49 U	1.71 U	1.47 U	1.64 U	1.76 U	1.74 U	18,000,000	HH
Dichloroprop	0.662 U	0.667 U	0.752 U	0.733 U	0.614 U	0.740 U	0.653 U	0.748 U	0.645 U	0.718 U	0.770 U	0.763 U	21.0	Eco
Dinoseb	0.512 U	0.516 U	0.582 U	0.568 U	0.476 U	0.573 U	0.506 U	0.579 U	0.499 U	0.556 U	0.596 U	0.591 U	620,000	HH
MCPA	0.936 U	0.943 U	1.06 U	1.04 U	0.868 U	1.05 U	0.923 U	1.06 U	0.912 U	1.02 U	1.09 U	1.08 U	21.0	Eco
MCPP	1.70 U	1.71 U	1.93 U	1.88 U	1.58 U	1.90 U	1.68 U	1.92 U	1.66 U	1.85 U	1.98 U	1.96 U	21.0	Eco
Pentachlorophenol	0.725 U	0.730 U	0.824 U	0.803 U	0.673 U	0.810 U	0.715 U	0.819 U	0.706 U	0.787 U	0.843 U	0.836 U	2,100	Eco
Pesticides (µg/kg dry)														
4,4'-DDD	0.192 U	0.207 U	0.217 U	0.201 U	0.185 U	0.219 U	0.201 U	0.209 U	0.203 U	0.206 U	0.386 U	2.25 U	21.0	Eco
4,4'-DDE	0.227 U	0.245 U	0.257 U	**0.604 J**	0.219 U	0.260 U	0.238 U	0.247 U	0.240 U	0.243 U	0.457 U	**2.44 J**	21.0	Eco
4,4'-DDT	**0.436 J**	0.275 U	**3.09**	**4.39**	**0.478 J**	0.292 U	0.268 U	0.278 U	0.270 U	0.274 U	0.514 U	🟨 **22.2 J**	21.0	Eco
Aldrin	0.425 U	0.458 U	0.482 U	0.446 U	0.410 U	0.487 U	0.446 U	0.436 U	0.450 U	0.456 U	0.856 U	1.12 U	4.90	Eco
BHC (alpha)	0.306 U	0.330 U	0.347 U	0.321 U	0.295 U	0.350 U	0.321 U	0.333 U	0.324 U	0.329 U	0.617 U	1.12 U	340	HH
BHC (beta)	0.417 U	0.450 U	0.473 U	0.438 U	0.402 U	0.477 U	0.438 U	0.454 U	0.441 U	0.448 U	0.840 U	1.12 U	960	HH
BHC (delta)	0.378 UJ	0.408 UJ	0.429 UJ	0.397 UJ	0.365 UJ	0.433 U	0.397 U	0.412 U	0.400 U	0.406 U	0.762 U	1.12 U	340	HH
BHC (gamma) Lindane	0.377 U	0.406 U	0.427 U	0.395 U	0.363 U	0.431 U	0.395 U	0.410 U	0.398 U	**2.17**	0.759 U	1.12 U	2,000	HH
Chlordane (technical)	1.39 U	1.50 U	1.57 U	1.46 U	1.34 U	1.59 U	1.46 U	1.51 U	1.47 U	1.49 U	2.79 U	11.2 U	7,200	HH
Dieldrin	0.323 U	0.348 U	**0.823 J**	**0.428 J**	0.312 U	0.370 U	0.339 U	0.352 U	0.342 U	0.347 U	0.651 U	2.25 U	4.90	Eco
Endosulfan I	0.420 U	0.452 U	0.476 U	0.441 U	0.405 U	0.480 U	0.440 U	0.457 U	0.444 U	0.450 U	0.845 U	1.12 U	20,000	Eco
Endosulfan II	0.381 U	0.411 U	0.432 U	0.400 U	0.367 U	0.436 U	0.400 U	0.415 U	0.403 U	0.409 U	**0.960 J**	2.25 U	20,000	Eco
Endosulfan Sulfate	**0.577 J**	0.387 U	0.406 U	0.377 U	0.346 U	0.410 U	0.376 U	0.390 U	0.379 U	0.385 U	0.722 U	2.25 U	20,000	Eco
Endrin	0.356 UJ	0.383 UJ	0.403 UJ	0.373 UJ	0.343 UJ	0.407 U	0.373 U	0.387 U	0.376 U	0.382 U	0.716 U	2.25 U	4.90	Eco
Endrin Aldehyde	0.402 U	0.433 U	0.455 U	**2.02 J**	0.387 U	0.460 U	0.422 U	0.437 U	0.425 U	0.431 U	0.809 U	2.25 U	4.90	Eco
Endrin Ketone	0.277 U	0.299 U	0.314 U	0.291 U	0.367 U	0.317 U	0.291 U	0.301 U	0.293 U	**1.87 J**	**2.53 J**	**3.61 J**	4.90	Eco
Heptachlor	0.339 U	0.366 U	0.385 U	0.356 U	0.327 U	0.388 U	0.356 U	0.369 U	0.359 U	0.364 U	0.683 U	1.12 U	480	HH
Heptachlor Epoxide	0.360 U	0.388 U	0.408 U	0.378 U	0.347 U	0.412 U	0.378 U	0.392 U	0.381 U	0.386 U	0.725 U	1.12 U	240	HH
Methoxychlor	1.36 U	1.46 U	1.54 U	1.42 U	1.31 U	1.55 U	1.42 U	1.48 U	1.44 U	1.46 U	2.73 U	11.2 U	500,000	Eco
Toxaphene	6.18 U	6.66 U	7.00 U	6.48 U	5.95 U	7.07 U	6.48 U	6.72 U	6.53 U	6.63 U	12.4 U	112 U	2,000	HH

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4b
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage and Sandblast Areas
Volatile Organic Compounds
(Page 1 of 2)

Site ID	DSA01	DSA02	DSA03	DSA04	DSA05	DSA06	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA01SS	011204DSA02SS	011204DSA03SS	011204DSA04SS	011204DSA05SS	011204DSA06SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0		
Volatile Organic Compounds (µg/kg dry)								
1,1,1,2-Tetrachloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	9,300	HH
1,1,1-Trichloroethane (TCA)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	38,000,000	HH
1,1,2,2-Tetrachloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,800	HH
1,1,2-Trichloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,700	HH
1,1-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5,900	HH
1,1-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	680,000	HH
1,1-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	8,100	HH
1,2,3-Trichlorobenzene	2.00 U	2.00 U	3.00 U	2.00 U	2.00 U	2.00 U	20,000	Eco
1,2,3-Trichloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	95.0	HH
1,2,4-Trichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20,000	Eco
1,2,4-Trimethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	200,000	Eco
1,2-Dibromo-3-chloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	69.0	HH
1,2-Dibromoethane (EDB)	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	140	HH
1,2-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
1,2-Dichloroethane (EDC)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	590	HH
1,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	4,500	HH
1,3,5-Trimethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	150,000	HH
1,3-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
1,3-Dichloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	20,000,000	HH
1,4-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	17,000	HH
2,2-Dichloropropane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4,500	HH
2-Butanone (MEK)	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	200,000,000	HH
2-Chlorotoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20,000,000	HH
2-Hexanone	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	1,250,000	Eco
4-Chlorotoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	72,000,000	HH
4-Isopropyltoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	200,000	Eco
4-Methyl-2-pentanone (MIBK)	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1,250,000	Eco
Acetone	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	1,250,000	Eco
Benzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,200	HH
Bromobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800,000	HH
Bromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,900	HH
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,900	HH
Bromoform	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	360,000	HH
Bromomethane	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	17,000	HH
Carbon Disulfide	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1,000,000	Eco
Carbon Tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	630	HH
Chlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	40,000	Eco
Chloroethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	61,000,000	HH
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	410	HH
Chloromethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	300,000	HH
cis-1,2-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500,000	Eco
cis-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	8,100	HH
Dibromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	34,000	HH
Dibromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	110,000	HH
Dichlorodifluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	730,000	Eco
Dichloromethane (Methylene Chloride)	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	20,000	HH
Ethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
Hexachlorobutadiene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	22,000	HH
Isopropylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
m,p-Xylenes	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	120,000	Eco
Naphthalene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	23,000	HH
n-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	-	-
n-Propylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
o-Xylene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,000	Eco
sec-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
Styrene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	300,000	Eco
tert-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,260	Eco
Tetrachloroethene (PCE)	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,600	HH
Toluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	200,000	Eco
trans-1,2-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	200,000	HH
trans-1,3-Dichloropropene	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	8,100	HH
Trichloroethene (TCE)	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	130	HH
Trichlorofluoromethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	730,000	Eco
Vinyl Acetate	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	4,100,000	HH
Vinyl Chloride	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4b
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage and Sandblast Areas
Volatile Organic Compounds
(Page 2 of 2)

Site ID	DSA07	DSA08	DSA09	DSA10	DSA11*	DSA12*	SBB18	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA07SS	011204DSA08SS	011204DSA09SS	011204DSA10SS	011204DSA11SS	011204DSA12SS	011205SBB20SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/5/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0	2.5		
Volatile Organic Compounds (µg/kg dry)									
1,1,1,2-Tetrachloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1,200 U	9,300	HH
1,1,1-Trichloroethane (TCA)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,800 U	38,000,000	HH
1,1,2,2-Tetrachloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,500 U	2,800	HH
1,1,2-Trichloroethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,500 U	2,700	HH
1,1-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	5,900	HH
1,1-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3,000 U	680,000	HH
1,1-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	8,100	HH
1,2,3-Trichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,800 U	20,000	Eco
1,2,3-Trichloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,800 U	95.0	HH
1,2,4-Trichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	20,000	Eco
1,2,4-Trimethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**12,000**	200,000	Eco
1,2-Dibromo-3-chloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3,800 U	69.0	HH
1,2-Dibromoethane (EDB)	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1,800 U	140	HH
1,2-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	2,260	Eco
1,2-Dichloroethane (EDC)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,800 U	590	HH
1,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	4,500	HH
1,3,5-Trimethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**6,500**	150,000	HH
1,3-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	2,260	Eco
1,3-Dichloropropane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,500 U	20,000,000	HH
1,4-Dichlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	17,000	HH
2,2-Dichloropropane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,500 U	4,500	HH
2-Butanone (MEK)	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	12,000 U	200,000,000	HH
2-Chlorotoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	20,000,000	HH
2-Hexanone	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	10.0 UJ	7,500 U	1,250,000	Eco
4-Chlorotoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	72,000,000	HH
4-Isopropyltoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	200,000	Eco
4-Methyl-2-pentanone (MIBK)	10.0 U	10.0 U	10.0 U	10.0 U	2.00 U	10.0 U	10,000 U	1,250,000	Eco
Acetone	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	15.0 U	10,000 U	1,250,000	Eco
Benzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	1,200	HH
Bromobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	1,800,000	HH
Bromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,900 U	1,900	HH
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	1,900	HH
Bromoform	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,500 U	360,000	HH
Bromomethane	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	6,200 UJ	17,000	HH
Carbon Disulfide	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2,500 UJ	1,000,000	Eco
Carbon Tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,500 U	630	HH
Chlorobenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	40,000	Eco
Chloroethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	6,200 UJ	61,000,000	HH
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1,800 U	410	HH
Chloromethane	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	5,000 UJ	300,000	HH
cis-1,2-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	2,500,000	Eco
cis-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	8,100	HH
Dibromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,500 U	34,000	HH
Dibromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2,800 U	110,000	HH
Dichlorodifluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	4,200 U	730,000	Eco
Dichloromethane (Methylene Chloride)	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	2.00 U	1,200 U	20,000	HH
Ethylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	2,260	Eco
Hexachlorobutadiene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	22,000	HH
Isopropylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3,000 U	2,260	Eco
m,p-Xylenes	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	**7,400**	120,000	Eco
Naphthalene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	23,000	HH
n-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	-	-
n-Propylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,800 U	2,260	Eco
o-Xylene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**3,200 J**	1,000	Eco
sec-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	2,260	Eco
Styrene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2,500 U	300,000	Eco
tert-Butylbenzene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 U	2,260	Eco
Tetrachloroethene (PCE)	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**3.10 J**	**420,000**	1,600	HH
Toluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**39,000**	200,000	Eco
trans-1,2-Dichloroethene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3,000 U	200,000	HH
trans-1,3-Dichloropropene	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	1,800 U	8,100	HH
Trichloroethene (TCE)	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**3,200 J**	130	HH
Trichlorofluoromethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1,800 UJ	730,000	Eco
Vinyl Acetate	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	6,200 U	4,100,000	HH
Vinyl Chloride	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3,800 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4c
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage Area
Semivolatile Organic Compounds
(Page 1 of 2)

Site ID	DSA01	DSA02	DSA03	DSA04	DSA05	DSA06	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA01SS	011204DSA02SS	011204DSA03SS	011204DSA04SS	011204DSA05SS	011204DSA06SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0		
Semivolatile Organic Compounds (µg/kg dry)								
1,2,4-Trichlorobenzene	1.02 U	0.972 U	1.09 U	1.17 U	1.16 U	1.24 U	20,000	Eco
1,2-Dichlorobenzene	1.26 U	1.21 U	1.35 U	1.46 U	1.43 U	1.54 U	2,260	Eco
1,3-Dichlorobenzene	1.72 U	1.64 U	1.84 U	1.98 U	1.95 U	2.09 U	2,260	Eco
1,4-Dichlorobenzene	1.96 U	1.87 U	2.10 U	2.26 U	2.23 U	2.39 U	17,000	HH
2,4,5-Trichlorophenol	2.21 U	2.11 U	2.36 U	2.54 U	2.51 U	2.68 U	4,000	Eco
2,4,6-Trichlorophenol	1.63 UJ	1.56 UJ	1.74 UJ	1.88 UJ	1.85 UJ	1.98 UJ	10,000	Eco
2,4-Dichlorophenol	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	20,000	Eco
2,4-Dimethylphenol	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	20,000	Eco
2,4-Dinitrophenol	2.95 U	2.81 U	3.15 U	3.39 U	3.34 U	3.58 U	20,000	Eco
2,4-Dinitrotoluene	1.60 U	1.52 U	1.70 U	1.84 U	1.81 U	1.94 U	5,500	HH
2,6-Dinitrotoluene	2.21 UJ	2.11 UJ	2.36 UJ	2.54 UJ	2.51 UJ	2.68 UJ	240,000	HH
2-Chloronaphthalene	0.368 U	0.351 U	0.393 U	0.424 U	0.418 U	0.447 U	82,000,000	HH
2-Chlorophenol	1.84 U	1.76 U	1.97 U	2.12 U	2.09 U	2.24 U	60,000	Eco
2-Methylphenol	1.47 U	1.40 U	1.57 U	1.70 U	1.67 U	1.79 U	50,000	Eco
2-Nitroaniline	1.60 U	1.52 U	1.70 U	1.84 U	1.81 U	1.94 U	6,000,000	HH
2-Nitrophenol	1.72 U	1.64 U	1.84 U	1.98 U	1.95 U	2.09 U	180,000,000	HH
3,3'-Dichlorobenzidine	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	4,800	HH
3-Nitroaniline	2.09 U	1.99 U	2.23 U	2.40 U	2.37 U	2.53 U	70,000	Eco
4,6-Dinitro-2-methylphenol	1.51 U	4.33 U	4.85 U	5.23 U	5.15 U	5.52 U	49,000	HH
4-Bromophenyl Phenyl Ether	1.63 U	1.56 U	1.74 U	1.88 U	1.85 U	1.98 U	-	-
4-Chloro-3-methylphenol	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	62,000,000	HH
4-Chloroaniline	1.14 U	1.09 U	1.22 U	1.31 U	1.30 U	1.39 U	8,600	HH
4-Chlorophenyl Phenyl Ether	2.06 U	1.97 U	2.20 U	2.37 U	2.34 U	2.50 U	-	-
4-Nitroaniline	2.09 U	1.99 U	2.23 U	2.40 U	2.37 U	2.53 U	40,000	Eco
4-Nitrophenol	2.33 U	2.22 U	2.49 U	2.69 U	2.65 U	2.83 U	7,000	Eco
Aniline	6.14 U	5.85 U	6.56 U	7.07 U	6.96 U	7.45 U	200,000	Eco
Benzidine	2.32 UJ	2.21 UJ	2.48 UJ	2.67 UJ	2.63 UJ	2.82 UJ	55,000	HH
Benzoic Acid	**88.5 J**	**38.5 J**	4.46 U	**50.6 J**	**40.8 J**	**26.7 J**	200,000	Eco
Benzyl Alcohol	2.58 U	2.46 U	2.75 U	2.97 U	2.92 U	3.13 U	2,260	Eco
Bis(2-chloroethoxy)methane	1.47 U	1.40 U	1.57 U	1.70 U	1.67 U	1.79 U	730,000	Eco
Bis(2-chloroethyl) Ether	2.34 UJ	2.24 UJ	2.50 UJ	2.70 UJ	2.66 UJ	2.85 UJ	1,000	HH
Bis(2-chloroisopropyl) Ether	3.19 UJ	3.04 UJ	3.41 UJ	3.68 UJ	3.62 UJ	3.88 UJ	1,000	HH
Bis(2-ethylhexyl) Phthalate	61.7 UJ	29.3 U	48.1 UJ	35.3 U	**1,040**	160 UJ	4,500	Eco
Butyl Benzyl Phthalate	2.33 U	2.22 U	2.49 U	2.69 U	**9.05 J**	2.83 U	450	Eco
Carbazole	4.79 U	4.57 U	5.11 U	5.51 U	5.43 U	5.81 U	2,260	Eco
Dibenzofuran	1.42 U	**1.40 J**	1.52 U	1.64 U	**1.67 J**	**2.24 J**	2.00	Eco
Diethyl Phthalate	2.09 U	1.99 U	2.23 U	2.40 U	2.37 U	2.53 U	100,000	Eco
Dimethyl Phthalate	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	150,000	HH
Di-n-butyl Phthalate	61.4 UJ	58.5 UJ	65.6 UJ	70.7 UJ	141 UJ	130 UJ	450	Eco
Di-n-octyl Phthalate	3.19 U	3.04 U	3.41 U	3.68 U	3.62 U	3.88 U	450	Eco
Hexachlorobenzene	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	1,800	HH
Hexachlorobutadiene	1.10 U	1.05 U	1.18 U	1.27 U	1.25 U	1.34 U	22,000	HH
Hexachlorocyclopentadiene	1.73 UJ	1.65 UJ	1.85 UJ	1.99 UJ	1.96 UJ	2.10 UJ	10,000	Eco
Hexachloroethane	2.33 U	2.22 U	2.49 U	2.69 U	2.65 U	2.83 U	150,000	HH
Isophorone	1.72 U	1.64 U	1.84 U	1.98 U	1.95 U	2.09 U	1,800,000	HH
Nitrobenzene	1.68 U	1.60 U	1.80 U	1.94 U	1.91 U	2.04 U	8,000	Eco
N-Nitrosodimethylamine	1.35 U	1.29 U	1.05 U	1.56 U	1.53 U	1.64 U	34.0	HH
N-Nitrosodi-n-propylamine	1.35 U	1.29 U	1.44 U	1.56 U	1.53 U	1.64 U	250	HH
N-Nitrosodiphenylamine	0.982 U	0.937 U	1.44 U	1.13 U	1.11 U	1.19 U	20,000	Eco
p-cresol (4-Methylphenol)	1.82 U	1.73 U	1.94 U	2.09 U	2.06 U	2.21 U	-	-
Pentachlorophenol	2.58 UJ	2.46 UJ	2.75 UJ	2.97 UJ	2.92 UJ	3.13 UJ	2,100	Eco
Phenol	2.45 U	2.34 U	2.62 U	2.83 U	2.79 U	2.98 U	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)								
2-Methylnaphthalene	0.191 U	0.183 U	0.205 U	0.221 U	0.217 U	**2.98**	4,100,000	HH
Acenaphthene	0.607 U	**6.44**	0.649 U	0.700 U	**4.46**	0.738 U	19,000,000	HH
Acenaphthylene	0.535 U	0.510 U	**3.67**	0.616 U	0.607 U	0.650 U	23,000	HH
Anthracene	**1.72**	**4.21**	**5.25**	0.356 U	**9.19**	**11.3**	93,000,000	HH
Fluorene	0.573 U	**2.46**	**3.02**	0.660 U	**3.06**	**7.01**	12,000,000	HH
Naphthalene	0.574 U	0.548 U	**1.70**	0.662 U	**1.95**	**4.17**	23,000	HH
Phenanthrene	**5.64**	**19.4**	**21.8**	**5.80**	**31.3**	**49.8**	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**9.50 J**	**33.5 J**	**36.1 J**	**8.79 J**	**50.6 J**	**73.6 J**	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)								
Benzo(a)anthracene	0.749 U	**15.0**	**15.6**	**3.96**	**66.6**	**29.5**	2,700	HH
Benzo(a)pyrene	**10.2**	**20.4**	**20.3**	**7.49**	**151**	**43.5**	270	HH
Benzo(g,h,i)perylene	0.202 U	**9.72**	0.216 U	0.233 U	**107**	0.246 U	27,000	HH
Benzofluoranthenes, Total	**13.5**	**26.3**	**35.8**	**10.2**	**175**	**74.2**	2,700	HH
Chrysene	**6.50**	**16.3**	**22.8**	**6.36**	**68.4**	**45.9**	270,000	HH
Dibenz(a,h)anthracene	0.286 U	0.273 U	0.306 U	0.329 U	**25.8**	0.347 U	270	HH
Fluoranthene	**8.47**	**31.6**	**35.4**	**10.0**	**75.9**	**62.9**	8,900,000	HH
Indeno(1,2,3-cd)pyrene	0.286 U	**11.1**	**14.3**	**3.68**	**97.8**	0.347 U	2,700	HH
Pyrene	**11.0**	**31.0**	**32.3**	**10.0**	**83.8**	**68.6**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**37.0 J**	**135 J**	**141 J**	**42.0 J**	**676**	**251 J**	1,100	Eco

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4c
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Drum Storage Area
Semivolatile Organic Compounds
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Site ID	DSA07	DSA08	DSA09	DSA10	DSA11*	DSA12*	SBB18	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204DSA07SS	011204DSA08SS	011204DSA09SS	011204DSA10SS	011204DSA11SS	011204DSA12SS	011205SBB20SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/5/2001		
Sample Depth (Feet bgs)	0.0	0.0	0.0	0.0	0.0	0.0	2.5		
Semivolatile Organic Compounds (µg/kg dry)									
1,2,4-Trichlorobenzene	1.08 U	1.01 U	1.20 U	12.1 U	10.6 U	1.32 U	-	20,000	Eco
1,2-Dichlorobenzene	1.34 U	1.26 U	1.49 U	15.1 U	13.1 U	1.64 U	-	2,260	Eco
1,3-Dichlorobenzene	1.82 U	1.71 U	2.02 U	20.5 U	17.8 U	2.22 U	-	2,260	Eco
1,4-Dichlorobenzene	2.08 U	1.95 U	2.31 U	23.4 U	20.4 U	2.54 U	-	17,000	HH
2,4,5-Trichlorophenol	2.34 U	2.20 U	2.60 U	26.3 UJ	25.9 U	2.86 U	-	4,000	Eco
2,4,6-Trichlorophenol	1.73 UJ	1.63 UJ	1.92 UJ	19.5 UJ	19.1 UJ	2.11 UJ	-	10,000	Eco
2,4-Dichlorophenol	1.43 U	1.34 U	1.59 U	16.1 UJ	15.8 U	1.75 U	-	20,000	Eco
2,4-Dimethylphenol	1.43 U	1.34 U	1.59 U	16.1 UJ	15.8 U	1.75 U	-	20,000	Eco
2,4-Dinitrophenol	3.12 U	2.93 U	3.46 U	35.1 UJ	34.5 U	3.81 U	-	20,000	Eco
2,4-Dinitrotoluene	1.69 U	1.59 U	1.88 U	19.0 U	16.5 U	2.07 U	-	5,500	HH
2,6-Dinitrotoluene	2.34 UJ	2.20 UJ	2.60 UJ	26.3 UJ	22.9 UJ	2.86 UJ	-	240,000	HH
2-Chloronaphthalene	0.390 U	0.367 U	0.433 U	4.39 U	3.82 U	0.477 U	-	82,000,000	HH
2-Chlorophenol	1.95 U	1.83 U	2.17 U	21.9 UJ	21.5 U	2.38 U	-	60,000	Eco
2-Methylphenol	1.56 U	1.47 U	1.73 U	17.6 UJ	17.2 U	1.91 U	-	50,000	Eco
2-Nitroaniline	1.69 U	1.59 U	1.88 U	19.0 U	16.5 U	2.07 U	-	6,000,000	HH
2-Nitrophenol	1.82 U	1.71 U	2.02 U	20.5 UJ	20.1 U	2.22 U	-	180,000,000	HH
3,3'-Dichlorobenzidine	1.43 U	1.34 U	1.59 U	16.1 U	14.0 U	1.75 U	-	4,800	HH
3-Nitroaniline	2.21 U	2.08 U	2.45 U	24.9 U	21.6 U	2.70 U	-	70,000	Eco
4,6-Dinitro-2-methylphenol	4.81 U	4.52 U	5.34 U	54.1 UJ	53.2 U	5.88 U	-	49,000	HH
4-Bromophenyl Phenyl Ether	1.73 U	1.63 U	1.92 U	19.5 U	16.9 U	2.11 U	-	-	-
4-Chloro-3-methylphenol	1.43 U	1.34 U	1.59 U	16.1 UJ	15.8 U	1.75 U	-	62,000,000	HH
4-Chloroaniline	1.21 U	1.14 U	1.34 U	13.6 U	11.8 U	1.48 U	-	8,600	HH
4-Chlorophenyl Phenyl Ether	2.19 U	2.05 U	2.43 U	24.6 U	21.4 U	2.67 U	-	-	-
4-Nitroaniline	2.21 U	2.08 U	2.45 U	24.9 U	21.6 U	2.70 U	-	40,000	Eco
4-Nitrophenol	2.47 U	2.32 U	2.74 U	27.8 UJ	27.3 U	3.02 U	-	7,000	Eco
Aniline	6.50 U	6.11 U	7.22 U	73.2 U	63.7 U	7.95 U	-	200,000	Eco
Benzidine	2.46 UJ	2.31 UJ	2.73 UJ	27.7 UJ	24.1 UJ	3.00 UJ	-	55,000	HH
Benzoic Acid	4.42 U	4.15 U	**15.3 J**	49.7 U	43.3 U	5.40 U	-	200,000	Eco
Benzyl Alcohol	2.73 U	2.57 U	3.03 U	30.7 U	26.7 U	3.34 U	-	2,260	Eco
Bis(2-chloroethoxy)methane	1.56 U	1.47 U	1.73 U	17.6 U	15.3 U	1.91 U	-	730,000	Eco
Bis(2-chloroethyl) Ether	2.48 UJ	2.33 UJ	2.76 UJ	27.9 UJ	24.3 UJ	3.04 UJ	-	1,000	HH
Bis(2-chloroisopropyl) Ether	3.38 UJ	3.18 UJ	3.75 UJ	38.0 UJ	33.1 UJ	4.13 UJ	-	1,000	HH
Bis(2-ethylhexyl) Phthalate	32.5 U	88.6 UJ	151 UJ	366 U	**20,100**	**1,500**	**21,600 J**	4,500	Eco
Butyl Benzyl Phthalate	2.47 U	**3.67 J**	2.74 U	27.8 U	**125 J**	**15.7 J**	-	450	Eco
Carbazole	5.07 U	4.77 U	5.63 UJ	57.1 U	**157 J**	**240 J**	-	2,260	Eco
Dibenzofuran	1.51 U	1.42 U	**3.03 J**	17.0 U	**35.4 J**	**141 J**	**485 J**	2.00	Eco
Diethyl Phthalate	2.21 U	2.08 U	2.45 U	24.9 U	21.6 U	2.70 U	-	100,000	Eco
Dimethyl Phthalate	1.43 U	1.34 U	1.59 U	16.1 U	14.0 U	1.75 U	-	150,000	HH
Di-n-butyl Phthalate	65.0 UJ	61.1 UJ	72.2 UJ	127 UJ	637 UJ	131 UJ	-	450	Eco
Di-n-octyl Phthalate	3.38 U	3.18 U	**11.3 J**	38.0 U	33.1 U	**31.0**	-	450	Eco
Hexachlorobenzene	1.43 U	1.34 U	1.59 U	16.1 U	14.0 U	1.75 U	-	1,800	HH
Hexachlorobutadiene	1.17 U	1.10 U	1.30 U	13.2 U	11.5 U	1.43 U	-	22,000	HH
Hexachlorocyclopentadiene	1.83 UJ	1.72 UJ	2.04 UJ	20.6 UJ	17.9 UJ	2.24 UJ	-	10,000	Eco
Hexachloroethane	2.47 U	2.32 U	2.74 U	27.8 U	24.2 U	3.02 U	-	150,000	HH
Isophorone	1.82 U	1.71 U	2.02 U	20.5 U	17.8 U	2.22 U	-	1,800,000	HH
Nitrobenzene	1.78 U	1.67 U	1.98 U	20.0 U	17.4 U	2.18 U	-	8,000	Eco
N-Nitrosodimethylamine	1.43 U	1.34 U	1.59 U	16.1 U	14.0 U	1.75 U	-	34.0	HH
N-Nitrosodi-n-propylamine	1.43 U	1.34 U	1.59 U	16.1 U	14.0 U	1.75 U	-	250	HH
N-Nitrosodiphenylamine	1.04 U	0.977 U	1.15 U	11.7 U	10.2 U	1.27 U	-	20,000	Eco
p-cresol (4-Methylphenol)	1.93 U	1.81 U	2.14 U	21.7 UJ	21.3 U	2.35 U	-	-	-
Pentachlorophenol	2.73 UJ	2.57 UJ	3.03 UJ	30.7 UJ	30.2 UJ	3.34 UJ	-	2,100	Eco
Phenol	2.60 U	2.44 U	2.89 U	29.3 UJ	28.7 U	3.18 U	-	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)									
2-Methylnaphthalene	0.203 U	0.191 U	0.225 U	2.28 U	**22.9**	**150**	**124 J**	4,100,000	HH
Acenaphthene	**2.60**	**2.81**	**15.4**	**29.3**	**132**	**470**	**3,200 J**	19,000,000	HH
Acenaphthylene	0.567 U	0.533 U	0.629 U	6.38 U	**27.6**	**87.7**	**295 J**	23,000	HH
Anthracene	**2.08**	**2.20**	**18.0**	**80.5**	**304**	**822**	**2,040 J**	93,000,000	HH
Fluorene	**1.69**	**1.83**	**7.65**	**24.9**	**94.6**	**463**	**779 J**	12,000,000	HH
Naphthalene	0.609 U	0.572 U	0.676 U	6.85 U	**26.9**	**227**	**256 J**	23,000	HH
Phenanthrene	**11.3**	**13.6**	**59.0**	**345**	**1,054**	**3,020**	**6,550 J**	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**18.8 J**	**21.5 J**	**101 J**	**492 J**	**1,639**	**5,089**	**13,120 J**	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)									
Benzo(a)anthracene	**7.28**	**16.5**	**46.3**	**398**	**1,640**	**1,325**	**12,300 J**	2,700	HH
Benzo(a)pyrene	**14.0**	**25.4**	**52.0**	**435**	**2,045**	**1,580**	**11,700 J**	270	HH
Benzo(g,h,i)perylene	**6.89**	**13.7**	**21.2**	**195**	**1,015**	**559**	**3,350 J**	27,000	HH
Benzofluoranthenes, Total	**17.8**	**36.3**	**72.2**	**682**	**2,835**	**1,850**	**16,300 J**	2,700	HH
Chrysene	**9.89**	**20.3**	**56.6**	**465**	**1,640**	**1,620**	**12,000 J**	270,000	HH
Dibenz(a,h)anthracene	0.303 U	0.285 U	0.336 U	3.41 U	**418**	**216**	**1,080 J**	270	HH
Fluoranthene	**19.0**	**27.2**	**98.2**	**806**	**2,290**	**2,610**	**28,600 J**	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**7.02**	**14.3**	**21.1**	**202**	**998**	**547**	**4,170 J**	2,700	HH
Pyrene	**21.2**	**35.1**	**106**	**844**	**2,480**	**3,485**	**32,000 J**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**85.6 J**	**153 J**	**402 J**	**3,348 J**	**12,525**	**11,941**	**105,200 J**	1,100	Eco

Notes:

µg/kg = microgram per kilogram	-- = SLV for analyte not available
bgs = below ground surface	U = The analyte was not detected at or above the MDL.
Eco = Ecological	UJ = The analyte was not detected. The reported MDL is an estimate.
HH = Human Health	**bold** = analyte detected above MDL.
MDL = method detection limit	🟨 = The reported concentration exceeds the selected SLV
SLV = screening level value	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
UPL = Reference Area Upper Prediction Limit	
- = Not Analyzed	

Table 5-4d
2002 Sandblast Preliminary Assessment/Site Inspection Soil and Sandblast Grit Analytical Results
Sandblast Area
PCB Aroclors, Metals, Petroleum Hydrocarbons, and Butyltins
(Page 1 of 2)

Site ID	SBB01*	SBB03	SBB04	SBB05	SBB06	SBB07*	SBB09	SBB10	SBB11	SBB12	SBB13	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011205SBB01SBG	011205SBB03SBG	011205SBB04SBG	011205SBB05SBG	011205SBB06SBG	011205SBB07SBG	011205SBB09SBG	011205SBB10SBG	011205SBB11SBG	011205SBB12SBG	011205SBB13SBG		
Sample Date	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001		
Sample Depth (Feet bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	2.0		
Medium	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Sandblast Grit	Soil		
PCB Aroclors (µg/kg dry)													
Aroclor 1016	1.28 U	1.23 U	1.19 U	1.29 U	1.25 U	1.43 U	1.22 U	1.18 U	1.17 U	1.24 U	1.41 U	371	Eco
Aroclor 1221	5.50 U	5.26 U	5.08 U	5.53 U	5.37 U	6.14 U	5.23 U	5.04 U	5.02 U	5.32 U	6.04 U	371	Eco
Aroclor 1232	4.39 U	4.20 U	4.06 U	4.42 U	4.29 U	4.90 U	4.17 U	4.02 U	4.00 U	4.24 U	4.82 U	371	Eco
Aroclor 1242	2.35 U	2.25 U	2.17 U	2.36 U	2.29 U	2.62 U	2.23 U	2.15 U	2.14 U	2.27 U	2.58 U	371	Eco
Aroclor 1248	5.84 U	5.59 U	5.40 U	5.87 U	5.70 U	6.52 U	5.55 U	5.35 U	5.32 U	5.64 U	6.41 U	371	Eco
Aroclor 1254	1.82 U	1.74 U	1.68 U	1.83 U	1.78 U	2.03 U	1.73 U	1.67 U	1.66 U	1.76 U	2.00 U	371	Eco
Aroclor 1260	**6.44 J**	**30.6**	**17.7**	**23.7**	**15.5**	**5.79 J**	**81.8**	**26.0**	**52.1**	**202**	2.00 U	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**8.26 J**	**32.3 J**	**19.4 J**	**25.5 J**	**17.3 J**	**7.81 J**	**83.5 J**	**27.7 J**	**53.8 J**	**204 J**	4.00 U	371	Eco
Metals (mg/kg dry)													
Aluminum	**2,465 J**	**5,190**	**4,640 J**	**5,690 J**	**2,350**	**7,620**	**1,660**	**1,530**	**2,440**	**4,020**	**14,100**	31,400	UPL
Antimony	3.16 U	**2.71 J**	3.29 U	3.54 U	**1.92 J**	**2.60 J**	**1.28 J**	**1.81 J**	**2.74 J**	**13.7**	**1.20 J**	0.270	Eco
Arsenic	**2.37**	**4.70**	**5.93**	**3.04**	**0.866 J**	**5.12**	**2.12**	**6.02**	**4.64**	**6.24**	**6.24**	5.40	UPL
Barium	**22.4**	**119**	**58.2**	**97.0**	**27.7**	**70.9**	**16.2**	**27.2**	**44.4**	**78.2**	**59.6**	330	Eco
Beryllium	0.170 U	0.176 U	0.177 U	0.191 U	0.159 U	**0.218 J**	0.166 U	0.173 U	0.179 U	0.177 U	**0.525**	21.0	Eco
Cadmium	**0.717**	**1.04**	**0.663**	**0.649**	**0.470 J**	**1.04**	**0.895**	**2.14**	**1.45**	**2.19**	**1.02**	0.360	Eco
Calcium	**1,840 J**	**2,720**	**2,590 J**	**2,700 J**	**1,310**	**5,055**	**863**	**1,700**	**2,500**	**2,750**	**7,470**	10,400	UPL
Chromium	**1,215**	**536**	**358**	**69.7**	**880**	**127**	**67.4**	**637**	**648**	**705**	**21.7**	28.1	UPL
Cobalt	**25.0**	**14.9**	**9.44**	**7.97**	**16.3**	**11.9**	**2.52**	**17.4**	**14.3**	**15.1**	**19.7**	19.9	UPL
Copper	**32.2**	**58.1**	**28.6**	**25.0**	**25.0**	**56.2**	**23.1**	**82.8**	**73.7**	**183**	**73.7**	56.7	UPL
Iron	**32,300**	**25,200**	**19,700**	**17,300**	**22,100**	**21,800**	**10,100**	**44,500**	**39,500**	**39,400**	**41,500**	36,900	UPL
Lead	**124**	**1,200 J**	**262**	**300**	**501 J**	**119 J**	**502 J**	**272 J**	**415 J**	**863 J**	**19.3 J**	25.5	UPL
Magnesium	**43,500 J**	**19,800**	**14,000 J**	**4,000 J**	**31,400**	**6,175**	**1,370**	**19,500**	**18,600**	**13,900**	**9.75 J**	12,400	UPL
Manganese	**509 J**	**448**	**285 J**	**290 J**	**392**	**392**	**171**	**536**	**518**	**464**	**631**	885	UPL
Mercury	0.0301 U	**0.0404 J**	**0.0423 J**	0.0300 U	**0.0425**	**0.0461 J**	0.0269 U	0.0285 U	**0.0380 J**	**0.0425**	0.0338 U	0.0660	UPL
Nickel	**1,015**	**382**	**130**	**55.3**	**597**	**93.8**	**28.8**	**844**	**296**	**347**	**27.8**	38.0	Eco
Potassium	**138 J**	**918**	**338 J**	**894**	**173 J**	**601**	**172 J**	**144 J**	**236 J**	**323 J**	**464 J**	2,050	UPL
Selenium	0.407 U	**0.704 J**	0.424 U	0.456 U	0.380 U	**0.656 J**	**0.670 J**	0.412 U	0.428 U	0.422 U	**0.678 J**	0.520	Eco
Silver	**0.0667 J**	**0.212 J**	**0.0976 J**	**0.155 J**	**0.114 J**	**0.143 J**	**0.0627 J**	**0.102 J**	**0.139 J**	**0.259 J**	**0.174 J**	4.20	Eco
Sodium	153 U	157 U	159 U	171 U	143 U	166 U	149 U	155 U	161 U	158 U	**196 J**	341	UPL
Thallium	**0.0622 J**	**0.0681 J**	**0.0987 J**	**0.0802 J**	**0.0551 J**	**0.101 J**	0.0487 U	0.0505 U	**0.0687 J**	**0.0557 J**	**0.147 J**	1.00	Eco
Vanadium	**21.1**	**29.2**	**27.0**	**34.4**	**12.5**	**47.7**	**6.89**	**21.9**	**30.0**	**47.7**	**73.7**	104	UPL
Zinc	**84.1 J**	**229**	**113 J**	**83.0 J**	**112**	**107**	**129**	**120**	**176**	**328**	**50.3**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)													
Diesel Range Organics	**94.0**	**31.6**	**33.4**	**19.5 J**	**63.1**	**22.1 J**	**30.3**	**66.4**	**46.4**	**53.4**	**22.1 J**	23,000	HH
Residual Range Organics	**388**	**224**	**177**	**165**	**469**	**106**	**328**	**448**	**321**	**511**	**124**	40,000	HH
Gasoline Range Organics	-	-	-	-	-	-	-	-	-	-	-	13,000	HH
Butyltins (µg/kg dry)													
Dibutyltin	0.589 U	**37.4**	0.653 U	0.755 U	0.695 U	0.842 U	0.721 U	0.582 U	0.683 U	0.651 U	0.786 U	28,000	Eco
Monobutyltin	1.30 U	1.40 U	**24.0**	1.66 U	1.53 U	1.86 U	1.59 U	1.28 U	1.51 U	1.43 U	1.73 U	28,000	Eco
Tetrabutyltin	0.455 U	0.492 U	0.505 U	0.583 U	0.537 U	0.651 U	0.557 U	0.449 U	0.528 U	0.503 U	0.607 U	28,000	Eco
Tributyltin	0.938 U	**45.4**	**38.9**	1.20 U	1.11 U	1.34 U	1.15 U	0.926 U	1.09 U	1.04 U	1.25 U	28,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4d
2002 Sandblast Preliminary Assessment/Site Inspection Soil and Sandblast Grit Analytical Results
Sandblast Area
PCB Aroclors, Metals, Petroleum Hydrocarbons, and Butyltins
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Site ID	SBB14	SBB15	SBB15	SBB16	SBB16	SBB17	SBB17	SBB18	SBB18	SBB23	SBB24	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011205SBB14SBG	011205SBB15SBG	011205SBB21SS	011205SBB16SBG	011206SBB22ss	011205SBB17SBG	011205SBB19SS	011205SBB18SBG	011205SBB20SS	011206SBB23SBG	011206SBB24SBG		
Sample Date	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/6/2001	12/5/2001	12/5/2001	12/5/2001	12/5/2001	12/6/2001	12/6/2001		
Sample Depth (Feet bgs)	2.0	0.0-0.5	1.0	0.0-0.5	1.5	0.0-0.5	3.0	0.0-0.5	2.5	0.0-0.5	0.0-0.5		
Medium	Sandblast Grit	Sandbl	Soil	Sandblast Grit	Soil	Sandblast Grit	Soil	Sandblast Grit	Soil	Sandblast Grit	Sandblast Grit		
PCB Aroclors (µg/kg dry)													
Aroclor 1016	1.24 U	1.09 U	1.22 U	1.18 U	1.33 U	1.23 U	1.38 U	1.20 U	1.45 U	1.32 U	1.28 U	371	Eco
Aroclor 1221	5.32 U	4.66 U	5.21 U	5.07 U	5.70 U	5.28 U	5.89 U	5.15 U	6.21 U	5.67 U	5.49 U	371	Eco
Aroclor 1232	4.24 U	3.72 U	4.16 U	4.05 U	4.55 U	4.21 U	4.70 U	4.11 U	4.95 U	4.53 U	4.38 U	371	Eco
Aroclor 1242	2.27 U	1.99 U	2.23 U	2.16 U	2.43 U	2.25 U	2.51 U	2.20 U	2.65 U	2.42 U	2.34 U	371	Eco
Aroclor 1248	5.64 U	4.95 U	5.54 U	5.39 U	6.05 U	5.60 U	6.26 U	5.46 U	6.59 U	6.02 U	5.82 U	371	Eco
Aroclor 1254	1.76 U	1.54 U	1.73 U	1.68 U	1.89 U	1.75 U	1.95 U	1.70 U	2.06 U	1.88 U	1.82 U	371	Eco
Aroclor 1260	**4.95 J**	**64.0**	**20.8**	**193**	**13.4**	**18.7**	**4.17 J**	**17.4**	2.06 U	**7.09 J**	**6.95 J**	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**6.71 J**	**65.5 J**	**22.5 J**	**195 J**	**15.3 J**	**20.5 J**	**6.12 J**	**19.1 J**	4.12 U	**8.97 J**	**8.77 J**	371	Eco
Metals (mg/kg dry)													
Aluminum	**7,570**	**1,830**	**7,130**	**2,390**	**8,430**	**4,880**	**9,760**	**7,650**	**16,000 J**	**1,590**	**2,130**	31,400	UPL
Antimony	**1.19 J**	**1.14 J**	**0.510 J**	**1.13 J**	**0.832 J**	**0.858 J**	**1.06 J**	**9.51**	4.01 U	**0.406 J**	**0.249 J**	0.270	Eco
Arsenic	**3.14**	**0.794 J**	**3.91**	**2.89**	**4.51**	**1.52**	**4.80**	**80.9**	**1.64**	**0.981 J**	0.159 U	5.40	UPL
Barium	**73.6**	**26.0**	**59.4**	**63.1**	**51.0**	**54.7**	**82.1**	**118**	**112**	**10.7**	**12.3**	330	Eco
Beryllium	**0.184 J**	0.147 U	**0.351 J**	0.155 U	**0.318 J**	0.191 U	**0.482 J**	0.181 U	**0.598**	0.175 U	0.168 U	21.0	Eco
Cadmium	**1.26**	**2.61**	**0.613**	**1.04**	**1.27**	**0.677**	**0.978**	**1.42**	**0.867**	**0.429 J**	**0.305 J**	0.360	Eco
Calcium	**5,360**	**1,170**	**4,300**	**1,070**	**5,310**	**2,630**	**4,460**	**15,100**	**7,670 J**	**1,180**	**1,520**	10,400	UPL
Chromium	**55.9**	**1,100**	**21.9**	**783**	**51.8**	**625**	**53.4**	**533**	**25.1**	**931**	**1,320**	28.1	UPL
Cobalt	**11.6**	**13.9**	**11.5**	**13.7**	**12.1**	**15.0**	**15.1**	**19.3**	**16.3**	**20.3**	**21.6**	19.9	UPL
Copper	**58.3**	**23.4**	**45.7**	**36.7**	**57.0**	**25.1**	**45.3**	**319**	**65.7**	**18.8**	**15.8**	56.7	UPL
Iron	**22,500**	**24,200**	**19,000**	**22,800**	**22,600**	**22,200**	**19,800**	**39,000**	**33,600**	**22,700**	**27,900**	36,900	UPL
Lead	**508 J**	**280 J**	**134 J**	**783 J**	**390 J**	**516 J**	**31.9 J**	**258 J**	**31.2**	**67.5 J**	**51.5 J**	25.5	UPL
Magnesium	**5,850**	**32,600**	**5,160**	**22,000**	**6,660**	**22,300**	**5,480**	**19,600**	**11,400 J**	**33,500**	**47,500**	12,400	UPL
Manganese	**281**	**413**	**399**	**350**	**372**	**408**	**323**	**674**	**585 J**	**362**	**493**	885	UPL
Mercury	**0.0363**	0.0281 U	**0.0406 J**	**0.0335 J**	**0.0560**	**0.0345 J**	**0.0341 J**	0.0275 U	**0.153**	0.0263 U	0.0285 U	0.0660	UPL
Nickel	**33.4**	**444**	**18.8**	**586**	**32.2**	**399**	**40.7**	**321**	**23.9**	**1,060**	**617**	38.0	Eco
Potassium	**636**	**74.9 J**	**551**	**105 J**	**566**	**330 J**	**602**	**1,020**	**644**	**91.4 J**	**116 J**	2,050	UPL
Selenium	**0.558 J**	0.351 U	**0.511 J**	**0.586 J**	**0.642 J**	0.455 U	**0.835 J**	**0.675 J**	0.517 U	**0.453 J**	0.401 U	0.520	Eco
Silver	**0.165 J**	0.0440 U	**0.0882 J**	**0.0596 J**	**0.117 J**	**0.0813 J**	**0.265 J**	**0.268 J**	**0.146 J**	0.0524 U	0.0503 U	4.20	Eco
Sodium	**173 J**	132 U	158 U	139 U	171 U	171 U	195 U	163 U	**219 J**	157 U	150 U	341	UPL
Thallium	**0.118 J**	0.0429 U	**0.0915 J**	0.0455 U	**0.0981 J**	0.0558 U	**0.129 J**	**0.114 J**	**0.110 J**	0.0511 U	0.0490 U	1.00	Eco
Vanadium	**54.6**	**12.7**	**36.9**	**8.66**	**33.0**	**25.3**	**53.5**	**34.4**	**72.4**	**14.4**	**16.1**	104	UPL
Zinc	**74.5**	**1,160**	**58.2**	**230**	**94.2**	**145**	**62.6**	**703**	**77.6 J**	**56.1**	**57.9**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)													
Diesel Range Organics	**39.8**	**740**	**972**	**107**	**23.6 J**	**45.7**	**21.2 J**	**69.0**	**1,440**	**92.0**	**97.9**	23,000	HH
Residual Range Organics	**369**	**325**	**158**	**1,340**	**98.4**	**328**	**45.6 J**	**523**	**641**	**639**	**607**	40,000	HH
Gasoline Range Organics	-	-	-	-	-	-	-	-	-	-	-	13,000	HH
Butyltins (µg/kg dry)													
Dibutyltin	0.613 U	-	-	**64.5**	0.799 U	0.706 U	0.769 U	**210 J**	0.850 U	0.738 U	0.709 U	28,000	Eco
Monobutyltin	1.35 U	-	-	**8.78**	1.76 U	**8.00**	1.69 U	**108 J**	1.87 U	1.63 U	1.56 U	28,000	Eco
Tetrabutyltin	0.473 U	-	-	0.531 U	0.618 U	0.546 U	0.594 U	**3.99 J**	0.657 U	0.571 U	0.548 U	28,000	Eco
Tributyltin	0.975 U	-	-	**23.6**	1.27 U	**39.2**	1.22 U	**1,860 J**	1.35 U	1.18 U	1.13 U	28,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-4e
2002 Sandblast Preliminary Assessment/Site Inspection Soil Analytical Results
Transformer Release Area
PCB Aroclors, Metals, Petroleum Hydrocarbons, and Butyltins

Site ID	TRA01	TRA01	TRA02	TRA03	TRA03	TRA04	TRA05	TRA05	TRA06*	TRA07	TRA07	TRA09*	TRA11	TRA12	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	011204TRA01SS	011204TRA14SS	011204TRA02SS	011204TRA03SS	011204TRA13SS	011204TRA04SS	011204TRA05SS	011206TRA16ss	011204TRA06SS	011204TRA07SS	011206TRA15ss	011204TRA09SS	011204TRA11SS	011204TRA12SS		
Sample Date	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/4/2001	12/6/2001	12/4/2001	12/4/2001	12/6/2001	12/4/2001	12/4/2001	12/4/2001		
Sample Depth (Feet bgs)	0.0-1.0	3.0	0.0-1.0	0.0-1.0	1.8	0.0-1.0	0.0-1.0	2.5	0.0-1.0	0.0-1.0	2.0	0.0-1.0	0.0-1.0	0.0-1.0		
PCB Aroclors (µg/kg dry)																
Aroclor 1016	1.20 U	1.38 U	1.16 U	1.22 U	1.28 U	1.25 U	1.25 U	1.28 U	1.28 U	1.31 U	1.24 U	1.32 U	1.27 U	1.27 U	371	Eco
Aroclor 1221	5.16 U	5.91 U	4.98 U	5.24 U	5.49 U	5.37 U	5.34 U	5.47 U	5.49 U	5.61 U	5.33 U	5.67 U	5.42 U	5.44 U	371	Eco
Aroclor 1232	4.12 U	4.72 U	3.98 U	4.18 U	4.39 U	4.28 U	4.26 U	4.36 U	4.39 U	4.48 U	4.25 U	4.52 U	4.33 U	4.35 U	371	Eco
Aroclor 1242	2.20 U	2.52 U	2.13 U	2.24 U	2.34 U	2.29 U	2.28 U	2.33 U	2.22 U	2.39 U	2.27 U	2.42 U	2.31 U	2.32 U	371	Eco
Aroclor 1248	5.47 U	6.28 U	5.29 U	5.57 U	5.83 U	5.70 U	5.67 U	5.80 U	5.83 U	5.95 U	5.66 U	6.02 U	5.75 U	5.78 U	371	Eco
Aroclor 1254	1.71 U	1.96 U	1.65 U	1.74 U	1.82 U	1.78 U	1.77 U	1.81 U	1.82 U	1.86 U	1.76 U	1.88 U	1.80 U	1.80 U	371	Eco
Aroclor 1260	**23.5**	1.96 U	**42.2**	**43.2**	**2.64 J**	**98.8**	**121**	1.81 U	**65.8**	**21.7**	**4.42 J**	**26.8**	**282**	**96.2**	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**25.2 J**	3.92 U	**43.9 J**	**44.9 J**	**4.46 J**	**101 J**	**123 J**	3.62 U	**67.6 J**	**23.6 J**	**6.18 J**	**28.7 J**	**284 J**	**98.0 J**	371	Eco
Metals (mg/kg dry)																
Aluminum	**5,280 J**	**8,170 J**	**2,260 J**	**2,370 J**	**6,280 J**	**2,560 J**	**2,800 J**	**8,620 J**	**1,915 J**	**6,350 J**	**9,320 J**	**8,905 J**	**3,090 J**	**2,590 J**	31,400	UPL
Antimony	**1.75 J**	**1.15 J**	2.83 U	**1.74 J**	**1.10 J**	**2.56 J**	**1.52 J**	3.33 U	**2.14 J**	**1.86 J**	3.01 U	**5.74 J**	**2.42 J**	3.43 U	0.270	Eco
Arsenic	**3.03**	**7.58**	**2.08**	**4.69**	**7.73**	**9.57**	**2.37**	**7.64**	**9.73**	**5.83**	**9.29**	**12.0**	**8.15**	**2.87**	5.40	UPL
Barium	**60.3**	**69.8**	**34.0**	**27.7**	**50.4**	**45.5**	**29.3**	**72.0**	**40.1**	**55.1**	**60.2**	**86.2**	**54.1**	**35.7**	330	Eco
Beryllium	0.162 U	**0.295 J**	0.153 U	0.157 U	**0.248 J**	0.176 U	0.171 U	**0.380 J**	0.168 U	0.190 U	**0.369 J**	**0.241 J**	0.190 U	0.185 U	21.0	Eco
Cadmium	**0.824**	**1.16**	**1.19**	**0.750**	**0.646**	**1.82**	**1.04**	**0.853**	**1.27**	**1.55**	**0.801**	**1.76**	**2.53**	**1.07**	0.360	Eco
Calcium	**2,970**	**5,530**	**1,760**	**1,830**	**4,600**	**2,230**	**1,800**	**5,650**	**2,760**	**3,490**	**5,970**	**4,610**	**2,680**	**2,610**	10,400	UPL
Chromium	**43.2 J**	**27.1 J**	**25.6 J**	**171 J**	**38.2 J**	**560 J**	**70.1 J**	**19.0 J**	**518 J**	**104 J**	**14.8 J**	**205 J**	**749 J**	**123 J**	28.1	UPL
Cobalt	**7.28**	**13.5**	**4.63**	**7.46**	**10.8**	**12.1**	**5.20**	**14.1**	**11.7**	**10.8**	**15.1**	**14.2**	**13.8**	**6.95**	19.9	UPL
Copper	**24.6**	**42.7**	**37.9**	**25.8**	**31.1**	**116**	**26.9**	**37.9**	**96.4**	**52.4**	**42.6**	**68.3**	**68.4**	**29.6**	56.7	UPL
Iron	**15,900 J**	**22,700 J**	**15,500 J**	**17,200 J**	**19,100 J**	**46,500 J**	**15,500 J**	**22,900 J**	**34,400 J**	**24,400 J**	**23,700 J**	**30,950 J**	**30,000 J**	**15,800 J**	36,900	UPL
Lead	**1,080 J**	**767 J**	**612 J**	**193 J**	**75.4 J**	**462 J**	**627 J**	**30.2 J**	**273 J**	**639 J**	**17.5 J**	**547 J**	**358 J**	**346 J**	25.5	UPL
Magnesium	**3,240 J**	**5,670 J**	**1,630 J**	**6,880 J**	**5,620 J**	**15,300 J**	**2,770 J**	**6,860 J**	**15,800 J**	**7,250 J**	**7,540 J**	**9,860 J**	**23,000 J**	**5,110 J**	12,400	UPL
Manganese	**206 J**	**475 J**	**226 J**	**211 J**	**350 J**	**558 J**	**229 J**	**531 J**	**426 J**	**386 J**	**418 J**	**603 J**	**529 J**	**198 J**	885	UPL
Mercury	0.0230 U	**0.0518**	0.0277 U	0.0283 U	**0.0329 J**	**0.0666**	**0.105**	**0.0254 J**	**0.0440**	**0.105**	0.0297 U	**0.0672**	**0.0301 J**	0.0268 U	0.0660	UPL
Nickel	**22.1 J**	**20.7 J**	**15.9 J**	**74.4 J**	**21.0 J**	**269 J**	**33.9 J**	**18.0 J**	**262 J**	**44.7 J**	**16.6 J**	**96.7 J**	**247 J**	**60.2 J**	38.0	Eco
Potassium	**268 J**	**509**	**137 J**	**119 J**	**363 J**	**158 J**	**144 J**	**499**	**145 J**	**331 J**	**564**	**386 J**	**186 J**	**225 J**	2,050	UPL
Selenium	0.39 U	0.46 U	**0.384 J**	0.38 U	0.43 U	0.42 U	0.41 U	**0.501 J**	**0.403 J**	**0.675 J**	0.39 U	**0.649 J**	0.45 U	0.44 U	0.520	Eco
Silver	**0.138 J**	**0.156 J**	**0.0840 J**	**0.0837 J**	**0.105 J**	**0.101 J**	**0.0847 J**	**0.159 J**	**0.110 J**	**0.173 J**	**0.141 J**	**0.167 J**	**0.118 J**	**0.0880 J**	4.20	Eco
Sodium	**419**	174 U	137 U	141 U	**183 J**	158 U	154 U	**267**	151 U	171 U	**249**	164 U	171 U	166 U	341	UPL
Thallium	**0.0803 J**	**0.152 J**	0.045 U	**0.0477 J**	**0.103 J**	0.052 U	**0.0519 J**	**0.255 J**	0.049 U	**0.145 J**	**0.156 J**	**0.0872 J**	0.056 U	0.054 U	1.00	Eco
Vanadium	**38.7**	**49.8**	**17.0**	**23.4**	**36.8**	**28.8**	**24.8**	**46.0**	**24.0**	**46.4**	**49.5**	**48.3**	**29.7**	**30.4**	104	UPL
Zinc	**82.7**	**85.4**	**121**	**75.6**	**69.6**	**211**	**91.9**	**47.8**	**175**	**190**	**45.6**	**259**	**211**	**119**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)																
Diesel Range Organics	**30.3**	**70.6**	**70.4**	**59.3**	14.6 U	**54.7**	**48.2**	14.2 U	**39.7**	**35.1**	14.9 U	**16.1 J**	**122**	**40.9**	23,000	HH
Residual Range Organics	**168**	**1,280**	**550**	**1,010**	**35.0 J**	**453**	**525**	**29.8 J**	**301**	**195**	29.7 U	**140**	**276**	**407**	40,000	HH
Gasoline Range Organics	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13,000	HH
Butyltins (µg/kg dry)																
Dibutyltin	0.65 U	0.80 U	0.58 U	0.58 U	0.76 U	0.70 U	0.68 U	0.77 U	**44.8**	0.69 U	0.72 U	0.67 U	**63.5**	0.78 U	28,000	Eco
Monobutyltin	1.03 U	1.77 U	1.29 U	0.92 U	1.67 U	1.54 U	1.49 U	1.71 U	**10.5**	1.10 U	1.59 U	1.48 U	**8.91**	1.73 U	28,000	Eco
Tetrabutyltin	0.50 U	0.62 U	0.45 U	0.45 U	0.59 U	0.54 U	0.52 U	0.60 U	0.51 U	0.54 U	0.56 U	0.52 U	0.60 U	0.61 U	28,000	Eco
Tributyltin	1.43 U	1.28 U	0.93 U	1.27 U	1.21 U	1.11 U	1.49 U	1.23 U	**427**	1.53 U	1.15 U	1.15 U	**65.8**	1.25 U	28,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5a
2004 Sandblast Supplemental Site Inspection Soil and Sandblast Grit Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, and Pesticides
(Page 1 of 3)

Site ID	DP10	DP11*	DP12	DP5	DP6	DP7*	DP8	DP9	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041118SGA10SS	041118SGA11SS	041118SGA13SS	041116SGA02SS	041117SGA04SS	041117SGA05SS	041117SGA08SS	041117SGA09SS				
Sample Date	11/17/2004	11/17/2004	11/17/2004	11/16/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004				
Sample Depth (Feet bgs)	9.0-12.0	7.5-9.5	6.5-9.5	21.0-23.0	15.0-17.0	14.0-16.5	13.0-15.0	14.0-17.0				
Medium	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
PCB Aroclors (µg/kg dry)												
Aroclor 1016	-	-	-	2.61 U	2.85 U	2.76 U	2.65 U	3.00 U	371	Eco	21,000	HH
Aroclor 1221	-	-	-	2.61 U	2.85 U	2.76 U	2.65 U	3.00 U	371	Eco	540	HH
Aroclor 1232	-	-	-	2.61 U	2.85 U	2.76 U	2.65 U	3.00 U	371	Eco	540	HH
Aroclor 1242	-	-	-	2.61 U	2.85 U	2.76 U	2.65 U	3.00 U	371	Eco	740	HH
Aroclor 1248	-	-	-	2.61 U	2.85 U	2.76 U	2.65 U	3.00 U	371	Eco	740	HH
Aroclor 1254	-	-	-	1.43 U	1.57 U	1.51 U	1.45 U	1.65 U	371	Eco	740	HH
Aroclor 1260	-	-	-	1.43 U	1.57 U	1.51 U	1.45 U	1.65 U	371	Eco	740	HH
Total PCBs as Aroclors (NDs at MDL) [1]	-	-	-	2.86 U	3.14 U	3.02 U	2.90 U	3.30 U	371	Eco	740	HH
Metals (mg/kg dry)												
Aluminum	**15,600**	**13,600**	**17,000**	**10,200**	**12,900**	**11,550**	**7,460**	**12,500**	31,400	UPL	990,000	HH
Antimony	**0.194 J**	**0.218 J**	**0.285**	**0.256**	**0.228 J**	**0.433 J**	**0.107 J**	**0.184 J**	0.270	Eco	410	HH
Arsenic	**2.66**	**3.68**	**4.20**	**7.28**	**6.75**	**9.83 J**	**1.32**	**4.83**	5.40	UPL	5.40	UPL
Barium	**41.8**	**101**	**108**	**77.7**	**97.3**	**91.5**	**48.8**	**89.0**	330	Eco	60,000	HH
Beryllium	**0.314**	**0.371**	**0.372**	**0.454**	**0.379**	**0.380**	**0.258**	**0.488**	21.0	Eco	610	HH
Cadmium	0.0135 U	0.0130 U	0.0140 U	0.0125 U	0.0150 U	0.0135 U	0.0121 U	0.0143 U	0.360	Eco	150	HH
Calcium	**6,150**	**3,930**	**4,410**	**5,700**	**7,420**	**7,155**	**3,860**	**7,410**	10,400	UPL	10,400	UPL
Chromium	**23.6**	**20.1**	**26.4**	**19.0 J**	**19.9**	**21.3 J**	**10.5**	**20.3**	28.1	UPL	190	HH
Cobalt	**18.7**	**14.6**	**15.7**	**13.5**	**13.5**	**15.5 J**	**11.4**	**14.6**	19.9	UPL	300	HH
Copper	**67.6**	**30.0**	**33.5**	**47.4**	**51.6**	**51.9**	**26.7**	**53.3 J**	56.7	UPL	12,000	HH
Iron	**30,200**	**22,200**	**26,500**	**23,700**	**25,300**	**23,800**	**17,000**	**27,000**	36,900	UPL	720,000	HH
Lead	**6.06**	**5.24**	**5.70**	**6.23**	**5.35**	**6.64**	**2.60**	**5.37**	25.5	UPL	800	HH
Magnesium	**13,600**	**5,125**	**7,540**	**5,770**	**8,010**	**7,130**	**5,280**	**8,660**	12,400	UPL	12,400	UPL
Manganese	**500**	**411**	**818**	**423**	**481**	**439**	**380**	**599**	885	UPL	7,200	HH
Mercury	**0.0301**	**0.0203 J**	**0.0534**	**0.0362**	**0.0201 J**	**0.0544**	**0.0215 J**	**0.0209 J**	0.0660	UPL	93.0	HH
Nickel	**24.4**	**15.4**	**29.0**	**17.4**	**19.5**	**21.7**	**12.7**	**22.4**	38.0	Eco	6,100	HH
Potassium	**377**	**705**	**546**	**544**	**773**	**634**	**550**	**670**	2,050	UPL	2,050	UPL
Selenium	**0.343**	**0.324**	**0.316**	**0.407**	**0.322**	**0.602 J**	**0.180 J**	**0.302**	0.520	Eco	5,100	HH
Silver	**0.103 J**	**0.144 J**	**0.122 J**	**0.136 J**	**0.149 J**	**0.158 J**	**0.114 J**	**0.109 J**	4.20	Eco	1,500	HH
Sodium	**119**	12.4 U	**114 J**	11.9 U	**96.9 J**	**141**	11.5 U	**187 J**	341	UPL	341	UPL
Thallium	**0.0940 J**	**0.135 J**	**0.216 J**	**0.130 J**	**0.157 J**	**0.180 J**	**0.0765 J**	**0.145 J**	1.00	Eco	0.203	UPL
Vanadium	**53.3**	**65.0**	**72.2**	**54.3**	**60.3**	**57.9 J**	**45.0**	**52.2**	104	UPL	104	UPL
Zinc	**53.9**	**44.9**	**50.6**	**46.3**	**54.1**	**53.3**	**35.1**	**54.1**	71.7	UPL	310,000	HH
Petroleum Hydrocarbons (mg/kg dry)												
Diesel Range Organics	5.69 U	5.57 U	5.56 U	5.31 U	5.44 U	5.50 U	5.14 U	5.89 U	23,000	HH	23,000	HH
Residual Range Organics	11.3 U	11.1 U	11.1 U	10.6 U	10.9 U	11.0 U	10.2 U	11.7 U	40,000	HH	40,000	HH
Gasoline Range Organics	0.136 U	4.72 U	4.85 U	4.63 U	4.83 U	4.73 U	4.32 U	4.79 U	13,000	HH	13,000	HH
Butyltins (µg/kg dry)												
Dibutyltin	-	-	-	**5.73**	**7.75 J**	**16.6 J**	**28.3 J**	**3.62 J**	28,000	Eco	180,000	HH
Monobutyltin	-	-	-	**11.1**	**6.28 J**	**7.43 J**	**13.0 J**	**8.89 J**	28,000	Eco	180,000	HH
Tetrabutyltin	-	-	-	0.846 U	0.913 U	0.877 U	0.843 U	0.930 U	28,000	Eco	180,000	HH
Tributyltin	-	-	-	1.04 U	1.12 U	1.08 U	**2.58 J**	1.14 U	28,000	Eco	180,000	HH
Pesticides (µg/kg dry)												
4,4'-DDD	-	-	-	0.222 U	0.241 U	0.222 U	0.217 U	0.250 U	21.0	Eco	11,000	HH
4,4'-DDE	-	-	-	0.218 U	0.236 U	0.218 U	0.213 U	0.245 U	21.0	Eco	7,700	HH
4,4'-DDT	-	-	-	0.256 U	0.278 U	0.256 U	0.250 U	0.288 U	21.0	Eco	7,700	HH
Aldrin	-	-	-	0.112 U	0.122 U	0.112 U	0.110 U	0.126 U	4.90	Eco	130	HH
BHC (alpha)	-	-	-	0.109 U	0.118 U	0.109 U	0.107 U	0.122 U	340	HH	340	HH
BHC (beta)	-	-	-	0.121 U	0.131 U	0.121 U	0.118 U	0.136 U	960	HH	960	HH
BHC (delta)	-	-	-	0.109 U	0.118 U	0.109 U	0.107 U	0.122 U	340	HH	340	HH
BHC (gamma) Lindane	-	-	-	0.131 U	0.142 U	0.131 U	0.128 U	0.147 U	2,000	HH	2,000	HH
Chlordane (alpha)	-	-	-	0.118 U	0.128 U	0.117 U	0.115 U	0.132 U	7,200	HH	7,200	HH
Chlordane (gamma)	-	-	-	0.132 U	0.143 U	0.132 U	0.129 U	0.148 U	7,200	HH	7,200	HH
Dieldrin	-	-	-	0.264 U	0.287 U	0.264 U	0.259 U	0.298 U	4.90	Eco	130	HH
Endosulfan I	-	-	-	0.122 U	0.132 U	0.122 U	0.119 U	0.137 U	20,000	Eco	1,400,000	HH
Endosulfan II	-	-	-	0.278 U	0.302 U	0.277 U	0.272 U	0.312 U	20,000	Eco	1,400,000	HH
Endosulfan Sulfate	-	-	-	0.520 U	0.565 U	0.520 U	0.509 U	0.585 U	20,000	Eco	1,400,000	HH
Endrin	-	-	-	0.136 U	0.148 U	0.136 U	0.133 U	0.153 U	4.90	Eco	71,000	HH
Endrin Aldehyde	-	-	-	0.631 U	0.686 U	0.631 U	0.618 U	0.710 U	4.90	Eco	71,000	HH
Endrin Ketone	-	-	-	0.122 U	0.132 U	0.122 U	0.119 U	0.137 U	4.90	Eco	71,000	HH
Heptachlor	-	-	-	0.109 U	0.118 U	0.109 U	0.107 U	0.122 U	480	HH	480	HH
Heptachlor Epoxide	-	-	-	0.149 U	0.162 U	0.149 U	0.146 U	0.168 U	240	HH	240	HH
Methoxychlor	-	-	-	0.157 U	0.170 U	0.157 U	0.153 U	0.176 U	500,000	Eco	3,100,000	HH
Toxaphene	-	-	-	10.9 U	11.8 U	10.9 U	10.7 U	12.2 U	2,000	HH	2,000	HH

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.

- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5a
2004 Sandblast Supplemental Site Inspection Soil and Sandblast Grit Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, and Pesticides
(Page 2 of 3)

Site ID	HA1*	HA10	HA11	HA11	HA12	HA2	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA14SS	041123SGA29SS	041123SGA30SS	041123SGA31SS	041123SGA33SS	041122SGA16SS				
Sample Date	11/22/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004	11/22/2004				
Sample Depth (Feet bgs)	0.5	0.5	1.0	3.0	4.0	0.5				
Medium	Soil	Soil	Soil	Soil	Soil	Soil				
PCB Aroclors (µg/kg dry)										
Aroclor 1016	3.41 U	2.90 U	3.48 U	3.47 U	-	3.01 U	371	Eco	21,000	HH
Aroclor 1221	3.41 U	2.90 U	3.48 U	3.47 U	-	3.01 U	371	Eco	540	HH
Aroclor 1232	3.41 U	2.90 U	3.48 U	3.47 U	-	3.01 U	371	Eco	540	HH
Aroclor 1242	3.41 U	2.90 U	3.48 U	3.47 U	-	3.01 U	371	Eco	740	HH
Aroclor 1248	3.41 U	2.90 U	3.48 U	3.47 U	-	3.01 U	371	Eco	740	HH
Aroclor 1254	1.87 U	1.59 U	1.91 U	1.91 U	-	1.65 U	371	Eco	740	HH
Aroclor 1260	**8.54 J**	1.59 U	**6.40 J**	1.91 U	-	**4.11 J**	371	Eco	740	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**10.4 J**	3.18 U	**8.31 J**	3.82 U	-	**5.76 J**	371	Eco	740	HH
Metals (mg/kg dry)										
Aluminum	**11,390**	**3,770**	**15,000**	**23,100**	**14,600**	**7,100**	31,400	UPL	990,000	HH
Antimony	**0.316**	**0.0895 J**	**0.893**	**0.245 J**	**1.70**	**0.164 J**	0.270	Eco	410	HH
Arsenic	**4.44**	**0.613**	**3.26**	**3.05**	**8.22**	**0.936**	5.40	UPL	5.40	UPL
Barium	**100**	**49.2**	**112**	**123**	**104**	**64.1**	330	Eco	60,000	HH
Beryllium	**0.304**	**0.131 J**	**0.349**	**0.385**	**0.378**	**0.260**	21.0	Eco	610	HH
Cadmium	0.0127 U	0.0127 U	0.0129 U	0.0148 U	0.0133 U	0.0123 U	0.360	Eco	150	HH
Calcium	**6,245**	**3,740**	**10,200**	**9,860**	**7,090**	**4,390**	10,400	UPL	10,400	UPL
Chromium	**19.3**	**5.27**	**221**	**29.8**	**55.4**	**6.19**	28.1	UPL	190	HH
Cobalt	**15.9**	**11.0**	**16.0**	**19.7**	**14.7**	**14.0**	19.9	UPL	300	HH
Copper	**47.6**	**16.7**	**64.0**	**66.4**	**77.6**	**21.3**	56.7	UPL	12,000	HH
Iron	**28,450**	**19,400**	**33,300**	**35,200**	**27,600**	**23,200**	36,900	UPL	720,000	HH
Lead	**128**	**9.71**	**49.1**	**8.61**	**21.5**	**46.3**	25.5	UPL	800	HH
Magnesium	**7,850**	**2,600**	**9,110**	**13,900**	**7,590**	**3,900**	12,400	UPL	12,400	UPL
Manganese	**554**	**301**	**611**	**816**	**582**	**459**	885	UPL	7,200	HH
Mercury	**0.0149 J**	**0.0268**	**0.0359**	**0.0131 J**	**0.0219**	0.00528 U	0.0660	UPL	93.0	HH
Nickel	**20.2**	**5.35**	**58.6**	**26.9**	**28.3**	**6.81**	38.0	Eco	6,100	HH
Potassium	**787**	**360**	**627**	**615**	**654**	**778**	2,050	UPL	2,050	UPL
Selenium	**0.272**	**0.255 J**	**0.284**	**0.330**	**0.277**	**0.289**	0.520	Eco	5,100	HH
Silver	**0.123**	**0.0870**	**0.107**	**0.154**	**0.170**	**0.120**	4.20	Eco	1,500	HH
Sodium	12.1 U	12.1 U	12.3 U	**278**	12.7 U	11.7 U	341	UPL	341	UPL
Thallium	**0.116 J**	**0.0463 J**	**0.135 J**	**0.110 J**	**0.102 J**	**0.101 J**	1.00	Eco	0.203	UPL
Vanadium	**58.9**	**52.7**	**69.6**	**89.1**	**68.7**	**61.9**	104	UPL	104	UPL
Zinc	**88.0**	**31.1**	**90.9**	**58.5**	**120**	**103**	71.7	UPL	310,000	HH
Petroleum Hydrocarbons (mg/kg dry)										
Diesel Range Organics	**24.7 J**	**7.30 J**	-	5.74 U	5.53 U	5.03 U	23,000	HH	23,000	HH
Residual Range Organics	**216**	**153**	-	11.4 U	11.0 U	10.0 U	40,000	HH	40,000	HH
Gasoline Range Organics	4.68 U	0.121 U	-	**132**	4.89 U	4.37 U	13,000	HH	13,000	HH
Butyltins (µg/kg dry)										
Dibutyltin	0.831 U	0.763 U	-	0.887 U	-	0.774 U	28,000	Eco	180,000	HH
Monobutyltin	**6.26 J**	**3.45 J**	-	0.632 U	-	**4.08 J**	28,000	Eco	180,000	HH
Tetrabutyltin	0.853 U	0.783 U	-	0.910 U	-	0.795 U	28,000	Eco	180,000	HH
Tributyltin	1.05 U	0.963 U	-	1.12 U	-	0.977 U	28,000	Eco	180,000	HH
Pesticides (µg/kg dry)										
4,4'-DDD	0.236 U	0.200 U	0.255 U	0.256 U	-	0.208 U	21.0	Eco	11,000	HH
4,4'-DDE	0.231 U	0.196 U	0.250 U	0.251 U	-	0.204 U	21.0	Eco	7,700	HH
4,4'-DDT	**5.27**	0.230 U	0.294 U	0.295 U	-	0.240 U	21.0	Eco	7,700	HH
Aldrin	0.119 U	0.101 U	0.129 U	0.129 U	-	0.105 U	4.90	Eco	130	HH
BHC (alpha)	0.116 U	0.0981 U	0.125 U	0.126 U	-	0.102 U	340	HH	340	HH
BHC (beta)	2.09 U	0.109 U	0.139 U	0.139 U	-	1.87 U	960	HH	960	HH
BHC (delta)	0.116 U	0.0981 U	0.125 U	0.126 U	-	0.102 U	340	HH	340	HH
BHC (gamma) Lindane	0.139 U	0.118 U	0.150 U	0.151 U	-	0.122 U	2,000	HH	2,000	HH
Chlordane (alpha)	0.125 U	0.106 U	0.135 U	0.136 U	-	0.110 U	7,200	HH	7,200	HH
Chlordane (gamma)	0.140 U	0.119 U	0.151 U	0.152 U	-	0.123 U	7,200	HH	7,200	HH
Dieldrin	0.281 U	0.238 U	0.304 U	0.305 U	-	0.248 U	4.90	Eco	130	HH
Endosulfan I	0.129 U	0.110 U	0.140 U	0.141 U	-	0.114 U	20,000	Eco	1,400,000	HH
Endosulfan II	0.295 U	0.250 U	0.319 U	0.320 U	-	0.260 U	20,000	Eco	1,400,000	HH
Endosulfan Sulfate	0.553 U	0.469 U	0.598 U	0.600 U	-	0.488 U	20,000	Eco	1,400,000	HH
Endrin	0.145 U	0.123 U	0.156 U	0.157 U	-	0.128 U	4.90	Eco	71,000	HH
Endrin Aldehyde	0.671 U	0.569 U	0.725 U	0.728 U	-	0.592 U	4.90	Eco	71,000	HH
Endrin Ketone	0.129 U	0.110 U	0.140 U	0.141 U	-	0.114 U	4.90	Eco	71,000	HH
Heptachlor	0.116 U	0.0981 U	0.125 U	0.126 U	-	0.102 U	480	HH	480	HH
Heptachlor Epoxide	0.158 U	0.134 U	0.171 U	**0.634 J**	-	0.140 U	240	HH	240	HH
Methoxychlor	0.166 U	0.141 U	0.180 U	0.181 U	-	0.147 U	500,000	Eco	3,100,000	HH
Toxaphene	11.6 U	9.81 U	12.5 U	12.6 U	-	10.2 U	2,000	HH	2,000	HH

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5a
2004 Sandblast Supplemental Site Inspection Soil and Sandblast Grit Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, and Pesticides
(Page 3 of 3)

Site ID	HA3	HA4	HA5	HA6	HA7*	HA8	HA9	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA17SS	041122SGA21SS	041122SGA23SS	041122SGA24SG	041122SGA25SG	041122SGA27SG	041123SGA28SS				
Sample Date	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/23/2004				
Sample Depth (Feet bgs)	0.5	3.0	3.0	0.0	0.0	0.0	0.5				
Medium	Soil	Soil	Soil	Sandblast Grit	Sandblast Grit	Sandblast Grit	Soil				
PCB Aroclors (µg/kg dry)											
Aroclor 1016	3.23 U	-	-	-	-	-	3.15 U	371	Eco	21,000	HH
Aroclor 1221	3.23 U	-	-	-	-	-	3.15 U	371	Eco	540	HH
Aroclor 1232	3.23 U	-	-	-	-	-	3.15 U	371	Eco	540	HH
Aroclor 1242	3.23 U	-	-	-	-	-	3.15 U	371	Eco	740	HH
Aroclor 1248	3.23 U	-	-	-	-	-	3.15 U	371	Eco	740	HH
Aroclor 1254	1.77 U	-	-	-	-	-	1.73 U	371	Eco	740	HH
Aroclor 1260	**26.1**	-	-	-	-	-	**11.9**	371	Eco	740	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**27.9 J**	-	-	-	-	-	**13.6 J**	371	Eco	740	HH
Metals (mg/kg dry)											
Aluminum	**3,010**	**15,300**	**12,400**	-	-	-	**8,730**	31,400	UPL	990,000	HH
Antimony	**1.11**	**0.495**	**0.319**	-	-	-	**0.441**	0.270	Eco	410	HH
Arsenic	**4.97**	**2.30**	**4.99**	-	-	-	**3.85**	5.40	UPL	5.40	UPL
Barium	**20.9**	**106**	**110**	-	-	-	**86.0**	330	Eco	60,000	HH
Beryllium	**0.0587 J**	**0.387**	**0.433**	-	-	-	**0.243 J**	21.0	Eco	610	HH
Cadmium	**0.0561 J**	0.0143 U	0.0153 U	-	-	-	0.0122 U	0.360	Eco	150	HH
Calcium	**1,980**	**7,030**	**6,040**	-	-	-	**4,960**	10,400	UPL	10,400	UPL
Chromium	**16.1**	**35.4**	**21.1**	**2,650**	**2,305**	**2,480**	**18.2**	28.1	UPL	190	HH
Cobalt	**4.60**	**14.2**	**11.7**	-	-	-	**11.6**	19.9	UPL	300	HH
Copper	**27.4**	**63.6**	**40.2**	-	-	-	**31.0**	56.7	UPL	12,000	HH
Iron	**22,200 J**	**26,700**	**24,700**	-	-	-	**22,700**	36,900	UPL	720,000	HH
Lead	**3,260**	**19.2**	**9.39**	**117**	**68.4**	**66.6**	**354**	25.5	UPL	800	HH
Magnesium	**1,350**	**8,760**	**6,610**	-	-	-	**6,000**	12,400	UPL	12,400	UPL
Manganese	**167**	**366**	**317**	-	-	-	**345**	885	UPL	7,200	HH
Mercury	**0.0114 J**	**0.0804**	**0.0349**	-	-	-	**0.0163 J**	0.0660	UPL	93.0	HH
Nickel	**10.9**	**50.7**	**17.3**	-	-	-	**20.4**	38.0	Eco	6,100	HH
Potassium	**273**	**576**	**1,200**	-	-	-	**433**	2,050	UPL	2,050	UPL
Selenium	0.0781 U	**0.299**	**0.209 J**	-	-	-	**0.175 J**	0.520	Eco	5,100	HH
Silver	**0.0571**	**0.110**	**0.147**	-	-	-	**0.110**	4.20	Eco	1,500	HH
Sodium	12.3 U	**371**	14.6 U	-	-	-	11.7 U	341	UPL	341	UPL
Thallium	**0.0288 J**	**0.164 J**	**0.125 J**	-	-	-	**0.0922 J**	1.00	Eco	0.203	UPL
Vanadium	**28.7**	**71.0**	**59.4**	-	-	-	**55.1**	104	UPL	104	UPL
Zinc	**72.1**	**56.0**	**59.0**	-	-	-	**86.7**	71.7	UPL	310,000	HH
Petroleum Hydrocarbons (mg/kg dry)											
Diesel Range Organics	**1,090 J**	**1,280**	**6.44 J**	-	-	-	5.02 U	23,000	HH	23,000	HH
Residual Range Organics	**1,980 J**	**189**	12.1 U	-	-	-	10.0 U	40,000	HH	40,000	HH
Gasoline Range Organics	4.55 U	**3,960 J**	5.00 U	-	-	-	4.42 U	13,000	HH	13,000	HH
Butyltins (µg/kg dry)											
Dibutyltin	**3.53 J**	-	-	0.710 U	0.813 U	0.805 U	**3.93**	28,000	Eco	180,000	HH
Monobutyltin	**4.90 J**	-	-	0.506 U	0.579 U	0.573 U	0.570 U	28,000	Eco	180,000	HH
Tetrabutyltin	0.842 U	-	-	0.729 U	0.835 U	0.826 U	0.821 U	28,000	Eco	180,000	HH
Tributyltin	**1.65 J**	-	-	0.896 U	**2.53 J**	1.02 U	1.01 U	28,000	Eco	180,000	HH
Pesticides (µg/kg dry)											
4,4'-DDD	0.223 U	-	-	-	-	-	0.220 U	21.0	Eco	11,000	HH
4,4'-DDE	**0.835 J**	-	-	-	-	-	**1.70 J**	21.0	Eco	7,700	HH
4,4'-DDT	**9.83**	-	-	-	-	-	**3.39**	21.0	Eco	7,700	HH
Aldrin	0.113 U	-	-	-	-	-	0.111 U	4.90	Eco	130	HH
BHC (alpha)	0.109 U	-	-	-	-	-	0.108 U	340	HH	340	HH
BHC (beta)	3.78 U	-	-	-	-	-	**0.952 J**	960	HH	960	HH
BHC (delta)	**3.03 J**	-	-	-	-	-	0.108 U	340	HH	340	HH
BHC (gamma) Lindane	**9.68 J**	-	-	-	-	-	0.129 U	2,000	HH	2,000	HH
Chlordane (alpha)	0.118 U	-	-	-	-	-	0.116 U	7,200	HH	7,200	HH
Chlordane (gamma)	0.132 U	-	-	-	-	-	0.130 U	7,200	HH	7,200	HH
Dieldrin	0.266 U	-	-	-	-	-	0.262 U	4.90	Eco	130	HH
Endosulfan I	0.123 U	-	-	-	-	-	0.121 U	20,000	Eco	1,400,000	HH
Endosulfan II	**1.99 J**	-	-	-	-	-	0.275 U	20,000	Eco	1,400,000	HH
Endosulfan Sulfate	0.523 U	-	-	-	-	-	0.515 U	20,000	Eco	1,400,000	HH
Endrin	0.137 U	-	-	-	-	-	0.135 U	4.90	Eco	71,000	HH
Endrin Aldehyde	0.635 U	-	-	-	-	-	0.625 U	4.90	Eco	71,000	HH
Endrin Ketone	0.123 U	-	-	-	-	-	0.121 U	4.90	Eco	71,000	HH
Heptachlor	0.109 U	-	-	-	-	-	0.108 U	480	HH	480	HH
Heptachlor Epoxide	0.150 U	-	-	-	-	-	0.148 U	240	HH	240	HH
Methoxychlor	0.158 U	-	-	-	-	-	0.155 U	500,000	Eco	3,100,000	HH
Toxaphene	10.9 U	-	-	-	-	-	10.8 U	2,000	HH	2,000	HH

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV

* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5b
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Volatile Organic Compounds
(Page 1 of 3)

Site ID	DP10	DP11*	DP12	DP5	DP6	DP7*	DP8	DP9	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041118SGA10SS	041118SGA11SS	041118SGA13SS	041116SGA02SS	041117SGA04SS	041117SGA05SS	041117SGA08SS	041117SGA09SS				
Sample Date	11/17/2004	11/17/2004	11/17/2004	11/16/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004				
Sample Depth (Feet bgs)	9.0-12.0	7.5-9.5	6.5-9.5	21.0-23.0	15.0-17.0	14.0-16.5	13.0-15.0	14.0-17.0				
Medium	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Volatile Organic Compounds (µg/kg dry)												
1,1,1,2-Tetrachloroethane	0.0444 U	0.0600 U	0.0607 U	0.0907 U	0.136 U	0.130 U	0.124 U	0.0979 U	9,300	HH	9,300	HH
1,1,1-Trichloroethane (TCA)	0.0651 U	0.0881 U	**0.0969 J**	0.133 U	0.199 U	0.191 U	0.181 U	0.144 U	38,000,000	HH	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.0639 U	0.0864 U	0.0875 U	0.131 U	0.195 U	0.187 U	0.178 U	0.141 U	2,800	HH	2,800	HH
1,1,2-Trichloroethane	0.0901 U	0.122 U	0.123 U	0.184 U	0.275 U	0.264 U	0.251 U	0.199 U	2,700	HH	2,700	HH
1,1-Dichloroethane	0.0573 U	0.0775 U	0.0784 U	0.117 U	0.175 U	0.168 U	0.160 U	0.126 U	5,900	HH	5,900	HH
1,1-Dichloroethene	0.442 U	0.599 U	0.606 U	0.904 U	1.35 U	1.30 U	1.23 U	0.976 U	680,000	HH	680,000	HH
1,1-Dichloropropene	0.906 U	1.23 U	1.24 U	1.85 U	2.77 U	2.66 U	2.53 U	2.00 U	8,100	HH	8,100	HH
1,2,3-Trichlorobenzene	0.108 U	0.146 U	0.148 U	0.221 U	0.330 U	0.317 U	0.301 U	0.238 U	20,000	Eco	490,000	HH
1,2,3-Trichloropropane	0.0758 U	0.103 U	0.104 U	0.155 U	0.232 U	0.222 U	0.211 U	0.167 U	95.0	HH	95.0	HH
1,2,4-Trichlorobenzene	0.110 U	0.149 U	0.151 UJ	0.225 U	0.337 U	0.323 U	0.307 U	0.243 U	20,000	Eco	99,000	HH
1,2,4-Trimethylbenzene	0.0479 U	0.0648 U	0.0655 U	0.0978 U	0.146 U	0.140 U	0.133 U	0.106 U	200,000	Eco	980,000	HH
1,2-Dibromo-3-chloropropane	0.135 U	0.183 U	0.185 U	0.276 U	0.413 U	0.396 U	0.376 U	0.298 U	69.0	HH	69.0	HH
1,2-Dibromoethane (EDB)	0.0576 U	0.0780 U	0.0789 U	0.118 U	0.176 U	0.169 U	0.161 U	0.127 U	140	HH	140	HH
1,2-Dichlorobenzene	0.0576 U	0.0780 U	0.0789 U	0.118 U	0.176 U	0.169 U	0.161 U	0.127 U	2,260	Eco	19,000,000	HH
1,2-Dichloroethane (EDC)	0.0879 U	0.119 U	0.120 U	0.180 U	0.269 U	0.258 U	0.245 U	0.194 U	590	HH	590	HH
1,2-Dichloropropane	0.0429 U	0.0580 U	0.0587 U	0.0876 U	0.131 U	0.126 U	0.120 U	0.0946 U	4,500	HH	4,500	HH
1,3,5-Trimethylbenzene	0.0432 U	0.0585 U	0.0592 U	0.0883 U	0.132 U	0.127 U	0.120 U	0.0954 U	150,000	HH	150,000	HH
1,3-Dichlorobenzene	0.0391 U	0.0530 U	0.0536 U	0.0800 U	0.120 U	0.115 U	0.109 U	0.0864 U	2,260	Eco	17,000	HH
1,3-Dichloropropane	0.0608 U	0.0823 U	0.0833 U	0.124 U	0.186 U	0.178 U	0.169 U	0.134 U	20,000,000	HH	20,000,000	HH
1,4-Dichlorobenzene	0.0552 U	0.0748 U	0.0756 UJ	0.113 U	0.169 U	0.162 U	0.154 U	0.122 UJ	17,000	HH	17,000	HH
2,2-Dichloropropane	0.0765 U	0.103 U	0.105 U	0.156 U	0.234 U	0.224 U	0.213 U	0.169 U	4,500	HH	4,500	HH
2-Butanone (MEK)	2.08 U	2.81 U	2.84 U	4.24 U	6.34 U	6.09 U	5.79 U	4.58 U	200,000,000	HH	200,000,000	HH
2-Chlorotoluene	0.0491 U	0.0665 U	0.0673 U	0.100 U	0.150 U	0.144 U	0.137 U	0.108 U	20,000,000	HH	20,000,000	HH
2-Hexanone	1.24 U	1.67 U	1.69 U	2.53 U	3.78 U	3.63 U	3.45 U	2.73 U	1,250,000	Eco	1,400,000	HH
4-Chlorotoluene	0.0939 U	0.127 U	0.129 U	0.192 U	0.287 U	0.276 U	0.262 U	0.207 U	72,000,000	HH	72,000,000	HH
4-Isopropyltoluene	0.0634 U	0.0858 U	0.0868 U	0.130 U	0.194 U	0.186 U	0.177 U	0.140 U	200,000	Eco	24,000,000	HH
4-Methyl-2-pentanone (MIBK)	0.719 U	0.973 U	0.985 U	1.47 U	2.20 U	2.11 U	2.00 U	1.59 U	1,250,000	Eco	53,000,000	HH
Acetone	2.93 U	15.4 U	7.77 U	31.2 U	8.94 U	28.1 U	35.8 U	6.46 U	1,250,000	Eco	630,000,000	HH
Benzene	1.13 U	**0.506 J**	1.55 U	2.32 U	**0.631 J**	3.33 U	3.16 U	2.50 U	1,200	HH	1,200	HH
Bromobenzene	0.0450 U	0.0610 U	0.0617 U	0.0920 U	0.138 U	0.132 U	0.126 U	0.0994 U	1,800,000	HH	1,800,000	HH
Bromochloromethane	0.0520 U	0.0703 U	0.0711 U	0.106 U	0.159 U	0.152 U	0.145 U	0.115 U	1,900	HH	1,900	HH
Bromodichloromethane	0.0701 U	0.0949 U	0.0960 U	0.143 U	0.214 U	0.206 U	0.195 U	0.155 U	1,900	HH	1,900	HH
Bromoform	0.0702 U	0.0950 U	0.0961 U	0.144 U	0.215 U	0.206 U	0.196 U	0.155 U	360,000	HH	360,000	HH
Bromomethane	0.398 UJ	0.539 UJ	0.545 UJ	0.814 UJ	1.22 UJ	1.17 UJ	1.11 UJ	0.879 UJ	17,000	HH	17,000	HH
Carbon Disulfide	0.313 U	0.424 U	0.429 U	**1.04 J**	0.957 U	0.978 U	3.16 U	0.691 U	1,000,000	Eco	3,700,000	HH
Carbon Tetrachloride	0.0955 U	0.129 U	0.131 U	0.195 U	0.292 U	**0.528 J**	0.266 U	0.211 U	630	HH	630	HH
Chlorobenzene	0.0504 U	0.0682 U	0.0690 U	0.103 U	0.154 U	0.148 U	0.140 U	0.111 U	40,000	Eco	4,300,000	HH
Chloroethane	0.650 U	0.880 U	0.890 U	1.33 U	1.99 U	1.91 U	1.81 U	1.43 U	61,000,000	HH	61,000,000	HH
Chloroform	0.0603 U	0.0817 U	0.0826 U	0.123 U	0.184 U	0.177 U	0.168 U	0.133 U	410	HH	410	HH
Chloromethane	0.397 U	0.537 U	0.544 U	0.811 U	1.21 U	1.17 U	1.11 U	0.876 U	300,000	HH	300,000	HH
cis-1,2-Dichloroethene	0.102 U	**58.5**	**4.95**	0.209 U	**0.410 J**	0.300 U	**1.54 J**	**0.628 J**	2,500,000	Eco	3,100,000	HH
cis-1,3-Dichloropropene	0.0414 U	0.0560 U	0.0567 U	0.0846 U	0.127 U	0.122 U	0.115 U	0.0914 U	8,100	HH	8,100	HH
Dibromochloromethane	0.0732 U	0.0990 U	0.100 U	0.150 U	0.224 U	0.215 U	0.204 U	0.161 U	34,000	HH	34,000	HH
Dibromomethane	0.0735 U	0.0995 U	0.101 U	0.150 U	0.225 U	0.216 U	0.205 U	0.162 U	110,000	HH	110,000	HH
Dichlorodifluoromethane	**0.0630 J**	**0.0850 J**	0.0635 U	**0.162 J**	0.142 U	**0.467 J**	0.129 U	**0.132 J**	730,000	Eco	780,000	HH
Dichloromethane (Methylene Chloride)	0.186 U	0.252 U	0.255 U	**1.14 J**	0.569 U	**13.8**	0.519 U	2.50 U	20,000	HH	20,000	HH
Ethylbenzene	1.13 U	1.54 U	0.0384 U	2.32 U	3.47 U	3.33 U	3.16 U	2.50 U	2,260	Eco	12,000	HH
Hexachlorobutadiene	0.0665 U	0.0900 U	0.0910 U	0.136 U	0.203 U	0.195 U	0.185 U	0.147 U	22,000	HH	22,000	HH
Isopropylbenzene	0.0423 U	0.0573 U	0.0579 U	0.0865 U	0.129 U	0.124 U	0.118 U	0.0934 U	2,260	Eco	24,000,000	HH
m,p-Xylenes	2.27 U	0.129 U	3.11 U	4.64 U	6.93 U	0.281 U	6.32 U	5.01 U	120,000	Eco	2,700,000	HH
Naphthalene	0.467 U	0.633 U	0.640 U	0.955 U	1.43 U	1.37 U	1.30 U	1.03 U	23,000	HH	23,000	HH
n-Butylbenzene	0.105 U	0.142 U	0.144 U	0.215 U	0.321 U	0.308 U	0.293 U	0.232 U	-	-	-	-
n-Propylbenzene	0.0532 U	0.0720 U	0.0728 U	0.109 U	0.163 U	0.156 U	0.148 U	0.117 U	2,260	Eco	21,000,000	HH
o-Xylene	1.13 U	0.0515 U	1.55 U	2.32 U	**0.184 J**	3.33 U	3.16 U	2.50 U	1,000	Eco	19,000,000	HH
sec-Butylbenzene	0.0442 U	0.0599 U	0.0606 U	0.0904 U	0.135 U	0.130 U	0.123 U	0.0976 U	2,260	Eco	-	-
Styrene	0.0272 U	0.0368 U	0.0373 U	2.32 U	0.0832 U	0.0799 U	0.0759 U	0.0601 U	300,000	Eco	51,000,000	HH
tert-Butylbenzene	0.0273 U	0.0370 U	0.0374 U	0.0559 U	0.0836 U	0.0802 U	0.0762 U	0.0603 U	2,260	Eco	-	-
Tetrachloroethene (PCE)	**0.235 J**	**54.0**	**14.4**	0.234 U	0.350 U	0.336 U	**0.437 J**	0.253 U	1,600	HH	1,600	HH
Toluene	1.13 U	1.54 U	1.55 U	2.32 U	**5.20**	3.33 U	3.16 U	2.50 U	200,000	Eco	24,000,000	HH
trans-1,2-Dichloroethene	0.284 U	0.384 U	0.388 U	0.580 U	0.867 U	0.832 U	0.790 U	0.626 U	200,000	HH	200,000	HH
trans-1,3-Dichloropropene	0.0514 U	0.0696 U	0.0704 U	0.105 U	0.157 U	0.151 U	0.143 U	0.113 U	8,100	HH	8,100	HH
Trichloroethene (TCE)	**0.374 J**	**24.5**	**4.06**	**0.0809 J**	**0.298 J**	**0.150 J**	**0.108 J**	**0.230 J**	130	HH	130	HH
Trichlorofluoromethane	0.397 U	0.537 U	0.544 U	0.811 U	1.21 U	1.17 U	1.11 U	0.876 U	730,000	Eco	63,000,000	HH
Vinyl Acetate	1.15 U	1.55 U	1.57 U	2.34 U	3.50 U	3.36 U	3.19 U	2.53 U	4,100,000	HH	4,100,000	HH
Vinyl Chloride	0.211 U	0.286 U	0.289 U	0.431 U	0.645 U	0.619 U	0.588 U	0.466 U	2,200	HH	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5b
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Volatile Organic Compounds
(Page 2 of 3)

Site ID	HA1*	HA10	HA11	HA11	HA12	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA14SS	041123SGA29SS	041123SGA30SS	041123SGA31SS	041123SGA33SS				
Sample Date	11/22/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004				
Sample Depth (Feet bgs)	0.5	0.5	1.0	3.0	4.0				
Medium	Soil	Soil	Soil	Soil	Soil				
Volatile Organic Compounds (µg/kg dry)									
1,1,1,2-Tetrachloroethane	0.0575 U	0.0536 U	0.0656 U	0.0934 U	0.0473 U	9,300	HH	9,300	HH
1,1,1-Trichloroethane (TCA)	0.0844 U	0.0787 U	0.0963 U	0.137 U	0.0694 U	38,000,000	HH	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.0828 U	0.0771 U	0.0944 U	0.135 U	0.0680 U	2,800	HH	2,800	HH
1,1,2-Trichloroethane	0.117 U	0.109 U	0.133 U	0.190 U	0.0960 U	2,700	HH	2,700	HH
1,1-Dichloroethane	0.0743 U	0.0692 U	0.0847 U	0.121 U	0.0610 U	5,900	HH	5,900	HH
1,1-Dichloroethene	0.574 U	0.534 U	0.654 U	0.932 U	0.471 U	680,000	HH	680,000	HH
1,1-Dichloropropene	1.18 U	1.09 U	1.34 U	1.91 U	0.966 U	8,100	HH	8,100	HH
1,2,3-Trichlorobenzene	0.140 U	0.130 U	0.160 U	0.227 U	0.115 U	20,000	Eco	490,000	HH
1,2,3-Trichloropropane	0.0983 U	0.0915 U	0.112 U	0.160 U	0.0807 U	95.0	HH	95.0	HH
1,2,4-Trichlorobenzene	0.143 U	0.133 U	0.163 U	0.232 U	0.117 U	20,000	Eco	99,000	HH
1,2,4-Trimethylbenzene	**0.523 J**	0.0578 U	**0.252 J**	0.101 U	0.0510 U	200,000	Eco	980,000	HH
1,2-Dibromo-3-chloropropane	0.175 UJ	0.163 UJ	0.200 UJ	0.284 UJ	0.144 UJ	69.0	HH	69.0	HH
1,2-Dibromoethane (EDB)	0.0747 U	0.0696 U	0.0852 U	0.121 U	0.0614 U	140	HH	140	HH
1,2-Dichlorobenzene	0.0747 U	0.0696 U	0.0852 U	0.121 U	0.0614 U	2,260	Eco	19,000,000	HH
1,2-Dichloroethane (EDC)	0.114 U	0.106 U	0.130 U	0.185 U	0.0937 U	590	HH	590	HH
1,2-Dichloropropane	0.0556 U	0.0518 U	0.0634 U	0.0903 U	0.0457 U	4,500	HH	4,500	HH
1,3,5-Trimethylbenzene	**0.0929 J**	0.0522 U	0.0639 U	0.0910 U	0.0460 U	150,000	HH	150,000	HH
1,3-Dichlorobenzene	0.0507 U	0.0473 U	0.0579 U	0.0824 U	0.0417 U	2,260	Eco	17,000	HH
1,3-Dichloropropane	0.0788 U	0.0734 U	0.0899 U	0.128 U	0.0648 U	20,000,000	HH	20,000,000	HH
1,4-Dichlorobenzene	0.0716 U	0.0667 U	0.0817 U	0.116 U	0.0589 U	17,000	HH	17,000	HH
2,2-Dichloropropane	0.0991 U	0.0924 U	0.113 U	0.161 U	0.0815 U	4,500	HH	4,500	HH
2-Butanone (MEK)	17.8 U	10.7 U	19.3 U	29.2 U	10.6 U	200,000,000	HH	200,000,000	HH
2-Chlorotoluene	0.0637 U	0.0593 U	0.0726 U	0.103 U	0.0523 U	20,000,000	HH	20,000,000	HH
2-Hexanone	1.60 U	1.49 U	1.83 U	2.60 U	1.32 U	1,250,000	Eco	1,400,000	HH
4-Chlorotoluene	0.122 U	0.113 U	0.139 U	0.198 U	0.100 U	72,000,000	HH	72,000,000	HH
4-Isopropyltoluene	**0.0833 J**	0.0766 U	**0.152 J**	**1.11 J**	0.0676 U	200,000	Eco	24,000,000	HH
4-Methyl-2-pentanone (MIBK)	0.933 U	0.869 U	1.06 U	1.52 U	0.766 U	1,250,000	Eco	53,000,000	HH
Acetone	95.4 U	144 U	329 U	292 U	76.6 U	1,250,000	Eco	630,000,000	HH
Benzene	1.47 U	1.37 U	**0.474 J**	**0.514 J**	**0.396 J**	1,200	HH	1,200	HH
Bromobenzene	0.0584 U	0.0544 U	0.0666 U	0.0949 U	0.0480 U	1,800,000	HH	1,800,000	HH
Bromochloromethane	0.0674 U	0.0628 U	0.0768 U	0.109 U	0.0554 U	1,900	HH	1,900	HH
Bromodichloromethane	0.0909 U	0.0847 U	0.104 U	0.148 U	0.0747 U	1,900	HH	1,900	HH
Bromoform	0.0911 UJ	0.0848 UJ	0.104 UJ	0.148 UJ	0.0748 UJ	360,000	HH	360,000	HH
Bromomethane	0.516 U	0.481 U	0.589 U	0.839 U	1.21 U	17,000	HH	17,000	HH
Carbon Disulfide	0.406 U	0.378 U	**0.549 J**	0.660 U	0.334 U	1,000,000	Eco	3,700,000	HH
Carbon Tetrachloride	0.124 U	0.115 U	0.141 U	0.201 U	0.102 U	630	HH	630	HH
Chlorobenzene	0.0653 U	0.0608 U	0.0745 U	0.106 U	0.0537 U	40,000	Eco	4,300,000	HH
Chloroethane	0.843 U	0.785 U	0.961 U	1.37 U	0.693 U	61,000,000	HH	61,000,000	HH
Chloroform	0.0783 U	0.0729 U	0.0892 U	0.127 U	0.0643 U	410	HH	410	HH
Chloromethane	0.515 U	0.480 U	0.587 U	0.836 U	0.423 U	300,000	HH	300,000	HH
cis-1,2-Dichloroethene	0.132 U	0.123 U	0.151 U	0.215 U	0.109 U	2,500,000	Eco	3,100,000	HH
cis-1,3-Dichloropropene	0.0537 U	0.0500 U	0.0612 U	0.0872 U	0.0441 U	8,100	HH	8,100	HH
Dibromochloromethane	0.0949 U	0.0884 U	0.108 U	0.154 U	0.0780 U	34,000	HH	34,000	HH
Dibromomethane	0.0953 U	0.0888 U	0.109 U	0.155 U	0.0783 U	110,000	HH	110,000	HH
Dichlorodifluoromethane	0.0602 U	0.0560 U	0.0686 U	0.0977 U	0.0494 U	730,000	Eco	780,000	HH
Dichloromethane (Methylene Chloride)	1.47 U	4.35 U	5.38 U	9.54 U	2.14 U	20,000	HH	20,000	HH
Ethylbenzene	1.47 U	1.37 U	1.68 U	2.39 U	1.21 U	2,260	Eco	12,000	HH
Hexachlorobutadiene	0.0862 U	0.0803 U	0.0983 U	0.140 U	0.0708 U	22,000	HH	22,000	HH
Isopropylbenzene	0.0549 U	0.0511 U	0.0626 U	0.0891 U	0.0451 U	2,260	Eco	24,000,000	HH
m,p-Xylenes	2.94 U	2.74 U	3.35 U	4.78 U	2.42 U	120,000	Eco	2,700,000	HH
Naphthalene	0.606 U	0.565 U	0.691 U	0.985 U	0.498 U	23,000	HH	23,000	HH
n-Butylbenzene	0.136 U	0.127 U	0.155 U	0.221 U	0.112 U	-	-	-	-
n-Propylbenzene	0.0690 U	0.0643 U	0.0787 U	0.112 U	0.0567 U	2,260	Eco	21,000,000	HH
o-Xylene	1.47 U	0.0411 U	1.68 U	2.39 U	1.21 U	1,000	Eco	19,000,000	HH
sec-Butylbenzene	0.0574 U	0.0534 U	0.0654 U	0.0932 U	0.0471 U	2,260	Eco	-	-
Styrene	1.47 U	1.37 U	0.0403 U	2.39 U	1.21 U	300,000	Eco	51,000,000	HH
tert-Butylbenzene	0.0355 U	0.0330 U	0.0404 U	0.0576 U	0.0291 U	2,260	Eco	-	-
Tetrachloroethene (PCE)	**0.162 J**	0.138 U	0.169 U	0.241 U	**0.950 J**	1,600	HH	1,600	HH
Toluene	1.47 U	1.37 U	**0.786 J**	**1.33 J**	1.21 U	200,000	Eco	24,000,000	HH
trans-1,2-Dichloroethene	0.368 U	0.343 U	0.419 U	0.597 U	0.302 U	200,000	HH	200,000	HH
trans-1,3-Dichloropropene	0.0666 U	0.0621 U	0.0760 U	0.108 U	0.0547 U	8,100	HH	8,100	HH
Trichloroethene (TCE)	**0.171 J**	0.0440 U	0.0538 U	0.0767 U	**0.0450 J**	130	HH	130	HH
Trichlorofluoromethane	0.515 U	0.480 U	0.587 U	0.836 U	0.423 U	730,000	Eco	63,000,000	HH
Vinyl Acetate	1.49 U	1.38 U	1.69 U	2.41 U	1.22 U	4,100,000	HH	4,100,000	HH
Vinyl Chloride	0.274 U	0.255 U	0.312 U	0.444 U	0.225 U	2,200	HH	2,200	HH

Notes:
µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5b
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Volatile Organic Compounds
(Page 3 of 3)

Site ID	HA2	HA3	HA4	HA5	HA9	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA16SS	041122SGA17SS	041122SGA21SS	041122SGA23SS	041123SGA28SS				
Sample Date	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/23/2004				
Sample Depth (Feet bgs)	0.5	0.5	3.0	3.0	0.5				
Medium	Soil	Soil	Soil	Soil	Soil				
Volatile Organic Compounds (µg/kg dry)									
1,1,1,2-Tetrachloroethane	0.0443 U	0.0610 U	0.0553 U	0.0957 U	0.0553 U	9,300	HH	9,300	HH
1,1,1-Trichloroethane (TCA)	0.0650 U	0.0896 U	0.0812 U	0.140 U	0.0812 U	38,000,000	HH	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.0638 U	0.0879 U	0.0797 U	0.138 U	0.0796 U	2,800	HH	2,800	HH
1,1,2-Trichloroethane	0.0899 U	0.124 U	0.112 U	0.194 U	0.112 U	2,700	HH	2,700	HH
1,1-Dichloroethane	0.0572 U	0.0788 U	0.0715 U	0.124 U	0.0714 U	5,900	HH	5,900	HH
1,1-Dichloroethene	0.442 U	0.609 U	0.552 U	0.954 U	0.551 U	680,000	HH	680,000	HH
1,1-Dichloropropene	0.905 U	1.25 U	1.13 U	1.95 U	1.13 U	8,100	HH	8,100	HH
1,2,3-Trichlorobenzene	0.108 U	0.149 U	0.135 U	0.233 U	0.135 U	20,000	Eco	490,000	HH
1,2,3-Trichloropropane	0.0756 U	0.104 U	0.0946 U	0.163 U	0.0945 U	95.0	HH	95.0	HH
1,2,4-Trichlorobenzene	0.110 U	0.152 U	0.137 U	0.238 U	0.137 U	20,000	Eco	99,000	HH
1,2,4-Trimethylbenzene	0.0478 U	0.0658 U	**14,300**	**3.96**	**0.215 J**	200,000	Eco	980,000	HH
1,2-Dibromo-3-chloropropane	0.135 UJ	0.186 UJ	0.168 UJ	0.291 UJ	0.168 UJ	69.0	HH	69.0	HH
1,2-Dibromoethane (EDB)	0.0575 U	0.0793 U	0.0719 U	0.124 U	0.0718 U	140	HH	140	HH
1,2-Dichlorobenzene	0.0575 U	0.0793 U	0.0719 U	0.124 U	0.0718 U	2,260	Eco	19,000,000	HH
1,2-Dichloroethane (EDC)	0.0878 U	0.121 U	0.110 U	0.190 U	0.110 U	590	HH	590	HH
1,2-Dichloropropane	0.0428 U	0.0590 U	0.0535 U	0.0925 U	0.0535 U	4,500	HH	4,500	HH
1,3,5-Trimethylbenzene	**0.0435 J**	**0.125 J**	**219**	**1.83 J**	0.0539 U	150,000	HH	150,000	HH
1,3-Dichlorobenzene	0.0391 U	0.0538 U	0.0488 U	0.0844 U	0.0488 U	2,260	Eco	17,000	HH
1,3-Dichloropropane	0.0607 U	0.0836 U	0.0759 U	0.131 U	0.0758 U	20,000,000	HH	20,000,000	HH
1,4-Dichlorobenzene	0.0551 U	0.0760 U	0.0689 U	0.119 U	0.0689 U	17,000	HH	17,000	HH
2,2-Dichloropropane	0.0763 U	0.105 U	0.0954 U	0.165 U	0.0953 U	4,500	HH	4,500	HH
2-Butanone (MEK)	14.4 U	19.8 U	2.59 U	4.48 U	8.89 U	200,000,000	HH	200,000,000	HH
2-Chlorotoluene	0.0490 U	0.0676 U	0.0613 U	0.106 U	0.0612 U	20,000,000	HH	20,000,000	HH
2-Hexanone	1.23 U	1.70 U	1.54 U	2.67 U	1.54 U	1,250,000	Eco	1,400,000	HH
4-Chlorotoluene	0.0938 U	0.129 U	0.117 U	0.203 U	0.117 U	72,000,000	HH	72,000,000	HH
4-Isopropyltoluene	**2.63**	**0.196 J**	**161**	**0.912 J**	**0.253 J**	200,000	Eco	24,000,000	HH
4-Methyl-2-pentanone (MIBK)	0.718 U	0.989 U	0.897 U	1.55 U	0.896 U	1,250,000	Eco	53,000,000	HH
Acetone	173 U	389 U	146 U	65.5 U	89.1 U	1,250,000	Eco	630,000,000	HH
Benzene	1.13 U	1.56 U	1.42 U	**0.600 J**	1.41 U	1,200	HH	1,200	HH
Bromobenzene	0.0450 U	0.0619 U	0.0562 U	0.0971 U	0.0561 U	1,800,000	HH	1,800,000	HH
Bromochloromethane	0.0519 U	0.0715 U	0.0648 U	0.112 U	0.0648 U	1,900	HH	1,900	HH
Bromodichloromethane	0.0700 U	0.0964 U	0.0875 U	0.151 U	0.0874 U	1,900	HH	1,900	HH
Bromoform	0.0701 UJ	0.0966 UJ	0.0876 UJ	0.151 UJ	0.0875 UJ	360,000	HH	360,000	HH
Bromomethane	0.397 U	0.548 U	1.42 U	0.859 U	0.496 U	17,000	HH	17,000	HH
Carbon Disulfide	0.313 U	0.431 U	1.42 U	0.675 U	0.390 U	1,000,000	Eco	3,700,000	HH
Carbon Tetrachloride	0.0953 U	0.131 U	0.119 U	0.206 U	0.119 U	630	HH	630	HH
Chlorobenzene	0.0503 U	0.0693 U	0.0628 U	0.109 U	0.0628 U	40,000	Eco	4,300,000	HH
Chloroethane	0.649 U	0.894 U	0.811 U	1.40 U	0.810 U	61,000,000	HH	61,000,000	HH
Chloroform	0.0602 U	0.0830 U	0.0753 U	0.130 U	0.0752 U	410	HH	410	HH
Chloromethane	0.396 U	0.546 U	0.495 U	0.856 U	0.495 U	300,000	HH	300,000	HH
cis-1,2-Dichloroethene	0.102 U	0.140 U	**120**	0.220 U	0.127 U	2,500,000	Eco	3,100,000	HH
cis-1,3-Dichloropropene	0.0413 U	0.0570 U	0.0517 U	0.0893 U	0.0516 U	8,100	HH	8,100	HH
Dibromochloromethane	0.0730 U	0.101 U	0.0913 U	0.158 U	0.0912 U	34,000	HH	34,000	HH
Dibromomethane	0.0734 U	0.101 U	0.0917 U	0.159 U	0.0916 U	110,000	HH	110,000	HH
Dichlorodifluoromethane	0.0463 U	0.0638 U	0.0579 U	0.100 U	0.0578 U	730,000	Eco	780,000	HH
Dichloromethane (Methylene Chloride)	2.27 U	2.46 U	6.37 U	5.63 U	2.43 U	20,000	HH	20,000	HH
Ethylbenzene	1.13 U	1.56 U	**37.4**	2.45 U	1.41 U	2,260	Eco	12,000	HH
Hexachlorobutadiene	0.0664 U	0.0914 U	0.0829 U	0.143 U	0.0829 U	22,000	HH	22,000	HH
Isopropylbenzene	0.0422 U	0.0582 U	**47.3**	0.0913 U	0.0527 U	2,260	Eco	24,000,000	HH
m,p-Xylenes	2.26 U	3.12 U	**40.0**	4.89 U	2.83 U	120,000	Eco	2,700,000	HH
Naphthalene	0.467 U	0.643 U	**19.5**	**2.04 J**	0.583 U	23,000	HH	23,000	HH
n-Butylbenzene	0.105 U	0.144 U	0.131 U	0.227 U	0.131 U	-	-	-	-
n-Propylbenzene	0.0531 U	0.0732 U	**122**	**0.409 J**	0.0663 U	2,260	Eco	21,000,000	HH
o-Xylene	1.13 U	1.56 U	**57.1**	**0.197 J**	1.41 U	1,000	Eco	19,000,000	HH
sec-Butylbenzene	0.0442 U	0.0609 U	**90.2**	**0.435 J**	0.0551 U	2,260	Eco	-	-
Styrene	1.13 U	1.56 U	0.0340 U	2.45 U	1.41 U	300,000	Eco	51,000,000	HH
tert-Butylbenzene	0.0273 U	0.0376 U	0.0341 U	0.0590 U	0.0341 U	2,260	Eco	-	-
Tetrachloroethene (PCE)	0.114 U	0.158 U	**9,410**	**5.84**	0.143 U	1,600	HH	1,600	HH
Toluene	1.13 U	1.56 U	**4.78**	2.45 U	1.41 U	200,000	Eco	24,000,000	HH
trans-1,2-Dichloroethene	0.283 U	0.390 U	**2.28**	0.612 U	0.354 U	200,000	HH	200,000	HH
trans-1,3-Dichloropropene	0.0513 U	0.0707 U	0.0641 U	0.111 U	0.0641 U	8,100	HH	8,100	HH
Trichloroethene (TCE)	**0.0667 J**	**0.0655 J**	**6,080**	**1.35 J**	**0.0614 J**	130	HH	130	HH
Trichlorofluoromethane	0.396 U	0.546 U	0.495 U	0.856 U	0.495 U	730,000	Eco	63,000,000	HH
Vinyl Acetate	1.14 U	1.58 U	1.43 U	2.47 U	1.43 U	4,100,000	HH	4,100,000	HH
Vinyl Chloride	0.211 U	0.290 U	0.263 U	0.455 U	0.263 U	2,200	HH	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
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J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5c
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Semivolatile Organic Compounds
(Page 1 of 3)

Site ID	DP10	DP11*	DP12	DP5	DP6	DP7*	DP8	DP9	Selected SLV (0-3 ft bgs)	SLV Source (0-3 ft bgs)	Selected SLV (>3 ft bgs)	SLV Source (>3 ft bgs)
Sample ID	041118SGA10SS	041118SGA11SS	041118SGA13SS	041116SGA02SS	041117SGA04SS	041117SGA05SS	041117SGA08SS	041117SGA09SS				
Sample Date	11/17/2004	11/17/2004	11/17/2004	11/16/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004				
Sample Depth (Feet bgs)	9.0-12.0	7.5-9.5	6.5-9.5	21.0-23.0	15.0-17.0	14.0-16.5	13.0-15.0	14.0-17.0				
Medium	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Semivolatile Organic Compounds (µg/kg dry)												
1,2,4-Trichlorobenzene	1.04 U	1.02 U	1.03 UJ	0.998 U	1.00 U	0.981 U	0.935 U	1.01 U	20,000	Eco	99,000	HH
1,2-Dichlorobenzene	0.836 U	0.815 U	0.824 U	0.798 U	0.802 U	0.785 U	0.748 U	0.811 U	2,260	Eco	19,000,000	HH
1,3-Dichlorobenzene	1.05 U	1.02 U	1.03 U	1.00 U	1.01 U	0.985 U	0.939 U	1.02 U	2,260	Eco	17,000	HH
1,4-Dichlorobenzene	1.03 U	1.01 U	1.02 UJ	0.988 U	0.993 U	0.972 U	0.927 U	1.00 UJ	17,000	HH	17,000	HH
2,4,5-Trichlorophenol	0.955 U	0.931 U	0.941 U	0.912 U	0.917 U	0.897 U	0.855 U	0.927 U	4,000	Eco	62,000,000	HH
2,4,6-Trichlorophenol	0.973 U	0.949 U	0.959 U	0.930 U	0.934 U	0.914 U	0.872 U	0.945 U	10,000	Eco	200,000	HH
2,4-Dichlorophenol	1.09 U	1.06 U	1.08 U	1.04 U	1.05 U	1.03 U	0.977 U	1.06 U	20,000	Eco	1,800,000	HH
2,4-Dimethylphenol	0.941 UJ	0.918 UJ	0.928 UJ	0.899 UJ	0.904 UJ	0.884 UJ	0.843 UJ	0.914 UJ	20,000	Eco	12,000,000	HH
2,4-Dinitrophenol	8.60 U	8.39 U	8.48 U	8.22 U	8.26 U	8.08 U	7.70 U	8.35 U	20,000	Eco	1,200,000	HH
2,4-Dinitrotoluene	2.09 U	2.04 U	2.06 UJ	2.00 U	2.01 U	1.97 U	1.87 U	2.03 U	5,500	HH	5,500	HH
2,6-Dinitrotoluene	1.32 U	1.28 U	1.30 U	1.26 U	1.26 U	1.24 U	1.18 U	1.28 U	240,000	HH	240,000	HH
2-Chloronaphthalene	0.831 U	0.810 U	0.819 U	0.793 U	0.797 U	0.780 U	0.744 U	0.806 U	82,000,000	HH	82,000,000	HH
2-Chlorophenol	0.828 U	0.808 U	0.816 U	0.791 U	0.795 U	0.778 U	0.742 U	0.804 U	60,000	Eco	5,100,000	HH
2-Methylphenol	1.16 U	1.13 U	1.15 U	1.11 U	1.12 U	1.09 U	1.04 U	1.13 U	50,000	Eco	31,000,000	HH
2-Nitroaniline	0.668 U	0.652 U	0.659 U	0.638 U	0.641 U	0.628 U	0.598 U	0.649 U	6,000,000	HH	6,000,000	HH
2-Nitrophenol	1.40 U	1.37 U	1.38 U	1.34 U	1.35 U	1.32 U	1.26 U	1.36 U	180,000,000	HH	180,000,000	HH
3,3'-Dichlorobenzidine	5.34 U	5.21 U	5.26 U	5.10 U	5.13 U	5.02 U	4.78 U	5.18 U	4,800	HH	4,800	HH
3-Nitroaniline	3.61 U	3.52 U	3.55 U	3.44 U	3.46 U	3.39 U	3.23 U	3.50 U	70,000	Eco	6,000,000	HH
4,6-Dinitro-2-methylphenol	2.22 U	2.16 U	2.18 U	2.12 U	2.13 U	2.08 U	1.98 U	2.15 U	49,000	HH	49,000	HH
4-Bromophenyl Phenyl Ether	2.26 U	2.21 U	2.23 U	2.16 U	2.17 U	2.13 U	2.03 U	2.20 U	-	-	-	-
4-Chloro-3-methylphenol	1.10 U	1.07 U	1.08 U	1.05 U	1.05 U	1.03 U	0.984 U	1.07 U	62,000,000	HH	62,000,000	HH
4-Chloroaniline	1.14 U	1.12 U	1.13 U	1.09 U	1.10 U	1.08 U	1.02 U	1.11 U	8,600	HH	8,600	HH
4-Chlorophenyl Phenyl Ether	2.65 U	2.58 U	2.61 U	2.53 U	2.54 U	2.49 U	2.37 U	2.57 U	-	-	-	-
4-Nitroaniline	5.05 UJ	4.92 UJ	4.97 UJ	4.82 UJ	4.84 UJ	4.74 UJ	4.52 UJ	4.90 UJ	40,000	Eco	86,000	HH
4-Nitrophenol	10.1 U	9.83 U	9.93 U	9.63 U	9.67 U	9.47 U	9.02 U	9.78 U	7,000	Eco	180,000,000	HH
Aniline	2.3 U	2.2 U	2.2 U	2.2 U	2.2 U	2.1 U	2.0 U	2.2 U	200,000	Eco	300,000	HH
Benzidine	3.47 U	3.38 U	3.42 U	3.31 U	3.33 U	3.26 U	3.11 U	3.37 U	55,000	HH	55,000	HH
Benzoic Acid	19.7 U	19.2 U	19.4 U	18.8 U	18.9 U	18.5 U	17.6 U	19.1 U	200,000	Eco	2,500,000,000	HH
Benzyl Alcohol	2.45 U	2.39 U	2.41 U	2.34 U	2.35 U	2.30 U	2.19 U	2.38 U	2,260	Eco	62,000,000	HH
Bis(2-chloroethoxy)methane	2.36 U	2.30 U	2.33 U	2.26 U	2.27 U	2.22 U	2.12 U	2.29 U	730,000	Eco	1,800,000	HH
Bis(2-chloroethyl) Ether	1.93 U	1.88 U	1.90 U	1.85 U	1.85 U	1.81 U	1.73 U	1.88 U	1,000	HH	1,000	HH
Bis(2-chloroisopropyl) Ether	9.83 U	9.59 U	9.69 U	9.39 U	9.44 U	9.24 U	8.80 U	9.54 U	1,000	HH	1,000	HH
Bis(2-ethylhexyl) Phthalate	**32.1**	**75.0 J**	**6.67 J**	**11.2 J**	**10.9 J**	**147**	**266**	**44.1**	4,500	Eco	150,000	HH
Butyl Benzyl Phthalate	2.63 U	2.57 U	2.60 U	2.52 U	2.53 U	2.47 U	2.36 U	2.56 U	450	Eco	910,000	HH
Carbazole	2.45 U	2.39 U	2.41 U	2.34 U	2.35 U	2.30 U	2.19 U	2.38 U	2,260	Eco	1,000,000	HH
Dibenzofuran	0.569 U	0.555 U	0.560 U	0.543 U	0.546 U	0.534 U	0.509 U	0.552 U	2.00	Eco	1,000,000	HH
Diethyl Phthalate	4.44 U	4.33 U	4.38 U	4.24 U	4.26 U	4.17 U	3.98 U	4.31 U	100,000	Eco	490,000,000	HH
Dimethyl Phthalate	2.41 U	2.35 U	2.38 U	2.30 U	2.32 U	2.27 U	2.16 U	2.34 U	150,000	HH	150,000	HH
Di-n-butyl Phthalate	12.3 U	2.18 U	2.21 U	2.14 U	11.8 U	11.6 U	11.0 U	11.9 U	450	Eco	62,000,000	HH
Di-n-octyl Phthalate	2.26 U	2.21 U	2.23 U	2.16 U	**7.06 J**	**4.40 J**	2.03 U	2.20 U	450	Eco	150,000	HH
Hexachlorobenzene	0.651 U	0.635 U	0.642 U	0.622 U	0.625 U	0.612 U	0.583 U	0.632 U	1,800	HH	1,800	HH
Hexachlorobutadiene	0.900 U	0.877 U	0.887 U	0.859 U	0.864 U	0.845 U	0.805 U	0.873 U	22,000	HH	22,000	HH
Hexachlorocyclopentadiene	0.976 U	0.952 U	0.962 U	0.932 U	0.937 U	0.917 U	0.874 U	0.947 U	10,000	Eco	3,700,000	HH
Hexachloroethane	2.08 U	2.03 U	2.05 U	1.99 U	2.00 U	1.95 U	1.86 U	2.02 U	150,000	HH	150,000	HH
Isophorone	0.620 U	0.605 U	0.611 U	0.592 U	0.595 U	0.583 U	0.555 U	0.602 U	1,800,000	HH	1,800,000	HH
Nitrobenzene	3.70 U	3.61 U	3.65 U	3.54 U	3.56 U	3.48 U	3.32 U	3.60 U	8,000	Eco	24,000	HH
N-Nitrosodimethylamine	3.75 U	3.66 U	3.70 U	3.58 U	3.60 U	3.53 U	3.36 U	3.64 U	34.0	HH	34.0	HH
N-Nitrosodi-n-propylamine	1.65 U	1.61 U	1.63 U	1.58 U	1.58 U	1.55 U	1.48 U	1.60 U	250	HH	250	HH
N-Nitrosodiphenylamine	0.704 U	0.687 U	0.694 U	0.672 U	0.676 U	0.661 U	0.630 U	0.683 U	20,000	Eco	350,000	HH
p-cresol (4-Methylphenol)	1.45 U	1.42 U	1.43 U	1.39 U	1.39 U	1.36 U	1.30 U	1.41 U	-	-	-	-
Pentachlorophenol	2.39 UJ	2.33 UJ	2.35 UJ	2.28 UJ	2.29 UJ	2.24 UJ	2.14 UJ	2.32 UJ	2,100	Eco	13,000	HH
Phenol	0.890 U	0.868 U	0.877 U	0.850 U	0.854 U	0.836 U	0.797 U	0.864 U	30,000	Eco	180,000,000	HH
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)												
2-Methylnaphthalene	0.640 U	0.624 U	0.631 U	0.611 U	**7.98 J**	0.601 U	0.573 U	0.621 U	4,100,000	HH	4,100,000	HH
Acenaphthene	0.631 U	0.616 U	0.622 U	0.603 U	0.606 U	0.593 U	0.565 U	0.613 U	19,000,000	HH	19,000,000	HH
Acenaphthylene	0.725 U	0.707 U	0.714 U	0.692 U	0.696 U	0.681 U	0.649 U	0.704 U	23,000	HH	23,000	HH
Anthracene	0.468 U	0.456 U	0.461 U	0.447 U	0.449 U	0.439 U	0.419 U	0.454 U	93,000,000	HH	93,000,000	HH
Fluorene	0.795 U	0.775 U	0.784 U	0.759 U	0.763 U	0.747 U	0.712 U	0.772 U	12,000,000	HH	12,000,000	HH
Naphthalene	1.09 U	1.06 U	1.07 U	1.04 U	**4.24**	1.02 U	0.976 U	1.06 U	23,000	HH	23,000	HH
Phenanthrene	0.731 U	0.713 U	0.720 U	0.698 U	0.702 U	0.687 U	**1.82 J**	0.710 U	93,000,000	HH	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	NC	NC	NC	NC	NC	NC	NC	NC	29,000	Eco	-	-
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)												
Benzo(a)anthracene	1.24 U	1.21 U	1.23 U	1.19 U	1.19 U	1.17 U	1.11 U	1.21 U	2,700	HH	2,700	HH
Benzo(a)pyrene	0.779 U	0.760 U	0.768 U	0.744 U	0.748 U	**1.32 J**	0.697 U	0.756 U	270	HH	270	HH
Benzo(g,h,i)perylene	0.592 U	0.577 U	0.583 U	0.565 U	0.568 U	0.556 U	0.530 U	0.575 U	27,000	HH	27,000	HH
Benzofluoranthenes, Total	1.11 U	1.09 U	1.10 U	1.06 U	1.07 U	**2.72 J**	**2.97 J**	1.08 U	2,700	HH	2,700	HH
Chrysene	0.880 U	0.858 U	0.867 U	0.840 U	0.845 U	0.827 U	0.788 U	0.854 U	270,000	HH	270,000	HH
Dibenz(a,h)anthracene	0.764 U	0.745 U	0.753 U	0.730 U	0.734 U	0.718 U	0.684 U	0.742 U	270	HH	270	HH
Fluoranthene	1.24 U	1.21 U	1.23 U	1.19 U	1.19 U	**3.53**	**3.90**	1.21 U	8,900,000	HH	8,900,000	HH
Indeno(1,2,3-cd)pyrene	0.561 U	0.547 U	0.553 U	0.536 U	0.539 U	0.527 U	**0.511 J**	0.545 U	2,700	HH	2,700	HH
Pyrene	0.418 U	0.408 U	0.412 U	0.400 U	**3.71**	**3.31**	**2.60**	0.406 U	6,700,000	HH	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	NC	NC	NC	NC	NC	NC	NC	NC	1,100	Eco	-	-

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5c
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Semivolatile Organic Compounds
(Page 2 of 3)

Site ID	HA1*	HA10	HA11	HA11	HA12	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA14SS	041123SGA29SS	041123SGA30SS	041123SGA31SS	041123SGA33SS				
Sample Date	11/22/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004				
Sample Depth (Feet bgs)	0.5	0.5	1.0	3.0	4.0				
Medium	Soil	Soil	Soil	Soil	Soil				
Semivolatile Organic Compounds (µg/kg dry)									
1,2,4-Trichlorobenzene	0.987 U	0.880 U	1.05 U	1.07 U	1.01 U	20,000	Eco	99,000	HH
1,2-Dichlorobenzene	0.790 U	0.703 U	0.837 U	0.857 U	0.808 U	2,260	Eco	19,000,000	HH
1,3-Dichlorobenzene	0.991 U	0.883 U	1.05 U	1.08 U	1.01 U	2,260	Eco	17,000	HH
1,4-Dichlorobenzene	0.978 U	0.871 U	1.04 U	1.06 U	1.00 U	17,000	HH	17,000	HH
2,4,5-Trichlorophenol	0.902 U	0.804 U	0.956 U	0.980 U	0.923 U	4,000	Eco	62,000,000	HH
2,4,6-Trichlorophenol	0.920 U	0.819 U	0.975 U	0.999 U	0.941 U	10,000	Eco	200,000	HH
2,4-Dichlorophenol	1.03 U	0.919 U	1.09 U	1.12 U	1.06 U	20,000	Eco	1,800,000	HH
2,4-Dimethylphenol	0.890 UJ	0.793 UJ	0.943 UJ	0.966 UJ	0.910 UJ	20,000	Eco	12,000,000	HH
2,4-Dinitrophenol	8.13 U	7.24 U	8.61 U	8.82 U	8.32 U	20,000	Eco	1,200,000	HH
2,4-Dinitrotoluene	1.98 U	1.76 U	2.09 U	2.15 U	2.02 U	5,500	HH	5,500	HH
2,6-Dinitrotoluene	1.24 U	1.11 U	1.32 U	1.35 U	1.27 U	240,000	HH	240,000	HH
2-Chloronaphthalene	0.785 U	0.699 U	0.832 U	0.852 U	0.803 U	82,000,000	HH	82,000,000	HH
2-Chlorophenol	0.783 U	0.697 U	0.829 U	0.850 U	0.801 U	60,000	Eco	5,100,000	HH
2-Methylphenol	1.10 U	0.978 U	1.16 U	1.19 U	1.12 U	50,000	Eco	31,000,000	HH
2-Nitroaniline	0.631 U	0.563 U	0.669 U	0.685 U	0.646 U	6,000,000	HH	6,000,000	HH
2-Nitrophenol	1.33 U	1.18 U	1.40 U	1.44 U	1.36 U	180,000,000	HH	180,000,000	HH
3,3'-Dichlorobenzidine	5.05 U	4.50 U	5.35 U	5.48 U	5.16 U	4,800	HH	4,800	HH
3-Nitroaniline	3.41 U	3.04 U	3.61 U	3.70 U	3.49 U	70,000	Eco	6,000,000	HH
4,6-Dinitro-2-methylphenol	2.09 U	1.86 U	2.22 U	2.27 U	2.14 U	49,000	HH	49,000	HH
4-Bromophenyl Phenyl Ether	2.14 U	1.91 U	2.27 U	2.32 U	2.19 U	-	-	-	-
4-Chloro-3-methylphenol	1.04 U	0.925 U	1.10 U	1.13 U	1.06 U	62,000,000	HH	62,000,000	HH
4-Chloroaniline	1.08 U	0.963 U	1.15 U	1.17 U	1.11 U	8,600	HH	8,600	HH
4-Chlorophenyl Phenyl Ether	2.50 U	2.23 U	2.65 U	2.71 U	2.56 U	-	-	-	-
4-Nitroaniline	4.77 U	4.25 U	5.05 U	5.18 U	4.88 U	40,000	Eco	86,000	HH
4-Nitrophenol	9.52 U	8.48 U	10.1 U	10.3 U	9.74 U	7,000	Eco	180,000,000	HH
Aniline	2.14 U	1.91 U	2.27 U	2.32 U	2.19 U	200,000	Eco	300,000	HH
Benzidine	3.28 U	2.92 U	3.48 U	3.56 U	3.35 U	55,000	HH	55,000	HH
Benzoic Acid	**108 J**	16.6 U	**27.3 J**	20.2 U	19.0 U	200,000	Eco	2,500,000,000	HH
Benzyl Alcohol	2.31 U	2.06 U	2.45 U	2.51 U	2.37 U	2,260	Eco	62,000,000	HH
Bis(2-chloroethoxy)methane	2.23 UJ	1.99 UJ	2.37 UJ	2.42 UJ	2.28 UJ	730,000	Eco	1,800,000	HH
Bis(2-chloroethyl) Ether	1.83 U	1.63 U	1.93 U	1.98 U	1.87 U	1,000	HH	1,000	HH
Bis(2-chloroisopropyl) Ether	9.29 U	8.28 U	9.85 U	10.1 U	9.50 U	1,000	HH	1,000	HH
Bis(2-ethylhexyl) Phthalate	**1,035**	1.90 U	**332**	2.31 U	**542**	4,500	Eco	150,000	HH
Butyl Benzyl Phthalate	**39.7 J**	2.22 U	2.64 U	2.70 U	2.55 U	450	Eco	910,000	HH
Carbazole	**19.4**	2.06 U	**9.49 J**	2.51 U	2.37 U	2,260	Eco	1,000,000	HH
Dibenzofuran	**2.48 J**	0.479 U	0.569 U	0.583 U	0.550 U	2.00	Eco	1,000,000	HH
Diethyl Phthalate	4.20 U	3.74 U	4.45 U	4.56 U	4.29 U	100,000	Eco	490,000,000	HH
Dimethyl Phthalate	2.28 U	2.03 U	2.42 U	2.47 U	2.33 U	150,000	HH	150,000	HH
Di-n-butyl Phthalate	2.16 UJ	1.89 UJ	2.24 UJ	13.1 UJ	19.0 UJ	450	Eco	62,000,000	HH
Di-n-octyl Phthalate	**127**	1.91 U	**61.6**	2.32 U	**88.1**	450	Eco	150,000	HH
Hexachlorobenzene	0.615 U	0.548 U	0.652 U	0.668 U	0.629 U	1,800	HH	1,800	HH
Hexachlorobutadiene	0.850 U	0.757 U	0.901 U	0.923 U	0.870 U	22,000	HH	22,000	HH
Hexachlorocyclopentadiene	0.922 U	0.822 U	0.977 U	1.00 U	0.943 U	10,000	Eco	3,700,000	HH
Hexachloroethane	1.97 U	1.75 U	2.08 U	2.13 U	2.01 U	150,000	HH	150,000	HH
Isophorone	0.586 U	0.522 U	0.621 U	0.636 U	0.600 U	1,800,000	HH	1,800,000	HH
Nitrobenzene	3.50 U	3.12 U	3.71 U	3.80 U	3.58 U	8,000	Eco	24,000	HH
N-Nitrosodimethylamine	3.55 U	3.16 U	3.76 U	3.85 U	3.63 U	34.0	HH	34.0	HH
N-Nitrosodi-n-propylamine	1.56 U	1.39 U	1.65 U	1.69 U	1.59 U	250	HH	250	HH
N-Nitrosodiphenylamine	0.665 U	0.593 U	0.705 U	0.722 U	0.680 U	20,000	Eco	350,000	HH
p-cresol (4-Methylphenol)	1.37 U	1.22 U	1.45 U	1.49 U	1.40 U	-	-	-	-
Pentachlorophenol	2.26 U	2.01 U	2.39 U	2.45 U	2.31 U	2,100	Eco	13,000	HH
Phenol	0.841 U	0.749 U	0.891 U	0.913 U	0.860 U	30,000	Eco	180,000,000	HH
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)									
2-Methylnaphthalene	**4.84 J**	0.539 U	0.641 U	0.656 U	**2.64 J**	4,100,000	HH	4,100,000	HH
Acenaphthene	**10.9**	0.531 U	**5.88**	0.648 U	**8.09**	19,000,000	HH	19,000,000	HH
Acenaphthylene	**4.33**	0.610 U	0.726 U	0.744 U	0.701 U	23,000	HH	23,000	HH
Anthracene	**14.7**	0.394 U	**8.55**	0.480 U	**6.41**	93,000,000	HH	93,000,000	HH
Fluorene	**8.53**	0.669 U	**7.13**	0.816 U	0.768 U	12,000,000	HH	12,000,000	HH
Naphthalene	**4.11**	0.918 U	**2.50**	1.12 U	1.05 U	23,000	HH	23,000	HH
Phenanthrene	**116 J**	**7.86**	**24.8**	0.750 U	**18.3**	93,000,000	HH	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**158 J**	**11.0 J**	**49.6 J**	4.56 U	NC	29,000	Eco	-	-
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)									
Benzo(a)anthracene	**183 J**	1.05 U	**48.3 J**	1.28 U	**26.5 J**	2,700	HH	2,700	HH
Benzo(a)pyrene	**160**	0.656 U	**40.4**	0.799 U	**28.9**	270	HH	270	HH
Benzo(g,h,i)perylene	**94.6 J**	0.498 U	**29.8 J**	0.607 U	**18.9 J**	27,000	HH	27,000	HH
Benzofluoranthenes, Total	**290**	0.939 U	**73.4**	1.14 U	**39.0**	2,700	HH	2,700	HH
Chrysene	**225**	0.741 U	**85.8**	0.903 U	**32.7**	270,000	HH	270,000	HH
Dibenz(a,h)anthracene	**34.2 J**	0.643 U	**1.23 J**	0.784 U	0.739 U	270	HH	270	HH
Fluoranthene	**218**	1.05 U	**52.7**	1.28 U	**41.6**	8,900,000	HH	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**83.6 J**	0.472 U	**26.5 J**	0.576 U	**15.3 J**	2,700	HH	2,700	HH
Pyrene	**367 J**	0.352 U	**51.6**	0.429 U	**44.8**	6,700,000	HH	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**1,364 J**	5.46 U	**336 J**	6.66 U	NC	1,100	Eco	-	-

Notes:

µg/kg = microgram per kilogram	J = The reported value is an estimate.
bgs = below ground surface	U = The analyte was not detected at or above the MDL.
Eco = Ecological	UJ = The analyte was not detected. The reported MDL is an estimate.
HH = Human Health	**bold** = analyte detected above MDL.
MDL = method detection limit	🟨 = The reported concentration exceeds the selected SLV
SLV = screening level value	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
- = Not Analyzed	
-- = SLV for analyte not available	

Table 5-5c
2004 Sandblast Supplemental Site Inspection Soil Analytical Results
Semivolatile Organic Compounds
(Page 3 of 3)

Site ID	HA2	HA3	HA4	HA5	HA9	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**	**Selected SLV (>3 ft bgs)**	**SLV Source (>3 ft bgs)**
Sample ID	041122SGA16SS	041122SGA17SS	041122SGA21SS	041122SGA23SS	041123SGA28SS				
Sample Date	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/23/2004				
Sample Depth (Feet bgs)	0.5	0.5	3.0	3.0	0.5				
Medium	Soil	Soil	Soil	Soil	Soil				
Semivolatile Organic Compounds (µg/kg dry)									
1,2,4-Trichlorobenzene	0.895 U	9.57 U	1.07 U	1.06 U	0.939 U	20,000	Eco	99,000	HH
1,2-Dichlorobenzene	0.716 U	7.65 U	0.859 U	0.850 U	0.751 U	2,260	Eco	19,000,000	HH
1,3-Dichlorobenzene	0.898 U	9.60 U	1.08 U	1.07 U	0.942 U	2,260	Eco	17,000	HH
1,4-Dichlorobenzene	0.887 U	9.48 U	1.06 U	1.05 U	0.930 U	17,000	HH	17,000	HH
2,4,5-Trichlorophenol	0.818 U	8.75 U	0.981 U	0.971 U	0.858 U	4,000	Eco	62,000,000	HH
2,4,6-Trichlorophenol	0.834 U	8.92 U	1.00 U	0.990 U	0.875 U	10,000	Eco	200,000	HH
2,4-Dichlorophenol	0.935 U	10.0 U	1.12 U	1.11 U	0.981 U	20,000	Eco	1,800,000	HH
2,4-Dimethylphenol	0.807 UJ	8.62 U	0.967 U	0.957 UJ	0.846 UJ	20,000	Eco	12,000,000	HH
2,4-Dinitrophenol	7.37 U	78.8 U	8.84 U	8.75 U	7.73 U	20,000	Eco	1,200,000	HH
2,4-Dinitrotoluene	1.79 U	19.2 UJ	2.15 U	2.13 U	1.88 U	5,500	HH	5,500	HH
2,6-Dinitrotoluene	1.13 U	12.1 U	1.35 U	1.34 U	1.18 U	240,000	HH	240,000	HH
2-Chloronaphthalene	0.712 U	7.61 U	0.853 U	0.845 U	0.746 U	82,000,000	HH	82,000,000	HH
2-Chlorophenol	0.710 U	7.59 U	0.851 U	0.842 U	0.744 U	60,000	Eco	5,100,000	HH
2-Methylphenol	0.995 U	10.6 U	1.19 U	1.18 U	1.04 U	50,000	Eco	31,000,000	HH
2-Nitroaniline	0.573 U	6.12 U	0.687 U	0.680 U	0.600 U	6,000,000	HH	6,000,000	HH
2-Nitrophenol	1.20 U	12.8 U	1.44 U	1.43 U	1.26 U	180,000,000	HH	180,000,000	HH
3,3'-Dichlorobenzidine	4.58 U	48.9 U	5.49 U	5.43 U	4.80 U	4,800	HH	4,800	HH
3-Nitroaniline	3.09 U	33.0 U	3.70 U	3.67 U	3.24 U	70,000	Eco	6,000,000	HH
4,6-Dinitro-2-methylphenol	1.90 U	20.3 U	2.28 U	2.25 U	1.99 U	49,000	HH	49,000	HH
4-Bromophenyl Phenyl Ether	1.94 U	20.7 U	2.33 U	2.30 U	2.03 U	-	-	-	-
4-Chloro-3-methylphenol	0.942 U	10.1 UJ	1.13 U	1.12 U	0.987 U	62,000,000	HH	62,000,000	HH
4-Chloroaniline	0.981 U	10.5 U	1.18 U	1.16 U	1.03 U	8,600	HH	8,600	HH
4-Chlorophenyl Phenyl Ether	2.27 U	24.2 U	2.72 U	2.69 U	2.38 U	-	-	-	-
4-Nitroaniline	4.32 U	46.2 UJ	5.18 U	5.13 U	4.53 U	40,000	Eco	86,000	HH
4-Nitrophenol	8.64 U	92.3 UJ	10.4 U	10.3 U	9.05 U	7,000	Eco	180,000,000	HH
Aniline	1.94 U	20.7 U	2.33 U	2.30 U	2.03 U	200,000	Eco	300,000	HH
Benzidine	2.97 U	31.8 U	3.57 U	3.53 U	3.12 U	55,000	HH	55,000	HH
Benzoic Acid	**175 J**	180 U	20.2 U	20.0 U	17.7 U	200,000	Eco	2,500,000,000	HH
Benzyl Alcohol	2.10 U	22.4 U	2.52 U	2.49 U	**7.81**	2,260	Eco	62,000,000	HH
Bis(2-chloroethoxy)methane	2.02 UJ	21.6 U	2.43 U	2.40 UJ	2.12 UJ	730,000	Eco	1,800,000	HH
Bis(2-chloroethyl) Ether	1.66 U	17.7 U	1.99 U	1.97 U	1.74 U	1,000	HH	1,000	HH
Bis(2-chloroisopropyl) Ether	8.42 U	90.1 U	10.1 U	10.0 U	8.83 U	1,000	HH	1,000	HH
Bis(2-ethylhexyl) Phthalate	**174**	**2,220 J**	**19,800**	**127**	**220**	4,500	Eco	150,000	HH
Butyl Benzyl Phthalate	21.1 U	24.1 U	**31.7 J**	2.68 U	2.37 U	450	Eco	910,000	HH
Carbazole	**24.0**	**524**	2.52 U	2.49 U	**4.56 J**	2,260	Eco	1,000,000	HH
Dibenzofuran	**3.61 J**	**76.6**	**123**	0.578 U	**0.996 J**	2.00	Eco	1,000,000	HH
Diethyl Phthalate	3.81 U	40.7 U	4.56 U	4.52 U	3.99 U	100,000	Eco	490,000,000	HH
Dimethyl Phthalate	2.07 U	22.1 U	2.48 U	2.45 U	2.17 U	150,000	HH	150,000	HH
Di-n-butyl Phthalate	1.92 UJ	**73.7 J**	**23.9**	2.28 UJ	11.1 U	450	Eco	62,000,000	HH
Di-n-octyl Phthalate	1.94 U	20.7 U	2.33 U	**22.9 J**	**16.1 J**	450	Eco	150,000	HH
Hexachlorobenzene	0.558 U	5.96 U	0.669 U	0.662 U	0.585 U	1,800	HH	1,800	HH
Hexachlorobutadiene	0.771 U	8.24 U	0.924 U	0.915 U	0.808 U	22,000	HH	22,000	HH
Hexachlorocyclopentadiene	0.836 U	8.94 U	1.00 U	0.993 U	0.877 U	10,000	Eco	3,700,000	HH
Hexachloroethane	1.78 U	19.0 U	2.14 U	2.12 U	1.87 U	150,000	HH	150,000	HH
Isophorone	0.531 U	5.68 U	0.637 U	0.631 U	0.557 U	1,800,000	HH	1,800,000	HH
Nitrobenzene	3.17 U	33.9 U	3.81 U	3.77 U	3.33 U	8,000	Eco	24,000	HH
N-Nitrosodimethylamine	3.22 U	34.4 U	3.86 U	3.82 U	3.37 U	34.0	HH	34.0	HH
N-Nitrosodi-n-propylamine	1.41 U	15.1 U	1.69 U	1.68 U	1.48 U	250	HH	250	HH
N-Nitrosodiphenylamine	0.603 U	6.45 U	0.723 U	0.716 U	0.632 U	20,000	Eco	350,000	HH
p-cresol (4-Methylphenol)	1.24 U	13.3 U	1.49 U	1.48 U	**2.46 J**	-	-	-	-
Pentachlorophenol	2.05 U	21.9 UJ	2.45 U	2.43 U	2.14 U	2,100	Eco	13,000	HH
Phenol	0.762 U	8.15 U	0.914 U	0.905 U	0.799 U	30,000	Eco	180,000,000	HH
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)									
2-Methylnaphthalene	**2.53 J**	**31.8**	0.657 U	0.651 U	**1.29 J**	4,100,000	HH	4,100,000	HH
Acenaphthene	**16.1**	**296**	**328**	0.642 U	**5.41**	19,000,000	HH	19,000,000	HH
Acenaphthylene	**4.65**	**54.7**	**9.14**	0.737 U	**1.39 J**	23,000	HH	23,000	HH
Anthracene	**21.3**	**832**	**447**	0.476 U	**5.03**	93,000,000	HH	93,000,000	HH
Fluorene	**10.5**	**278**	**164**	0.809 U	0.714 U	12,000,000	HH	12,000,000	HH
Naphthalene	0.934 U	**78.2**	1.12 U	**2.04 J**	**2.56**	23,000	HH	23,000	HH
Phenanthrene	**115**	**3,250**	**1,580**	**2.47 J**	**38.2**	93,000,000	HH	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**168 J**	**4,789**	**2,529 J**	**6.41 J**	**53.3 J**	29,000	Eco	-	-
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)									
Benzo(a)anthracene	**114 J**	**6,440**	**2,030**	1.26 U	**62.3 J**	2,700	HH	2,700	HH
Benzo(a)pyrene	**108**	**6,470**	**1,970**	0.792 U	**74.1**	270	HH	270	HH
Benzo(g,h,i)perylene	**61.9 J**	**3,830**	**914**	**4.33 J**	**66.4 J**	27,000	HH	27,000	HH
Benzofluoranthenes, Total	**212**	**12,100**	**3,040**	**7.70**	**135**	2,700	HH	2,700	HH
Chrysene	**129**	**7,590**	**1,910**	0.895 U	**75.3**	270,000	HH	270,000	HH
Dibenz(a,h)anthracene	**25.4 J**	**1,430**	**347**	0.777 U	**16.5 J**	270	HH	270	HH
Fluoranthene	**216**	**20,700**	**4,330**	**6.29**	**71.9**	8,900,000	HH	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**60.8 J**	**3,910**	**939**	**3.52 J**	**49.8 J**	2,700	HH	2,700	HH
Pyrene	**217**	**21,900**	**5,470 J**	**9.14**	**79.3**	6,700,000	HH	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**932 J**	**72,270**	**17,910 J**	**26.4 J**	**496 J**	1,100	Eco	-	-

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5d
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Pesticides, and General Chemistry Parameters
(Page 1 of 2)

Site ID	DP1	DP10	DP11	DP12	DP12	DP2	DP3*	DP4	DP5*	DP7	DP9	**Selected Discharge to Surface Water / Bioaccumulation**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	041116SGA01GW	041118SGA06GW	041119SGA12GW	041119SGA11GW	041122SGA11GW	041117SGA02GW	041117SGA03GW	041117SGA05GW	041118SGA07GW	041119SGA09GW	041119SGA10GW				
Sample Date	11/16/2004	11/17/2004	11/19/2004	11/19/2004	11/22/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/19/2004	11/19/2004				
Sample Depth (Feet bgs)	12.0-17.0	7.8-12.8	7.0-17.0	7.8-17.8	7.8-17.8	12.0-17.0	11.0-16.0	13.0-18.0	18.5-28.5	12.9-17.9	10.0-20.0				
Total PCB Aroclors (µg/L)															
Aroclor 1016	0.00226 U	-	-	-	-	0.00216 U	0.00207 U	0.00244 U	0.00208 U	0.00206 U	0.00237 U	0.0000640	HH	0.0140	Eco
Aroclor 1221	0.00226 U	-	-	-	-	0.00216 U	0.00207 U	0.00244 U	0.00208 U	0.00206 U	0.00237 U	0.0000640	HH	0.00680	HH
Aroclor 1232	0.00226 U	-	-	-	-	0.00216 U	0.00207 U	0.00244 U	0.00208 U	0.00206 U	0.00237 U	0.0000640	HH	0.00680	HH
Aroclor 1242	0.00226 U	-	-	-	-	0.00216 U	0.00207 U	0.00244 U	0.00208 U	0.00206 U	0.00237 U	0.0000640	HH	0.0140	Eco
Aroclor 1248	0.00226 U	-	-	-	-	0.00216 U	0.00207 U	0.00244 U	0.00208 U	0.00206 U	0.00237 U	0.0000640	HH	0.0140	Eco
Aroclor 1254	0.00248 U	-	-	-	-	0.00238 U	0.00228 U	0.00269 U	0.00228 U	0.00227 U	0.00261 U	0.0000640	HH	0.0140	Eco
Aroclor 1260	0.00248 U	-	-	-	-	0.00238 U	0.00228 U	0.00269 U	0.00228 U	0.00227 U	0.00261 U	0.0000640	HH	0.0140	Eco
Total Metals (µg/L)															
Aluminum	**12,400**	**6,730**	**17,900**	-	**17,500**	**2,250**	**93.7 J**	**1,080**	**280**	**494**	**74.2 J**	-	-	37,000	HH
Antimony	**0.898**	**0.362 J**	**1.57**	-	**0.233 J**	**0.934**	**0.476 J**	**0.586**	0.500 U	**0.477 J**	**0.317 J**	5.60	HH	15.0	HH
Arsenic	**4.61**	**1.87**	**7.70**	-	**0.262 J**	**2.50**	**0.978**	**1.17**	**0.114 J**	0.102 U	0.102 U	0.0180	HH	0.0380	HH
Barium	**83.7**	**26.2**	**97.8**	-	**70.2**	**12.5**	**3.76**	**11.7**	**24.9**	**16.2**	**8.99**	1,000	HH	7,300	HH
Beryllium	**0.307 J**	**0.157 J**	**0.219 J**	-	**0.785**	0.0782 U	0.0782 U	0.0782 U	0.0782 U	0.0782 U	0.0782 U	-	-	73.0	HH
Cadmium	0.0247 U	0.0247 U	0.0247 U	-	0.0247 U	0.0247 U	0.0247 U	0.0247 U	0.0247 U	0.0247 U	0.0247 U	-	-	18.0	HH
Calcium	**33,700**	**32,400**	**22,000**	-	**24,400**	**22,800**	**24,850**	**18,300**	**32,850**	**32,900**	**31,100**	-	-	-	-
Chromium	**10.7**	**16.2**	**21.5**	-	**31.8**	**9.37**	**4.65**	**8.08**	**4.74**	**2.61**	**5.26**	-	-	55,000	HH
Cobalt	**6.46**	**5.71**	**13.1**	-	**2.78 J**	**1.68 J**	0.770 U	0.770 U	**3.75 J**	0.770 U	0.770 U	-	-	11.0	HH
Copper	**36.5**	**19.0**	**43.4**	-	**204**	**7.29**	**1.38**	**3.80**	**2.55**	**3.84**	**1.44 J**	1,300	HH	1,500	HH
Iron	**16,500**	**9,820**	**25,900**	-	**23,700**	**3,220**	**84.4 J**	**1,290**	**546**	**613**	14.0 U	300	HH	26,000	HH
Lead	**5.01**	**2.58**	**6.82**	-	**13.7**	**1.08**	0.500 U	**0.652**	0.500 U	0.500 U	**0.0580 J**	-	-	15.0	HH
Magnesium	**11,800**	**15,400**	**14,400**	-	**8,700**	**6,130**	**5,835**	**5,130**	**10,400**	**9,310**	**8,300**	-	-	-	-
Manganese	**219**	**182**	**489**	-	**473**	**68.2**	**2.10 J**	**22.7**	**709**	**73.8**	**9.11**	50.0	HH	880	HH
Mercury	**0.0760 J**	0.0530 U	0.0530 U	-	0.0530 U	**0.100 J**	0.0530 U	0.0530 U	0.0530 U	0.0530 U	0.0530 U	-	-	11.0	HH
Nickel	**8.96 J**	**7.94 J**	**21.4**	-	**10.8**	**2.45 J**	0.370 U	**1.16 J**	**3.27 J**	**1.39 J**	**1.02 J**	610	HH	730	HH
Potassium	**2,050**	**1,050**	**3,210**	-	**2,150**	**898 J**	**916 J**	**1,520**	**1,540**	**2,060**	**2,260**	-	-	-	-
Selenium	**2.06**	**1.21**	**1.27**	-	**1.29**	**0.904**	**1.09**	**0.895**	**1.70**	**2.04**	**0.815**	170	HH	180	HH
Silver	**0.241**	**0.0690 J**	**0.166**	-	**0.376**	**0.0450 J**	0.0188 U	**0.0280 J**	**0.0195 J**	**0.0330 J**	**0.0270 J**	-	-	180	HH
Sodium	**10,700**	**8,240**	**42,900**	-	**21,400**	**6,350**	**6,445**	**6,420**	**10,750**	**7,160**	**8,630**	-	-	-	-
Thallium	**0.0920 J**	**0.0490 J**	**0.146 J**	-	**0.0530 J**	**0.0570 J**	0.0292 U	0.0292 U	**0.0855 J**	**0.0430 J**	0.0292 U	0.240	HH	2.00	HH
Vanadium	**31.5**	**22.8**	**47.0**	-	**77.6**	**9.25 J**	**2.43 J**	**5.40 J**	**2.08 J**	**3.35 J**	**1.82 J**	-	-	2.60	HH
Zinc	**30.7**	**19.9**	**44.4**	-	**21.2**	**8.58 J**	**3.87 J**	**6.88 J**	**5.19 J**	**4.19 J**	**2.88 J**	7,400	HH	11,000	HH
Dissolved Metals (µg/L)															
Aluminum	**277**	**7.06 J**	**28.4 J**	-	**1,370**	**15.1 J**	**5.88 J**	5.88 U	5.88 U	5.88 U	**12.5 J**	87.0	Eco	87.0	Eco
Antimony	**0.305 J**	**0.207 J**	**1.67**	-	**0.339 J**	**0.326 J**	**0.297 J**	**0.253 J**	**0.209 J**	**0.302 J**	**0.149 J**	5.60	HH	15.0	HH
Arsenic	**0.650**	**1.34**	**1.36**	-	**0.262 J**	**1.01**	**1.15**	**1.19**	**0.700**	**0.570**	**1.06**	0.0180	HH	0.0380	HH
Barium	**7.63**	**7.55**	**15.0**	-	**11.2**	**3.39**	**3.52**	**5.91**	**20.7**	**11.5**	**7.98**	4.00	Eco	4.00	Eco
Beryllium	0.0782 U	0.0782 U	0.0782 U	-	0.0782 U	0.0782 U	0.0782 U	0.0782 U	0.0782 U	0.0782 U	0.0782 U	5.30	Eco	5.30	Eco
Cadmium	0.0247 U	0.0247 U	0.0247 U	-	0.0247 U	**0.0300 J**	0.0247 U	0.0247 U	0.0247 U	0.0247 U	0.0247 U	0.250	Eco	0.250	Eco
Calcium	**28,000**	**30,400**	**16,800**	-	**10,800**	**22,200**	**25,350**	**18,500**	**29,650**	**34,100**	**31,300**	116,000	Eco	116,000	Eco
Chromium	**1.94**	**3.83**	**3.48**	-	**4.29**	**1.69**	**1.85**	**0.838**	**2.93**	**3.12**	**3.48**	74.0	Eco	74.0	Eco
Cobalt	**2.48 J**	**1.21 J**	**3.23 J**	-	**5.08**	**1.42 J**	**1.53 J**	0.770 U	**4.65 J**	**2.26 J**	0.770 U	23.0	Eco	11.0	HH
Copper	**1.12 J**	0.500 U	1.00 U	-	**4.38**	**0.752 J**	**0.804 J**	**0.782 J**	**0.958 J**	1.23 U	**1.08 J**	9.00	Eco	9.00	Eco
Iron	**228**	14.0 U	**37.3 J**	-	**476**	14.0 U	14.0 U	14.0 U	**105 J**	14.0 U	14.0 U	300	HH	1,000	Eco
Lead	**0.0960 J**	**0.0270 J**	0.500 U	-	**0.378 J**	**0.0350 J**	**0.0260 J**	0.0240 U	**0.0310 J**	0.500 U	0.500 U	2.50	Eco	2.50	Eco
Magnesium	**7,650**	**12,000**	**5,230**	-	**3,310**	**5,350**	**6,055**	**4,940**	**9,470**	**9,550**	**8,270**	82,000	Eco	82,000	Eco
Manganese	**92.3**	**16.7**	**106**	-	**31.3**	**9.85**	**1.71 J**	**4.63**	**587**	**59.6**	**6.87**	50.0	HH	120	Eco
Mercury	**0.0600 J**	0.0530 U	0.0530 U	-	0.0530 U	0.0530 U	0.0530 U	0.0530 U	**0.0550 J**	0.0530 U	0.0530 U	0.770	Eco	0.770	Eco
Nickel	**0.403 J**	0.370 U	10.0 U	-	**0.880 J**	0.370 U	0.370 U	0.370 U	**2.10 J**	10.0 U	10.0 U	52.0	Eco	52.0	Eco
Potassium	**1,050**	**604 J**	**2,210**	-	**1,610**	**527 J**	**720 J**	**1,230**	**1,115**	**2,080**	**1,880**	53,000	Eco	53,000	Eco
Selenium	**0.797**	**0.819**	**0.605**	-	**0.328 J**	**0.383 J**	**0.597**	**0.235 J**	**1.25**	**1.30**	**0.654**	5.00	Eco	5.00	Eco
Silver	**0.0470 J**	**0.0270 J**	0.0188 U	-	**0.0790 J**	**0.0270 J**	**0.0265 J**	**0.0340 J**	**0.0265 J**	0.0188 U	**0.0240 J**	0.120	Eco	0.120	Eco
Sodium	**10,900**	**8,530**	**47,700**	-	**26,400**	**6,860**	**7,135**	**6,560**	**11,700**	**7,240**	**9,110**	680,000	Eco	680,000	Eco
Thallium	0.0292 U	0.0292 U	**0.0310 J**	-	0.0292 U	0.0292 U	0.0292 U	0.0292 U	**0.0855 J**	**0.0460 J**	0.0292 U	0.240	HH	2.00	HH
Vanadium	**1.00 J**	**0.582 J**	10.0 U	-	**2.61 J**	**1.02 J**	**1.45 J**	**1.46 J**	0.488 U	10.0 U	10.0 U	20.0	Eco	2.60	HH
Zinc	**2.00 J**	2.00 U	2.00 U	-	**3.48 J**	2.00 U	2.00 U	2.00 U	**2.04 J**	**2.47 J**	2.00 U	120	Eco	120	Eco

Table 5-5d
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Pesticides, and General Chemistry Parameters
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Site ID	DP1	DP10	DP11	DP12	DP12	DP2	DP3*	DP4	DP5*	DP7	DP9	**Selected Discharge to Surface Water / Bioaccumulation**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	041116SGA01GW	041118SGA06GW	041119SGA12GW	041119SGA11GW	041122SGA11GW	041117SGA02GW	041117SGA03GW	041117SGA05GW	041118SGA07GW	041119SGA09GW	041119SGA10GW				
Sample Date	11/16/2004	11/17/2004	11/19/2004	11/19/2004	11/22/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/19/2004	11/19/2004				
Sample Depth (Feet bgs)	12.0-17.0	7.8-12.8	7.0-17.0	7.8-17.8	7.8-17.8	12.0-17.0	11.0-16.0	13.0-18.0	18.5-28.5	12.9-17.9	10.0-20.0				
Total Petroleum Hydrocarbons (µg/L)															
Diesel Range Organics	-	74.7 U	-	-	-	-	-	-	89.7 U	87.0 U	76.8 U	-	-	90.0	HH
Residual Range Organics	-	92.5 U	-	-	-	-	-	-	111 U	**113 J**	95.2 U	-	-	290	HH
Gasoline Range Organics	-	**14.7 J**	**20.9 J**	13.0 U	-	-	-	-	13.0 U	13.0 U	13.0 UJ	-	-	100	HH
Total Butyltins (µg/L)															
Dibutyltin	0.000287 U	-	-	-	-	0.000236 U	0.000231 U	0.000248 U	-	-	-	0.0630	Eco	0.0630	Eco
Monobutyltin	0.000142 U	-	-	-	-	**0.00671 J**	0.000114 U	**0.00520 J**	-	-	-	0.0630	Eco	0.0630	Eco
Tetrabutyltin	0.000748 U	-	-	-	-	0.000615 U	0.000600 U	0.000645 U	-	-	-	0.0630	Eco	0.0630	Eco
Tributyltin	0.000552 U	-	-	-	-	0.000454 U	**0.00285 J**	**0.00435 J**	-	-	-	0.0630	Eco	0.0630	Eco
Total Pesticides (µg/L)															
4,4'-DDD	-	-	-	-	-	-	-	-	0.000453 U	0.000512 U	0.000575 U	0.000310	HH	0.00100	Eco
4,4'-DDE	-	-	-	-	-	-	-	-	0.000375 U	0.000424 U	0.000476 U	0.000220	HH	0.00100	Eco
4,4'-DDT	-	-	-	-	-	-	-	-	0.000480 U	0.000543 U	0.000609 U	0.000220	HH	0.00100	Eco
Aldrin	-	-	-	-	-	-	-	-	0.000110 U	0.000124 U	0.000140 U	0.0000490	HH	0.00330	HH
BHC (alpha)	-	-	-	-	-	-	-	-	0.000354 U	0.000400 U	0.000449 U	0.00260	HH	0.00900	HH
BHC (beta)	-	-	-	-	-	-	-	-	0.000411 U	0.000464 U	0.000521 U	0.00910	HH	0.0370	HH
BHC (delta)	-	-	-	-	-	-	-	-	0.000226 U	0.000255 U	0.000286 U	0.00260	HH	0.00900	HH
BHC (gamma) Lindane	-	-	-	-	-	-	-	-	**0.000930 J**	**0.00232**	**0.00249 J**	0.0800	Eco	0.0520	HH
Chlordane (alpha)	-	-	-	-	-	-	-	-	0.000339 U	0.000383 U	0.000429 U	0.000800	HH	0.00430	Eco
Chlordane (gamma)	-	-	-	-	-	-	-	-	0.000461 U	0.000521 U	0.000584 U	0.000800	HH	0.00430	Eco
Dieldrin	-	-	-	-	-	-	-	-	0.000290 U	0.000328 U	0.000368 U	0.0000520	HH	0.00350	HH
Endosulfan I	-	-	-	-	-	-	-	-	0.000480 U	0.000542 U	0.000608 U	0.0560	Eco	0.0560	Eco
Endosulfan II	-	-	-	-	-	-	-	-	0.00192 U	0.000411 U	0.000462 U	0.0560	Eco	0.0560	Eco
Endosulfan Sulfate	-	-	-	-	-	-	-	-	0.000517 U	0.000584 U	0.000655 U	0.0510	Eco	0.0510	Eco
Endrin	-	-	-	-	-	-	-	-	0.000298 U	0.000337 U	0.000378 U	0.0360	Eco	0.0360	Eco
Endrin Aldehyde	-	-	-	-	-	-	-	-	0.000936 U	0.00106 U	0.00119 U	0.150	Eco	0.150	Eco
Endrin Ketone	-	-	-	-	-	-	-	-	0.000332 U	0.000375 U	0.000421 U	0.0590	HH	11.0	HH
Heptachlor	-	-	-	-	-	-	-	-	0.000724 U	0.000819 U	0.000919 U	0.0000790	HH	0.00380	Eco
Heptachlor Epoxide	-	-	-	-	-	-	-	-	0.000360 U	0.000407 U	0.000456 U	0.0000390	HH	0.00380	Eco
Methoxychlor	-	-	-	-	-	-	-	-	**0.000983 J**	0.000584 U	**0.00521 J**	0.0300	Eco	0.0300	Eco
Toxaphene	-	-	-	-	-	-	-	-	0.0112 U	0.0127 U	0.0142 U	0.000280	HH	0.00200	Eco
General Chemistry Parameters (mg/L)															
Carbon, Total Organic	**1.67**	**1.41**	-	-	-	**1.84**	**1.49**	**1.51**	**2.41**	**1.80**	**1.84**	-	-	-	-
Total Suspended Solids	**232**	**494**	**457**	**944**	-	**17.0**	2.00 U	**18.0**	**22.0**	**7.00**	2.00 U	-	-	-	-

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
mg/L = milligram per liter	J = The reported value is an estimate.
btc = below top of well casing	U = The analyte was not detected at or above the MDL.
Eco = Ecological	UJ = The analyte was not detected. The reported MDL is an estimate.
HH = Human Health	**bold** = analyte detected above MDL.
MDL = method detection limit	🟨 = The reported concentration exceeds the selected SLV
SLV = screening level value	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
- = Not Analyzed	

Table 5-5e
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
Volatile Organic Compounds
(Page 1 of 2)

Site ID	DP1	DP10	DP11	DP12	DP2	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	041116SGA01GW	041118SGA06GW	041119SGA12GW	041119SGA11GW	041117SGA02GW				
Sample Date	11/16/2004	11/17/2004	11/19/2004	11/19/2004	11/17/2004				
Sample Depth (Feet bgs)	12.0-17.0	7.8-12.8	7.0-17.0	7.8-17.8	12.0-17.0				
Total Volatile Organic Compounds (µg/L)									
1,1,1,2-Tetrachloroethane	0.0528 UJ	0.0528 U	0.0528 U	0.0528 U	0.0528 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	**0.104 J**	0.0477 U	**0.509 J**	**0.0997 J**	0.0477 U	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	0.0680 UJ	0.0680 U	0.0680 U	0.0680 U	0.0680 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	0.0627 UJ	0.0627 U	0.0627 U	0.0627 U	0.0627 U	0.590	HH	0.230	HH
1,1-Dichloroethane	**0.0555 J**	0.0360 U	**0.173 J**	0.0360 U	0.0360 U	47.0	Eco	2.30	HH
1,1-Dichloroethene	0.0595 UJ	0.0595 U	**0.0624 J**	0.0595 U	0.0595 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	0.0695 UJ	0.0695 U	0.0695 U	0.0695 U	0.0695 U	-	-	0.430	HH
1,2,3-Trichlorobenzene	0.0605 UJ	0.0605 U	0.0605 U	0.0605 U	0.0605 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	0.123 UJ	0.123 U	0.123 U	0.123 U	0.123 U	-	-	0.000720	HH
1,2,4-Trichlorobenzene	0.0513 UJ	1.0000 U	0.0513 U	0.05 U	0.0513 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	**0.0485 J**	**0.0317 J**	0.0283 U	**0.0415 J**	0.0283 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	0.222 UJ	0.222 U	0.222 U	0.222 U	0.222 U	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	0.0637 UJ	0.0637 U	0.0637 U	0.0637 U	0.0637 U	-	-	0.00630	HH
1,2-Dichlorobenzene	0.0383 UJ	0.0383 U	0.0383 U	0.0383 U	0.0383 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	0.0533 UJ	0.0533 U	0.0533 U	0.0533 U	0.0533 U	0.380	HH	0.140	HH
1,2-Dichloropropane	0.0380 UJ	0.0380 U	0.0380 U	0.0380 U	0.0380 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	**0.0297 J**	0.0249 U	0.0249 U	0.0249 U	0.0249 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	0.0599 UJ	0.0599 U	0.0599 U	0.0599 U	0.0599 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	0.0738 UJ	0.0738 U	0.0738 U	0.0738 U	0.0738 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	0.0180 UJ	0.0180 U	0.0180 U	0.0180 U	0.0180 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.0487 UJ	0.0487 U	0.0487 U	0.0487 U	**0.130 J**	0.500	HH	0.390	HH
2-Butanone (MEK)	1.71 UJ	1.71 U	1.71 U	1.71 U	1.71 U	14,000	Eco	7,100	HH
2-Chlorotoluene	0.0857 UJ	0.0857 U	0.0857 U	0.0857 U	0.0857 U	-	-	730	HH
2-Hexanone	0.99 UJ	0.993 U	0.993 U	0.993 U	0.993 U	99.0	Eco	47.0	HH
4-Chlorotoluene	0.0491 UJ	0.0491 U	0.0491 U	0.0491 U	0.0491 U	-	-	2,600	HH
4-Isopropyltoluene	0.0397 UJ	0.0397 U	0.0397 U	0.0397 U	0.0397 U	-	-	-	-
4-Methyl-2-pentanone (MIBK)	0.31 UJ	0.309 U	0.309 U	0.309 U	0.309 U	170	Eco	170	Eco
Acetone	1.20 UJ	1.20 U	**1.59 J**	**3.88 J**	1.20 U	1,500	Eco	1,500	Eco
Benzene	**0.0579 J**	**0.0545 J**	**0.137 J**	**0.0800 J**	0.0417 U	2.20	HH	0.390	HH
Bromobenzene	0.0475 UJ	0.0475 U	0.0475 U	0.0475 U	0.0475 U	-	-	88.0	HH
Bromochloromethane	0.0573 UJ	0.0573 U	0.0573 U	0.0573 U	0.0573 U	0.550	HH	0.120	HH
Bromodichloromethane	0.0785 UJ	0.0785 U	0.0785 U	0.0785 U	0.0785 U	0.550	HH	0.120	HH
Bromoform	0.0830 UJ	0.0830 U	0.0830 U	**0.151 J**	0.0830 U	4.30	HH	7.20	HH
Bromomethane	0.0748 UJ	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	**0.0619 J**	0.0494 U	1.00 U	1.00 U	0.0494 U	0.920	Eco	0.920	Eco
Carbon Tetrachloride	0.0970 UJ	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.230	HH	0.190	HH
Chlorobenzene	0.0376 UJ	0.0376 U	0.0376 U	0.0376 U	0.0376 U	50.0	Eco	50.0	Eco
Chloroethane	0.187 UJ	0.187 U	0.187 U	0.187 U	0.187 U	-	-	21,000	HH
Chloroform	0.0717 UJ	0.0717 U	0.0717 U	0.0717 U	**0.174 J**	5.70	HH	0.190	HH
Chloromethane	0.110 UJ	0.110 U	0.110 U	0.110 U	0.110 U	-	-	190	HH
cis-1,2-Dichloroethene	**3.76 J**	0.0433 U	**150 J**	**4.86**	**0.693 J**	590	Eco	360	HH
cis-1,3-Dichloropropene	0.0301 UJ	0.0301 U	0.0301 U	0.0301 U	0.0301 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	0.0539 UJ	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.400	HH	0.680	HH
Dibromomethane	0.0864 UJ	0.0864 U	0.0864 U	0.0864 U	0.0864 U	-	-	8.20	HH
Dichlorodifluoromethane	0.0575 UJ	0.0575 U	0.0575 U	0.0575 U	0.0575 U	-	-	390	HH
Dichloromethane (Methylene Chloride)	0.0752 UJ	0.0752 U	1.00 U	0.0752 U	0.0752 U	4.60	HH	4.40	HH
Ethylbenzene	0.0226 UJ	**0.0400 J**	**0.0357 J**	**0.0447 J**	0.0226 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	0.152 UJ	0.152 U	0.152 U	0.152 U	0.152 U	0.440	HH	0.860	HH
Isopropylbenzene	**0.0197 J**	0.0165 U	0.0165 U	0.0165 U	0.0165 U	7.30	Eco	7.30	Eco
m,p-Xylenes	**0.132 J**	**0.131 J**	0.0718 U	**0.132 J**	0.0718 U	13.0	Eco	13.0	Eco
Naphthalene	0.0317 UJ	1.00 U	0.0317 U	1.00 U	1.00 U	620	Eco	0.140	HH
n-Butylbenzene	0.0603 UJ	0.0603 U	0.0603 U	0.0603 U	0.0603 U	-	-	-	-
n-Propylbenzene	0.0356 UJ	0.0356 U	0.0356 U	0.0356 U	0.0356 U	7.30	Eco	7.30	Eco
o-Xylene	**0.0735 J**	**0.0503 J**	0.0265 U	**0.0486 J**	0.0265 U	350	Eco	350	Eco
sec-Butylbenzene	0.0358 UJ	0.0358 U	0.0358 U	0.0358 U	0.0358 U	-	-	-	-
Styrene	0.0279 UJ	0.0279 U	0.0279 U	0.0279 U	0.0279 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	0.0535 UJ	0.0535 U	0.0535 U	0.0535 U	0.0535 U	-	-	-	-
Tetrachloroethene (PCE)	**5.08 J**	**0.584 J**	**54.5**	**9.44**	**1.76**	0.690	HH	0.0930	HH
Toluene	**0.221 J**	**0.289 J**	**0.177 J**	**0.154 J**	1.00 U	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	0.0584 UJ	0.0584 U	**1.09**	0.0584 U	0.0584 U	140	HH	110	HH
trans-1,3-Dichloropropene	0.0539 UJ	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	**2.03 J**	0.0641 U	**43.7**	**2.95**	**0.597 J**	2.50	HH	0.0390	HH
Trichlorofluoromethane	0.0620 UJ	0.0620 U	0.0620 U	0.0620 U	0.0620 U	-	-	1,300	HH
Vinyl Acetate	1.01 UJ	0.320 U	0.320 U	0.320 U	0.320 U	16.0	Eco	16.0	Eco
Vinyl Chloride	0.0604 UJ	0.0604 U	**0.132 J**	0.0604 U	0.0604 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5e
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
Volatile Organic Compounds
(Page 2 of 2)

Site ID	DP3*	DP4	DP5*	DP7	DP9	Selected Discharge to Surface Water / Bioaccumulation SLV	SLV Source	Selected Direct Contact SLV	SLV Source
Sample ID	041117SGA03GW	041117SGA05GW	041118SGA07GW	041119SGA09GW	041119SGA10GW				
Sample Date	11/17/2004	11/17/2004	11/17/2004	11/19/2004	11/19/2004				
Sample Depth (Feet bgs)	11.0-16.0	13.0-18.0	18.5-28.5	12.9-17.9	10.0-20.0				
Total Volatile Organic Compounds (µg/L)									
1,1,1,2-Tetrachloroethane	0.0528 U	0.0528 U	0.0528 U	0.0528 U	0.0528 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	**0.0701 J**	0.0477 U	**2.23**	**0.127 J**	**0.137 J**	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	0.0680 U	0.0680 U	0.0680 U	0.0680 U	0.0680 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	0.0627 U	0.0627 U	0.0627 U	0.0627 U	0.0627 U	0.590	HH	0.230	HH
1,1-Dichloroethane	0.0360 U	0.0360 U	**2.52**	**0.0982 J**	**0.178 J**	47.0	Eco	2.30	HH
1,1-Dichloroethene	0.0595 U	0.0595 U	**1.17**	0.0595 U	0.0595 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	0.0695 U	0.0695 U	0.0695 U	0.0695 U	0.0695 U	-	-	0.430	HH
1,2,3-Trichlorobenzene	0.0605 U	0.0605 U	0.0605 U	0.0605 U	0.0605 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	0.123 U	0.123 U	0.123 U	0.123 U	0.123 U	-	-	0.000720	HH
1,2,4-Trichlorobenzene	0.0513 U	0.0513 U	0.0513 U	0.0513 U	0.0513 UJ	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	0.0283 U	0.0283 U	0.0283 U	0.0283 U	0.0283 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	0.222 U	0.222 U	0.222 U	0.222 U	0.222 U	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	0.0637 U	0.0637 U	0.0637 U	0.0637 U	0.0637 U	-	-	0.00630	HH
1,2-Dichlorobenzene	0.0383 U	0.0383 U	0.0383 U	0.0383 U	0.0383 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	0.0533 U	0.0533 U	0.0533 U	0.0533 U	0.0533 U	0.380	HH	0.140	HH
1,2-Dichloropropane	0.0380 U	0.0380 U	0.0380 U	0.0380 U	0.0380 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	0.0249 U	0.0249 U	0.0249 U	0.0249 U	0.0249 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	0.0599 U	0.0599 U	0.0599 U	0.0599 U	0.0599 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	0.0738 U	0.0738 U	0.0738 U	0.0738 U	0.0738 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	0.0180 U	0.0180 U	0.0180 U	0.0180 U	0.0180 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	**0.117 J**	0.0487 U	0.0487 U	**0.179 J**	0.0487 U	0.500	HH	0.390	HH
2-Butanone (MEK)	1.71 U	1.71 U	1.71 U	1.71 U	1.71 U	14,000	Eco	7,100	HH
2-Chlorotoluene	0.0857 U	0.0857 U	0.0857 U	0.0857 U	0.0857 U	-	-	730	HH
2-Hexanone	0.993 U	0.993 U	0.993 U	0.993 U	0.993 U	99.0	Eco	47.0	HH
4-Chlorotoluene	0.0491 U	0.0491 U	0.0491 U	0.0491 U	0.0491 U	-	-	2,600	HH
4-Isopropyltoluene	0.0397 U	0.0397 U	0.0397 U	0.0397 U	0.0397 U	-	-	-	-
4-Methyl-2-pentanone (MIBK)	0.309 U	0.309 U	0.309 U	0.309 U	0.309 U	170	Eco	170	Eco
Acetone	1.20 U	1.20 U	**1.22 J**	1.20 U	1.20 U	1,500	Eco	1,500	Eco
Benzene	0.0417 U	0.0417 U	**0.0621 J**	0.0417 U	**0.0546 J**	2.20	HH	0.390	HH
Bromobenzene	0.0475 U	0.0475 U	0.0475 U	0.0475 U	0.0475 U	-	-	88.0	HH
Bromochloromethane	0.0573 U	0.0573 U	0.0573 U	0.0573 U	0.0573 U	0.550	HH	0.120	HH
Bromodichloromethane	0.0785 U	0.0785 U	0.0785 U	0.0785 U	0.0785 U	0.550	HH	0.120	HH
Bromoform	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	4.30	HH	7.20	HH
Bromomethane	0.0748 U	1.00 U	1.00 U	1.00 U	1.00 U	16.0	Eco	8.70	HH
Carbon Disulfide	0.0494 U	0.0494 U	1.00 U	1.00 U	0.0494 U	0.920	Eco	0.920	Eco
Carbon Tetrachloride	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.230	HH	0.190	HH
Chlorobenzene	0.0376 U	0.0376 U	0.0376 U	0.0376 U	0.0376 U	50.0	Eco	50.0	Eco
Chloroethane	0.187 U	0.187 U	0.187 U	0.187 U	0.187 U	-	-	21,000	HH
Chloroform	0.0717 U	0.0717 U	**0.0907 J**	0.0717 U	0.0717 U	5.70	HH	0.190	HH
Chloromethane	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	-	-	190	HH
cis-1,2-Dichloroethene	**0.842 J**	**0.0948 J**	**341**	**4.54**	**10.1**	590	Eco	360	HH
cis-1,3-Dichloropropene	0.0301 U	0.0301 U	0.0301 U	0.0301 U	0.0301 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.400	HH	0.680	HH
Dibromomethane	0.0864 U	0.0864 U	0.0864 U	0.0864 U	0.0864 U	-	-	8.20	HH
Dichlorodifluoromethane	0.0575 U	0.0575 U	0.0575 U	0.0575 U	0.0575 U	-	-	390	HH
Dichloromethane (Methylene Chloride)	0.0752 U	0.0752 U	0.0752 U	1.00 U	0.0752 U	4.60	HH	4.40	HH
Ethylbenzene	0.0226 U	1.00 U	**0.0403 J**	0.0226 U	0.0226 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	0.152 U	0.152 U	0.152 U	0.152 U	0.152 U	0.440	HH	0.860	HH
Isopropylbenzene	0.0165 U	0.0165 U	0.0165 U	0.0165 U	0.0165 U	7.30	Eco	7.30	Eco
m,p-Xylenes	0.0718 U	0.0718 U	**0.0823 J**	0.0718 U	0.0718 U	13.0	Eco	13.0	Eco
Naphthalene	0.0317 U	**0.0359 J**	1.00 U	**0.0452 J**	0.0317 U	620	Eco	0.140	HH
n-Butylbenzene	0.0603 U	0.0603 U	0.0603 U	0.0603 U	0.0603 U	-	-	-	-
n-Propylbenzene	0.0356 U	0.0356 U	0.0356 U	0.0356 U	0.0356 U	7.30	Eco	7.30	Eco
o-Xylene	0.0265 U	0.0265 U	**0.0304 J**	0.0265 U	0.0265 U	350	Eco	350	Eco
sec-Butylbenzene	0.0358 U	0.0358 U	0.0358 U	0.0358 U	0.0358 U	-	-	-	-
Styrene	0.0279 U	0.0279 U	0.0279 U	0.0279 U	0.0279 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	0.0535 U	0.0535 U	0.0535 U	0.0535 U	0.0535 U	-	-	-	-
Tetrachloroethene (PCE)	**1.14**	**0.336 J**	**3.70**	**0.411 J**	**1.09**	0.690	HH	0.0930	HH
Toluene	1.00 U	1.00 U	**0.299 J**	0.0588 U	**0.0917 J**	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	0.0584 U	0.0584 U	**1.80**	0.0584 U	**0.0955 J**	140	HH	110	HH
trans-1,3-Dichloropropene	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.0539 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	**0.342 J**	**0.0904 J**	**2.12**	**0.121 J**	**0.534 J**	2.50	HH	0.0390	HH
Trichlorofluoromethane	0.0620 U	0.0620 U	0.0620 U	0.0620 U	0.0620 U	-	-	1,300	HH
Vinyl Acetate	0.320 U	0.320 U	0.320 U	0.320 U	0.320 U	16.0	Eco	16.0	Eco
Vinyl Chloride	0.0604 U	0.0604 U	**0.611 J**	0.0604 U	0.0604 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5f
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
Total Semivolatile Organic Compounds

Site ID	DP1	DP10	DP11	DP2	DP3*	DP4	DP5*	DP7	DP9	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	041116SGA01GW	041118SGA06GW	041122SGA12GW	041117SGA02GW	041117SGA03GW	041117SGA05GW	041118SGA07GW	041119SGA09GW	041119SGA10GW				
Sample Date	11/16/2004	11/17/2004	11/22/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/19/2004	11/19/2004				
Sample Depth (Feet bgs)	12.0-17.0	7.8-12.8	7.0-17.0	12.0-17.0	11.0-16.0	13.0-18.0	18.5-28.5	12.9-17.9	10.0-20.0				
Total Semivolatile Organic Compounds (µg/L)													
1,2,4-Trichlorobenzene	0.0135 U	0.0123 UJ	0.0122 U	0.0123 U	0.0127 U	0.0129 U	0.0121 U	0.0151 U	0.0117 UJ	35.0	HH	2.30	HH
1,2-Dichlorobenzene	0.0305 U	0.0279 U	0.0276 U	0.0278 U	0.0287 U	0.0291 U	0.0273 U	0.0340 U	0.0264 U	14.0	Eco	14.0	Eco
1,3-Dichlorobenzene	0.0403 U	0.0368 U	0.0364 U	0.0367 U	0.0379 U	0.0385 U	0.0361 U	0.0449 U	0.0349 U	71.0	Eco	0.420	HH
1,4-Dichlorobenzene	0.0347 U	0.0317 U	0.0314 U	0.0316 U	0.0326 U	0.0331 U	0.0311 U	0.0387 U	0.0300 U	15.0	Eco	0.420	HH
2,4,5-Trichlorophenol	0.0487 UJ	0.0444 UJ	0.0440 UJ	0.0443 UJ	-	-	-	0.0542 UJ	0.0421 UJ	18.0	Eco	18.0	Eco
2,4,6-Trichlorophenol	0.0353 UJ	0.0322 UJ	0.0319 UJ	0.0321 UJ	-	-	-	0.0393 UJ	0.0305 UJ	1.40	HH	5.20	HH
2,4-Dichlorophenol	0.0204 UJ	0.0186 UJ	0.0185 UJ	0.0186 UJ	-	-	-	0.0228 UJ	0.0177 UJ	77.0	HH	110	HH
2,4-Dimethylphenol	0.201 UJ	0.183 UJ	0.182 UJ	0.183 UJ	-	-	-	0.224 UJ	0.174 UJ	42.0	Eco	42.0	Eco
2,4-Dinitrophenol	0.227 UJ	0.207 UJ	0.206 UJ	0.207 UJ	-	-	-	0.253 UJ	0.197 UJ	19.0	Eco	19.0	Eco
2,4-Dinitrotoluene	0.0631 U	0.0575 U	0.0570 U	0.0573 U	0.0592 U	0.0602 U	0.0564 U	0.0703 U	0.0545 U	0.110	HH	0.220	HH
2,6-Dinitrotoluene	0.0418 U	0.0381 U	0.0377 U	0.0380 U	0.0392 U	0.0398 U	0.0374 U	0.0465 U	0.0361 U	230	Eco	37.0	HH
2-Chloronaphthalene	0.00527 U	0.00481 U	0.00477 U	0.00480 U	0.00495 U	0.00503 U	0.00472 U	0.00588 U	0.00456 U	32.0	Eco	32.0	Eco
2-Chlorophenol	0.0463 UJ	0.0422 UJ	0.0418 UJ	0.0421 UJ	-	-	-	0.0515 UJ	0.0400 UJ	81.0	HH	180	HH
2-Methylphenol	0.0430 UJ	0.0392 UJ	0.0388 UJ	0.0391 UJ	-	-	-	0.0479 UJ	0.0371 UJ	13.0	Eco	13.0	Eco
2-Nitroaniline	0.0329 U	0.0300 U	0.0297 U	0.0299 U	0.0309 U	0.0313 U	0.0294 U	0.0366 U	0.0284 U	-	-	370	HH
2-Nitrophenol	0.0470 UJ	0.0429 UJ	0.0425 UJ	0.0428 UJ	-	-	-	0.0524 UJ	0.0406 UJ	10,000	HH	11,000	HH
3,3'-Dichlorobenzidine	0.206 U	0.188 U	0.186 U	0.187 U	0.193 U	0.196 U	0.184 U	0.229 U	0.178 U	0.0210	HH	0.130	HH
3-Nitroaniline	0.0621 U	0.0566 U	0.0561 U	0.0564 U	0.0583 U	0.0592 U	0.0556 U	0.0692 U	0.0537 U	-	-	3.40	HH
4,6-Dinitro-2-methylphenol	0.341 UJ	0.311 UJ	0.308 UJ	0.310 UJ	-	-	-	0.379 UJ	0.294 UJ	13.0	HH	2.90	HH
4-Bromophenyl Phenyl Ether	0.0241 U	0.0219 U	0.0217 U	0.0219 U	0.0226 U	0.0230 U	0.0215 U	0.0268 U	0.0208 U	1.50	Eco	1.50	Eco
4-Chloro-3-methylphenol	0.0268 UJ	0.0244 UJ	0.0242 UJ	0.0244 UJ	-	-	-	0.0299 UJ	0.0232 UJ	-	-	3700	HH
4-Chloroaniline	0.0795 U	0.0724 U	0.0718 U	0.0722 U	0.0746 U	0.0758 U	0.0711 U	0.0885 UJ	0.0687 UJ	50.0	Eco	0.340	HH
4-Chlorophenyl Phenyl Ether	0.0354 U	0.0323 U	0.0320 U	0.0322 U	0.0332 U	0.0338 U	0.0317 U	0.0394 U	0.0306 U	-	-	-	-
4-Nitroaniline	0.0426 U	0.0389 U	0.0385 U	0.0388 U	0.0400 U	0.0407 U	0.0382 U	0.0475 U	0.0368 U	-	-	3.40	HH
4-Nitrophenol	0.130 UJ	0.118 UJ	0.117 UJ	0.118 UJ	-	-	-	0.144 UJ	0.112 UJ	150	Eco	150	Eco
Aniline	0.330 U	0.031 U	0.298 U	0.300 U	0.310 U	0.314 U	0.295 U	0.367 U	0.285 U	2.20	Eco	2.20	Eco
Benzidine	1.10 UJ	1.00 UJ	0.993 UJ	0.999 UJ	1.03 UJ	1.05 UJ	0.983 UJ	1.22 U	0.950 U	0.0000860	HH	0.720	HH
Benzoic Acid	0.147 UJ	0.134 UJ	0.133 UJ	0.134 UJ	-	-	-	0.164 UJ	0.127 UJ	42.0	Eco	42.0	Eco
Benzyl Alcohol	0.0467 UJ	**0.0500 J**	0.0422 UJ	0.0425 UJ	-	-	**0.0523 J**	0.0520 UJ	0.0404 UJ	8.60	Eco	8.60	Eco
Bis(2-chloroethoxy)methane	0.0199 U	0.0181 U	0.0180 U	0.0181 U	0.0187 U	0.0190 U	0.0178 U	0.0222 U	0.0172 U	-	-	110	HH
Bis(2-chloroethyl) Ether	0.0356 U	0.0325 U	0.0322 U	0.0324 U	0.0334 U	0.0340 U	0.0319 U	0.0397 U	0.0308 U	0.0300	HH	0.0120	HH
Bis(2-chloroisopropyl) Ether	0.0471 U	0.0430 U	0.0426 U	0.0429 U	0.0443 U	0.0450 U	0.0422 U	0.0525 U	0.0407 U	1,400	HH	-	-
Bis(2-ethylhexyl) Phthalate	0.419 U	0.382 U	0.378 U	**0.408 J**	0.393 U	0.399 U	0.375 U	0.466 U	0.362 U	1.20	HH	3.00	Eco
Butyl Benzyl Phthalate	**0.120 J**	**0.171 J**	**0.228 J**	**0.173 J**	**0.131 J**	0.102 U	**0.141 J**	0.119 U	0.285 U	19.0	Eco	19.0	Eco
Carbazole	0.0238 U	0.0217 U	0.0215 U	0.0217 U	0.0224 U	0.0227 U	0.0213 U	0.0266 U	0.0206 U	-	-	-	-
Dibenzofuran	**0.0237 J**	0.0205 U	0.0204 U	0.0205 U	0.0212 U	0.0215 U	0.0202 U	**0.0421 J**	0.0195 U	3.70	Eco	3.70	Eco
Diethyl Phthalate	0.0612 U	0.0558 U	0.0553 U	0.0556 U	0.0575 U	0.0584 U	0.0548 U	0.0682 U	0.0529 U	210	Eco	210	Eco
Dimethyl Phthalate	0.0429 U	0.0391 U	0.0387 U	0.0390 U	0.0402 U	0.0409 U	0.0383 U	0.0477 U	0.0370 U	3.00	Eco	3.00	Eco
Di-n-butyl Phthalate	**0.180 J**	**0.239**	0.608 U	**0.129 J**	**0.170 J**	**0.100 J**	**0.153 J**	0.245 U	0.190 U	35.0	Eco	35.0	Eco
Di-n-octyl Phthalate	0.0300 U	0.0274 U	0.0271 U	0.0273 U	0.0282 U	0.0286 U	0.0268 U	0.0334 U	0.0259 U	1.20	HH	4.10	HH
Hexachlorobenzene	0.0275 U	0.0251 U	0.0248 U	0.0250 U	0.0258 U	0.0262 U	0.0246 U	0.0306 U	0.0237 U	0.000280	HH	0.000300	Eco
Hexachlorobutadiene	0.0162 U	0.0147 U	0.0146 U	0.0147 U	0.0152 U	0.0154 U	0.0145 U	0.0180 U	0.0140 U	0.440	HH	0.860	HH
Hexachlorocyclopentadiene	0.341 U	0.311 U	0.308 UJ	0.310 U	0.320 U	0.325 U	0.305 U	0.379 UJ	0.294 UJ	5.20	Eco	5.20	Eco
Hexachloroethane	0.0419 U	0.0382 U	0.0378 U	0.0381 U	0.0393 U	0.0399 U	0.0375 U	0.0466 U	0.0362 U	1.40	HH	4.10	HH
Isophorone	0.0311 U	0.0284 U	0.0281 U	0.0283 U	0.0292 U	0.0297 U	0.0278 U	**0.0842 J**	**0.0486 J**	35.0	HH	71.0	HH
Nitrobenzene	0.0571 U	0.0521 U	0.0516 U	0.0519 U	0.0537 U	0.0545 U	0.0511 U	0.0636 U	0.0494 U	17.0	HH	0.120	HH
N-Nitrosodimethylamine	1.10 UJ	1.00 UJ	0.993 U	0.999 UJ	1.03 UJ	1.05 UJ	0.983 UJ	1.22 U	0.950 U	0.000690	HH	0.000420	HH
N-Nitrosodi-n-propylamine	0.0405 U	0.0370 U	0.0366 U	0.0369 U	0.0381 U	0.0387 U	0.0363 U	0.0452 U	0.0350 U	0.00500	HH	0.00960	HH
N-Nitrosodiphenylamine	0.00934 U	0.00852 U	0.00844 U	0.00849 U	0.00877 U	0.00891 U	0.00836 U	0.0104 U	0.00807 U	3.30	HH	14.0	HH
p-cresol (4-Methylphenol)	0.0485 UJ	0.0442 UJ	0.0438 UJ	0.0441 UJ	-	-	-	0.0540 UJ	0.0419 UJ	-	-	-	-
Pentachlorophenol	0.220 UJ	0.200 UJ	0.199 UJ	0.200 UJ	-	-	-	0.245 UJ	0.190 UJ	0.270	HH	0.470	HH
Phenol	**0.0276 J**	**0.0291 J**	0.00457 UJ	**0.0228 J**	**0.0192 J**	**0.0111 J**	-	0.00563 UJ	0.00437 UJ	110	Eco	110	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)													
2-Methylnaphthalene	**0.0683 J**	**0.153**	0.0148 U	0.0149 U	**0.0195 J**	**0.0210 J**	**0.0258 J**	**0.114**	0.0142 U	72.2	Eco	72.2	Eco
Acenaphthene	**0.0173 J**	**0.00812 J**	0.00338 U	0.00340 U	**0.00547 J**	0.00356 U	**0.00811 J**	**0.0230 J**	0.00323 U	520	Eco	520	Eco
Acenaphthylene	0.00264 U	0.00240 U	0.00238 U	0.00240 U	0.00248 U	0.00252 U	0.00236 U	0.00294 U	0.00228 U	307	Eco	0.140	HH
Anthracene	0.00209 U	0.00190 U	0.00189 U	0.00190 U	0.00196 U	0.00199 U	0.00187 U	**0.0126 J**	0.00180 U	13.0	Eco	13.0	Eco
Fluorene	**0.0210 J**	**0.00982 J**	0.00169 U	**0.00584 J**	**0.00835 J**	0.00178 U	**0.0157 J**	**0.0351**	0.00161 U	3.90	Eco	3.90	Eco
Naphthalene	0.0191 UJ	0.0174 UJ	**0.0222 J**	0.0174 U	**0.0254 J**	**0.0359 J**	0.0171 U	**0.0452 J**	0.0165 U	620	Eco	0.140	HH
Phenanthrene	**0.0198 J**	**0.0140 J**	**0.00759 J**	**0.0111 J**	**0.00975 J**	**0.00795 J**	**0.00849 J**	**0.144**	0.00351 U	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)													
Benzo(a)anthracene	0.00571 U	0.00521 U	0.00516 U	0.00519 U	0.00537 U	0.00545 U	0.00511 U	0.00636 U	0.00494 U	0.00380	HH	0.0270	Eco
Benzo(a)pyrene	0.00363 U	0.00331 U	0.00328 U	0.00330 U	0.00341 U	0.00346 U	0.00324 U	**0.00895 J**	0.00313 U	0.00380	HH	0.00290	HH
Benzo(g,h,i)perylene	0.00560 U	0.00511 U	0.00506 U	0.00509 U	0.00526 U	0.00535 U	0.00501 U	0.00624 U	0.00484 U	0.380	HH	0.290	HH
Benzofluoranthenes, Total	0.0131 U	0.0119 U	0.0118 U	0.0119 U	0.0123 U	0.0125 U	0.0117 U	**0.0173 J**	0.0113 U	0.00380	HH	0.01400	Eco
Chrysene	0.00923 U	0.00842 U	0.00834 U	0.00839 U	0.00867 U	0.00881 U	0.00826 U	0.0103 U	0.00798 U	0.00380	HH	2.04	Eco
Dibenz(a,h)anthracene	0.00341 U	0.00311 U	0.00308 U	0.00310 U	0.00320 U	0.00325 U	0.00305 U	**0.00671 J**	0.00294 U	0.0180	HH	0.00290	HH
Fluoranthene	0.00626 U	0.00571 U	0.00566 U	0.00569 U	0.00588 U	0.00597 U	0.00560 U	**0.0311**	0.00541 U	6.16	Eco	6.16	Eco
Indeno(1,2,3-cd)pyrene	0.00308 UJ	0.00281 UJ	0.00278 U	0.00280 UJ	0.00289 UJ	0.00294 UJ	0.00275 UJ	**0.00797 J**	0.00266 U	0.00380	HH	0.0290	HH
Pyrene	0.00319 U	0.00291 U	0.00288 U	**0.00317 J**	**0.00329 J**	0.00304 U	0.00285 U	**0.0261**	0.00275 U	10.1	Eco	10.1	Eco

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
btc = below top of well casing	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-5g
2004 Sandblast Supplemental Site Inspection Groundwater Analytical Results
Dissolved Semivolatile Organic Compounds

Site ID	DP1	DP10	DP2	DP3*	DP4	DP5*	DP7	DP9	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	041116SGA01GW	041118SGA06GW	041117SGA02GW	041117SGA03GW	041117SGA05GW	041118SGA07GW	041119SGA09GW	041119SGA10GW				
Sample Date	11/16/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/19/2004	11/19/2004				
Sample Depth (Feet bgs)	12.0-17.0	7.8-12.8	12.0-17.0	11.0-16.0	13.0-18.0	18.5-28.5	12.9-17.9	10.0-20.0				
Dissolved Semivolatile Organic Compounds (µg/L)												
1,2,4-Trichlorobenzene	0.0123 U	0.0125 U	0.0129 U	0.0127 U	0.0120 U	0.0121 U	0.0134 U	0.0139 UJ	35.0	HH	2.30	HH
1,2-Dichlorobenzene	0.0279 U	0.0282 U	0.0292 U	0.0287 U	0.0272 U	0.0273 U	0.0303 U	0.0313 U	14.0	Eco	14.0	Eco
1,3-Dichlorobenzene	0.0368 U	0.0373 U	0.0385 U	0.0379 U	0.0359 U	0.0361 U	0.0400 U	0.0413 U	71.0	Eco	0.420	HH
1,4-Dichlorobenzene	0.0317 U	0.0321 U	0.0332 U	0.0326 U	0.0310 U	0.0311 U	0.0344 U	0.0356 U	15.0	Eco	0.420	HH
2,4,5-Trichlorophenol	-	-	0.0465 U	0.0457 UJ	-	-	-	0.0499 UJ	18.0	Eco	18.0	Eco
2,4,6-Trichlorophenol	-	-	0.0337 U	0.0331 UJ	-	-	-	0.0361 UJ	1.40	HH	5.20	HH
2,4-Dichlorophenol	-	-	0.0195 U	0.0192 UJ	-	-	-	0.0209 UJ	77.0	HH	110	HH
2,4-Dimethylphenol	-	-	0.192 U	0.189 UJ	-	-	-	0.206 UJ	42.0	Eco	42.0	Eco
2,4-Dinitrophenol	-	-	0.217 U	0.214 UJ	-	-	-	0.233 UJ	19.0	Eco	19.0	Eco
2,4-Dinitrotoluene	0.0576 U	0.0583 U	0.0602 U	0.0592 U	0.0562 U	0.0564 U	0.0625 U	0.0646 U	0.110	HH	0.220	HH
2,6-Dinitrotoluene	0.0381 U	0.0386 U	0.0399 U	0.0392 U	0.0372 U	0.0374 U	0.0414 U	0.0428 U	230	Eco	37.0	HH
2-Chloronaphthalene	0.00481 U	0.00487 U	0.00504 U	0.00495 U	0.00470 U	0.00472 U	0.00523 U	0.00541 U	32.0	Eco	32.0	Eco
2-Chlorophenol	-	-	0.0442 U	0.0434 UJ	-	-	-	0.0474 UJ	81.0	HH	180	HH
2-Methylphenol	-	-	0.0410 U	0.0404 UJ	-	-	-	0.0440 UJ	13.0	Eco	13.0	Eco
2-Nitroaniline	0.0300 U	0.0304 U	0.0314 U	0.0309 U	0.0293 U	0.0294 U	0.0326 U	0.0337 U	-	-	370	HH
2-Nitrophenol	-	-	0.0449 U	0.0442 UJ	-	-	-	0.0482 UJ	10,000	HH	11,000	HH
3,3'-Dichlorobenzidine	0.188 U	0.190 U	0.196 U	0.193 U	0.183 U	0.184 U	0.204 U	0.211 U	0.0210	HH	0.130	HH
3-Nitroaniline	0.0567 U	0.0574 U	0.0593 U	0.0583 U	0.0553 U	0.0556 U	0.0615 U	0.0636 U	-	-	3.40	HH
4,6-Dinitro-2-methylphenol	-	-	0.325 U	0.320 UJ	-	-	-	0.349 UJ	13.0	HH	2.90	HH
4-Bromophenyl Phenyl Ether	0.0220 U	0.0222 U	0.0230 U	0.0226 U	0.0214 U	0.0215 U	0.0239 U	0.0247 U	1.50	Eco	1.50	Eco
4-Chloro-3-methylphenol	-	-	0.0256 U	0.0252 UJ	-	-	-	0.0275 UJ	-	-	3700	HH
4-Chloroaniline	0.0725 U	0.0734 U	0.0759 U	0.0746 U	0.0708 U	0.0711 U	0.0788 UJ	0.0814 UJ	50.0	Eco	0.340	HH
4-Chlorophenyl Phenyl Ether	0.0323 U	0.0327 U	0.0338 U	0.0332 U	0.0315 U	0.0317 U	0.0351 U	0.0363 U	-	-	-	-
4-Nitroaniline	0.0389 U	0.0394 U	0.0407 U	0.0400 U	0.0380 U	0.0382 U	0.0423 U	0.0437 U	-	-	3.40	HH
4-Nitrophenol	-	-	0.124 U	0.122 UJ	-	-	-	0.133 UJ	150	Eco	150	Eco
Benzidine	1.00 UJ	1.02 UJ	1.05 UJ	1.03 UJ	0.979 UJ	0.983 UJ	1.09 U	1.13 U	0.0000860	HH	0.720	HH
Benzoic Acid	-	-	0.141 U	0.138 UJ	-	**0.317 J**	-	0.151 UJ	42.0	Eco	42.0	Eco
Benzyl Alcohol	-	-	0.0446 U	0.0439 UJ	-	-	-	0.0479 UJ	8.60	Eco	8.60	Eco
Bis(2-chloroethoxy)methane	0.0182 U	0.0184 U	0.0190 U	0.0187 U	0.0177 U	0.0178 U	0.0197 U	0.0204 U	-	-	110	HH
Bis(2-chloroethyl) Ether	0.0325 U	0.0329 U	0.0340 U	0.0334 U	0.0317 U	0.0319 U	0.0353 U	0.0365 U	0.0300	HH	0.0120	HH
Bis(2-chloroisopropyl) Ether	0.0430 U	0.0436 U	0.0450 U	0.0443 U	0.0420 U	0.0422 U	0.0467 U	0.0483 U	1,400	HH	-	-
Bis(2-ethylhexyl) Phthalate	0.382 U	0.387 U	0.400 U	0.393 U	0.373 U	0.375 U	0.415 U	0.429 U	1.20	HH	3.00	Eco
Butyl Benzyl Phthalate	**0.117 J**	**0.108 J**	**0.154 J**	**0.155 J**	**0.135 J**	**0.137 J**	0.327 U	0.338 U	19.0	Eco	19.0	Eco
Carbazole	0.0218 U	0.0220 U	0.0228 U	0.0224 U	0.0213 U	0.0213 U	0.0236 U	0.0244 U	-	-	-	-
Dibenzofuran	0.0206 U	0.0208 U	0.0215 U	0.0212 U	0.0201 U	0.0202 U	0.0223 U	0.0231 U	3.70	Eco	3.70	Eco
Diethyl Phthalate	**0.0585 J**	0.0565 U	0.0584 U	0.0575 U	0.0546 U	0.0548 U	**0.101 J**	**0.0687 J**	210	Eco	210	Eco
Dimethyl Phthalate	0.0391 U	0.0396 U	0.0409 U	0.0402 U	0.0382 U	0.0383 U	0.0425 U	0.0439 U	3.00	Eco	3.00	Eco
Di-n-butyl Phthalate	**0.130 J**	**0.124 J**	**0.207 J**	**0.177 J**	**0.148 J**	**0.157 J**	0.218 U	0.275 U	35.0	Eco	35.0	Eco
Di-n-octyl Phthalate	0.0274 U	0.0277 U	0.0286 U	0.0282 U	0.0267 U	0.0268 U	0.0297 U	0.0307 U	1.20	HH	4.10	HH
Hexachlorobenzene	0.0251 U	0.0254 U	0.0262 U	0.0258 U	0.0245 U	0.0246 U	0.0272 U	0.0282 U	0.000280	HH	0.000300	Eco
Hexachlorobutadiene	0.0147 U	0.0149 U	0.0154 U	0.0152 U	0.0144 U	0.0145 U	0.0160 U	0.0166 U	0.440	HH	0.860	HH
Hexachlorocyclopentadiene	0.311 U	0.315 U	0.325 U	0.320 U	0.304 U	0.305 U	0.338 UJ	0.349 UJ	5.20	Eco	5.20	Eco
Hexachloroethane	0.0382 U	0.0387 U	0.0400 U	0.0393 U	0.0373 U	0.0375 U	0.0415 U	0.0429 U	1.40	HH	4.10	HH
Isophorone	0.0284 U	0.0287 U	0.0297 U	0.0292 U	0.0277 U	0.0278 U	**0.0782 J**	**0.0483 J**	35.0	HH	71.0	HH
Nitrobenzene	0.0522 U	0.0528 U	0.0546 U	0.0537 U	0.0509 U	0.0511 U	0.0566 U	0.0586 U	17.0	HH	0.120	HH
N-Nitrosodimethylamine	1.00 UJ	1.02 UJ	1.05 UJ	1.03 UJ	0.979 UJ	0.983 UJ	1.09 U	1.13 U	0.000690	HH	0.000420	HH
N-Nitrosodi-n-propylamine	0.0370 U	0.0375 U	0.0387 U	0.0381 U	0.0361 UJ	0.0363 U	0.0402 U	0.0416 U	0.00500	HH	0.00960	HH
N-Nitrosodiphenylamine	0.00853 U	0.00863 U	0.00892 U	0.00877 U	0.00833 U	0.00836 U	0.00926 U	0.00957 U	3.30	HH	14.0	HH
p-cresol (4-Methylphenol)	-	-	0.0463 U	0.0455 UJ	-	-	-	0.0497 UJ	-	-	-	-
Pentachlorophenol	-	-	0.210 U	0.206 UJ	-	-	-	0.225 UJ	0.270	HH	0.470	HH
Phenol	-	-	0.00483 U	**0.0192 J**	**0.00999 J**	-	-	**0.0248 J**	110	Eco	110	Eco
Dissolved Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)												
2-Methylnaphthalene	**0.0158 J**	**0.280**	**0.193**	**0.0176 J**	**0.0369 J**	0.0147 U	**0.0203 J**	0.0168 U	72.2	Eco	72.2	Eco
Acenaphthene	**0.00491 J**	0.00345 U	**0.0104 J**	**0.00547 J**	0.00333 U	0.00334 U	**0.0348**	**0.0175 J**	520	Eco	520	Eco
Acenaphthylene	0.00241 U	0.00244 U	**0.00361 J**	0.00248 U	0.00235 U	0.00236 U	0.00261 U	0.00270 U	307	Eco	0.140	HH
Anthracene	0.00191 U	0.00193 U	0.00199 U	0.00196 U	0.00186 U	0.00187 U	0.00207 U	0.00214 U	13.0	Eco	13.0	Eco
Fluorene	**0.00731 J**	**0.00691 J**	**0.0116 J**	**0.00654 J**	**0.00714 J**	0.00167 U	0.00185 U	0.00191 U	3.90	Eco	3.90	Eco
Naphthalene	**0.0399 J**	**0.200**	**0.151**	**0.0350 J**	**0.186**	**0.0289 J**	0.0190 U	0.0196 U	620	Eco	0.140	HH
Phenanthrene	**0.00957 J**	**0.00801 J**	**0.0190 J**	**0.0111 J**	**0.0157 J**	**0.00427 J**	0.00403 U	0.00417 U	6.30	Eco	0.140	HH
Dissolved High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)												
Benzo(a)anthracene	0.00522 U	0.00528 U	0.00546 U	0.00537 U	0.00509 U	0.00511 U	0.00566 U	0.00586 U	0.00380	HH	0.0270	Eco
Benzo(a)pyrene	0.00331 U	0.00335 U	0.00346 U	0.00341 U	0.00323 U	0.00324 U	**0.00714 J**	0.00372 U	0.00380	HH	0.00290	HH
Benzo(g,h,i)perylene	0.00512 U	0.00518 U	0.00535 U	0.00526 U	0.00500 U	0.00501 U	0.00556 U	0.00574 U	0.380	HH	0.290	HH
Benzofluoranthenes, Total	0.0119 U	0.0121 U	0.0125 U	0.0123 U	0.0117 U	0.0117 U	0.0130 U	0.0134 U	0.00380	HH	0.01400	Eco
Chrysene	0.00843 U	0.00853 U	0.00881 U	0.00867 U	0.00823 U	0.00826 U	0.00915 U	0.00946 U	0.00380	HH	2.04	Eco
Dibenz(a,h)anthracene	0.00311 U	0.00315 U	0.00325 U	0.00320 U	0.00304 U	0.00305 U	**0.00381 J**	0.00349 U	0.0180	HH	0.00290	HH
Fluoranthene	0.00572 U	0.00579 U	0.00598 U	0.00588 U	0.00558 U	0.00560 U	0.00621 U	0.00642 U	6.16	Eco	6.16	Eco
Indeno(1,2,3-cd)pyrene	0.00281 UJ	0.00284 UJ	0.00294 UJ	0.00289 UJ	0.00274 UJ	0.00275 UJ	**0.00630 J**	0.00315 U	0.00380	HH	0.0290	HH
Pyrene	0.00291 U	0.00294 U	0.00304 U	0.00299 U	0.00284 U	0.00285 U	0.00316 U	0.00327 U	10.1	Eco	10.1	Eco

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-6
2002 Pistol Range Preliminary Assessment/Site Investigation Soil Analytical Results
Metals in mg/kg

			Analyte	Antimony	Arsenic	Copper	Lead	Mercury	Nickel	Zinc
			Selected SLV (0-3 ft bgs)	0.270	5.40	56.7	25.5	0.0660	38.0	71.7
			SLV Source (0-3 ft bgs)	Eco	UPL	UPL	UPL	UPL	Eco	UPL
Site ID	**Sample ID**	**Sample Date**	**Depth** (Feet bgs)							
PFR01	021119PFR01SS	11/19/2002	0.0-0.5	-	-	**52.3**	**185**	0.0500 U	**24.0 J**	**164**
PFR01	021119PFR02SS	11/19/2002	1.0-1.5	-	-	**46.8**	**37.0**	0.0600 U	**21.0 J**	**95.0**
PFR03	021119PFR03SS	11/19/2002	0.0-0.5	6.00 UJ	6.00 U	**46.8 J**	**758**	0.0500 U	**21.0 J**	**199**
PFR04	021119PFR04SS	11/19/2002	0.0-0.5	-	-	**46.0**	**84.0**	0.0600 U	**26.0 J**	**95.0**
PFR04	021119PFR05SS	11/19/2002	1.0-1.5	-	-	**50.2**	**30.0**	0.0600 U	**26.0 J**	**74.0**
PFR06	021119PFR06SS	11/19/2002	0.0-0.5	-	-	**38.7**	**124**	0.0500 U	**20.0 J**	**121**
PFR06	021119PFR07SS	11/19/2002	1.0-1.5	-	-	**46.4**	**160**	0.0600 U	**23.0 J**	**140**
PFR08	021119PFR08SS	11/19/2002	0.0-0.5	-	-	**37.6**	**269**	0.0600 U	**19.0 J**	**168**
PFR08	021119PFR09SS	11/19/2002	1.0-1.5	-	-	**53.1**	**48.0**	0.0500 U	**25.0 J**	**80.0**
PFR10	021119PFR10SS	11/19/2002	0.0-0.5	-	-	**46.5**	**78.0**	0.0600 U	**32.0 J**	**106**
PFR12	021119PFR12SS	11/19/2002	0.0-0.5	-	-	-	**81.0**	-	-	-
PFR12	021119PFR13SS	11/19/2002	1.0-1.5	-	-	-	**42.0**	-	-	-
PFR14	021119PFR14SS	11/19/2002	0.0-0.5	-	-	-	**98.0**	-	-	-
PFR14	021119PFR15SS	11/19/2002	1.0-1.5	-	-	-	**16.0**	-	-	-
PFR16	021119PFR16SS	11/19/2002	0.0-0.5	-	-	-	**52.0**	-	-	-
PFR17*	021119PFR17SS	11/19/2002	0.0-0.5	-	-	-	**36.5**	-	-	-
PFR17	021119PFR19SS	11/19/2002	1.0-1.5	-	-	-	**11.0**	-	-	-
PFR20*	021119PFR20SS	11/19/2002	0.0-0.5	-	-	-	**78.0**	-	-	-
PFR22	021119PFR22SS	11/19/2002	0.0-0.5	-	-	-	**39.0**	-	-	-
PFR22	021119PFR23SS	11/19/2002	1.0-1.5	-	-	-	**18.0**	-	-	-
PFR24	021119PFR24SS	11/19/2002	0.0-0.5	-	-	-	**60.0**	-	-	-
PFR25	021119PFR25SS	11/19/2002	0.0-0.5	-	-	-	**56.0**	-	-	-
PFR25	021119PFR26SS	11/19/2002	1.0-1.5	-	-	-	**24.0**	-	-	-
PFR27*	021119PFR27SS	11/19/2002	0.0-0.5	-	-	-	**45.0**	-	-	-
PFR29	021119PFR29SS	11/19/2002	0.0-0.5	-	-	-	**95.0**	-	-	-
PFR29	021119PFR30SS	11/19/2002	1.0-1.5	-	-	-	**57.0**	-	-	-
PFR31	021119PFR31SS	11/19/2002	0.0-0.5	-	-	-	**93.0**	-	-	-
PFR32	021119PFR32SS	11/19/2002	0.0-0.5	-	-	-	**59.0**	-	-	-
PFR32	021119PFR33SS	11/19/2002	1.0-1.5	-	-	-	**25.0**	-	-	-
PFR34	021119PFR34SS	11/19/2002	0.0-0.5	-	-	-	**156**	-	-	-
PFR35	021119PFR35SS	11/19/2002	0.0-0.5	-	-	-	**176**	-	-	-
PFR35	021119PFR37SS	11/19/2002	1.0-1.5	-	-	-	**21.0**	-	-	-
PFR38	021119PFR38SS	11/19/2002	0.0-0.5	-	-	-	**171**	-	-	-
PFR39	021119PFR39SS	11/19/2002	0.0-0.5	-	-	-	**527**	-	-	-
PFR39	021119PFR40SS	11/19/2002	1.0-1.5	-	-	-	**573**	-	-	-
PFR41	021119PFR41SS	11/19/2002	0.0-0.5	-	-	-	**733**	-	-	-
PFR42	021119PFR42SS	11/19/2002	0.0-0.5	-	-	-	**266**	-	-	-
PFR42	021119PFR43SS	11/19/2002	1.0-1.5	-	-	-	**43.0**	-	-	-
PFR44	021121PFR44SS	11/21/2002	0.0-0.5	-	-	-	**756**	-	-	-
PFR45	021121PFR45SS	11/21/2002	0.0-0.5	-	-	-	**761**	-	-	-
PFR45	021121PFR46SS	11/21/2002	1.0-1.5	-	-	-	**694**	-	-	-
PFR47	021121PFR47SS	11/21/2002	0.0-0.5	-	-	-	**543**	-	-	-
PFR48	021121PFR48SS	11/21/2002	0.0-0.5	5.00 UJ	5.00 U	**16.5 J**	**915**	-	-	-
PFR48	021121PFR49SS	11/21/2002	1.0-1.5	5.00 UJ	5.00 U	**19.0 J**	**835**	-	-	-
PFR50	021121PFR50SS	11/21/2002	0.0-0.5	5.00 UJ	5.00 U	**18.3 J**	**817**	-	-	-
PFR50	021121PFR51SS	11/21/2002	1.0-1.5	5.00 UJ	5.00 U	**15.6 J**	**1,110**	-	-	-
PFR52*	021121PFR52SS	11/21/2002	0.0-0.5	-	-	-	**60.5**	-	-	-
PFR52	021121PFR54SS	11/21/2002	1.0-1.5	-	-	-	**61.0**	-	-	-
PFR55	021121PFR55SS	11/21/2002	0.0-0.5	-	-	-	**46.0**	-	-	-
PFR56	021121PFR56SS	11/21/2002	0.0-0.5	-	-	-	**391**	-	-	-
PFR56	021121PFR57SS	11/21/2002	1.0-1.5	-	-	-	**410**	-	-	-
PFR58	021121PFR58SS	11/21/2002	0.0-0.5	-	-	-	**31.0**	-	-	-
PFR59	021121PFR59SS	11/21/2002	0.0-0.5	-	-	-	**19.0**	-	-	-
PFR60	021121PFR60SS	11/21/2002	0.0-0.5	-	-	-	**22.0**	-	-	-
PFR60	021121PFR61SS	11/21/2002	1.0-1.5	-	-	-	**28.0**	-	-	-
PFR62	021121PFR62SS	11/21/2002	0.0-0.5	-	-	-	**30.0**	-	-	-
PFR63	021121PFR63SS	11/21/2002	0.0-0.5	-	-	-	**15.0**	-	-	-
PFR63	021121PFR64SS	11/21/2002	1.0-1.5	-	-	-	**10.0**	-	-	-
PFR65*	021121PFR65SS	11/21/2002	0.0-0.5	-	-	-	**7.50**	0.0500 U	-	-
PFR67*	021121PFR67SS	11/21/2002	0.0-0.5	-	-	-	**29.5**	0.0600 U	-	-
PFR69*	021121PFR69SS	11/21/2002	0.0-0.5	-	-	-	**32.0**	0.0400 U	-	-
PFR71*	021121PFR71SS	11/21/2002	0.0-0.5	-	-	-	**26.0**	0.0600 U	-	-
PFR73	021121PFR73SS	11/21/2002	0.0-0.5	-	-	-	**45.0**	-	-	-

Notes:
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 5-7
2002 Bulb Slope Reconnaissance Investigation Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, and General Chemistry Parameters

Site ID	AREA A04	AREA A05	AREA B06	AREA B07	AREA C01	AREA C02*	AREA C08	AREA C09	PILE #3 BANK #1	PILE #3 BANK #2	PILE #3 BANK #3	PILE #3 BANK #4	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	021120BSA04SS	021120BSA05SS	021120BSB06SS	021120BSB07SS	021120BSC01SS	021120BSC02SS	021120BSC08SS	021120BSC09SS	020419P3B1SD	020419P3B2SD	020419P3B3SD	020419P3B4SD		
Sample Date	11/20/2002	11/20/2002	11/20/2002	11/20/2002	11/20/2002	11/20/2002	11/20/2002	11/20/2002	4/19/2002	4/19/2002	4/19/2002	4/19/2002		
Sample Depth (Feet bgs)	0.17-0.33	0.17-0.33	0.17-0.33	0.17-0.33	0.08-0.25	0.17-0.33	0.17-0.33	0.17-0.33	0.0	0.0	0.0	0.0		
PCB Aroclors (µg/kg)														
Aroclor 1016	20.0 U	19.0 U	19.0 U	20.0 U	20.0 U	19.0 U	20.0 U	20.0 U	67.0 U	67.0 U	67.0 U	67.0 U	371	Eco
Aroclor 1221	40.0 U	39.0 U	38.0 U	39.0 U	39.0 U	38.0 U	39.0 U	40.0 U	134 U	134 U	134 U	134 U	371	Eco
Aroclor 1232	20.0 U	19.0 U	19.0 U	20.0 U	20.0 U	19.0 U	20.0 U	20.0 U	67.0 U	67.0 U	67.0 U	67.0 U	371	Eco
Aroclor 1242	20.0 U	19.0 U	19.0 U	20.0 U	20.0 U	19.0 U	20.0 U	20.0 U	67.0 U	67.0 U	67.0 U	67.0 U	371	Eco
Aroclor 1248	20.0 U	19.0 U	19.0 U	20.0 U	20.0 U	19.0 U	20.0 U	20.0 U	67.0 U	67.0 U	67.0 U	67.0 U	371	Eco
Aroclor 1254	20.0 U	19.0 U	19.0 U	20.0 U	20.0 U	19.0 U	20.0 U	20.0 U	67.0 U	67.0 U	67.0 U	67.0 U	371	Eco
Aroclor 1260	**78.0**	**37.0**	**160**	**35.0**	**27.0**	19.0 U	**51.0**	20.0 U	67.0 U	**76.1**	67.0 U	**251**	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**78.0**	**37.0**	**160**	**35.0**	**27.0**	19.0 U	**51.0**	20.0 U	67.0 U	**76.1**	67.0 U	**251**	371	Eco
Metals (mg/kg)														
Lead	**234**	**202**	**444**	**170**	**67.0**	**47.5**	**142**	**25.0**	**196**	**247**	**289**	**597**	25.5	UPL
Mercury	**0.380**	**0.740**	**0.500**	**0.180**	**0.0600**	**0.0850**	**0.0500**	**0.130**	**0.150**	**0.584**	**0.452**	**1.54**	0.0660	UPL
Petroleum Hydrocarbons (mg/kg)														
Diesel Range Organics	**30.0**	**170**	**79.0**	**32.0**	**11.0**	**18.0**	**33.0**	**8.30**	-	-	-	-	23,000	HH
Residual Range Organics	**180**	**410**	**160**	**200**	**52.0**	**67.5**	**100**	**44.0**	-	-	-	-	40,000	HH
General Chemistry Parameters (mg/kg)														
Carbon, Total Organic	**54,200**	**69,200**	**43,600**	**38,900**	**24,400**	**17,200**	**19,400**	**18,100**	-	-	-	-	-	-
Solids, Total	**908,000**	**918,000**	**819,000**	**793,000**	**747,000**	**714,000**	**768,000**	**700,000**	**723,000**	**692,000**	**800,000**	**855,000**	-	-

Notes:

µg/kg = microgram per kilogram	[1] Only Aroclor 1260 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Bulb Slope AOPC soil samples.
mg/kg = milligram per kilogram	- = Not Analyzed
bgs = below ground surface	-- = SLV for analyte not available
Eco = Ecological	J = The reported value is an estimate.
HH = Human Health	U = The analyte was not detected at or above the MDL.
MDL = method detection limit	UJ = The analyte was not detected. The reported MDL is an estimate.
ND = non detect	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
UPL = Reference Area Upper Prediction Limit	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-1
Upland OU and River OU Enumeration of Samples Included in the Bradford Island Remedial Investigation

Upland OU	Matrix									
	Soil (0-1 ft)	Soil (0-3 ft)	Soil (0-10 ft)	Soil (>10 ft)	Soil Gas	Groundwater	Groundwater - DP	Seep Water	Surface Water	Lagoon Sediment
Bulb Slope AOPC	**12**	**-**	-	-	-	-	-	-	-	-
Landfill AOPC	**32**	**44**	**58**	-	-	**57**	-	**5**	4	-
Pistol Range AOPC	**65**	**-**	-	-	-	-	**2**	-	-	**5**
Sandblast AOPC	**85**	**118**	**121**	**6**	5	**20**	**12**	**-**	-	**-**
Reference Area	**14**	**-**	-	-	-	**4**	-	-	-	-

River OU	Matrix						
	Sediment	Tissue					Surface Water
		Crayfish	Sculpin	Smallmouth Bass	Clam	Largescale Sucker	
Forebay	**19**	17	**17**	19	**19**	**1**	5
Forebay - Pre-Sediment Removal	5	-	-	-	4	-	-
Forebay - Eagle Creek	2	-	-	-	-	-	-
Forebay - Goose Island	**2**	1	**1**	-	1	-	-
Downstream	6	-	-	-	-	-	-
Reference	**18**	20	**18**	19	18	-	5

Notes:

Analytical suites are not the same for all samples

The number of samples listed in this table include both the samples used in this RI Report from the Historical Investigations (Section 5) and Recent Investigations (Section 6).

- = no samples collected in this area for this matrix

Table 6-10a
Post-Removal Forebay Area Crayfish Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P01-CF	P02-CF	P03-CF	P04-CF	P05-CF	P06-CF		
Sample ID	08021901CF	08021902CF	08022003CF	08021904CF	08021505CF	08021406CF		
Sample Date	2/19/2008	2/19/2008	2/20/2008	2/19/2008	2/15/2008	2/14/2008		
Percent Lipds	1.2	1.7	0.62	0.55	1.4	1.1		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	0.570	HH
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	0.570	HH
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	0.570	HH
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.570	HH
Aroclor 1254	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	19.0 U	0.570	HH
Aroclor 1260	1.90 U	1.90 U	1.90 U	8.60 U	7.10 U	17.0 U	0.570	HH
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	9.80 U	10.0 U	0.570	HH
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	2.60 U	2.60 U	2.60 U	8.60 U	9.80 U	19.0 U	0.570	HH
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.00376**	-	-	**0.00654**	**0.0148**	**0.0207**	0.0760	HH
PCB 81	0.000239 EMPC	-	-	**0.000446**	0.000823 EMPC	**0.00132**	0.0250	HH
PCB 105	**0.0146**	-	-	**0.0931**	**0.0566**	0.0863 EMPC	0.250	HH
PCB 114	**0.00661**	-	-	**0.351**	**0.355**	**0.804**	0.250	HH
PCB 118	**0.206**	-	-	**3.52**	**6.34**	**14.0**	0.250	HH
PCB 123	**0.00475**	-	-	**0.247**	**0.206**	**0.460**	0.250	HH
PCB 126	**0.000800**	-	-	0.00351 U	**0.00360**	**0.00783**	0.0000760	HH
PCB 156	**0.0382 C**	-	-	**2.28 C**	**1.62 C**	**3.91 C**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.250	HH
PCB 167	**0.0230**	-	-	**1.18**	**0.629**	**1.53**	0.250	HH
PCB 169	0.000597 U	-	-	0.00295 U	0.00180 U	0.00120 U	0.000250	HH
PCB 189	**0.00269**	-	-	**0.0683**	**0.0414**	**0.0821**	0.250	HH
Total PCBs as Congeners (KM, capped)	**1.44 J**	-	-	**16.8 J**	**16.9 J**	**42.6 J**	0.570	HH
Metals (mg/kg wet)								
Aluminum	**94.3**	**157**	**96.6**	**106**	**149**	**139**	--	--
Antimony	**0.0210**	**0.0160**	**0.0500**	**0.0160**	**0.0630**	**0.133**	--	--
Arsenic	**0.610**	**0.680**	**0.420**	**0.550**	**0.640**	**0.520**	0.000760	HH
Barium	**72.2**	**75.6**	**68.5**	**62.1**	**84.3**	**80.4**	--	--
Beryllium	**0.00300 J**	**0.00380 J**	**0.00310 J**	**0.00410 J**	**0.00370 J**	**0.00330 J**	--	--
Cadmium	**0.193**	**0.210**	**0.101**	**0.129**	**0.137**	**0.149**	0.150	Eco
Chromium	**0.700**	**0.200**	**0.300**	**0.700**	**1.20**	**0.800**	--	--
Cobalt	**0.209**	**0.241**	**0.192**	**0.232**	**0.239**	**0.223**	--	--
Copper	**22.2 J**	**36.0 J**	**19.7 J**	**17.3 J**	**26.5 J**	**26.1 J**	--	--
Lead	**0.292 J**	**0.795 J**	**0.732 J**	**0.566 J**	**2.66 J**	**0.653 J**	0.120	Eco
Mercury	**0.0232**	**0.0218**	**0.0190**	**0.0167**	**0.0239**	**0.0251**	0.0490	HH
Methyl Mercury	**0.0370**	**0.0250**	**0.0310**	**0.0340**	**0.0360**	**0.0350**	--	--
Nickel	**4.83**	**4.48**	**4.31**	**4.72**	**5.34**	**4.68**	--	--
Thallium	**0.0177**	**0.0292**	**0.0149**	**0.0195**	**0.0258**	**0.0236**	--	--
Vanadium	**0.400**	**0.600**	**0.400**	**0.400**	**0.500**	**0.500**	--	--
Zinc	**23.2 J**	**21.0 J**	**19.3 J**	**21.6 J**	**22.8 J**	**21.6 J**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	66.0 U	-	-	66.0 U	**67.0 J**	**67.0 J**	81.9	HH
Butyl Benzyl Phthalate	7.30 U	-	-	7.30 U	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	-	-	9.10 U	9.10 U	9.10 U	-	-
Di-n-butyl Phthalate	16.0 U	-	-	180 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	-	-	11.0 U	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	-	-	7.70 U	7.70 U	7.70 U	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	0.110 U	-	-	0.110 U	**0.140 J**	**0.260 J**	15,000	HH
Anthracene	**0.0850 J**	-	-	0.0650 U	**0.160 J**	0.0650 U	15,000	HH
Fluorene	**0.160 J**	-	-	0.150 U	**0.150 J**	**0.210 J**	15,000	HH
Phenanthrene	**0.470**	-	-	0.360 U	**0.620**	**0.790**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	**0.280 J**	-	-	0.0660 U	**0.290 J**	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	-	-	**0.120 J**	0.0810 U	0.0810 U	0.157	HH
Benzo(b)fluoranthene	0.0700 U	-	-	0.0700 U	**0.100 J**	0.0700 U	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	-	-	0.0730 U	0.0730 U	0.0730 U	15.7	HH
Benzo(k)fluoranthene	0.0560 U	-	-	0.0560 U	**0.110 J**	0.0560 U	15.7	HH
Chrysene	0.0760 U	-	-	0.0760 U	**0.200 J**	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	-	-	0.0590 U	0.0590 U	0.0590 U	0.157	HH
Fluoranthene	**0.260 J**	-	-	**0.210 J**	**0.400 J**	**0.540**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	-	-	0.0640 U	0.0640 U	0.0640 U	1.57	HH
Pyrene	**0.270 J**	-	-	**0.170 J**	**0.410 J**	**0.470 J**	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-10a
Post-Removal Forebay Area Crayfish Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P07-CF	P08-CF	P13-CF	P14-CF	P15-CF	P16-CF		
Sample ID	08021407CF	08021408CF	08021413CF	08022014CF	08021915CF	08022216CF		
Sample Date	2/14/2008	2/14/2008	2/14/2008	2/20/2008	2/19/2008	2/22/2008		
Percent Lipids	0.61	0.74	0.82	0.58	0.87	1.1		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	0.570	HH
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	0.570	HH
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	0.570	HH
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.570	HH
Aroclor 1254	1.90 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	0.570	HH
Aroclor 1260	4.00 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	0.570	HH
Aroclor 1262	2.60 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	0.570	HH
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	4.00 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.0105**	**0.00433**	**0.00211**	**0.00174**	**0.00438**	**0.00514**	0.0760	HH
PCB 81	0.000361 U	0.000228 U	0.000215 U	0.000125 U	0.000273 U	0.000289 U	0.0250	HH
PCB 105	**0.134**	**0.0347**	0.00489 EMPC	0.00367 EMPC	**0.00746**	**0.0132**	0.250	HH
PCB 114	**0.121**	**0.0484**	**0.00370**	**0.00569**	**0.00407**	**0.00661**	0.250	HH
PCB 118	**4.40**	**0.847**	**0.0955**	**0.112**	**0.122**	**0.248**	0.250	HH
PCB 123	**0.0690**	**0.0302**	**0.00242**	**0.00581**	**0.00337**	**0.00682**	0.250	HH
PCB 126	0.00260 U	0.00130 U	**0.000306**	**0.000238**	**0.000468**	0.00110 U	0.0000760	HH
PCB 156	**0.655 C**	**0.211 C**	**0.0138 C**	**0.0263 C**	**0.0169 C**	**0.0280 C**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.250	HH
PCB 167	**0.222**	**0.0971**	**0.00853**	**0.0228**	**0.0121**	**0.0215**	0.250	HH
PCB 169	0.00222 U	0.000487 U	0.000249 U	0.000257 U	0.000350 U	0.000539 U	0.000250	HH
PCB 189	**0.0160**	**0.00548**	**0.00117**	0.00162 EMPC	**0.00126**	0.00155 EMPC	0.250	HH
Total PCBs as Congeners (KM, capped)	**12.4 J**	**3.12 J**	**0.591 J**	**0.825 J**	**0.816 J**	**1.34 J**	0.570	HH
Metals (mg/kg wet)								
Aluminum	**71.4**	**114**	**92.8**	**92.8**	**100**	**78.3**	--	--
Antimony	**0.0150**	**0.0200**	**0.0110 J**	**0.00900 J**	**0.0110 J**	**0.0390**	--	--
Arsenic	**0.380**	**0.460**	**0.390**	**0.390**	**0.420**	**0.460**	0.000760	HH
Barium	**64.9**	**55.5**	**59.2**	**51.7**	**73.0**	**58.3**	--	--
Beryllium	**0.00260 J**	**0.00340 J**	**0.00260 J**	**0.00310 J**	**0.00300 J**	**0.00170 J**	--	--
Cadmium	**0.0870**	**0.0740**	**0.0650**	**0.0730**	**0.0830**	**0.0620**	0.150	Eco
Chromium	**0.500**	**0.800**	**0.600**	**0.700**	**1.00**	**0.300**	--	--
Cobalt	**0.211**	**0.236**	**0.213**	**0.247**	**0.245**	**0.262**	--	--
Copper	**15.5 J**	**20.3 J**	**15.6 J**	**18.8 J**	**18.9 J**	**14.8 J**	--	--
Lead	**0.334 J**	**0.649 J**	**0.130 J**	**0.0980 J**	**0.140 J**	**1.41 J**	0.120	Eco
Mercury	**0.0221**	**0.0215**	**0.0263**	**0.0244**	**0.0207**	**0.0208**	0.0490	HH
Methyl Mercury	**0.0290**	**0.0290**	**0.0340**	**0.0330**	**0.0250**	**0.0300**	--	--
Nickel	**5.35**	**4.83**	**4.96**	**4.71**	**4.80**	**4.41**	--	--
Thallium	**0.0117**	**0.0155**	**0.0146**	**0.0166**	**0.0166**	**0.0194**	--	--
Vanadium	**0.300**	**0.400**	**0.400**	**0.500**	**0.500**	**0.400**	--	--
Zinc	**19.5 J**	**20.9 J**	**19.9 J**	**21.4 J**	**20.3 J**	**16.9 J**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	66.0 U	**110 J**	66.0 U	66.0 U	66.0 U	**88.0 J**	81.9	HH
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	-	-
Di-n-butyl Phthalate	58.0 U	16.0 U	39.0 U	48.0 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	0.110 U	**0.130 J**	0.110 U	**0.140 J**	**0.200 J**	0.110 U	15,000	HH
Anthracene	0.0650 U	**0.0690 J**	0.0650 U	0.0650 U	**0.130 J**	0.0650 U	15,000	HH
Fluorene	0.150 U	**0.150 J**	0.150 U	0.150 U	**0.180 J**	0.150 U	15,000	HH
Phenanthrene	0.360 U	**0.510**	0.360 U	**0.460 J**	**0.860**	**0.510**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	**0.230 J**	**0.260 J**	**0.260 J**	**0.270 J**	**0.350 J**	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	**0.170 J**	0.0810 U	0.157	HH
Benzo(b)fluoranthene	**0.0960 J**	**0.0980 J**	**0.110 J**	**0.140 J**	**0.220 J**	0.0700 U	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	**0.160 J**	**0.0980 J**	**0.390 J**	0.0730 U	15.7	HH
Benzo(k)fluoranthene	**0.0860 J**	**0.0980 J**	**0.0970 J**	**0.110 J**	**0.160 J**	0.0560 U	15.7	HH
Chrysene	**0.100 J**	**0.120 J**	0.0760 U	**0.140 J**	**0.310 J**	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.157	HH
Fluoranthene	**0.170 J**	**0.260 J**	**0.230 J**	**0.300 J**	**0.750**	**0.360 J**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	**0.160 J**	**0.180 J**	0.0640 U	1.57	HH
Pyrene	**0.160 J**	**0.290 J**	**0.280 J**	**0.340 J**	**1.20**	**0.280 J**	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-10a

Post-Removal Forebay Area Crayfish Tissue Analytical Results

PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds

(Page 3 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P17-CF	P18-CF	P19-CF	P20-CF	P21-CF		
Sample ID	08021917CF	08021918CF	08021919CF	08021920CF	08021921CF		
Sample Date	2/19/2008	2/19/2008	2/19/2008	2/19/2008	2/19/2008		
Percent Lipds	0.48	0.73	0.93	0.71	0.72		
PCB Aroclors (µg/kg wet)							
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	0.570	HH
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	0.570	HH
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	0.570	HH
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.570	HH
Aroclor 1254	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	0.570	HH
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	0.570	HH
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	0.570	HH
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
PCB Dioxin-Like Congeners (µg/kg wet)							
PCB 77	**0.00157**	**0.00412**	**0.00267**	**0.00338**	**0.00366**	0.0760	HH
PCB 81	0.000164 U	0.000313 EMPC	0.000218 U	**0.000211**	**0.000250**	0.0250	HH
PCB 105	**0.00636**	**0.00737**	**0.0111**	**0.0110**	**0.0127**	0.250	HH
PCB 114	**0.00214**	**0.00610**	0.00261 EMPC	**0.00361**	**0.00389**	0.250	HH
PCB 118	**0.0824**	**0.173**	**0.111**	**0.152**	**0.156**	0.250	HH
PCB 123	**0.00211**	**0.00506**	0.00311 EMPC	**0.00362**	**0.00400**	0.250	HH
PCB 126	0.000397 U	**0.000469**	0.000650 U	0.000748 U	0.000547 U	0.0000760	HH
PCB 156	**0.0136 C**	**0.0257 C**	**0.0139 C**	**0.0192 C**	**0.0191 C**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					0.250	HH
PCB 167	**0.0118**	**0.0177**	**0.0120**	**0.0141**	**0.0144**	0.250	HH
PCB 169	0.000167 U	0.000254 U	0.000240 U	0.000298 U	0.000265 U	0.000250	HH
PCB 189	**0.000926**	**0.00158**	**0.000923**	0.00109 EMPC	**0.00123**	0.250	HH
Total PCBs as Congeners (KM, capped)	**0.536 J**	**1.12 J**	**0.766 J**	**0.911 J**	**0.967 J**	0.570	HH
Metals (mg/kg wet)							
Aluminum	**109**	**85.6**	**97.9**	**103**	**103**	--	--
Antimony	**0.0280**	**0.0190**	**0.0180**	**0.0100 J**	**0.0110 J**	--	--
Arsenic	**0.410**	**0.410**	**0.500**	**0.440**	**0.460**	0.000760	HH
Barium	**54.1**	**59.9**	**71.8**	**64.8**	**55.3**	--	--
Beryllium	**0.00380 J**	**0.00240 J**	**0.00350 J**	**0.00330 J**	**0.00340 J**	--	--
Cadmium	**0.0620**	**0.0610**	**0.128**	**0.118**	**0.0810**	0.150	Eco
Chromium	**0.600**	**0.700**	**0.800**	**0.600**	**0.700**	--	--
Cobalt	**0.245**	**0.235**	**0.227**	**0.237**	**0.261**	--	--
Copper	**10.5 J**	**13.0 J**	**20.4 J**	**17.4 J**	**20.0 J**	--	--
Lead	**0.754 J**	**0.577 J**	**0.249 J**	**0.0990 J**	**0.106 J**	0.120	Eco
Mercury	**0.0215**	**0.0206**	**0.0214**	**0.0157**	**0.0315**	0.0490	HH
Methyl Mercury	**0.0290**	**0.0280**	**0.0260**	**0.0270**	**0.0400**	--	--
Nickel	**5.09**	**4.62**	**4.75**	**4.44**	**4.49**	--	--
Thallium	**0.0152**	**0.0148**	**0.0214**	**0.0192**	**0.0167**	--	--
Vanadium	**0.500**	**0.400**	**0.400**	**0.400**	**0.400**	--	--
Zinc	**18.5 J**	**19.2 J**	**20.8 J**	**19.9 J**	**21.7 J**	--	--
Semivolatile Organic Compounds (µg/kg wet)							
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	66.0 U	66.0 U	81.9	HH
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	-	-
Di-n-butyl Phthalate	76.0 U	16.0 U	16.0 U	37.0 U	38.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)							
Acenaphthene	0.110 U	0.110 U	**0.210 J**	**0.110 J**	0.110 U	15,000	HH
Anthracene	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	15,000	HH
Fluorene	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	15,000	HH
Phenanthrene	**0.420 J**	**0.420 J**	0.360 U	0.360 U	**0.440 J**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)							
Benzo(a)anthracene	**0.250 J**	**0.270 J**	**0.230 J**	0.0660 U	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	**0.160 J**	0.157	HH
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	0.0700 U	**0.240 J**	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	**0.170 J**	15.7	HH
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	0.0560 U	**0.150 J**	15.7	HH
Chrysene	**0.0850 J**	**0.110 J**	**0.0820 J**	0.0760 U	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.157	HH
Fluoranthene	**0.320 J**	**0.450 J**	**0.250 J**	**0.230 J**	**0.500**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	**0.180 J**	1.57	HH
Pyrene	**0.290 J**	**0.450 J**	**0.230 J**	**0.200 J**	**0.380 J**	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-10b
Post-Removal Reference Area Crayfish Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P100-CF	P105-CF	P22-CF	P33-CF	P38/42-CF	P38-CF
Sample ID	080312100CF	080314105CF	08022622CF	08022233CF	08021838/42CF	08021838CF
Sample Date	3/12/2002	3/14/2002	2/26/2008	2/26/2008	2/18/2008	2/18/2008
Percent Lipds	0.76	0.70	0.48	0.68	-	0.44
PCB Aroclors (µg/kg wet)						
Aroclor 1016	2.40 U	3.00 U	2.40 U	2.40 U	-	4.60 U
Aroclor 1221	2.60 U	3.30 U	2.60 U	2.60 U	-	5.00 U
Aroclor 1232	2.30 U	2.90 U	2.30 U	2.30 U	-	4.40 U
Aroclor 1242	2.20 U	2.80 U	2.20 U	2.20 U	-	4.30 U
Aroclor 1248	0.510 U	0.640 U	0.510 U	0.510 U	-	0.980 U
Aroclor 1254	1.80 U	2.30 U	1.80 U	1.80 U	-	3.50 U
Aroclor 1260	1.90 U	2.40 U	1.90 U	1.90 U	-	3.70 U
Aroclor 1262	2.50 U	3.20 U	2.50 U	2.50 U	-	4.80 U
Aroclor 1268	2.00 U	2.50 U	2.00 U	2.00 U	-	3.90 U
Total PCBs as Aroclors (NDs at MDL) [1]	2.60 U	3.30 U	2.60 U	2.60 U	-	5.00 U
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.00402**	-	**0.00130**	**0.00239**	**0.00288**	-
PCB 81	0.000193 EMPC	-	0.000135 U	**0.000176**	0.000175 U	-
PCB 105	**0.0118**	-	**0.00197**	**0.00762**	**0.00898**	-
PCB 114	**0.00458**	-	**0.00262**	**0.00320**	**0.00292**	-
PCB 118	**0.149**	-	**0.0526**	**0.0953**	**0.107**	-
PCB 123	**0.00417**	-	**0.00193**	**0.00271**	**0.00245**	-
PCB 126	**0.000481**	-	0.000207 U	0.000273 U	**0.000377**	-
PCB 156	**0.0244 C**	-	**0.0143 C**	**0.0147 C**	**0.0127 C**	-
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.0180**	-	**0.00980**	**0.00944**	**0.00888**	-
PCB 169	0.000325 U	-	0.000180 U	0.000158 U	0.000126 U	-
PCB 189	**0.00165**	-	**0.00124**	**0.000956**	**0.000767**	-
Total PCBs as Congeners (KM, capped)	**0.946 J**	-	**0.366 J**	**0.634 J**	**0.719 J**	-
Metals (mg/kg wet)						
Aluminum	**124 J**	**94.2 J**	**134 J**	**73.8 J**	-	**115 J**
Antimony	**0.0120 J**	**0.00800 J**	**0.00900 J**	**0.0200**	-	**0.0130 J**
Arsenic	**0.349**	**0.378**	**0.343**	**0.363**	-	**0.275**
Barium	**65.8**	**40.2**	**54.8**	**44.7**	-	**61.2**
Beryllium	**0.00320 J**	**0.00310 J**	**0.00260 J**	**0.00330 J**	-	**0.00370 J**
Cadmium	**0.121**	**0.0760**	**0.0460**	**0.0480**	-	**0.0560**
Chromium	**0.780**	**0.120 J**	**1.23**	**0.310**	-	**0.170 J**
Cobalt	**0.280**	**0.261**	**0.336**	**0.372**	-	**0.347**
Copper	**17.6 J**	**19.6 J**	**16.8 J**	**13.9 J**	-	**13.9 J**
Lead	**0.541**	**0.183**	**0.201**	**0.282**	-	**0.317**
Mercury	**0.0183 J**	**0.0169 J**	**0.0142 J**	**0.0137 J**	-	**0.0172 J**
Methyl Mercury	**0.0264**	**0.0364**	**0.0295**	**0.0367**	-	**0.0239**
Nickel	**2.15**	**1.28**	**2.51**	**1.12**	-	**1.43**
Thallium	**0.0200**	**0.0140**	**0.0214**	**0.0214**	-	**0.0236**
Vanadium	**0.425**	**0.378**	**0.715**	**0.658**	-	**0.637**
Zinc	**19.7**	**20.6**	**18.5**	**18.0**	-	**21.4**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	66.0 U	-	66.0 U	**70.0 J**	-	**69.0 J**
Butyl Benzyl Phthalate	7.30 U	-	7.30 U	7.30 U	-	7.30 U
Carbazole	9.10 U	-	9.10 U	9.10 U	-	9.10 U
Di-n-butyl Phthalate	39.0 U	-	80.0 U	50.0 U	-	92.0 U
Di-n-octyl Phthalate	11.0 U	-	**32.0 J**	11.0 U	-	11.0 U
p-cresol (4-Methylphenol)	7.70 U	-	7.70 U	7.70 U	-	7.70 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	0.110 U	-	0.110 U	0.110 U	-	0.110 U
Anthracene	0.0650 U	-	0.0650 U	0.0650 U	-	0.0650 U
Fluorene	0.150 U	-	0.150 U	0.150 U	-	0.150 U
Phenanthrene	0.360 U	-	0.360 U	**0.460 J**	-	0.360 U
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	0.0660 U	-	0.0660 U	0.0660 U	-	0.0660 U
Benzo(a)pyrene	0.0810 U	-	0.0810 U	0.0810 U	-	0.0810 U
Benzo(b)fluoranthene	0.0700 U	-	0.0700 U	0.0700 U	-	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	-	0.0730 U	0.0730 U	-	0.0730 U
Benzo(k)fluoranthene	0.0560 U	-	0.0560 U	0.0560 U	-	0.0560 U
Chrysene	0.0760 U	-	0.0760 U	0.0760 U	-	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	-	0.0590 U	0.0590 U	-	0.0590 U
Fluoranthene	0.490 U	-	0.490 U	0.490 U	-	0.500 U
Indeno(1,2,3-cd)pyrene	0.0640 U	-	0.0640 U	0.0640 U	-	0.0640 U
Pyrene	0.490 U	-	0.490 U	0.490 U	-	0.500 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area crayfish samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-10b
Post-Removal Reference Area Crayfish Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P42-CF	P72-CF	P73-CF	P74-CF	P75-CF	P76-CF	P78-CF
Sample ID	08022842CF	08030372CF	08030373CF	08030374CF	08030375CF	08030376CF	08030378CF
Sample Date	2/28/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008
Percent Lipds	1.0	0.80	1.0	0.55	0.37	0.70	0.82
PCB Aroclors (µg/kg wet)							
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors [1]	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
PCB Dioxin-Like Congeners (µg/kg wet)							
PCB 77	-	**0.00262**	**0.00329**	**0.00299**	**0.00257**	**0.00187**	**0.00209**
PCB 81	-	0.000169 U	0.000161 EMPC	**0.000167**	0.000194 U	0.000127 U	0.000104 U
PCB 105	-	**0.00357**	**0.00603**	**0.0127**	**0.0106**	**0.00301**	**0.00334**
PCB 114	-	**0.00369**	**0.00351**	**0.00390**	**0.00364**	**0.00252**	**0.00236**
PCB 118	-	**0.0958**	**0.111**	**0.138**	**0.157**	**0.0636**	**0.0697**
PCB 123	-	**0.00247**	**0.00307**	**0.00376**	**0.00372**	**0.00196**	**0.00205**
PCB 126	-	**0.000450**	**0.000455**	0.000376 U	0.00196 U	0.000231 U	0.000267 U
PCB 156	-	**0.0173 C**	**0.0169 C**	**0.0188 C**	**0.0222 C**	**0.0123 C**	**0.0130 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						
PCB 167	-	**0.0106**	**0.0106**	**0.0136**	**0.0167**	**0.00846**	**0.00816**
PCB 169	-	0.0000992 U	0.000154 U	0.000103 U	0.000171 U	0.000105 U	0.0000911 U
PCB 189	-	**0.00133**	**0.00119**	**0.00104**	**0.00125**	**0.000851**	**0.000907**
Total PCBs as Congeners (KM, capped)	-	**0.692 J**	**0.735 J**	**0.774 J**	**0.952 J**	**0.456 J**	**0.496 J**
Metals (mg/kg wet)							
Aluminum	**115 J**	**221 J**	**141 J**	**131 J**	**137 J**	**110 J**	**177 J**
Antimony	**0.0390**	**0.0310**	**0.0260**	**0.0120 J**	**0.00800 J**	**0.0230**	**0.0150**
Arsenic	**0.397**	**0.636**	**0.460**	**0.420**	**0.287**	**0.356**	**0.401**
Barium	**53.4**	**120**	**70.7**	**47.7**	**47.4**	**85.7**	**81.4**
Beryllium	**0.00320 J**	**0.00610 J**	**0.00310 J**	**0.00390 J**	**0.00290 J**	**0.00260 J**	**0.00340 J**
Cadmium	**0.0720**	**0.201**	**0.0840**	**0.0840**	**0.0670**	**0.116**	**0.102**
Chromium	**0.470**	**0.590**	**0.280 J**	**0.140 J**	0.130 U	**0.160 J**	**0.280 J**
Cobalt	**0.339**	**0.387**	**0.358**	**0.397**	**0.297**	**0.248**	**0.356**
Copper	**18.2 J**	**33.2 J**	**19.3 J**	**18.3 J**	**13.1 J**	**17.6 J**	**19.8 J**
Lead	**1.04**	**1.55**	**0.597**	**0.0900**	**0.0560**	**0.503**	**0.683**
Mercury	**0.0151 J**	**0.0206 J**	**0.0246 J**	**0.0169 J**	**0.0176 J**	**0.0195 J**	**0.0153 J**
Methyl Mercury	**0.0211**	**0.0299**	**0.0219**	**0.0258**	**0.0268**	**0.0296**	**0.0301**
Nickel	**1.57**	**2.24**	**1.36**	**1.18**	**0.992**	**1.30**	**1.33**
Thallium	**0.0240**	**0.0318**	**0.0192**	**0.0234**	**0.0198**	**0.0158**	**0.0219**
Vanadium	**0.711**	**0.733**	**0.593**	**0.710**	**0.570**	**0.346**	**0.494**
Zinc	**21.1**	**36.5**	**22.0**	**22.3**	**20.4**	**20.9**	**22.1**
Semivolatile Organic Compounds (µg/kg wet)							
Bis(2-ethylhexyl) Phthalate	**87.0 J**	66.0 U	66.0 U	66.0 U	66.0 U	66.0 U	66.0 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	110 U	79.0 U	16.0 U	45.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)							
Acenaphthene	0.110 U	**0.190 J**	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U
Anthracene	0.0650 U	**0.190 J**	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	0.150 U	**0.250 J**	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
Phenanthrene	0.360 U	**0.450 J**	0.360 U	0.360 U	0.360 U	0.360 U	**0.590**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)							
Benzo(a)anthracene	0.0660 U	**0.400 J**	0.0660 U	**0.310 J**	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.0810 U	**0.120 J**	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.0700 U	**0.230 J**	0.0700 U	**0.200 J**	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	0.480 U	0.0730 U	0.500 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.0560 U	**0.200 J**	0.0560 U	**0.180 J**	0.0560 U	0.0560 U	0.0560 U
Chrysene	**0.0910 J**	**0.270 J**	0.0760 U	**0.260 J**	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	**0.160 J**	0.0590 U	**0.120 J**	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	0.500 U	0.480 U	0.500 U	0.500 U	0.480 U	0.490 U	0.490 U
Indeno(1,2,3-cd)pyrene	0.0640 U	**0.180 J**	0.0640 U	**0.130 J**	0.0640 U	0.0640 U	0.0640 U
Pyrene	0.500 U	0.480 U	0.500 U	0.500 U	0.480 U	0.490 U	0.490 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area crayfish samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-10b
Post-Removal Reference Area Crayfish Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P79-CF	P82-CF	P90-CF	P91-CF	P92-CF	P94-CF	P98-CF
Sample ID	08030379CF	08030382CF	08031290CF	08031291CF	08031292CF	08031294CF	08031298CF
Sample Date	3/3/2008	3/3/2008	3/12/2008	3/12/2008	3/12/2008	3/12/2008	3/12/2008
Percent Lipds	1.2	0.70	0.23	0.81	0.56	0.50	0.42
PCB Aroclors (µg/kg wet)							
Aroclor 1016	2.40 U	2.40 U	2.40 U	4.80 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	5.20 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	4.60 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	4.40 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	0.510 U	0.510 U	0.510 U	1.10 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	1.80 U	1.80 U	1.80 U	3.60 U	1.80 U	1.80 U	1.80 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	3.80 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	5.00 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	4.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors [1]	2.60 U	2.60 U	2.60 U	5.20 U	2.60 U	2.60 U	2.60 U
PCB Dioxin-Like Congeners (µg/kg wet)							
PCB 77	**0.00349**	**0.00466**	**0.00187**	**0.00380**	**0.00190**	**0.00274**	**0.00228**
PCB 81	0.000162 U	0.000250 EMPC	0.000204 U	0.000188 U	0.000401 U	0.000151 U	0.000146 EMPC
PCB 105	**0.00799**	**0.0248**	**0.0155**	**0.0143**	**0.00225**	**0.00400**	**0.00433**
PCB 114	**0.00356**	**0.00815**	**0.00471**	**0.00417**	**0.00286**	**0.00302**	**0.00347**
PCB 118	**0.122**	**0.323**	**0.264**	**0.163**	**0.0697**	**0.112**	**0.101**
PCB 123	**0.00326**	**0.00736**	**0.00645**	**0.00372**	**0.00226**	**0.00291**	**0.00300**
PCB 126	**0.000530**	0.000792 U	0.000329 U	**0.000402**	0.000275 U	0.000243 EMPC	0.000261 EMPC
PCB 156	**0.0188 C**	**0.0391 C**	**0.0296 C**	**0.0204 C**	**0.0151 C**	**0.0167 C**	**0.0201 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						
PCB 167	**0.0112**	**0.0301**	**0.0273**	**0.0134**	**0.00947**	**0.0123**	**0.0166**
PCB 169	0.000114 U	0.000200 U	0.000223 U	0.000237 U	0.000301 U	0.000307 U	0.0000971 U
PCB 189	**0.00131**	**0.00220**	**0.00129**	0.00114 EMPC	**0.00131**	**0.000936**	**0.00132**
Total PCBs as Congeners (KM, capped)	**0.876 J**	**1.94 J**	**1.12 J**	**1.02 J**	**0.498 J**	**0.650 J**	**0.609 J**
Metals (mg/kg wet)							
Aluminum	**167 J**	**196 J**	**157 J**	**124 J**	**160 J**	**101 J**	**71.2 J**
Antimony	**0.0150**	**0.00800 J**	**0.00700 J**	**0.00600 J**	**0.00800 J**	**0.0190**	**0.0110 J**
Arsenic	**0.458**	**0.404**	**0.280**	**0.459**	**0.360**	**0.338**	**0.308**
Barium	**89.0**	**74.5**	**49.0**	**78.2**	**83.3**	**79.4**	**68.6**
Beryllium	**0.00400 J**	**0.00420 J**	**0.00390 J**	**0.00310 J**	**0.00400 J**	**0.00270 J**	**0.00330 J**
Cadmium	**0.129**	**0.0690**	**0.0520**	**0.0890**	**0.147**	**0.112**	**0.119**
Chromium	**0.530**	**0.780**	**1.06**	**0.310**	**0.530**	**0.530**	**0.570**
Cobalt	**0.350**	**0.395**	**0.338**	**0.439**	**0.298**	**0.258**	**0.224**
Copper	**28.0 J**	**17.4 J**	**12.2 J**	**18.6 J**	**19.5 J**	**14.6 J**	**13.3 J**
Lead	**0.387**	**0.151**	**0.153**	**0.0890**	**0.244**	**0.416**	**0.364**
Mercury	**0.0105 J**	**0.0181 J**	**0.0190 J**	**0.0185 J**	**0.0221 J**	**0.0182 J**	**0.0173 J**
Methyl Mercury	**0.0254**	**0.0333**	**0.0344**	**0.0221**	**0.0201**	**0.0200**	**0.0181**
Nickel	**1.87**	**2.42**	**3.44**	**1.82**	**2.00**	**1.85**	**2.36**
Thallium	**0.0216**	**0.0254**	**0.0147**	**0.0370**	**0.0197**	**0.0195**	**0.0158**
Vanadium	**0.557**	**0.754**	**0.703**	**0.804**	**0.509**	**0.355**	**0.261**
Zinc	**24.0**	**21.6**	**22.4**	**20.2**	**20.9**	**19.0**	**18.6**
Semivolatile Organic Compounds (µg/kg wet)							
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	66.0 U	**76.0 J**	66.0 U	66.0 U
Butyl Benzyl Phthalate	7.30 U	**15.0 J**	**18.0 J**	7.30 U	7.30 U	7.30 U	**31.0 J**
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	70.0 U	73.0 U	40.0 U	38.0 U	55.0 U	57.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)							
Acenaphthene	**0.120 J**	**0.130 J**	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U
Anthracene	0.0650 U	**0.0980 J**	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	0.150 U	**0.180 J**	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
Phenanthrene	**0.510**	**0.580**	0.360 U	0.360 U	0.360 U	0.360 U	0.360 U
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)							
Benzo(a)anthracene	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.0700 U	0.0700 U	**0.0820 J**	0.0700 U	0.0700 U	0.0700 U	**0.0860 J**
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.490 U
Benzo(k)fluoranthene	0.0560 U	0.0560 U	**0.0720 J**	0.0560 U	0.0560 U	0.0560 U	**0.0920 J**
Chrysene	0.0760 U	0.0760 U	**0.110 J**	0.0760 U	0.0760 U	0.0760 U	**0.120 J**
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	**0.0720 J**
Fluoranthene	0.490 U	0.490 U	0.450 U	0.500 U	0.500 U	0.490 U	0.490 U
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	**0.0870 J**
Pyrene	0.490 U	0.490 U	0.450 U	0.500 U	0.500 U	0.490 U	0.490 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area crayfish samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-11a
Post-Removal Forebay Area Sculpin Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, and Metals
(Page 1 of 2)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	SF-01	SF-02	SF-03	SF-04	SF-05	SF-06	SF-07	SF-08		
Sample ID	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8		
Sample Date	9/17/2008	9/17/2008	9/17/2008	9/17/2008	10/22/2008	9/19/2008	10/21/2008	9/17/2008		
Percent Lipids	3.59	4.83	3.94	2.56	4.38	7.69	4.62	4.05		
PCB Aroclors (µg/kg wet)										
Aroclor 1016	2.40 U	2.40 U	12.0 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	35.0	Eco
Aroclor 1221	2.60 U	2.60 U	13.0 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	35.0	Eco
Aroclor 1232	2.30 U	2.30 U	12.0 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	35.0	Eco
Aroclor 1242	2.20 U	2.20 U	11.0 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	2.60 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	35.0	Eco
Aroclor 1254	13.0 U	43.0 U	**1,700**	**470**	**130**	130 U	28.0 U	20.0 U	35.0	Eco
Aroclor 1260	1.90 U	36.0 U	9.50 U	1.90 U	1.90 U	82.0 U	1.90 U	1.90 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	13.0 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	10.0 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDLs) [1]	13.0 U	43.0 U	**1700**	**470**	**130**	130 U	28.0 U	20.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)										
PCB 77	**0.0108**	**0.0199**	**0.443**	**0.111**	**0.0400**	**0.0487**	**0.0128**	**0.0298**	0.160	Eco
PCB 81	0.000449 EMPC	0.000807 EMPC	0.295 U	0.00950 U	0.00523 U	0.00388 U	0.000553 U	**0.00145**	0.0800	Eco
PCB 105	**0.383**	**0.881**	**269**	**38.2**	**21.4**	**5.13**	**0.600**	**0.752**	20.0	Eco
PCB 114	**0.0448**	**0.162**	**19.9**	**3.51**	**2.89**	**0.356**	**0.0553**	**0.0734**	20.0	Eco
PCB 118	**1.63**	**6.70**	**757**	**111**	**86.9**	**19.3**	**2.43**	**3.00**	20.0	Eco
PCB 123	**0.0229**	**0.0610**	**11.8**	**1.66**	**0.920**	**0.268**	**0.0326**	**0.0376**	20.0	Eco
PCB 126	**0.00321**	**0.00731**	0.405 EMPC	**0.0540**	**0.0291**	**0.0117**	**0.00435**	**0.00597**	0.00580	Eco
PCB 156	**0.306 C**	**1.22 C**	**118 C**	**21.9 C**	**25.4 C**	**2.02 C**	**0.340 C**	**0.428 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**								20.0	Eco
PCB 167	**0.0979**	**0.322**	**30.8**	**5.23**	**3.52**	**0.766**	**0.116**	**0.140**	20.0	Eco
PCB 169	0.00246 U	0.00704 U	0.164 U	0.0232 U	0.0288 U	0.00551 U	**0.00365**	0.00363 U	0.0200	Eco
PCB 189	**0.0128**	**0.0881**	**2.48**	**0.400**	**0.501**	**0.0437**	**0.0135**	**0.0157**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**14.9 J**	**48.8 J**	**4773 J**	**915 J**	**559 J**	**141 J**	**22.9 J**	**26.1 J**	35.0	Eco
Metals (mg/kg wet)										
Arsenic	**0.289**	**0.334**	**0.272**	**0.435**	**0.308**	**0.421**	**0.232**	**0.332**	6.60	Eco
Cadmium	**0.0148**	**0.0183**	**0.0224**	**0.0279**	**0.0140**	**0.00720**	**0.0194**	**0.0134**	0.150	Eco
Lead	**0.0750**	**0.0740**	**0.0546**	**0.0499**	**0.136**	0.0214 U	**0.0393**	**0.0813**	0.120	Eco
Mercury	**0.114 J**	**0.240 J**	**0.308 J**	**0.122 J**	**0.143 J**	**0.0327 J**	**0.188 J**	**0.131 J**	0.0740	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing sculpin Total PCBs as Aroclors because all other aroclors were undetected in Forebay sculpin samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-11a
Post-Removal Forebay Area Sculpin Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, and Metals
(Page 2 of 2)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	SF-09	SF-10	SF-11	SF-12	SF-13	SF-14	SF-15	SF-16	SF-17		
Sample ID	F-9	F-10	F-11	F-12	F-13	F-14	F-15	F-16	F-17		
Sample Date	9/19/2008	10/21/2008	9/17/2008	2/22/2008	2/22/2008	10/22/2008	10/21/2008	10/21/2008	10/21/2008		
Percent Lipids	4.22	3.15	4.85	4.39	1.51	3.69	1.88	3.23	4.24		
PCB Aroclors (µg/kg wet)											
Aroclor 1016	2.40 U	2.40 U	2.40 U	14.0 UJ	8.20 UJ	2.40 U	2.40 U	2.40 U	2.40 U	35.0	Eco
Aroclor 1221	2.60 U	2.60 U	2.60 U	27.0 UJ	69.0 UJ	2.60 U	2.60 U	2.60 U	2.60 U	35.0	Eco
Aroclor 1232	2.30 U	2.30 U	2.30 U	38.0 UJ	62.0 UJ	2.30 U	2.30 U	2.30 U	2.30 U	35.0	Eco
Aroclor 1242	2.20 U	2.20 U	2.20 U	23.0 UJ	35.0 UJ	2.20 U	2.20 U	2.20 U	2.20 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	0.510 U	13.0 UJ	6.70 UJ	0.510 U	0.510 U	0.510 U	0.510 U	35.0	Eco
Aroclor 1254	27.0 U	19.0 U	28.0 U	23.0 UJ	35.0 UJ	29.0 U	27.0 U	37.0 U	32.0 U	35.0	Eco
Aroclor 1260	13.0 U	1.90 U	1.90 U	38.0 UJ	6.50 UJ	1.90 U	1.90 U	1.90 U	1.90 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	9.30 UJ	8.60 UJ	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	7.50 UJ	6.90 UJ	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDLs) [1]	27.0 U	19.0 U	28.0 U	23.0 UJ	35.0 UJ	29.0 U	27.0 U	37.0 U	32.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)											
PCB 77	**0.0114**	**0.0143**	**0.0142**	**0.0292 J**	**0.00431 J**	**0.0153**	**0.00464**	**0.0187**	**0.0154**	0.160	Eco
PCB 81	0.000382 EMPC	0.000524 U	0.000710 EMPC	0.000818 UJ	0.000225 UJ	0.000756 U	0.000278 U	0.000846 EMPC	0.00111 U	0.0800	Eco
PCB 105	**0.325**	**0.652**	**0.527**	**1.21 J**	**0.303 J**	**0.997**	**0.549**	**0.530**	**1.57**	20.0	Eco
PCB 114	**0.0327**	**0.0478**	**0.0682**	**0.0638 J**	**0.0212 J**	**0.0818**	**0.0488**	**0.239**	**0.128**	20.0	Eco
PCB 118	**1.36**	**2.09**	**2.88**	**3.84 J**	**0.870 J**	**3.75**	**1.86**	**7.34**	**4.80**	20.0	Eco
PCB 123	**0.0214**	**0.0241**	**0.0394**	**0.0303 J**	0.0128 EMPC	**0.0487**	**0.0196**	**0.160**	**0.0566**	20.0	Eco
PCB 126	**0.00321**	**0.00420**	**0.00550**	**0.0102 J**	**0.00239 J**	**0.00632**	**0.00290**	**0.00726**	**0.00596**	0.00580	Eco
PCB 156	**0.179 C**	**0.337 C**	**0.414 C**	**0.283 C J**	**0.123 C J**	**0.485 C**	**0.381 C**	**1.55 C**	**0.759 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**									20.0	Eco
PCB 167	**0.0716**	**0.0935**	**0.165**	**0.131 J**	**0.0432 J**	**0.179**	**0.0875**	**0.671**	**0.193**	20.0	Eco
PCB 169	0.00218 U	0.00322 U	0.00479 U	0.00405 UJ	0.00145 UJ	0.00562 U	0.00369 U	0.00416 U	0.00370 U	0.0200	Eco
PCB 189	**0.00813**	**0.0136**	**0.0209**	**0.00962 J**	**0.00586 J**	**0.0158**	**0.0205**	**0.0413**	**0.0248**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**12.3 J**	**23.1 J**	**24.1 J**	**39.6 J**	**9.87 J**	**35.3 J**	**19.4 J**	**35.6 J**	**40.7 J**	35.0	Eco
Metals (mg/kg wet)											
Arsenic	**0.243**	**0.407**	**0.269**	**0.402**	**0.280**	**0.401**	**0.243**	**0.244**	**0.184**	6.60	Eco
Cadmium	**0.0165**	**0.0135**	**0.0121**	**0.0162**	**0.0453**	**0.0194**	**0.0325**	**0.0214**	**0.0272**	0.150	Eco
Lead	**0.0833**	**0.0459**	**0.0334**	**0.0876**	**0.306**	**0.0315**	**0.0313**	**0.0918**	**0.0384**	0.120	Eco
Mercury	**0.162 J**	**0.0655 J**	**0.210 J**	**0.0543 J**	**0.0525 J**	**0.125 J**	**0.221 J**	**0.298 J**	**0.110 J**	0.0740	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing sculpin Total PCBs as Aroclors because all other aroclors were undected in Forebay sculpin samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-11b
Post-Removal Reference Area Sculpin Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, and Metals
(Page 1 of 2)

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	SR-01	SR-02	SR-03	SR-04	SR-05	SR-06	SR-07	SR-08	SR-09
Sample ID	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9
Sample Date	7/23/2008	7/24/2008	3/14/2008	10/9/2008	7/24/2008	2/26/2008	3/10/2008	10/9/2008	7/24/2008
Percent Lipids	3.5	3.7	2.3	4.3	5.0	1.9	4.2	3.2	5.0
PCB Aroclors (µg/kg wet)									
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	45.0 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	1.80 U	17.0 U	19.0 U	21.0 U	23.0 U	22.0 U	17.0 U	39.0 U	19.0 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDLs) [1]	45.0 U	17.0 U	19.0 U	21.0 U	23.0 U	22.0 U	17.0 U	39.0 U	19.0 U
PCB Dioxin-Like Congeners (µg/kg wet)									
PCB 77	**0.0114**	**0.0129**	**0.0107**	**0.0138**	**0.0217**	**0.00519**	**0.00981 J**	**0.0139**	**0.0132**
PCB 81	0.000938 EMPC	0.00140 EMPC	0.00136 EMPC	0.000689 EMPC	0.00198 EMPC	0.000711 U	0.00141 EMPC	0.00119 EMPC	0.00104 EMPC
PCB 105	**0.505**	**0.685**	**0.972**	**0.455**	**1.04**	**0.358**	**0.591 J**	**0.593**	**0.531**
PCB 114	**0.0320**	**0.0471**	**0.0821**	**0.0272**	**0.0716**	**0.0250**	**0.0392 J**	**0.0376**	**0.0347**
PCB 118	**1.54**	**2.18**	**3.87**	**1.27**	**3.49**	**1.05**	**1.71 J**	**1.79**	**1.72**
PCB 123	**0.0202**	**0.0258**	**0.0445**	**0.0214**	**0.0453**	**0.0153**	**0.0255 J**	**0.0216**	**0.0232**
PCB 126	**0.00306**	**0.00364**	**0.00462**	**0.00254**	**0.00589**	**0.00272**	**0.00397 J**	**0.00340**	0.00335 EMPC
PCB 156	**0.183 C**	**0.239 C**	**0.464 C**	**0.148 C**	**0.438 C**	**0.140 C**	**0.187 C J**	**0.192 C**	**0.178 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**								
PCB 167	**0.0708**	**0.0912**	**0.175**	**0.0606**	**0.149**	**0.0519**	**0.0770 J**	**0.0739**	**0.0811**
PCB 169	0.00336 U	0.00403 U	0.00777 U	0.00214 U	0.00756 U	0.00290 U	0.00395 UJ	0.00294 U	0.00384 U
PCB 189	**0.00691**	**0.00859**	0.000318 U	**0.00520**	**0.0172**	**0.00598**	**0.00673 J**	**0.00640**	**0.00593**
Total PCBs as Congeners (KM, capped)	**16.8 J**	**21.9 J**	**37.5 J**	**15.9 J**	**38.3 J**	**12.2 J**	**19.2 J**	**18.1 J**	**18.4 J**
Metals (mg/kg wet)									
Arsenic	**0.323**	**0.449**	**0.418**	**0.302**	**0.484**	**0.323**	**0.239**	**0.294**	**0.311**
Cadmium	**0.0244**	**0.0128**	**0.0158**	**0.0135**	**0.0114**	**0.0204**	**0.00970**	**0.0112**	**0.00870**
Lead	**0.0453**	**0.0526**	**0.0249**	**0.0239**	**0.0280**	**0.0370**	**0.0532**	**0.0402**	**0.0319**
Mercury	**0.0757 J**	**0.0694 J**	**0.0908 J**	**0.0889 J**	**0.102 J**	**0.102 J**	**0.0683 J**	**0.137 J**	**0.0533 J**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
\- = Not Analyzed
bold = analyte detected above MDL.
J = The reported value is an estimate.

[1] The sculpin Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area sculpin samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-11b
Post-Removal Reference Area Sculpin Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, and Metals
(Page 2 of 2)

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	SR-10	SR-11	SR-12	SR-13	SR-14	SR-15	SR-16	SR-17	SR-18
Sample ID	R-10	R-11	R-12	R-13	R-14	R-15	R-16	R-17	R-18
Sample Date	7/23/2008	3/3/2008	10/9/2008	7/23/2008	10/10/2008	10/9/2008	10/10/2008	10/9/2008	7/24/2008
Percent Lipids	5.5	3.3	4.1	3.6	4.9	2.9	4.1	5.5	3.4
PCB Aroclors (µg/kg wet)									
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	28.0 U	24.0 U	13.0 U	36.0 U	20.0 U	35.0 U	38.0 U	30.0 U	44.0 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDLs) [1]	28.0 U	24.0 U	13.0 U	36.0 U	20.0 U	35.0 U	38.0 U	30.0 U	44.0 U
PCB Dioxin-Like Congeners (µg/kg wet)									
PCB 77	**0.0178**	**0.0138**	**0.0177**	**0.0213**	**0.0194**	**0.0160**	**0.0140**	**0.0259**	**0.0132**
PCB 81	0.00139 EMPC	0.00142 EMPC	0.000998 EMPC	0.00156 EMPC	0.00157 EMPC	0.00149 EMPC	0.000829 EMPC	0.00221 EMPC	0.00122 EMPC
PCB 105	**0.692**	**0.937**	**0.828**	**0.885**	**0.614**	**0.694**	**0.442**	**0.908**	**0.717**
PCB 114	**0.0478**	**0.0683**	**0.0544**	**0.0605**	**0.0403**	**0.0644**	**0.0337**	**0.0578**	**0.0439**
PCB 118	**2.19**	**3.13**	**2.80**	**2.79**	**1.92**	**3.11**	**1.61**	**2.85**	**1.93**
PCB 123	**0.0298**	**0.0358**	**0.0333**	**0.0470**	0.0320 EMPC	**0.0423**	**0.0219**	**0.0402**	**0.0313**
PCB 126	**0.00380**	**0.00519**	**0.00593**	**0.00483**	**0.00520**	**0.00493**	**0.00313**	**0.00552**	**0.00391**
PCB 156	**0.270 C**	**0.374 C**	**0.322 C**	**0.402 C**	**0.203 C**	**0.402 C**	**0.193 C**	**0.350 C**	**0.257 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**								
PCB 167	**0.101**	**0.142**	**0.136**	**0.170**	**0.0968**	**0.146**	**0.0910**	**0.139**	**0.0992**
PCB 169	0.00456 U	0.00586 U	0.00384 U	0.00505 U	0.00366 U	0.00929 U	0.00488 U	0.00712 U	0.00467 U
PCB 189	**0.00963**	**0.0142**	**0.0115**	**0.00974**	**0.00690**	**0.0154**	**0.00820**	**0.0110 EMPC**	**0.00920**
Total PCBs as Congeners (KM, capped)	**24.0 J**	**32.4 J**	**27.5 J**	**31.5 J**	**22.3 J**	**27.2 J**	**17.3 J**	**30.5 J**	**24.2 J**
Metals (mg/kg wet)									
Arsenic	**0.473**	**0.370**	**0.484**	**0.427**	**0.398**	**0.350**	**0.355**	**0.461**	**0.407**
Cadmium	**0.0169**	**0.0156**	**0.0116**	**0.0146**	**0.0141**	**0.0154**	**0.0264**	**0.0176**	**0.0130**
Lead	**0.0252**	**0.0758**	0.0214 U	**0.0347**	**0.0312**	**0.0268**	**0.0314**	**0.0286**	**0.0341**
Mercury	**0.0790 J**	**0.112 J**	**0.0880 J**	**0.0922 J**	**0.0448 J**	**0.141 J**	**0.0902 J**	**0.0554 J**	**0.0862 J**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
- = Not Analyzed
bold = analyte detected above MDL.
J = The reported value is an estimate.

[1] The sculpin Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area sculpin samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-12a
Post-Removal Forebay Area Surface Water Analytical Results for High-Volume XAD Device Samples
PCB Aroclors, PCB Dioxin-Like Congeners, and Semivolatile Organic Compounds
(Page 1 of 2)

Area	Forebay			Forebay			Forebay			**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Site ID	P52			P53			P54						
Sample ID	08021252XAD			08022453XAD			08021354XAD						
Sample Date	2/12/2008			2/24/2008			2/13/2008						
Preparation Fraction	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)				
PCB Dioxin-Like Congeners (pg/L)													
PCB 77	0.0330 U	0.0310 U	0.0640 U	0.0770 EMPC	**0.0560**	**0.133 J**	0.0330 U	**0.0460**	**0.0790 J**	--	--	5,200	HH
PCB 81	0.00980 U	0.00450 U	0.0143 U	0.00590 U	0.00520 U	0.0111 U	0.00640 U	0.00600 U	0.0124 U	--	--	5,200	HH
PCB 105	**0.119**	**0.221**	**0.340**	**0.163**	**0.339**	**0.502**	**0.114**	**0.332**	**0.446**	--	--	5,200	HH
PCB 114	0.0120 U	0.0170 U	0.0290 U	0.00900 U	0.0200 U	0.0290 U	0.00800 U	0.0250 U	0.0330 U	--	--	100	HH
PCB 118	**0.360**	**0.518**	**0.878**	**0.499**	**1.07**	**1.57**	**0.325**	**0.947**	**1.27**	--	--	5,200	HH
PCB 123	0.00700 U	0.0130 U	0.0200 U	0.00900 EMPC	0.0170 U	0.0260 U	0.00370 U	0.0180 U	0.0217 U	--	--	5,200	HH
PCB 126	0.00540 U	0.00410 U	0.00950 U	0.00600 U	0.00570 U	0.0117 U	0.00420 U	0.0112 U	0.0154 U	--	--	5.20	HH
PCB 156	0.0260 C U	**0.0850 C**	**0.111 C J**	**0.0360 C**	**0.319 C**	**0.355 C**	0.0230 C U	**0.359 C**	**0.382 C J**	--	--	1,000	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**									--	--	1,000	HH
PCB 167	**0.0140**	**0.0330**	**0.0470**	**0.0130**	**0.139**	**0.152**	**0.0100**	**0.148**	**0.158**	--	--	52,000	HH
PCB 169	0.00290 U	0.00170 U	0.00460 U	0.00140 U	0.00660 U	0.00800 U	0.00210 U	0.00880 U	0.0109 U	--	--	52.0	HH
PCB 189	0.00400 U	0.00700 U	0.0110 U	0.00220 U	**0.0640**	**0.0662 J**	0.00250 U	0.0900 EMPC	0.0925 U	--	--	5,200	HH
Total PCBs as Congeners (KM, capped)	**97.7 J**	**14.7 J**	**112 J**	**153 J**	**55.7 J**	**209 J**	**95.7 J**	**61.2 J**	**157 J**	64.0	HH	14,000	Eco
Semivolatile Organic Compounds (ng/L)													
Bis(2-ethylhexyl) Phthalate	11.8 U	4.51 U	16.3 U	10.5 U	3.74 U	14.2 U	8.77 U	4.63 U	13.4 U	1,200	HH	3,000	Eco
Butyl Benzyl Phthalate	0.418 U	0.198 U	0.616 U	0.316 U	0.157 U	0.473 U	2.29 U	0.155 U	2.45 U	19,000	Eco	19,000	Eco
Di-n-butyl Phthalate	1.97 U	0.266 U	2.24 U	0.800 U	0.281 U	1.08 U	0.925 U	0.247 U	1.17 U	35,000	Eco	35,000	Eco
Di-n-octyl Phthalate	0.314 U	0.249 U	0.563 U	0.154 U	0.0960 U	0.250 U	0.852 U	0.160 U	1.01 U	1,200	HH	4,100	HH
Low Molecular Weight PAHs (LPAHs) (ng/L)													
Acenaphthene	**0.706**	0.0329 U	**0.739 J**	**1.12**	0.0282 U	**1.15 J**	**0.894**	0.015 U	**0.909 J**	520,000	Eco	520,000	Eco
Anthracene	0.0754 U	**0.0317**	**0.107 J**	0.0787 U	**0.0267**	**0.105 J**	0.0569 U	**0.0288**	**0.0857 J**	13,000	Eco	13,000	Eco
Phenanthrene	**1.39**	0.0919 U	**1.48 J**	**1.27**	0.107 U	**1.38 J**	**1.50**	0.105 U	**1.61 J**	6,300	Eco	140	HH
High Molecular Weight PAHs (HPAHs) (ng/L)													
Benzo(a)anthracene	0.0116 U	0.0519 U	0.0635 U	0.00830 EMPC	0.0288 U	0.0371 U	**0.0083**	0.0475 U	**0.0558 J**	3.80	HH	27.0	Eco
Benzo(a)pyrene	0.0246 U	0.0441 U	0.0687 U	0.0151 U	0.0467 U	0.0618 U	0.0269 U	0.0457 U	0.0726 U	3.80	HH	2.90	HH
Benzo(b)fluoranthene	0.0173 U	**0.0713**	**0.0886 J**	0.0107 U	0.0333 U	0.0440 U	0.0182 U	0.0774 EMPC	0.0956 U	3.80	HH	29.0	HH
Benzo(g,h,i)perylene	0.0118 U	0.0390 U	0.0508 U	0.0139 U	0.0241 U	0.0380 U	0.0098 U	0.0523 U	0.0621 U	380	HH	290	HH
Benzo(j,k)flouranthenes	0.0185 U	0.0430 U	0.0615 U	0.0115 U	0.0318 U	0.0433 U	0.0208 U	0.0497 U	0.0705 U	3.80	HH	14.0	Eco
Chrysene	**0.0512**	0.0844 U	**0.136 J**	**0.0385**	0.0626 U	**0.101 J**	**0.0494**	**0.113**	**0.162 J**	3.80	HH	2,040	Eco
Dibenz(a,h)anthracene	0.0211 U	0.0187 U	0.0398 U	0.0190 U	0.0250 U	0.0440 U	0.0142 U	0.0395 U	0.0537 U	18.0	HH	2.90	HH
Fluoranthene	0.516 U	**0.143**	**0.659 J**	0.538 U	**0.120**	**0.658 J**	0.561 U	**0.194**	**0.755 J**	6,160	Eco	6,160	Eco
Indeno(1,2,3-cd)pyrene	0.0127 U	0.0459 U	0.0586 U	0.0148 U	0.0308 U	0.0456 U	0.0101 U	0.0365 U	0.0466 U	3.80	HH	29.0	HH

Notes:
ng/L = Nanogram per liter
pg/L = Picogram per liter
Eco = Ecological
HH = Human Health
MDL = Method detection limit
ND = Non Detect
RDL = reported detection limit
SLV = Screening level value
- = Result not available or not calculated

-- = SLV for analyte not available
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-12a
Post-Removal Forebay Area Surface Water Analytical Results for High-Volume XAD Device Samples
PCB Aroclors, PCB Dioxin-Like Congeners, and Semivolatile Organic Compounds
(Page 2 of 2)

Area	Forebay			Forebay			**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Site ID	P55			P56						
Sample ID	08022555XAD			08022156XAD						
Sample Date	2/25/2008			2/21/2008						
Preparation Fraction	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)				
PCB Dioxin-Like Congeners (pg/L)										
PCB 77	0.0480 EMPC	0.0390 U	0.0870 U	0.0290 U	**0.0510**	**0.0800 J**	--	--	5,200	HH
PCB 81	0.00600 U	0.00730 U	0.0133 U	0.00760 U	0.00840 U	0.0160 U	--	--	5,200	HH
PCB 105	**0.147**	**0.339**	**0.486**	**0.119**	**0.421**	**0.540**	--	--	5,200	HH
PCB 114	0.0150 U	0.0210 U	0.0360 U	0.0100 U	0.0200 U	0.0300 U	--	--	100	HH
PCB 118	**0.448**	**0.825**	**1.27**	**0.361**	**1.07**	**1.43**	--	--	5,200	HH
PCB 123	0.00600 U	0.0150 U	0.0210 U	0.0100 EMPC	0.0230 U	0.0330 U	--	--	5,200	HH
PCB 126	0.00600 U	0.00460 U	0.0106 U	0.00570 U	0.00590 U	0.0116 U	--	--	5.20	HH
PCB 156	0.0280 C U	**0.110 C**	**0.138 C J**	0.0230 C U	**0.101 C**	**0.124 C J**	--	--	1,000	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						--	--	1,000	HH
PCB 167	0.0140 U	**0.0490**	**0.0630 J**	0.0110 EMPC	**0.0440**	**0.0550 J**	--	--	52,000	HH
PCB 169	0.00230 U	0.00400 U	0.00630 U	0.00180 U	0.00240 U	0.00420 U	--	--	52.0	HH
PCB 189	0.00220 U	0.00600 U	0.00820 U	0.00180 U	0.00800 U	0.00980 U	--	--	5,200	HH
Total PCBs as Congeners (KM, capped)	**154 J**	**22.6 J**	**177 J**	**138 J**	**26.4 J**	**164 J**	64.0	HH	14,000	Eco
Semivolatile Organic Compounds (ng/L)										
Bis(2-ethylhexyl) Phthalate	7.92 U	3.47 U	11.4 U	6.52 U	3.41 U	9.93 U	1,200	HH	3,000	Eco
Butyl Benzyl Phthalate	0.273 U	0.150 U	0.423 U	0.260 U	0.181 U	0.441 U	19,000	Eco	19,000	Eco
Di-n-butyl Phthalate	0.574 U	0.200 U	0.774 U	0.562 U	0.303 U	0.865 U	35,000	Eco	35,000	Eco
Di-n-octyl Phthalate	0.126 U	0.208 U	0.334 U	0.110 U	0.139 U	0.249 U	1,200	HH	4,100	HH
Low Molecular Weight PAHs (LPAHs) (ng/L)										
Acenaphthene	**1.26**	0.0191 U	**1.28 J**	**1.03**	0.0275 U	**1.06 J**	520,000	Eco	520,000	Eco
Anthracene	0.103 U	**0.0181**	**0.121 J**	0.0797 U	**0.0316**	**0.111 J**	13,000	Eco	13,000	Eco
Phenanthrene	**1.28**	0.0660 U	**1.35 J**	**1.39**	**0.188**	**1.58**	6,300	Eco	140	HH
High Molecular Weight PAHs (HPAHs) (ng/L)										
Benzo(a)anthracene	**0.0152**	0.0299 U	**0.0451 J**	**0.0120**	0.0480 U	**0.0600 J**	3.80	HH	27.0	Eco
Benzo(a)pyrene	0.0164 U	0.0221 U	0.0385 U	0.0131 U	0.0582 U	0.0713 U	3.80	HH	2.90	HH
Benzo(b)fluoranthene	0.0110 U	0.0422 U	0.0532 U	0.00920 EMPC	**0.0825**	**0.0917 J**	3.80	HH	29.0	HH
Benzo(g,h,i)perylene	0.0194 U	0.0289 U	0.0483 U	0.0195 U	0.0410 U	0.0605 U	380	HH	290	HH
Benzo(j,k)flouranthenes	0.0122 U	0.0376 U	0.0498 U	0.0100 U	0.0443 U	0.0543 U	3.80	HH	14.0	Eco
Chrysene	**0.0514**	0.0728 U	**0.124 J**	**0.0464**	**0.125**	**0.171 J**	3.80	HH	2,040	Eco
Dibenz(a,h)anthracene	0.0212 U	0.0232 U	0.0444 U	0.0107 U	0.0240 U	0.0347 U	18.0	HH	2.90	HH
Fluoranthene	0.562 U	**0.112**	**0.674 J**	0.572 U	**0.212**	**0.784 J**	6,160	Eco	6,160	Eco
Indeno(1,2,3-cd)pyrene	0.0200 U	0.0293 U	0.0493 U	0.0202 U	0.0367 U	0.0569 U	3.80	HH	29.0	HH

Notes:

ng/L = Nanogram per liter
pg/L = Picogram per liter
Eco = Ecological
HH = Human Health
MDL = Method detection limit
ND = Non Detect
RDL = reported detection limit
SLV = Screening level value
\- = Result not available or not calculated

-- = SLV for analyte not available
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-12b
Post-Removal Reference Area Surface Water Analytical Results for High-Volume XAD Device Samples
PCB Aroclors, PCB Dioxin-Like Congeners, and Semivolatile Organic Compounds
(Page 1 of 2)

Area	Reference			Reference			Reference		
Site ID	P57			P58			P59		
Sample ID	08022757XAD			08030758XAD			08022959XAD		
Sample Date	2/27/2008			3/7/2008			2/29/2008		
Preparation Fraction	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)
PCB Dioxin-Like Congeners (pg/L)									
PCB 77	**0.0470**	0.0320 U	**0.0790 J**	**0.0920**	**0.0470**	**0.139**	0.0430 U	0.0390 U	0.0820 U
PCB 81	0.00730 U	0.00550 U	0.0128 U	0.00700 U	0.00430 U	0.0113 U	0.00700 U	0.00470 U	0.0117 U
PCB 105	**0.125**	**0.262**	**0.387**	**0.178**	**0.282**	**0.460**	**0.149**	**0.297**	**0.446**
PCB 114	0.0110 U	0.0140 U	0.0250 U	0.0110 U	0.0200 U	0.0310 U	0.0170 U	0.0170 U	0.0340 U
PCB 118	**0.378**	**0.743**	**1.12**	**0.593**	**0.932**	**1.53**	**0.489**	**0.884**	**1.37**
PCB 123	0.00700 U	0.0170 U	0.0240 U	0.0140 U	0.0190 U	0.0330 U	0.00900 U	0.0200 U	0.0290 U
PCB 126	0.00680 U	0.00550 U	0.0123 U	0.00600 U	0.00700 U	0.0130 U	0.00390 U	0.00630 U	0.0102 U
PCB 156	0.0260 C U	**0.0850 C**	**0.111 C**	0.0360 C U	**0.0940 C**	**0.130 C**	0.0320 C U	**0.0990 C**	**0.131 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**								
PCB 167	0.0130 U	**0.0410**	**0.0540**	0.0180 U	**0.0570**	**0.0750**	0.0150 U	**0.0560**	**0.0710**
PCB 169	0.00300 U	0.00170 U	0.00470 U	0.00240 U	0.00340 U	0.00580 U	0.00100 U	0.00200 U	0.00300 U
PCB 189	0.00360 U	0.00500 U	0.00860 U	0.00210 U	0.00400 U	0.00610 U	0.00200 U	0.00600 U	0.00800 U
Total PCBs as Congeners (KM, capped)	**154 J**	**24.3 J**	**178 J**	**109 J**	**21.2 J**	**130 J**	**149 J**	**22.8 J**	**172 J**
Semivolatile Organic Compounds (ng/L)									
Bis(2-ethylhexyl) Phthalate	17.0 U	2.76 U	19.8 U	15.5 U	6.76 U	22.3 U	9.13 U	2.75 U	11.9 U
Butyl Benzyl Phthalate	0.450 U	0.203 U	0.653 U	0.501 U	5.47 U	5.97 U	0.322 U	0.158 U	0.480 U
Di-n-butyl Phthalate	0.657 U	0.290 U	0.947 U	0.733 U	0.548 U	1.28 U	0.642 U	0.243 U	0.885 U
Di-n-octyl Phthalate	0.187 U	0.129 U	0.316 U	0.202 U	1.09 U	1.29 U	0.155 U	0.120 U	0.275 U
Low Molecular Weight PAHs (LPAHs) (ng/L)									
Acenaphthene	**1.28**	0.0161 U	**1.30 J**	**0.862**	0.0262 U	**0.888 J**	**2.41**	0.0213 U	**2.43 J**
Anthracene	0.0846 U	**0.0109**	**0.0955 J**	0.0687 U	**0.0194**	**0.0881 J**	0.133 U	**0.0172**	**0.150 J**
Phenanthrene	**1.26**	0.0571 U	**1.32 J**	**1.20**	0.0877 U	**1.29 J**	**1.52**	0.0722 U	**1.59 J**
High Molecular Weight PAHs (HPAHs) (ng/L)									
Benzo(a)anthracene	0.00930 EMPC	0.0205 U	0.0298 U	0.0177 U	0.0209 U	0.0386 U	**0.0162**	0.0276 U	**0.0438 J**
Benzo(a)pyrene	0.0171 U	0.0195 U	0.0366 U	0.0146 U	0.0226 U	0.0372 U	0.0204 U	0.0300 U	0.0504 U
Benzo(b)fluoranthene	0.0120 U	0.0235 U	0.0355 U	0.0100 U	0.0230 U	0.0330 U	0.0146 U	0.0327 U	0.0473 U
Benzo(g,h,i)perylene	0.0199 U	0.0254 U	0.0453 U	0.0121 U	0.0174 U	0.0295 U	0.0148 U	0.0224 U	0.0372 U
Benzo(j,k)flouranthenes	0.0136 U	0.0222 U	0.0358 U	0.0110 U	0.0209 U	0.0319 U	0.0159 U	0.0326 U	0.0485 U
Chrysene	**0.0393**	0.0450 U	**0.0843 J**	**0.0482**	0.0588 U	**0.107 J**	**0.0457**	0.0731 U	**0.119 J**
Dibenz(a,h)anthracene	0.0179 U	0.0224 U	0.0403 U	0.0215 U	0.0289 U	0.0504 U	0.0163 U	0.0182 U	0.0345 U
Fluoranthene	0.485 U	0.0793 U	0.564 U	0.591 U	**0.101**	**0.692 J**	**0.626**	**0.129**	**0.755 J**
Indeno(1,2,3-cd)pyrene	0.0222 U	0.0276 U	0.0498 U	0.0128 U	0.0187 U	0.0315 U	0.0164 U	0.0147 U	0.0311 U

Notes:

ng/L = Nanogram per liter
pg/L = Picogram per liter
MDL = Method detection limit
ND = Non Detect
RDL = reported detection limit
- = Result not available or not calculated
J = The reported value is an estimate.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.

Table 6-12b
Post-Removal Reference Area Surface Water Analytical Results for High-Volume XAD Device Samples
PCB Aroclors, PCB Dioxin-Like Congeners, and Semivolatile Organic Compounds
(Page 2 of 2)

Area	Reference			Reference		
Site ID	P60			P61		
Sample ID	08030460XAD			08030661XAD		
Sample Date	3/4/2008			3/6/2008		
Preparation Fraction	Column	Filter	Column+ Filter (ND=RDL/MDL)	Column	Filter	Column+ Filter (ND=RDL/MDL)
PCB Dioxin-Like Congeners (pg/L)						
PCB 77	0.0410 U	**0.0570**	**0.0980**	**0.0800**	**0.0710**	**0.151**
PCB 81	0.00620 U	0.00470 U	0.0109 U	0.00660 U	0.00570 U	0.0123 U
PCB 105	**0.144**	**0.3270**	**0.471**	**0.160**	**0.403**	**0.563**
PCB 114	0.0100 U	0.0200 U	0.0300 U	0.00900 U	0.0220 U	0.0310 U
PCB 118	**0.553**	**1.080**	**1.63**	**0.552**	**1.22**	**1.77**
PCB 123	0.0140 U	0.0260 U	0.0400 U	0.0110 U	0.0260 U	0.0370 U
PCB 126	0.00410 U	0.0080 U	0.0121 U	0.00700 U	0.00800 U	0.0150 U
PCB 156	C 0.0300 U	**0.115 C**	**0.145 C**	0.0340 C U	**0.104 C**	**0.138 C**
PCB 157						
PCB 167	0.0160 U	**0.0700**	**0.0860**	0.0180 U	**0.0600**	**0.0780**
PCB 169	0.00160 U	0.00320 U	0.00480 U	0.00140 U	0.00240 U	0.00380 U
PCB 189	0.00200 U	0.00400 U	0.00600 U	0.00140 U	0.00500 U	0.00640 U
Total PCBs as Congeners (KM, capped)	**146 J**	**26.7 J**	**172 J**	**123 J**	**25.6 J**	**148 J**
Semivolatile Organic Compounds (ng/L)						
Bis(2-ethylhexyl) Phthalate	5.77 U	13.0 U	18.8 U	8.37 U	5.01 U	13.4 U
Butyl Benzyl Phthalate	0.299 U	0.452 U	0.751 U	0.263 U	0.402 U	0.665 U
Di-n-butyl Phthalate	0.626 U	0.595 U	1.22 U	0.517 U	0.324 U	0.841 U
Di-n-octyl Phthalate	0.0990 U	0.285 U	0.384 U	0.0910 U	0.180 U	0.271 U
Low Molecular Weight PAHs (LPAHs) (ng/L)						
Acenaphthene	**1.57**	0.0328 U	**1.60 J**	**0.971**	0.0141 U	**0.985 J**
Anthracene	0.0804 U	**0.0218**	**0.102 J**	0.0594 U	**0.0238**	**0.0832 J**
Phenanthrene	**1.46**	0.108 U	**1.57 J**	**1.23**	0.114 U	**1.34 J**
High Molecular Weight PAHs (HPAHs) (ng/L)						
Benzo(a)anthracene	**0.0159**	0.0374 U	**0.0533 J**	**0.0115**	0.0376 U	**0.0491 J**
Benzo(a)pyrene	0.0172 U	0.0392 U	0.0564 U	0.0131 U	0.0405 U	0.0536 U
Benzo(b)fluoranthene	0.0114 U	**0.0555**	**0.0669 J**	0.00870 U	**0.0512**	**0.0599 J**
Benzo(g,h,i)perylene	0.0163 U	0.0344 U	0.0507 U	0.0203 U	0.0400 U	0.0603 U
Benzo(j,k)flouranthenes	0.0124 U	0.0344 U	0.0468 U	0.00930 U	0.0551 U	0.0644 U
Chrysene	**0.0661**	0.0832 U	**0.149 J**	**0.0562**	0.0930 U	**0.149 J**
Dibenz(a,h)anthracene	0.0147 U	0.0224 U	0.0371 U	0.0179 U	0.0221 U	0.0400 U
Fluoranthene	**0.630**	**0.139**	**0.769**	**0.620**	**0.163**	**0.783**
Indeno(1,2,3-cd)pyrene	0.0182 U	0.0328 U	0.0510 U	0.0222 U	0.0417 U	0.0639 U

Notes:

ng/L = Nanogram per liter
pg/L = Picogram per liter
MDL = Method detection limit
ND = Non Detect
RDL = reported detection limit
- = Result not available or not calculated
J = The reported value is an estimate.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.

Table 6-12c
Post-Removal Forebay Surface Water Analytical Results for Grab Samples
Metals, Petroleum Hydrocarbons, and General Chemistry Parameters

Area	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Site ID	P52	P53	P54	P55	P56				
Sample ID	08021252SW	08022453SW	08021354SW	08022555SW	08022156SW				
Sample Date	2/12/2008	2/24/2008	2/13/2008	2/25/2008	2/21/2008				
Total Metals (µg/L)									
Aluminum	145 U	**91.0**	152 U	**99.0**	**141**	--	--	37000	HH
Antimony	7.00 U	7.00 U	7.00 U	50.0 U	7.00 U	5.6	HH	15	HH
Arsenic	**0.810**	**0.930**	**0.880**	**0.920**	**1.01**	0.018	HH	0.038	HH
Barium	**22.0**	**25.0**	**23.0**	**24.0**	**27.0**	1000	HH	7300	HH
Beryllium	**0.00900**	0.0200 U	**0.00300**	0.0200 U	0.0200 U	--	--	73	HH
Cadmium	**0.0130**	**0.0170 J**	**0.00900**	**0.0190 J**	**0.0130 J**	--	--	18	HH
Chromium	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	--	--	55000	HH
Cobalt	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	--	--	11	HH
Copper	**0.670**	**0.670**	**0.670**	**0.790**	**0.720**	1300	HH	1500	HH
Lead	**0.0790**	**0.175**	**0.0870**	**0.108**	**0.140**	--	--	15	HH
Mercury	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	--	--	11	HH
Nickel	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	610	HH	730	HH
Thallium	**0.0330**	**0.0260**	**0.0310**	**0.0280**	**0.0280**	0.24	HH	2	HH
Vanadium	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--	--	2.6	HH
Zinc	7.00 U	7.00 U	7.00 U	7.00 U	7.00 U	7400	HH	11000	HH
Dissolved Metals (µg/L)									
Aluminum	50 U	20.0 U	50.0 U	20.0 U	20.0 U	87	Eco	87	Eco
Antimony	7.00 U	7.00 U	7.00 U	50.0 U	7.00 U	5.6	HH	15	HH
Arsenic	**0.720**	**0.890**	**0.820**	**0.940**	**0.890**	0.018	HH	0.038	HH
Barium	**21.0**	**24.0**	**22.0**	**23.0**	**24.0**	4	Eco	4	Eco
Beryllium	**0.00300**	0.0200 U	**0.00400**	0.0200 U	0.0200 U	5.3	Eco	5.3	Eco
Cadmium	**0.00800**	0.00700 U	0.00800 U	0.00700 U	**0.0100 J**	0.25	Eco	0.25	Eco
Chromium	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	74	Eco	74	Eco
Cobalt	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	23	Eco	11	HH
Copper	**0.520**	**0.450**	**0.440**	**0.480**	**0.460**	9	Eco	9	Eco
Lead	**0.0360**	**0.0220**	0.00300 U	**0.0140 J**	0.00900 U	2.5	Eco	2.5	Eco
Mercury	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.77	Eco	0.77	Eco
Nickel	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	52	Eco	52	Eco
Thallium	**0.0300**	**0.0240**	**0.0310**	**0.0230**	**0.0240**	0.24	HH	2	HH
Vanadium	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	20	Eco	2.6	HH
Zinc	**7.50**	7.00 U	7.00 U	7.00 U	7.00 U	120	Eco	120	Eco
Total Petroleum Hydrocarbons (µg/L)									
Diesel Range Organics	**15.0 J**	11.0 U	**15.0 J**	11.0 U	11.0 U	--	--	90	HH
Residual Range Organics	110 U	100 U	120 U	100 U	19.0 U	--	--	290	HH
Dissolved Petroleum Hydrocarbons (µg/L)									
Diesel Range Organics	**15.0 J**	**14.0 J**	**28.0 J**	**46.0 J**	**18.0 J**	--	--	90	HH
Residual Range Organics	110 U	19.0 U	120 U	100 U	100 U	--	--	290	HH
General Chemistry Parameters (mg/L)									
Total Chloride	**3.20**	**4.20**	**2.90**	**3.30**	**3.30**	230	Eco	230	Eco
Total Sulfate	**13.3**	**14.7**	**13.8**	**14.7**	**14.9**	--	--	--	--
Total Nitrate+Nitrite Nitrogen	**0.200**	**0.300**	**0.200**	**0.200**	**0.200**	--	--	10	HH
Total Organic Carbon	**1.90**	**1.80**	**1.80**	**1.90**	**1.70**	--	--	--	--
Dissolved Organic Carbon	**2.10**	**1.80**	**1.80**	**1.70**	**1.80**	--	--	--	--

Notes:

µg/L = Microgram per liter	-- = SLV for analyte not available
mg/L = Milligram per liter	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = Method detection limit	**bold** = analyte detected above MDL.
SLV = Screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Result not available	

Table 6-12d
Reference Area Surface Water Analytical Results for Grab Samples
Metals, Petroleum Hydrocarbons, and General Chemistry Parameters

Area	Reference	Reference	Reference	Reference	Reference
Site ID	P57*	P58	P59	P60	P61
Sample ID	08022757SW	08030758SW	08022959SW	08030460SW	08030661SW
Sample Date	2/27/2008	3/7/2008	2/29/2008	3/4/2008	3/6/2008
Total Metals (µg/L)					
Aluminum	**91.0**	**118**	**123**	**100**	**115**
Antimony	7.00 U	7.00 U	7.00 U	**9.30 J**	7.00 U
Arsenic	**0.910**	1.05 U	**1.22**	**1.25**	**1.22**
Barium	**21.0**	**22.1**	**25.0**	**25.3**	**25.6**
Beryllium	0.0200 U	0.00800 U	**0.0210**	**0.00900 J**	**0.0110 J**
Cadmium	**0.0100 J**	0.0200 U	**0.0210**	0.0200 U	0.0200 U
Chromium	2.00 U	2.00 U	2.00 U	2.00 U	**2.00 J**
Cobalt	**2.00 J**	2.00 U	2.00 U	2.00 U	2.00 U
Copper	**0.605**	**0.770**	**0.710**	**0.760**	**0.830**
Lead	**0.0580**	**0.203**	**0.0910**	**0.0770**	**0.0920**
Mercury	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U
Nickel	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Thallium	**0.0205**	0.0200 U	0.0370 U	0.0240 U	0.0270 U
Vanadium	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	7.00 U	7.00 U	7.00 U	7.00 U	7.00 U
Dissolved Metals (µg/L)					
Aluminum	**27.0 J**	20.0 U	20.0 U	20.0 U	20.0 U
Antimony	7.00 U	7.00 U	7.00 U	7.00 U	7.00 U
Arsenic	**0.935**	1.15 U	**1.26**	1.10 U	1.14 U
Barium	**21.5**	**22.2**	**23.5**	**23.3**	**23.5**
Beryllium	0.0200 U	0.00800 U	0.00800 U	0.00800 U	0.00800 U
Cadmium	0.00700 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Chromium	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Cobalt	**2.20 J**	2.00 U	2.00 U	2.00 U	2.00 U
Copper	**0.450**	**0.550**	**0.550**	**0.600**	**0.610**
Lead	**0.0140 J**	**0.0150**	0.0090 U	0.00900 U	**0.0240**
Mercury	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U
Nickel	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Thallium	**0.0185 J**	**0.0200**	0.0240 U	0.0200 U	0.0200 U
Vanadium	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	7.00 U	7.00 U	7.00 U	7.00 U	7.00 U
Total Petroleum Hydrocarbons (µg/L)					
Diesel Range Organics	11.0 U	12.0 U	**13.0 J**	**14.0 J**	**19.0 J**
Residual Range Organics	100 U	20 U	**24 J**	**22 J**	**71 J**
Dissolved Petroleum Hydrocarbons (µg/L)					
Diesel Range Organics	11.0 U	12.0 U	11.0 U	**13.0 J**	12.0 U
Residual Range Organics	100 U	21 U	**24 J**	**20 J**	**21 J**
General Chemistry Parameters (mg/L)					
Total Chloride	**3.30**	**3.20**	**3.50**	**3.50**	**3.30**
Total Sulfate	**14.0**	**13.9**	**14.5**	**14.3**	**14.5**
Total Nitrate+Nitrite Nitrogen	**0.200**	**0.250**	**0.290**	**0.300**	**0.310**
Total Organic Carbon	**1.70**	**1.90**	**1.80**	**2.00**	**2.10**
Dissolved Organic Carbon	**1.70**	**1.80**	**1.80**	**1.80**	**2.30**

Notes:

µg/L = Microgram per liter
mg/L Milligram per liter
MDL = Method detection limit
- = Result not available
J = The reported value is an estimate.

U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-13a
Goose Island Area Crayfish, Sculpin, and Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds

Area	Forebay - Goose Island	Forebay - Goose Island	Forebay - Goose Island	**Selected SLV (Crayfish)**	**SLV Source (Crayfish)**	**Selected SLV (Sculpin and Clam)**	**SLV Source (Sculpin and Clam)**
Site ID	P110	P110	P110				
Sample ID	090429110CF	090429110SC	090429110TC				
Sample Date	4/29/2009	4/29/2009	4/29/2009				
Percent Lipds	0.62	4.2	3.0				
Medium	Crayfish Tissue	Sculpin Tissue	Clam Tissue				
PCB Aroclors (µg/kg wet)							
Aroclor 1016	2.40 U	-	6.10 UJ	0.570	HH	35.0	Eco
Aroclor 1221	2.60 U	-	5.90 UJ	0.570	HH	35.0	Eco
Aroclor 1232	2.30 U	-	9.70 UJ	0.570	HH	35.0	Eco
Aroclor 1242	2.20 U	-	6.60 UJ	0.570	HH	35.0	Eco
Aroclor 1248	0.510 U	-	5.20 UJ	0.570	HH	35.0	Eco
Aroclor 1254	1.80 U	-	14.0 UJ	0.570	HH	35.0	Eco
Aroclor 1260	1.90 U	-	6.30 UJ	0.570	HH	35.0	Eco
Aroclor 1262	2.50 U	-	3.20 UJ	0.570	HH	35.0	Eco
Aroclor 1268	2.00 U	-	2.00 UJ	0.570	HH	35.0	Eco
Total PCBs as Aroclors (NDs at MDL)[1]	2.60 U	-	14.0 UJ	0.570	HH	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)							
PCB 77	**0.00226**	**0.00799**	**0.0337**	0.0760	HH	0.160	Eco
PCB 81	0.000145 U	0.000882 EMPC	0.00217 EMPC	0.0250	HH	0.0800	Eco
PCB 105	**0.00624**	**0.362**	**0.352**	0.250	HH	20.0	Eco
PCB 114	**0.00235**	**0.0220**	**0.0228**	0.250	HH	20.0	Eco
PCB 118	**0.0870**	**0.872**	**1.59**	0.250	HH	20.0	Eco
PCB 123	**0.00256**	**0.0163**	**0.0280**	0.250	HH	20.0	Eco
PCB 126	0.000261 EMPC	**0.00315**	**0.00307**	0.0000760	HH	0.00580	Eco
PCB 156	**0.0133 C**	**0.106 C**	**0.0969 C**	0.250	HH	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**			0.250	HH	20.0	Eco
PCB 167	**0.0112**	**0.0348**	**0.0925**	0.250	HH	20.0	Eco
PCB 169	0.000164 U	0.00131 U	0.00108 U	0.000250	HH	0.0200	Eco
PCB 189	**0.000662**	**0.00383**	**0.00157**	0.250	HH	20.0	Eco
Total PCBs as Congeners (KM, capped)	**0.587 J**	**8.14 J**	**21.4 J**	0.570	HH	35.0	Eco
Metals (mg/kg wet)							
Aluminum	**147**	-	**75.5**	--	--	--	--
Antimony	**0.00800 J**	-	0.00100 U	--	--	--	--
Arsenic	**0.303**	-	**1.59**	0.000760	HH	6.60	Eco
Barium	**57.0**	-	**1.66**	--	--	--	--
Beryllium	**0.00400 J**	-	**0.00200 J**	--	--	--	--
Cadmium	**0.0769**	-	**0.243**	0.150	Eco	0.150	Eco
Chromium	**0.190**	-	**0.492**	--	--	--	--
Cobalt	**0.391**	-	**0.0996**	--	--	--	--
Copper	**15.5**	-	**6.75**	--	--	--	--
Lead	**0.471**	-	**0.0615**	0.120	Eco	0.120	Eco
Mercury	**0.0359 J**	-	**0.0163 J**	0.0490	HH	0.0740	Eco
Methyl Mercury	-	-	-	--	--	--	--
Nickel	**1.21**	-	**0.221**	--	--	--	--
Thallium	**0.0128**	-	**0.00650**	--	--	--	--
Vanadium	**0.729**	-	**0.253**	--	--	--	--
Zinc	**20.3**	-	**20.5**	--	--	--	--
Semivolatile Organic Compounds (µg/kg wet)							
Bis(2-ethylhexyl) Phthalate	66.0 U	-	66.0 U	81.9	HH	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	-	7.30 U	310	Eco	310	Eco
Carbazole	7.70 U	-	7.70 U	-	-	--	--
Di-n-butyl Phthalate	140 U	-	170 U	626	Eco	626	Eco
Di-n-octyl Phthalate	11.0 U	-	11.0 U	626	Eco	626	Eco
p-cresol (4-Methylphenol)	11.0 U	-	**29.0 J**	-	-	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)							
Acenaphthene	0.500 U	-	**0.680**	15,000	HH	19,000	Eco
Anthracene	**0.430 J**	-	**1.20**	15,000	HH	19,000	Eco
Fluorene	**0.510**	-	**1.80**	15,000	HH	19,000	Eco
Phenanthrene	**0.820**	-	**10.0**	15,000	HH	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)							
Benzo(a)anthracene	0.500 U	-	**3.40**	1.57	HH	1,000	Eco
Benzo(a)pyrene	0.0610 U	-	**0.750**	0.157	HH	1,000	Eco
Benzo(b)fluoranthene	**0.150 J**	-	**2.20**	1.57	HH	1,000	Eco
Benzo(g,h,i)perylene	**0.110 J**	-	**0.740**	15.7	HH	1,000	Eco
Benzo(k)fluoranthene	**0.110 J**	-	**1.30**	15.7	HH	1,000	Eco
Chrysene	0.200 U	-	**2.50**	157	HH	1,000	Eco
Dibenz(a,h)anthracene	0.0450 U	-	**0.480 J**	0.157	HH	1,000	Eco
Fluoranthene	0.500 U	-	**18.0**	19,000	Eco	19,000	Eco
Indeno(1,2,3-cd)pyrene	**0.150 J**	-	**0.890**	1.57	HH	1,000	Eco
Pyrene	0.500 U	-	**5.40**	1,000	Eco	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect
J = The reported value is an estimate.

[1] Only Aroclor 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-13b
Mouth of Eagle Creek and Goose Island Area Sediment Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size

Area	Forebay - Eagle Creek	Forebay - Eagle Creek	Forebay - Goose Island	Forebay - Goose Island		
Site ID	P43	P44	P110	P111		
Sample ID	08032043SD	08032044SD	090427110SD	090429111SD	**Selected SLV**	**SLV Source**
Sample Date	3/20/2008	3/20/2008	4/27/2009	4/29/2009		
PCB Aroclors (µg/kg dry)						
Aroclor 1016	1.70 U	1.70 U	2.50 U	2.70 U	0.0480	HH
Aroclor 1221	1.70 U	1.70 U	2.50 U	2.70 U	0.0480	HH
Aroclor 1232	1.70 U	1.70 U	2.50 U	2.70 U	0.0480	HH
Aroclor 1242	1.70 U	1.70 U	2.50 U	2.70 U	0.0480	HH
Aroclor 1248	**76.0**	1.70 U	2.50 U	2.70 U	0.0480	HH
Aroclor 1254	1.70 U	1.70 U	2.50 U	**9.90 J**	0.0480	HH
Aroclor 1260	1.70 U	1.70 U	2.50 UJ	2.70 UJ	0.0480	HH
Aroclor 1262	1.70 U	1.70 U	-	-	0.0480	HH
Aroclor 1268	1.70 U	1.70 U	-	-	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**77.7 J**	3.40 U	5.00 U	**12.6 J**	0.0480	HH
PCB Dioxin-Like Congeners (µg/kg dry)						
PCB 77	-	-	**0.00285**	**0.00353**	0.00640	HH
PCB 81	-	-	**0.000135**	0.000150 EMPC	0.00210	HH
PCB 105	-	-	**0.0249**	**0.0277**	0.0210	HH
PCB 114	-	-	**0.00129**	**0.00137**	0.0210	HH
PCB 118	-	-	**0.0657**	**0.0695**	0.0260	HH
PCB 123	-	-	**0.000963**	0.000970 EMPC	0.0260	HH
PCB 126	-	-	0.000255 EMPC	0.000419 EMPC	0.00000620	HH
PCB 156	-	-	**0.00850 C**	**0.0104 C**	0.0260	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**				0.0260	HH
PCB 167	-	-	**0.00402**	**0.00381**	0.0260	HH
PCB 169	-	-	0.000241 U	0.000250 U	0.0000210	HH
PCB 189	-	-	**0.000615**	**0.000869**	0.140	HH
Total PCBs as Congeners (KM, capped)	-	-	**1.20 J**	**1.34 J**	0.0480	HH
Metals (mg/kg dry)						
Aluminum	**16,300**	**18,000**	**17,100**	**18,800**	38,000	UPL
Antimony	**0.0400 J**	**0.0800 J**	**0.440**	**0.580**	3.00	Eco
Arsenic	**0.680**	**3.23**	**4.00**	**4.25**	6.00	Eco
Barium	**74.4**	**110**	**112**	**131**	315	UPL
Beryllium	**0.353**	**0.371**	**0.561**	**0.505**	0.847	UPL
Cadmium	0.0750 U	0.131 U	**0.887**	**1.17**	0.674	UPL
Chromium	**20.2**	**23.5**	**20.6**	**21.6**	37.0	Eco
Cobalt	**11.0**	**9.93**	**11.6**	**11.2**	15.2	UPL
Copper	**16.6**	**24.8**	**32.6**	**34.2**	55.6	UPL
Lead	**4.19**	**10.9**	**13.1**	**13.6**	35.0	Eco
Mercury	**0.00700**	**0.0290**	**0.181**	**0.179**	0.214	UPL
Nickel	**19.9**	**15.6**	**19.4**	**18.1**	21.2	UPL
Thallium	0.0560 U	0.156 U	**0.272**	**0.435**	0.354	UPL
Vanadium	**70.3**	**62.5**	**61.5**	**59.3**	70.6	UPL
Zinc	**52.7**	**65.1**	**115**	**148**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)						
Diesel Range Organics	**2.90 J**	**13.0 J**	**53.0 J**	**49.0 J**	--	--
Residual Range Organics	150 U	150 U	**480**	**410**	--	--
Semivolatile Organic Compounds (µg/kg dry)						
Bis(2-ethylhexyl) Phthalate	200 U	200 U	**13.0 J**	**9.90 J**	750	Eco
Butyl Benzyl Phthalate	9.90 U	9.90 U	1.80 U	1.90 U	110	Eco
Carbazole	1.30 U	**2.20 J**	1.60 U	1.70 U	140	Eco
Di-n-butyl Phthalate	9.90 U	11.0 U	**10.0 J**	**5.60 J**	110	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	1.50 U	1.60 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	**8.50 J**	3.70 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)						
Acenaphthene	1.00 U	1.00 U	1.20 U	1.30 U	*290*	*Eco*
Anthracene	1.40 U	**2.60 J**	1.70 U	1.80 U	57.0	Eco
Fluorene	1.70 U	1.70 U	2.10 U	2.20 U	*77.0*	*Eco*
Phenanthrene	**2.30 J**	**6.50 J**	**3.80 J**	**4.60 J**	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**6.40 J**	**11.8 J**	**8.80 J**	**9.90 J**	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)						
Benzo(a)anthracene	1.40 U	**6.60 J**	**4.20 J**	**7.80 J**	32.0	Eco
Benzo(a)pyrene	1.60 U	**7.10 J**	**8.70 J**	**13.0 J**	32.0	Eco
Benzo(b)fluoranthene	2.50 U	**11.0**	**6.50 J**	**15.0**	27.0	Eco
Benzo(g,h,i)perylene	2.30 U	**5.00 J**	**5.60 J**	**9.90 J**	300	Eco
Benzo(k)fluoranthene	2.50 U	**3.40 J**	3.00 U	**4.10 J**	27.0	Eco
Chrysene	**1.80 J**	**13.0**	**5.80 J**	**11.0 J**	57.0	Eco
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.70 U	2.80 U	33.0	Eco
Fluoranthene	2.20 U	**11.0**	**7.30 J**	**9.60 J**	111	Eco
Indeno(1,2,3-cd)pyrene	1.90 U	**4.60 J**	**5.00 J**	**7.10 J**	17.0	Eco
Pyrene	**3.40 J**	**17.0**	**7.20 J**	**8.80 J**	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**17.2 J**	**80.9 J**	**55.7 J**	**89.1 J**	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)						
Total PAHs (KM, capped; NDs at MDL)	**19.5 J**	**90.8 J**	**60.1 J**	**96.1 J**	1600	Eco
General Chemistry Parameters (mg/kg dry) and Grain Size (%)						
Carbon, Total Organic	**2,300**	**5,700**	**25,600**	**11,000**	--	--
Gravel (>2.00 mm)	**15.2**	**37.4**	**5.84**	**1.94**	--	--
Sand, Very Coarse (1.00 - 2.00 mm)	**10.9**	**9.70**	**7.41**	**1.77**	--	--
Sand, Coarse (0.50 - 1.00 mm)	**27.7**	**13.3**	**5.99**	**1.31**	--	--
Sand, Medium (0.25 - 0.50 mm)	**27.5**	**13.9**	**5.74**	**2.04**	--	--
Sand, Fine (0.125 - 0.25 mm)	**14.5**	**14.6**	**7.56**	**5.34**	--	--
Sand, Very Fine (0.0625 - 0.125 mm)	**2.23**	**5.84**	**8.44**	**14.3**	--	--
Silt (0.039 - 0.0625 mm)	**2.00**	**6.09**	**42.9**	**59.6**	--	--
Clay (<0.039 mm)	**0.470**	**0.920**	**11.8**	**10.3**	--	--

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
ND = Non Detect
SLV = screening level value
RDL = reported detection limit
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available

[1] Only Aroclors 1248 and 1254 were included in summing sediment Total PCBs as Aroclors because all other aroclors were undected in Forebay sediment
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-14
Post-Removal Downstream Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size

Area	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Selected SLV	SLV Source
Site ID	P46	P47	P48	P49	P50	P51		
Sample ID	08031046SD	08031047SD	08031048SD	08031049SD	08031150SD	08031151SD		
Sample Date	3/10/2008	3/10/2008	3/10/2008	3/10/2008	3/11/2008	3/11/2008		
PCB Aroclors (µg/kg dry)								
Aroclor 1016	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1221	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1232	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1242	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1248	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1254	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
PCB Dioxin-Like Congeners (µg/kg dry)								
PCB 77	0.000259 EMPC	0.000531 EMPC	**0.000478**	**0.00160**	**0.00201**	**0.000573**	0.00640	HH
PCB 81	0.0000831 U	0.0000707 U	0.0000492 U	**0.000260**	0.000100 U	0.0000981 U	0.00210	HH
PCB 105	**0.00179**	**0.00626**	**0.00426**	**0.00943**	**0.0197**	**0.00398**	0.0210	HH
PCB 114	0.0000976 U	**0.000383**	**0.000239**	**0.000650**	**0.000957**	**0.000315**	0.0210	HH
PCB 118	**0.00409**	**0.0132**	**0.00918**	**0.0167**	**0.0456**	**0.0109**	0.0260	HH
PCB 123	0.000168 EMPC	**0.000271**	**0.000130**	**0.000497**	**0.000874**	**0.000226**	0.0260	HH
PCB 126	0.000113 U	0.0000805 U	0.0000787 U	0.000171 U	**0.000211**	0.0000962 U	0.00000620	HH
PCB 156	0.000604 EMPC	**0.00182 C**	0.00139 C EMPC	**0.00289 C**	**0.00625 C**	**0.00174 C**	0.0260	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.0260	HH
PCB 167	**0.000320**	**0.000697**	**0.000554**	**0.00103**	**0.00261**	**0.000765**	0.0260	HH
PCB 169	0.0000697 U	0.0000894 U	0.0000630 U	0.0000900 U	0.000154 U	0.0000837 U	0.0000210	HH
PCB 189	0.0000733 U	0.000115 EMPC	**0.0000970**	**0.000254**	**0.000596**	**0.000140**	0.140	HH
Total PCBs as Congeners (KM, capped)	**0.0880 J**	**0.215 J**	**0.173 J**	**0.418 J**	**0.917 J**	**0.213 J**	0.0480	HH
Metals (mg/kg dry)								
Aluminum	**20,700**	**10,600**	**11,100**	**10,600**	**18,800**	**21,600**	38,000	UPL
Antimony	**0.240 J**	**0.0600 J**	**0.0800 J**	**0.120 J**	**0.230 J**	**0.400 J**	3.00	Eco
Arsenic	**5.84**	**3.72**	**2.48**	**2.80**	**3.25**	**5.71**	6.00	Eco
Barium	**161**	**96.5**	**99.0**	**124**	**172**	**140**	315	UPL
Beryllium	**0.444**	**0.288**	**0.286**	**0.300**	**0.472**	**0.513**	0.847	UPL
Cadmium	**0.209**	**0.290**	**0.229**	**0.345**	**0.791**	**0.308**	0.674	UPL
Chromium	**25.0**	**16.1**	**20.1**	**19.7**	**22.8**	**29.9**	37.0	Eco
Cobalt	**10.1**	**7.05**	**6.93**	**8.06**	**8.53**	**11.5**	15.2	UPL
Copper	**20.0**	**12.5**	**13.3**	**14.5**	**20.9**	**24.1**	55.6	UPL
Lead	**8.18**	**8.50**	**6.67**	**11.6**	**12.7**	**9.00**	35.0	Eco
Mercury	**0.0340**	**0.0330**	**0.0690**	**0.0480**	**0.136**	**0.0580**	0.214	UPL
Nickel	**12.5**	**13.2**	**13.0**	**13.6**	**14.1**	**15.2**	21.2	UPL
Thallium	**0.163**	**0.165**	0.130 U	**0.205**	**0.234**	**0.178**	0.354	UPL
Vanadium	**65.0**	**43.8**	**44.6**	**47.4**	**49.8**	**73.5**	70.6	UPL
Zinc	**67.7**	**79.6**	**56.7**	**105**	**117**	**70.5**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)								
Diesel Range Organics	**8.20 J**	**8.10 J**	**8.70 J**	**5.90 J**	**21.0**	**25.0**	--	--
Residual Range Organics	140 U	140 U	150 U	**41.0 J**	180 U	150 U	--	--
Semivolatile Organic Compounds (µg/kg dry)								
Bis(2-ethylhexyl) Phthalate	200 U	200 U	200 U	200 U	200 U	200 U	750	Eco
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	9.90 U	1.50 U	1.50 U	110	Eco
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	**1.60 J**	1.30 U	140	Eco
Di-n-butyl Phthalate	11.0 U	11.0 U	14.0 U	10.0 U	9.90 U	9.80 U	110	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	2.90 U	2.90 U	**130**	**3.40 J**	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)								
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	290	Eco
Anthracene	**2.70 J**	1.40 U	1.40 U	1.40 U	**3.10 J**	**1.60 J**	57.0	Eco
Fluorene	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	77.0	Eco
Phenanthrene	**4.80 J**	1.30 U	1.30 U	**2.20 J**	**4.90 J**	**4.00 J**	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**10.2 J**	5.40 U	5.40 U	**6.30 J**	**10.7 J**	**8.30 J**	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)								
Benzo(a)anthracene	**9.60 J**	**1.70 J**	**1.80 J**	**3.30 J**	**12.0**	**3.70 J**	32.0	Eco
Benzo(a)pyrene	**11.0**	**1.90 J**	1.60 U	**4.30 J**	**14.0**	**4.50 J**	32.0	Eco
Benzo(b)fluoranthene	**9.70 J**	2.50 U	2.50 U	**4.50 J**	**16.0**	**3.30 J**	27.0	Eco
Benzo(g,h,i)perylene	**5.80 J**	2.30 U	2.30 U	**2.80 J**	**6.80 J**	2.30 U	300	Eco
Benzo(k)fluoranthene	**4.20 J**	2.50 U	2.50 U	2.50 U	**6.50 J**	2.50 U	27.0	Eco
Chrysene	**9.60 J**	**1.60 J**	1.40 U	**3.50 J**	**18.0**	**3.40 J**	57.0	Eco
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	**2.30 J**	2.20 U	33.0	Eco
Fluoranthene	**20.0**	**2.90 J**	2.20 U	**4.30 J**	**22.0**	**6.20 J**	111	Eco
Indeno(1,2,3-cd)pyrene	**6.30 J**	1.90 U	1.90 U	**2.80 J**	**8.20 J**	1.90 U	17.0	Eco
Pyrene	**20.0**	**2.60 J**	**1.80 J**	**4.60 J**	**21.0**	**6.40 J**	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**98.4 J**	**19.2 J**	**16.0 J**	**34.5 J**	**127 J**	**35.1 J**	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)								
Total PAHs (KM, capped; NDs at MDL)	**107 J**	**21.4 J**	**16.8 J**	**37.5 J**	**137 J**	**40.6 J**	1600	Eco
General Chemistry Parameters (mg/kg dry) and Grain Size (%)								
Carbon, Total Organic	**3,600**	**3,400**	**3,600**	**7,500**	**11,500**	**5,200**	--	--
Gravel (>2.00 mm)	**0.0600**	**0.640**	**1.66**	**0.530**	**1.53**	**4.58**	--	--
Sand, Very Coarse (1.00 - 2.00 mm)	**0.160**	**2.42**	**1.03**	**0.380**	**2.02**	**6.61**	--	--
Sand, Coarse (0.50 - 1.00 mm)	**0.330**	**15.6**	**1.57**	**0.630**	**2.86**	**10.3**	--	--
Sand, Medium (0.25 - 0.50 mm)	**11.6**	**43.8**	**31.1**	**6.31**	**2.92**	**24.4**	--	--
Sand, Fine (0.125 - 0.25 mm)	**65.3**	**26.7**	**35.6**	**66.4**	**10.2**	**30.1**	--	--
Sand, Very Fine (0.0625 - 0.125 mm)	**20.6**	**3.89**	**9.19**	**16.2**	**35.7**	**9.35**	--	--
Silt (0.039 - 0.0625 mm)	**0.0200**	**8.13**	**15.1**	**5.33**	**39.1**	**9.71**	--	--
Clay (<0.039 mm)	**8.74**	**0.440**	**1.97**	**1.31**	**5.76**	**1.22**	--	--

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed
-- = SLV for analyte not available

[1] Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undetected in Downstream sediment samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-2a
2009 Landfill Soil Analytical Results
Volatile and Semivolatile Organic Compounds, Total Solids, and Grain Size

Site ID	L-01	L-01	L-02	L-02	L-03	L-03	L-04*	L-04	LF-EUA	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090129-L-L1-0-1So	090129-L-L1-1-3So	090129-L-L2-0-1So	090129-L-L2-1-3So	090129-L-L3-0-1So	090129-L-L3-1-3So	090129-L-L4-0-1So	090129-L-L4-1-3So	090319-LF-EUA-So		
Sample Date	1/29/2009	1/29/2009	1/29/2009	1/29/2009	1/29/2009	1/29/2009	1/29/2009	1/29/2009	3/19/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-0.17		
Volatile Organic Compounds (µg/kg dry)											
o-Xylene	0.0950 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0620 U	0.0590 U	-	1,000	Eco
Tetrachloroethene (PCE)	**2.90 J**	**25.0 J**	**1.50 J**	**19.0 J**	**5.90 J**	**2.80 J**	**9.70 J**	**27.0 J**	-	1,600	HH
Toluene	**1.30 J**	**3.90 J**	**0.350 J**	**0.900 J**	**0.690 J**	**0.170 J**	**1.46 J**	**1.80 J**	-	200,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)											
Acenaphthene	**66.0**	**170**	**220**	**1,900**	**700**	**360**	**1,160**	**420**	-	19,000,000	HH
Acenaphthylene	**3.40**	**12.0**	**15.0**	**41.0**	**13.0**	**15.0**	**19.0**	**13.0**	-	23,000	HH
Anthracene	**99.0**	**400**	**650**	**2,100**	**880**	**900**	**1,070**	**740**	-	93,000,000	HH
Fluorene	**33.0**	**99.0**	**130**	**630**	**340**	**210**	**510**	**240**	-	12,000,000	HH
Naphthalene	**5.00**	**22.0**	**14.0**	**140**	**49.0**	**49.0**	**79.0**	**57.0**	-	23,000	HH
Phenanthrene	**350**	**1,500**	**2,000**	**7,400**	**3,400**	**2,800**	**4,200**	**2,800**	-	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**556**	**2,203**	**3,029**	**12,211**	**5,382**	**4,334**	**7,043**	**4,270**	-	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)											
Benzo(a)anthracene	**690**	**4,500**	**4,100**	**11,000**	**4,500**	**4,800**	**4,500**	**4,800**	-	2,700	HH
Benzo(a)pyrene	**820**	**5,800**	**4,700**	**16,000**	**5,900**	**5,800**	**5,800**	**6,200**	-	270	HH
Benzo(b)fluoranthene	**990**	**7,100**	**5,700**	**16,000**	**6,400**	**6,500**	**6,500**	**7,200**	-	2,700	HH
Benzo(g,h,i)perylene	**460**	**3,300**	**2,500**	**9,500**	**3,300**	**3,100**	**3,250**	**3,500**	-	27,000	HH
Benzo(k)fluoranthene	**310**	**2,400**	**2,000**	**5,900**	**2,300**	**2,400**	**2,300**	**2,500**	-	27,000	HH
Chrysene	**790**	**5,000**	**4,900**	**14,000**	**5,000**	**5,400**	**5,150**	**5,600**	-	270,000	HH
Dibenz(a,h)anthracene	**130**	**970**	**710**	**2,300**	**1,000**	**900**	**900**	**1,100**	-	270	HH
Fluoranthene	**1,200**	**7,700**	**7,000**	**21,000**	**8,200**	**8,700**	**8,700**	**8,600**	-	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**620**	**4,500**	**3,500**	**13,000**	**4,600**	**4,400**	**4,450**	**4,900**	-	2,700	HH
Pyrene	**1,200**	**7,500**	**6,700**	**21,000**	**7,900**	**9,400**	**8,150**	**8,600**	-	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**7,210**	**48,770**	**41,810**	**129,700**	**49,100**	**51,400**	**49,700**	**53,000**	-	1,100	Eco
Total Solids (mg/kg) and Grain Size (%)											
Solids, Total	**750,000**	**820,000**	**807,000**	**835,000**	**833,000**	**836,000**	**828,000**	**858,000**	**667,000**	-	-
Gravel (>2.00 mm)	-	-	-	-	-	-	-	-	**52.6**	-	-
Sand, Very Coarse (1.00 - 2.00 mm)	-	-	-	-	-	-	-	-	**7.81**	-	-
Sand, Coarse (0.50 - 1.00 mm)	-	-	-	-	-	-	-	-	**5.66**	-	-
Sand, Medium (0.25 - 0.50 mm)	-	-	-	-	-	-	-	-	**6.07**	-	-
Sand, Fine (0.125 - 0.25 mm)	-	-	-	-	-	-	-	-	**7.17**	-	-
Sand, Very Fine (0.0625 - 0.125 mm)	-	-	-	-	-	-	-	-	**6.05**	-	-
Silt (0.039 - 0.0625 mm)	-	-	-	-	-	-	-	-	**16.6**	-	-
Clay (<0.039 mm)	-	-	-	-	-	-	-	-	**2.88**	-	-

Notes:

µg/kg = microgram per kilogram	-- = SLV for analyte not available
bgs = below ground surface	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-2b
2008-2009 Landfill AOPC Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Volatile Organic Compounds, Semivolatile Organic Compounds, and General Chemistry Parameters
(Page 1 of 3)

Site ID	MW-01	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-03	MW-04	MW-04	MW-04	MW-04	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080416MW1 GW	080718MW1GW	081024MW1GW	090115MW1GW	080416MW2 GW	080715MW2GW	081022MW2GW	090113MW2GW	080417MW3 GW	080717MW3GW	081023MW3GW	090113MW3GW	080417MW4 GW	080717MW4GW	081023MW4GW	090114MW4GW				
Sample Date	4/16/2008	7/18/2008	10/24/2008	1/15/2009	4/16/2008	7/15/2008	10/22/2008	1/13/2009	4/17/2008	7/17/2008	10/23/2008	1/13/2009	4/17/2008	7/17/2008	10/23/2008	1/14/2009				
Sample Depth (Feet btc)	25	28	31	31	27	27	27	28	16	19	20	19	27	26	23	18				
Sample Depth (Feet btc)	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater				
Total Metals (µg/L)																				
Arsenic	**21.3**	**19.6**	**16.2**	**15.8**	**6.93**	**9.06**	**8.81**	**8.20**	**0.350 J**	**0.400 J**	**0.520**	0.500 U	**0.550**	**0.300 J**	**0.340 J**	0.500 U	0.0180	HH	0.0380	HH
Iron	**75.5**	**7,910**	**2,620**	**4,710**	**185**	**178**	**174**	**198**	**112**	57.8 U	**9.40 J**	60.6 U	**746**	**14,700**	**28,100**	**156**	300	HH	26,000	HH
Lead	**0.558**	**6.36**	**1.70**	**1.44**	**0.397**	**0.556**	**0.343**	**0.377**	**0.154**	0.0560 U	0.0200 U	**0.0400**	**26.9**	**4.96**	**1.65**	**7.45**	-	-	15.0	HH
Manganese	**3.85**	**291**	**69.0**	**77.6**	**6.74**	**4.50 J**	**2.50**	**3.25**	**6.25**	**4.20 J**	**0.810**	**2.07**	**53.2**	**780**	**1,260**	**36.8**	50.0	HH	880	HH
Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.0	HH
Dissolved Metals (µg/L)																				
Arsenic	**19.3**	**18.3**	-	**14.2**	**7.98**	**9.11**	**8.54**	**8.30**	0.500 U	**0.220 J**	**0.640**	0.500 U	0.500 U	**0.410 J**	**0.370 J**	0.500 U	0.0180	HH	0.0380	HH
Calcium	**42,000**	-	-	-	**9,510**	-	-	-	**12,300**	-	-	-	**98,000**	-	-	-	116,000	Eco	116,000	Eco
Iron	**14.6 J**	**534**	-	20.0 U	**20.1**	20.0 U	**7.50 J**	20.0 U	**5.80 J**	4.00 U	4.00 U	20.0 U	**8.80 J**	**13,200**	**29,600**	27.7 U	300	HH	1,000	Eco
Lead	**0.281**	**0.536**	-	**0.0160 J**	0.00900 U	0.0520 U	0.0230 U	**0.0270 J**	**0.0120 J**	0.0300 U	0.0200 U	0.00600 U	**3.50**	**1.62**	**0.372**	**3.16**	2.50	Eco	2.50	Eco
Magnesium	**2,810**	-	-	-	**1,210**	-	-	-	**4,200**	-	-	-	**7,550**	-	-	-	82,000	Eco	82,000	Eco
Manganese	**0.280**	**22.8**	-	**11.3**	**0.120**	**1.10 J**	0.400 U	**0.330**	**0.550**	**0.400 J**	0.400 U	**0.450**	**53.1**	**737**	**1,340**	**37.1**	50.0	HH	120	Eco
Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.770	Eco	0.770	Eco
Potassium	**4,620**	-	-	-	**5,020**	-	-	-	**808 J**	-	-	-	**3,750**	-	-	-	53,000	Eco	53,000	Eco
Sodium	**355,000**	-	-	-	**77,400**	-	-	-	**4,100**	-	-	-	**4,040**	-	-	-	680,000	Eco	680,000	Eco
Total Petroleum Hydrocarbons (µg/L)																				
Diesel Range Organics	12.0 U	-	**480**	-	110 U	110 U	13.0 U	**19.0 J**	110 U	110 U	**13.0 J**	**23.0 J**	120 U	**130**	**120**	**210**	-	-	90.0	HH
Residual Range Organics	21.0 U	-	**200**	-	110 U	110 U	120 U	**57.0 J**	110 U	110 U	110 U	**51.0 J**	110 U	140 U	**160**	**160**	-	-	290	HH
Gasoline Range Organics	13.0 U	13.0 U	**14.0 J**	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	**18.0 J**	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	-	-	100	HH
Total Butyltins (µg/L)																				
Dibutyltin	0.00810 U	-	-	-	0.00810 U	0.00730 U	0.00730 U	0.00730 U	**0.0150 J**	**0.0910 J**	0.00730 U	0.00730 U	0.00810 U	**0.110 J**	0.00730 U	0.00730 U	0.0630	Eco	0.0630	Eco
Monobutyltin	0.0110 U	-	-	-	0.0110 U	**0.0290 J**	0.0290 U	0.0290 U	0.0110 U	0.0290 UJ	0.0290 U	0.0290 U	0.0110 U	0.0290 UJ	0.0290 U	0.0290 U	0.0630	Eco	0.0630	Eco
Total Volatile Organic Compounds (µg/L)																				
Chloroform	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	**2.20**	**0.100 J**	0.0820 U	**3.70**	5.70	HH	0.190	HH
Tetrachloroethene (PCE)	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	**6.80**	**7.20**	**5.90**	**5.70**	**0.250 J**	0.0970 U	0.0970 U	**0.230 J**	0.690	HH	0.0930	HH
Vinyl Chloride	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	**0.410 J**	**0.330 J**	0.0440 U	0.0250	HH	0.0250	HH
Total Semivolatile Organic Compounds (µg/L)																				
1,4-Dichlorobenzene	0.0310 U	-	-	-	0.0290 U	0.0290 U	0.0310 UJ	0.0330 U	0.0300 U	0.0320 U	0.0300 UJ	0.0300 U	0.0310 U	0.0290 U	0.0300 UJ	0.0340 U	15.0	Eco	0.420	HH
4-Nitrophenol	0.300 U	-	-	-	0.280 U	0.280 U	0.300 U	0.320 U	0.290 U	0.310 U	0.290 U	0.290 U	0.300 U	0.280 U	0.290 U	0.330 U	150	Eco	150	Eco
Phenanthrene	0.0230 U	-	-	-	0.0220 U	0.0220 U	0.0240 U	0.0250 U	0.0230 U	0.0240 U	0.0230 U	0.0230 U	0.0240 U	0.0220 U	0.0230 U	0.0260 U	6.30	Eco	0.140	HH
Phenol	0.0660 U	-	-	-	0.0630 U	0.0630 U	0.0680 U	0.0700 U	0.0650 U	0.0690 U	0.0650 U	0.0650 U	0.0670 U	0.0630 U	0.0640 U	0.0740 U	110	Eco	110	Eco
General Chemistry Parameters (mg/L)																				
Dissolved Bromide	**0.0720 J**	-	-	-	0.0100 U	-	-	-	0.0100 U	-	-	-	0.0100 U	-	-	-	-	-	-	-
Dissolved Chloride	**5.30**	-	-	-	**3.80**	-	-	-	**0.900**	-	-	-	**1.60**	-	-	-	230	Eco	230	Eco
Dissolved Fluoride	**0.500**	-	-	-	**0.0600 J**	-	-	-	0.200 U	-	-	-	**0.121 J**	-	-	-	-	-	1.50	HH
Dissolved Sulfate	**708**	-	-	-	**93.8**	-	-	-	**4.20**	-	-	-	**7.70**	-	-	-	-	-	-	-
Dissolved Ammonia	0.0500 U	-	-	-	0.0500 U	-	-	-	**0.100**	-	-	-	0.0500 U	-	-	-	-	-	-	-
Dissolved Nitrate+Nitrite	**0.470**	-	-	-	**0.0260 J**	-	-	-	**0.570**	-	-	-	**0.320**	-	-	-	-	-	10.0	HH
Total Organic Carbon	**2.80**	-	-	-	**1.30**	-	-	-	**1.80**	-	-	-	**3.90**	-	-	-	-	-	-	-
Dissolved Organic Carbon	**2.80**	-	-	-	**1.30**	-	-	-	**1.70**	-	-	-	**4.10 J**	-	-	-	-	-	-	-
Dissolved Bicarbonate as CaCO3	**66.0**	-	-	-	**96.0**	-	-	-	**44.0**	-	-	-	**287**	-	-	-	-	-	-	-
Dissolved Carbonate as CaCO3	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	-	-	-	-

Notes:

µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-2b
2008-2009 Landfill AOPC Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Volatile Organic Compounds, Semivolatile Organic Compounds, and General Chemistry Parameters
(Page 2 of 3)

Site ID	MW-05	MW-05	MW-05	MW-05	MW-06	MW-06*	MW-06*	MW-06*	MW-07*	MW-07	MW-07	MW-07	MW-08	MW-08	MW-08	MW-08	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080416MW5 GW	080716MW5GW	081022MW5GW	090114MW5GW	080417MW6 GW	080716MW6GW	081022MW6GW	090114MW6GW	080416MW7 GW	080717MW07GW	081021MW7GW	090112MW7GW	080418MW8GW	080716MW8GW	081023MW8GW	090115MW8GW				
Sample Date	4/16/2008	7/16/2008	10/22/2008	1/14/2009	4/17/2008	7/16/2008	10/22/2008	1/14/2009	4/16/2008	7/17/2008	10/21/2008	1/12/2009	4/18/2008	7/16/2008	10/23/2008	1/15/2009				
Sample Depth (Feet btc)	30	30	30	32	28	28	28	30	28	30	20	20	58	55.5	55	57				
Sample Depth (Feet btc)	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater				
Total Metals (µg/L)																				
Arsenic	**2.65**	**2.85**	**4.16**	**2.30**	**2.69**	**3.21**	**3.50**	**2.90**	**15.9**	**16.8**	**17.4**	**18.7**	**6.86**	**5.76**	**5.40**	**7.20**	0.0180	HH	0.0380	HH
Iron	**19,300**	**21,500**	**25,100**	**21,300**	**25,100**	**23,800**	**25,850**	**28,150**	**29,000**	**30,700**	**36,600**	**35,700**	**854**	**631**	33.7 U	**112**	300	HH	26,000	HH
Lead	**0.442**	0.0740 U	0.0680 U	**0.102**	**0.0560**	0.0300 U	0.0200 U	0.00600 U	**0.272**	0.136 U	0.0380 U	**0.129**	**0.463**	**0.540**	**0.338**	**0.140**	-	-	15.0	HH
Manganese	**2,210**	**2,460**	**2,840**	**4,220**	**3,280**	**2,930**	**3,110**	**5,385**	**1,445**	**1,710**	**2,000**	**3,300**	**265**	**173**	**172**	**270**	50.0	HH	880	HH
Mercury	-	-	0.0500 U	-	-	-	0.0500 U	-	-	-	0.0500 U	-	**0.0300 J**	-	-	-	-	-	11.0	HH
Dissolved Metals (µg/L)																				
Arsenic	**2.52**	**2.97**	**3.68**	**2.30**	**2.33**	**3.18**	**3.54**	**2.90**	**10.7**	**14.7**	**15.7**	**16.7**	**7.92**	**5.65**	**5.24**	**7.10**	0.0180	HH	0.0380	HH
Calcium	**66,300**	-	-	-	**76,600**	-	-	-	**43,100**	-	-	-	**172,000**	-	-	-	116,000	Eco	116,000	Eco
Iron	**18,800**	**19,800**	**24,400**	**19,900**	**24,200**	**22,750**	**25,650**	**27,150**	**25,650**	**27,900**	**35,400**	**33,800**	**5.80 J**	20.0 U	**8.90 J**	4.00 U	300	HH	1,000	Eco
Lead	**0.0140 J**	0.0300 U	0.0200 U	**0.0130 J**	**0.0170 J**	0.00600 U	0.00600 U	0.00600 U	0.00900 U	0.00600 U	0.0200 U	0.0300 U	0.00900 U	0.0460 U	**0.227**	**0.0130 J**	2.50	Eco	2.50	Eco
Magnesium	**21,800**	-	-	-	**25,800**	-	-	-	**16,850**	-	-	-	**13,000**	-	-	-	82,000	Eco	82,000	Eco
Manganese	**2,200**	**2,360**	**2,760**	**3,790**	**3,200**	**3,015**	**3,115**	**5,545**	**1,455**	**1,650**	**1,940**	**3,410**	**238**	**151**	**172**	**266**	50.0	HH	120	Eco
Mercury	-	-	0.0500 U	-	-	-	0.0500 U	-	-	-	0.0500 U	-	0.0300 U	-	-	-	0.770	Eco	0.770	Eco
Potassium	**7,310**	-	-	-	**7,240**	-	-	-	**3,195**	-	-	-	**12,900**	-	-	-	53,000	Eco	53,000	Eco
Sodium	**15,400**	-	-	-	**41,300**	-	-	-	**7,340**	-	-	-	**740,000**	-	-	-	680,000	Eco	680,000	Eco
Total Petroleum Hydrocarbons (µg/L)																				
Diesel Range Organics	**490**	**980**	**730**	**970**	**360**	**465**	**395**	**515**	110 U	110 U	**97.0 J**	**77.0 J**	**15.0 J**	**110**	**440**	**53.0 J**	-	-	90.0	HH
Residual Range Organics	**180**	**370**	**260**	**330**	120 U	**230**	170 U	**140**	110 U	110 U	130 U	**80.0 J**	22.0 U	100 U	**150**	**52.0 J**	-	-	290	HH
Gasoline Range Organics	**120 J**	**110 J**	**32.0 J**	**90.0 J**	**30.0 J**	**35.5 J**	**30.0 J**	**29.5 J**	**13.0 J**	13.0 U	13.0 U	13.0 U	13.0 U	**14.0 J**	**13.0 J**	13.0 U	-	-	100	HH
Total Butyltins (µg/L)																				
Dibutyltin	0.00810 U	0.00730 U	0.00730 U	0.00730 U	0.00810 U	0.00730 U	0.00730 U	0.00730 U	0.00810 U	**0.130 J**	0.00730 U	0.00730 U	0.00810 U	0.00730 U	0.00730 U	**0.0130 J**	0.0630	Eco	0.0630	Eco
Monobutyltin	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 UJ	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0630	Eco	0.0630	Eco
Total Volatile Organic Compounds (µg/L)																				
Chloroform	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	5.70	HH	0.190	HH
Tetrachloroethene (PCE)	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.0970 U	0.690	HH	0.0930	HH
Vinyl Chloride	**0.180 J**	**0.310 J**	**0.390 J**	**0.250 J**	**0.160 J**	**0.170 J**	**0.160 J**	**0.205 J**	**0.955**	**0.880**	**0.340 J**	**0.680**	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0250	HH	0.0250	HH
Total Semivolatile Organic Compounds (µg/L)																				
1,4-Dichlorobenzene	0.0290 U	0.0290 U	0.0290 UJ	0.0290 U	0.0290 U	0.0290 U	0.0310 UJ	0.0300 U	0.0310 U	0.0290 U	0.0320 U	0.0310 U	0.0330 U	0.0290 U	0.0290 UJ	0.0290 U	15.0	Eco	0.420	HH
4-Nitrophenol	0.280 U	0.280 U	0.280 U	0.280 U	0.280 U	0.280 U	0.300 U	0.290 U	0.300 U	0.280 U	0.310 U	0.300 U	0.320 U	0.280 U	0.280 U	0.280 U	150	Eco	150	Eco
Phenanthrene	**0.210**	**0.300**	0.0220 U	0.0220 U	0.0220 U	0.0220 U	0.0230 U	0.0230 U	0.0240 U	0.0220 U	0.0240 U	0.0240 U	0.0250 U	0.0220 U	**3.90**	0.0220 U	6.30	Eco	0.140	HH
Phenol	0.0630 U	0.0630 U	0.0630 U	0.0630 U	0.0630 U	0.0630 U	0.0660 U	0.0640 U	0.0670 U	0.0630 U	0.0690 U	0.0670 U	0.0710 U	0.0630 U	0.0630 U	0.0630 U	110	Eco	110	Eco
General Chemistry Parameters (mg/L)																				
Dissolved Bromide	**0.0200 J**	-	-	-	**0.0290 J**	-	-	-	0.0100 U	-	-	-	**0.0490 J**	-	-	-	-	-	-	-
Dissolved Chloride	**4.70**	-	-	-	**22.6**	-	-	-	**1.40**	-	-	-	**13.5**	-	-	-	230	Eco	230	Eco
Dissolved Fluoride	**0.120 J**	-	-	-	**0.200**	-	-	-	**0.300**	-	-	-	0.0120 U	-	-	-	-	-	1.50	HH
Dissolved Sulfate	**1.70**	-	-	-	**13.7**	-	-	-	**1.30**	-	-	-	**1,790**	-	-	-	-	-	-	-
Dissolved Ammonia	**1.51**	-	-	-	**1.16**	-	-	-	**0.690**	-	-	-	**0.300**	-	-	-	-	-	-	-
Dissolved Nitrate+Nitrite	0.00500 UJ	-	-	-	**0.150**	-	-	-	0.00500 U	-	-	-	0.00500 U	-	-	-	-	-	10.0	HH
Total Organic Carbon	**9.40**	-	-	-	**9.30**	-	-	-	**7.05**	-	-	-	**2.80**	-	-	-	-	-	-	-
Dissolved Organic Carbon	**8.70 J**	-	-	-	**9.30**	-	-	-	**7.55 J**	-	-	-	**2.90**	-	-	-	-	-	-	-
Dissolved Bicarbonate as CaCO3	**305**	-	-	-	**356**	-	-	-	**196**	-	-	-	**44.0**	-	-	-	-	-	-	-
Dissolved Carbonate as CaCO3	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	-	-	-	-

Notes:

µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-2b
2008-2009 Landfill AOPC Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Volatile Organic Compounds, Semivolatile Organic Compounds, and General Chemistry Parameters
(Page 3 of 3)

Site ID	MW-09	MW-09	S2	S2	S2	S2	S4	S4	S4	S4	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080417MW9GW	090114MW9GW	08041852SP	08041852SW	090111S2SP	090111S2SW	08041754 SP	08041754 SW	090111S4SP	090111S4SW				
Sample Date	4/17/2008	1/14/2009	4/18/2008	4/18/2008	1/11/2009	1/11/2009	4/17/2008	4/17/2008	1/11/2009	1/11/2009				
Sample Depth (Feet btc)	15.5	15	0.0	1.0	0.0	0.5	0.0	1.0	0.0	0.5				
Sample Depth (Feet btc)	Groundwater	Groundwater	Seep Water	Surface Water	Seep Water	Surface Water	Seep Water	Surface Water	Seep Water	Surface Water				
Total Metals (µg/L)														
Arsenic	0.720 U	0.500 U	1.01 U	1.10 U	**0.500**	**0.900**	**12.8**	**1.17**	**1.10**	**0.800**	0.0180	HH	0.0380	HH
Iron	**2,550**	**532**	**5,300**	**251**	**433**	**167**	**121,000**	**446**	**271**	**188**	300	HH	26,000	HH
Lead	**0.718**	**0.871**	**2.23**	**0.243**	**0.342**	**0.105**	**25.7**	**0.407**	**0.113**	**0.289**	-	-	15.0	HH
Manganese	**103**	**10.4**	**75.0**	**11.1**	**15.5**	**6.37**	**3,240**	**13.6**	**8.90**	**5.90**	50.0	HH	880	HH
Mercury	**0.0300 J**	-	**0.0300 J**	0.0300 U	-	-	-	-	-	-	-	-	11.0	HH
Dissolved Metals (µg/L)														
Arsenic	**1.40**	0.500 U	0.520 U	**1.01**	**0.500**	**0.800**	**1.00**	**0.870**	**1.00**	**0.800**	0.0180	HH	0.0380	HH
Calcium	**11,600**	-	**22,600**	**20,500**	-	-	**76,400**	**19,900**	-	-	116,000	Eco	116,000	Eco
Iron	**176**	20.0 U	**14.9 J**	4.00 U	20.0 U	20.0 U	**9.70 J**	**9.20 J**	20.0 U	20.0 U	300	HH	1,000	Eco
Lead	**0.107**	**0.0440**	**0.0650**	**0.0160 J**	0.0300 U	**0.0100 J**	**0.0180 J**	0.00900 U	**0.00800 J**	**0.0100 J**	2.50	Eco	2.50	Eco
Magnesium	**2,560**	-	**5,070**	**6,330**	-	-	**16,600**	**6,190**	-	-	82,000	Eco	82,000	Eco
Manganese	**48.9**	**10.4**	**5.41**	**0.490**	0.160 U	**1.01**	**1.99**	**0.560**	0.140 U	**0.930**	50.0	HH	120	Eco
Mercury	0.0300 U	-	0.0300 U	0.0300 U	-	-	-	-	-	-	0.770	Eco	0.770	Eco
Potassium	**2,680**	-	**771 J**	**1,490 J**	-	-	**4,160**	**1,510 J**	-	-	53,000	Eco	53,000	Eco
Sodium	**11,800**	-	**19,700**	**7,900**	-	-	**6,680**	**7,630**	-	-	680,000	Eco	680,000	Eco
Total Petroleum Hydrocarbons (µg/L)														
Diesel Range Organics	**65.0 J**	**110 J**	13.0 U	12.0 U	**29.0 J**	**26.0 J**	120 U	120 U	**130**	**30.0 J**	-	-	90.0	HH
Residual Range Organics	**130**	**130**	23.0 U	20.0 U	110 U	100 U	120 U	120 U	**130**	100 U	-	-	290	HH
Gasoline Range Organics	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	-	-	100	HH
Total Butyltins (µg/L)														
Dibutyltin	0.00810 U	0.00730 U	0.00810 U	0.00810 U	0.00730 U	0.00730 U	0.00810 U	0.00810 U	0.00730 U	0.00730 U	0.0630	Eco	0.0630	Eco
Monobutyltin	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0110 U	0.0290 U	0.0290 U	0.0630	Eco	0.0630	Eco
Total Volatile Organic Compounds (µg/L)														
Chloroform	**0.220 J**	**0.450 J**	0.0820 U	0.0820 U	0.0820 U	0.0820 U	**0.740**	0.0820 U	**2.80**	0.0820 U	5.70	HH	0.190	HH
Tetrachloroethene (PCE)	**2.60**	**4.80**	**0.150 J**	0.0970 U	0.0970 U	0.0970 U	**1.70**	0.0970 U	**4.40**	0.0970 U	0.690	HH	0.0930	HH
Vinyl Chloride	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0250	HH	0.0250	HH
Total Semivolatile Organic Compounds (µg/L)														
1,4-Dichlorobenzene	0.0290 U	0.0310 U	0.0330 U	0.0290 U	0.0300 U	0.0290 U	0.0290 U	0.0310 U	0.0300 U	0.0290 U	15.0	Eco	0.420	HH
4-Nitrophenol	0.280 U	0.300 U	0.320 U	0.280 U	0.290 U	0.280 U	0.280 U	0.300 U	0.290 U	0.280 U	150	Eco	150	Eco
Phenanthrene	0.0220 U	0.0240 U	0.0250 U	0.0220 U	0.0230 U	0.0220 U	0.0220 U	0.0230 U	0.0230 U	0.0220 U	6.30	Eco	0.140	HH
Phenol	0.0630 U	0.0670 U	0.0710 U	0.0630 U	0.0650 U	0.0630 U	0.0630 U	0.0660 U	0.0640 U	0.0630 U	110	Eco	110	Eco
General Chemistry Parameters (mg/L)														
Dissolved Bromide	0.0100 U	-	0.0100 U	0.0100 U	-	-	0.0100 U	0.0100 U	-	-	-	-	-	-
Dissolved Chloride	**0.900**	-	**1.10**	**3.70**	-	-	**1.60**	**3.70**	-	-	230	Eco	230	Eco
Dissolved Fluoride	0.0120 U	-	**0.0310 J**	**0.147 J**	-	-	**0.0930 J**	**0.150 J**	-	-	-	-	1.50	HH
Dissolved Sulfate	**16.2**	-	**13.6**	**14.5**	-	-	**20.4**	**14.4**	-	-	-	-	-	-
Dissolved Ammonia	**0.0800**	-	0.0500 U	0.0500 U	-	-	0.0500 U	0.0500 U	-	-	-	-	-	-
Dissolved Nitrate+Nitrite	**0.00700 J**	-	**1.11**	**0.360**	-	-	**0.180**	**0.440**	-	-	-	-	10.0	HH
Total Organic Carbon	**4.50**	-	**2.50**	**2.10**	-	-	**3.40**	**2.00**	-	-	-	-	-	-
Dissolved Organic Carbon	**6.10 J**	-	**2.50**	**2.30 J**	-	-	**3.50 J**	**2.10 J**	-	-	-	-	-	-
Dissolved Bicarbonate as CaCO3	**46.0**	-	**102**	**76.0**	-	-	**256**	**76.0**	-	-	-	-	-	-
Dissolved Carbonate as CaCO3	1.00 U	-	1.00 U	1.00 U	-	-	1.00 U	1.00 U	-	-	-	-	-	-

Notes:

µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3a
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Pesticides, and General Chemistry Parameters
(Page 1 of 2)

Site ID	LD-01	LD-01	LD-02	LD-02	LD-03	LD-03	LD-04	LD-04	LD-05	LD-05	LD-06	LD-07	LD-08	LD-09	LD-10	LD-11*	Selected SLV (0-3 ft bgs)	SLV Source (0-3 ft bgs)
Sample ID	090320-LD-1So-0-1	090320-LD-1So-1-3	090320-LD-2So-0-1	090320-LD-2So-1-3	090320-LD-3So-0-1	090320-LD-3So-1-3	090320-LD-4So-0-1	090320-LD-4So-1-3	090320-LD-5So-0-1	090320-LD-5So-1-3	090319-LD-6-So	090319-LD-7-So	090319-LD-8-So	090319-LD-9-So	090319-LD-10-So	090319-LD-11-So		
Sample Date	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17		
PCB Aroclors (µg/kg dry)																		
Aroclor 1016	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1221	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1232	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1242	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1248	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1254	700	23.0	280	16.0	160	11.0	2.10 U	2.10 U	1,500	230	2.10 U	2.10 U	2.10 U	2.10 U	1,700	475	371	Eco
Aroclor 1260	690	22.0	130	18.0	160	11.0	2.10 U	2.10 U	480	130	50.0	660 J	2.10 U	7.50 J	440	215	371	Eco
Aroclor 1262	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Aroclor 1268	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	11.0 U	2.10 U	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	1390	45.0	410	34.0	320	22.0	4.20 U	4.20 U	1980	360	52.1 J	662 J	4.20 U	9.60 J	2140	690	371	Eco
Metals (mg/kg dry)																		
Aluminum	10,100	15,400	12,200	16,200	9,960	15,600	12,200	15,000	16,100	17,400	6,360	12,100	24,300	18,600	12,800	21,100	31,400	UPL
Antimony	1.72 J	0.140 J	1.07 J	0.0900 J	0.310 J	0.0800 J	0.130 J	0.0700 J	0.560 J	0.170 J	0.360 U	0.540 J	0.160 U	0.170 U	0.830 J	0.455 J	0.270	Eco
Arsenic	5.89	7.26	5.79	5.30	2.96	5.70	3.86	6.44	5.04	5.80	1.86	5.50	4.81	4.22	15.0	7.63	5.40	UPL
Barium	95.3	103	114	91.3	70.4	85.1	111	93.7	113	138	72.3	93.6	109	101	104	133	330	Eco
Beryllium	0.240 J	0.470 J	0.260 J	0.530 J	0.320 J	0.370 J	0.350 J	0.410 J	0.370 J	0.500 J	0.230 J	0.290 J	0.630 J	0.520 J	0.280 J	0.505 J	21.0	Eco
Cadmium	6.45	0.259	7.92	0.154	1.31	0.134	0.235	0.0770	17.3	0.383	0.379	4.88	0.146	0.276	3.98	7.73	0.360	Eco
Calcium	5,060 J	7,120 J	5,240 J	7,850 J	5,290 J	8,080 J	6,400 J	7,470 J	7,290 J	9,030 J	4,520 J	7,610 J	10,700 J	9,680 J	5,520 J	8,840 J	10,400	UPL
Chromium	94.9 J	19.5 J	49.5 J	17.3 J	33.3 J	15.4 J	12.0 J	16.8 J	35.7 J	29.3 J	169 J	33.1 J	18.6 J	22.5 J	129 J	80.7 J	28.1	UPL
Cobalt	12.8	16.1	13.4	15.6	10.0	15.9	10.6	14.4	13.3	18.4	10.6	12.5	15.7	16.2	12.7	18.6	19.9	UPL
Copper	189 J	60.6 J	195 J	60.5 J	103 J	55.4 J	32.6 J	51.7 J	165 J	64.8 J	30.8 J	73.7 J	71.4 J	57.2 J	298 J	158 J	56.7	UPL
Iron	44,800	29,000	42,400	29,900	26,700	28,000	28,000	27,200	40,400	32,500	28,400	33,100	33,000	30,800	39,300	41,400	36,900	UPL
Lead	765	26.5	963	11.6	233	18.7	279	13.4	311	34.9	591	988	15.4	80.1	408	95.8	25.5	UPL
Magnesium	6,250	8,060	5,590	8,920	5,020	9,490	6,020	8,140	7,470	10,700	8,260	6,070	13,700	10,300	7,100	10,600	12,400	UPL
Manganese	526	512	614	466	391	460	360	430	500	487	342	526	789	678	508	598	885	UPL
Mercury	0.497	0.0470	0.267	0.0330	0.0940	0.0400	0.0170 J	0.0570	0.723	0.106	0.0480	0.0370	0.0650	0.0490	0.358	0.124	0.0660	UPL
Nickel	57.7 J	20.4 J	41.5 J	20.8 J	26.3 J	25.2 J	16.7 J	19.4 J	42.2 J	35.3 J	61.8 J	26.3 J	24.4 J	24.3 J	71.9 J	57.0 J	38.0	Eco
Potassium	610	895	636	809	429	705	630	860	835	1,010	580	1,230	1,480	1,250	827	1,100	2,050	UPL
Selenium	0.800 J	0.700 J	0.900 J	0.800 J	0.500 J	0.600 J	0.800 J	0.600 J	0.600 J	0.700 J	0.500 U	0.600 J	0.600 J	0.700 J	0.800 J	0.750 J	0.520	Eco
Silver	0.376	0.0700 J	0.406	0.0550 J	0.135	0.0450 J	0.0660	0.0520 J	0.431	0.0650	0.107	0.148	0.0740	0.0880	0.270	0.128	4.20	Eco
Sodium	413	391	391	382	373	547	453	365	470	461	269	285	350	444	433	459	341	UPL
Thallium	0.0790	0.115	0.0940	0.0940	0.0580	0.104	0.0830	0.126	0.0920	0.108	0.0340	0.104	0.112	0.120	0.212	0.124	1.00	Eco
Vanadium	67.7	68.1	74.0	66.6	68.9	63.4	84.7	69.4	75.0	77.5	67.3	65.0	62.4	75.0	72.9	80.0	104	UPL
Zinc	377 J	61.6 J	456 J	59.4 J	164 J	58.8 J	56.6 J	50.0 J	210 J	75.2 J	132 J	548 J	65.5 J	70.2 J	412 J	219 J	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)																		
Diesel Range Organics	260	6.30 J	410	7.50 J	85.0	50.0	5.90 J	5.90 J	160	14.0 J	61.0	170	3.60 J	13.0 J	260	38.5	23,000	HH
Residual Range Organics	1,300	25.0 J	2,300	23.0 J	860	82.0 J	21.0 J	16.0 J	270	52.0 J	290	430	30.0 J	85.0 J	1,200	170	40,000	HH
Gasoline Range Organics	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.60 J	3.40 J	1.50 U	1.50 U	3.10 J	1.50 U	13,000	HH
Butyltins (µg/kg dry)																		
Dibutyltin	5.80	0.290 U	4.80	0.280 U	2.50	0.290 U	0.270 U	0.270 U	1.20 J	0.300 U	5.70	13.0	0.310 U	0.800 J	3.40	0.290 U	28,000	Eco
Monobutyltin	2.20	0.250 U	1.60	0.250 U	0.570 J	0.250 U	0.240 U	0.240 U	1.10 J	0.260 U	2.10	2.10	0.270 U	0.420 J	2.50	0.900 J	28,000	Eco
Tributyltin	3.00	0.360 U	1.80	0.350 U	0.340 U	0.360 U	0.340 U	0.340 U	0.340 U	0.370 U	36.0	0.440 U	0.390 U	0.400 U	3.10	0.360 U	28,000	Eco

Table 6-3a
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Pesticides, and General Chemistry Parameters
(Page 2 of 2)

Site ID	LD-01	LD-01	LD-02	LD-02	LD-03	LD-03	LD-04	LD-04	LD-05	LD-05	LD-06	LD-07	LD-08	LD-09	LD-10	LD-11*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090320-LD-1So-0-1	090320-LD-1So-1-3	090320-LD-2So-0-1	090320-LD-2So-1-3	090320-LD-3So-0-1	090320-LD-3So-1-3	090320-LD-4So-0-1	090320-LD-4So-1-3	090320-LD-5So-0-1	090320-LD-5So-1-3	090319-LD-6-So	090319-LD-7-So	090319-LD-8-So	090319-LD-9-So	090319-LD-10-So	090319-LD-11-So		
Sample Date	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17		
Pesticides (µg/kg dry)																		
4,4'-DDD	1.90 U	0.110 U	0.640 U	0.140 U	**0.690 J**	0.570 U	0.110 U	0.110 U	3.40 U	0.200 U	**0.990 J**	10.0 U	0.110 U	0.110 U	5.00 U	0.550 U	21.0	Eco
4,4'-DDE	5.00 U	0.190 U	7.80 U	0.640 U	4.40 U	1.00 U	0.110 U	0.110 U	5.10 U	0.970 U	0.610 U	5.00 U	0.110 U	**0.610 J**	0.550 U	1.70 U	21.0	Eco
4,4'-DDT	**130**	**3.00**	**28.0**	**2.80**	**24.0**	**2.40**	**0.840 J**	0.170 U	**140**	**27.0**	5.10 U	78.0 U	0.270 U	**1.80**	**140**	**53.0**	21.0	Eco
Aldrin	**4.40 J**	0.160 U	1.00 U	0.160 U	0.980 U	0.160 U	0.160 U	0.160 U	0.800 U	0.160 U	0.800 U	5.00 U	0.160 U	0.160 U	5.00 U	0.160 U	4.90	Eco
BHC (alpha)	0.550 U	0.110 U	1.00 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.550 U	0.110 U	0.550 U	0.550 U	0.110 U	0.110 U	0.550 U	0.110 U	340	HH
BHC (beta)	0.900 U	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	0.900 U	0.180 U	0.900 U	0.900 U	0.180 U	0.180 U	0.900 U	0.180 U	960	HH
BHC (delta)	0.380 U	0.0740 U	0.490 U	0.0740 U	0.200 U	0.0740 U	0.0740 U	0.0740 U	0.370 U	0.0740 U	0.370 U	0.370 U	0.0740 U	0.0740 U	5.00 U	0.0740 U	340	HH
BHC (gamma) Lindane	0.400 U	0.0800 U	1.00 U	0.0800 U	0.980 U	0.0800 U	0.0800 U	0.0800 U	0.400 U	**0.200 J**	0.400 U	5.00 U	0.0800 U	0.120 U	37.0 U	0.0800 U	2,000	HH
Chlordane (alpha)	**1.50 J**	0.100 U	0.470 U	0.100 U	**0.660 J**	0.100 U	0.100 U	0.100 U	0.810 U	0.100 U	**0.860 J**	0.800 U	0.100 U	0.100 U	5.00 U	0.100 U	7,200	HH
Chlordane (gamma)	**40.0**	**0.760 J**	**12.0**	**0.890 J**	**7.60**	**0.610 J**	0.0900 U	0.0900 U	**86.0**	**9.20**	5.00 U	9.90 U	0.0900 U	1.00 U	**97.0**	**19.5**	7,200	HH
Dieldrin	8.70 U	1.00 U	3.90 U	1.00 U	1.90 U	1.00 U	0.140 U	0.140 U	31.0 U	3.60 U	0.700 U	18.0 U	0.140 U	1.00 U	31.0 U	5.70 U	4.90	Eco
Endosulfan I	5.00 U	0.0630 U	1.00 U	**0.260 J**	**2.20**	**0.140 J**	0.0630 U	0.0630 U	9.50 U	**2.00**	0.740 U	5.00 U	0.0660 U	0.0630 U	8.30 U	**6.45**	20,000	Eco
Endosulfan II	5.60 U	0.140 U	8.40 U	0.140 U	0.980 U	0.290 U	0.140 U	0.140 U	4.90 U	0.970 U	0.700 U	5.00 U	0.140 U	0.140 U	5.00 U	1.00 U	20,000	Eco
Endosulfan Sulfate	2.50 U	0.110 U	**1.80**	0.110 U	0.980 U	0.110 U	0.110 U	0.110 U	**0.630 J**	0.110 U	**1.70 J**	5.00 U	0.110 U	0.110 U	**3.30 J**	0.110 U	20,000	Eco
Endrin	5.00 U	0.0940 U	1.10 U	1.00 U	0.980 U	0.0940 U	0.0940 U	0.0940 U	**17.0**	**2.10**	0.470 U	6.80 U	0.0940 U	0.0940 U	**15.0**	**3.00 J**	4.90	Eco
Endrin Aldehyde	9.60 U	0.220 U	2.80 U	0.160 U	1.10 U	0.170 U	0.120 U	0.120 U	**16.0**	**1.90**	0.600 U	5.00 U	0.120 U	0.120 U	**11.0**	**4.40**	4.90	Eco
Endrin Ketone	20.0 U	1.00 U	2.90 U	1.00 U	2.70 U	0.170 U	0.0930 U	0.0930 U	**13.0**	0.690 U	5.00 U	21.0 U	0.0930 U	0.190 U	8.50 U	1.10 U	4.90	Eco
Heptachlor	0.600 U	0.120 U	0.530 U	0.120 U	**0.180 J**	0.120 U	0.120 U	0.120 U	4.90 U	0.120 U	0.600 U	**2.90 J**	0.120 U	0.120 U	5.00 U	0.120 U	480	HH
Heptachlor Epoxide	5.00 U	0.0840 U	1.50 U	0.0970 U	0.980 U	0.130 U	0.0840 U	0.0840 U	0.870 U	0.350 U	0.420 U	0.420 U	0.0840 U	0.0840 U	0.420 U	1.00 U	240	HH
Methoxychlor	6.90 U	0.190 U	**1.20**	1.00 U	**1.00**	0.190 U	0.190 U	0.190 U	4.90 U	0.970 U	2.00 U	5.10 U	0.190 U	0.190 U	4.40 U	1.00 U	500,000	Eco
Toxaphene	2,200 U	50.0 U	230 U	44.0 U	180 U	31.0 U	4.80 U	4.80 U	2,900 U	330 U	110 U	980 U	19.0 U	17.0 U	1,700 U	440 U	2,000	HH
General Chemistry Parameters (mg/kg)																		
Carbon, Total Organic	**29,900**	**3,000**	**35,900**	**1,300**	**17,600**	**1,300**	**1,000**	**1,100**	**7,400**	**1,500**	**13,200**	**26,600**	**9,500**	**30,600**	**52,800**	**9,550**	-	-
Solids, Total	**836,000**	**831,000**	**824,000**	**850,000**	**867,000**	**838,000**	**901,000**	**878,000**	**860,000**	**789,000**	**859,000**	**694,000**	**768,000**	**737,000**	**871,000**	**854,000**	-	-

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3b
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
Volatile Organic Compounds
(Page 1 of 2)

Site ID	LD-01	LD-01	LD-02	LD-02	LD-03	LD-03	LD-04	LD-04	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090320-LD-1So-0-1	090320-LD-1So-1-3	090320-LD-2So-0-1	090320-LD-2So-1-3	090320-LD-3So-0-1	090320-LD-3So-1-3	090320-LD-4So-0-1	090320-LD-4So-1-3		
Sample Date	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0		
Volatile Organic Compounds (µg/kg dry)										
1,1,1,2-Tetrachloroethane	0.190 U	0.180 U	0.180 U	0.180 U	0.210 U	0.180 U	0.180 U	0.180 U	9,300	HH
1,1,1-Trichloroethane (TCA)	0.160 U	0.150 U	0.150 U	0.150 U	0.170 U	0.150 U	0.150 U	0.150 U	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.0940 U	0.0890 U	0.0890 U	0.0890 U	0.110 U	0.0890 U	0.0890 U	0.0890 U	2,800	HH
1,1,2-Trichloroethane	0.0930 U	0.0880 U	0.0880 U	0.0880 U	0.100 U	0.0880 U	0.0880 U	0.0880 U	2,700	HH
1,1-Dichloroethane	0.0510 U	0.0480 U	0.0480 U	0.0480 U	0.0550 U	0.0480 U	0.0480 U	0.0480 U	5,900	HH
1,1-Dichloroethene	0.0740 U	0.0700 U	0.0700 U	0.0700 U	0.0800 U	0.0700 U	0.0700 U	0.0700 U	680,000	HH
1,1-Dichloropropene	0.160 U	0.150 U	0.150 U	0.150 U	0.170 U	0.150 U	0.150 U	0.150 U	8,100	HH
1,2,3-Trichlorobenzene	0.150 U	0.140 U	0.140 U	0.140 U	0.160 U	0.140 U	0.140 U	0.140 U	20,000	Eco
1,2,3-Trichloropropane	0.290 U	0.270 U	0.270 U	0.270 U	0.310 U	0.270 U	0.270 U	0.270 U	95.0	HH
1,2,4-Trichlorobenzene	0.240 U	0.220 U	0.220 U	0.220 U	0.250 U	0.220 U	0.220 U	0.220 U	20,000	Eco
1,2,4-Trimethylbenzene	**0.110 J**	0.0930 U	0.0930 U	**0.110 J**	0.110 U	**0.0980 J**	0.0930 U	0.0930 U	200,000	Eco
1,2-Dibromo-3-chloropropane	0.830 U	0.780 U	0.780 U	0.780 U	0.890 U	0.780 U	0.780 U	0.780 U	69.0	HH
1,2-Dibromoethane (EDB)	0.210 U	0.190 U	0.190 U	0.190 U	0.220 U	0.190 U	0.190 U	0.190 U	140	HH
1,2-Dichlorobenzene	0.0670 U	0.0630 U	0.0630 U	0.0630 U	0.0720 U	0.0630 U	0.0630 U	0.0630 U	2,260	Eco
1,2-Dichloroethane (EDC)	0.0570 U	0.0540 U	0.0540 U	0.0540 U	0.0620 U	0.0540 U	0.0540 U	0.0540 U	590	HH
1,2-Dichloropropane	0.0690 U	0.0650 U	0.0650 U	0.0650 U	0.0740 U	0.0650 U	0.0650 U	0.0650 U	4,500	HH
1,3,5-Trimethylbenzene	0.0430 U	0.0400 U	0.0400 U	0.0400 U	0.0460 U	0.0400 U	0.0400 U	0.0400 U	150,000	HH
1,3-Dichlorobenzene	0.0740 U	0.0700 U	0.0700 U	0.0700 U	0.0800 U	0.0700 U	0.0700 U	0.0700 U	2,260	Eco
1,3-Dichloropropane	0.0630 U	0.0590 U	0.0590 U	0.0590 U	0.0670 U	0.0590 U	0.0590 U	0.0590 U	20,000,000	HH
1,4-Dichlorobenzene	0.110 U	0.100 U	0.100 U	0.100 U	0.120 U	0.100 U	0.100 U	0.100 U	17,000	HH
2,2-Dichloropropane	0.110 U	0.100 U	0.100 U	0.100 U	0.120 U	0.100 U	0.100 U	0.100 U	4,500	HH
2-Butanone (MEK)	1.70 U	**4.30 J**	**12.0 J**	1.60 U	**4.90 J**	**2.40 J**	1.60 U	1.60 U	200,000,000	HH
2-Chlorotoluene	0.0540 U	0.0510 U	0.0510 U	0.0510 U	0.0580 U	0.0510 U	0.0510 U	0.0510 U	20,000,000	HH
2-Hexanone	0.830 U	0.780 U	0.780 U	0.780 U	0.890 U	0.780 U	0.780 U	0.780 U	1,250,000	Eco
4-Chlorotoluene	0.0980 U	0.0920 U	0.0920 U	0.0920 U	0.110 U	0.0920 U	0.0920 U	0.0920 U	72,000,000	HH
4-Isopropyltoluene	0.0880 U	0.0830 U	0.0830 U	0.0830 U	0.0940 U	0.0830 U	0.0830 U	0.0830 U	200,000	Eco
4-Methyl-2-pentanone (MIBK)	0.260 U	0.240 U	**0.330 J**	0.240 U	0.280 U	0.240 U	0.240 U	0.240 U	1,250,000	Eco
Acetone	**88.0**	**54.0**	**160**	**9.90 J**	**67.0**	**22.0**	**7.90 J**	**10.0 J**	1,250,000	Eco
Benzene	**0.490 J**	0.140 U	**0.340 J**	0.140 U	**0.180 J**	0.140 U	**0.210 J**	0.140 U	1,200	HH
Bromobenzene	0.0980 U	0.0920 U	0.0920 U	0.0920 U	0.110 U	0.0920 U	0.0920 U	0.0920 U	1,800,000	HH
Bromochloromethane	0.270 U	0.250 U	0.250 U	0.250 U	0.290 U	0.250 U	0.250 U	0.250 U	1,900	HH
Bromodichloromethane	0.0470 U	0.0440 U	0.0440 U	0.0440 U	0.0500 U	0.0440 U	0.0440 U	0.0440 U	1,900	HH
Bromoform	0.270 U	0.250 U	0.250 U	0.250 U	0.290 U	0.250 U	0.250 U	0.250 U	360,000	HH
Bromomethane	0.450 U	0.420 U	**0.480 J**	0.420 U	0.480 U	0.420 U	**4.40 J**	0.420 U	17,000	HH
Carbon Disulfide	**0.180 J**	**0.490 J**	**0.180 J**	**0.590 J**	**0.240 J**	**2.70 J**	**1.60 J**	**0.580 J**	1,000,000	Eco
Carbon Tetrachloride	0.0830 U	0.0780 U	0.0780 U	0.0780 U	0.0890 U	0.0780 U	0.0780 U	0.0780 U	630	HH
Chlorobenzene	0.0570 U	0.0540 U	0.0540 U	0.0540 U	0.0620 U	0.0540 U	0.0540 U	0.0540 U	40,000	Eco
Chloroethane	0.320 U	0.300 U	0.300 U	0.300 U	0.340 U	0.300 U	0.300 U	0.300 U	61,000,000	HH
Chloroform	0.0510 U	0.0480 U	0.0480 U	0.0480 U	0.0550 U	0.0480 U	0.0480 U	0.0480 U	410	HH
Chloromethane	0.0610 U	0.0570 U	0.0570 U	0.0570 U	0.0650 U	0.0570 U	0.0570 U	0.0570 U	300,000	HH
cis-1,2-Dichloroethene	0.0860 U	0.0810 U	0.0810 U	0.0810 U	0.0920 U	0.0810 U	0.0810 U	0.0810 U	2,500,000	Eco
cis-1,3-Dichloropropene	0.0330 U	0.0310 U	0.0310 U	0.0310 U	0.0360 U	0.0310 U	0.0310 U	0.0310 U	8,100	HH
Dibromochloromethane	0.170 U	0.160 U	0.160 U	0.160 U	0.190 U	0.160 U	0.160 U	0.160 U	34,000	HH
Dibromomethane	0.190 U	0.180 U	0.180 U	0.180 U	0.210 U	0.180 U	0.180 U	0.180 U	110,000	HH
Dichlorodifluoromethane	0.0760 U	0.0720 U	0.0720 U	0.0720 U	0.0820 U	0.0720 U	0.0720 U	0.0720 U	730,000	Eco
Dichloromethane (Methylene Chloride)	**0.280 J**	**0.280 J**	**0.370 J**	**0.300 J**	**0.460 J**	**0.630 J**	0.140 U	**0.310 J**	20,000	HH
Ethylbenzene	0.0440 U	0.0410 U	0.0410 U	0.0410 U	0.0470 U	0.0410 U	0.0410 U	0.0410 U	2,260	Eco
Hexachlorobutadiene	0.180 U	0.170 U	0.170 U	0.170 U	0.200 U	0.170 U	0.170 U	0.170 U	22,000	HH
Isopropylbenzene	0.0330 U	0.0310 U	0.0310 U	0.0310 U	0.0360 U	0.0310 U	0.0310 U	0.0310 U	2,260	Eco
m,p-Xylenes	0.0990 U	0.0930 U	0.0930 U	0.0930 U	0.110 U	0.0930 U	0.0930 U	0.0930 U	120,000	Eco
Naphthalene	0.340 U	0.320 U	0.320 U	0.320 U	0.370 U	0.320 U	**0.500 J**	0.320 U	23,000	HH
n-Butylbenzene	0.0930 U	0.0880 U	0.0880 U	0.0880 U	0.100 U	0.0880 U	0.0880 U	0.0880 U	-	-
n-Propylbenzene	0.0660 U	0.0620 U	0.0620 U	0.0620 U	0.0710 U	0.0620 U	0.0620 U	0.0620 U	2,260	Eco
o-Xylene	0.0630 U	0.0590 U	0.0590 U	0.0590 U	0.0670 U	0.0590 U	0.0590 U	0.0590 U	1,000	Eco
sec-Butylbenzene	0.0690 U	0.0650 U	0.0650 U	0.0650 U	0.0740 U	0.0650 U	0.0650 U	0.0650 U	2,260	Eco
Styrene	0.0810 U	0.0760 U	0.0760 U	0.0760 U	0.0860 U	0.0760 U	0.0760 U	0.0760 U	300,000	Eco
tert-Butylbenzene	0.0570 U	0.0540 U	0.0540 U	0.0540 U	0.0620 U	0.0540 U	0.0540 U	0.0540 U	2,260	Eco
Tetrachloroethene (PCE)	0.130 U	0.120 U	0.120 U	0.120 U	0.140 U	0.120 U	0.120 U	0.120 U	1,600	HH
Toluene	**0.460 J**	**0.110 J**	**0.340 J**	**0.120 J**	**0.240 J**	**0.150 J**	0.0440 U	**0.140 J**	200,000	Eco
trans-1,2-Dichloroethene	0.0510 U	0.0480 U	0.0480 U	0.0480 U	0.0550 U	0.0480 U	0.0480 U	0.0480 U	200,000	HH
trans-1,3-Dichloropropene	0.110 U	0.100 U	0.100 U	0.100 U	0.120 U	0.100 U	0.100 U	0.100 U	8,100	HH
Trichloroethene (TCE)	0.140 U	0.130 U	0.130 U	0.130 U	0.150 U	0.130 U	0.130 U	0.130 U	130	HH
Trichlorofluoromethane	0.0570 U	0.0540 U	0.0540 U	0.0540 U	0.0620 U	0.0540 U	0.0540 U	0.0540 U	730,000	Eco
Vinyl Acetate	0.640 U	0.600 U	0.600 U	0.600 U	0.680 U	0.600 U	0.600 U	0.600 U	4,100,000	HH
Vinyl Chloride	0.0610 U	0.0570 U	0.0570 U	0.0570 U	0.0650 U	0.0570 U	0.0570 U	0.0570 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3b
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
Volatile Organic Compounds
(Page 2 of 2)

Site ID	LD-05	LD-05	LD-06	LD-07	LD-08	LD-09	LD-10	LD-11*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090320-LD-5So-0-1	090320-LD-5So-1-3	090319-LD-6-So	090319-LD-7-So	090319-LD-8-So	090319-LD-9-So	090319-LD-10-So	090319-LD-11-So		
Sample Date	3/20/2009	3/20/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17		
Volatile Organic Compounds (µg/kg dry)										
1,1,1,2-Tetrachloroethane	0.180 U	0.190 U	0.190 U	0.220 U	0.200 U	0.220 U	0.240 U	0.230 U	9,300	HH
1,1,1-Trichloroethane (TCA)	**0.580 J**	0.160 U	0.160 U	0.180 U	0.170 U	0.190 U	0.200 U	**0.490 J**	38,000,000	HH
1,1,2,2-Tetrachloroethane	0.0890 U	0.0920 U	0.0920 U	0.110 U	0.0990 U	0.110 U	0.120 U	0.120 U	2,800	HH
1,1,2-Trichloroethane	0.0880 U	0.0910 U	0.0910 U	0.110 U	0.0970 U	0.110 U	0.120 U	0.120 U	2,700	HH
1,1-Dichloroethane	**0.290 J**	0.0500 U	0.0500 U	0.0580 U	0.0530 U	0.0590 U	0.0620 U	0.0610 U	5,900	HH
1,1-Dichloroethene	0.0700 U	0.0730 U	0.0720 U	0.0840 U	0.0780 U	0.0860 U	0.0910 U	0.0880 U	680,000	HH
1,1-Dichloropropene	0.150 U	0.160 U	0.160 U	0.180 U	0.170 U	0.190 U	0.200 U	0.190 U	8,100	HH
1,2,3-Trichlorobenzene	0.140 U	0.150 U	0.150 U	0.170 U	0.160 U	0.180 U	0.190 U	0.180 U	20,000	Eco
1,2,3-Trichloropropane	0.270 U	0.280 U	0.280 U	0.330 U	0.300 U	0.330 U	0.350 U	0.340 U	95.0	HH
1,2,4-Trichlorobenzene	0.220 U	0.230 U	0.230 U	0.270 U	0.250 U	0.270 U	0.290 U	0.280 U	20,000	Eco
1,2,4-Trimethylbenzene	**0.260 J**	**0.160 J**	**0.380 J**	**0.190 J**	**0.240 J**	0.120 U	0.120 U	**0.205 J**	200,000	Eco
1,2-Dibromo-3-chloropropane	0.780 U	0.810 U	0.810 U	0.940 U	0.860 U	0.960 U	1.10 U	0.980 U	69.0	HH
1,2-Dibromoethane (EDB)	0.190 U	0.200 U	0.200 U	0.230 U	0.210 U	0.240 U	0.250 U	0.240 U	140	HH
1,2-Dichlorobenzene	0.0630 U	0.0650 U	0.0650 U	0.0760 U	0.0700 U	0.0770 U	0.0820 U	0.0790 U	2,260	Eco
1,2-Dichloroethane (EDC)	0.0540 U	0.0560 U	0.0560 U	0.0650 U	0.0600 U	0.0660 U	0.0700 U	0.0680 U	590	HH
1,2-Dichloropropane	0.0650 U	0.0670 U	0.0670 U	0.0780 U	0.0720 U	0.0800 U	0.0840 U	0.0820 U	4,500	HH
1,3,5-Trimethylbenzene	**0.0930 J**	0.0420 U	**0.100 J**	0.0480 U	0.0450 U	0.0490 U	0.0520 U	0.0510 U	150,000	HH
1,3-Dichlorobenzene	0.0700 U	0.0730 U	0.0720 U	0.0840 U	0.0780 U	0.0860 U	0.0910 U	0.0880 U	2,260	Eco
1,3-Dichloropropane	0.0590 U	0.0610 U	0.0610 U	0.0710 U	0.0650 U	0.0720 U	0.0760 U	0.0740 U	20,000,000	HH
1,4-Dichlorobenzene	**0.160 J**	**0.140 J**	0.110 U	0.120 U	0.120 U	0.130 U	0.130 U	0.130 U	17,000	HH
2,2-Dichloropropane	0.100 U	0.110 U	0.110 U	0.120 U	0.120 U	0.130 U	0.130 U	0.130 U	4,500	HH
2-Butanone (MEK)	**13.0 J**	**2.30 J**	**14.0 J**	**13.0 J**	**12.0 J**	**15.0 J**	**32.0**	**8.80 J**	200,000,000	HH
2-Chlorotoluene	0.0510 U	0.0530 U	0.0530 U	0.0620 U	0.0570 U	0.0630 U	0.0660 U	0.0640 U	20,000,000	HH
2-Hexanone	0.780 U	0.810 U	0.810 U	0.940 U	0.860 U	0.960 U	1.10 U	0.980 U	1,250,000	Eco
4-Chlorotoluene	0.0920 U	0.0950 U	0.0950 U	0.120 U	0.110 U	0.120 U	0.120 U	0.120 U	72,000,000	HH
4-Isopropyltoluene	**0.350 J**	0.0860 U	**1.60 J**	**0.340 J**	**0.290 J**	**12.0 J**	**0.900 J**	0.110 U	200,000	Eco
4-Methyl-2-pentanone (MIBK)	**0.550 J**	0.250 U	**0.690 J**	**0.500 J**	0.270 U	0.300 U	**0.670 J**	**0.510 J**	1,250,000	Eco
Acetone	**150**	**18.0 J**	**150**	**180**	**150**	**250**	**330**	**124**	1,250,000	Eco
Benzene	**0.450 J**	0.150 U	**1.20 J**	**0.540 J**	**0.310 J**	0.220 U	**0.700 J**	**0.390 J**	1,200	HH
Bromobenzene	0.0920 U	0.0950 U	0.0950 U	0.120 U	0.110 U	0.120 U	0.120 U	0.120 U	1,800,000	HH
Bromochloromethane	0.250 U	0.260 U	0.260 U	0.300 U	0.280 U	0.310 U	0.330 U	0.320 U	1,900	HH
Bromodichloromethane	0.0440 U	0.0460 U	0.0460 U	0.0530 U	0.0490 U	0.0540 U	0.0570 U	0.0560 U	1,900	HH
Bromoform	0.250 U	0.260 U	0.260 U	0.300 U	0.280 U	0.310 U	0.330 U	0.320 U	360,000	HH
Bromomethane	**0.500 J**	**0.840 J**	0.440 U	**0.530 J**	**0.570 J**	0.520 U	0.550 U	0.530 U	17,000	HH
Carbon Disulfide	**0.530 J**	**1.40 J**	**1.60 J**	**0.750 J**	**6.90**	**0.830 J**	**0.360 J**	**0.715 J**	1,000,000	Eco
Carbon Tetrachloride	0.0780 U	0.0810 U	0.0810 U	0.0940 U	0.0860 U	0.0960 U	0.110 U	0.0980 U	630	HH
Chlorobenzene	0.0540 U	0.0560 U	0.0560 U	0.0650 U	0.0600 U	0.0660 U	0.0700 U	0.0680 U	40,000	Eco
Chloroethane	0.300 U	0.310 U	0.310 U	0.360 U	0.340 U	0.370 U	0.390 U	0.380 U	61,000,000	HH
Chloroform	0.0480 U	0.0500 U	0.0500 U	0.0580 U	0.0530 U	0.0590 U	0.0620 U	0.0610 U	410	HH
Chloromethane	0.0570 U	0.0590 U	0.0590 U	0.0690 U	0.0630 U	0.0700 U	0.0740 U	0.0720 U	300,000	HH
cis-1,2-Dichloroethene	0.0810 U	0.0840 U	0.0840 U	0.0970 U	0.0900 U	0.0990 U	0.110 U	0.110 U	2,500,000	Eco
cis-1,3-Dichloropropene	0.0310 U	0.0320 U	0.0320 U	0.0380 U	0.0350 U	0.0380 U	0.0400 U	0.0390 U	8,100	HH
Dibromochloromethane	0.160 U	0.170 U	0.170 U	0.200 U	0.180 U	0.200 U	0.210 U	0.210 U	34,000	HH
Dibromomethane	0.180 U	0.190 U	0.190 U	0.220 U	0.200 U	0.220 U	0.240 U	0.230 U	110,000	HH
Dichlorodifluoromethane	**16.0**	0.0750 U	**0.260 J**	0.0870 U	0.0800 U	0.0880 U	0.0930 U	**0.695 J**	730,000	Eco
Dichloromethane (Methylene Chloride)	**0.770 J**	**0.480 J**	0.150 U	**0.390 J**	**0.500 J**	0.180 U	**0.240 J**	**0.430 J**	20,000	HH
Ethylbenzene	**0.180 J**	**0.0720 J**	**0.320 J**	**0.0720 J**	**0.0770 J**	0.0500 U	0.0530 U	**0.100 J**	2,260	Eco
Hexachlorobutadiene	0.170 U	0.180 U	0.180 U	0.210 U	0.190 U	0.210 U	0.220 U	0.220 U	22,000	HH
Isopropylbenzene	0.0310 U	0.0320 U	0.0320 U	0.0380 U	0.0350 U	0.0380 U	0.0400 U	0.0390 U	2,260	Eco
m,p-Xylenes	**0.410 J**	**0.150 J**	**0.440 J**	**0.140 J**	**0.140 J**	0.120 U	0.120 U	**0.250 J**	120,000	Eco
Naphthalene	**1.50 J**	**0.520 J**	**0.850 J**	**0.540 J**	**0.470 J**	0.390 U	0.420 U	**0.550 J**	23,000	HH
n-Butylbenzene	0.0880 U	0.0910 U	**0.0920 J**	0.110 U	0.0970 U	0.110 U	0.120 U	0.120 U	-	-
n-Propylbenzene	0.0620 U	0.0640 U	**0.150 J**	0.0750 U	0.0690 U	0.0760 U	0.0800 U	0.0780 U	2,260	Eco
o-Xylene	**0.180 J**	0.0610 U	**0.170 J**	0.0710 U	0.0650 U	0.0720 U	0.0760 U	0.0740 U	1,000	Eco
sec-Butylbenzene	0.0650 U	0.0670 U	0.0670 U	0.0780 U	0.0720 U	0.0800 U	0.0840 U	0.0820 U	2,260	Eco
Styrene	0.0760 U	0.0790 U	0.0790 U	0.0910 U	0.0840 U	0.0930 U	0.0980 U	0.0960 U	300,000	Eco
tert-Butylbenzene	0.0540 U	0.0560 U	0.0560 U	0.0650 U	0.0600 U	0.0660 U	0.0700 U	0.0680 U	2,260	Eco
Tetrachloroethene (PCE)	0.120 U	0.130 U	0.130 U	0.150 U	0.140 U	0.150 U	0.160 U	0.160 U	1,600	HH
Toluene	**0.630 J**	**0.360 J**	**1.50 J**	**0.800 J**	**0.630 J**	**5.80 J**	**0.990 J**	**0.415 J**	200,000	Eco
trans-1,2-Dichloroethene	0.0480 U	0.0500 U	0.0500 U	0.0580 U	0.0530 U	0.0590 U	0.0620 U	0.0610 U	200,000	HH
trans-1,3-Dichloropropene	0.100 U	0.110 U	0.110 U	0.120 U	0.120 U	0.130 U	0.130 U	0.130 U	8,100	HH
Trichloroethene (TCE)	0.130 U	0.140 U	0.140 U	0.160 U	0.150 U	0.160 U	0.170 U	0.170 U	130	HH
Trichlorofluoromethane	0.0540 U	0.0560 U	0.0560 U	0.0650 U	0.0600 U	0.0660 U	0.0700 U	0.0680 U	730,000	Eco
Vinyl Acetate	0.600 U	0.620 U	0.620 U	0.720 U	0.670 U	0.740 U	0.780 U	0.760 U	4,100,000	HH
Vinyl Chloride	0.0570 U	0.0590 U	0.0590 U	0.0690 U	0.0630 U	0.0700 U	0.0740 U	0.0720 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3c
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
Semivolatile Organic Compounds
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Site ID	LD-01	LD-01	LD-02	LD-02	LD-03	LD-03	LD-04	LD-04	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090320-LD-1So-0-1	090320-LD-1So-1-3	090320-LD-2So-0-1	090320-LD-2So-1-3	090320-LD-3So-0-1	090320-LD-3So-1-3	090320-LD-4So-0-1	090320-LD-4So-1-3		
Sample Date	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009	3/20/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0	0.0-1.0	1.0-3.0		
Semivolatile Organic Compounds (µg/kg dry)										
1,2,4-Trichlorobenzene	38.0 U	1.50 U	38.0 U	1.50 U	38.0 U	1.50 U	1.50 U	1.50 U	20,000	Eco
1,2-Dichlorobenzene	33.0 U	1.30 U	33.0 U	1.30 U	33.0 U	1.30 U	1.30 U	1.30 U	2,260	Eco
1,3-Dichlorobenzene	40.0 U	1.60 U	40.0 U	1.60 U	40.0 U	1.60 U	1.60 U	1.60 U	2,260	Eco
1,4-Dichlorobenzene	48.0 U	1.90 U	48.0 U	1.90 U	48.0 U	1.90 U	1.90 U	1.90 U	17,000	HH
2,4,5-Trichlorophenol	75.0 U	3.00 U	75.0 U	3.00 U	75.0 U	3.00 U	3.00 U	3.00 U	4,000	Eco
2,4,6-Trichlorophenol	45.0 U	1.80 U	45.0 U	1.80 U	45.0 U	1.80 U	1.80 U	1.80 U	10,000	Eco
2,4-Dichlorophenol	45.0 U	1.80 U	45.0 U	1.80 U	45.0 U	1.80 U	1.80 U	1.80 U	20,000	Eco
2,4-Dimethylphenol	140 U	5.50 U	140 U	5.50 U	140 U	5.50 U	5.50 U	5.50 U	20,000	Eco
2,4-Dinitrophenol	900 U	36.0 U	900 U	36.0 U	900 U	36.0 U	36.0 U	36.0 U	20,000	Eco
2,4-Dinitrotoluene	70.0 U	2.80 U	70.0 U	2.80 U	70.0 U	2.80 U	2.80 U	2.80 U	5,500	HH
2,6-Dinitrotoluene	70.0 U	2.80 U	70.0 U	2.80 U	70.0 U	2.80 U	2.80 U	2.80 U	240,000	HH
2-Chloronaphthalene	90.0 U	3.60 U	90.0 U	3.60 U	90.0 U	3.60 U	3.60 U	3.60 U	82,000,000	HH
2-Chlorophenol	43.0 U	1.70 U	43.0 U	1.70 U	43.0 U	1.70 U	1.70 U	1.70 U	60,000	Eco
2-Methylphenol	85.0 U	3.40 U	85.0 U	3.40 U	85.0 U	3.40 U	3.40 U	3.40 U	50,000	Eco
2-Nitroaniline	68.0 U	2.70 U	68.0 U	2.70 U	68.0 U	2.70 U	2.70 U	2.70 U	6,000,000	HH
2-Nitrophenol	65.0 U	2.60 U	65.0 U	2.60 U	65.0 U	2.60 U	2.60 U	2.60 U	180,000,000	HH
3,3'-Dichlorobenzidine	93.0 U	3.70 U	93.0 U	3.70 U	93.0 U	3.70 U	3.70 U	3.70 U	4,800	HH
3-Nitroaniline	65.0 U	2.60 U	65.0 U	2.60 U	65.0 U	2.60 U	2.60 U	2.60 U	70,000	Eco
4,6-Dinitro-2-methylphenol	43.0 U	1.70 U	43.0 U	1.70 U	43.0 U	1.70 U	1.70 U	1.70 U	49,000	HH
4-Bromophenyl Phenyl Ether	35.0 U	1.40 U	35.0 U	1.40 U	35.0 U	1.40 U	1.40 U	1.40 U	-	-
4-Chloro-3-methylphenol	53.0 U	2.10 U	53.0 U	2.10 U	53.0 U	2.10 U	2.10 U	2.10 U	62,000,000	HH
4-Chloroaniline	53.0 U	2.10 U	53.0 U	2.10 U	53.0 U	2.10 U	2.10 U	2.10 U	8,600	HH
4-Chlorophenyl Phenyl Ether	50.0 U	2.00 U	50.0 U	2.00 U	50.0 U	2.00 U	2.00 U	2.00 U	-	-
4-Nitroaniline	85.0 U	3.40 U	85.0 U	3.40 U	85.0 U	3.40 U	3.40 U	3.40 U	40,000	Eco
4-Nitrophenol	750 U	30.0 U	750 U	30.0 U	750 U	30.0 U	30.0 U	30.0 U	7,000	Eco
Aniline	38.0 U	1.50 U	38.0 U	1.50 U	38.0 U	1.50 U	1.50 U	1.50 U	200,000	Eco
Benzoic Acid	2,400 U	96.0 U	2,400 U	96.0 U	2,400 U	96.0 U	96.0 U	96.0 U	200,000	Eco
Benzyl Alcohol	93.0 U	3.70 U	93.0 U	3.70 U	93.0 U	3.70 U	3.70 U	3.70 U	2,260	Eco
Bis(2-chloroethoxy)methane	33.0 U	1.30 U	33.0 U	1.30 U	33.0 U	1.30 U	1.30 U	1.30 U	730,000	Eco
Bis(2-chloroethyl) Ether	60.0 U	2.40 U	60.0 U	2.40 U	60.0 U	2.40 U	2.40 U	2.40 U	1,000	HH
Bis(2-chloroisopropyl) Ether	30.0 U	1.20 U	30.0 U	1.20 U	30.0 U	1.20 U	1.20 U	1.20 U	1,000	HH
Bis(2-ethylhexyl) Phthalate	**7,600**	**360**	**9,200**	**39.0 J**	**3,500**	**170**	**170**	**15.0 J**	4,500	Eco
Butyl Benzyl Phthalate	38.0 U	1.50 U	38.0 U	1.50 U	38.0 U	1.50 U	1.50 U	1.50 U	450	Eco
Carbazole	**270**	**2.20 J**	**280**	**6.50 J**	**530**	**9.20**	**1.40 J**	1.30 U	2,260	Eco
Dibenzofuran	**69.0 J**	1.30 U	**45.0 J**	**3.30 J**	**220**	**1.90 J**	1.30 U	1.30 U	2.00	Eco
Diethyl Phthalate	88.0 U	3.50 U	88.0 U	3.50 U	88.0 U	3.50 U	3.50 U	3.50 U	100,000	Eco
Dimethyl Phthalate	45.0 U	1.80 U	45.0 U	1.80 U	45.0 U	1.80 U	1.80 U	1.80 U	150,000	HH
Di-n-butyl Phthalate	**180 J**	**28.0**	**130 J**	2.60 U	65.0 U	**3.70 J**	2.60 U	2.60 U	450	Eco
Di-n-octyl Phthalate	30.0 U	1.20 U	30.0 U	1.20 U	30.0 U	1.20 U	1.20 U	1.20 U	450	Eco
Hexachlorobenzene	53.0 U	2.10 U	53.0 U	2.10 U	53.0 U	2.10 U	2.10 U	2.10 U	1,800	HH
Hexachlorobutadiene	35.0 U	1.40 U	35.0 U	1.40 U	35.0 U	1.40 U	1.40 U	1.40 U	22,000	HH
Hexachlorocyclopentadiene	380 U	15.0 U	380 U	15.0 U	380 U	15.0 U	15.0 U	15.0 U	10,000	Eco
Hexachloroethane	55.0 U	2.20 U	55.0 U	2.20 U	55.0 U	2.20 U	2.20 U	2.20 U	150,000	HH
Isophorone	40.0 U	1.60 U	40.0 U	1.60 U	40.0 U	1.60 U	1.60 U	1.60 U	1,800,000	HH
Nitrobenzene	50.0 U	2.00 U	50.0 U	2.00 U	50.0 U	2.00 U	2.00 U	2.00 U	8,000	Eco
N-Nitrosodimethylamine	160 U	6.10 U	160 U	6.10 U	160 U	6.10 U	6.10 U	6.10 U	34.0	HH
N-Nitrosodi-n-propylamine	80.0 U	3.20 U	80.0 U	3.20 U	80.0 U	3.20 U	3.20 U	3.20 U	250	HH
N-Nitrosodiphenylamine	55.0 U	2.20 U	55.0 U	2.20 U	55.0 U	2.20 U	2.20 U	2.20 U	20,000	Eco
p-cresol (4-Methylphenol)	73.0 U	2.90 U	73.0 U	2.90 U	73.0 U	2.90 U	2.90 U	2.90 U	50,000	Eco
Pentachlorophenol	220 U	8.50 U	220 U	8.50 U	220 U	8.50 U	8.50 U	8.50 U	2,100	Eco
Phenol	48.0 U	**2.40 J**	48.0 U	**35.0**	48.0 U	1.90 U	**2.00 J**	**3.00 J**	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)										
2-Methylnaphthalene	**40.0 J**	1.20 U	**40.0 J**	**3.30 J**	**43.0 J**	1.20 U	1.20 U	1.20 U	4,100,000	HH
Acenaphthene	**160 J**	**1.10 J**	**140 J**	**9.00**	**430**	**4.10 J**	**1.50 J**	1.00 U	19,000,000	HH
Acenaphthylene	35.0 U	1.40 U	**37.0 J**	1.40 U	35.0 U	1.40 U	1.40 U	1.40 U	23,000	HH
Anthracene	**330**	**1.80 J**	**280**	**14.0**	**780**	**11.0**	**2.00 J**	1.40 U	93,000,000	HH
Fluorene	**130 J**	1.70 U	**120 J**	**9.70**	**380**	**3.80 J**	1.70 U	1.70 U	12,000,000	HH
Naphthalene	**66.0 J**	1.30 U	**69.0 J**	**6.30 J**	**62.0 J**	**2.20 J**	1.30 U	1.30 U	23,000	HH
Phenanthrene	**1,900**	**15.0**	**1,900**	**71.0**	**4,000**	**59.0**	**16.0**	1.30 U	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**2,621 J**	**21.2 J**	**2,546 J**	**111 J**	**5,687 J**	**81.5 J**	**23.5 J**	8.10 U	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)										
Benzo(a)anthracene	**1,500**	**15.0**	**2,700**	**37.0**	**2,100**	**71.0**	**27.0**	1.40 U	2,700	HH
Benzo(a)pyrene	**1,400**	**19.0**	**2,800**	**35.0**	**1,900**	**72.0**	**38.0**	1.60 U	270	HH
Benzo(b)fluoranthene	**2,000**	**27.0**	**4,100**	**45.0**	**2,600**	**100**	**53.0**	2.50 U	2,700	HH
Benzo(g,h,i)perylene	**950**	**21.0**	**2,000**	**33.0**	**1,100**	**54.0**	**42.0**	2.30 U	27,000	HH
Benzo(k)fluoranthene	**770**	**10.0**	**1,400**	**16.0**	**880**	**36.0**	**19.0**	2.50 U	27,000	HH
Chrysene	**1,900**	**21.0**	**3,500**	**42.0**	**2,300**	**85.0**	**39.0**	**1.80 J**	270,000	HH
Dibenz(a,h)anthracene	**270**	**4.40 J**	**640**	**7.00**	**350**	**15.0**	**9.70**	2.20 U	270	HH
Fluoranthene	**3,100**	**29.0**	**4,700**	**71.0**	**5,000**	**130**	**36.0**	2.20 U	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**1,100**	**16.0**	**2,200**	**25.0**	**1,300**	**55.0**	**35.0**	1.90 U	2,700	HH
Pyrene	**2,800**	**29.0**	**4,400**	**76.0**	**4,200**	**120**	**47.0**	**2.10 J**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**15,790**	**191 J**	**28,440**	**387**	**21,730**	**738**	**346**	**16.5 J**	1,100	Eco

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3c
2009 Sandblast Area AOPC - Laydown Area Soil Analytical Results
Semivolatile Organic Compounds
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Site ID	LD-05	LD-05	LD-06	LD-07	LD-08	LD-09	LD-10	LD-11*	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090320-LD-5So-0-1	090320-LD-5So-1-3	090319-LD-6-So	090319-LD-7-So	090319-LD-8-So	090319-LD-9-So	090319-LD-10-So	090319-LD-11-So		
Sample Date	3/20/2009	3/20/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009	3/19/2009		
Sample Depth (Feet bgs)	0.0-1.0	1.0-3.0	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17	0.0-0.17		
Semivolatile Organic Compounds (µg/kg dry)										
1,2,4-Trichlorobenzene	1.50 U	1.50 U	15.0 U	15.0 U	1.50 U	1.50 U	15.0 U	1.50 U	20,000	Eco
1,2-Dichlorobenzene	1.30 U	1.30 U	13.0 U	13.0 U	1.30 U	1.30 U	13.0 U	1.30 U	2,260	Eco
1,3-Dichlorobenzene	1.60 U	1.60 U	16.0 U	16.0 U	1.60 U	1.60 U	16.0 U	1.60 U	2,260	Eco
1,4-Dichlorobenzene	1.90 U	1.90 U	19.0 U	19.0 U	1.90 U	1.90 U	19.0 U	1.90 U	17,000	HH
2,4,5-Trichlorophenol	3.00 U	3.00 U	30.0 U	30.0 U	3.00 U	3.00 U	30.0 U	3.00 U	4,000	Eco
2,4,6-Trichlorophenol	1.80 U	1.80 U	18.0 U	18.0 U	1.80 U	1.80 U	18.0 U	1.80 U	10,000	Eco
2,4-Dichlorophenol	1.80 U	1.80 U	18.0 U	18.0 U	1.80 U	1.80 U	18.0 U	1.80 U	20,000	Eco
2,4-Dimethylphenol	5.50 U	5.50 U	55.0 U	55.0 U	5.50 U	5.50 U	55.0 U	5.50 U	20,000	Eco
2,4-Dinitrophenol	36.0 U	36.0 U	360 U	360 U	36.0 U	36.0 U	360 U	36.0 U	20,000	Eco
2,4-Dinitrotoluene	2.80 U	2.80 U	28.0 U	28.0 U	2.80 U	2.80 U	28.0 U	2.80 U	5,500	HH
2,6-Dinitrotoluene	2.80 U	2.80 U	28.0 U	28.0 U	2.80 U	2.80 U	28.0 U	2.80 U	240,000	HH
2-Chloronaphthalene	3.60 U	3.60 U	36.0 U	36.0 U	3.60 U	3.60 U	36.0 U	3.60 U	82,000,000	HH
2-Chlorophenol	1.70 U	1.70 U	17.0 U	17.0 U	1.70 U	1.70 U	17.0 U	1.70 U	60,000	Eco
2-Methylphenol	3.40 U	3.40 U	34.0 U	34.0 U	3.40 U	3.40 U	34.0 U	3.40 U	50,000	Eco
2-Nitroaniline	2.70 U	2.70 U	27.0 U	27.0 U	2.70 U	2.70 U	27.0 U	2.70 U	6,000,000	HH
2-Nitrophenol	2.60 U	2.60 U	26.0 U	26.0 U	2.60 U	2.60 U	26.0 U	2.60 U	180,000,000	HH
3,3'-Dichlorobenzidine	3.70 U	3.70 U	37.0 U	37.0 U	3.70 U	3.70 U	37.0 U	3.70 U	4,800	HH
3-Nitroaniline	2.60 U	2.60 U	26.0 U	26.0 U	2.60 U	2.60 U	26.0 U	2.60 U	70,000	Eco
4,6-Dinitro-2-methylphenol	1.70 U	1.70 U	17.0 U	17.0 U	1.70 U	1.70 U	17.0 U	1.70 U	49,000	HH
4-Bromophenyl Phenyl Ether	1.40 U	1.40 U	14.0 U	14.0 U	1.40 U	1.40 U	14.0 U	1.40 U	-	-
4-Chloro-3-methylphenol	2.10 U	2.10 U	21.0 U	21.0 U	2.10 U	2.10 U	21.0 U	2.10 U	62,000,000	HH
4-Chloroaniline	2.10 U	2.10 U	21.0 U	21.0 U	2.10 U	2.10 U	21.0 U	2.10 U	8,600	HH
4-Chlorophenyl Phenyl Ether	2.00 U	2.00 U	20.0 U	20.0 U	2.00 U	2.00 U	20.0 U	2.00 U	-	-
4-Nitroaniline	3.40 U	3.40 U	34.0 U	34.0 U	3.40 U	3.40 U	34.0 U	3.40 U	40,000	Eco
4-Nitrophenol	30.0 U	30.0 U	300 U	300 U	30.0 U	30.0 U	300 U	30.0 U	7,000	Eco
Aniline	1.50 U	1.50 U	15.0 U	15.0 U	1.50 U	1.50 U	15.0 U	1.50 U	200,000	Eco
Benzoic Acid	96.0 U	96.0 U	**980 J**	960 U	96.0 U	**100 J**	960 U	**120 J**	200,000	Eco
Benzyl Alcohol	3.70 U	3.70 U	37.0 U	37.0 U	3.70 U	3.70 U	37.0 U	3.70 U	2,260	Eco
Bis(2-chloroethoxy)methane	1.30 U	1.30 U	13.0 U	13.0 U	1.30 U	1.30 U	13.0 U	1.30 U	730,000	Eco
Bis(2-chloroethyl) Ether	2.40 U	2.40 U	24.0 U	24.0 U	2.40 U	2.40 U	24.0 U	2.40 U	1,000	HH
Bis(2-chloroisopropyl) Ether	1.20 U	1.20 U	12.0 U	12.0 U	1.20 U	1.20 U	12.0 U	1.20 U	1,000	HH
Bis(2-ethylhexyl) Phthalate	**980**	**320**	**9,900**	**13,000**	**260**	**630**	**13,000**	**895**	4,500	Eco
Butyl Benzyl Phthalate	1.50 U	1.50 U	15.0 U	15.0 U	1.50 U	1.50 U	15.0 U	1.50 U	450	Eco
Carbazole	**46.0**	**9.50**	**150**	**240**	**2.60 J**	**22.0**	**130**	**32.5**	2,260	Eco
Dibenzofuran	**10.0**	**1.80 J**	**59.0 J**	**58.0 J**	1.30 U	**4.50 J**	**38.0 J**	**7.80 J**	2.00	Eco
Diethyl Phthalate	3.50 U	3.50 U	35.0 U	35.0 U	3.50 U	3.50 U	35.0 U	**8.80 J**	100,000	Eco
Dimethyl Phthalate	1.80 U	1.80 U	**32.0 J**	**30.0 J**	1.80 U	1.80 U	**41.0 J**	1.80 U	150,000	HH
Di-n-butyl Phthalate	**46.0**	**22.0**	**130**	**52.0 J**	**7.60 J**	**6.10 J**	**280**	**165**	450	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	12.0 U	12.0 U	1.20 U	1.20 U	12.0 U	1.20 U	450	Eco
Hexachlorobenzene	2.10 U	2.10 U	21.0 U	21.0 U	2.10 U	2.10 U	21.0 U	2.10 U	1,800	HH
Hexachlorobutadiene	1.40 U	1.40 U	14.0 U	14.0 U	1.40 U	1.40 U	14.0 U	1.40 U	22,000	HH
Hexachlorocyclopentadiene	15.0 U	15.0 U	150 U	150 U	15.0 U	15.0 U	150 U	15.0 U	10,000	Eco
Hexachloroethane	2.20 U	2.20 U	22.0 U	22.0 U	2.20 U	2.20 U	22.0 U	2.20 U	150,000	HH
Isophorone	1.60 U	1.60 U	16.0 U	16.0 U	1.60 U	1.60 U	16.0 U	1.60 U	1,800,000	HH
Nitrobenzene	2.00 U	2.00 U	20.0 U	20.0 U	2.00 U	2.00 U	20.0 U	2.00 U	8,000	Eco
N-Nitrosodimethylamine	6.10 U	6.10 U	61.0 U	61.0 U	6.10 U	6.10 U	61.0 U	6.10 U	34.0	HH
N-Nitrosodi-n-propylamine	3.20 U	3.20 U	32.0 U	32.0 U	3.20 U	3.20 U	32.0 U	3.20 U	250	HH
N-Nitrosodiphenylamine	2.20 U	2.20 U	**27.0 J**	22.0 U	2.20 U	2.20 U	22.0 U	2.20 U	20,000	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	29.0 U	29.0 U	2.90 U	2.90 U	29.0 U	2.90 U	50,000	Eco
Pentachlorophenol	**11.0 J**	8.50 U	85.0 U	85.0 U	8.50 U	8.50 U	85.0 U	**32.0 J**	2,100	Eco
Phenol	**3.70 J**	1.90 U	19.0 U	19.0 U	1.90 U	1.90 U	19.0 U	1.90 U	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)										
2-Methylnaphthalene	**6.90**	1.20 U	**29.0 J**	**27.0 J**	1.20 U	**2.80 J**	**36.0 J**	**7.60 J**	4,100,000	HH
Acenaphthene	**30.0**	**4.70 J**	**210**	**110**	1.00 U	**14.0**	**99.0 J**	**20.0**	19,000,000	HH
Acenaphthylene	**4.60 J**	1.40 U	**15.0 J**	**31.0 J**	1.40 U	**2.60 J**	**25.0 J**	**3.15 J**	23,000	HH
Anthracene	**90.0**	**13.0**	**220**	**270**	**2.90 J**	**29.0**	**170**	**55.0**	93,000,000	HH
Fluorene	**29.0**	**5.20 J**	**130**	**130**	1.70 U	**13.0**	**75.0 J**	**17.5**	12,000,000	HH
Naphthalene	**8.90**	**4.00 J**	**78.0 J**	**41.0 J**	**3.90 J**	**6.70 J**	**45.0 J**	**8.75 J**	23,000	HH
Phenanthrene	**460**	**79.0**	**1,100**	**1,800**	**16.0**	**180**	**810**	**260**	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**623 J**	**107 J**	**1,753 J**	**2,382 J**	**25.8 J**	**245 J**	**1,224 J**	**364 J**	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)										
Benzo(a)anthracene	**530**	**96.0**	**960**	**1,800**	**16.0**	**190**	**660**	**275**	2,700	HH
Benzo(a)pyrene	**450**	**86.0**	**1,100**	**1,600**	**17.0**	**200**	**670**	**265**	270	HH
Benzo(b)fluoranthene	**640**	**120**	**1,500**	**2,600**	**25.0**	**290**	**1,100**	**365**	2,700	HH
Benzo(g,h,i)perylene	**280**	**54.0**	**820**	**1,100**	**11.0**	**120**	**440**	**165**	27,000	HH
Benzo(k)fluoranthene	**220**	**45.0**	**560**	**860**	**8.30 J**	**89.0**	**360**	**125**	27,000	HH
Chrysene	**620**	**120**	**1,100**	**2,100**	**20.0**	**220**	**870**	**305**	270,000	HH
Dibenz(a,h)anthracene	**91.0**	**18.0**	**240**	**350**	2.20 U	**38.0**	**130**	**47.0**	270	HH
Fluoranthene	**1,100**	**170**	**1,700**	**3,300**	**31.0**	**350**	**1,300**	**555**	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**320**	**60.0**	**880**	**1,200**	**12.0**	**130**	**450**	**180**	2,700	HH
Pyrene	**950**	**150**	**1,600**	**2,800**	**28.0**	**310**	**1,300**	**500**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**5,201**	**919**	**10,460**	**17,710**	**171 J**	**1,937**	**7,280**	**2,782**	1,100	Eco

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3d
2009 Sandblast Area AOPC - Soil Analytical Results
Lead

Location	Sample ID	Sample Date	Sample Grain Size	Sample Interval (feet bgs)	Lead
Metals by EPA Method 6010B (mg/kg dry)					
SB-01	090127-SB-SB1-0-1So	1/27/2009	<250um	0.0-1.0	**398**
SB-01	090127-SB-SB1-0-1So	1/27/2009	<2mm	0.0-1.0	**258**
SB-01	090127-SB-SB1-1-3So	1/27/2009	<250um	1.0-3.0	**16.2**
SB-01	090127-SB-SB1-1-3So	1/27/2009	<2mm	1.0-3.0	**13.9**
SB-02	090127-SB-SB2-0-1So	1/27/2009	<250um	0.0-1.0	**220**
SB-02	090127-SB-SB2-0-1So	1/27/2009	<2mm	0.0-1.0	**176**
SB-02	090127-SB-SB2-1-3So	1/27/2009	<250um	1.0-3.0	**12.0**
SB-02	090127-SB-SB2-1-3So	1/27/2009	<2mm	1.0-3.0	**8.10 J**
SB-03	090127-SB-SB3-0-1So	1/27/2009	<250um	0.0-1.0	**921**
SB-03	090127-SB-SB3-0-1So	1/27/2009	<2mm	0.0-1.0	**768**
SB-03	090127-SB-SB3-1-3So	1/27/2009	<250um	1.0-3.0	**44.8**
SB-03	090127-SB-SB3-1-3So	1/27/2009	<2mm	1.0-3.0	**25.2**
SB-04	090127-SB-SB4-0-1So	1/27/2009	<250um	0.0-1.0	**90.8**
SB-04	090127-SB-SB4-0-1So	1/27/2009	<2mm	0.0-1.0	**52.7**
SB-04	090127-SB-SB4-1-3So	1/27/2009	<250um	1.0-3.0	**9.5 J**
SB-04	090127-SB-SB4-1-3So	1/27/2009	<2mm	1.0-3.0	**6.90 J**
SB-05	090127-SB-SB5-0-1So	1/27/2009	<250um	0.0-1.0	**525**
SB-05	090127-SB-SB5-0-1So	1/27/2009	<2mm	0.0-1.0	**451**
SB-05	090127-SB-SB5-1-3So	1/27/2009	<250um	1.0-3.0	**738**
SB-05	090127-SB-SB5-1-3So	1/27/2009	<2mm	1.0-3.0	**426**
SB-06*	090127-SB-SB6-0-1So	1/27/2009	<250um	0.0-1.0	**90.6**
SB-06*	090127-SB-SB6-0-1So	1/27/2009	<2mm	0.0-1.0	**42.4**
SB-06	090127-SB-SB6-1-3So	1/27/2009	<250um	1.0-3.0	**6.80 J**
SB-06	090127-SB-SB6-1-3So	1/27/2009	<2mm	1.0-3.0	**6.50 J**
SB-07	090127-SB-SB7-0-1So	1/27/2009	<250um	0.0-1.0	**99.4**
SB-07	090127-SB-SB7-0-1So	1/27/2009	<2mm	0.0-1.0	**90.0**
SB-07	090127-SB-SB7-1-3So	1/27/2009	<250um	1.0-3.0	**6.60 J**
SB-07	090127-SB-SB7-1-3So	1/27/2009	<2mm	1.0-3.0	**14.8**
SB-08	090127-SB-SB8-0-1So	1/27/2009	<250um	0.0-1.0	**53.9**
SB-08	090127-SB-SB8-0-1So	1/27/2009	<2mm	0.0-1.0	**27.5**
SB-08	090127-SB-SB8-1-3So	1/27/2009	<250um	1.0-3.0	**7.90 J**
SB-08	090127-SB-SB8-1-3So	1/27/2009	<2mm	1.0-3.0	**6.70 J**
Selected SLV (0-3 ft bgs)					**25.5**

Notes:

mg/kg = milligram per kilogram
bgs = below ground surface
MDL = Method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
The source for the selected lead SLV is the Reference area UPL.
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3e
2009 Sandblast Area AOPC - Erodibility Study Surface Soil Grab Sample Analytical Results
Petroleum Hydrocarbons and Volatile Organic Compounds

Site ID	SB-EUA-02	SB-EUA-04	SB-EUA-06	SB-EUA-08	SB-EUB-02	SB-EUB-03	SB-EUB-12	SB-EUB-15	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090318-SB-EUA-2So	090318-SB-EUA-4So	090318-SB-EUA-6So	090318-SB-EUA-8So	090318-SB-EUB-2So	090318-SB-EUB-3So	090318-SB-EUB-12So	090318-SB-EUB-15So		
Sample Date	3/18/2009	3/18/2009	3/18/2009	3/18/2009	3/18/2009	3/18/2009	3/18/2009	3/18/2009		
Sample Depth (Feet bgs)	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.17	0.0-0.17		
Petroleum Hydrocarbons (mg/kg dry)										
Gasoline Range Organics	1.50 U	**3.20 J**	**2.10 J**	**1.80 J**	1.50 U	1.50 U	1.50 U	**2.90 J**	13,000	HH
Volatile Organic Compounds (µg/kg dry)										
1,1,1,2-Tetrachloroethane	9.40 U	0.190 U	0.190 U	0.210 U	0.200 U	0.240 U	0.210 U	0.210 U	9,300	HH
1,1,1-Trichloroethane (TCA)	4.30 U	0.160 U	0.160 U	0.180 U	0.170 U	0.200 U	0.170 U	0.180 U	38,000,000	HH
1,1,2,2-Tetrachloroethane	7.40 U	0.0900 U	0.0930 U	0.110 U	0.0990 U	0.120 U	0.110 U	0.110 U	2,800	HH
1,1,2-Trichloroethane	7.90 U	0.0890 U	0.0920 U	0.110 U	0.0980 U	0.120 U	0.100 U	0.110 U	2,700	HH
1,1-Dichloroethane	9.30 U	0.0490 U	0.0510 U	0.0560 U	0.0540 U	0.0630 U	0.0550 U	0.0560 U	5,900	HH
1,1-Dichloroethene	7.30 U	0.0710 U	0.0740 U	0.0820 U	0.0780 U	0.0920 U	0.0800 U	0.0810 U	680,000	HH
1,1-Dichloropropene	9.40 U	0.160 U	0.160 U	0.180 U	0.170 U	0.200 U	0.170 U	0.180 U	8,100	HH
1,2,3-Trichlorobenzene	12.0 U	0.150 U	0.150 U	0.170 U	0.160 U	0.190 U	0.160 U	0.170 U	20,000	Eco
1,2,3-Trichloropropane	17.0 U	0.280 U	0.290 U	0.320 U	0.300 U	0.360 U	0.310 U	0.320 U	95.0	HH
1,2,4-Trichlorobenzene	6.50 U	0.230 U	0.230 U	0.260 U	0.250 U	0.290 U	0.250 U	0.260 U	20,000	Eco
1,2,4-Trimethylbenzene	3.70 U	**0.280 J**	**0.180 J**	**0.230 J**	**0.160 J**	**0.220 J**	**0.240 J**	0.110 U	200,000	Eco
1,2-Dibromo-3-chloropropane	140 U	0.790 U	0.820 U	0.910 U	0.870 U	1.10 U	0.890 U	0.900 U	69.0	HH
1,2-Dibromoethane (EDB)	6.90 U	0.200 U	0.200 U	0.230 U	0.220 U	0.250 U	0.220 U	0.220 U	140	HH
1,2-Dichlorobenzene	6.60 U	0.0640 U	0.0660 U	0.0740 U	0.0700 U	0.0830 U	0.0720 U	0.0730 U	2,260	Eco
1,2-Dichloroethane (EDC)	9.70 U	0.0550 U	0.0570 U	0.0630 U	0.0600 U	0.0710 U	0.0620 U	0.0630 U	590	HH
1,2-Dichloropropane	11.0 U	0.0660 U	0.0680 U	0.0760 U	0.0720 U	0.0850 U	0.0740 U	0.0750 U	4,500	HH
1,3,5-Trimethylbenzene	6.50 U	0.0410 U	0.0420 U	0.0470 U	0.0450 U	0.0530 U	0.0460 U	0.0460 U	150,000	HH
1,3-Dichlorobenzene	6.10 U	0.0710 U	0.0740 U	0.0820 U	0.0780 U	0.0920 U	0.0800 U	0.0810 U	2,260	Eco
1,3-Dichloropropane	5.30 U	0.0600 U	0.0620 U	0.0690 U	0.0660 U	0.0770 U	0.0670 U	0.0680 U	20,000,000	HH
1,4-Dichlorobenzene	5.70 U	0.110 U	0.110 U	0.120 U	0.120 U	0.140 U	0.120 U	0.120 U	17,000	HH
2,2-Dichloropropane	9.50 U	0.110 U	0.110 U	0.120 U	0.120 U	0.140 U	0.120 U	0.120 U	4,500	HH
2-Butanone (MEK)	290 U	**21.0 J**	**5.00 J**	**32.0**	**9.90 J**	**39.0**	**50.0**	**32.0**	200,000,000	HH
2-Chlorotoluene	4.90 U	0.0520 U	0.0540 U	0.0600 U	0.0570 U	0.0670 U	0.0580 U	0.0590 U	20,000,000	HH
2-Hexanone	170 U	**5.50 J**	0.820 U	**4.70 J**	0.870 U	1.10 U	**8.80 J**	0.900 U	1,250,000	Eco
4-Chlorotoluene	5.50 U	0.0930 U	0.0960 U	0.110 U	0.110 U	0.120 U	0.110 U	0.110 U	72,000,000	HH
4-Isopropyltoluene	6.10 U	0.0840 U	0.0870 U	0.0970 U	**2.50 J**	**0.480 J**	0.0940 U	**0.990 J**	200,000	Eco
4-Methyl-2-pentanone (MIBK)	460 U	**0.770 J**	0.260 U	**0.790 J**	0.270 U	0.320 U	**1.20 J**	0.280 U	1,250,000	Eco
Acetone	230 U	**170**	**47.0**	**290**	**98.0**	**350**	**540**	**270**	1,250,000	Eco
Benzene	5.70 U	0.300 U	**0.160 J**	**0.470 J**	**0.200 J**	0.380 U	**1.00 J**	0.230 U	1,200	HH
Bromobenzene	8.20 U	0.0930 U	0.0960 U	0.110 U	0.110 U	0.120 U	0.110 U	0.110 U	1,800,000	HH
Bromochloromethane	9.40 U	0.260 U	0.270 U	0.300 U	0.280 U	0.330 U	0.290 U	0.290 U	1,900	HH
Bromodichloromethane	6.20 U	0.0450 U	0.0460 U	0.0520 U	0.0490 U	0.0580 U	0.0500 U	0.0510 U	1,900	HH
Bromoform	13.0 U	0.260 U	0.270 U	0.300 U	0.280 U	0.330 U	0.290 U	0.290 U	360,000	HH
Bromomethane	29.0 U	0.430 U	**5.00 J**	0.490 U	**1.20 J**	0.550 U	0.480 U	0.490 U	17,000	HH
Carbon Disulfide	7.40 U	**0.680 J**	**0.670 J**	**1.00 J**	**0.620 J**	**0.940 J**	**0.960 J**	**0.700 J**	1,000,000	Eco
Carbon Tetrachloride	11.0 U	0.0790 U	0.0820 U	0.0910 U	0.0870 U	0.110 U	0.0890 U	0.0900 U	630	HH
Chlorobenzene	6.60 U	0.0550 U	0.0570 U	0.0630 U	0.0600 U	0.0710 U	0.0620 U	0.0630 U	40,000	Eco
Chloroethane	24.0 U	0.310 U	0.320 U	0.350 U	0.340 U	0.400 U	0.340 U	0.350 U	61,000,000	HH
Chloroform	**19.0 J**	0.0490 U	0.0510 U	**0.260 J**	0.0540 U	0.0630 U	**0.290 J**	0.0560 U	410	HH
Chloromethane	8.70 U	0.0580 U	**0.250 J**	0.0670 U	**0.230 J**	0.0750 U	0.0650 U	0.0660 U	300,000	HH
cis-1,2-Dichloroethene	**12.0 J**	0.0820 U	0.0850 U	0.0950 U	0.0900 U	0.110 U	0.0920 U	0.0940 U	2,500,000	Eco
cis-1,3-Dichloropropene	8.30 U	0.0320 U	0.0330 U	0.0370 U	0.0350 U	0.0410 U	0.0360 U	0.0360 U	8,100	HH
Dibromochloromethane	9.10 U	0.170 U	0.170 U	0.190 U	0.180 U	0.210 U	0.190 U	0.190 U	34,000	HH
Dibromomethane	18.0 U	0.190 U	0.190 U	0.210 U	0.200 U	0.240 U	0.210 U	0.210 U	110,000	HH
Dichlorodifluoromethane	**94.0**	0.0730 U	0.0760 U	0.0840 U	0.0800 U	0.0940 U	0.0820 U	0.0830 U	730,000	Eco
Dichloromethane (Methylene Chloride)	**460**	**0.390 J**	**0.330 J**	**0.550 J**	0.160 U	0.190 U	0.160 U	0.170 U	20,000	HH
Ethylbenzene	6.10 U	**0.110 J**	0.0430 U	**0.100 J**	0.0460 U	0.0540 U	**0.200 J**	0.0480 U	2,260	Eco
Hexachlorobutadiene	15.0 U	0.180 U	0.180 U	0.200 U	0.190 U	0.230 U	0.200 U	0.200 U	22,000	HH
Isopropylbenzene	6.10 U	0.0320 U	0.0330 U	0.0370 U	0.0350 U	0.0410 U	0.0360 U	0.0360 U	2,260	Eco
m,p-Xylenes	13.0 U	**0.190 J**	0.0980 U	**0.240 J**	0.110 U	0.130 U	**0.360 J**	0.110 U	120,000	Eco
Naphthalene	7.90 U	**0.540 J**	0.340 U	0.380 U	0.360 U	0.420 U	**0.450 J**	0.370 U	23,000	HH
n-Butylbenzene	6.50 U	0.0890 U	0.0920 U	0.110 U	0.0980 U	0.120 U	0.100 U	0.110 U	-	-
n-Propylbenzene	5.70 U	0.0630 U	0.0650 U	0.0730 U	0.0690 U	0.0810 U	0.0710 U	0.0720 U	2,260	Eco
o-Xylene	6.90 U	0.0600 U	0.0620 U	0.0690 U	0.0660 U	0.0770 U	0.0670 U	0.0680 U	1,000	Eco
sec-Butylbenzene	6.50 U	0.0660 U	0.0680 U	0.0760 U	0.0720 U	0.0850 U	0.0740 U	0.0750 U	2,260	Eco
Styrene	6.10 U	0.0770 U	0.0800 U	0.0890 U	0.0850 U	0.100 U	0.0860 U	0.0880 U	300,000	Eco
tert-Butylbenzene	4.30 U	0.0550 U	0.0570 U	0.0630 U	0.0600 U	0.0710 U	0.0620 U	0.0630 U	2,260	Eco
Tetrachloroethene (PCE)	8.30 U	0.130 U	0.130 U	0.140 U	0.140 U	0.160 U	0.140 U	0.140 U	1,600	HH
Toluene	6.10 U	**0.770 J**	**0.240 J**	**1.30 J**	**0.550 J**	**0.860 J**	**1.20 J**	**0.760 J**	200,000	Eco
trans-1,2-Dichloroethene	9.90 U	0.0490 U	0.0510 U	0.0560 U	0.0540 U	0.0630 U	0.0550 U	0.0560 U	200,000	HH
trans-1,3-Dichloropropene	12.0 U	0.110 U	0.110 U	0.120 U	0.120 U	0.140 U	0.120 U	0.120 U	8,100	HH
Trichloroethene (TCE)	13.0 U	0.140 U	0.140 U	0.160 U	0.150 U	0.170 U	0.150 U	0.150 U	130	HH
Trichlorofluoromethane	11.0 U	0.0550 U	0.0570 U	0.0630 U	0.0600 U	0.0710 U	0.0620 U	0.0630 U	730,000	Eco
Vinyl Acetate	52.0 U	0.610 U	0.630 U	0.700 U	0.670 U	0.790 U	0.680 U	0.690 U	4,100,000	HH
Vinyl Chloride	13.0 U	0.0580 U	0.0600 U	0.0670 U	0.0640 U	0.0750 U	0.0650 U	0.0660 U	2,200	HH

Notes:

µg/kg = microgram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-3f
2009 Sandblast Area AOPC - Erodibility Study Surface Soil Composite Sample Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Butyltins, Pesticides, General Chemistry Parameters, and Grain Size

Site ID	SB-EUA*	SB-EUB	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090318-SB-EUA-So	090318-SB-EUB-So		
Sample Date	3/18/2009	3/18/2009		
Sample Depth (Feet bgs)	0.0-0.17	0.0-0.17		
PCB Aroclors (µg/kg dry)				
Aroclor 1016	2.10 U	2.10 U	371	Eco
Aroclor 1221	2.10 U	2.10 U	371	Eco
Aroclor 1232	2.10 U	2.10 U	371	Eco
Aroclor 1242	2.10 U	2.10 U	371	Eco
Aroclor 1248	2.10 U	2.10 U	371	Eco
Aroclor 1254	2.10 U	2.10 U	371	Eco
Aroclor 1260	**27.0**	**67.0**	371	Eco
Aroclor 1262	2.10 U	2.10 U	371	Eco
Aroclor 1268	2.10 U	2.10 U	371	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**29.1 J**	**69.1 J**	371	Eco
Metals (mg/kg dry)				
Aluminum	**13,000**	**8,050**	31,400	UPL
Antimony	**0.220 J**	**0.340 J**	0.270	Eco
Arsenic	**5.91**	**5.94**	5.40	UPL
Barium	**108**	**75.8**	330	Eco
Beryllium	**0.350 J**	**0.240 J**	21.0	Eco
Cadmium	**0.458**	**1.06**	0.360	Eco
Calcium	**5,920 J**	**4,400 J**	10,400	UPL
Chromium	**108 J**	**162 J**	28.1	UPL
Cobalt	**13.4**	**10.9**	19.9	UPL
Copper	**46.4 J**	**71.6 J**	56.7	UPL
Iron	**30,800**	**27,700**	36,900	UPL
Lead	**302**	**319**	25.5	UPL
Magnesium	**8,140**	**7,350**	12,400	UPL
Manganese	**479**	**369**	885	UPL
Mercury	**0.0390**	**0.0330**	0.0660	UPL
Nickel	**57.5 J**	**74.9 J**	38.0	Eco
Potassium	**1,110**	**643**	2,050	UPL
Selenium	**0.650 J**	**0.500 J**	0.520	Eco
Silver	**0.127**	**0.175**	4.20	Eco
Sodium	**310**	**264**	341	UPL
Thallium	**0.117**	**0.0670**	1.00	Eco
Vanadium	**69.8**	**59.3**	104	UPL
Zinc	**123 J**	**203 J**	71.7	UPL
Petroleum Hydrocarbons (mg/kg dry)				
Diesel Range Organics	**33.0 J**	**69.0**	23,000	HH
Residual Range Organics	**400**	**1,000**	40,000	HH
Gasoline Range Organics	-	-	13,000	HH
Butyltins (µg/kg dry)				
Dibutyltin	**6.70**	**9.10**	28,000	Eco
Monobutyltin	**8.25**	**3.20**	28,000	Eco
Tributyltin	**12.8**	**3.20**	28,000	Eco
Pesticides (µg/kg dry)				
4,4'-DDD	0.110 U	0.300 U	21.0	Eco
4,4'-DDE	**0.440 J**	**0.250 J**	21.0	Eco
4,4'-DDT	**4.40**	**10.0**	21.0	Eco
Aldrin	0.160 U	0.160 U	4.90	Eco
BHC (alpha)	0.110 U	0.110 U	340	HH
BHC (beta)	0.180 U	0.660 U	960	HH
BHC (delta)	0.140 U	**0.0780 J**	340	HH
BHC (gamma) Lindane	0.0800 U	1.30 U	2,000	HH
Chlordane (alpha)	0.100 U	0.100 U	7,200	HH
Chlordane (gamma)	0.630 U	0.660 U	7,200	HH
Dieldrin	0.140 U	0.810 U	4.90	Eco
Endosulfan I	0.110 U	0.660 U	20,000	Eco
Endosulfan II	0.140 U	**0.240 J**	20,000	Eco
Endosulfan Sulfate	0.110 U	**0.770**	20,000	Eco
Endrin	0.0940 U	0.660 U	4.90	Eco
Endrin Aldehyde	0.630 U	0.700 U	4.90	Eco
Endrin Ketone	0.630 U	2.90 U	4.90	Eco
Heptachlor	**0.185 J**	**0.380 J**	480	HH
Heptachlor Epoxide	0.0840 U	0.180 U	240	HH
Methoxychlor	0.630 U	1.50 U	500,000	Eco
Toxaphene	43.0 U	190 U	2,000	HH
General Chemistry Parameters (mg/kg) and Grain Size (%)				
Carbon, Total Organic	**25,400**	**36,200**	-	-
Solids, Total	**752,000**	**755,000**	-	-
Gravel (>2.00 mm)	**27.8**	**34.2**	-	-
Sand, Very Coarse (1.00 - 2.00 mm)	**6.48**	**5.89**	-	-
Sand, Coarse (0.50 - 1.00 mm)	**4.98**	**5.83**	-	-
Sand, Medium (0.25 - 0.50 mm)	**7.38**	**7.18**	-	-
Sand, Fine (0.125 - 0.25 mm)	**10.7**	**10.3**	-	-
Sand, Very Fine (0.0625 - 0.125 mm)	**7.53**	**7.71**	-	-
Silt (0.039 - 0.0625 mm)	**31.2**	**25.1**	-	-
Clay (<0.039 mm)	**6.62**	**5.16**	-	-

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available

[1] Only Aroclors 1254 and 1260 were included in summing Total PCBs as Aroclors because all other aroclors were undected in Sandlbast Area AOPC soil samples.
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3g
2009 Sandblast Area AOPC - Erodibility Study Surface Soil Composite Sample Analytical Results
Semivolatile Organic Compounds

Site ID	SB-EUA*	SB-EUB	**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Sample ID	090318-SB-EUA-So	090318-SB-EUB-So		
Sample Date	3/18/2009	3/18/2009		
Sample Depth (Feet bgs)	0.0-0.17	0.0-0.17		
Semivolatile Organic Compounds (µg/kg dry)				
1,2,4-Trichlorobenzene	38.0 U	75.0 U	20,000	Eco
1,2-Dichlorobenzene	33.0 U	65.0 U	2,260	Eco
1,3-Dichlorobenzene	40.0 U	80.0 U	2,260	Eco
1,4-Dichlorobenzene	48.0 U	95.0 U	17,000	HH
2,4,5-Trichlorophenol	75.0 U	150 U	4,000	Eco
2,4,6-Trichlorophenol	45.0 U	90.0 U	10,000	Eco
2,4-Dichlorophenol	45.0 U	90.0 U	20,000	Eco
2,4-Dimethylphenol	140 U	280 U	20,000	Eco
2,4-Dinitrophenol	900 U	1,800 U	20,000	Eco
2,4-Dinitrotoluene	70.0 U	140 U	5,500	HH
2,6-Dinitrotoluene	70.0 U	140 U	240,000	HH
2-Chloronaphthalene	90.0 U	180 U	82,000,000	HH
2-Chlorophenol	43.0 U	85.0 U	60,000	Eco
2-Methylphenol	85.0 U	170 U	50,000	Eco
2-Nitroaniline	68.0 U	140 U	6,000,000	HH
2-Nitrophenol	65.0 U	130 U	180,000,000	HH
3,3'-Dichlorobenzidine	93.0 U	190 U	4,800	HH
3-Nitroaniline	65.0 U	130 U	70,000	Eco
4,6-Dinitro-2-methylphenol	43.0 U	85.0 U	49,000	HH
4-Bromophenyl Phenyl Ether	35.0 U	70.0 U	-	-
4-Chloro-3-methylphenol	53.0 U	110 U	62,000,000	HH
4-Chloroaniline	53.0 U	110 U	8,600	HH
4-Chlorophenyl Phenyl Ether	50.0 U	100 U	-	-
4-Nitroaniline	85.0 U	170 U	40,000	Eco
4-Nitrophenol	750 U	1,500 U	7,000	Eco
Aniline	38.0 U	75.0 U	200,000	Eco
Benzoic Acid	2,400 U	4,800 U	200,000	Eco
Benzyl Alcohol	93.0 U	190 U	2,260	Eco
Bis(2-chloroethoxy)methane	33.0 U	65.0 U	730,000	Eco
Bis(2-chloroethyl) Ether	60.0 U	120 U	1,000	HH
Bis(2-chloroisopropyl) Ether	30.0 U	60.0 U	1,000	HH
Bis(2-ethylhexyl) Phthalate	**58,000**	**260,000**	4,500	Eco
Butyl Benzyl Phthalate	38.0 U	75.0 U	450	Eco
Carbazole	**37.5 J**	**91.0 J**	2,260	Eco
Dibenzofuran	33.0 U	65.0 U	2.00	Eco
Diethyl Phthalate	88.0 U	180 U	100,000	Eco
Dimethyl Phthalate	45.0 U	90.0 U	150,000	HH
Di-n-butyl Phthalate	65.0 U	130 U	450	Eco
Di-n-octyl Phthalate	30.0 U	60.0 U	450	Eco
Hexachlorobenzene	53.0 U	110 U	1,800	HH
Hexachlorobutadiene	35.0 U	70.0 U	22,000	HH
Hexachlorocyclopentadiene	380 U	750 U	10,000	Eco
Hexachloroethane	55.0 U	110 U	150,000	HH
Isophorone	40.0 U	80.0 U	1,800,000	HH
Nitrobenzene	50.0 U	100 U	8,000	Eco
N-Nitrosodimethylamine	160 U	310 U	34.0	HH
N-Nitrosodi-n-propylamine	80.0 U	160 U	250	HH
N-Nitrosodiphenylamine	55.0 U	110 U	20,000	Eco
p-cresol (4-Methylphenol)	73.0 U	150 U	50,000	Eco
Pentachlorophenol	220 U	430 U	2,100	Eco
Phenol	48.0 U	95.0 U	30,000	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)				
2-Methylnaphthalene	30.0 U	60.0 U	4,100,000	HH
Acenaphthene	**34.5 J**	**68.0 J**	19,000,000	HH
Acenaphthylene	35.0 U	70.0 U	23,000	HH
Anthracene	**53.5 J**	**150 J**	93,000,000	HH
Fluorene	43.0 U	85.0 U	12,000,000	HH
Naphthalene	33.0 U	65.0 U	23,000	HH
Phenanthrene	**360**	**940**	93,000,000	HH
Total LPAHs (KM, capped; NDs at MDL)	**549 J**	**1,356 J**	29,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)				
Benzo(a)anthracene	**455**	**1,200**	2,700	HH
Benzo(a)pyrene	**435**	**1,000**	270	HH
Benzo(b)fluoranthene	**645**	**1,600**	2,700	HH
Benzo(g,h,i)perylene	**270**	**590**	27,000	HH
Benzo(k)fluoranthene	**230**	**570**	27,000	HH
Chrysene	**575**	**1,500**	270,000	HH
Dibenz(a,h)anthracene	**95.5 J**	**220 J**	270	HH
Fluoranthene	**825**	**2,100**	8,900,000	HH
Indeno(1,2,3-cd)pyrene	**300**	**690**	2,700	HH
Pyrene	**775**	**1,900**	6,700,000	HH
Total HPAHs (KM, capped; NDs at MDL)	**4,606 J**	**11,370 J**	1,100	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3h
2008-2009 Sandblast Area AOPC Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Polycyclic Aromatic Hydrodarbons, and General Chemistry Parameters
(Page 1 of 2)

Site ID	MW-11*	MW-11	MW-11*	MW-11*	MW-12	MW-12	MW-12	MW-12	MW-13	MW-13*	MW-13	MW-13	MW-14	MW-14	MW-14	MW-14	MW-15	MW-15	MW-15	MW-15	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080415MW11GW	080715MW11GW	081020MW11GW	090112MW11GW	080415MW12GW	080715MW12GW	081021MW12GW	090113MW12GW	080414MW13GW	080714MW13GW	081020MW13GW	090112MW13GW	080414MW14GW	080714MW14GW	081021MW14GW	090113MW14GW	080414MW15GW	080714MW15GW	081021MW15GW	090113MW15GW				
Sample Date	4/15/2008	7/15/2008	10/20/2008	1/12/2009	4/15/2008	7/15/2008	10/21/2008	1/13/2009	4/14/2008	7/14/2008	10/20/2008	1/12/2009	4/14/2008	7/14/2008	10/21/2008	1/13/2009	4/14/2008	7/14/2008	10/21/2008	1/13/2009				
Sample Depth (Feet btc)	31	31	31	31	28	21	26	26	31	31	31	30	18	18	18	18	17	17	17	17				
Total Metals (µg/L)																								
Arsenic	**11.6**	**1.13**	**0.690**	**0.600**	**0.610**	**0.760**	**0.710**	**0.600**	**1.86**	**0.785**	**0.860**	**1.00**	**0.790**	**1.02**	**1.12**	**1.00**	**0.540**	**0.750**	**0.590**	**0.600**	0.0180	HH	0.0380	HH
Iron	**1,500**	**179**	**88.9**	**148**	50.4 U	**108**	**14.1 J**	20.0 U	55.6 U	**222**	**312**	**265**	**188**	**25.7**	**12.9 J**	43.2 U	**163**	**190**	**36.8**	**90.6**	300	HH	26,000	HH
Vanadium	**5.90 J**	**0.860**	**0.315**	**0.365**	**1.10 J**	**1.27**	**0.960**	**1.43**	**1.00 J**	0.200 U	0.0700 U	**0.130 J**	**1.80 J**	**1.64**	**2.00**	**1.72**	**1.40 J**	**1.68**	**1.30**	**1.57**	-	-	2.60	HH
Dissolved Metals (µg/L)																								
Arsenic	**8.99**	**1.11**	**0.610**	**0.550**	**0.610**	**0.870**	**0.620**	**0.800**	**1.79**	**0.780**	**0.900**	**0.900**	**0.840**	**1.01**	**0.970**	**0.900**	**0.510**	**0.630**	**0.620**	**0.600**	0.0180	HH	0.0380	HH
Calcium	**6,690**	-	-	-	**30,900**	-	-	-	**44,300**	-	-	-	**22,700**	-	-	-	**28,200**	-	-	-	116,000	Eco	116,000	Eco
Iron	4.00 U	**52.5**	20.0 U	20.0 U	4.00 U	**7.10 J**	20.0 U	20.0 U	**12.4 J**	**202**	**270**	**202**	4.00 U	4.00 U	4.00 U	20.0 U	**6.40 J**	4.00 U	4.00 U	20.0 U	300	HH	1,000	Eco
Magnesium	**883**	-	-	-	**8,430**	-	-	-	**14,000**	-	-	-	**6,140**	-	-	-	**7,120**	-	-	-	82,000	Eco	82,000	Eco
Potassium	**2,610**	-	-	-	**2,260**	-	-	-	**1,480 J**	-	-	-	**1,170 J**	-	-	-	**782 J**	-	-	-	53,000	Eco	53,000	Eco
Sodium	**89,400**	-	-	-	**13,400**	-	-	-	**18,400**	-	-	-	**6,860**	-	-	-	**7,620**	-	-	-	680,000	Eco	680,000	Eco
Vanadium	**3.10 J**	0.690 U	**0.205 J**	**0.145 J**	0.800 U	**1.05**	**0.820**	**1.17**	**1.10 J**	0.200 U	0.0700 U	0.0700 U	**1.10 J**	**1.68**	**1.98**	**1.64**	**0.900 J**	**1.19**	**1.22**	**1.41**	20.0	Eco	2.60	HH
Total Petroleum Hydrocarbons (µg/L)																								
Diesel Range Organics	12.0 U	**18.0 J**	11.0 U	110 U	120 U	**17.0 J**	12.0 U	12.0 U	12.0 U	100 U	12.0 U	120 U	11.0 U	100 U	12.0 U	13.0 U	13.0 U	110 U	12.0 U	120 U	-	-	90.0	HH
Residual Range Organics	20.0 U	110 U	19.0 U	110 U	22.0 U	110 U	21.0 U	110 U	20.0 U	100 U	21.0 U	120 U	19.0 U	100 U	20.0 U	120 U	22.0 U	110 U	20.0 U	120 U	-	-	290	HH
Gasoline Range Organics	**13.5 J**	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	**15.0 J**	**23.5 J**	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	-	-	100	HH
Total Butyltins (µg/L)																								
Monobutyltin	**0.0260 J**	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	**0.0140 J**	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0630	Eco	0.0630	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)																								
Phenanthrene	0.0230 U	0.0220 U	0.0220 U	0.0220 U	0.0230 U	0.0220 U	0.0220 U	0.0220 U	**0.0840 J**	0.0220 U	0.0220 U	0.0240 U	0.0240 U	0.0220 U	0.0220 U	0.0250 U	0.0230 U	0.0240 U	0.0220 U	0.0240 U	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)																								
Benzo(b)fluoranthene	0.0180 U	0.0170 U	0.0170 U	0.0170 U	**0.0180 J**	0.0170 U	0.0170 U	0.0170 U	0.0200 U	0.0170 U	0.0170 U	0.0190 U	0.0190 U	0.0170 U	0.0170 U	0.0200 U	0.0180 U	0.0190 U	0.0170 U	0.0190 U	0.00380	HH	0.0290	HH
Benzo(k)fluoranthene	0.0250 U	0.0240 U	0.0240 U	0.0240 U	0.0250 U	0.0240 U	0.0240 U	0.0240 U	0.0270 U	0.0240 U	0.0240 U	0.0260 U	0.0260 U	0.0240 U	0.0240 U	0.0280 U	0.0250 U	0.0270 U	0.0240 U	0.0260 U	0.00380	HH	0.290	HH
General Chemistry Parameters (mg/L)																								
Dissolved Bromide	**0.0140 J**	-	-	-	**0.0160 J**	-	-	-	0.0100 U	-	-	-	0.0100 U	-	-	-	0.0100 U	-	-	-	-	-	-	-
Dissolved Chloride	**2.50**	-	-	-	**4.40**	-	-	-	**3.00**	-	-	-	**2.10**	-	-	-	**2.40**	-	-	-	230	Eco	230	Eco
Dissolved Fluoride	**0.200**	-	-	-	**0.0820 J**	-	-	-	**0.0690 J**	-	-	-	**0.0550 J**	-	-	-	**0.0510 J**	-	-	-	-	-	1.50	HH
Dissolved Sulfate	**25.0**	-	-	-	**10.1**	-	-	-	**14.5**	-	-	-	**13.1**	-	-	-	**13.1**	-	-	-	-	-	-	-
Dissolved Ammonia	**0.0650 J**	-	-	-	**0.0500 J**	-	-	-	**0.100**	-	-	-	**0.0400 J**	-	-	-	**0.0300 J**	-	-	-	-	-	-	-
Dissolved Nitrate+Nitrite	**0.0185 J**	-	-	-	**0.110**	-	-	-	**0.00700 J**	-	-	-	**0.200**	-	-	-	**0.0260 J**	-	-	-	-	-	10.0	HH
Total Organic Carbon	**1.00**	-	-	-	**1.90**	-	-	-	**0.800**	-	-	-	**0.800**	-	-	-	**1.00**	-	-	-	-	-	-	-
Dissolved Organic Carbon	**1.80 J**	-	-	-	**1.70**	-	-	-	**0.700**	-	-	-	**2.50 J**	-	-	-	**1.00**	-	-	-	-	-	-	-
Dissolved Carbonate as CaCO3	**38.0 J**	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	1.00 U	-	-	-	-	-	-	-

Notes:

µg/L = microgram per liter	-- = SLV for analyte not available
btc = below top of well casing	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3h
2008-2009 Sandblast Area AOPC Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Polycyclic Aromatic Hydrodarbons, and General Chemistry Parameters
(Page 2 of 2)

Site ID	MW-13	MW-13	MW-14	MW-14	MW-14	MW-14	MW-15	MW-15	MW-15	MW-15	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	081020MW13GW	090112MW13GW	080414MW14GW	080714MW14GW	081021MW14GW	090113MW14GW	080414MW15GW	080714MW15GW	081021MW15GW	090113MW15GW				
Sample Date	10/20/2008	1/12/2009	4/14/2008	7/14/2008	10/21/2008	1/13/2009	4/14/2008	7/14/2008	10/21/2008	1/13/2009				
Sample Depth (Feet btc)	31	30	18	18	18	18	17	17	17	17				
Total Metals (µg/L)														
Arsenic	**0.860**	**1.00**	**0.790**	**1.02**	**1.12**	**1.00**	**0.540**	**0.750**	**0.590**	**0.600**	0.0180	HH	0.0380	HH
Iron	**312**	**265**	**188**	**25.7**	**12.9 J**	43.2 U	**163**	**190**	**36.8**	**90.6**	300	HH	26,000	HH
Vanadium	0.0700 U	**0.130 J**	**1.80 J**	**1.64**	**2.00**	**1.72**	**1.40 J**	**1.68**	**1.30**	**1.57**	-	-	2.60	HH
Dissolved Metals (µg/L)														
Arsenic	**0.900**	**0.900**	**0.840**	**1.01**	**0.970**	**0.900**	**0.510**	**0.630**	**0.620**	**0.600**	0.0180	HH	0.0380	HH
Calcium	-	-	**22,700**	-	-	-	**28,200**	-	-	-	116,000	Eco	116,000	Eco
Iron	**270**	**202**	4.00 U	4.00 U	4.00 U	20.0 U	**6.40 J**	4.00 U	4.00 U	20.0 U	300	HH	1,000	Eco
Magnesium	-	-	**6,140**	-	-	-	**7,120**	-	-	-	82,000	Eco	82,000	Eco
Potassium	-	-	**1,170 J**	-	-	-	**782 J**	-	-	-	53,000	Eco	53,000	Eco
Sodium	-	-	**6,860**	-	-	-	**7,620**	-	-	-	680,000	Eco	680,000	Eco
Vanadium	0.0700 U	0.0700 U	**1.10 J**	**1.68**	**1.98**	**1.64**	**0.900 J**	**1.19**	**1.22**	**1.41**	20.0	Eco	2.60	HH
Total Petroleum Hydrocarbons (µg/L)														
Diesel Range Organics	12.0 U	120 U	11.0 U	100 U	12.0 U	13.0 U	13.0 U	110 U	12.0 U	120 U	-	-	90.0	HH
Residual Range Organics	21.0 U	120 U	19.0 U	100 U	20.0 U	120 U	22.0 U	110 U	20.0 U	120 U	-	-	290	HH
Gasoline Range Organics	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	13.0 U	-	-	100	HH
Total Butyltins (µg/L)														
Monobutyltin	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0110 U	0.0290 U	0.0290 U	0.0290 U	0.0630	Eco	0.0630	Eco
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)														
Phenanthrene	0.0220 U	0.0240 U	0.0240 U	0.0220 U	0.0220 U	0.0250 U	0.0230 U	0.0240 U	0.0220 U	0.0240 U	6.30	Eco	0.140	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)														
Benzo(b)fluoranthene	0.0170 U	0.0190 U	0.0190 U	0.0170 U	0.0170 U	0.0200 U	0.0180 U	0.0190 U	0.0170 U	0.0190 U	0.00380	HH	0.0290	HH
Benzo(k)fluoranthene	0.0240 U	0.0260 U	0.0260 U	0.0240 U	0.0240 U	0.0280 U	0.0250 U	0.0270 U	0.0240 U	0.0260 U	0.00380	HH	0.290	HH
General Chemistry Parameters (mg/L)														
Dissolved Bromide	-	-	0.0100 U	-	-	-	0.0100 U	-	-	-	-	-	-	-
Dissolved Chloride	-	-	**2.10**	-	-	-	**2.40**	-	-	-	230	Eco	230	Eco
Dissolved Fluoride	-	-	**0.0550 J**	-	-	-	**0.0510 J**	-	-	-	-	-	1.50	HH
Dissolved Sulfate	-	-	**13.1**	-	-	-	**13.1**	-	-	-	-	-	-	-
Dissolved Ammonia	-	-	**0.0400 J**	-	-	-	**0.0300 J**	-	-	-	-	-	-	-
Dissolved Nitrate+Nitrite	-	-	**0.200**	-	-	-	**0.0260 J**	-	-	-	-	-	10.0	HH
Total Organic Carbon	-	-	**0.800**	-	-	-	**1.00**	-	-	-	-	-	-	-
Dissolved Organic Carbon	-	-	**2.50 J**	-	-	-	**1.00**	-	-	-	-	-	-	-
Dissolved Carbonate as CaCO3	-	-	1.00 U	-	-	-	1.00 U	-	-	-	-	-	-	-

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3i
2008-2009 Sandblast Area AOPC Quarterly Groundwater Analytical Results
Volatile Organic Compounds
(Page 1 of 3)

Site ID	MW-11*	MW-11	MW-11*	MW-11*	MW-12	MW-12	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080415MW11GW	080715MW11GW	081020MW11GW	090112MW11GW	080415MW12GW	080715MW12GW				
Sample Date	4/15/2008	7/15/2008	10/20/2008	1/12/2009	4/15/2008	7/15/2008				
Sample Depth (Feet btc)	31	31	31	31	28	21				
Total Volatile Organic Compounds (µg/L)										
1,1,1,2-Tetrachloroethane	0.0450 U	-	-	-	0.0450 U	-	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	0.0620 U	-	-	-	**1.90**	-	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	0.0880 U	-	-	-	0.0880 U	-	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	0.0940 U	-	-	-	0.0940 U	-	0.590	HH	0.230	HH
1,1-Dichloroethane	0.0590 U	-	-	-	**5.00**	-	47.0	Eco	2.30	HH
1,1-Dichloroethene	0.100 U	-	-	-	**2.10**	-	25.0	Eco	25.0	Eco
1,1-Dichloropropene	0.0620 U	-	-	-	0.0620 U	-	-	-	0.430	HH
1,2,3-Trichlorobenzene	0.0840 U	-	-	-	0.0840 U	-	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	0.240 U	-	-	-	0.240 U	-	-	-	0.000720	HH
1,2,4-Trichlorobenzene	0.180 U	-	-	-	0.180 U	-	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	0.0620 U	-	-	-	0.0620 U	-	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	0.500 U	-	-	-	0.500 U	-	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	0.0720 U	-	-	-	0.0720 U	-	-	-	0.00630	HH
1,2-Dichlorobenzene	0.0690 U	-	-	-	0.0690 U	-	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	0.0660 U	-	-	-	0.0660 U	-	0.380	HH	0.140	HH
1,2-Dichloropropane	0.0620 U	-	-	-	0.0620 U	-	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	0.0660 U	-	-	-	0.0660 U	-	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	0.0820 U	-	-	-	0.0820 U	-	71.0	Eco	0.420	HH
1,3-Dichloropropane	0.0570 U	-	-	-	0.0570 U	-	5,700	Eco	730	HH
1,4-Dichlorobenzene	0.0840 U	-	-	-	0.0840 U	-	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.420 U	0.500	HH	0.390	HH
2-Butanone (MEK)	2.30 U	-	-	-	2.30 U	-	14,000	Eco	7,100	HH
2-Chlorotoluene	0.0790 U	-	-	-	0.0790 U	-	-	-	730	HH
2-Hexanone	2.40 U	-	-	-	2.40 U	-	99.0	Eco	47.0	HH
4-Chlorotoluene	0.0570 U	-	-	-	0.0570 U	-	-	-	2,600	HH
4-Isopropyltoluene	0.0700 U	-	-	-	0.0700 U	-	-	-	-	-
4-Methyl-2-pentanone (MIBK)	1.40 U	-	-	-	1.40 U	-	170	Eco	170	Eco
Acetone	3.00 U	-	-	-	3.00 U	-	1,500	Eco	1,500	Eco
Benzene	0.0620 U	-	-	-	0.0620 U	-	2.20	HH	0.390	HH
Bromobenzene	0.0660 U	-	-	-	0.0660 U	-	-	-	88.0	HH
Bromochloromethane	0.0990 U	-	-	-	0.0990 U	-	0.550	HH	0.120	HH
Bromodichloromethane	0.0550 U	-	-	-	0.0550 U	-	0.550	HH	0.120	HH
Bromoform	0.0990 U	-	-	-	0.0990 U	-	4.30	HH	7.20	HH
Bromomethane	0.120 U	-	-	-	0.120 U	-	16.0	Eco	8.70	HH
Carbon Disulfide	**0.255 J**	-	-	-	**0.200 J**	-	0.920	Eco	0.920	Eco
Carbon Tetrachloride	0.0480 U	-	-	-	0.0480 U	-	0.230	HH	0.190	HH
Chlorobenzene	0.0640 U	-	-	-	0.0640 U	-	50.0	Eco	50.0	Eco
Chloroethane	0.130 U	-	-	-	0.130 U	-	-	-	21,000	HH
Chloroform	**0.180 J**	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.410 U	5.70	HH	0.190	HH
Chloromethane	0.110 U	-	-	-	0.110 U	-	-	-	190	HH
cis-1,2-Dichloroethene	0.0660 U	0.0660 U	0.0660 U	0.0660 U	**550**	**660**	590	Eco	360	HH
cis-1,3-Dichloropropene	0.0550 U	-	-	-	0.0550 U	-	0.0550	Eco	0.0550	Eco
Dibromochloromethane	0.0720 U	-	-	-	0.0720 U	-	0.400	HH	0.680	HH
Dibromomethane	0.120 U	-	-	-	0.120 U	-	-	-	8.20	HH
Dichlorodifluoromethane	0.0750 U	-	-	-	0.0750 U	-	-	-	390	HH
Dichloromethane (Methylene Chloride)	**0.175 J**	-	-	-	0.0840 U	-	4.60	HH	4.40	HH
Ethylbenzene	0.0680 U	-	-	-	0.0680 U	-	7.30	Eco	1.40	HH
Hexachlorobutadiene	0.150 U	-	-	-	0.150 U	-	0.440	HH	0.860	HH
Isopropylbenzene	0.0760 U	-	-	-	0.0760 U	-	7.30	Eco	7.30	Eco
m,p-Xylenes	0.110 U	-	-	-	0.110 U	-	13.0	Eco	13.0	Eco
Naphthalene	0.0960 U	-	-	-	0.0960 U	-	620	Eco	0.140	HH
n-Butylbenzene	0.0850 U	-	-	-	0.0850 U	-	-	-	-	-
n-Propylbenzene	0.00590 U	-	-	-	0.00590 U	-	7.30	Eco	7.30	Eco
o-Xylene	0.0680 U	-	-	-	0.0680 U	-	350	Eco	350	Eco
sec-Butylbenzene	0.0710 U	-	-	-	0.0710 U	-	-	-	-	-
Styrene	0.0770 U	-	-	-	0.0770 U	-	72.0	Eco	72.0	Eco
tert-Butylbenzene	0.0590 U	-	-	-	0.0590 U	-	-	-	-	-
Tetrachloroethene (PCE)	0.0970 U	0.0970 U	0.0970 U	0.0970 U	**5.10**	**5.10**	0.690	HH	0.0930	HH
Toluene	**0.510 J**	-	-	-	**0.580**	-	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	0.0690 U	-	-	-	**1.70**	-	140	HH	110	HH
trans-1,3-Dichloropropene	0.0750 U	-	-	-	0.0750 U	-	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	0.0730 U	0.0730 U	0.0730 U	0.0730 U	**3.20**	**3.00**	2.50	HH	0.0390	HH
Trichlorofluoromethane	0.0990 U	-	-	-	0.0990 U	-	-	-	1,300	HH
Vinyl Acetate	0.910 U	-	-	-	0.910 U	-	16.0	Eco	16.0	Eco
Vinyl Chloride	0.0440 U	0.0440 U	0.0440 U	0.0440 U	**4.10**	**0.900 J**	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3i
2008-2009 Sandblast Area AOPC Quarterly Groundwater Analytical Results
Volatile Organic Compounds
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Site ID	MW-12	MW-12	MW-13	MW-13*	MW-13	MW-13	MW-14	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	081021MW12GW	090113MW12GW	080414MW13GW	080714MW13GW	081020MW13GW	090112MW13GW	080414MW14GW				
Sample Date	10/21/2008	1/13/2009	4/14/2008	7/14/2008	10/20/2008	1/12/2009	4/14/2008				
Sample Depth (Feet btc)	26	26	31	31	31	30	18				
Total Volatile Organic Compounds (µg/L)											
1,1,1,2-Tetrachloroethane	-	-	0.0450 U	-	-	-	0.0450 U	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	-	-	0.0620 U	-	-	-	**0.220 J**	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	-	-	0.0880 U	-	-	-	0.0880 U	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	-	-	0.0940 U	-	-	-	0.0940 U	0.590	HH	0.230	HH
1,1-Dichloroethane	-	-	0.0590 U	-	-	-	**0.320 J**	47.0	Eco	2.30	HH
1,1-Dichloroethene	-	-	0.100 U	-	-	-	0.100 U	25.0	Eco	25.0	Eco
1,1-Dichloropropene	-	-	0.0620 U	-	-	-	0.0620 U	-	-	0.430	HH
1,2,3-Trichlorobenzene	-	-	0.0840 U	-	-	-	0.0840 U	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	-	-	0.240 U	-	-	-	0.240 U	-	-	0.000720	HH
1,2,4-Trichlorobenzene	-	-	0.180 U	-	-	-	0.180 U	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	-	-	0.0620 U	-	-	-	0.0620 U	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	-	-	0.500 U	-	-	-	0.500 U	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	-	-	0.0720 U	-	-	-	0.0720 U	-	-	0.00630	HH
1,2-Dichlorobenzene	-	-	0.0690 U	-	-	-	0.0690 U	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	-	-	0.0660 U	-	-	-	0.0660 U	0.380	HH	0.140	HH
1,2-Dichloropropane	-	-	0.0620 U	-	-	-	0.0620 U	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	-	-	0.0660 U	-	-	-	0.0660 U	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	-	-	0.0820 U	-	-	-	0.0820 U	71.0	Eco	0.420	HH
1,3-Dichloropropane	-	-	0.0570 U	-	-	-	0.0570 U	5,700	Eco	730	HH
1,4-Dichlorobenzene	-	-	0.0840 U	-	-	-	0.0840 U	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.210 U	0.210 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.500	HH	0.390	HH
2-Butanone (MEK)	-	-	2.30 U	-	-	-	2.30 U	14,000	Eco	7,100	HH
2-Chlorotoluene	-	-	0.0790 U	-	-	-	0.0790 U	-	-	730	HH
2-Hexanone	-	-	2.40 U	-	-	-	2.40 U	99.0	Eco	47.0	HH
4-Chlorotoluene	-	-	0.0570 U	-	-	-	0.0570 U	-	-	2,600	HH
4-Isopropyltoluene	-	-	0.0700 U	-	-	-	0.0700 U	-	-	-	-
4-Methyl-2-pentanone (MIBK)	-	-	1.40 U	-	-	-	1.40 U	170	Eco	170	Eco
Acetone	-	-	3.00 U	-	-	-	3.00 U	1,500	Eco	1,500	Eco
Benzene	-	-	0.0620 U	-	-	-	0.0620 U	2.20	HH	0.390	HH
Bromobenzene	-	-	0.0660 U	-	-	-	0.0660 U	-	-	88.0	HH
Bromochloromethane	-	-	0.0990 U	-	-	-	0.0990 U	0.550	HH	0.120	HH
Bromodichloromethane	-	-	0.0550 U	-	-	-	0.0550 U	0.550	HH	0.120	HH
Bromoform	-	-	0.0990 U	-	-	-	0.0990 U	4.30	HH	7.20	HH
Bromomethane	-	-	0.120 U	-	-	-	0.120 U	16.0	Eco	8.70	HH
Carbon Disulfide	-	-	**0.170 J**	-	-	-	**0.120 J**	0.920	Eco	0.920	Eco
Carbon Tetrachloride	-	-	0.0480 U	-	-	-	0.0480 U	0.230	HH	0.190	HH
Chlorobenzene	-	-	0.0640 U	-	-	-	0.0640 U	50.0	Eco	50.0	Eco
Chloroethane	-	-	0.130 U	-	-	-	0.130 U	-	-	21,000	HH
Chloroform	0.210 U	0.210 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	5.70	HH	0.190	HH
Chloromethane	-	-	0.110 U	-	-	-	0.110 U	-	-	190	HH
cis-1,2-Dichloroethene	**600**	**530**	**2.00**	**2.10**	**2.50**	**2.40**	**46.0**	590	Eco	360	HH
cis-1,3-Dichloropropene	-	-	0.0550 U	-	-	-	0.0550 U	0.0550	Eco	0.0550	Eco
Dibromochloromethane	-	-	0.0720 U	-	-	-	0.0720 U	0.400	HH	0.680	HH
Dibromomethane	-	-	0.120 U	-	-	-	0.120 U	-	-	8.20	HH
Dichlorodifluoromethane	-	-	0.0750 U	-	-	-	0.0750 U	-	-	390	HH
Dichloromethane (Methylene Chloride)	-	-	0.0840 U	-	-	-	0.0840 U	4.60	HH	4.40	HH
Ethylbenzene	-	-	0.0680 U	-	-	-	0.0680 U	7.30	Eco	1.40	HH
Hexachlorobutadiene	-	-	0.150 U	-	-	-	0.150 U	0.440	HH	0.860	HH
Isopropylbenzene	-	-	0.0760 U	-	-	-	0.0760 U	7.30	Eco	7.30	Eco
m,p-Xylenes	-	-	0.110 U	-	-	-	0.110 U	13.0	Eco	13.0	Eco
Naphthalene	-	-	0.0960 U	-	-	-	0.0960 U	620	Eco	0.140	HH
n-Butylbenzene	-	-	0.0850 U	-	-	-	0.0850 U	-	-	-	-
n-Propylbenzene	-	-	0.00590 U	-	-	-	0.00590 U	7.30	Eco	7.30	Eco
o-Xylene	-	-	0.0680 U	-	-	-	0.0680 U	350	Eco	350	Eco
sec-Butylbenzene	-	-	0.0710 U	-	-	-	0.0710 U	-	-	-	-
Styrene	-	-	0.0770 U	-	-	-	0.0770 U	72.0	Eco	72.0	Eco
tert-Butylbenzene	-	-	0.0590 U	-	-	-	0.0590 U	-	-	-	-
Tetrachloroethene (PCE)	**6.20**	**5.80**	**0.360 J**	**0.470 J**	**0.660**	**0.710**	**1.50**	0.690	HH	0.0930	HH
Toluene	-	-	**0.260 J**	-	-	-	**0.640**	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	-	-	0.0690 U	-	-	-	**0.110 J**	140	HH	110	HH
trans-1,3-Dichloropropene	-	-	0.0750 U	-	-	-	0.0750 U	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	**3.40**	**3.00**	**1.90**	**2.95**	**3.40**	**3.10**	**0.820**	2.50	HH	0.0390	HH
Trichlorofluoromethane	-	-	0.0990 U	-	-	-	0.0990 U	-	-	1,300	HH
Vinyl Acetate	-	-	0.910 U	-	-	-	0.910 U	16.0	Eco	16.0	Eco
Vinyl Chloride	**0.480 J**	**1.60**	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter	
btc = below top of well casing	J = The reported value is an estimate.
Eco = Ecological	U = The analyte was not detected at or above the MDL.
HH = Human Health	UJ = The analyte was not detected. The reported MDL is an estimate.
MDL = method detection limit	**bold** = analyte detected above MDL.
SLV = screening level value	🟨 = The reported concentration exceeds the selected SLV
- = Not Analyzed	* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
-- = SLV for analyte not available	

Table 6-3i
2008-2009 Sandblast Area AOPC Quarterly Groundwater Analytical Results
Volatile Organic Compounds
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Site ID	MW-14	MW-14	MW-14	MW-15	MW-15	MW-15	MW-15	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	080714MW14GW	081021MW14GW	090113MW14GW	080414MW15GW	080714MW15GW	081021MW15GW	090113MW15GW				
Sample Date	7/14/2008	10/21/2008	1/13/2009	4/14/2008	7/14/2008	10/21/2008	1/13/2009				
Sample Depth (Feet btc)	18	18	18	17	17	17	17				
Total Volatile Organic Compounds (µg/L)											
1,1,1,2-Tetrachloroethane	-	-	-	0.0450 U	-	-	-	186	Eco	0.520	HH
1,1,1-Trichloroethane (TCA)	-	-	-	0.0620 U	-	-	-	11.0	Eco	11.0	Eco
1,1,2,2-Tetrachloroethane	-	-	-	0.0880 U	-	-	-	0.170	HH	0.0670	HH
1,1,2-Trichloroethane	-	-	-	0.0940 U	-	-	-	0.590	HH	0.230	HH
1,1-Dichloroethane	-	-	-	0.0590 U	-	-	-	47.0	Eco	2.30	HH
1,1-Dichloroethene	-	-	-	0.100 U	-	-	-	25.0	Eco	25.0	Eco
1,1-Dichloropropene	-	-	-	0.0620 U	-	-	-	-	-	0.430	HH
1,2,3-Trichlorobenzene	-	-	-	0.0840 U	-	-	-	8.00	Eco	2.30	HH
1,2,3-Trichloropropane	-	-	-	0.240 U	-	-	-	-	-	0.000720	HH
1,2,4-Trichlorobenzene	-	-	-	0.180 U	-	-	-	35.0	HH	2.30	HH
1,2,4-Trimethylbenzene	-	-	-	0.0620 U	-	-	-	7.30	Eco	7.30	Eco
1,2-Dibromo-3-chloropropane	-	-	-	0.500 U	-	-	-	-	-	0.000320	HH
1,2-Dibromoethane (EDB)	-	-	-	0.0720 U	-	-	-	-	-	0.00630	HH
1,2-Dichlorobenzene	-	-	-	0.0690 U	-	-	-	14.0	Eco	14.0	Eco
1,2-Dichloroethane (EDC)	-	-	-	0.0660 U	-	-	-	0.380	HH	0.140	HH
1,2-Dichloropropane	-	-	-	0.0620 U	-	-	-	0.500	HH	0.390	HH
1,3,5-Trimethylbenzene	-	-	-	0.0660 U	-	-	-	7.30	Eco	7.30	Eco
1,3-Dichlorobenzene	-	-	-	0.0820 U	-	-	-	71.0	Eco	0.420	HH
1,3-Dichloropropane	-	-	-	0.0570 U	-	-	-	5,700	Eco	730	HH
1,4-Dichlorobenzene	-	-	-	0.0840 U	-	-	-	15.0	Eco	0.420	HH
2,2-Dichloropropane	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.0830 U	0.500	HH	0.390	HH
2-Butanone (MEK)	-	-	-	2.30 U	-	-	-	14,000	Eco	7,100	HH
2-Chlorotoluene	-	-	-	0.0790 U	-	-	-	-	-	730	HH
2-Hexanone	-	-	-	2.40 U	-	-	-	99.0	Eco	47.0	HH
4-Chlorotoluene	-	-	-	0.0570 U	-	-	-	-	-	2,600	HH
4-Isopropyltoluene	-	-	-	0.0700 U	-	-	-	-	-	-	-
4-Methyl-2-pentanone (MIBK)	-	-	-	1.40 U	-	-	-	170	Eco	170	Eco
Acetone	-	-	-	3.00 U	-	-	-	1,500	Eco	1,500	Eco
Benzene	-	-	-	0.0620 U	-	-	-	2.20	HH	0.390	HH
Bromobenzene	-	-	-	0.0660 U	-	-	-	-	-	88.0	HH
Bromochloromethane	-	-	-	0.0990 U	-	-	-	0.550	HH	0.120	HH
Bromodichloromethane	-	-	-	0.0550 U	-	-	-	0.550	HH	0.120	HH
Bromoform	-	-	-	0.0990 U	-	-	-	4.30	HH	7.20	HH
Bromomethane	-	-	-	0.120 U	-	-	-	16.0	Eco	8.70	HH
Carbon Disulfide	-	-	-	**0.120 J**	-	-	-	0.920	Eco	0.920	Eco
Carbon Tetrachloride	-	-	-	0.0480 U	-	-	-	0.230	HH	0.190	HH
Chlorobenzene	-	-	-	0.0640 U	-	-	-	50.0	Eco	50.0	Eco
Chloroethane	-	-	-	0.130 U	-	-	-	-	-	21,000	HH
Chloroform	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	0.0820 U	5.70	HH	0.190	HH
Chloromethane	-	-	-	0.110 U	-	-	-	-	-	190	HH
cis-1,2-Dichloroethene	**10.0**	**0.620**	**50.0**	**0.440 J**	**0.170 J**	**0.0800 J**	0.0660 U	590	Eco	360	HH
cis-1,3-Dichloropropene	-	-	-	0.0550 U	-	-	-	0.0550	Eco	0.0550	Eco
Dibromochloromethane	-	-	-	0.0720 U	-	-	-	0.400	HH	0.680	HH
Dibromomethane	-	-	-	0.120 U	-	-	-	-	-	8.20	HH
Dichlorodifluoromethane	-	-	-	0.0750 U	-	-	-	-	-	390	HH
Dichloromethane (Methylene Chloride)	-	-	-	0.0840 U	-	-	-	4.60	HH	4.40	HH
Ethylbenzene	-	-	-	0.0680 U	-	-	-	7.30	Eco	1.40	HH
Hexachlorobutadiene	-	-	-	0.150 U	-	-	-	0.440	HH	0.860	HH
Isopropylbenzene	-	-	-	0.0760 U	-	-	-	7.30	Eco	7.30	Eco
m,p-Xylenes	-	-	-	0.110 U	-	-	-	13.0	Eco	13.0	Eco
Naphthalene	-	-	-	0.0960 U	-	-	-	620	Eco	0.140	HH
n-Butylbenzene	-	-	-	0.0850 U	-	-	-	-	-	-	-
n-Propylbenzene	-	-	-	0.00590 U	-	-	-	7.30	Eco	7.30	Eco
o-Xylene	-	-	-	0.0680 U	-	-	-	350	Eco	350	Eco
sec-Butylbenzene	-	-	-	0.0710 U	-	-	-	-	-	-	-
Styrene	-	-	-	0.0770 U	-	-	-	72.0	Eco	72.0	Eco
tert-Butylbenzene	-	-	-	0.0590 U	-	-	-	-	-	-	-
Tetrachloroethene (PCE)	**1.10**	**0.380 J**	**1.80**	**1.80**	**1.60**	**2.10**	**1.10**	0.690	HH	0.0930	HH
Toluene	-	-	-	**0.230 J**	-	-	-	9.80	Eco	9.80	Eco
trans-1,2-Dichloroethene	-	-	-	0.0690 U	-	-	-	140	HH	110	HH
trans-1,3-Dichloropropene	-	-	-	0.0750 U	-	-	-	0.0550	Eco	0.0550	Eco
Trichloroethene (TCE)	**0.610**	**0.140 J**	**0.890**	**0.270 J**	**0.230 J**	**0.250 J**	0.0730 U	2.50	HH	0.0390	HH
Trichlorofluoromethane	-	-	-	0.0990 U	-	-	-	-	-	1,300	HH
Vinyl Acetate	-	-	-	0.910 U	-	-	-	16.0	Eco	16.0	Eco
Vinyl Chloride	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0440 U	0.0250	HH	0.0250	HH

Notes:

µg/L = microgram per liter
btc = below top of well casing
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-3j
2009 Sandblast Area AOPC Soil Gas Analytical Results
Volatile Organic Compounds

Site ID	SB-10	SB-11	SB-12*	SB-13	SB-14	**Selected SLV**	**SLV Source**
Sample ID	090126-SB-SB10-3_5-4SG	090126-SB-SB11-3_5-4SG	090126-SB-SB12-3_5-4SG	090126-SB-SB13-3_5-4SG	090126-SB-SB14-3_5-4SG		
Sample Date	1/26/2009	1/26/2009	1/26/2009	1/26/2009	1/26/2009		
Sample Depth (Feet bgs)	3.5-4.0	3.5-4.0	3.5-4.0	3.5-4.0	3.5-4.0		
Total Volatile Organic Compounds (µg/m^3)							
1,1,1-Trichloroethane (TCA)	**8.10 J**	**13.0**	**98.0 J**	**5.20 J**	**16.0 J**	22,000,000	HH
1,1,2,2-Tetrachloroethane	1.90 U	2.70 U	110 U	5.80 U	6.00 U	210	HH
1,1,2-Trichloroethane	2.00 U	2.90 U	110 U	6.20 U	6.30 U	770	HH
1,1-Dichloroethane	0.980 U	1.40 U	56.0 U	3.00 U	3.10 U	7,700	HH
1,1-Dichloroethene	0.840 U	1.20 U	48.0 U	2.60 U	2.70 U	880,000	HH
1,2,4-Trichlorobenzene	12.0 U	17.0 U	660 U	36.0 U	37.0 U	8,800	HH
1,2,4-Trimethylbenzene	**95.0**	**930**	**18,500**	**2,000**	**270**	31,000	HH
1,2-Dibromoethane (EDB)	1.20 U	1.70 U	66.0 U	3.60 U	3.70 U	20.0	HH
1,2-Dichlorobenzene	1.60 U	2.40 U	93.0 U	5.10 U	5.20 U	880,000	HH
1,2-Dichloroethane (EDC)	0.860 U	1.20 U	49.0 U	2.70 U	2.70 U	470	HH
1,2-Dichloropropane	0.980 U	1.40 U	56.0 U	3.00 U	3.10 U	1,200	HH
1,3,5-Trimethylbenzene	**30.0**	**240**	**6,250**	**610**	**68.0**	26,000	HH
1,3-Butadiene	**10.0**	**2.20 J**	23.0 U	**12.0**	**210**	410	HH
1,3-Dichlorobenzene	1.80 U	2.60 U	100 U	5.60 U	5.80 U	1,100	HH
1,4-Dichlorobenzene	1.80 U	2.60 U	100 U	5.60 U	5.80 U	1,100	HH
1,4-Dioxane	**1.10 J**	1.10 U	43.0 U	2.40 U	2.40 U	1,600	HH
2,2,4-Trimethylpentane	**1.80 J**	1.20 U	48.0 U	2.60 U	2.70 U	31,000	HH
2-Butanone (MEK)	**31.0**	1.70 U	66.0 U	3.60 U	**16.0**	22,000,000	HH
2-Hexanone	2.40 U	3.40 U	130 U	7.30 U	7.50 U	130,000	HH
2-Propanol	1.50 U	2.20 U	84.0 U	4.60 U	4.80 U	31,000,000	HH
3-Chloropropene	2.60 U	3.90 U	150 U	8.20 U	8.50 U	2,000	HH
4-Ethyltoluene	**85.0**	**260**	**9,150**	**680**	**74.0**	22,000,000	HH
4-Methyl-2-pentanone (MIBK)	**2.10 J**	1.10 U	42.0 U	2.30 U	2.40 U	13,000,000	HH
Acetone	**97.0**	21.0 U	86.0 U	4.70 U	**83.0**	140,000,000	HH
alpha-Chlorotoluene	1.60 U	2.30 U	89.0 U	4.90 U	5.00 U	250	HH
Benzene	**18.0**	**2.10 J**	27.0 U	**7.00 J**	**85.0**	1,600	HH
Bromodichloromethane	0.610 U	0.890 U	34.0 U	1.90 U	1.90 U	330	HH
Bromoform	3.10 U	4.60 U	180 U	9.70 U	10.0 U	11,000	HH
Bromomethane	1.40 U	2.00 U	80.0 U	4.40 U	4.50 U	22,000	HH
Carbon Disulfide	4.70 U	**1.80 J**	27.0 U	**5.90 J**	**42.0**	3,100,000	HH
Carbon Tetrachloride	1.10 U	1.70 U	65.0 U	3.50 U	3.60 U	820	HH
Chlorobenzene	1.10 U	1.60 U	63.0 U	3.50 U	3.60 U	220,000	HH
Chloroethane	0.640 U	0.930 U	36.0 U	2.00 U	2.00 U	44,000,000	HH
Chloroform	**0.750 J**	1.10 U	42.0 U	2.30 U	2.40 U	530	HH
Chloromethane	0.940 U	1.40 U	53.0 U	2.90 U	3.00 U	390,000	HH
cis-1,2-Dichloroethene	**330**	**69.0**	**145 J**	**8.60 J**	**21.0**	260,000	HH
cis-1,3-Dichloropropene	0.550 U	0.800 U	31.0 U	1.70 U	1.80 U	3,100	HH
Cyclohexane	**3.00 J**	0.760 U	30.0 U	**1.80 J**	**24.0**	26,000,000	HH
Dibromochloromethane	1.80 U	2.60 U	100 U	5.60 U	5.80 U	450	HH
Dichlorodifluoromethane	**3.20 J**	**3.00 J**	76.0 U	4.20 U	4.30 U	880,000	HH
Dichloromethane (Methylene Chloride)	**1.80 J**	1.50 U	60.0 U	3.30 U	3.40 U	26,000	HH
Ethanol	**13.0**	**13.0 J**	100 U	5.70 U	5.80 U	--	--
Ethylbenzene	**82.0**	**27.0**	**1,550**	**78.0**	**25.0**	4,900	HH
Freon 113	1.20 U	1.70 U	66.0 U	3.60 U	3.70 U	130,000,000	HH
Freon 114	1.50 U	2.20 U	84.0 U	4.60 U	4.70 U	130,000,000	HH
Heptane	**36.0**	9.00 U	**87.0 J**	**7.60 J**	**67.0**	3,100,000	HH
Hexachlorobutadiene	17.0 U	25.0 U	970 U	53.0 U	55.0 U	560	HH
Hexane	**12.0**	**1.30 J**	42.0 U	**8.60 J**	**110**	3,100,000	HH
Isopropylbenzene	**4.30 J**	**12.0**	**675**	**42.0**	**5.40 J**	1,800,000	HH
m,p-Xylenes	**350**	**100**	**5,850**	**310**	**61.0**	440,000	HH
Methyl tert-butyl ether	1.40 U	2.10 U	81.0 U	4.40 U	4.50 U	47,000	HH
n-Propylbenzene	**21.0**	**56.0**	**2,300**	**170**	**16.0 J**	4,400,000	HH
o-Xylene	**120**	**52.0**	**2,800**	**150**	**28.0**	3,100,000	HH
Styrene	1.30 U	1.90 U	73.0 U	4.00 U	4.10 U	4,400,000	HH
Tetrachloroethene (PCE)	**610**	**800**	**34,000**	**1,800**	**730**	2,100	HH
Tetrahydrofuran	1.10 U	1.60 U	61.0 U	3.30 U	3.40 U	--	--
Toluene	**300**	**1,200**	**47,500**	**2,400**	**2,000**	22,000,000	HH
trans-1,2-Dichloroethene	**4.00 J**	2.60 U	100 U	5.60 U	5.80 U	260,000	HH
trans-1,3-Dichloropropene	0.960 U	1.40 U	55.0 U	3.00 U	3.10 U	3,100	HH
Trichloroethene (TCE)	**360**	**33.0**	**610 J**	**27.0**	**41.0**	140	HH
Trichlorofluoromethane	**2.20 J**	1.70 U	68.0 U	3.70 U	3.80 U	3,100,000	HH
Vinyl Chloride	0.930 U	1.40 U	53.0 U	2.90 U	3.00 U	2,800	HH

Notes:

µg/m3 = microgram per cubic meter
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-4a
2009 Pistol Range AOPC Soil and Lagoon Sediment Analytical Results
Metals, General Chemistry Parameters, and Grain Size

Sample Description	Pistol Range Soil Composite Samples		Lagoon Sediment Grab Samples					**Selected SLV (0-3 ft bgs)**	**SLV Source (0-3 ft bgs)**
Site ID	PR-EUA	PR-EUB	PR-04	PR-05	PR-06*	PR-07	PR-08		
Sample ID	090319-PR-EUA-So	090319-PR-EUB-So	090111-PR4-0-1SD	090111-PR5-0-1SD	090111-PR6-0-1SD	090111-PR7-0-1SD	090111-PR8-0-1SD		
Sample Date	3/19/2009	3/19/2009	1/11/2009	1/11/2009	1/11/2009	1/11/2009	1/11/2009		
Sample Depth (Feet bgs or brb)	0.0-0.17	0.0-0.17	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0		
Metals (mg/kg dry)									
Copper	-	-	**24.4**	**23.9**	**25.4**	**21.7**	**20.2**	55.6	UPL
Lead	-	-	**27.5**	**30.2**	**33.0**	**24.9**	**20.0**	35.0	Eco
Nickel	-	-	**14.5**	**15.0**	**15.4**	**13.2**	**12.9**	21.2	UPL
Zinc	-	-	**160 J**	**171 J**	**174 J**	**146 J**	**128 J**	123	Eco
General Chemistry Parameters and Grain Size (%)									
Carbon, Total Organic	-	-	**9,500**	**10,700**	**19,600 J**	**14,500**	**12,200**	--	--
Solids, Total	**800,000**	**756,000**	**688,000**	**690,000**	**678,000**	**637,000**	**609,000**	--	--
Gravel (>2.00 mm)	**32.7**	**20.3**	**2.22**	**0.320**	**0.0750**	**1.76**	**0.270**	--	--
Sand, Very Coarse (1.00 - 2.00 mm)	**10.2**	**4.62**	**0.940**	**0.390**	**0.125**	**0.490**	**0.300**	--	--
Sand, Coarse (0.50 - 1.00 mm)	**7.66**	**6.67**	**2.01**	**3.73**	**3.26**	**2.65**	**0.760**	--	--
Sand, Medium (0.25 - 0.50 mm)	**7.51**	**9.14**	**3.57**	**4.37**	**3.18**	**3.91**	**1.70**	--	--
Sand, Fine (0.125 - 0.25 mm)	**7.80**	**10.6**	**5.54**	**5.49**	**4.52**	**5.93**	**5.27**	--	--
Sand, Very Fine (0.0625 - 0.125 mm)	**6.08**	**8.73**	**18.1**	**10.9**	**12.5**	**16.4**	**24.9**	--	--
Silt (0.039 - 0.0625 mm)	**18.7**	**25.3**	**60.3**	**62.0**	**63.2**	**58.1**	**60.2**	--	--
Clay (<0.039 mm)	**6.40**	**10.1**	**7.96**	**9.83**	**10.1**	**4.35**	**2.73**	--	--

Notes:
mg/kg = milligram per kilogram
bgs = below ground surface
brb = below river bottom
Eco = Ecological
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed

-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-4b
2009 Pistol Range AOPC Groundwater Analytical Results
Metals and General Chemistry Parameters

Site ID	PR-01	PR-02D*	**Selected Discharge to Surface Water / Bioaccumulation SLV**	**SLV Source**	**Selected Direct Contact SLV**	**SLV Source**
Sample ID	090202-PR-PR1-16-20GW	090202-PR-PR2D-9-19GW				
Sample Date	2/2/2009	2/2/2009				
Sample Depth (Feet bgs)	16.0-20.0	9.0-19.0				
Total Metals (mg/L)						
Copper	**0.0548 J**	**0.0400 J**	1.30	HH	1.50	HH
Lead	**0.0105**	**0.0125 J**	--	--	0.0150	HH
Nickel	**0.0501**	**0.0215 J**	0.610	HH	0.730	HH
Zinc	**0.149**	**0.0781 J**	7.40	HH	11.0	HH
Dissolved Metals (mg/L)						
Copper	**0.000800 J**	**0.000665 J**	0.00900	Eco	0.00900	Eco
Lead	0.0000200 U	0.0000200 U	0.00250	Eco	0.00250	Eco
Nickel	**0.003900 J**	0.00200 U	0.0520	Eco	0.0520	Eco
Zinc	**0.004100 J**	**0.00210 J**	0.120	Eco	0.120	Eco
General Chemistry Parameters (mg/L)						
Solids, Total Dissolved	**307**	**219**	--	--	--	--
Total Suspended Solids	5.00 U	**3,170 J**	--	--	--	--

Notes:

mg/L = milligram per liter
bgs = below ground surface
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-5a
2009 Reference Area Soil Analytical Results
Metals, Polycyclic Aromatic Hydrodarbons, Total Solids, and Grain Size

Site ID	R-01	R-02	R-03	R-04	R-05	R-06	R-07*	R-08	R-09	R-10	R-11	R-12	R-13	R-14
Sample ID	090128-R-R1-0-0.5So	090128-R-R2-0-0.5So	090128-R-R3-0-0.5So	090128-R-R4-0-0.5So	090128-R-R5-0-0.5So	090128-R-R6-0-0.5So	090128-R-R7-0-0.5So	090128-R-R8-0-0.5So	090128-R-R9-0-0.5So	090128-R-R10-0-0.5So	090128-R-R11-0-0.5So	090128-R-R12-0-0.5So	090128-R-R13-0-0.5So	090128-R-R14-0-0.5So
Sample Date	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009	1/28/2009
Sample Depth (Feet bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Metals (mg/kg)														
Aluminum	**21,300**	**20,300**	**19,000**	**21,800**	**26,200**	**15,900**	**22,200**	**23,700**	**16,500**	**19,900**	**26,300**	**23,200**	**28,900**	**33,200**
Antimony	**0.120 J**	**0.130 J**	**0.130 J**	**0.170 J**	**0.130 J**	**0.130 J**	**0.140 J**	**0.110 J**	**0.180 J**	**0.120 J**	**0.130 J**	**0.0700 J**	**0.110 J**	**0.120 J**
Arsenic	**3.55**	**3.27**	**2.04**	**4.70**	**2.64**	**5.18**	**1.78**	**4.55**	**4.20**	**3.38**	**3.16**	**1.09**	**2.03**	**1.80**
Barium	**81.5**	**118**	**95.2**	**131**	**182**	**91.6**	**75.0**	**137**	**88.7**	**98.8**	**122**	**57.4**	**145**	**112**
Beryllium	**0.433**	**0.513**	**0.579**	**0.504**	**0.625**	**0.393**	**0.564**	**0.459**	**0.387**	**0.448**	**0.492**	**0.319**	**0.531**	**0.629**
Cadmium	**0.164**	**0.156**	**0.162**	**0.150**	**0.175**	**0.0990**	**0.340**	**0.194**	**0.105**	**0.143**	**0.155**	**0.102**	**0.132**	**0.191**
Calcium	**7,160**	**9,120**	**8,720**	**6,110**	**9,060**	**4,310**	**8,500**	**7,700**	**4,760**	**6,810**	**6,970**	**3,510**	**7,590**	**8,880**
Chromium	**21.8**	**21.4**	**23.4**	**21.7**	**27.3**	**19.2**	**18.8**	**23.1**	**17.8**	**18.8**	**23.5**	**15.5**	**26.4**	**25.9**
Cobalt	**19.1**	**18.3**	**19.2**	**15.8**	**17.9**	**12.8**	**19.9**	**17.5**	**11.4**	**17.0**	**17.2**	**9.66**	**16.6**	**18.5**
Copper	**37.6**	**45.1**	**35.3**	**33.0**	**49.4**	**22.8**	**43.7**	**30.3**	**29.4**	**35.5**	**44.4**	**32.0**	**49.2**	**58.2**
Iron	**29,900**	**26,400**	**29,100**	**28,500**	**32,000**	**24,500**	**33,500**	**30,300**	**27,300**	**29,200**	**33,000**	**22,900**	**34,000**	**37,000**
Lead	**14.9**	**17.4**	**26.5**	**19.5**	**19.2**	**15.4**	**24.0**	**22.3**	**15.4**	**13.1**	**14.6**	**12.5**	**19.0**	**14.6**
Magnesium	**10,500**	**6,770**	**5,160**	**6,700**	**8,300**	**4,770**	**3,710**	**8,740**	**5,100**	**8,450**	**10,100**	**9,080**	**10,100**	**12,000**
Manganese	**589**	**685**	**526**	**733**	**716**	**498**	**920**	**622**	**423**	**627**	**650**	**415**	**580**	**799**
Mercury	**0.0430**	**0.0550**	**0.0680**	**0.0590**	**0.0510**	**0.0430**	**0.0620**	**0.0490**	**0.0440**	**0.0480**	**0.0340 J**	**0.0470**	**0.0480**	**0.0400**
Nickel	**18.2**	**19.0**	**20.8**	**15.7**	**23.8**	**11.5**	**17.6**	**19.6**	**12.9**	**20.9**	**19.5**	**12.8**	**22.9**	**26.1**
Potassium	**923**	**1,490**	**1,920**	**1,200**	**1,930**	**1,020**	**1,240**	**1,740**	**1,070**	**1,290**	**1,370**	**572 J**	**1,200**	**1,710**
Selenium	0.400 U	0.400 U	0.400 U	0.400 U	0.400 U	0.500 U	0.400 U	0.400 U	0.500 U	0.400 U	0.400 U	0.400 U	0.400 U	0.400 U
Silver	**0.0870**	**0.0950**	**0.0530 J**	**0.0660**	**0.0450 J**	**0.187**	**0.0515 J**	**0.0270 J**	0.0230 U	**0.0440 J**	**0.0370 J**	0.0220 U	**0.0330 J**	**0.0370 J**
Sodium	**324**	**131**	**123**	**139**	**131**	**136**	**69.6 J**	**279**	**222**	**142**	**186**	**124**	**276**	**115**
Thallium	**0.153**	**0.203**	0.100 U	**0.143**	0.103 U	**0.147**	**0.154**	**0.190**	**0.142**	0.0980 U	**0.128**	0.0420 U	0.0930 U	0.0810 U
Vanadium	**79.4**	**69.6**	**83.7**	**82.0**	**91.8**	**69.4**	**75.1**	**81.0**	**75.2**	**73.7**	**90.2**	**43.0**	**89.1**	**99.3**
Zinc	**54.7 J**	**68.5 J**	**66.7 J**	**58.8 J**	**65.9 J**	**45.6 J**	**59.9 J**	**66.7 J**	**50.6 J**	**52.9 J**	**56.0 J**	**55.1 J**	**56.5 J**	**65.8 J**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)														
Acenaphthene	**1.90 J**	**1.20 J**	**3.40 J**	1.00 U	**1.60 J**	**1.20 J**	**1.75 J**	**1.80 J**	1.00 U	**1.50 J**	1.00 U	**1.40 J**	1.00 U	1.00 U
Acenaphthylene	1.40 U	1.40 U	**1.60 J**	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U
Anthracene	**2.70 J**	**2.00 J**	**4.90 J**	**1.50 J**	**1.90 J**	**2.00 J**	**3.30 J**	**2.20 J**	**3.50 J**	**2.10 J**	1.40 U	**1.70 J**	**1.80 J**	1.40 U
Fluorene	1.70 U	1.70 U	**3.20 J**	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Naphthalene	1.30 U	**1.60 J**	**2.20 J**	1.30 U	1.30 U	**1.30 J**	**1.80 J**	**1.60 J**	1.30 U	**1.70 J**	1.30 U	1.30 U	1.30 U	1.30 U
Phenanthrene	**16.0**	**16.0**	**34.0**	**9.10 J**	**13.0**	**9.60 J**	**16.0**	**18.0**	**13.0**	**11.0**	**5.50 J**	**9.60 J**	**8.30 J**	**5.80 J**
Total LPAHs (KM, capped; NDs at MDL)	**24.5 J**	**23.3 J**	**49.3 J**	**14.7 J**	**20.5 J**	**16.6 J**	**25.7 J**	**26.5 J**	**20.5 J**	**19.2 J**	**12.3 J**	**16.6 J**	**14.1 J**	**12.6 J**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)														
Benzo(a)anthracene	**16.0**	**17.0**	**34.0**	**9.90 J**	**17.0**	**11.0**	**20.5**	**16.0**	**13.0**	**10.0**	**7.40 J**	**12.0**	**8.00 J**	**4.60 J**
Benzo(a)pyrene	**20.0**	**22.0**	**45.0**	**11.0**	**20.0**	**16.0**	**26.5**	**22.0**	**15.0**	**15.0**	**8.30 J**	**16.0**	**10.0**	**7.70 J**
Benzo(b)fluoranthene	**27.0**	**29.0**	**55.0**	**16.0**	**27.0**	**19.0**	**33.0**	**27.0**	**22.0**	**18.0**	**13.0**	**20.0**	**12.0**	**9.10 J**
Benzo(g,h,i)perylene	**14.0**	**16.0**	**32.0**	**11.0**	**16.0**	**13.0**	**20.5**	**15.0**	**11.0**	**12.0**	**8.20 J**	**9.70 J**	**7.30 J**	**5.80 J**
Benzo(k)fluoranthene	**8.30 J**	**9.70 J**	**19.0**	**6.70 J**	**9.50 J**	**7.70 J**	**10.8 J**	**8.70 J**	**7.10 J**	**6.90 J**	**3.40 J**	**7.20 J**	**4.30 J**	**2.70 J**
Chrysene	**20.0**	**23.0**	**45.0**	**13.0**	**22.0**	**17.0**	**25.5**	**21.0**	**15.0**	**15.0**	**8.90 J**	**15.0**	**10.0**	**6.40 J**
Dibenz(a,h)anthracene	**4.30 J**	2.20 U	**6.90 J**	2.20 U	**3.60 J**	**3.70 J**	**4.90 J**	**4.40 J**	2.20 U	2.20 U	**2.70 J**	2.20 U	2.20 U	2.20 U
Fluoranthene	**31.0**	**33.0**	**66.0**	**19.0**	**31.0**	**22.0**	**39.5**	**31.0**	**26.0**	**21.0**	**13.0**	**21.0**	**15.0**	**10.0**
Indeno(1,2,3-cd)pyrene	**17.0**	**16.0**	**34.0**	**12.0**	**16.0**	**12.0**	**22.0**	**17.0**	**12.0**	**5.20 J**	**8.20 J**	**12.0**	**7.60 J**	**6.00 J**
Pyrene	**29.0**	**31.0**	**64.0**	**18.0**	**30.0**	**23.0**	**39.0**	**31.0**	**26.0**	**21.0**	**15.0**	**24.0**	**14.0**	**10.0**
Total HPAHs (KM, capped; NDs at MDL)	**187 J**	**199 J**	**401 J**	**119 J**	**192 J**	**144 J**	**242 J**	**193 J**	**149 J**	**126 J**	**88.1 J**	**139 J**	**90.4 J**	**64.5 J**
General Chemistry Parameters (mg/kg) and Grain Size (%)														
Carbon, Total Organic	**37,200**	**39,800**	**53,100**	**50,800**	**55,300**	**37,300**	**38,800**	**44,600**	**29,900**	**42,700**	**33,100**	**77,800**	**39,200**	**46,100**
Solids, Total	**671,000**	**653,000**	**661,000**	**661,000**	**633,000**	**720,000**	**834,000**	**679,000**	**717,000**	**698,000**	**676,000**	**664,000**	**653,000**	**655,000**
Gravel (>2.00 mm)	**22.8**	**31.6**	**27.4**	**32.9**	**22.6**	**29.4**	**33.4**	**32.7**	**13.1**	**32.3**	**13.5**	**15.4**	**26.2**	**25.9**
Sand, Very Coarse (1.00 - 2.00 mm)	**14.2**	**14.9**	**20.5**	**15.3**	**14.2**	**7.50**	**20.9**	**15.2**	**9.29**	**15.3**	**9.05**	**16.2**	**14.2**	**12.8**
Sand, Coarse (0.50 - 1.00 mm)	**11.1**	**7.95**	**14.2**	**9.55**	**9.50**	**8.30**	**11.7**	**10.7**	**8.28**	**11.1**	**7.22**	**14.5**	**8.83**	**10.8**
Sand, Medium (0.25 - 0.50 mm)	**8.07**	**5.26**	**7.95**	**7.39**	**7.07**	**12.2**	**5.94**	**6.92**	**11.3**	**8.48**	**8.98**	**10.4**	**5.67**	**6.62**
Sand, Fine (0.125 - 0.25 mm)	**7.05**	**5.49**	**5.37**	**6.25**	**5.81**	**8.51**	**4.08**	**5.55**	**13.6**	**6.98**	**9.89**	**8.86**	**5.64**	**5.26**
Sand, Very Fine (0.0625 - 0.125 mm)	**5.38**	**4.79**	**3.31**	**4.31**	**4.26**	**5.81**	**3.26**	**4.19**	**11.3**	**4.48**	**7.26**	**8.76**	**5.18**	**4.00**
Silt (0.039 - 0.0625 mm)	**22.4**	**21.9**	**14.9**	**18.1**	**25.8**	**21.4**	**9.76**	**18.4**	**24.9**	**17.0**	**29.0**	**23.2**	**22.5**	**23.7**
Clay (<0.039 mm)	**10.9**	**11.0**	**6.37**	**8.03**	**11.9**	**12.1**	**10.2**	**8.09**	**8.98**	**7.08**	**17.7**	**5.84**	**14.1**	**13.2**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
bgs = below ground surface
MDL = method detection limit
ND = non detect
\- = Not Analyzed
-- = SLV for analyte not available

J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped

Table 6-5b
2008-2009 Reference Area Quarterly Groundwater Analytical Results
Metals, Petroleum Hydrocarbons, Butyltins, Volatile Organic Compounds, Semivolatile Organic Compounds, and General Chemistry Parameters

Site ID	MW-10*	MW-10*	MW-10*	MW-10*
Sample ID	080415MW10GW	080716MW10GW	081022MW10GW	090113MW10GW
Sample Date	4/15/2008	7/16/2008	10/22/2008	1/13/2009
Sample Depth (Feet btc)	40	52	50	52
Total Metals (µg/L)				
Aluminum	**211**	**48.4**	**174**	**6.45**
Antimony	**0.0800**	**0.0300 J**	**0.0250 J**	**0.0710 J**
Arsenic	1.32 U	**1.23**	**1.68**	**1.60**
Barium	**26.5**	**20.8**	**18.5**	**17.3**
Beryllium	**0.0100 J**	0.0200 U	0.0200 U	0.0200 U
Cadmium	0.0570 U	0.0200 U	**0.0490**	0.00500 U
Calcium	**29,350**	**30,950**	**29,150**	**30,550 J**
Chromium	0.570 U	**0.210**	**3.98 J**	**0.145 J**
Cobalt	**0.295**	**0.170**	**0.323**	**0.0710**
Copper	0.670 U	**0.260**	**1.12**	**0.125**
Iron	434 U	**116**	**451 J**	37.0 U
Lead	0.363 U	**0.130**	**0.248**	**0.102**
Magnesium	**8,315**	**8,140**	**7,620**	**7,710**
Manganese	**245**	**259**	**208**	**204**
Mercury	0.0300 U	0.0500 U	0.0500 U	0.0500 U
Nickel	0.500 U	**1.07**	**6.62**	**0.570**
Potassium	**4,800**	**4,955**	**4,705**	**4,945**
Selenium	0.400 U	0.500 U	0.400 U	0.400 U
Silver	0.0660 U	0.00900 U	0.00900 U	**0.00900 J**
Sodium	**5,625**	**5,255**	**4,940**	**5,015**
Thallium	0.00800 U	0.00500 U	0.00500 U	0.00500 U
Vanadium	**1.55 J**	**0.175 J**	**0.320**	0.0700 U
Zinc	**6.15 J**	**1.75**	**8.28 J**	**2.25 J**
Dissolved Metals (µg/L)				
Aluminum	**2.25**	**2.35**	**2.60**	**2.00 J**
Antimony	**0.0500 J**	0.0100 U	**0.0140 J**	0.0100 U
Arsenic	**1.32**	**1.13**	**1.47**	**1.55**
Barium	**22.9**	**19.5**	**17.4**	**15.3**
Beryllium	0.00800 U	0.0200 U	0.0200 U	0.0200 U
Cadmium	**0.0310**	0.0200 U	**0.0425**	0.00500 U
Calcium	**29,800**	**30,100**	**28,950**	**29,800 J**
Chromium	**0.180 J**	**0.120 J**	**0.290**	**0.0600 J**
Cobalt	0.0790 U	**0.109**	**0.139**	**0.0630**
Copper	0.300 U	**0.0950 J**	**0.315**	**0.0800 J**
Iron	**10.7 J**	**9.80 J**	**24.9**	20.0 U
Lead	**0.0220 J**	0.0300 U	0.0680 U	**0.00600 J**
Magnesium	**8,085**	**7,840**	**7,360**	**7,475**
Manganese	**218**	**228**	**197**	**187**
Mercury	0.0300 U	0.0500 U	0.0500 U	0.0500 U
Nickel	0.500 U	**1.07**	**1.41**	**0.660**
Potassium	**4,880**	**4,710**	**4,710**	**4,840**
Selenium	0.400 U	0.500 U	0.400 U	0.400 U
Silver	**0.117**	0.00900 U	0.00900 U	0.00900 U
Sodium	5,440 U	**4,975**	**4,825**	**4,875**
Thallium	0.00800 U	0.00500 U	0.00500 U	0.00500 U
Vanadium	0.800 U	0.0700 U	0.0700 U	0.0700 U
Zinc	10.0 U	**1.30**	**3.15**	**1.15 J**
Total Petroleum Hydrocarbons (µg/L)				
Diesel Range Organics	14.0 U	-	-	-
Residual Range Organics	24.0 U	-	-	-
Gasoline Range Organics	13.0 U	-	-	-
Total Butyltins (µg/L)				
Dibutyltin	0.00810 U	-	-	-
Monobutyltin	**0.0345 J**	-	-	-
Total Volatile Organic Compounds (µg/L)				
Chloroform	0.0820 U	-	-	-
Tetrachloroethene (PCE)	0.0970 U	-	-	-
Vinyl Chloride	0.0440 U	-	-	-
Total Semivolatile Organic Compounds (µg/L)				
1,4-Dichlorobenzene	0.0330 U	-	-	-
4-Nitrophenol	0.320 U	-	-	-
Phenol	0.0700 U	-	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/L)				
Phenanthrene	0.0250 U	-	-	-
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/L)				
Benzo(b)fluoranthene	**0.0250 J**	-	-	-
Benzo(k)fluoranthene	0.0270 U	-	-	-
General Chemistry Parameters (mg/L)				
Dissolved Bromide	0.0100 U	-	-	-
Dissolved Chloride	**1.80**	-	-	-
Dissolved Fluoride	**0.0270 J**	-	-	-
Dissolved Sulfate	**6.80**	-	-	-
Dissolved Ammonia	**0.0200 J**	-	-	-
Dissolved Nitrate+Nitrite	**0.0240 J**	-	-	-
Total Organic Carbon	**0.600**	-	-	-
Dissolved Organic Carbon	**0.500**	-	-	-
Dissolved Bicarbonate as CaCO3	**118**	-	-	-
Dissolved Carbonate as CaCO3	1.00 U	-	-	-

Notes:
µg/L = microgram per liter
mg/L = milligram per liter
btc = below top of well casing
MDL = method detection limit
\- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-6a
Forebay Area Smallmouth Bass and Largescale Sucker Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	1	2	3	4	5	6	7		
Sample ID	060605100SB	060605101SB	060605200SB	060605201SB	060605202SB	060605203SB	060605204SB		
Sample Date	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006		
Percent Lipids	2	3.2	1.7	1.7	1.4	2.8	3.6		
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass		
PCB Aroclors (µg/kg wet)									
Aroclor 1016	2.40 UJ	24.0 UJ	2.40 UJ	2.40 UJ	2.40 UJ	2.50 UJ	2.40 UJ	0.570	HH
Aroclor 1221	2.60 UJ	26.0 UJ	2.60 UJ	2.60 UJ	2.60 UJ	2.70 UJ	2.60 UJ	0.570	HH
Aroclor 1232	2.30 UJ	23.0 UJ	2.30 UJ	2.30 UJ	2.30 UJ	2.40 UJ	2.30 UJ	0.570	HH
Aroclor 1242	2.20 UJ	22.0 UJ	2.20 UJ	2.20 UJ	2.20 UJ	2.30 UJ	2.20 UJ	0.570	HH
Aroclor 1248	0.510 UJ	5.10 UJ	68.0 UJ	0.510 UJ	5.00 UJ	12.0 UJ	11.0 UJ	0.570	HH
Aroclor 1254	28.0 UJ	**1,300 J**	240 UJ	67.0 UJ	**51.0 J**	95.0 UJ	38.0 UJ	0.570	HH
Aroclor 1260	24.0 UJ	19.0 UJ	150 UJ	48.0 UJ	25.0 UJ	73.0 UJ	37.0 UJ	0.570	HH
Aroclor 1262	2.50 UJ	25.0 UJ	98.0 UJ	21.0 UJ	8.40 UJ	21.0 UJ	12.0 UJ	0.570	HH
Aroclor 1268	2.00 UJ	20.0 UJ	2.00 UJ	2.00 UJ	2.00 UJ	2.10 UJ	2.00 UJ	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	30.2 UJ	**1,322 J**	242 UJ	69.2 UJ	**53.2 J**	97.3 UJ	40.2 UJ	0.570	HH
PCB Congeners (µg/kg wet)									
PCB 77	**0.0241 J**	**0.165 J**	**0.205 J**	**0.0448 J**	**0.0315 J**	**0.0703 J**	**0.0624 J**	0.0760	HH
PCB 81	**0.00143 J**	**0.0195 J**	**0.0238 J**	**0.00384 J**	**0.00205 J**	**0.00422 J**	**0.00324 J**	0.0250	HH
PCB 105	**0.966 J**	**50.4 J**	**45.5 J**	**2.98 J**	**1.23 J**	**3.54 J**	**1.54 J**	0.250	HH
PCB 114	**0.0926 J**	**3.20 J**	**4.04 J**	**0.281 J**	**0.106 J**	**0.337 J**	**0.120 J**	0.250	HH
PCB 118	**3.31 J**	**138 J**	**132 J**	**8.31 J**	**3.61 J**	**10.8 J**	**3.75 J**	0.250	HH
PCB 123	**0.0557 J**	**1.60 J**	**2.45 J**	**0.118 J**	**0.0633 J**	**0.217 J**	**0.0695 J**	0.250	HH
PCB 126	**0.00505 J**	**0.0553 J**	**0.0755 J**	**0.00974 J**	**0.00807 J**	**0.0159 J**	**0.0111 J**	0.0000760	HH
PCB 156	**0.654 C J**	**26.6 C J**	**31.4 C J**	**2.22 C J**	**0.735 C J**	**2.89 C J**	**0.846 C J**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**							0.250	HH
PCB 167	**0.226 J**	**6.50 J**	**9.65 J**	**0.428 J**	**0.239 J**	**0.961 J**	**0.250 J**	0.250	HH
PCB 169	0.00152 UJ	0.00728 UJ	0.00449 UJ	0.00275 UJ	0.00129 UJ	0.00503 UJ	0.00260 UJ	0.000250	HH
PCB 189	**0.0216 J**	**0.482 J**	**0.531 J**	**0.0759 J**	**0.0250 J**	**0.113 J**	**0.0390 J**	0.250	HH
Total PCBs as Congeners (KM, capped)	**33.7 J**	**1440 J**	**879 J**	**96.7 J**	**42.0 J**	**137 J**	**59.3 J**	0.570	HH
Metals (mg/kg wet)									
Aluminum	**9.89**	**6.66**	**11.3**	**4.00**	**4.75**	**1.26 J**	**1.37**	-	-
Antimony	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	-	-
Arsenic	**0.170**	**0.700**	**0.170**	**0.390**	**0.330**	**0.350**	**0.560**	0.000760	HH
Barium	**2.32**	**1.30**	**1.95**	**2.43**	**1.73**	**0.870**	**0.960**	-	-
Beryllium	**0.000600**	**0.000500**	0.000500 U	0.000500 U	0.000500 U	**0.000700**	**0.000600**	-	-
Cadmium	**0.0110**	**0.00700**	**0.0230**	**0.00600**	**0.00600**	**0.0110**	**0.00700**	0.150	Eco
Chromium	**0.190**	0.130 U	**0.270**	0.120 U	**0.290**	0.140 U	0.130 U	-	-
Cobalt	**0.0553**	**0.0516**	**0.0582**	**0.0452**	**0.0537**	**0.0594**	**0.0447**	-	-
Copper	**1.06**	**0.583**	**1.42**	**0.721**	**0.767**	**0.482**	**0.439**	-	-
Lead	**0.0200**	**0.0180**	**0.00800**	**0.0170**	**0.00900**	**0.00500 J**	**0.00500**	0.120	Eco
Mercury	**0.0710 J**	**0.342 J**	**0.131 J**	**0.187 J**	**0.0760 J**	**0.283 J**	**0.315 J**	0.0490	HH
Methyl Mercury	-	-	-	-	-	-	-	-	-
Nickel	**0.309**	**0.271**	**0.399**	**0.225**	**0.357**	**0.304 J**	**0.213**	-	-
Thallium	**0.0148**	**0.0198**	**0.0112**	**0.0146**	**0.0154**	**0.00930**	**0.0177**	-	-
Vanadium	**0.0700**	**0.0400**	**0.0600**	**0.0400**	**0.0400**	**0.0300**	**0.0300**	-	-
Zinc	**13.9**	**12.9**	**15.1**	**15.1**	**14.8**	**18.0**	**12.2**	-	-
Semivolatile Organic Compounds (µg/kg wet)									
Bis(2-ethylhexyl) Phthalate	66.0 UJ	**140 J**	**100 J**	66.0 UJ	66.0 UJ	**130 J**	**89.0 J**	81.9	HH
Butyl Benzyl Phthalate	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	310	Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	-	-
Di-n-butyl Phthalate	16.0 UJ	48.0 UJ	16.0 UJ	16.0 UJ	36.0 UJ	16.0 UJ	16.0 UJ	626	Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	626	Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)									
Acenaphthene	**0.200 J**	0.110 UJ	**0.300 J**	**0.160 J**	**0.200 J**	**0.790 J**	0.110 UJ	15,000	HH
Anthracene	**0.110 J**	**0.230 J**	**0.320 J**	**0.0780 J**	**0.180 J**	**2.20 J**	**0.320 J**	15,000	HH
Fluorene	**0.410 J**	0.150 UJ	**0.670 J**	**0.300 J**	**0.370 J**	**1.30 J**	**0.970**	15,000	HH
Phenanthrene	**0.610**	**1.30**	**0.870 J**	**0.540**	**0.790**	**2.20 J**	**1.60**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)									
Benzo(a)anthracene	0.0660 UJ	0.0660 UJ	**1.20 J**	0.0660 UJ	0.0660 UJ	**5.00 J**	0.0660 UJ	1.57	HH
Benzo(a)pyrene	0.0810 UJ	0.0810 UJ	**0.770 J**	0.0810 UJ	0.0810 UJ	**3.50 J**	0.0810 UJ	0.157	HH
Benzo(b)fluoranthene	**0.110 J**	0.0700 UJ	0.140 UJ	0.0700 UJ	0.0700 UJ	**2.20 J**	0.0700 UJ	1.57	HH
Benzo(g,h,i)perylene	0.0730 UJ	0.0730 UJ	**0.420 J**	0.0730 UJ	0.0730 UJ	**1.50 J**	0.0730 UJ	15.7	HH
Benzo(k)fluoranthene	**0.110 J**	0.0560 UJ	**1.40 J**	0.0560 UJ	0.0560 UJ	**3.80 J**	0.0560 UJ	15.7	HH
Chrysene	0.0760 UJ	0.0760 UJ	**0.530 J**	0.0760 UJ	0.0760 UJ	**2.30 J**	0.0760 UJ	157	HH
Dibenz(a,h)anthracene	0.0590 UJ	0.0590 UJ	**0.410 J**	0.0590 UJ	0.0590 UJ	**1.90 J**	0.0590 UJ	0.157	HH
Fluoranthene	0.0900 UJ	0.0900 UJ	**0.840 J**	0.0900 UJ	0.0900 UJ	**3.30 J**	0.0900 UJ	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 UJ	0.0640 UJ	**0.700 J**	0.0640 UJ	0.0640 UJ	**2.80 J**	0.0640 UJ	1.57	HH
Pyrene	**0.140 J**	0.0980 UJ	**0.590 J**	0.0980 UJ	**0.110 J**	0.490 UJ	0.0980 UJ	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclors 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Forebay smallmouth bass samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-6a
Forebay Area Smallmouth Bass and Largescale Sucker Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	12	13	14	8	9	10	11		
Sample ID	060606102SB	060606103SB	060606104SB	060605205SB	060605207SB	060605208SB	060605209SB		
Sample Date	6/6/2006	6/6/2006	6/6/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006		
Percent Lipids	2.1	2.4	2.4	2.8	2.5	2.4	4.1		
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass		
PCB Aroclors (µg/kg wet)									
Aroclor 1016	2.40 UJ	120 UJ	6.00 UJ	24.0 UJ	4.70 UJ	2.40 UJ	240 UJ	0.570	HH
Aroclor 1221	2.60 UJ	20.0 UJ	32.0 UJ	26.0 UJ	25.0 UJ	2.60 UJ	260 UJ	0.570	HH
Aroclor 1232	2.30 UJ	8.90 UJ	12.0 UJ	23.0 UJ	14.0 UJ	2.30 UJ	230 UJ	0.570	HH
Aroclor 1242	2.20 UJ	3.80 UJ	10.0 UJ	22.0 UJ	4.40 UJ	2.20 UJ	220 UJ	0.570	HH
Aroclor 1248	33.0 UJ	61.0 UJ	4.20 UJ	5.10 UJ	9.10 UJ	12.0 UJ	51.0 UJ	0.570	HH
Aroclor 1254	85.0 UJ	420 UJ	11.0 UJ	**1,300 J**	25.0 UJ	96.0 UJ	**14,000 J**	0.570	HH
Aroclor 1260	300 UJ	200 UJ	26.0 UJ	19.0 UJ	67.0 UJ	78.0 UJ	190 UJ	0.570	HH
Aroclor 1262	110 UJ	160 UJ	16.0 UJ	25.0 UJ	24.0 UJ	50.0 UJ	250 UJ	0.570	HH
Aroclor 1268	5.90 UJ	9.90 UJ	5.00 UJ	20.0 UJ	6.40 UJ	16.0 UJ	200 UJ	0.570	HH
Total PCBs as Aroclors (NDs at MDL)[1]	87.2 UJ	424 UJ	21.0 UJ	**1,322 J**	29.4 UJ	98.2 UJ	**14,220 J**	0.570	HH
PCB Congeners (µg/kg wet)									
PCB 77	**0.102 J**	**0.186 J**	**0.0217 J**	**0.214 J**	**0.0367 J**	**0.0772 J**	**3.53 J**	0.0760	HH
PCB 81	**0.00807 J**	**0.0117 J**	**0.00121 J**	**0.0191 J**	**0.00233 J**	**0.00576 J**	0.0231 UJ	0.0250	HH
PCB 105	**11.2 J**	**57.7 J**	**0.717 J**	**66.3 J**	**2.09 J**	**3.91 J**	**766 J**	0.250	HH
PCB 114	**1.68 J**	**4.47 J**	**0.0594 J**	**4.87 J**	**0.173 J**	**0.332 J**	**65.7 J**	0.250	HH
PCB 118	**52.4 J**	**164 J**	**2.42 J**	**199 J**	**6.43 J**	**10.3 J**	**2,180 J**	0.250	HH
PCB 123	**0.948 J**	**2.07 J**	**0.0323 J**	**1.94 J**	**0.0810 J**	**0.136 J**	**35.6 J**	0.250	HH
PCB 126	**0.0262 J**	**0.0453 J**	**0.00642 J**	**0.0857 J**	**0.00890 J**	**0.0143 J**	**1.26 J**	0.0000760	HH
PCB 156	**12.8 C J**	**38.6 C J**	**0.541 C J**	**44.6 C J**	**1.36 C J**	**2.39 C J**	**403 C J**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**							0.250	HH
PCB 167	**3.65 J**	**7.99 J**	**0.161 J**	**9.35 J**	**0.311 J**	**0.574 J**	**116 J**	0.250	HH
PCB 169	0.00824 UJ	0.0145 UJ	0.00347 UJ	0.0112 UJ	0.00327 UJ	0.00508 UJ	0.127 UJ	0.000250	HH
PCB 189	**0.324 J**	**0.661 J**	**0.0311 J**	**0.841 J**	**0.0491 J**	**0.0910 J**	**9.30 J**	0.250	HH
Total PCBs as Congeners (KM, capped)	**325 J**	**1306 J**	**32.1 J**	**1733 J**	**69.6 J**	**149 J**	**19303 J**	0.570	HH
Metals (mg/kg wet)									
Aluminum	**15.5**	**2.49**	**1.06**	**4.72**	**2.25**	**1.33**	**3.90**	-	-
Antimony	0.00500 U	0.00600 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00600 U	-	-
Arsenic	**0.310**	**0.350**	**0.560**	**0.520**	**0.450**	**0.490**	**0.600**	0.000760	HH
Barium	**1.34**	**1.28**	**0.720**	**1.13**	**0.860**	**1.57**	**1.96**	-	-
Beryllium	0.000500 U	0.000600 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000600 U	-	-
Cadmium	**0.00700**	**0.00400**	**0.0190**	**0.0130**	**0.00900**	**0.00400**	**0.00600**	0.150	Eco
Chromium	**0.200**	0.150 U	0.120 U	0.130 U	0.120 U	0.140 U	0.140 U	-	-
Cobalt	**0.0567**	**0.0758**	**0.0469**	**0.0588**	**0.0441**	**0.0575**	**0.0650**	-	-
Copper	**0.688**	**0.540**	**0.560**	**0.769**	**0.586**	**0.434**	**0.588**	-	-
Lead	**0.00900**	**0.00500**	**0.0100**	**0.00500**	**0.0100**	**0.00400**	**0.00500**	0.120	Eco
Mercury	**0.131 J**	**0.512 J**	**0.383 J**	**0.367 J**	**0.305 J**	**0.372 J**	**0.251 J**	0.0490	HH
Methyl Mercury	-	-	-	-	-	-	-	-	-
Nickel	**0.282**	**0.392**	**0.273**	**0.324**	**0.213**	**0.292**	**0.338**	-	-
Thallium	**0.0188**	**0.0128**	**0.0153**	**0.0157**	**0.0162**	**0.0133**	**0.0153**	-	-
Vanadium	**0.130**	**0.0700**	**0.0600**	**0.0500**	**0.0400**	**0.0500**	**0.0500**	-	-
Zinc	**12.3**	**15.5**	**16.1**	**14.8**	**13.3**	**13.3**	**14.4**	-	-
Semivolatile Organic Compounds (µg/kg wet)									
Bis(2-ethylhexyl) Phthalate	66.0 UJ	66.0 UJ	**120 J**	**190**	66.0 UJ	66.0 UJ	66.0 UJ	81.9	HH
Butyl Benzyl Phthalate	7.30 UJ	7.30 UJ	**33.0 J**	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	310	Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	-	-
Di-n-butyl Phthalate	16.0 UJ	71.0 UJ	**150 J**	16.0 UJ	16.0 UJ	37.0 UJ	16.0 UJ	626	Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	626	Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)									
Acenaphthene	**0.260 J**	**0.280 J**	**0.230 J**	**0.260 J**	0.110 UJ	**0.390 J**	**0.350 J**	15,000	HH
Anthracene	**0.220 J**	**0.320 J**	0.0650 UJ	**0.160 J**	**0.170 J**	**0.450 J**	**0.450 J**	15,000	HH
Fluorene	**0.460 J**	**0.670**	**0.550**	**0.650**	**0.400 J**	**0.850 J**	0.150 UJ	15,000	HH
Phenanthrene	**1.00**	**1.90**	**0.760**	**1.10**	**0.980**	**2.00 J**	**2.10**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)									
Benzo(a)anthracene	0.0660 UJ	0.0660 UJ	0.0660 UJ	0.0660 UJ	0.0660 UJ	**1.00 J**	0.0660 UJ	1.57	HH
Benzo(a)pyrene	0.0810 UJ	0.0810 UJ	0.0810 UJ	0.0810 UJ	0.0810 UJ	**0.720 J**	0.0810 UJ	0.157	HH
Benzo(b)fluoranthene	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.140 UJ	0.0700 UJ	1.57	HH
Benzo(g,h,i)perylene	0.0730 UJ	0.0730 UJ	0.0730 UJ	0.0730 UJ	0.0730 UJ	0.150 UJ	0.0730 UJ	15.7	HH
Benzo(k)fluoranthene	0.0560 UJ	0.0560 UJ	0.0560 UJ	0.0560 UJ	0.0560 UJ	**1.40 J**	0.0560 UJ	15.7	HH
Chrysene	0.0760 UJ	0.0760 UJ	0.0760 UJ	0.0760 UJ	0.0760 UJ	**0.500 J**	0.0760 UJ	157	HH
Dibenz(a,h)anthracene	0.0590 UJ	0.0590 UJ	0.0590 UJ	0.0590 UJ	0.0590 UJ	0.120 UJ	0.0590 UJ	0.157	HH
Fluoranthene	0.0900 UJ	**0.730**	0.0900 UJ	0.0900 UJ	0.0900 UJ	**1.30 J**	**0.490**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 UJ	0.0640 UJ	0.0640 UJ	0.0640 UJ	0.0640 UJ	**0.720 J**	0.0640 UJ	1.57	HH
Pyrene	0.0980 UJ	0.0980 UJ	0.0980 UJ	0.0980 UJ	0.0980 UJ	**0.720 J**	0.0980 UJ	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
\- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclors 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Forebay smallmouth bass samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-6a
Forebay Area Smallmouth Bass and Largescale Sucker Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	15	16	17	18	19	SUCKER		
Sample ID	060606210SB	060815402SB	060815403SB	060815405SB	060815406SB	070505LS		
Sample Date	6/6/2006	8/15/2006	8/15/2006	8/15/2006	8/15/2006	5/5/2007		
Percent Lipids	1.7	5.3	5.5	4.7	6.6	10.4		
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Largescale Sucker		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	10.0 UJ	2.40 UJ	120 UJ	24.0 UJ	9.90 UJ	2.40 U	0.570	HH
Aroclor 1221	20.0 UJ	2.60 UJ	130 UJ	26.0 UJ	2.60 UJ	2.60 U	0.570	HH
Aroclor 1232	10.0 UJ	2.30 UJ	120 UJ	23.0 UJ	9.90 UJ	2.30 U	0.570	HH
Aroclor 1242	8.50 UJ	**260 J**	110 UJ	22.0 UJ	4.70 UJ	2.20 U	0.570	HH
Aroclor 1248	10.0 UJ	0.510 UJ	26.0 UJ	5.10 UJ	5.70 UJ	0.510 U	0.570	HH
Aroclor 1254	16.0 UJ	**330 J**	**18,000 J**	**1,400 J**	13.0 UJ	**160**	0.570	HH
Aroclor 1260	31.0 UJ	1.90 UJ	95.0 UJ	19.0 UJ	37.0 UJ	1.90 U	0.570	HH
Aroclor 1262	10.0 UJ	2.50 UJ	130 UJ	25.0 UJ	12.0 UJ	-	0.570	HH
Aroclor 1268	2.50 UJ	2.00 UJ	100 UJ	20.0 UJ	3.50 UJ	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	24.5 UJ	**590 J**	**18,110 J**	**1,422 J**	17.7 UJ	**160**	0.570	HH
PCB Congeners (µg/kg wet)								
PCB 77	**0.0236 J**	**0.334 J**	**8.95 J**	**0.577 J**	**0.0568 J**	**0.110**	0.0760	HH
PCB 81	**0.00130 J**	**0.0198 J**	**1.19 J**	0.00615 UJ	**0.00358 J**	**0.00902**	0.0250	HH
PCB 105	**1.60 J**	**30.1 J**	**1,300 J**	**109 J**	**0.738 J**	**4.35**	0.250	HH
PCB 114	**0.122 J**	**2.33 J**	**89.8 J**	**11.2 J**	**0.115 J**	**0.289**	0.250	HH
PCB 118	**4.97 J**	**92.1 J**	**3,270 J**	**312 J**	**3.82 J**	**10.3**	0.250	HH
PCB 123	**0.0574 J**	**1.20 J**	**55.3 J**	**6.10 J**	**0.0750 J**	**0.179**	0.250	HH
PCB 126	**0.00755 J**	0.0480 UJ	**3.03 J**	**0.125 J**	**0.0123 J**	**0.0191**	0.0000760	HH
PCB 156	**1.20 C J**	**16.9 C J**	**486 C J**	**83.0 C J**	**0.791 C J**	**1.77 C**	0.250	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.250	HH
PCB 167	**0.270 J**	**4.71 J**	**140 J**	**21.0 J**	**0.356 J**	**0.565**	0.250	HH
PCB 169	0.00318 UJ	0.0151 UJ	0.607 UJ	0.0280 UJ	0.00439 UJ	**0.0111**	0.000250	HH
PCB 189	**0.0407 J**	**0.402 J**	**10.1 J**	**1.88 J**	**0.0419 J**	**0.0780**	0.250	HH
Total PCBs as Congeners (KM, capped)	**54.8 J**	**1193 J**	**26505 J**	**2482 J**	**40.7 J**	**201 J**	0.570	HH
Metals (mg/kg wet)								
Aluminum	**10.3**	**4.24**	**1.33**	**1.97**	**7.54**	**19.7 J**	-	-
Antimony	0.00500 U	0.00600 U	0.00600 U	0.00600 U	0.00500 U	0.00600 U	-	-
Arsenic	**0.540**	**0.190**	**0.290**	**0.450**	**0.410**	**0.350**	0.000760	HH
Barium	**0.980**	**2.64**	**1.74**	**1.24**	**1.66**	**1.92**	-	-
Beryllium	0.000500 U	0.000600 U	0.000600 U	0.000600 U	0.000500 U	0.000600 U	-	-
Cadmium	**0.0280**	**0.00500**	**0.00700**	**0.00500**	**0.00700**	**0.0420**	0.150	Eco
Chromium	**0.860**	0.150 U	0.150 U	0.150 U	0.130 U	**0.480**	-	-
Cobalt	**0.0519**	**0.0625**	**0.0566**	**0.0508**	**0.0457**	**0.0775**	-	-
Copper	**0.619**	**0.905**	**0.591**	**0.364**	**0.505**	**0.728**	-	-
Lead	**0.0360**	**0.0120**	**0.00800**	**0.0160**	**0.00500**	**0.0440**	0.120	Eco
Mercury	**0.203 J**	**0.301 J**	**0.165 J**	**0.498 J**	**0.147 J**	**0.139 J**	0.0490	HH
Methyl Mercury	-	-	-	-	-	-	-	-
Nickel	**0.333**	**0.327**	**0.295**	**0.281**	**0.228**	**0.343**	-	-
Thallium	**0.0215**	**0.00790**	**0.0136**	**0.0145**	**0.0142**	**0.00560**	-	-
Vanadium	**0.0500**	**0.0800**	**0.0700**	**0.0800**	**0.0900**	**0.170**	-	-
Zinc	**13.4**	**15.8**	**14.9**	**13.2**	**11.4**	**17.5**	-	-
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	**1,600**	5,000 U	66.0 UJ	66.0 UJ	66.0 UJ	66.0 U	81.9	HH
Butyl Benzyl Phthalate	7.30 UJ	**440**	7.30 UJ	7.30 UJ	7.30 UJ	7.30 U	310	Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 U	-	-
Di-n-butyl Phthalate	16.0 UJ	16.0 UJ	16.0 UJ	16.0 UJ	16.0 UJ	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 U	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	**0.300 J**	**1.40 J**	**1.50 J**	**1.50 J**	**1.60 J**	1.10 U	15,000	HH
Anthracene	**0.400 J**	**17.0 J**	**5.70 J**	**6.00 J**	**6.60 J**	**4.50 J**	15,000	HH
Fluorene	**0.520 J**	**4.70 J**	**2.40 J**	**3.70 J**	**3.30 J**	1.50 U	15,000	HH
Phenanthrene	**1.00 J**	**5.70 J**	**4.60 J**	**5.20 J**	**5.40 J**	**3.80 J**	15,000	HH
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	**1.20 J**	**17.0 J**	0.660 UJ	0.660 UJ	0.660 UJ	0.660 U	1.57	HH
Benzo(a)pyrene	**0.740 J**	**6.80 J**	**7.10 J**	**6.40 J**	**7.40 J**	**6.30 J**	0.157	HH
Benzo(b)fluoranthene	0.140 UJ	**4.20 J**	**3.90 J**	**4.40 J**	**4.40 J**	0.700 U	1.57	HH
Benzo(g,h,i)perylene	0.150 UJ	**2.60 J**	**2.80 J**	**3.10 J**	**3.30 J**	**2.00 J**	15.7	HH
Benzo(k)fluoranthene	**1.60 J**	**7.70 J**	**7.20 J**	**7.20 J**	**7.60 J**	**11.0**	15.7	HH
Chrysene	**0.620 J**	**10.0 J**	**4.50 J**	**4.60 J**	**4.90 J**	0.760 U	157	HH
Dibenz(a,h)anthracene	0.120 UJ	**3.40 J**	**3.40 J**	**3.40 J**	**4.10 J**	**3.70 J**	0.157	HH
Fluoranthene	**0.960 J**	**5.90 J**	**5.90 J**	**6.30 J**	**6.50 J**	**5.90**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.130 UJ	**5.60 J**	**5.30 J**	**6.00 J**	**6.10 J**	**6.50**	1.57	HH
Pyrene	**0.670 J**	**7.20 J**	**4.90 J**	**5.00 J**	**5.30 J**	**7.40**	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclors 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Forebay smallmouth bass
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-6b
Reference Area Smallmouth Bass Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	20	21	22	23	24	25
Sample ID	071027R01SB	071027R02SB	071027R03SB	071027R04SB	071027R05SB	071027R06SB
Sample Date	10/27/2007	10/27/2007	10/27/2007	10/27/2007	10/27/2007	10/27/2007
Percent Lipids	6.2	7	7.2	8.5	7.9	5.9
PCB Aroclors (µg/kg wet)						
Aroclor 1016	3.50 U	4.70 U	3.40 U	2.40 U	9.90 U	2.40 U
Aroclor 1221	4.70 U	2.60 U	2.60 U	2.60 U	20.0 U	2.60 U
Aroclor 1232	6.10 U	5.90 U	3.90 U	2.30 U	9.90 U	2.30 U
Aroclor 1242	4.50 UJ	6.30 UJ	2.20 UJ	2.20 UJ	**14.0 J**	**9.50 J**
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	**59.0 J**	**32.0 J**	**51.0 J**	9.60 UJ	**110 J**	**58.0 J**
Aroclor 1260	1.90 U	1.90 U	1.90 U	14.0 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**63.5 J**	**38.3 J**	**53.2 J**	11.8 UJ	**124 J**	**67.5 J**
PCB Congeners (µg/kg wet)						
PCB 77	**0.0470**	**0.0358**	**0.0435**	**0.0254**	**0.195**	**0.0381**
PCB 81	0.00681 U	0.00574 U	0.00504 U	0.00547 U	0.0205 U	0.00944 U
PCB 105	**1.15**	**1.07**	**1.11**	**0.498**	**4.06**	**1.16**
PCB 114	**0.0770**	**0.0723**	**0.0652**	**0.0292**	**0.300**	0.0856 EMPC
PCB 118	**3.30**	**3.05**	**3.01**	**1.33**	**10.2**	**3.14**
PCB 123	**0.0554**	**0.0477**	0.0435 EMPC	**0.0248**	**0.184**	0.0470 EMPC
PCB 126	0.0112 U	0.0116 EMPC	0.0122 U	**0.00561**	0.0301 U	0.0157 U
PCB 156	**0.468 C**	**0.402 C**	**0.378 C**	**0.194 C**	**1.39 C**	**0.490 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.193**	**0.169**	**0.157**	**0.0843**	**0.536**	**0.181**
PCB 169	0.00551 U	0.00890 U	0.00536 U	0.00227 U	0.0109 U	0.00489 U
PCB 189	0.0165 EMPC	**0.0174**	0.0168 EMPC	**0.0133**	**0.0677**	0.0195 EMPC
Total PCBs as Congeners (KM, capped)	**47.9 J**	**41.8 J**	**44.7 J**	**22.1 J**	**164 J**	**44.4 J**
Metals (mg/kg wet)						
Aluminum	**0.802**	**1.55**	**1.13**	**0.330 J**	**0.663**	**2.11**
Antimony	0.00500 U	0.00500 U	0.00600 U	0.00600 U	0.00500 U	0.00500 U
Arsenic	**0.311**	**0.406**	**0.434**	**0.159**	**0.761**	**0.277 J**
Barium	**1.06**	**0.837**	**1.20**	**0.430**	**0.456**	**0.748**
Beryllium	0.000500 U	0.000500 U	0.000600 U	0.000600 U	0.000500 U	0.000500 U
Cadmium	**0.00800 J**	**0.00500 J**	**0.00600 J**	**0.00500 J**	**0.00400 J**	**0.00600 J**
Chromium	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Cobalt	0.0255 U	0.0309 U	0.0278 U	0.0248 U	0.0255 U	0.0267 U
Copper	**0.571**	**0.344**	**0.457**	**0.336**	**0.327**	**0.419**
Lead	0.0130 U	0.0140 U	0.0140 U	0.0150 U	0.0140 U	0.0130 U
Mercury	**0.106 J**	**0.217 J**	**0.0904 J**	**0.130 J**	**0.144 J**	**0.0548 J**
Methyl Mercury	-	-	-	-	-	-
Nickel	**0.324**	**0.399**	**0.328**	0.298 U	0.306 U	0.277 U
Thallium	**0.0159**	**0.0201**	**0.0205**	**0.0120**	**0.0189**	**0.0165**
Vanadium	**0.0400 J**	**0.0400 J**	**0.0400 J**	**0.0500 J**	**0.0300 J**	**0.0300 J**
Zinc	**13.4**	**13.9**	**12.9**	**13.4**	**11.2**	**14.6 J**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	66.0 U	2,500 U	2,400 U	1,800 U	1,800 U	1,500 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	220 U	16.0 U	150 U	280 U	150 U	230 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 UJ
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.700 J**	**0.770**	**1.00 J**	**0.560 J**	**0.820**	**0.570 J**
Anthracene	**0.0900 J**	0.650 U	**0.380 J**	0.0650 UJ	0.650 U	0.310 U
Fluorene	**1.00 J**	1.80 U	**1.40 J**	**1.50 J**	2.00 U	**0.890 J**
Phenanthrene	**2.50 J**	**3.70 J**	**3.00**	**3.10 J**	**4.60 J**	**2.20**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	0.0660 UJ	0.660 U	0.260 U	0.0660 UJ	0.660 U	0.140 U
Benzo(a)pyrene	0.0810 UJ	0.810 U	0.320 U	0.0810 UJ	0.810 U	0.170 U
Benzo(b)fluoranthene	0.0700 UJ	0.700 U	0.280 U	0.0700 UJ	0.700 U	0.140 U
Benzo(g,h,i)perylene	0.0730 UJ	0.730 U	0.290 U	0.0730 UJ	0.730 U	0.150 U
Benzo(k)fluoranthene	0.0560 UJ	0.560 U	0.220 U	0.0560 UJ	0.560 U	0.120 U
Chrysene	0.0760 UJ	0.760 U	0.300 U	0.0760 UJ	0.760 U	0.160 U
Dibenz(a,h)anthracene	0.0590 UJ	0.590 U	0.230 U	0.0590 UJ	0.590 U	0.120 U
Fluoranthene	0.0900 UJ	**1.90 J**	**1.40 J**	0.0900 UJ	**2.50 J**	1.20 U
Indeno(1,2,3-cd)pyrene	0.0640 UJ	0.640 U	0.250 U	0.0640 UJ	0.640 U	0.130 U
Pyrene	0.0980 UJ	0.980 U	**0.420 J**	0.0980 UJ	0.980 U	0.200 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
- = Not Analyzed
ND = Non Detect
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclor 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Reference Area smallmouth bass samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.

Table 6-6b
Reference Area Smallmouth Bass Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	26	27	28	29	30	31	32
Sample ID	071115R07SB	080517R10SB	080517R11SB	080517R12SB	080517R13SB	080517R14SB	080521R15SB
Sample Date	11/15/2007	5/17/2008	5/17/2008	5/17/2008	5/17/2008	5/17/2008	5/21/2008
Percent Lipids	5.4	6.1	4.7	2.5	5.1	3.7	4.2
PCB Aroclors (µg/kg wet)							
Aroclor 1016	3.80 U	2.40 U	7.90 U	4.80 U	2.40 U	6.00 U	3.10 U
Aroclor 1221	3.80 U	2.60 U	18.0 U	2.60 U	2.60 U	20.0 U	2.60 U
Aroclor 1232	3.10 U	2.30 U	10.0 U	5.10 U	2.30 U	9.90 U	10.0 U
Aroclor 1242	2.20 UJ	**5.60 J**	10.0 UJ	2.20 UJ	**2.40 J**	2.20 UJ	2.20 UJ
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	6.90 U	0.510 U
Aroclor 1254	**27.0 J**	**34.0 J**	**37.0 J**	**29.0 J**	**80.0 J**	17.0 UJ	**47.0 J**
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	46.0 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	21.0 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.40 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**29.2 J**	**39.6 J**	**47.0 J**	**31.2 J**	**82.4 J**	19.2 UJ	**49.2 J**
PCB Congeners (µg/kg wet)							
PCB 77	**0.0301**	**0.0754**	**0.0362**	**0.0436**	**0.0701**	**0.0548**	**0.0493**
PCB 81	0.00253 U	**0.00552**	**0.00256**	**0.00263**	**0.00326**	**0.00263**	**0.00235**
PCB 105	**1.01**	**3.50**	**0.940**	**1.00**	**1.91**	**1.37**	**1.31**
PCB 114	0.0684 EMPC	**0.272**	**0.0599**	**0.0802**	**0.123**	**0.145**	**0.0872**
PCB 118	**3.11**	**11.8**	**2.58**	**3.63**	**4.85**	**6.21**	**3.74**
PCB 123	**0.0531**	**0.148**	**0.0430**	**0.0553**	**0.0811**	**0.104**	**0.0606**
PCB 126	0.0107 U	**0.0259**	**0.00603**	**0.00955**	**0.0126**	**0.0143**	**0.00945**
PCB 156	**0.448 C**	**1.89 C**	**0.290 C**	**0.430 C**	**0.638 C**	**0.882 C**	**0.447 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						
PCB 167	**0.168**	**0.571**	**0.117**	**0.211**	**0.242**	**0.380**	**0.180**
PCB 169	0.00857 U	0.00812 U	0.00130 U	0.00186 U	0.00279 U	0.00307 U	0.00154 U
PCB 189	0.0232 EMPC	**0.102**	**0.0147**	**0.0217**	**0.0313**	**0.0444**	**0.0197**
Total PCBs as Congeners (KM, capped)	**41.7 J**	**117 J**	**35.8 J**	**39.8 J**	**69.0 J**	**50.2 J**	**43.1 J**
Metals (mg/kg wet)							
Aluminum	**1.55**	**1.52**	**3.86**	**10.1**	**2.44**	**0.970**	**5.41**
Antimony	0.00600 U	**0.0250**	**0.00300 J**	**0.00300 J**	0.00200 U	**0.00300 J**	0.00200 U
Arsenic	**0.270**	**0.640**	**0.240**	**0.420**	**0.290**	**0.430**	**0.230**
Barium	**1.50**	**0.915**	**0.875**	**1.72**	**0.871**	**1.65**	**1.11**
Beryllium	0.000600 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Cadmium	**0.00400 J**	**0.143**	**0.130**	**0.111**	**0.140**	**0.125**	**0.111**
Chromium	0.100 U	**7.15**	**0.210 J**	**0.160 J**	**0.0900 J**	**0.0900 J**	**0.0700 J**
Cobalt	0.0361 U	**0.0838**	**0.0576**	**0.0602**	**0.0487**	**0.0551**	**0.0748**
Copper	**0.575**	**0.680**	**0.490**	**0.500**	**0.700**	**0.440**	**0.690**
Lead	0.0140 U	**1.81**	**1.70**	**1.43**	**1.69**	**1.47**	**1.47**
Mercury	**0.0932 J**	**0.333 J**	**0.0630 J**	**0.102 J**	**0.141 J**	**0.233 J**	**0.0600 J**
Methyl Mercury	-	-	-	-	-	-	-
Nickel	**0.408**	**1.48**	**1.38**	**1.34**	**1.18**	**1.31**	**1.29**
Thallium	**0.0149**	**0.0261**	**0.0152**	**0.0149**	**0.0123**	**0.0152**	**0.0118**
Vanadium	**0.0600**	0.00600 U	**0.0510 J**	**0.102**	**0.0480 J**	**0.0710**	**0.0730**
Zinc	**12.9**	**15.1**	**14.8**	**13.1**	**12.8**	**13.0**	**11.5**
Semivolatile Organic Compounds (µg/kg wet)							
Bis(2-ethylhexyl) Phthalate	1,700 U	66.0 U	**150 J**	66.0 U	66.0 U	66.0 U	66.0 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Di-n-butyl Phthalate	87.0 U	100 U	100 U	100 U	100 U	100 U	100 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)							
Acenaphthene	**1.00 J**	**0.970**	**0.810**	0.110 U	**0.980**	**0.510**	**0.900**
Anthracene	**0.220 J**	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	**1.30 J**	**1.50**	**1.20**	0.150 U	**1.60**	**0.920**	**1.60**
Phenanthrene	**2.40**	**2.10**	**2.40**	**1.40**	**2.40**	**2.00**	**4.70**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)							
Benzo(a)anthracene	0.190 U	**0.940**	**0.560**	0.0660 U	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.230 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.200 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.200 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.160 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U
Chrysene	0.210 U	**0.550**	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.170 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	**0.690 J**	0.0900 U	0.0900 U	0.0900 U	0.0900 U	0.0900 U	**1.40**
Indeno(1,2,3-cd)pyrene	0.180 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U
Pyrene	**0.380 J**	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
- = Not Analyzed
ND = Non Detect
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclor 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Reference Area smallmouth bass samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-6b
Reference Area Smallmouth Bass Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	33	34	35	36	37	38
Sample ID	080521R16SB	080521R17SB	080521R18SB	080521R19SB	080521R20SB	080521R21SB
Sample Date	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008
Percent Lipids	2.6	4.1	4.2	5.3	4.1	2.8
PCB Aroclors (µg/kg wet)						
Aroclor 1016	5.90 U	5.20 U	4.50 U	5.40 U	7.30 U	4.50 U
Aroclor 1221	6.90 U	5.90 U	7.40 U	20.0 U	12.0 U	3.70 U
Aroclor 1232	5.70 U	3.90 U	4.40 U	5.40 U	10.0 U	11.0 U
Aroclor 1242	2.20 UJ	2.90 UJ	10.0 UJ	2.20 UJ	10.0 UJ	3.80 UJ
Aroclor 1248	33.0 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	130 UJ	**47.0 J**	**46.0 J**	**85.0 J**	**37.0 J**	**58.0 J**
Aroclor 1260	140 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	110 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	10.0 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL)[1]	132 UJ	**49.9 J**	**56.0 J**	**87.2 J**	**47.0 J**	**58.0 J**
PCB Congeners (µg/kg wet)						
PCB 77	**0.172**	**0.0537**	**0.0597**	**0.0701**	**0.0528**	**0.0497**
PCB 81	**0.0159**	**0.00340**	**0.00406**	**0.00376**	**0.00202**	**0.00311**
PCB 105	**23.4**	**1.32**	**2.00**	**2.09**	**1.44**	**1.68**
PCB 114	**2.91**	**0.0826**	**0.132**	**0.137**	**0.0971**	**0.106**
PCB 118	**98.6**	**3.65**	**5.97**	**5.35**	**4.78**	**4.46**
PCB 123	**1.83**	**0.0648**	**0.0840**	**0.0802**	**0.0761**	**0.0691**
PCB 126	**0.0746**	**0.00901**	**0.0134**	**0.0129**	**0.0107**	**0.00865**
PCB 156	**20.0 C**	**0.420 C**	**0.786 C**	**0.714 C**	**0.557 C**	**0.544 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**6.54**	**0.175**	**0.286**	**0.242**	**0.276**	**0.198**
PCB 169	0.00662 U	0.00216 U	0.00482 U	0.00596 U	0.00356 U	0.00210 U
PCB 189	**0.532**	**0.0209**	**0.0386**	**0.0375**	**0.0295**	**0.0205**
Total PCBs as Congeners (KM, capped)	**499 J**	**44.2 J**	**60.6 J**	**77.9 J**	**52.9 J**	**52.8 J**
Metals (mg/kg wet)						
Aluminum	**1.13**	**3.02**	**0.680**	**4.01**	**3.95**	**2.28**
Antimony	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Arsenic	**0.180**	**0.240**	**0.290**	**0.320**	**0.440**	**0.390**
Barium	**1.42**	**1.22**	**0.843**	**0.957**	**1.36**	**1.70**
Beryllium	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Cadmium	**0.138**	**0.126**	**0.117**	**0.124**	**0.129**	**0.112**
Chromium	**0.130 J**	**0.0600 J**	**0.0600 J**	**0.0400 J**	**0.0700 J**	**0.0800 J**
Cobalt	**0.0704**	**0.0601**	**0.0552**	**0.0523**	**0.0536**	**0.0574**
Copper	**0.630**	**0.590**	**0.410**	**0.370**	**0.730**	**0.430**
Lead	**1.66**	**1.65**	**1.53**	**1.62**	**1.59**	**1.42**
Mercury	**0.123 J**	**0.0650 J**	**0.178 J**	**0.105 J**	**0.176 J**	**0.0730 J**
Methyl Mercury	-	-	-	-	-	-
Nickel	**1.79**	**1.38**	**1.29**	**1.23**	**1.18**	**1.33**
Thallium	**0.0113**	**0.0139**	**0.0109**	**0.0133**	**0.0218**	**0.0180**
Vanadium	**0.104**	**0.0510 J**	**0.0600**	**0.0800**	**0.0660**	**0.0570**
Zinc	**12.8**	**12.7**	**12.3**	**14.3**	**14.8**	**15.5**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	66.0 U	**81.0 J**	66.0 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Di-n-butyl Phthalate	100 U	100 U	100 U	100 U	100 U	100 U
Di-n-octyl Phthalate	**15.0 J**	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.540**	**0.870**	**0.990**	**1.30**	**0.800**	**0.540**
Anthracene	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	**0.940**	**1.40**	**1.70**	**2.10**	**1.50**	**0.990**
Phenanthrene	**3.70**	**3.80**	**4.10**	**5.10**	**2.30**	**3.60**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	0.0660 U	0.0660 U	0.0660 U	0.0660 U	**0.610**	0.0660 U
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U
Chrysene	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	**1.20**	**1.00**	**1.10**	**1.60**	**0.750**	**0.780**
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U
Pyrene	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
- = Not Analyzed
ND = Non Detect
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclor 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Reference Area smallmouth bass samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped

U = The analyte was not detected at or above the MDL (except PCB congeners). For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-7a
Pre-Removal Sediment Analytical Results
PCB Aroclors, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size

Area	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	**Selected SLV**	**SLV Source**
Site ID	A1	A2*	A3	A4	A5		
Sample ID	070926A1 SD	070926A2 SD	070927A3 SD	070925A4 SD	070925A5 SD		
Sample Date	9/26/2007	9/26/2007	9/27/2007	9/25/2007	9/25/2007		
PCB Aroclors (µg/kg dry)							
Aroclor 1016	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1221	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1232	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1242	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1248	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1254	**130**	**44.0**	5.80 U	**100**	**13.0**	0.0480	HH
Aroclor 1260	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1262	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Aroclor 1268	2.60 U	2.80 U	5.80 U	3.00 U	2.80 U	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**133 J**	**46.8 J**	11.6 U	**103 J**	**15.8 J**	0.0480	HH
Metals (mg/kg dry)							
Aluminum	**8,830**	**14,000 J**	**13,400**	**13,100**	**11,900**	38,000	UPL
Antimony	**0.0500**	**0.115**	**0.130 J**	**0.170**	**0.170**	3.00	Eco
Arsenic	**5.68**	**4.24**	**2.00**	**2.33**	**2.36**	6.00	Eco
Barium	**89.8**	**116**	**93.3**	**108**	**149**	315	UPL
Beryllium	**0.353**	**0.358**	**0.314**	**0.331**	**0.280**	0.847	UPL
Cadmium	**0.265**	**0.608 J**	**0.498**	**0.540**	**0.490**	0.674	UPL
Chromium	**14.8**	**22.0**	**15.2**	**16.3**	**16.1**	37.0	Eco
Cobalt	**10.4**	**10.1**	**5.87**	**7.48**	**7.03**	15.2	UPL
Copper	**38.9**	**28.2 J**	**15.3**	**17.8**	**15.9**	55.6	UPL
Lead	**7.27**	**18.4 J**	**9.39**	**9.78**	**9.11**	35.0	Eco
Mercury	**0.0620**	**0.0915 J**	**0.224**	**0.269**	**0.366**	0.214	UPL
Nickel	**15.9**	**15.8**	**9.92**	**12.5**	**11.4**	21.2	UPL
Thallium	**0.112**	**0.171 J**	**0.132**	**0.165**	**0.139**	0.354	UPL
Vanadium	**34.6**	**58.2**	**45.9**	**58.6**	**56.8**	70.6	UPL
Zinc	**46.0**	**93.6**	**87.4**	**102**	**108**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)							
Diesel Range Organics	**35.0**	**11.7 J**	**16.0 J**	**12.0 J**	**8.80 J**	--	--
Residual Range Organics	**77.0 J**	**63.5 J**	**120 J**	**98.0 J**	**70.0 J**	--	--
Semivolatile Organic Compounds (µg/kg dry)							
Bis(2-ethylhexyl) Phthalate	7.00 UJ	**15.5 J**	**16.0 J**	**180 J**	**51.0 J**	750	Eco
Butyl Benzyl Phthalate	3.20 U	3.20 U	**10.0 J**	3.20 U	3.20 U	110	Eco
Carbazole	1.30 U	1.30 U	**2.60 J**	1.30 U	1.30 U	140	Eco
Di-n-butyl Phthalate	**9.10 J**	**11.4 J**	**24.0 J**	**14.0 J**	**12.0 J**	110	Eco
Di-n-octyl Phthalate	1.70 U	1.70 U	2.90 U	1.70 U	1.70 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	**4,100**	4.70 U	**4.40 J**	2.90 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)							
Acenaphthene	1.40 U	1.40 U	2.40 U	1.40 U	1.40 U	290	Eco
Anthracene	**4.30 J**	14.0 U	2.30 U	1.40 U	1.40 U	57.0	Eco
Fluorene	1.10 U	1.10 U	1.90 U	1.10 U	1.10 U	77.0	Eco
Phenanthrene	**9.10**	**3.25 J**	**2.90 J**	**4.50 J**	**5.00 J**	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**15.9 J**	**19.8 J**	**9.50 J**	**8.40 J**	**8.90 J**	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)							
Benzo(a)anthracene	**5.70 J**	**3.05 J**	**3.70 J**	**3.30 J**	**3.50 J**	32.0	Eco
Benzo(a)pyrene	**32.0**	16.0 U	2.60 U	**6.10 J**	**7.40 J**	32.0	Eco
Benzo(b)fluoranthene	**11.0**	**7.05 J**	**4.20 J**	**6.40 J**	**7.40 J**	27.0	Eco
Benzo(g,h,i)perylene	**5.40 J**	**3.70 J**	**5.20 J**	**4.40 J**	**4.70 J**	300	Eco
Benzo(k)fluoranthene	**3.20 J**	**3.40 J**	**3.30 J**	**2.30 J**	**2.50 J**	27.0	Eco
Chrysene	**7.90**	**5.35 J**	**4.10 J**	**4.70 J**	**5.20 J**	57.0	Eco
Dibenz(a,h)anthracene	1.50 U	**2.50 J**	**3.10 J**	1.50 U	1.50 U	33.0	Eco
Fluoranthene	**13.0**	**7.10 J**	**4.40 J**	**7.10 J**	**8.30**	111	Eco
Indeno(1,2,3-cd)pyrene	**6.30 J**	**4.60 J**	**13.0 J**	**4.00 J**	**3.90 J**	17.0	Eco
Pyrene	**13.0**	**6.85 J**	**4.50 J**	**6.60 J**	**7.80 J**	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**99.0 J**	**48.4 J**	**48.1 J**	**46.4 J**	**52.2 J**	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)							
Total PAHs (KM, capped; NDs at MDL)	**114 J**	**57.2 J**	**56.0 J**	**53.8 J**	**60.1 J**	1600	Eco
General Chemistry Parameters (mg/kg) and Grain Size (%)							
Carbon, Total Organic	**10,200**	**5,500**	**10,900**	**9,200**	**7,300**	--	--
Gravel (>2.00 mm)	**40.0**	**49.4**	**29.3**	**0.350**	**0.0600**	--	--
Sand, Very Coarse (1.00 - 2.00 mm)	**15.8**	**11.9**	**1.46**	**0.590**	**0.610**	--	--
Sand, Coarse (0.50 - 1.00 mm)	**13.5**	**14.4**	**1.19**	**0.940**	**0.830**	--	--
Sand, Medium (0.25 - 0.50 mm)	**7.59**	**9.57**	**1.26**	**2.93**	**2.92**	--	--
Sand, Fine (0.125 - 0.25 mm)	**5.68**	**6.83**	**2.75**	**19.8**	**34.1**	--	--
Sand, Very Fine (0.0625 - 0.125 mm)	**4.24**	**4.12**	**6.11**	**30.6**	**29.4**	--	--
Silt (0.039 - 0.0625 mm)	**12.0**	**10.0**	**34.2**	**33.9**	**26.7**	--	--
Clay (<0.039 mm)	**1.37**	**2.38**	**6.36**	**6.65**	**6.76**	--	--

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.

[1] Only Aroclor 1248 and 1254 were included in summing sediment Total PCBs as Aroclors because all other aroclors were undected in Forebay sediment samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-7b
Pre-Removal Clam Tissue Analytical Results
PCB Aroclors, Metals, and Semivolatile Organic Compounds

Area	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	**Selected SLV**	**SLV Source**
Site ID	A1*	A2	A3	A5		
Sample ID	070926A1TC	070926A2TC	070927A3TC	070925A5TC		
Sample Date	9/26/2007	9/26/2007	9/27/2007	9/25/2007		
Percent Lipids	3.4	3.6	3.3	3.5		
PCB Aroclors (µg/kg wet)						
Aroclor 1016	2.40 U	2.40 U	2.40 U	4.70 U	35.0	Eco
Aroclor 1221	2.60 U	2.60 U	2.60 U	5.10 U	35.0	Eco
Aroclor 1232	2.30 U	2.30 U	2.30 U	4.50 U	35.0	Eco
Aroclor 1242	2.20 U	2.20 U	2.20 U	4.40 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	0.510 U	1.00 U	35.0	Eco
Aroclor 1254	**355**	**250**	**180**	**120**	35.0	Eco
Aroclor 1260	1.90 U	1.90 U	1.90 U	3.80 U	35.0	Eco
Aroclor 1262	-	-	-	-	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	4.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**355 J**	**250 J**	**180 J**	**120 J**	35.0	Eco
Metals (mg/kg wet)						
Aluminum	**196**	**166**	**184**	**151**	--	--
Antimony	0.00500 U	0.00500 UJ	0.00500 U	0.00500 U	--	--
Arsenic	**2.56**	**3.03**	**3.13**	**2.56**	6.60	Eco
Barium	**2.51**	**2.68**	**2.25**	**2.07**	--	--
Beryllium	**0.00565**	**0.00420**	**0.00550**	**0.00360**	--	--
Cadmium	**0.438**	**0.454**	**0.426**	**0.340**	0.150	Eco
Chromium	**0.700**	**1.20**	**1.20**	**0.600**	--	--
Cobalt	**0.143**	**0.135**	**0.172**	**0.121**	--	--
Copper	**10.8**	**12.3**	**13.5**	**10.1**	--	--
Lead	**0.133**	**0.101**	**0.184**	**0.104**	0.120	Eco
Mercury	**0.0101**	**0.0114 J**	**0.0132**	**0.0114**	0.0740	Eco
Methyl Mercury	-	-	-	-	--	--
Nickel	**0.304**	**0.394**	**0.343**	**0.275**	--	--
Thallium	**0.0192**	**0.0159**	**0.0155**	**0.0162**	--	--
Vanadium	**0.493**	**0.416**	**0.540**	**0.391**	--	--
Zinc	**28.2**	**23.7**	**25.0**	**25.1**	--	--
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	-	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	-	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	-	--	--
Di-n-butyl Phthalate	**71.0 J**	16.0 U	**59.0 J**	-	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	-	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	-	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.225 J**	**0.240 J**	**0.250 J**	-	19,000	Eco
Anthracene	**0.945**	**1.10 J**	**1.00**	-	19,000	Eco
Fluorene	**1.30**	**1.30**	**1.30**	-	19,000	Eco
Phenanthrene	**6.60**	**7.00**	**6.70**	-	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	**1.02**	**0.670**	**0.600**	-	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	-	1,000	Eco
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	-	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	-	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	-	1,000	Eco
Chrysene	**2.55**	**2.50**	**2.10**	-	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	-	1,000	Eco
Fluoranthene	**12.5**	**12.0**	**12.0**	-	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	-	1,000	Eco
Pyrene	**2.80**	**2.80**	**2.70**	-	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.

[1] Only Aroclor 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
🟨 = The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-8a
Post-Removal Forebay Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 1 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P04	P05	P06	P07	P08	P09		
Sample ID	08022604SD	08031905SD	08031806SD	08021507SD	08021508SD	08021409SD		
Sample Date	2/26/2008	3/19/2008	3/18/2008	2/15/2008	2/15/2008	2/14/2008		
PCB Aroclors (µg/kg dry)								
Aroclor 1016	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1221	1.70 U	1.70 U	1.70 U	2.20 U	12.0 U	1.70 U	0.0480	HH
Aroclor 1232	1.70 U	1.70 U	1.70 U	7.90 U	7.40 U	1.70 U	0.0480	HH
Aroclor 1242	1.70 U	1.70 U	1.70 U	4.30 U	5.70 U	1.70 U	0.0480	HH
Aroclor 1248	1.70 U	1.70 U	1.70 U	3.50 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1254	**27.0**	1.70 U	**4.60 J**	2.50 U	1.90 U	2.60 U	0.0480	HH
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**28.7 J**	3.40 U	**6.30 J**	6.00 U	3.60 U	4.30 U	0.0480	HH
PCB Dioxin-Like Congeners (µg/kg dry)								
PCB 77	**0.00709**	**0.000209**	**0.000596**	**0.00110**	**0.00121**	**0.00199**	0.00640	HH
PCB 81	0.00340 EMPC	0.0000773 U	0.000106 U	0.000192 EMPC	0.000103 EMPC	0.000140 U	0.00210	HH
PCB 105	**1.08**	**0.00954**	**0.0246**	**0.0475**	**0.0335**	**0.0572**	0.0210	HH
PCB 114	**0.0603**	**0.000631**	**0.00160**	**0.00280**	**0.00185**	**0.00327**	0.0210	HH
PCB 118	**2.65**	**0.0294**	**0.0687**	**0.131**	**0.0926**	**0.145**	0.0260	HH
PCB 123	**0.0363**	0.000610 EMPC	0.00111 EMPC	0.00190 EMPC	**0.00144**	**0.00204**	0.0260	HH
PCB 126	0.00269 U	0.0000725 U	0.000318 U	0.000203 U	0.000177 EMPC	0.000219 EMPC	0.00000620	HH
PCB 156	**0.380 C**	**0.00350 C**	**0.00765 C**	**0.0120 C**	**0.0104 C**	**0.0195 C**	0.0260	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.0260	HH
PCB 167	**0.113**	**0.00152**	**0.00255**	**0.00452**	**0.00430**	**0.00633**	0.0260	HH
PCB 169	0.000879 U	0.0000479 U	0.0000626 U	0.0000923 U	0.0000881 U	0.000126 U	0.0000210	HH
PCB 189	**0.00901**	0.000127 EMPC	0.000241 EMPC	0.000331 EMPC	0.000347 EMPC	**0.000787**	0.140	HH
Total PCBs as Congeners (KM, capped)	**29.7 J**	**0.301 J**	**0.778 J**	**1.69 J**	**1.08 J**	**2.10 J**	0.0480	HH
Metals (mg/kg dry)								
Aluminum	**11,200**	**11,300**	**10,800**	**22,900**	**13,500**	**13,300**	38,000	UPL
Antimony	**0.180 J**	0.0400 UJ	**0.0400 J**	**0.140 J**	**0.150 J**	**0.210 J**	3.00	Eco
Arsenic	**3.24**	**1.40**	**2.22**	**5.39**	**4.24**	**2.73**	6.00	Eco
Barium	**121**	**53.1**	**71.2**	**202**	**147**	**123**	315	UPL
Beryllium	**0.367**	**0.215**	**0.295**	**0.597**	**0.398**	**0.369**	0.847	UPL
Cadmium	**0.509**	0.121 U	**0.175**	**0.429**	**0.430**	**0.694**	0.674	UPL
Chromium	**16.0**	**24.1**	**16.9**	**33.5**	**18.4**	**18.5**	37.0	Eco
Cobalt	**7.60**	**8.83**	**10.8**	**10.3**	**7.86**	**7.36**	15.2	UPL
Copper	**20.3**	**19.9**	**24.4**	**33.1**	**19.9**	**19.1**	55.6	UPL
Lead	**10.5**	**3.30**	**5.03**	**9.03**	**8.53**	**10.1**	35.0	Eco
Mercury	**0.264**	**0.0160**	**0.0230**	**0.102**	**0.117**	**0.174**	0.214	UPL
Nickel	**11.8**	**12.8**	**13.8**	**16.4**	**12.6**	**11.5**	21.2	UPL
Thallium	**0.172**	0.108 U	0.132 U	**0.218**	**0.203**	**0.207**	0.354	UPL
Vanadium	**35.1**	**40.3**	**45.0**	**59.3**	**37.9**	**37.4**	70.6	UPL
Zinc	**86.1**	**57.4**	**58.2**	**83.4**	**81.9**	**88.9**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)								
Diesel Range Organics	**21.0**	**2.60 J**	**4.70 J**	**16.0 J**	**13.0 J**	**22.0**	-	-
Residual Range Organics	**98.0 J**	140 U	150 U	**71.0 J**	**55.0 J**	**120 J**	-	-
Semivolatile Organic Compounds (µg/kg dry)								
Bis(2-ethylhexyl) Phthalate	**340**	200 U	200 U	200 U	200 U	200 U	750	Eco
Butyl Benzyl Phthalate	1.50 U	10.0 U	9.80 U	1.50 U	1.50 U	1.50 U	110	Eco
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	140	Eco
Di-n-butyl Phthalate	10.0 U	15.0 U	9.80 U	9.90 U	9.80 U	9.90 U	110	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	2.90 U	**4.80 J**	2.90 U	2.90 U	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)								
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	290	Eco
Anthracene	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	1.40 U	57.0	Eco
Fluorene	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	77.0	Eco
Phenanthrene	**3.30 J**	**1.40 J**	1.30 U	**3.40 J**	1.30 U	**1.80 J**	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**7.40 J**	**5.50 J**	5.40 U	**7.50 J**	5.40 U	**5.90 J**	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)								
Benzo(a)anthracene	**3.90 J**	**1.60 J**	1.40 U	1.40 U	1.40 U	**2.70 J**	32.0	Eco
Benzo(a)pyrene	**4.40 J**	**1.70 J**	1.60 U	1.60 U	1.60 U	**4.50 J**	32.0	Eco
Benzo(b)fluoranthene	**6.10 J**	2.50 U	2.50 U	2.50 U	2.50 U	**5.80 J**	27.0	Eco
Benzo(g,h,i)perylene	**3.90 J**	2.30 U	2.30 U	2.30 U	2.30 U	**3.30 J**	300	Eco
Benzo(k)fluoranthene	**2.50 J**	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	27.0	Eco
Chrysene	**7.80 J**	**1.80 J**	**1.50 J**	**1.40 J**	1.40 U	**4.20 J**	57.0	Eco
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	33.0	Eco
Fluoranthene	**5.50 J**	**3.00 J**	2.20 U	**2.50 J**	2.20 U	**3.70 J**	111	Eco
Indeno(1,2,3-cd)pyrene	**3.30 J**	1.90 U	1.90 U	1.90 U	1.90 U	**3.20 J**	17.0	Eco
Pyrene	**5.60 J**	**2.40 J**	**1.80 J**	**2.00 J**	1.30 U	**3.50 J**	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**45.2 J**	**19.2 J**	**15.4 J**	**16.2 J**	19.3 U	**35.3 J**	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)								
Total PAHs (KM, capped; NDs at MDL)	**50.3 J**	**22.3 J**	**16.6 J**	**20.5 J**	24.7 U	**38.1 J**	1600	Eco
General Chemistry Parameters (mg/kg dry) and Grain Size (%)								
Carbon, Total Organic	**10,100**	**15,400**	**2,400**	**5,100**	**5,600**	**12,500**	-	-
Gravel (>2.00 mm)	**0.290**	**31.0**	**32.5**	**26.7**	**18.2**	**0.640**	-	-
Sand, Very Coarse (1.00 - 2.00 mm)	**0.380**	**17.6**	**8.42**	**8.50**	**4.82**	**0.280**	-	-
Sand, Coarse (0.50 - 1.00 mm)	**0.830**	**23.9**	**16.3**	**9.36**	**4.96**	**0.710**	-	-
Sand, Medium (0.25 - 0.50 mm)	**5.87**	**16.4**	**17.4**	**17.8**	**10.0**	**1.78**	-	-
Sand, Fine (0.125 - 0.25 mm)	**33.3**	**6.58**	**11.6**	**18.9**	**30.8**	**14.1**	-	-
Sand, Very Fine (0.0625 - 0.125 mm)	**23.1**	**2.74**	**5.08**	**6.12**	**11.3**	**30.3**	-	-
Silt (0.039 - 0.0625 mm)	**40.4**	**6.47**	**7.40**	**16.0**	**17.5**	**44.8**	-	-
Clay (<0.039 mm)	**7.59**	**1.66**	**1.22**	**3.67**	**5.60**	**6.99**	-	-

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
ND = Non Detect
SLV = screening level value
RDL = reported detection limit
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed
-- = SLV for analyte not available

[1] Only Aroclors 1248 and 1254 were included in summing sediment Total PCBs as Aroclors because all other aroclors were undected in Forebay sediment samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-8a
Post-Removal Forebay Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 2 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P10	P11	P13	P14	P15	P16		
Sample ID	08021410SD	08021411SD	08031713SD	08031814SD	08022115SD	08022116SD		
Sample Date	2/14/2008	2/14/2008	3/17/2008	3/18/2008	2/21/2008	2/21/2008		
PCB Aroclors (µg/kg dry)								
Aroclor 1016	10.0 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1221	21.0 U	20.0 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1232	8.20 U	6.30 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1242	2.20 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1248	1.90 U	4.00 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1254	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	3.60 U	5.70 U	3.40 U	3.40 U	3.40 U	3.40 U	0.0480	HH
PCB Dioxin-Like Congeners (µg/kg dry)								
PCB 77	**0.00198**	**0.00231**	**0.00163**	**0.000417**	**0.00240**	**0.00217**	0.00640	HH
PCB 81	0.000147 EMPC	0.000129 U	0.0000910 U	0.0000694 U	0.000138 U	0.0000754 U	0.00210	HH
PCB 105	**0.0311**	**0.0211**	**0.0124**	**0.00287**	**0.0188**	**0.0168**	0.0210	HH
PCB 114	0.00171 EMPC	**0.00117**	**0.000661**	0.000136 EMPC	0.000965 EMPC	**0.000813**	0.0210	HH
PCB 118	**0.0794**	**0.0528**	**0.0384**	**0.00690**	**0.0516**	**0.0408**	0.0260	HH
PCB 123	**0.00119**	**0.000859**	**0.000661**	0.000107 EMPC	**0.000796**	**0.000833**	0.0260	HH
PCB 126	0.000252 EMPC	0.000212 EMPC	0.000199 EMPC	0.0000662 U	0.000296 EMPC	**0.000238**	0.00000620	HH
PCB 156	**0.0106 C**	**0.00874 C**	**0.00473 C**	**0.00113 C**	**0.00653 C**	**0.00661 C**	0.0260	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						0.0260	HH
PCB 167	**0.00391**	**0.00349**	**0.00246**	**0.000461**	**0.00337**	**0.00287**	0.0260	HH
PCB 169	0.000123 U	0.000111 U	0.000104 U	0.0000484 U	0.000161 EMPC	0.000132 U	0.0000210	HH
PCB 189	**0.000617**	**0.000589**	**0.000620 EMPC**	0.000814 U	0.000534 EMPC	**0.000452**	0.140	HH
Total PCBs as Congeners (KM, capped)	**1.24 J**	**1.12 J**	**0.684 J**	**0.143 J**	**0.973 J**	**0.836 J**	0.0480	HH
Metals (mg/kg dry)								
Aluminum	**14,200**	**16,500**	**13,500**	**15,600**	**14,600**	**13,100**	38,000	UPL
Antimony	**0.240 J**	**0.210 J**	**0.280 J**	**0.120 J**	**0.200 J**	**0.200 J**	3.00	Eco
Arsenic	**2.87**	**3.08**	**3.06**	**3.49**	**2.93**	**2.74**	6.00	Eco
Barium	**126**	**134**	**118**	**188**	**141**	**120**	315	UPL
Beryllium	**0.437**	**0.468**	**0.385**	**0.251**	**0.425**	**0.417**	0.847	UPL
Cadmium	**0.691**	**0.719**	**0.531**	**0.307**	**0.652**	**0.690**	0.674	UPL
Chromium	**17.6**	**20.9**	**20.0**	**26.8**	**21.6**	**19.2**	37.0	Eco
Cobalt	**7.55**	**8.52**	**9.33**	**15.1**	**10.0**	**8.04**	15.2	UPL
Copper	**24.0**	**23.6**	**19.4**	**18.4**	**21.0**	**20.9**	55.6	UPL
Lead	**10.1**	**11.3**	**10.0**	**7.04**	**10.3**	**11.0**	35.0	Eco
Mercury	**0.306**	**0.244**	**0.00800**	**0.0410**	**0.109**	**0.373**	0.214	UPL
Nickel	**12.2**	**15.1**	**19.0**	**51.5**	**17.8**	**14.2**	21.2	UPL
Thallium	**0.182**	**0.194**	**0.193**	**0.179**	**0.197**	**0.196**	0.354	UPL
Vanadium	**37.1**	**45.2**	**49.5**	**30.9**	**54.7**	**45.2**	70.6	UPL
Zinc	**87.9**	**97.2**	**113**	**59.3**	**104**	**97.9**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)								
Diesel Range Organics	**27.0**	**28.0**	**11.0 J**	**4.60 J**	**24.0**	**26.0**	-	-
Residual Range Organics	**150 J**	**160 J**	180 U	140 U	**170 J**	**150 J**	-	-
Semivolatile Organic Compounds (µg/kg dry)								
Bis(2-ethylhexyl) Phthalate	200 U	200 U	200 U	200 U	**140 J**	**38.0 J**	750	Eco
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	9.90 U	1.50 U	1.50 U	110	Eco
Carbazole	1.30 U	1.30 U	**1.40 J**	1.30 U	1.30 U	1.30 U	140	Eco
Di-n-butyl Phthalate	9.90 U	10.0 U	19.0 U	14.0 U	10.0 U	9.90 U	110	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	**6.50 J**	**7.30 J**	2.90 U	**21.0**	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)								
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	290	Eco
Anthracene	1.40 U	**2.00 J**	**2.70 J**	1.40 U	1.40 U	**1.90 J**	57.0	Eco
Fluorene	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	77.0	Eco
Phenanthrene	**1.90 J**	**7.10 J**	**5.40 J**	**2.10 J**	**4.60 J**	**5.00 J**	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**6.00 J**	**11.8 J**	**10.8 J**	**6.20 J**	**8.70 J**	**9.60 J**	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)								
Benzo(a)anthracene	**2.30 J**	**7.40 J**	**12.0**	**2.20 J**	**2.10 J**	**5.90 J**	32.0	Eco
Benzo(a)pyrene	**3.00 J**	**7.50 J**	**6.10 J**	**2.00 J**	1.60 U	**6.50 J**	32.0	Eco
Benzo(b)fluoranthene	**4.10 J**	**9.10 J**	**6.00 J**	2.50 U	2.50 U	**8.00 J**	27.0	Eco
Benzo(g,h,i)perylene	**2.90 J**	**4.40 J**	**3.50 J**	2.30 U	2.30 U	**5.00 J**	300	Eco
Benzo(k)fluoranthene	2.50 U	**3.30 J**	**4.90 J**	2.50 U	2.50 U	**3.10 J**	27.0	Eco
Chrysene	**4.10 J**	**9.30 J**	**20.0**	**2.40 J**	**3.40 J**	**7.60 J**	57.0	Eco
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	33.0	Eco
Fluoranthene	**3.80 J**	**10.0**	**5.30 J**	**3.20 J**	**4.00 J**	**9.70 J**	111	Eco
Indeno(1,2,3-cd)pyrene	**2.20 J**	**4.70 J**	**3.60 J**	1.90 U	1.90 U	**5.40 J**	17.0	Eco
Pyrene	**3.70 J**	**12.0**	**8.90 J**	**3.20 J**	**5.30 J**	**11.0**	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**30.5 J**	**69.9 J**	**72.5 J**	**23.0 J**	**25.1 J**	**64.4 J**	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)								
Total PAHs (KM, capped; NDs at MDL)	**33.7 J**	**80.1 J**	**81.4 J**	**25.0 J**	**29.1 J**	**72.4 J**	1600	Eco
General Chemistry Parameters (mg/kg dry) and Grain Size (%)								
Carbon, Total Organic	**15,000**	**14,200**	**11,900**	**15,400**	**10,600**	**12,500**	-	-
Gravel (>2.00 mm)	**1.91**	**0.400**	**2.02**	**40.0**	**4.61**	**0.500**	-	-
Sand, Very Coarse (1.00 - 2.00 mm)	**0.660**	**0.230**	**3.36**	**13.7**	**0.890**	**0.260**	-	-
Sand, Coarse (0.50 - 1.00 mm)	**0.660**	**0.550**	**4.42**	**16.4**	**1.36**	**0.580**	-	-
Sand, Medium (0.25 - 0.50 mm)	**2.06**	**1.53**	**7.39**	**8.63**	**8.82**	**2.73**	-	-
Sand, Fine (0.125 - 0.25 mm)	**9.54**	**10.1**	**25.6**	**8.36**	**36.7**	**15.2**	-	-
Sand, Very Fine (0.0625 - 0.125 mm)	**18.9**	**24.3**	**27.2**	**4.77**	**24.6**	**28.1**	-	-
Silt (0.039 - 0.0625 mm)	**62.3**	**52.4**	**30.0**	**8.95**	**28.3**	**40.4**	-	-
Clay (<0.039 mm)	**12.9**	**11.3**	**4.12**	**1.04**	**5.57**	**9.88**	-	-

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
ND = Non Detect
SLV = screening level value
RDL = reported detection limit
UPL = Reference Area Upper Prediction Limit
- = Not Analyzed
-- = SLV for analyte not available

[1] Only Aroclors 1248 and 1254 were included in summing sediment Total PCBs as Aroclors because all other aroclors were undected in Forebay sediment samples.
-- = SLV for analyte not available
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-8a
Post-Removal Forebay Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 3 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P17	P18	P21	P65	P67	P88	P89		
Sample ID	08022117SD	08021118SD	08021221SD	08022965SD	08030367SD	08031788SD	08031789SD		
Sample Date	2/21/2008	2/11/2008	2/12/2008	2/29/2008	3/3/2008	3/17/2008	3/17/2008		
PCB Aroclors (µg/kg dry)									
Aroclor 1016	9.90 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1221	29.0 U	13.0 U	16.0 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1232	18.0 U	7.50 U	14.0 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1242	1.70 U	2.90 U	5.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1248	1.90 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1254	2.20 U	1.70 U	2.40 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1260	1.70 U	1.70 U	4.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	0.0480	HH
Total PCBs as Aroclors (NDs at MDL) [1]	4.10 U	3.40 U	4.10 U	3.40 U	3.40 U	3.40 U	3.40 U	0.0480	HH
PCB Dioxin-Like Congeners (µg/kg dry)									
PCB 77	**0.00151**	**0.00132**	**0.00147**	**0.00104**	**0.000289**	**0.000409**	**0.000341**	0.00640	HH
PCB 81	0.0000802 U	0.000115 U	0.0000934 U	0.000102 U	0.0000693 U	0.0000662 U	0.0000486 U	0.00210	HH
PCB 105	**0.0120**	**0.0113**	**0.0125**	**0.00849**	**0.00130**	**0.00402**	**0.00306**	0.0210	HH
PCB 114	**0.000665**	**0.000621**	**0.000666**	**0.000429**	0.0000580 EMPC	**0.000267**	**0.000174**	0.0210	HH
PCB 118	**0.0274**	**0.0290**	**0.0299**	**0.0209**	**0.00271**	**0.0127**	**0.0100**	0.0260	HH
PCB 123	**0.000459**	**0.000582**	**0.000569**	0.000327 EMPC	0.0000640 EMPC	0.000201 U	0.000158 U	0.0260	HH
PCB 126	**0.000173**	0.000123 EMPC	**0.000189**	0.000135 EMPC	0.0000479 U	0.0000635 U	0.0000693 U	0.00000620	HH
PCB 156	**0.00448 C**	**0.00381 C**	**0.00470 C**	**0.00308 C**	**0.000399 C**	**0.00135 C**	0.000935 C U	0.0260	HH
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**							0.0260	HH
PCB 167	**0.00184**	**0.00190**	**0.00190**	**0.00137**	0.000173 EMPC	0.000710 U	0.000640 U	0.0260	HH
PCB 169	0.000109 U	0.0000841 U	0.000103 U	0.0000931 U	0.0000479 U	0.0000485 U	0.0000454 U	0.0000210	HH
PCB 189	**0.000428 EMPC**	0.000217 EMPC	**0.000332**	**0.000242**	0.0000479 U	**0.000100**	**0.0000980**	0.140	HH
Total PCBs as Congeners (KM, capped)	**0.588 J**	**0.523 J**	**0.571 J**	**0.399 J**	**0.0611 J**	**0.204 J**	**0.151 J**	0.0480	HH
Metals (mg/kg dry)									
Aluminum	**11,000**	**12,400**	**12,100**	**12,500**	**14,400**	**10,400**	**9,000**	38,000	UPL
Antimony	**0.150 J**	**0.150 J**	**0.200 J**	**0.160 J**	**0.0400 J**	**0.140 J**	**0.0900 J**	3.00	Eco
Arsenic	**2.33**	**5.39**	**3.29**	**2.86**	**3.24**	**2.81**	**2.02**	6.00	Eco
Barium	**98.8**	**128**	**129**	**112**	**79.6**	**125**	**85.7**	315	UPL
Beryllium	**0.334**	**0.398**	**0.390**	**0.307**	**0.331**	**0.270**	**0.228**	0.847	UPL
Cadmium	**0.460**	**0.396**	**0.579**	**0.423**	0.115 U	**0.312**	**0.256**	0.674	UPL
Chromium	**15.3**	**20.7**	**17.8**	**18.4**	**27.1**	**15.9**	**10.1**	37.0	Eco
Cobalt	**7.24**	**8.78**	**8.31**	**6.71**	**8.95**	**7.12**	**4.82**	15.2	UPL
Copper	**16.5**	**20.1**	**19.5**	**14.9**	**27.0**	**15.6**	**11.3**	55.6	UPL
Lead	**8.13**	**16.8**	**10.6**	**10.7**	**4.31**	**7.58**	**5.28**	35.0	Eco
Mercury	**0.263**	**0.0910 J**	**0.167**	**0.118 J**	**0.0220**	**0.0430**	**0.0360**	0.214	UPL
Nickel	**13.0**	**13.4**	**14.2**	**11.4**	**16.1**	**11.6**	**6.39**	21.2	UPL
Thallium	**0.135**	**0.158**	**0.187**	**0.178**	0.122 U	**0.143**	0.113 U	0.354	UPL
Vanadium	**36.5**	**39.1**	**36.9**	**36.5**	**29.5**	**35.5**	**27.5**	70.6	UPL
Zinc	**69.0**	**78.2**	**94.1**	**101**	**50.3**	**86.3**	**59.1**	123	Eco
Petroleum Hydrocarbons (mg/kg dry)									
Diesel Range Organics	**54.0**	**10.0 J**	**10.0 J**	**9.30 J**	**3.10 J**	**7.90 J**	**4.00 J**	-	-
Residual Range Organics	**180 J**	**62.0 J**	**67.0 J**	150 U	**17.0 J**	130 U	150 U	-	-
Semivolatile Organic Compounds (µg/kg dry)									
Bis(2-ethylhexyl) Phthalate	200 U	200 U	200 U	200 U	200 U	200 U	200 U	750	Eco
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	1.50 U	9.90 U	9.80 U	9.80 U	110	Eco
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	140	Eco
Di-n-butyl Phthalate	10.0 U	10.0 U	10.0 U	9.90 U	11.0 U	14.0 U	14.0 U	110	Eco
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	110	Eco
p-cresol (4-Methylphenol)	2.90 U	2.90 U	2.90 U	**11.0**	2.90 U	2.90 U	**18.0**	-	-
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)									
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	290	Eco
Anthracene	**1.90 J**	1.40 U	1.40 U	**1.50 J**	1.40 U	1.40 U	1.40 U	57.0	Eco
Fluorene	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	77.0	Eco
Phenanthrene	**7.40 J**	**2.90 J**	1.30 U	**2.20 J**	1.30 U	**1.70 J**	1.30 U	42.0	Eco
Total LPAHs (KM, capped; NDs at MDL)	**12.0 J**	**7.00 J**	5.40 U	**6.40 J**	5.40 U	**5.80 J**	5.40 U	76.0	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)									
Benzo(a)anthracene	**6.00 J**	**2.00 J**	1.40 U	**7.00 J**	1.40 U	1.40 U	1.40 U	32.0	Eco
Benzo(a)pyrene	**7.20 J**	**2.60 J**	1.60 U	**6.10 J**	1.60 U	1.60 U	1.60 U	32.0	Eco
Benzo(b)fluoranthene	**7.50 J**	**4.00 J**	2.50 U	**5.60 J**	2.50 U	2.50 U	2.50 U	27.0	Eco
Benzo(g,h,i)perylene	**6.20 J**	**2.60 J**	2.30 U	**4.20 J**	2.30 U	2.30 U	2.30 U	300	Eco
Benzo(k)fluoranthene	2.50 U	2.50 U	2.50 U	**3.20 J**	2.50 U	2.50 U	2.50 U	27.0	Eco
Chrysene	**7.90 J**	**3.20 J**	**1.80 J**	**12.0**	1.40 U	**1.70 J**	1.40 U	57.0	Eco
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	33.0	Eco
Fluoranthene	**12.0**	**4.80 J**	**2.70 J**	**4.60 J**	2.20 U	**2.60 J**	2.20 U	111	Eco
Indeno(1,2,3-cd)pyrene	**5.70 J**	**2.50 J**	1.90 U	**4.10 J**	1.90 U	1.90 U	1.90 U	17.0	Eco
Pyrene	**17.0**	**4.80 J**	**2.20 J**	**4.40 J**	1.30 U	**2.20 J**	1.30 U	53.0	Eco
Total HPAHs (KM, capped; NDs at MDL)	**73.9 J**	**30.5 J**	**17.5 J**	**53.4 J**	19.3 U	**17.2 J**	19.3 U	193	Eco
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)									
Total PAHs (KM, capped; NDs at MDL)	**83.4 J**	**34.9 J**	**18.6 J**	**58.4 J**	24.7 U	**19.5 J**	24.7 U	1600	Eco
General Chemistry Parameters (mg/kg dry) and Grain Size (%)									
Carbon, Total Organic	**16,200**	**8,600**	**11,600**	**6,100**	**1,100**	**3,000**	**2,100**	-	-
Gravel (>2.00 mm)	**1.19**	**3.69**	**19.3**	**0.180**	**20.7**	**47.9**	**66.2**	-	-
Sand, Very Coarse (1.00 - 2.00 mm)	**0.950**	**1.96**	**1.00**	**0.210**	**10.6**	**6.39**	**4.70**	-	-
Sand, Coarse (0.50 - 1.00 mm)	**2.32**	**3.67**	**1.40**	**0.540**	**20.2**	**7.02**	**9.54**	-	-
Sand, Medium (0.25 - 0.50 mm)	**9.88**	**18.1**	**4.86**	**5.14**	**19.6**	**15.6**	**12.2**	-	-
Sand, Fine (0.125 - 0.25 mm)	**19.8**	**31.9**	**22.0**	**43.6**	**8.95**	**12.1**	**8.80**	-	-
Sand, Very Fine (0.0625 - 0.125 mm)	**25.3**	**18.6**	**17.9**	**18.3**	**4.72**	**3.53**	**1.92**	-	-
Silt (0.039 - 0.0625 mm)	**34.8**	**22.1**	**34.8**	**22.3**	**10.7**	**6.35**	**2.86**	-	-
Clay (<0.039 mm)	**7.13**	**4.75**	**8.06**	**4.60**	**4.21**	**0.860**	**0.460**	-	-

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
ND = Non Detect
SLV = screening level value
RDL = reported detection limit
UPL = Reference Area Upper Prediction Limit
\- = Not Analyzed
-- = SLV for analyte not available

[1] Only Aroclors 1248 and 1254 were included in summing sediment Total PCBs as Aroclors because all other aroclors were undected in Forebay sediment samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-8b
Post-Removal Reference Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 1 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P22	P24	P26	P27	P28	P29
Sample ID	08030522SD	08030524SD	08030426SD	08030427SD	08030428SD	08022229SD
Sample Date	3/5/2008	3/5/2008	3/4/2008	3/4/2008	3/4/2008	2/22/2008
PCB Aroclors (µg/kg dry)						
Aroclor 1016	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1221	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1232	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1242	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1248	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1254	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
Total PCBs as Aroclors (NDs at MDL) [1]	1.70 U	1.70 U	1.70 U	1.70 U	1.80 U	1.70 U
PCB Dioxin-Like Congeners (µg/kg dry)						
PCB 77	**0.000989**	**0.000983**	**0.000699**	**0.00139**	**0.00111**	**0.00140**
PCB 81	0.0000630 EMPC	0.0000786 U	0.0000490 EMPC	0.000100 EMPC	0.0000832 U	0.0000730 EMPC
PCB 105	**0.00892**	**0.00801**	**0.00717**	**0.0132**	**0.00906**	**0.0109**
PCB 114	**0.000410**	**0.000485**	**0.000378**	**0.000798**	**0.000479**	**0.000602**
PCB 118	**0.0222**	**0.0224**	**0.0209**	**0.0642**	**0.0221**	**0.0283**
PCB 123	0.000380 U	0.000429 U	0.000442 U	**0.00122**	0.000408 U	0.000446 U
PCB 126	0.000175 EMPC	0.000147 EMPC	**0.000117**	**0.000234**	0.000185 EMPC	**0.000205**
PCB 156	**0.00254 C**	**0.00258 C**	**0.00242 C**	**0.00517 C**	**0.00282 C**	**0.00319 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.00118**	**0.00130**	**0.00125**	**0.00384**	**0.00118**	**0.00146**
PCB 169	0.0000685 U	0.000102 U	0.0000571 U	0.0000971 U	0.000110 U	0.0000811 U
PCB 189	**0.000225**	**0.000260**	0.000264 EMPC	**0.000351**	**0.000416**	0.000357 EMPC
Total PCBs as Congeners (KM, capped)	**0.413 J**	**0.448 J**	**0.361 J**	**0.932 J**	**0.458 J**	**0.585 J**
Metals (mg/kg dry)						
Aluminum	**21,300**	**18,200**	**33,000**	**20,700**	**29,800**	**11,500**
Antimony	**0.200 J**	**0.210 J**	**0.320 J**	**0.520 J**	**0.220 J**	**0.340 J**
Arsenic	**3.72**	**4.00**	**5.67**	**4.12**	**4.98**	**3.63**
Barium	**207**	**205**	**247**	**225**	**242**	**109**
Beryllium	**0.540**	**0.552**	**0.633**	**0.621**	**0.694**	**0.319**
Cadmium	**0.467**	**0.411**	**0.368**	**0.444**	**0.592**	**0.593**
Chromium	**19.5**	**17.9**	**23.3**	**23.2**	**23.3**	**19.0**
Cobalt	**10.7**	**11.4**	**14.7**	**12.6**	**13.3**	**7.73**
Copper	**33.9**	**37.5**	**40.0**	**45.7**	**43.1**	**17.2**
Lead	**10.5**	**10.0**	**15.1**	**11.1**	**14.1**	**10.3**
Mercury	**0.130**	**0.108**	**0.0630**	**0.196**	**0.130**	**0.225 J**
Nickel	**14.0**	**14.1**	**17.1**	**17.0**	**17.2**	**14.9**
Thallium	**0.240**	**0.234**	**0.360**	**0.280**	**0.318**	**0.236**
Vanadium	**46.1 J**	**50.9 J**	**55.4 J**	**50.9 J**	**66.5 J**	**42.6 J**
Zinc	**75.9**	**70.2**	**82.3**	**74.7**	**88.9**	**82.7**
Petroleum Hydrocarbons (mg/kg dry)						
Diesel Range Organics	**12.0 J**	**9.80 J**	**18.0**	**25.0**	**15.0 J**	**15.0 J**
Residual Range Organics	**34.0 J**	180 U	**52.0 J**	**73.0 J**	**47.0 J**	**41.0 J**
Semivolatile Organic Compounds (µg/kg dry)						
Bis(2-ethylhexyl) Phthalate	**6.60 J**	**4.90 J**	**29.0 J**	**6.70 J**	**11.0 J**	**15.0 J**
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	**2.50 J**	1.60 U	1.50 U
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	1.40 U	1.30 U
Di-n-butyl Phthalate	**5.20 J**	**4.10 J**	2.60 UJ	**6.30 J**	**7.40 J**	2.60 UJ
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.30 U	1.20 U
p-cresol (4-Methylphenol)	**210**	**170**	**7.10 J**	**130**	**120**	**9.10 J**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)						
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.10 U	1.00 U
Anthracene	1.40 U	1.40 U	1.40 U	1.40 U	1.50 U	1.40 U
Fluorene	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ	1.80 UJ	1.70 UJ
Phenanthrene	**2.30 J**	**2.20 J**	**3.60 J**	**3.30 J**	**2.10 J**	**3.70 J**
Total LPAHs (KM, capped; NDs at MDL)	**6.40 J**	**6.30 J**	**7.70 J**	**7.40 J**	**6.50 J**	**7.80 J**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)						
Benzo(a)anthracene	**1.80 J**	**1.60 J**	**2.30 J**	**3.60 J**	**3.60 J**	**3.30 J**
Benzo(a)pyrene	**1.60 J**	1.60 U	**3.20 J**	1.60 U	**4.80 J**	**3.80 J**
Benzo(b)fluoranthene	2.50 U	2.50 U	**4.40 J**	**4.80 J**	**5.80 J**	**5.00 J**
Benzo(g,h,i)perylene	2.30 U	2.30 U	**4.70 J**	**3.20 J**	**3.60 J**	**3.50 J**
Benzo(k)fluoranthene	2.50 U	2.50 U	2.50 U	2.50 U	2.60 U	2.50 U
Chrysene	**9.70 J**	**2.10 J**	**3.70 J**	**3.50 J**	**4.90 J**	**4.00 J**
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.30 U	2.20 U
Fluoranthene	**3.60 J**	**2.60 J**	**6.40 J**	**6.20 J**	**6.10 J**	2.20 UJ
Indeno(1,2,3-cd)pyrene	1.90 UJ	1.90 UJ	**3.30 J**	**2.70 J**	**3.20 J**	1.90 UJ
Pyrene	**2.60 J**	**1.70 J**	**7.00 J**	**4.50 J**	**4.90 J**	**4.90 J**
Total HPAHs (KM, capped; NDs at MDL)	**27.8 J**	**18.1 J**	**39.5 J**	**33.3 J**	**41.5 J**	**32.1 J**
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)						
Total PAHs (KM, capped; NDs at MDL)	**31.6 J**	**21.2 J**	**43.9 J**	**37.8 J**	**45.0 J**	**35.2 J**
General Chemistry Parameters (mg/kg dry) and Grain Size (%)						
Carbon, Total Organic	**11,900**	**10,200**	**10,700**	**12,400**	**16,700**	**9,100**
Clay (<0.039 mm)	**4.16**	**7.22**	**3.82**	**4.97**	**6.56**	**4.26**
Gravel (>2.00 mm)	**0.290**	**3.17**	**8.84**	**36.4**	**0.250**	**0.660**
Sand, Coarse (0.50 - 1.00 mm)	**3.21**	**3.77**	**8.71**	**2.26**	**0.560**	**1.44**
Sand, Fine (0.125 - 0.25 mm)	**12.0**	**10.9**	**6.01**	**4.80**	**4.66**	**6.71**
Sand, Medium (0.25 - 0.50 mm)	**8.44**	**3.34**	**5.06**	**1.78**	**1.11**	**5.90**
Sand, Very Coarse (1.00 - 2.00 mm)	**0.770**	**2.99**	**8.44**	**4.84**	**0.230**	**0.380**
Sand, Very Fine (0.0625 - 0.125 mm)	**24.6**	**28.5**	**20.7**	**19.5**	**25.4**	**29.0**
Silt (0.039 - 0.0625 mm)	**50.1**	**51.0**	**38.5**	**51.7**	**64.9**	**54.8**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
\- = Not Analyzed
J = The reported value is an estimate.
bold = analyte detected above MDL/RDL.

[1] The sediment Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area sediment samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-8b
Post-Removal Reference Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 2 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P34	P35	P36	P37	P38	P39
Sample ID	08022534SD	08022535SD	08022536SD	08022637SD	08022738SD	08022739SD
Sample Date	2/25/2008	2/25/2008	2/25/2008	2/26/2008	2/27/2008	2/27/2008
PCB Aroclors (µg/kg dry)						
Aroclor 1016	1.70 U	10.0 U	1.70 U	1.70 U	13.0 U	1.70 U
Aroclor 1221	1.70 U	6.00 U	1.70 U	9.80 U	11.0 U	1.70 U
Aroclor 1232	1.70 U	10.0 U	1.70 U	11.0 U	12.0 U	1.70 U
Aroclor 1242	1.70 U	16.0 U	1.70 U	14.0 U	1.70 U	1.70 U
Aroclor 1248	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1254	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Total PCBs as Aroclors (NDs at MDL) [1]	1.70 U	16.00 U	1.70 U	14.00 U	13.00 U	1.70 U
PCB Dioxin-Like Congeners (µg/kg dry)						
PCB 77	**0.00201**	**0.00104**	**0.000965**	**0.00102**	**0.00113**	**0.000637**
PCB 81	**0.000143**	0.0000750 U	0.0000896 U	0.0000639 U	0.0000767 U	0.0000556 U
PCB 105	**0.0275**	**0.00818**	**0.00803**	**0.00653**	**0.00985**	**0.00534**
PCB 114	**0.00163**	**0.000382**	**0.000372**	0.000352 EMPC	**0.000422**	0.000337 EMPC
PCB 118	**0.0705**	**0.0199**	**0.0207**	**0.0157**	**0.0356**	**0.0131**
PCB 123	**0.000980**	0.000309 U	0.000401 U	**0.000374**	**0.000656**	0.000235 EMPC
PCB 126	**0.000337**	**0.000126**	0.000139 U	**0.000175**	**0.000184**	0.000115 EMPC
PCB 156	**0.00850 C**	**0.00242 C**	**0.00240 C**	**0.00225 C**	**0.00312 C**	**0.00180 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.00320**	0.00110 U	0.00101 U	**0.000918**	**0.00186**	**0.000761**
PCB 169	0.000179 U	0.0000711 U	0.0000891 U	0.0000860 EMPC	0.0000951 U	0.000200 U
PCB 189	**0.000573**	0.000248 EMPC	**0.000237**	**0.000197**	**0.000188**	0.000159 EMPC
Total PCBs as Congeners (KM, capped)	**1.20 J**	**0.405 J**	**0.402 J**	**0.378 J**	**0.591 J**	**0.272 J**
Metals (mg/kg dry)						
Aluminum	**15,100**	**9,890**	**10,100**	**11,200**	**10,100**	**9,380**
Antimony	**0.350 J**	**0.370 J**	**0.260 J**	**0.260 J**	**0.250 J**	**0.220 J**
Arsenic	**3.37**	**3.64**	**3.74**	**4.49**	**3.76**	**3.71**
Barium	**146**	**124**	**120**	**123**	**101**	**98.5**
Beryllium	**0.379**	**0.310**	**0.283**	**0.328**	**0.298**	**0.274**
Cadmium	**0.748**	**0.536**	**0.508**	**0.523**	**0.478**	**0.398**
Chromium	**27.2**	**16.5**	**16.6**	**16.9**	**15.6**	**15.8**
Cobalt	**10.8**	**7.18**	**7.13**	**7.94**	**6.86**	**6.58**
Copper	**20.1**	**14.6**	**14.4**	**15.7**	**14.2**	**13.7**
Lead	**11.5**	**11.0**	**11.3**	**13.2**	**11.2**	**11.4**
Mercury	**0.154 J**	**0.193 J**	**0.120 J**	**0.101 J**	**0.114 J**	**0.119 J**
Nickel	**25.6**	**12.9**	**11.9**	**13.7**	**11.8**	**11.6**
Thallium	**0.245**	**0.205**	**0.208**	**0.234**	**0.197**	**0.185**
Vanadium	**40.5 J**	**30.3 J**	**33.5 J**	**41.9 J**	**37.2 J**	**31.8 J**
Zinc	**93.6**	**92.1**	**98.5**	**109**	**93.3**	**94.6**
Petroleum Hydrocarbons (mg/kg dry)						
Diesel Range Organics	**31.0**	**7.00 J**	**16.0 J**	**9.70 J**	**11.0 J**	**11.0 J**
Residual Range Organics	**100 J**	160 U	**34.0 J**	**41.0 J**	**29.0 J**	**29.0 J**
Semivolatile Organic Compounds (µg/kg dry)						
Bis(2-ethylhexyl) Phthalate	**7.50 J**	**11.0 J**	**11.0 J**	**5.50 J**	**5.90 J**	**6.80 J**
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	**3.80 J**
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U
Di-n-butyl Phthalate	**7.80 J**	**6.40 J**	**5.80 J**	**4.70 J**	**8.60 J**	**4.60 J**
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U
p-cresol (4-Methylphenol)	**4.50 J**	2.90 U	**6.30 J**	2.90 U	2.90 U	2.90 U
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)						
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Anthracene	1.40 U	**2.30 J**	1.40 U	1.40 U	1.40 U	1.40 U
Fluorene	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ
Phenanthrene	**3.00 J**	**2.30 J**	**3.20 J**	**4.40 J**	**2.60 J**	1.30 U
Total LPAHs (KM, capped; NDs at MDL)	**7.10 J**	**7.30 J**	**7.30 J**	**8.50 J**	**6.70 J**	5.40 UJ
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)						
Benzo(a)anthracene	**2.90 J**	**2.20 J**	**3.30 J**	**3.90 J**	**2.50 J**	1.40 U
Benzo(a)pyrene	1.60 U	1.60 U	**6.20 J**	**4.60 J**	1.60 U	1.60 U
Benzo(b)fluoranthene	**5.50 J**	**3.70 J**	**8.30 J**	**6.90 J**	**4.20 J**	2.50 U
Benzo(g,h,i)perylene	**3.60 J**	**2.70 J**	**7.90 J**	**4.60 J**	2.30 U	2.30 U
Benzo(k)fluoranthene	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Chrysene	**4.40 J**	**3.10 J**	**4.80 J**	**4.80 J**	**3.20 J**	1.40 U
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U
Fluoranthene	**5.10 J**	**5.60 J**	**5.50 J**	**9.70 J**	**4.10 J**	**2.30 J**
Indeno(1,2,3-cd)pyrene	1.90 UJ	**2.20 J**	**8.80 J**	**4.90 J**	**2.30 J**	1.90 UJ
Pyrene	**4.80 J**	**3.30 J**	**7.10 J**	**7.80 J**	**3.60 J**	**2.10 J**
Total HPAHs (KM, capped; NDs at MDL)	**32.7 J**	**27.9 J**	**56.3 J**	**51.6 J**	**26.5 J**	**16.4 J**
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)						
Total PAHs (KM, capped; NDs at MDL)	**36.3 J**	**33.0 J**	**60.1 J**	**56.6 J**	**29.7 J**	**17.1 J**
General Chemistry Parameters (mg/kg dry) and Grain Size (%)						
Carbon, Total Organic	**14,800**	**7,300**	**7,000**	**6,600**	**6,400**	**5,500**
Clay (<0.039 mm)	**7.39**	**4.18**	**3.78**	**3.41**	**3.50**	**4.38**
Gravel (>2.00 mm)	**1.39**	**1.37**	**0.180**	**0.000**	**0.220**	**0.0600**
Sand, Coarse (0.50 - 1.00 mm)	**2.83**	**1.16**	**0.470**	**0.710**	**0.670**	**0.450**
Sand, Fine (0.125 - 0.25 mm)	**13.9**	**37.6**	**43.6**	**49.0**	**45.9**	**47.7**
Sand, Medium (0.25 - 0.50 mm)	**7.30**	**5.68**	**2.77**	**5.09**	**5.56**	**11.1**
Sand, Very Coarse (1.00 - 2.00 mm)	**1.74**	**0.0100**	**0.280**	**0.0500**	**0.350**	**0.130**
Sand, Very Fine (0.0625 - 0.125 mm)	**26.2**	**18.2**	**18.4**	**17.8**	**18.9**	**12.0**
Silt (0.039 - 0.0625 mm)	**43.9**	**31.6**	**29.1**	**30.6**	**30.1**	**25.7**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
- = Not Analyzed
J = The reported value is an estimate.
bold = analyte detected above MDL/RDL.

[1] The sediment Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area sediment samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-8b
Post-Removal Reference Area Sediment Analytical Results
PCB Aroclors, PCB Congeners, Metals, Petroleum Hydrocarbons, Semivolatile Organic Compounds, General Chemistry Parameters, and Grain Size
(Page 3 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P40	P41	P42	P85	P86	P87
Sample ID	08022740SD	08022741SD	08022742SD	08030685SD	08030686SD	08030687SD
Sample Date	2/27/2008	2/27/2008	2/27/2008	3/6/2008	3/6/2008	3/6/2008
PCB Aroclors (µg/kg dry)						
Aroclor 1016	3.40 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1221	6.20 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1232	10.0 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1242	13.0 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1248	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1254	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1260	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1262	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Aroclor 1268	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
Total PCBs as Aroclors (NDs at MDL) [1]	13.00 U	1.70 U	1.70 U	1.70 U	1.70 U	1.70 U
PCB Dioxin-Like Congeners (µg/kg dry)						
PCB 77	**0.000883**	**0.000709**	**0.000434**	**0.00127**	**0.000734**	**0.000890**
PCB 81	**0.0000580**	0.0000927 U	0.0000700 U	0.0000748 U	0.0000680 U	0.0000988 U
PCB 105	**0.00746**	**0.00489**	**0.00296**	**0.0103**	**0.00582**	**0.00691**
PCB 114	**0.000345**	**0.000284**	**0.000154**	**0.000542**	**0.000328**	**0.000336**
PCB 118	**0.0244**	**0.0139**	**0.00831**	**0.0298**	**0.0141**	**0.0168**
PCB 123	**0.000406**	**0.000272**	0.000172 EMPC	**0.000679**	**0.000309**	**0.000342**
PCB 126	0.000147 EMPC	0.0000930 EMPC	0.0000583 U	0.000184 EMPC	**0.0000840**	**0.000123**
PCB 156	**0.00246 C**	**0.00165 C**	**0.000930 C**	**0.00374 C**	**0.00204 C**	**0.00266 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.00140**	**0.000870**	0.000482 EMPC	**0.00197**	**0.000915**	**0.00120**
PCB 169	0.000100 U	0.000100 U	0.0000542 U	0.000200 U	0.000100 U	0.000100 U
PCB 189	**0.000181**	**0.000132**	**0.0000720**	**0.000250**	**0.000158**	**0.000243**
Total PCBs as Congeners (KM, capped)	**0.442 J**	**0.273 J**	**0.161 J**	**0.634 J**	**0.326 J**	**0.409 J**
Metals (mg/kg dry)						
Aluminum	**10,700**	**8,550**	**7,380**	**33,500**	**22,100**	**29,400**
Antimony	**0.190 J**	**0.160 J**	**0.150 J**	**0.180 J**	**0.270 J**	**0.290 J**
Arsenic	**3.75**	**3.36**	**3.03**	**5.10**	**6.04**	**5.36**
Barium	**117**	**104**	**86.3**	**312**	**201**	**231**
Beryllium	**0.303**	**0.244**	**0.194**	**0.748**	**0.522**	**0.628**
Cadmium	**0.413**	**0.332**	**0.262**	**0.449**	**0.484**	**0.558**
Chromium	**18.2**	**13.5**	**12.8**	**27.3**	**23.0**	**26.5**
Cobalt	**7.11**	**6.08**	**5.68**	**15.2**	**10.0**	**12.9**
Copper	**13.6**	**10.5**	**8.22**	**47.8**	**30.7**	**39.2**
Lead	**11.6**	**9.59**	**8.65**	**13.1**	**11.7**	**13.4**
Mercury	**0.167 J**	**0.0870 J**	**0.0410**	**0.0870**	**0.166**	**0.128**
Nickel	**12.3**	**11.2**	**9.87**	**18.2**	**13.3**	**16.1**
Thallium	**0.208**	**0.172**	**0.145**	**0.337**	**0.233**	**0.346**
Vanadium	**33.4 J**	**30.4 J**	**25.7 J**	**76.9 J**	**50.4 J**	**66.3 J**
Zinc	**101**	**88.0**	**85.1**	**76.1**	**81.2**	**89.3**
Petroleum Hydrocarbons (mg/kg dry)						
Diesel Range Organics	**31.0**	**8.10 J**	**7.40 J**	**31.0**	**11.0 J**	**13.0 J**
Residual Range Organics	**50.0 J**	150 U	150 U	**73.0 J**	180 U	**32.0 J**
Semivolatile Organic Compounds (µg/kg dry)						
Bis(2-ethylhexyl) Phthalate	**7.50 J**	**6.80 J**	**5.70 J**	**110 J**	**5.80 J**	**15.0 J**
Butyl Benzyl Phthalate	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U	1.50 UJ
Carbazole	1.30 U	1.30 U	1.30 U	1.30 U	1.30 U	1.30 UJ
Di-n-butyl Phthalate	**11.0 J**	**3.80 J**	**3.50 J**	2.60 UJ	**4.10 J**	**4.30 J**
Di-n-octyl Phthalate	1.20 U	1.20 U	1.20 U	1.20 U	1.20 U	1.20 UJ
p-cresol (4-Methylphenol)	2.90 U	2.90 U	2.90 U	**5.50 J**	**6.60 J**	**7.90 J**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg dry)						
Acenaphthene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ
Anthracene	1.40 U	**1.40 J**	1.40 U	1.40 U	1.40 U	1.40 UJ
Fluorene	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ	1.70 UJ
Phenanthrene	**1.30 J**	**5.90 J**	1.30 U	**1.90 J**	**2.00 J**	**3.60 J**
Total LPAHs (KM, capped; NDs at MDL)	**5.40 J**	**10.0 J**	5.40 UJ	**6.00 J**	**6.10 J**	**7.70 J**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg dry)						
Benzo(a)anthracene	1.40 U	**10.0**	1.40 U	1.40 U	**1.80 J**	**3.00 J**
Benzo(a)pyrene	1.60 U	**11.0**	1.60 U	**2.80 J**	1.60 U	**2.60 J**
Benzo(b)fluoranthene	2.50 U	**17.0**	2.50 U	**3.60 J**	**2.70 J**	**3.50 J**
Benzo(g,h,i)perylene	2.30 U	**7.30 J**	2.30 U	2.30 U	2.30 U	**2.30 J**
Benzo(k)fluoranthene	2.50 U	**5.00 J**	2.50 U	2.50 U	2.50 U	2.50 UJ
Chrysene	**1.90 J**	**9.80**	1.40 U	1.40 U	**2.40 J**	**3.10 J**
Dibenz(a,h)anthracene	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 UJ
Fluoranthene	**2.30 J**	**31.0 J**	2.20 UJ	2.20 UJ	**3.60 J**	**5.00 J**
Indeno(1,2,3-cd)pyrene	1.90 UJ	**8.40 J**	1.90 UJ	1.90 UJ	1.90 UJ	**2.00 J**
Pyrene	**1.80 J**	**23.0 J**	**1.50 J**	**2.70 J**	**2.10 J**	**4.90 J**
Total HPAHs (KM, capped; NDs at MDL)	**16.9 J**	**125 J**	**19.5 J**	**18.9 J**	**21.4 J**	**30.5 J**
Total Polycyclic Aromatic Hydrodarbons (PAHs) (µg/kg dry)						
Total PAHs (KM, capped; NDs at MDL)	**19.6 J**	**133 J**	**24.9 J**	**21.5 J**	**24.0 J**	**35.7 J**
General Chemistry Parameters (mg/kg dry) and Grain Size (%)						
Carbon, Total Organic	**5,900**	**5,100**	**2,900**	**12,800**	**8,100**	**10,300**
Clay (<0.039 mm)	**2.89**	**2.94**	**1.65**	**6.16**	**4.49**	**4.80**
Gravel (>2.00 mm)	**1.23**	**0.000**	**0.0200**	**10.8**	**18.8**	**1.47**
Sand, Coarse (0.50 - 1.00 mm)	**0.520**	**0.420**	**0.470**	**1.61**	**3.24**	**1.46**
Sand, Fine (0.125 - 0.25 mm)	**46.6**	**38.3**	**40.5**	**10.0**	**5.43**	**5.77**
Sand, Medium (0.25 - 0.50 mm)	**14.0**	**36.3**	**47.9**	**1.45**	**2.02**	**1.36**
Sand, Very Coarse (1.00 - 2.00 mm)	**0.210**	**0.110**	**0.0700**	**2.59**	**8.47**	**1.98**
Sand, Very Fine (0.0625 - 0.125 mm)	**9.20**	**7.21**	**3.87**	**33.4**	**18.3**	**25.2**
Silt (0.039 - 0.0625 mm)	**22.3**	**16.3**	**7.31**	**36.2**	**43.1**	**60.6**

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
ND = Non Detect
RDL = reported detection limit
\- = Not Analyzed
J = The reported value is an estimate.
bold = analyte detected above MDL/RDL.

[1] The sediment Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area sediment samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P04	P05	P06	P07	P08	P09		
Sample ID	08022604TC	08031905TC	08031806TC	08021507TC	08021508TC	08021409TC		
Sample Date	2/26/2008	3/19/2008	3/18/2008	2/15/2008	2/15/2008	2/14/2008		
Percent Lipds	3.0	3.0	2.9	2.6	2.6	2.3		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	18.0 U	2.40 U	2.40 U	19.0 U	23.0 U	23.0 U	35.0	Eco
Aroclor 1221	20.0 U	2.60 U	2.60 U	20.0 U	20.0 U	20.0 U	35.0	Eco
Aroclor 1232	40.0 U	2.30 U	2.30 U	27.0 U	25.0 U	30.0 U	35.0	Eco
Aroclor 1242	48.0 U	2.20 U	2.20 U	35.0 U	29.0 U	30.0 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	0.510 U	26.0 U	13.0 U	6.00 U	35.0	Eco
Aroclor 1254	**120 J**	**23.0 J**	**32.0 J**	74.0 U	55.0 U	49.0 U	35.0	Eco
Aroclor 1260	1.90 U	1.90 U	1.90 U	11.0 U	9.40 U	8.50 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**120 J**	**23.0 J**	**32.0 J**	74.0 U	55.0 U	49.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.0690**	**0.0410**	**0.0523**	**0.0359**	**0.0348**	-	0.160	Eco
PCB 81	0.00330 EMPC	0.00270 EMPC	0.00197 EMPC	0.00156 EMPC	0.00142 EMPC	-	0.0800	Eco
PCB 105	**6.20**	**1.02**	**1.73**	**0.924**	**0.741**	-	20.0	Eco
PCB 114	**0.445**	**0.0774**	**0.126**	**0.0655**	**0.0525**	-	20.0	Eco
PCB 118	**64.7**	**10.3**	**15.9**	**12.1**	**7.97**	-	20.0	Eco
PCB 123	**1.15**	**0.239**	**0.293**	**0.229**	**0.152**	-	20.0	Eco
PCB 126	**0.0110**	**0.00527**	**0.00574**	**0.00457**	**0.00417**	-	0.00580	Eco
PCB 156	**3.61 C**	**0.614 C**	**0.828 C**	**0.584 C**	**0.405 C**	-	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						20.0	Eco
PCB 167	**3.80**	**0.956**	**1.18**	**0.944**	**0.566**	-	20.0	Eco
PCB 169	0.0165 U	0.00173 U	0.00660 U	0.00560 U	0.00473 U	-	0.0200	Eco
PCB 189	**0.0101**	**0.00277**	**0.00403**	**0.00222**	**0.00212**	-	20.0	Eco
Total PCBs as Congeners (KM, capped)	**312 J**	**65.8 J**	**95.1 J**	**65.7 J**	**51.5 J**	-	35.0	Eco
Metals (mg/kg wet)								
Aluminum	**61.1**	**13.2**	**10.9**	**21.9**	**21.7**	**76.8**	--	--
Antimony	0.00200 U	0.00400 U	0.00400 U	0.00200 U	**0.00700 J**	**0.00200 J**	--	--
Arsenic	**2.48**	**2.44**	**2.26**	**2.38**	**2.24**	**2.12**	6.60	Eco
Barium	**2.14**	**1.23**	**1.35**	**2.23**	**1.62**	**2.45**	--	--
Beryllium	**0.00240 J**	**0.00100 J**	**0.00100 J**	**0.00170 J**	**0.00230 J**	**0.00280 J**	--	--
Cadmium	**0.369**	**0.383**	**0.406**	**0.377**	**0.351**	**0.305**	0.150	Eco
Chromium	**0.700**	**0.380**	**0.340**	**0.900**	**0.800**	**0.700**	--	--
Cobalt	**0.133**	**0.0790**	**0.0700**	**0.117**	**0.0970**	**0.148**	--	--
Copper	**10.4**	**9.63**	**9.45**	**9.80**	**9.36**	**8.36**	--	--
Lead	**0.0570**	**0.0260**	**0.0280**	**0.0330**	**0.0310**	**0.0890**	0.120	Eco
Mercury	**0.0160**	**0.00780**	**0.00660**	**0.00850**	**0.00710**	**0.0341**	0.0740	Eco
Methyl Mercury	**0.00460**	**0.00480**	**0.00490**	**0.00410**	**0.00350**	**0.00480**	--	--
Nickel	**0.281**	**0.114**	**0.117**	**0.306**	**0.263**	**0.336**	--	--
Thallium	**0.00660**	**0.00720**	**0.00970**	**0.00570**	**0.0119**	**0.00630**	--	--
Vanadium	**0.301**	**0.0810**	**0.0850**	**0.117**	**0.141**	**0.314**	--	--
Zinc	**26.5**	**19.8**	**19.9**	**20.6**	**18.0**	**22.3**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	**150 J**	**670**	**740**	**130 J**	**130 J**	**150 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	**14.0 J**	7.30 U	7.30 U	7.30 U	11.0 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	13.0 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	56.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	16.0 U	626	Eco
p-cresol (4-Methylphenol)	**25.0 J**	**18.0 J**	**14.0 J**	**20.0 J**	**10.0 J**	11.0 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	**0.990**	**1.10**	**1.10 J**	**1.10**	**0.910**	**0.940**	19,000	Eco
Anthracene	0.0650 U	**0.960 J**	**1.00 J**	0.0650 U	**0.990**	**0.280 J**	19,000	Eco
Fluorene	**2.30**	**3.00**	**2.80 J**	**2.50**	**2.40**	**2.00**	19,000	Eco
Phenanthrene	**9.10**	**8.90**	**9.60 J**	**12.0**	**11.0**	**9.80**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	0.0660 U	12.0 U	15.0 U	0.0660 U	**0.800**	**1.20**	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.410 U	0.410 U	0.0810 U	**0.440 J**	0.610 U	1,000	Eco
Benzo(b)fluoranthene	0.0700 U	0.350 U	0.350 U	0.800 U	**0.530**	**0.950**	1,000	Eco
Benzo(g,h,i)perylene	**0.300 J**	0.370 U	0.370 U	0.0730 U	**0.0900 J**	**0.360 J**	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	0.280 U	0.280 U	0.0560 U	0.0560 U	0.0560 U	1,000	Eco
Chrysene	0.0760 U	5.60 U	6.60 U	0.0760 U	**3.00**	**4.00**	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.300 U	0.300 U	0.0590 U	0.0590 U	0.0590 U	1,000	Eco
Fluoranthene	**11.0**	**11.0**	**12.0 J**	16.0 U	**12.0**	11.0 U	19,000	Eco
Indeno(1,2,3-cd)pyrene	**2.50**	0.320 U	0.320 U	0.0640 U	**0.0900 J**	**0.320 J**	1,000	Eco
Pyrene	0.0980 U	4.90 U	5.30 U	0.0980 U	**1.70**	2.30 U	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P10	P11	P13	P14	P15	P16		
Sample ID	08021410TC	08021411TC	08031713TC	08031814TC	08022115TC	08022116TC		
Sample Date	2/14/2008	2/14/2008	3/17/2008	3/18/2008	2/21/2008	2/21/2008		
Percent Lipds	2.0	2.6	2.7	2.8	2.6	2.3		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	23.0 U	21.0 U	2.40 U	2.40 U	19.0 U	17.0 U	35.0	Eco
Aroclor 1221	20.0 U	20.0 U	2.60 U	2.60 U	20.0 U	20.0 U	35.0	Eco
Aroclor 1232	34.0 U	36.0 U	2.30 U	2.30 U	35.0 U	30.0 U	35.0	Eco
Aroclor 1242	19.0 U	19.0 U	2.20 U	2.20 U	17.0 U	15.0 U	35.0	Eco
Aroclor 1248	12.0 U	9.90 U	0.510 U	0.510 U	4.60 U	4.50 U	35.0	Eco
Aroclor 1254	36.0 U	32.0 U	**22.0**	**22.0**	32.0 U	30.0 U	35.0	Eco
Aroclor 1260	6.90 U	6.40 U	1.90 U	1.90 U	6.70 U	6.80 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	36.0 U	32.0 U	**22.0**	**22.0**	32.0 U	30.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.0269**	**0.0336**	**0.0375**	**0.0388**	**0.0333**	**0.0301**	0.160	Eco
PCB 81	0.000693 EMPC	0.00142 EMPC	**0.00194**	0.00208 EMPC	0.00131 EMPC	0.00154 EMPC	0.0800	Eco
PCB 105	**0.455**	**0.407**	**0.437**	**0.464**	**0.397**	**0.361**	20.0	Eco
PCB 114	**0.0281**	**0.0238**	**0.0260**	**0.0274**	**0.0231**	**0.0209**	20.0	Eco
PCB 118	**4.09**	**2.26**	**2.73**	**2.87**	**2.30**	**2.17**	20.0	Eco
PCB 123	**0.0837**	**0.0462**	**0.0512**	**0.0595**	**0.0471**	**0.0420**	20.0	Eco
PCB 126	**0.00337**	**0.00413**	**0.00506**	**0.00531**	**0.00386**	**0.00402**	0.00580	Eco
PCB 156	**0.228 C**	**0.136 C**	**0.157 C**	**0.171 C**	**0.133 C**	**0.128 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						20.0	Eco
PCB 167	**0.302**	**0.146**	**0.209**	**0.213**	**0.157**	**0.149**	20.0	Eco
PCB 169	0.00337 U	0.00327 U	0.00135 U	0.00109 U	0.00356 U	0.00353 U	0.0200	Eco
PCB 189	**0.00152**	**0.00171**	**0.00166**	**0.00203**	**0.00156**	**0.00156**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**30.6 J**	**26.7 J**	**33.1 J**	**34.0 J**	**26.9 J**	**25.5 J**	35.0	Eco
Metals (mg/kg wet)								
Aluminum	**81.4**	**33.7**	**9.53**	**9.42**	**18.7**	**15.9**	--	--
Antimony	**0.00200 J**	0.00200 U	0.00400 U	0.00400 U	0.00200 U	0.00200 U	--	--
Arsenic	**1.79**	**2.04**	**2.49**	**2.47**	**2.43**	**2.11**	6.60	Eco
Barium	**2.22**	**2.04**	**1.74**	**1.18**	**1.77**	**1.63**	--	--
Beryllium	**0.00270 J**	**0.00190 J**	**0.00150 J**	**0.00170 J**	**0.00160 J**	**0.00140 J**	--	--
Cadmium	**0.286**	**0.321**	**0.461**	**0.442**	**0.366**	**0.321**	0.150	Eco
Chromium	**0.600**	**0.700**	**0.560**	**0.390**	**0.900**	**0.600**	--	--
Cobalt	**0.140**	**0.135**	**0.0980**	**0.0720**	**0.120**	**0.104**	--	--
Copper	**7.00**	**7.95**	**11.4**	**9.72**	**10.4**	**8.67**	--	--
Lead	**0.0610**	**0.0510**	**0.0290**	**0.0290**	**0.0370**	**0.0350**	0.120	Eco
Mercury	**0.00870**	**0.0108**	**0.00720**	**0.0169**	**0.0132**	**0.0103**	0.0740	Eco
Methyl Mercury	**0.00500**	**0.00500**	**0.00530**	**0.00650**	**0.00530**	**0.00480**	--	--
Nickel	**0.348**	**0.320**	**0.136**	**0.0950**	**0.242**	**0.222**	--	--
Thallium	**0.00500**	**0.00570**	**0.00710**	**0.00720**	**0.00580**	**0.00470**	--	--
Vanadium	**0.311**	**0.196**	**0.0850**	**0.0930**	**0.136**	**0.175**	--	--
Zinc	**22.9**	**23.5**	**17.8**	**16.3**	**20.8**	**17.7**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	**97.0 J**	**120 J**	**890**	**720**	**180 J**	**130 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**13.0 J**	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	**38.0 J**	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	**14.0 J**	**8.60 J**	7.70 U	7.70 U	7.70 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	**0.800**	**0.970**	**4.10**	**0.840**	**1.00 J**	**0.820**	19,000	Eco
Anthracene	**0.440 J**	**0.850**	**2.30 J**	**1.10 J**	**0.940 J**	**0.980**	19,000	Eco
Fluorene	**1.60**	**2.30**	**3.80**	**2.70**	**2.50 J**	**2.00**	19,000	Eco
Phenanthrene	**6.70**	**12.0**	**15.0**	**9.60**	**13.0 J**	**8.00**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	**0.480 J**	**2.10**	22.0 U	15.0 U	0.0660 UJ	**0.990**	1,000	Eco
Benzo(a)pyrene	0.0810 U	**0.580**	0.410 U	0.410 U	0.0810 UJ	0.0810 U	1,000	Eco
Benzo(b)fluoranthene	**0.400 J**	**0.810**	0.350 U	0.350 U	**0.780 J**	**0.600**	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	**0.120 J**	2.50 U	0.370 U	**0.240 J**	**0.270 J**	1,000	Eco
Benzo(k)fluoranthene	**0.160 J**	0.0560 U	0.280 U	0.280 U	0.0560 UJ	0.0560 U	1,000	Eco
Chrysene	**2.90**	**3.00**	6.70 U	7.80 U	0.0760 UJ	**3.20**	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.300 U	0.300 U	0.0590 UJ	0.0590 U	1,000	Eco
Fluoranthene	**8.90**	**13.0**	**14.0**	**12.0**	**6.30 J**	**11.0**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	**0.0800 J**	0.320 U	0.320 U	0.0640 UJ	**0.400 J**	1,000	Eco
Pyrene	**2.40**	**2.20**	7.20 U	4.60 U	**3.60 J**	**1.60**	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
\- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	**Selected SLV**	**SLV Source**
Site ID	P17	P18	P21	P65	P67	P88	P89		
Sample ID	08022117TC	08021118TC	08021221TC	08022965TC	08030367TC	08031788TC	08031789TC		
Sample Date	2/21/2008	2/12/2008	2/12/2008	2/29/2008	3/3/2008	3/17/2008	3/17/2008		
Percent Lipds	2.2	2.4	2.4	3.3	3.7	2.8	2.6		
PCB Aroclors (µg/kg wet)									
Aroclor 1016	17.0 U	17.0 U	15.0 U	2.40 U	2.40 U	2.40 U	2.40 U	35.0	Eco
Aroclor 1221	20.0 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	35.0	Eco
Aroclor 1232	31.0 U	23.0 U	19.0 U	2.30 U	2.30 U	2.30 U	2.30 U	35.0	Eco
Aroclor 1242	15.0 U	22.0 U	10.0 U	2.20 U	2.20 U	2.20 U	2.20 U	35.0	Eco
Aroclor 1248	9.20 U	9.90 U	4.60 U	0.510 U	0.510 U	0.510 U	0.510 U	35.0	Eco
Aroclor 1254	28.0 U	28.0 U	30.0 U	**21.0**	**21.0**	**23.0**	**21.0**	35.0	Eco
Aroclor 1260	5.90 U	5.90 U	6.20 U	1.90 U	1.90 U	1.90 U	1.90 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	28.0 U	28.0 U	30.0 U	**21.0**	**21.0**	**23.0**	**21.0**	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)									
PCB 77	**0.0307**	**0.0339**	**0.0320**	**0.0420**	-	**0.0398**	**0.0359**	0.160	Eco
PCB 81	0.00155 EMPC	0.00142 EMPC	0.00138 EMPC	**0.00246**	-	**0.00201**	**0.00238**	0.0800	Eco
PCB 105	**0.365**	**0.377**	**0.371**	**0.478**	-	**0.476**	**0.444**	20.0	Eco
PCB 114	**0.0202**	**0.0228**	**0.0216**	**0.0291**	-	**0.0287**	**0.0273**	20.0	Eco
PCB 118	**2.08**	**2.13**	**2.05**	**2.54**	-	**2.76**	**2.67**	20.0	Eco
PCB 123	**0.0384**	**0.0413**	**0.0392**	**0.0438**	-	**0.0520**	**0.0544**	20.0	Eco
PCB 126	**0.00339**	**0.00363**	**0.00400**	**0.00530**	-	**0.00510**	**0.00472**	0.00580	Eco
PCB 156	**0.120 C**	**0.124 C**	**0.121 C**	**0.156 C**	-	**0.168 C**	**0.158 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**							20.0	Eco
PCB 167	**0.134**	**0.131**	**0.125**	**0.154**	-	**0.185**	**0.201**	20.0	Eco
PCB 169	0.00340 U	0.00366 U	0.00362 U	0.000940 U	-	0.000901 U	0.00110 U	0.0200	Eco
PCB 189	**0.00167**	**0.00160**	**0.00166**	**0.00221**	-	**0.00218**	**0.00181**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**24.5 J**	**25.9 J**	**24.6 J**	**33.1 J**	-	**33.2 J**	**31.6 J**	35.0	Eco
Metals (mg/kg wet)									
Aluminum	**35.2**	**34.5**	**49.2**	**83.2**	**15.2**	**9.37**	**18.9**	--	--
Antimony	**0.00300 J**	0.00200 U	**0.00400 J**	0.00400 U	0.00500 U	0.00400 U	0.00400 U	--	--
Arsenic	**1.88**	**1.88**	**2.07**	**2.31**	**2.15**	**2.34**	**2.38**	6.60	Eco
Barium	**1.76**	**2.05**	**2.29**	**3.05**	**1.64**	**1.49**	**1.62**	--	--
Beryllium	**0.00210 J**	**0.00180 J**	**0.00250 J**	**0.00380 J**	**0.00120 J**	**0.000700 J**	**0.00170 J**	--	--
Cadmium	**0.287**	**0.342**	**0.313**	**0.355**	**0.396**	**0.396**	**0.412**	0.150	Eco
Chromium	**0.600**	**0.700**	**0.800**	**0.480**	**0.300**	**0.330**	**0.530**	--	--
Cobalt	**0.115**	**0.110**	**0.124**	**0.138**	**0.0720**	**0.0670**	**0.0840**	--	--
Copper	**8.00**	**8.31**	**8.29**	**9.56**	**9.00**	**8.86**	**9.61**	--	--
Lead	**0.0370**	**0.0580**	**0.0580**	**0.0800**	**0.0330**	**0.0210**	**0.0260**	0.120	Eco
Mercury	**0.0116**	**0.0102**	**0.00770**	**0.00880**	**0.00860**	**0.0101**	**0.00580**	0.0740	Eco
Methyl Mercury	**0.00400**	**0.00510**	**0.00360**	**0.00480**	**0.00630**	**0.00430**	**0.00360**	--	--
Nickel	**0.238**	**0.303**	**0.324**	**0.227**	**0.144**	**0.126**	**0.178**	--	--
Thallium	**0.00450**	**0.00600**	**0.00590**	**0.00850**	**0.00950**	**0.00710**	**0.00700**	--	--
Vanadium	**0.205**	**0.207**	**0.204**	**0.426**	**0.104**	**0.0780**	**0.107**	--	--
Zinc	**20.2**	**25.1**	**23.5**	**25.0**	**24.3**	**20.4**	**21.6**	--	--
Semivolatile Organic Compounds (µg/kg wet)									
Bis(2-ethylhexyl) Phthalate	**67.0 J**	**130 J**	**110 J**	**760**	**830**	**710**	**750 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	**15.0 J**	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	40.0 U	16.0 U	16.0 U	16.0 U	16.0 UJ	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 UJ	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	**31.0 J**	**8.60 J**	**9.30 J**	7.70 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)									
Acenaphthene	**0.670**	**0.910**	**0.980**	**0.420 J**	0.110 U	**0.460 J**	**1.10**	19,000	Eco
Anthracene	**0.460 J**	**1.20**	**0.790**	0.330 U	0.330 U	**0.800 J**	**1.50**	19,000	Eco
Fluorene	**1.60**	**2.20**	**2.10**	**1.70**	**0.920**	**1.50 J**	**2.90**	19,000	Eco
Phenanthrene	**6.90**	**9.70**	**8.50**	**7.90**	**4.50**	**5.30 J**	**12.0**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)									
Benzo(a)anthracene	**0.680**	**1.30**	**0.970**	0.330 U	0.330 U	17.0 UJ	1.30 U	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.620 U	**0.380 J**	0.410 U	0.410 U	0.410 UJ	0.860 U	1,000	Eco
Benzo(b)fluoranthene	**0.710**	**0.640**	**0.550**	0.350 U	0.350 U	0.350 UJ	0.740 U	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	**0.130 J**	**0.130 J**	0.370 U	0.370 U	0.370 UJ	0.500 U	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	**0.250 J**	0.0560 U	0.280 U	0.280 U	0.280 UJ	0.580 U	1,000	Eco
Chrysene	**2.60**	**1.90**	**3.70**	0.380 U	0.380 U	6.50 UJ	2.50 U	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.300 U	0.300 U	0.300 UJ	0.500 U	1,000	Eco
Fluoranthene	**9.40**	14.0 U	**11.0**	14.0 U	8.60 U	**7.60 J**	**16.0**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	**0.0850 J**	0.0640 U	0.320 U	0.320 U	0.320 UJ	0.500 U	1,000	Eco
Pyrene	**2.90**	2.90 U	1.50 U	0.490 U	0.490 U	4.00 UJ	**6.30**	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated
numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
🟨 = The reported concentration exceeds the selected SLV

Table 6-9b

Post-Removal Reference Area Clam Tissue Analytical Results

PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds

(Page 1 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P22	P24	P26	P27	P28	P29
Sample ID	08030522TC	08030524TC	08030426TC	08030427TC	08030428TC	08022229TC
Sample Date	3/5/2008	3/5/2008	3/4/2008	3/4/2008	3/4/2008	2/22/2008
Percent Lipds	2.9	2.6	3.0	3.1	2.7	3.0
PCB Aroclors (µg/kg wet)						
Aroclor 1016	13.0 U	11.0 U	11.0 U	12.0 U	8.90 U	13.0 U
Aroclor 1221	14.0 U	14.0 U	14.0 U	8.20 U	9.60 U	16.0 U
Aroclor 1232	19.0 U	18.0 U	22.0 U	27.0 U	18.0 U	26.0 U
Aroclor 1242	13.0 U	7.90 U	11.0 U	12.0 U	12.0 U	13.0 U
Aroclor 1248	5.70 U	5.70 U	7.60 U	8.30 U	5.70 U	7.70 U
Aroclor 1254	**36.0**	**30.0**	**35.0**	**37.0**	**33.0**	**32.0**
Aroclor 1260	6.40 U	6.20 U	6.50 U	6.80 U	6.60 U	5.70 U
Aroclor 1262	9.30 U	7.20 U	7.70 U	7.80 U	7.50 U	8.00 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**36.0**	**30.0**	**35.0**	**37.0**	**33.0**	**32.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0378**	**0.0338**	**0.0332**	**0.0343**	**0.0373**	**0.0364**
PCB 81	**0.00189**	**0.00204**	0.00143 EMPC	0.000961 EMPC	**0.00211**	**0.00207**
PCB 105	**0.438**	**0.399**	**0.350**	**0.370**	**0.434**	**0.406**
PCB 114	**0.0267**	**0.0228**	**0.0213**	**0.0242**	**0.0258**	**0.0236**
PCB 118	**2.42**	**2.22**	**1.91**	**2.13**	**2.66**	**2.14**
PCB 123	**0.0484**	**0.0423**	**0.0390**	**0.0421**	**0.0540**	**0.0403**
PCB 126	**0.00501**	**0.00444**	**0.00407**	**0.00451**	**0.00504**	**0.00405**
PCB 156	**0.138 C**	**0.126 C**	**0.137 C**	**0.149 C**	**0.152 C**	**0.125 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.149**	**0.127**	**0.151**	**0.167**	**0.170**	**0.130**
PCB 169	0.000809 U	0.000933 U	0.00153 U	0.00170 U	0.000872 U	0.000900 U
PCB 189	**0.00183**	**0.00175**	**0.00144**	0.00151 EMPC	**0.00185**	**0.00168**
Total PCBs as Congeners (KM, capped)	**30.8 J**	**28.3 J**	**31.6 J**	**32.9 J**	**31.3 J**	**29.7 J**
Metals (mg/kg wet)						
Aluminum	**34.3**	**50.4**	**46.5**	**52.2**	**39.8**	**16.8**
Antimony	**0.00500**	0.00400 U	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.53**	**2.03**	**2.51**	**2.46**	**2.32**	**2.22**
Barium	**1.79**	**2.11**	**1.77**	**1.80**	**2.17**	**1.89**
Beryllium	0.000400 U	**0.000900**	**0.00110**	0.000400 U	**0.000900**	0.000400 U
Cadmium	**0.307**	**0.275**	**0.377**	**0.370**	**0.340**	**0.254**
Chromium	**0.510**	**0.600**	**0.730**	**0.690**	**0.660**	**0.480**
Cobalt	**0.132**	**0.132**	**0.124**	**0.141**	**0.150**	**0.116**
Copper	**9.67**	**8.91**	**10.7**	**10.7**	**10.4**	**8.46**
Lead	**0.0660**	**0.0570**	**0.0570**	**0.0590**	**0.0570**	**0.0690**
Mercury	**0.0179**	**0.00600**	**0.0128**	**0.00890**	**0.0130**	**0.00760**
Methyl Mercury	**0.00990**	**0.00470**	**0.00490**	**0.00470**	**0.00520**	**0.00780**
Nickel	**0.311**	**0.405**	**0.338**	**0.347**	**0.347**	**0.408**
Thallium	**0.00590**	**0.00530**	**0.00650**	**0.00630**	**0.00560**	**0.00560**
Vanadium	**0.169**	**0.170**	**0.172**	**0.182**	**0.150**	**0.135**
Zinc	**18.7**	**19.9**	**21.0**	**20.2**	**19.4**	**19.8**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**310**	**320**	**430**	**680**	**340**	**680**
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**57.0 J**	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**44.0**	**52.0**	**18.0 J**	**42.0**	**55.0**	**63.0**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.710**	**0.480 J**	**0.730**	**0.450 J**	**0.510**	**1.20 J**
Anthracene	1.40 U	3.20 U	1.40 U	1.30 UJ	3.20 U	**1.80 J**
Fluorene	**2.00**	**1.50**	**2.00**	**1.60 J**	**1.50**	**3.10 J**
Phenanthrene	**9.10**	**6.70**	**9.00**	**8.10 J**	**7.50**	**14.0 J**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	18.0 U	3.70 U	26.0 U	15.0 UJ	7.30 U	12.0 UJ
Benzo(a)pyrene	0.410 U	0.410 U	0.410 U	0.410 UJ	0.410 U	0.410 UJ
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 U	0.350 UJ	0.350 U	0.350 UJ
Benzo(g,h,i)perylene	0.370 U	0.370 U	0.370 U	0.370 UJ	0.370 U	0.370 UJ
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 U	0.280 UJ	0.280 U	0.280 UJ
Chrysene	5.50 U	5.30 U	5.30 U	13.0 UJ	6.30 U	1.30 UJ
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 U	0.300 UJ	0.300 U	0.300 UJ
Fluoranthene	**11.0**	**8.50**	**11.0**	**10.0 J**	**9.30**	**17.0 J**
Indeno(1,2,3-cd)pyrene	0.320 U	**1.70 J**	0.320 U	0.320 UJ	0.320 U	0.320 UJ
Pyrene	3.70 U	2.00 U	4.10 U	2.80 UJ	2.40 U	5.60 UJ

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-9b
Post-Removal Reference Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P34	P35	P36	P37	P38	P39
Sample ID	08022534TC	08022535TC	08022536TC	08022637TC	08022738TC	08022739TC
Sample Date	2/25/2008	2/25/2008	2/25/2008	2/26/2008	2/27/2008	2/27/2008
Percent Lipids	2.8	3.6	3.5	3.1	3.2	3.2
PCB Aroclors (µg/kg wet)						
Aroclor 1016	12.0 U	9.50 U	8.40 U	9.70 U	15.0 U	15.0 U
Aroclor 1221	15.0 U	8.80 U	12.0 U	16.0 U	6.30 U	7.40 U
Aroclor 1232	23.0 U	28.0 U	19.0 U	29.0 U	35.0 U	33.0 U
Aroclor 1242	13.0 U	14.0 U	13.0 U	9.30 U	12.0 U	11.0 U
Aroclor 1248	6.40 U	9.10 U	9.90 U	9.90 U	9.40 U	9.60 U
Aroclor 1254	**32.0**	**37.0**	**38.0**	**35.0**	**37.0**	**38.0**
Aroclor 1260	5.90 U	7.70 U	7.60 U	7.30 U	8.10 U	7.50 U
Aroclor 1262	8.10 U	8.10 U	7.70 U	3.70 U	7.60 U	9.10 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**32.0**	**37.0**	**38.0**	**35.0**	**37.0**	**38.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0361**	**0.0428**	**0.0443**	**0.0384**	**0.0371**	**0.0432**
PCB 81	0.00223 EMPC	**0.00260**	**0.00251**	0.00167 EMPC	0.00199 EMPC	0.00213 EMPC
PCB 105	**0.424**	**0.484**	**0.484**	**0.419**	**0.416**	**0.484**
PCB 114	**0.0246**	**0.0299**	**0.0272**	**0.0240**	**0.0233**	**0.0287**
PCB 118	**2.20**	**2.47**	**2.42**	**2.18**	**2.14**	**2.52**
PCB 123	**0.0384**	**0.0461**	**0.0439**	**0.0418**	**0.0368**	**0.0469**
PCB 126	**0.00403**	**0.00535**	**0.00519**	**0.00464**	**0.00474**	**0.00533**
PCB 156	**0.129 C**	**0.148 C**	**0.154 C**	**0.138 C**	**0.135 C**	**0.166 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.127**	**0.139**	**0.139**	**0.146**	**0.123**	**0.154**
PCB 169	0.000939 U	0.000901 U	0.00132 U	0.000698 U	0.000987 U	0.00101 U
PCB 189	**0.00198**	**0.00223**	**0.00240**	**0.00209**	**0.00195**	**0.00234**
Total PCBs as Congeners (KM, capped)	**30.4 J**	**34.5 J**	**33.7 J**	**30.2 J**	**28.6 J**	**34.3 J**
Metals (mg/kg wet)						
Aluminum	**29.2**	**12.0**	**17.1**	**14.5**	**20.6**	**19.9**
Antimony	**0.00400**	0.00500 U	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.00**	**2.28**	**2.38**	**2.22**	**2.24**	**2.46**
Barium	**1.78**	**1.79**	**1.72**	**1.83**	**1.71**	**1.97**
Beryllium	**0.000400**	**0.000700**	0.000400 U	**0.000500**	0.000400 U	**0.000900**
Cadmium	**0.247**	**0.308**	**0.356**	**0.320**	**0.335**	**0.385**
Chromium	**0.490**	**0.450**	**0.470**	**0.540**	**0.460**	**0.570**
Cobalt	**0.121**	**0.100**	**0.0969**	**0.106**	**0.0974**	**0.104**
Copper	**8.18**	**9.57**	**9.61**	**10.1**	**9.50**	**10.4**
Lead	**0.0670**	**0.0660**	**0.0650**	**0.0650**	**0.0670**	**0.0670**
Mercury	**0.00850**	**0.0121**	**0.00610**	**0.00460**	**0.0113**	**0.00630**
Methyl Mercury	**0.00750**	**0.00610**	**0.00590**	**0.00610**	**0.00590**	**0.00610**
Nickel	**0.324**	**0.392**	**0.389**	**0.359**	**0.289**	**0.341**
Thallium	**0.00630**	**0.00820**	**0.00740**	**0.00640**	**0.00810**	**0.00660**
Vanadium	**0.188**	**0.0860**	**0.104**	**0.124**	**0.171**	**0.138**
Zinc	**20.5**	**22.9**	**23.2**	**20.3**	**21.7**	**23.0**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**440**	**510**	**510**	**400**	**480**	**350**
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**74.0 J**	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**20.0 J**	**45.0**	**72.0**	**110**	**36.0 J**	**52.0**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.610**	**0.650**	**1.00**	**0.910**	**0.530 J**	**0.590**
Anthracene	1.50 U	1.90 U	1.90 U	2.00 U	1.40 UJ	1.60 U
Fluorene	**1.90**	**2.40**	**2.70**	**2.70**	**1.90 J**	**2.10**
Phenanthrene	**9.40**	**12.0**	**12.0**	**13.0**	**9.30 J**	**10.0**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	16.0 U	22.0 U	26.0 U	27.0 U	20.0 UJ	27.0 U
Benzo(a)pyrene	0.410 U	0.410 U	0.410 U	0.410 U	0.410 UJ	0.410 U
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 U	0.350 U	0.350 UJ	0.350 U
Benzo(g,h,i)perylene	0.370 U	**0.500 J**	0.370 U	0.370 U	**0.850 J**	**1.40 J**
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 U	0.280 U	0.280 UJ	0.280 U
Chrysene	4.60 U	3.70 U	4.00 U	4.10 U	6.20 UJ	4.80 U
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 U	0.300 U	0.300 UJ	0.300 U
Fluoranthene	**11.0**	**14.0**	**14.0**	**14.0**	**11.0 J**	**12.0**
Indeno(1,2,3-cd)pyrene	0.320 U	**1.40 J**	**0.830 J**	**0.800 J**	0.320 UJ	**1.50 J**
Pyrene	3.70 U	4.30 U	4.80 U	4.60 U	3.70 UJ	3.80 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.

KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-9b
Post-Removal Reference Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P40	P41	P42	P85	P86	P87
Sample ID	08022740TC	08022741TC	08022742TC	08030685TC	08030686TC	08030687TC
Sample Date	2/27/2008	2/27/2008	2/27/2008	3/6/2008	3/6/2008	3/6/2008
Percent Lipds	3.3	3.3	3.1	2.8	2.7	3.1
PCB Aroclors (µg/kg wet)						
Aroclor 1016	12.0 U	14.0 U	12.0 U	14.0 U	12.0 U	9.50 U
Aroclor 1221	12.0 U	7.50 U	16.0 U	12.0 U	9.10 U	9.20 U
Aroclor 1232	22.0 U	31.0 U	20.0 U	28.0 U	24.0 U	26.0 U
Aroclor 1242	9.70 U	14.0 U	9.40 U	9.90 U	9.20 U	9.50 U
Aroclor 1248	8.70 U	8.90 U	8.20 U	9.90 U	7.10 U	5.50 U
Aroclor 1254	**37.0**	**39.0**	**35.0**	**34.0**	**31.0**	**33.0**
Aroclor 1260	6.90 U	7.70 U	7.50 U	6.70 U	6.20 U	6.60 U
Aroclor 1262	9.90 U	7.80 U	9.10 U	8.20 U	7.90 U	8.40 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**37.0**	**39.0**	**35.0**	**34.0**	**31.0**	**33.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0463**	**0.0468**	**0.0414**	**0.0408**	**0.0384**	**0.0357**
PCB 81	**0.00275**	**0.00221**	**0.00203**	0.00188 EMPC	**0.00180**	0.00151 EMPC
PCB 105	**0.535**	**0.556**	**0.488**	**0.478**	**0.440**	**0.414**
PCB 114	**0.0308**	**0.0330**	**0.0281**	**0.0271**	**0.0249**	**0.0247**
PCB 118	**2.77**	**2.82**	**2.53**	**2.64**	**2.29**	**2.27**
PCB 123	**0.0532**	**0.0506**	**0.0438**	**0.0500**	**0.0412**	**0.0409**
PCB 126	**0.00564**	**0.00536**	**0.00512**	0.00588 U	**0.00446**	**0.00451**
PCB 156	**0.158 C**	**0.161 C**	**0.145 C**	**0.137 C**	**0.123 C**	**0.125 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.146**	**0.146**	**0.137**	**0.165**	**0.123**	**0.131**
PCB 169	0.00125 U	0.00103 U	0.00101 U	0.00173 U	0.00117 U	0.00157 U
PCB 189	**0.00241**	**0.00237**	**0.00217**	**0.00201**	**0.00171**	**0.00172**
Total PCBs as Congeners (KM, capped)	**32.9 J**	**32.8 J**	**29.7 J**	**30.7 J**	**27.0 J**	**26.9 J**
Metals (mg/kg wet)						
Aluminum	**11.5**	**16.9**	**8.00**	**36.3**	**26.7**	**83.4**
Antimony	0.00400 U	**0.00800**	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.41**	**2.44**	**2.26**	**2.62**	**2.09**	**2.01**
Barium	**1.82**	**1.71**	**1.87**	**1.81**	**2.02**	**2.38**
Beryllium	0.000400 U	**0.000800**	0.000400 U	0.000400 U	0.000400 U	**0.00140**
Cadmium	**0.363**	**0.347**	**0.353**	**0.405**	**0.298**	**0.328**
Chromium	**0.470**	**0.490**	**0.470**	**0.760**	**0.570**	**0.460**
Cobalt	**0.0929**	**0.0965**	**0.0902**	**0.129**	**0.138**	**0.147**
Copper	**9.94**	**9.65**	**9.10**	**11.6**	**9.24**	**9.67**
Lead	**0.0570**	**0.0600**	**0.0490**	**0.0530**	**0.0550**	**0.0720**
Mercury	**0.00620**	**0.00720**	**0.00510**	**0.00710**	**0.00640**	**0.0135**
Methyl Mercury	**0.00160**	**0.00550**	**0.00140**	**0.00320**	**0.00460**	**0.00500**
Nickel	**0.273**	**0.289**	**0.402**	**0.346**	**0.333**	**0.482**
Thallium	**0.00660**	**0.0105**	**0.00570**	**0.00610**	**0.00650**	**0.00800**
Vanadium	**0.0840**	**0.104**	**0.0740**	**0.150**	**0.127**	**0.286**
Zinc	**22.4**	**21.3**	**22.1**	**18.5**	**21.0**	**22.2**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**460**	**390**	**600**	**330**	**370**	**390**
Butyl Benzyl Phthalate	7.30 U	7.30 U	**57.0 J**	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 UJ	16.0 U	35.0 U	48.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 UJ	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**52.0**	**60.0**	**30.0 J**	**38.0**	**13.0 J**	**35.0 J**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.270 J**	**0.330 J**	**0.810 J**	**0.670**	**0.470**	**0.720**
Anthracene	1.60 U	1.30 UiJ	**0.850 J**	1.50 U	2.90 U	1.40 U
Fluorene	**2.00**	**1.80**	**2.30 J**	**1.90**	**1.80**	**2.20**
Phenanthrene	**8.30**	**8.80**	**8.80 J**	**8.60**	**8.20**	**10.0**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	21.0 U	26.0 UiJ	20.0 UJ	20.0 U	8.50 U	22.0 U
Benzo(a)pyrene	0.410 U	0.410 U	0.410 UJ	0.410 U	0.410 U	0.410 U
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 UJ	0.350 U	0.350 U	0.350 U
Benzo(g,h,i)perylene	**1.40 J**	**0.600 J**	0.370 UJ	0.370 U	0.370 U	0.370 U
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 UJ	0.280 U	0.280 U	0.280 U
Chrysene	5.80 U	5.10 UiJ	6.50 UJ	5.80 U	5.10 U	5.20 U
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 UJ	0.300 U	0.300 U	0.300 U
Fluoranthene	**13.0**	**12.0**	**13.0 J**	**11.0**	**12.0**	**13.0**
Indeno(1,2,3-cd)pyrene	**2.00 J**	**1.80 J**	0.320 UJ	0.320 U	0.320 U	0.320 U
Pyrene	3.30 U	3.50 UiJ	4.00 UJ	2.90 U	3.20 U	4.10 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
\- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 7-1
Upland OU Limited and Estimated Data Sets
Bradford Island Remedial Investigation

	Limited Data Set (Sample Size less than 8)	**High Proportion of Estimated Data**		
		Majority of Detected Data is Estimated (J-flagged)[1]	**Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > HH SLV**	**Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > Eco SLV**
Landfill AOPC				
Soil (0-1 ft bgs)	Dibutyltin, monobutyltin, tetrabutyltin, tributyltin, 4-nitrophenol, pentachlorophenol, chlordane (technical), and total benzofluoranthenes	1 metal, 3 SVOCs, 3 VOCs	NA	Butyl benzyl phthalate and ethylbenzene
Soil (0-3 ft bgs)	4-Nitrophenol, pentachlorophenol, chlordane (technical), and total benzofluoranthenes	2 metals, 4 SVOCs, 4 VOCs	Thallium and dibenz(a,h)anthracene	Selenium, butyl benzyl phthalate, and ethylbenzene
Soil (0-10 ft bgs)	-	3 metals, GRO, 6 SVOCs, 7 VOCs	Thallium and dibenz(a,h)anthracene	NA
Mass Wasting Soil Subset	All herbicides, TPHs, and VOCs; & aniline	4 SVOCs, 1 VOC	-	Dibenzofuran
Groundwater	Dissolved antimony, barium, beryllium, cadmium, chromium, copper, nickel, selenium, silver, thallium, and zinc	4 metals (total), 1 metal (dissolved), 1 pesticide, GRO, 3 SVOCs, 3 VOCs	Total antimony and thallium; dieldrin; GRO 1,4-dichlorobenzene; and vinyl chloride	Lead (dissolved) and dieldrin
Seep Water	All analytes	1 metal (total), 3 metals (dissolved), DRO	DRO	-
Surface Water	All analytes	3 metals (dissolved), DRO	DRO	-
Sandblast AOPC				
Soil (0-1 ft bgs)	-	5 metals, 12 pesticides, GRO, 14 SVOCs, 26 VOCs	NA	Antimony, selenium, aldrin, dieldrin, endrin aldehyde, endrin ketone, dibenzofuran, di-n-butyl phthalate, and pentachlorophenol
Soil (0-3 ft bgs)	-	5 metals, 12 pesticides, GRO, 13 SVOCs, 26 VOCs	Thallium, 1,1-dichloroethane, benzene, chloroform, and trichloroethene (TCE)	Antimony, selenium, aldrin, dieldrin, endrin aldehyde, endrin ketone, dibenzofuran, di-n-butyl phthalate, pentachlorophenol, and ethylbenzene
Soil (0-10 ft bgs)	-	5 metals, 12 pesticides, GRO, 14 SVOCs, 25 VOCs	Thallium, 1,1-dichloroethane, benzene, chloroform, and trichloroethene (TCE)	NA
Soil (>10 ft bgs)	All analytes	4 metals, 1 butyltin, 4 SVOCs, 8 VOCS	Thallium	NA

Table 7-1
Upland OU Limited and Estimated Data Sets
Bradford Island Remedial Investigation

	Limited Data Set (Sample Size less than 8)	**High Proportion of Estimated Data**		
		Majority of Detected Data is Estimated (J-flagged)[1]	**Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > HH SLV**	**Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > Eco SLV**
Erodible Soil Subset	All metals, butyltins, pesticides, PCBs, SVOCs, & DRO and RRO	2 metals, 4 pesticides, DRO, GRO, 4 SVOCs, 15 VOCs	Dibenz(a,h)anthracene	Selenium
Groundwater	Dissolved calcium, magnesium, potassium, and sodium; & the majority of VOCs	1 butyltin, DRO, GRO, 2 SVOCs, 7 VOCs, 1 metal (dissolved)	Potassium (dissolved), DRO, GRO, benzo(b)fluoranthene, chloroform, and vinyl chloride	Monobutyltin
DP Groundwater	All butyltins, pesticides, PCBs, and TPHs; & the following total and dissolved SVOCs: 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, benzoic acid, benzyl alcohol, p-cresol (4-methylphenol), pentachlorophenol, and phenol (dissolved only)	8 metals (total), 10 metals (dissolved), 1 pesticide, RRO, GRO, 18 SVOCs (total), 15 SVOCs (dissolved), 19 VOCs	Total & dissolved thallium and vanadium; RRO; total SVOCs benzo(a)pyrene, benzofluoranthenes (total), bis(2-ethylhexyl) phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene; dissolved SVOCs benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene; and total VOCs 2,2-dichloropropane, benzene, chloroform, naphthalene, trichloroethene (TCE), and vinyl chloride	Dissolved aluminum and cadmium; total SVOCs benzo(a)pyrene and benzofluoranthenes (total); dissolved SVOC benzo(a)pyrene; and total VOC carbon disulfide
Soil Gas	All VOCs	15 VOCs	-	NA
Pistol Range AOPC				
Soil (0-1 ft bgs)	Antimony and arsenic	-	-	-
DP Groundwater	All analytes	1 metal (total), 2 metals (dissolved	-	-
Lagoon Sediment	All analytes	-	-	-
Bulb Slope AOPC				
Soil (0-1 ft bgs)	-	-	-	-
All Four AOPC Combined				
Soil (0-1 ft bgs)	-	5 metals, 12 pesticides, GRO, 12 SVOCs, 26 VOCs	NA	Antimony, selenium, aldrin, dieldrin, endrin aldehyde, endrin ketone, butyl benzyl phthalate, dibenzofuran, di-n-butyl phthalate, pentachlorophenol, and ethylbenzene
Soil (0-3 ft bgs)	-	5 metals, 12 pesticides, GRO, 11 SVOCs, 26 VOCs	Thallium, 1,1-dichloroethane, benzene, chloroform,and trichloroethene (TCE)	Antimony, selenium, aldrin, dieldrin, endrin ketone, butyl benzyl phthalate, dibenzofuran, pentachlorophenol, and ethylbenzene

Table 7-1
Upland OU Limited and Estimated Data Sets
Bradford Island Remedial Investigation

	Limited Data Set (Sample Size less than 8)	High Proportion of Estimated Data		
		Majority of Detected Data is Estimated (J-flagged)[1]	Majority of Detected Data is Estimated (J-flagged)[1] ***AND*** MRL is > HH SLV	Majority of Detected Data is Estimated (J-flagged)[1] ***AND*** MRL is > Eco SLV
Soil (0-10 ft bgs)	-	5 metals, 12 pesticides, GRO, 11 SVOCs, 27 VOCs	Thallium, 1,1-dichloroethane, benzene, chloroform, and trichloroethene (TCE)	NA
Groundwater	Dissolved antimony, barium, beryllium, cadmium, chromium, copper, nickel, selenium, silver, thallium, and zinc	5 metals (total), 1 pesticide, GRO, 7 SVOCs, 9 VOCs	Total antimony and thallium; dieldrin; GRO 1,4-dichlorobenzene; chloroform; and vinyl chloride	Dieldrin
DP Groundwater	All butyltins, PCBs, TPHs, pesticides; & the following total and dissovled SVOCs: 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, benzoic acid, benzyl alcohol, p-cresol, pentachlorophenol, and phenol (dissolved only)	8 metals (total), 10 metals (dissolved), RRO, GRO, 1 pesticide, 18 SVOCs (total), 15 SVOCs (dissolved), 19 VOCs	Total & dissolved thallium and vanadium; RRO; total SVOCs benzo(a)pyrene, benzofluoranthenes (total), bis(2-ethylhexyl) phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene; dissolved SVOCs benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene; and total VOCs benzene, chloroform, naphthalene, trichloroethene (TCE), and vinyl chloride	Dissolved aluminum and cadmium; total SVOCs benzo(a)pyrene and benzofluoranthenes (total); dissolved SVOC benzo(a)pyrene; and total VOC carbon disulfide
Reerence Area				
Soil (0-1 ft bgs)	-	1 metal, 7 SVOCs	NA	NA
Groundwater	All analytes	5 metals (total), 5 metals (dissolved), 1 butyltin, 1 SVOC,	NA	NA

Notes:

1) Detected analytes are listed if they were estimated (J-flagged) in 50% or more of the total number of detected samples

* Analytes were listed, but there is no SLV available

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 7-2
River OU Limited and Estimated Data Sets
Bradford Island Remedial Investigation

	Limited Data Set (Sample Size less than 8)	High Proportion of Estimated Data		
		Majority of Detected Data is Estimated (J-flagged)[1]	Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > HH SLV	Majority of Detected Data is Estimated (J-flagged)[1] *AND* MRL is > Eco SLV
Pre-Removal Sediment Forebay				
Sediment	All analytes	DRO, RRO, 17 SVOCs	-	Anthracene and benzo(a)pyrene
Clam	All analytes	1 metal, 1 SVOC	NA	-
Random Forebay				
Surface Water	All analytes	2 metals (total) 3 metals (dissolved), DRO	Dissolved cadmium; and total & dissolved DRO	Dissolved cadmium
Sediment	-	DRO, RRO, Aroclor 1254, 14 SVOCs	Aroclor 1254	Aroclor 1254
Clam	-	2 metals, 9 SVOCs	NA	-
Crayfish	-	1 metal, 13 SVOCs	Benzo(a)pyrene and bis(2-ethylhexyl) phthalate	-
Sculpin	-	-	NA	-
Smallmouth Bass	-	1 metal, 10 SVOCs	Benzo(b)fluoranthene, bis(2-ethylhexyl) phthalate, and dibenz(a,h)anthracene	Bis(2-ethylhexyl) phthalate
Largescale Sucker	All analytes	1 metal, 4 SVOCs	Dibenz(a,h)anthracene	-
Targeted Forebay - Eagle Creek				
Sediment	All analytes	2 metals, DRO, 10 SVOCs	-	-
Targeted Forebay - Goose Island				
Sediment	All analytes	DRO, Aroclor 1254, 13 SVOCs	Aroclor 1254	Aroclor 1254
Clam	All analytes	1 metal, 2 SVOCs	NA	-
Crayfish	All analytes	2 metals, 5 SVOCs	-	-
Downstream				
Sediment	All analytes	DRO, RRO, 14 SVOCs,	-	-
Reference Area				
Surface Water	All analytes	4 metals (dissolved), 5 metals (total), DRO and RRO (total & dissolved)	NA	NA
Sediment	-	DRO, RRO, 15 SVOCs	NA	NA
Clam	-	2 metals, 4 SVOCs	NA	NA
Crayfish	-	1 metal, 13 SVOCs	NA	NA
Sculpin	-	-	NA	NA
Smallmouth Bass	-	3 metals, Aroclor 1242, 4 SVOCs	NA	NA

Table 7-2
River OU Limited and Estimated Data Sets
Bradford Island Remedial Investigation

Notes:
1) Detected analytes are listed if they were estimated (J-flagged) in 50% or more of the total number of detected samples
* Analytes were listed, but there is no SLV available

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 7-3
Upland OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Landfill AOPC				
Soil (0-1 ft bgs)	NA	NA	Herbicides 2,4,5-TP (silvex), 2,4-D, 2,4-DB, and MCPA; pesticides 4,4'-DDD, endrin aldehyde, endrin ketone, and endrin; SVOC di-n-octyl phthalate; and VOCs 1,2-dichlorobenzene, 1,3-dichlorobenzene, isopropylbenzene, n-propylbenzene, sec-butylbenzene, and tert-butylbenzene	Antimony, mercury, and selenium; herbicides 2,4,5-T, dichloroprop, and MCPP; pesticide dieldrin; and SVOCs dibenzofuran, di-n-butyl phthalate, and dibenz(a,h)anthracene
Soil (0-3 ft bgs)	N-Nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), benzene, bromochloromethane, bromodichloromethane, carbon tetrachloride, chloroform, trichloroethene (TCE), and vinyl chloride	Thallium and dibenz(a,h)anthracene	Herbicides 2,4,5-TP (silvex), 2,4-D, 2,4-DB, and MCPA; pesticides 4,4'-DDD, endrin aldehyde, endrin ketone, and endrin; SVOC di-n-octyl phthalate; and VOCs 1,2-dichlorobenzene, 1,3-dichlorobenzene, isopropylbenzene, n-propylbenzene, sec-butylbenzene, and tert-butylbenzene	Antimony, mercury, and selenium; herbicides 2,4,5-T, dichloroprop, and MCPP; pesticide dieldrin; and SVOCs dibenzofuran, di-n-butyl phthalate, and dibenz(a,h)anthracene
Soil (0-10 ft bgs)	N-nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), benzene, bromochloromethane, bromodichloromethane, carbon tetrachloride, chloroform, trichloroethene (TCE), and vinyl chloride	Thallium and dibenz(a,h)anthracene	NA	NA
Mass Wasting Soil Subset	N-Nitrosodimethylamine, N-nitrosodi-n-propylamine, 1,2,3-trichloropropane, and 1,2-dibromo-3-chloropropane	Thallium	Antimony; herbicides 2,4,5-T, 2,4,5-TP (Silvex), 2,4-D, 2,4-DB, dichloroprop, MCPA, and MCPP; and pesticides endrin aldehyde, endrin ketone, and endrin	Dieldrin and dibenzofuran

Table 7-3
Upland OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Groundwater	Dissolved antimony and thallium; herbicides MCPA and MCPP; pesticides 4,4'-DDD, 4,4'-DDT, aldrin, BHC (alpha), BHC (beta), BHC (delta), chlordane (alpha), chlordane (gamma), chlordane (technical), dieldrin, endrin ketone, endrin, heptachlor epoxide, heptachlor, and toxaphene; all PCBs as Aroclors; SVOCs 1,2,4-trichlorobenzene, 1,3-dichlorobenzene, 2,4,6-trichlorophenol, 2,4-dinitrotoluene, 3,3'-dichlorobenzidine, 3-nitroaniline, 4,6-dinitro-2-methylphenol, 4-chloroaniline, 4-nitroaniline, acenaphthylene, benzidine, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzofluoranthenes (total), bis(2-chloroethyl) ether, chrysene, dibenz(a,h)anthracene, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, Indeno(1,2,3-cd)pyrene, nitrobenzene, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, N-nitrosodiphenylamine, and pentachlorophenol; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2,4-trichlorobenzene, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,2-dichloropropane, benzene, bromochloromethane, bromodichloromethane, cis-1,3-dichloropropene, dibromochloromethane, dichloromethane, hexachlorobutadiene, naphthalene, trans-1,3-dichloropropene, and trichloroethene (TCE)	Total antimony, arsenic, and thallium and dissolved arsenic; pesticide 4,4'-DDE; DRO and RRO; SVOCs 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate, di-n-octyl phthalate, naphthalene; and VOCs carbon tetrachloride, chloroform, tetrachloroethene (PCE), and vinyl chloride	Dissolved cadmium, copper, and silver; herbicides dinoseb and MCPA; all PCBs as Aroclors; pesticides 4,4'-DDD, 4,4'-DDT, chlordane (alpha), chlordane (gamma), chlordane (technical), endosulfan II, endosulfan sulfate, endrin, heptachlor epoxide, heptachlor, methoxychlor, and toxaphene; SVOCs 2,4,5-trichlorophenol, 2,4-dinitrophenol, 3,3'-dichlorobenzidine, 4-bromophenyl phenyl ether, aniline, benzidine, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzofluoranthenes (total), benzyl alcohol, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, indeno(1,2,3-cd)pyrene, and pentachlorophenol; VOCs cis-1,3-dichloropropene and trans-1,3-dichloropropene	Dissolved lead; pesticides 4,4'-DDEand dieldrin; SVOCs benzoic acid, bis(2-ethylhexyl) phthalate, dimethyl phthalate, and phenanthrene; and VOC carbon disulfide

Table 7-3
Upland OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Seep Water	Total & dissolved thallium; herbicides MCPA and MCPP; pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, BHC (alpha), BHC (beta), BHC (delta), chlordane (alpha), chlordane (gamma), dieldrin, endrin, heptachlor epoxide, heptachlor, and toxaphene; all PCBs as Aroclors; GRO; SVOCs 1,2,4-trichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4,6-trichlorophenol, 2,4-dinitrotoluene, 3,3'-dichlorobenzidine, 3-nitroaniline, 4,6-dinitro-2-methylphenol, 4-chloroaniline, 4-nitroaniline, acenaphthylene, benzidine, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-chloroethyl) ether, bis(2-ethylhexyl) phthalate, chrysene, dibenz(a,h)anthracene, di-n-octyl phthalate, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, indeno(1,2,3-cd)pyrene, naphthalene, nitrobenzene, N-nitrosodimethylamine, N-nitrosodi-n-propylamine, N-nitrosodiphenylamine, and pentachlorophenol; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,2-dichloropropane, benzene, bromochloromethane, bromodichloromethane, carbon tetrachloride, cis-1,3-dichloropropene, dibromochloromethane, dichloromethane, hexachlorobutadiene, naphthalene, tetrachloroethene (PCE), trans-1,3-dichloropropene, and vinyl chloride	Total & dissolved arsenic; DRO and RRO; and VOCs chloroform and tetrachloroethene (PCE)	Dissolved cadmium, mercury, and silver; herbicides dinoseb and MCPA; all PCBs as Aroclors; pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane (alpha), chlordane (gamma), dieldrin, endosulfan sulfate, endrin, heptachlor epoxide, heptachlor, methoxychlor, and toxaphene; SVOCs 3,3'-dichlorobenzidine, 4-bromophenyl phenyl ether, aniline, benzidine, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl) phthalate, chrysene, dibenz(a,h)anthracene, dibenzofuran, dimethyl phthalate, fluorene, hexachlorobenzene, and indeno(1,2,3-cd)pyrene; and VOCs 1,1-dichloropropene, carbon disulfide, cis-1,3-dichloropropene, and trans-1,3-dichloropropene	-
Surface Water	Tetrachloroethene (PCE) and vinyl chloride	Arsenic and DRO	-	-

Table 7-3
Upland OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Sandblast AOPC				
Soil (0-1 ft bgs)	NA	NA	-	Antimony, 4,4'-DDT, aldrin, dieldrin, endrin aldehyde, endrin ketone, endrin, dibenzofuran, and di-n-butyl phthalate
Soil (0-3 ft bgs)	Toxaphene, N-nitrosodimethylamine, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), bromodichloromethane, carbon tetrachloride, and vinyl chloride	Benzene and chloroform	1,2-Dichlorobenzene	Antimony, 4,4'-DDT, aldrin, dieldrin, endrin aldehyde, endrin ketone, endrin, dibenzofuran, di-n-butyl phthalate, isopropylbenzene, and n-propylbenzene
Soil (0-10 ft bgs)	Toxaphene, N-nitrosodimethylamine, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), bromodichloromethane, carbon tetrachloride, and vinyl chloride	Benzene and chloroform	NA	NA
Soil (>10 ft bgs)	-	-	NA	NA
Erodible Soil Subset	N-Nitrosodimethylamine and 1,2-dibromo-3-chloropropane	-	Dibenzofuran	-
Groundwater	SVOC benzo(k)fluoranthene; and VOCs 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), and 2,2-dichloropropane	DRO; SVOC benzo(b)fluoranthene; and VOCs chloroform, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride	trans-1,3-Dichloropropene	-
DP Groundwater	Pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, heptachlor epoxide, heptachlor, and toxaphene; all PCBs as Aroclors; total and dissolved SVOCs 3,3'-dichlorobenzidine, benzidine, benzo(a)anthracene, total benzofluoranthenes (dissolved only), benzo(g,h,i)perylene, bis(2-chloroethyl) ether, chrysene, hexachlorobenzene, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, and 1,2-dibromoethane (EDB)	Total arsenic and dissolved vanadium; total and dissolved SVOCs benzo(a)pyrene, total benzofluoranthenes (total only), dibenz(a,h)anthracene; and VOCs naphthalene, trichloroethene (TCE), and vinyl chloride	Toxaphene and total & dissolved hexachlorobenzene	Carbon disulfide

Table 7-3
Upland OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Soil Gas	1,2-Dibromoethane (EDB) and hexachlorobutadiene	-	NA	NA
Pistol Range AOPC				
Soil (0-1 ft bgs)	Arsenic	-	Antimony	-
DP Groundwater	-	-	-	-
Lagoon Sediment	-	-	-	-
Bulb Slope AOPC				
Soil (0-1 ft bgs)	-	-	-	-

Notes:

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 7-4
Upland OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLVs	< 100% NDs without HH SLVs	100% NDs without Eco SLVs	< 100% NDs without Eco SLVs
Landfill AOPC				
Soil (0-1 ft bgs)	NA	NA	Herbicides dalapon, dicamba, and dinoseb; SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, benzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3 dichloropropene, hexachlorobutadiene, n-butylbenzene, trans-1,3-dichloropropene, and vinyl acetate	DRO, RRO and GRO
Soil (0-3 ft bgs)	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	Herbicides dalapon, dicamba, and dinoseb; SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, benzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3 dichloropropene, hexachlorobutadiene, n-butylbenzene, trans-1,3-dichloropropene, and vinyl acetate	DRO, RRO and GRO
Soil (0-10 ft bgs)	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	NA	NA

Table 7-4
Upland OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLVs	< 100% NDs without HH SLVs	100% NDs without Eco SLVs	< 100% NDs without Eco SLVs
Mass Wasting Soil Subset	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	Herbicides dalapon, dicamba, and dinoseb; DRO, RRO and GRO; SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3-dichloropropene, hexachlorobutadiene, n-butylbenzene, and trans-1,3-dichloropropene	-
Groundwater	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, bis(2-chloroisopropyl) ether, carbazole, 2-chloroethylvinylether, 4-isopropyltoluene, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	Herbicides 2,4,5-TP, 2,4-DB, dalapon, and MCPP; pesticide endrin ketone; SVOCs 2-nitroaniline, 2-nitrophenol, 3-nitroaniline, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, 4-nitroaniline, bis(2-chloroethoxy)methane, bis(2-chloroisopropyl) ether, and carbazole; and VOCs 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 2-chlorotoluene, 4-chlorotoluene, 4-isopropyltoluene, bromobenzene, bromochloromethane, bromodichloromethane, chloroethane, chloromethane, dibromochloromethane, dibromomethane, dichlorodifluoromethane, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and trichlorofluoromethane	DRO, RRO, and GRO
Seep Water	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, bis(2-chloroisopropyl) ether, carbazole, 4-isopropyltoluene, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	Herbicides 2,4,5-TP (silvex), 2,4-DB, dalapon, and MCPP; GRO; SVOCs 2-nitroaniline, 2-nitrophenol, 3-nitroaniline, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, 4-nitroaniline, bis(2-chloroethoxy)methane, bis(2-chloroisopropyl) ether, and carbazole; and VOCs 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 2-chlorotoluene, 4-chlorotoluene, 4-isopropyltoluene, bromobenzene, bromochloromethane, bromodichloromethane, chloroethane, chloromethane, dibromochloromethane, dibromomethane, dichlorodifluoromethane, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and trichlorofluoromethane	DRO and RRO
Surface Water	-	-	-	DRO, RRO, and GRO

Table 7-4
Upland OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLVs	< 100% NDs without HH SLVs	100% NDs without Eco SLVs	< 100% NDs without Eco SLVs
Sandblast AOPC				
Soil (0-1 ft bgs)	NA	NA	Herbicides dalapon, dicamba, and dinoseb; SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, benzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3 dichloropropene, hexachlorobutadiene, trans-1,3-dichloropropene, and vinyl acetate	DRO, RRO and GRO; and n-butylbenzene
Soil (0-3 ft bgs)	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, and tert-butylbenzene	n-Butylbenzene and sec-butylbenzene	Herbicides dalapon, dicamba, and dinoseb; SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, benzidine, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3 dichloropropene, hexachlorobutadiene, trans-1,3-dichloropropene, and vinyl acetate	DRO, RRO and GRO; and n-butylbenzene
Soil (0-10 ft bgs)	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, and tert-butylbenzene	n-Butylbenzene and sec-butylbenzene	NA	NA
Soil (>10 ft bgs)	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	NA	NA

Table 7-4
Upland OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLVs	< 100% NDs without HH SLVs	100% NDs without Eco SLVs	< 100% NDs without Eco SLVs
Erodible Soil Subset	4-Bromophenyl phenyl ether, 4-chlorophenyl phenyl ether, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	SVOCs 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-chloronaphthalene, 2-nitroaniline, 2-nitrophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, bis(2-chloroethyl) ether, bis(2-chloroisopropyl) ether, hexachlorobutadiene, hexachloroethane, isophorone, N-nitrosodimethylamine, and N-nitrosodi-n-propylamine; and VOCs 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 1,3-dichloropropane, 2,2-dichloropropane, 2-chlorotoluene, 4-chlorotoluene, bromobenzene, bromoform, chloroethane, cis-1,3-dichloropropene, hexachlorobutadiene, n-butylbenzene, trans-1,3-dichloropropene, and vinyl acetate	GRO
Groundwater	4-Isopropyltoluene, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	RRO; and VOCs 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 2-chlorotoluene, 4-chlorotoluene, 4-isopropyltoluene, bromobenzene, bromochloromethane, bromodichloromethane, chloroethane, chloromethane, dibromochloromethane, dibromomethane, dichlorodifluoromethane, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and trichlorofluoromethane	DRO and GRO
DP Groundwater	Total and dissolved SVOCs 4-bromophenyl phenyl ether, 4-chlorophenyl phenyl ether bis(2-chloroisopropyl) ether, and carbazole; and VOCs 4-isopropyltoluene, n-butylbenzene, sec-butylbenzene, and tert-butylbenzene	-	Endrin ketone; DRO; total and dissolved SVOCs 2-nitroaniline, 2-nitrophenol, 3-nitroaniline, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, 4-nitroaniline, bis(2-chloroethoxy)methane, bis(2-chloroisopropyl) ether, and carbazole; and VOCs 1,1-dichloropropene, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane (EDB), 2-chlorotoluene, 4-chlorotoluene, 4-isopropyltoluene, bromobenzene, bromochloromethane, bromodichloromethane, chloroethane, chloromethane, dibromochloromethane, dibromomethane, dichlorodifluoromethane, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, and trichlorofluoromethane	RRO and GRO
Soil Gas	Tetrahydrofuran	Ethanol	NA	NA
Pistol Range AOPC				
Soil (0-1 ft bgs)	-	-	-	-
DP Groundwater	-	-	-	-
Lagoon Sediment	-	-	-	-
Bulb Slope AOPC				
Soil (0-1 ft bgs)	-	-	-	-

Table 7-4
Upland OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLVs	< 100% NDs without HH SLVs	100% NDs without Eco SLVs	< 100% NDs without Eco SLVs

Notes:

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 7-5
River OU Non-detects Above SLVs
Bradford Island Remedial Investigation

	100% NDs with MDLs > HH SLV	< 100% NDs with MDLs > HH SLV	100% NDs with MDLs > Eco SLV	< 100% NDs with MDLs > Eco SLV
Pre-Removal Sediment Forebay				
Sediment	Aroclors 1016, 1221, 1232, 1242, 1248, 1260, 1262, and 1268	Aroclor 1254 and Total PCBs as Aroclors	Aroclors 1016, 1221, 1232, 1242, 1248, 1260, 1262, and 1268	Aroclor 1254 and Total PCBs as Aroclors
Clam	NA	NA	-	-
Random Forebay				
Surface Water	Total & dissolved antimony and vanadium	-	-	Dissolved cadmium; and total aluminum
Sediment	Aroclors 1016, 1221, 1232, 1242, 1248, 1260, 1262, and 1268	Aroclor 1254 and Total PCBs as Aroclors	Aroclors 1016, 1221, 1232, 1242, 1248, and 1260	Aroclor 1254 and Total PCBs as Aroclors
Clam	NA	NA	Aroclors 1232 and 1242	Aroclor 1254 and Total PCBs as Aroclors
Crayfish	Aroclors 1016, 1221, 1232, 1242, 1254, 1260, 1262, 1268, and Total PCBs as Aroclors	-	-	-
Sculpin	NA	NA	Aroclors 1221, 1232, 1260	Aroclor 1254 and Total PCBs as Aroclors
Smallmouth Bass	Aroclors 1016, 1221, 1232, 1248, 1260, 1262, and 1268	Aroclors 1242 and 1254, Total PCBs as Aroclors, and bis(2-ethylhexyl) phthalate	Aroclors 1016, 1221, 1232, 1248, 1260, 1262, and 1268	Aroclors 1242 and 1254, Total PCBs as Aroclors, and bis(2-ethylhexyl) phthalate
Largescale Sucker	Aroclors 1016, 1221, 1232, 1242, 1260, and 1268	-	-	-
Targeted Forebay - Eagle Creek				
Sediment	Aroclors 1016, 1221, 1232, 1242, 1254, 1260, 1262, and 1268	Aroclor 1248 and Total PCBs as Aroclors	-	Total PCBs as Aroclors
Targeted Forebay - Goose Island				
Sediment	Aroclors 1016, 1221, 1232, 1242, 1248, and 1260	Aroclor 1254 and Total PCBs as Aroclors	Aroclors 1016, 1221, 1232, 1242, 1248, and 1260	Aroclor 1254 and Total PCBs as Aroclors
Clam	NA	NA	-	-
Crayfish	Aroclors 1016, 1221, 1232, 1242, 1254, 1260, 1262, 1268, and Total PCBs as Aroclors	-	-	-
Downstream				
Sediment	All PCBs as Aroclors	-	-	-

Notes:
* Non-detect analytes were listed, but there is no SLV available

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 7-6
River OU Non-detects Without SLVs
Bradford Island Remedial Investigation

	100% NDs without HH SLV	< 100% NDs without HH SLV	100% NDs without Eco SLV	< 100% NDs without Eco SLV
Pre-Removal Sediment Forebay				
Sediment	di-n-octyl phthalate	bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, carbazole, and p-cresol	-	-
Clam	NA	NA	Antimony, carbazole, and p-cresol	-
Random Forebay				
Surface Water	-	-	Total and dissolved RRO	Total DRO
Sediment	butyl benzyl phthalate, di-n-butyl phthalate, and di-n-octyl phthalate	RRO, bis(2-ethylhexyl) phthalate, carbazole, and p-cresol	-	RRO
Clam	NA	NA	Carbazole	Antimony and p-cresol
Crayfish	Carbazole and p-cresol	-	Carbazole and p-cresol	-
Sculpin	NA	NA	-	-
Smallmouth Bass	Antimony, carbazole, and p-cresol	Beryllium and chromium	Antimony, carbazole, and p-cresol	Beryllium and chromium
Largescale Sucker	Antimony, beryllium, carbazole, and p-cresol	-	Antimony, beryllium, carbazole, and p-cresol	-
Targeted Forebay - Eagle Creek				
Sediment	RRO, bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, and p-cresol	Carbazole	RRO	-
Targeted Forebay - Goose Island				
Sediment	Butyl benzyl phthalate, carbazole, di-n-octyl phthalate	p-Cresol	-	-
Clam	NA	NA	Antimony and carbazole	-
Crayfish	Carbazole and p-cresol	-	Carbazole and p-cresol	-
Downstream				
Sediment	bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, and di-n-octyl phthalate	RRO, carbazole, and p-cresol	-	RRO

Notes:
* Non-detect analytes were listed, but there is no SLV available

DRO = diesel range organic
Eco = Ecological
GRO = gasoline range organic
HH = Human health
NA = not applicable
RRO = residual range organic
SLV = screening level value

Table 8-1
COIs for which Upland OU Soil Concentrations are Statistically Higher than Reference Area

Media	Analyte Group	Area of Potential concern (AOPC)				
		Landfill	Sandblast Area	Pistol Range[1]	Bulb Slope	All Four AOPCs Combined
Soils 0-1 ft bgs	**Metals**	Antimony Cadmium Lead Mercury Silver [2] Sodium Zinc	Antimony [2] Arsenic Cadmium Chromium Lead Nickel Selenium Silver Zinc	Lead Nickel Zinc	Lead Mercury	Antimony [2] Arsenic Cadmium Chromium Lead Mercury [2] Nickel Selenium Silver [2] Zinc
	Organics	all PAHs (no other organic COIs were evaluated)	all PAHs (no other organic COIs were evaluated)	all PAHs (no other organic COIs were evaluated)	all PAHs (no other organic COIs were evaluated)	all PAHs (no other organic COIs were evaluated)
Soils 0-3 ft bgs	**Metals**	Antimony Arsenic Cadmium Lead Mercury Silver [2] Sodium Zinc	Antimony [2] Arsenic Cadmium Chromium Lead Nickel Selenium Silver Zinc	(No subsurface samples)	(No subsurface samples)	Antimony [2] Arsenic Cadmium Chromium Lead Mercury [2] Nickel Selenium Silver [2] Zinc
	Organics	all PAHs (no other organic COIs were evaluated)	all PAHs (no other organic COIs were evaluated)			all PAHs (no other organic COIs were evaluated)
Soils 0-10 ft bgs	**Metals**	Antimony Cadmium Lead Mercury Nickel Selenium Silver Sodium Zinc	Antimony [2] Arsenic Cadmium Chromium Lead Nickel Selenium Silver Zinc	(No subsurface samples)	(No subsurface samples)	Antimony [2] Arsenic Cadmium Chromium Lead Mercury [2] Nickel Selenium Silver [2] Zinc
	Organics	all PAHs (no other organics were evaluated)	all PAHs (no other organics were evaluated)			all PAHs (no other organics were evaluated)

Notes

ft bgs - feet below ground surface

PAHs - polycyclic aromatic hydrocarbons

[1] Results from all Pistol Range AOPC samples (0-1.5 ft bgs) were included in the statistical comparison for the Depth Group 0-1 ft bgs for the Pistol Range AOPC and All Four AOPCs Combined.

[2] A portion of Upland AOPC data contained elevated MDLs/MRLs. Hence, the results were concluded to be not significant due to data censoring at median MDL/MRL for non-detects. Examination of the box-and-whisker plots in Appendix L indicated that these analytes should be considered as having higher concentrations than the Reference concentrations.

Table 8-2
COIs for which Upland OU Groundwater and Seep Water Concentrations are Higher than Reference Area

Media	Analyte Group	Area of Potential Concern (AOPC)	
		Landfill	**Sandblast Area**
Groundwater (total)	**Metals**	All metals analyzed	Arsenic Iron Vanadium (No other metals were analyzed in samples from montoring wells. Direct push results were not compared to MW-10.)
	Organics	GRO, DRO, RRO Butyltins Chloroform Tetrachloroethene (PCE) Vinyl Chloride 1,4-Dichlorobenzene Phenol Phenanthrene (Other organics may be elevated, but reference area data is not available for comparison)	GRO, DRO Chloroform Tetrachloroethene (PCE) Vinyl Chloride Phenanthrene (A few other VOCs may be elevated, but reference area data is not available for comparison) (Other organics were only analyzed in direct push samples. These results were not compared to MW-10.)
Groundwater (dissolved)	**Metals**	Arsenic Barium Calcium Iron Lead Magnesium Manganese Nickel Potassium Sodium Zinc	Arsenic Calcium Iron Magnesium Sodium Vanadium (No other metals were analyzed in samples from montoring wells. Direct push results were not compared to MW-10.)
	Organics	(not analyzed)	(not analyzed)
Seep Water	**Metals**	Arsenic Barium Copper Iron Lead Mercury Selenium	(no seep samples collected)
	Organics	DRO, RRO Chloroform Tetrachloroethene (PCE)	

Notes:

Only compounds that were analyzed in samples from MW-10 (Reference Area Well) were evaluated.
See Appendix L, Table L-3.

Table 8-3
COIs for which Forebay Sediment or Tissue Concentrations are Statistically Higher than Reference Area Concentrations

Chemical Class	Media				
	Sediment[1]	Clams	Crayfish	Sculpin[2]	Smallmouth Bass
Metals		Beryllium Cadmium	Antimony Arsenic Chromium Mercury Methyl Mercury Nickel	Cadmium Lead Mercury	Aluminum Barium Copper Mercury Zinc
PAHs and TPH	RRO	Acenaphthene Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Pyrene	Acenaphthene Benzo(a)anthracene Benzo(g,h,i)perylene Fluoranthene Phenanthrene Pyrene		Anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene pyrene
Phthalates					Bis(2-ethylhexyl) Phthalate
PCBs	Selected Dioxin-like Congeners	Selected Dioxin-like Congeners	Selected Dioxin-like Congeners Total PCBs (as Congeners)	Selected Dioxin-like Congeners Total PCBs (as Congeners)	All Dioxin-like Congeners Total PCBs (as Congeners)

Notes

PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
TPH = total petroleum hydrocarbons
RRO = residual range organics

[1] Sediment was the only media analyzed for TPH

[2] Due to insufficient sample volume, Scuplin were only analyzed for four metals (arsenic, cadmium, lead, and mercury), and they were not analyzed for PAHs or Phthalates.

Table 8-4
COIs for which Maximum Forebay Surface Water Total Concentrations Exceed Maximum Reference Area Concentrations

Chemical Class	Media
	Surface Water (total concentrations)
Metals	Aluminum Barium
PAHs	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Phenanthrene Indeno(1,2,3-cd)pyrene
Phthalates	none
PCBs	Selected Dioxin-like Congeners Total PCBs (as Congeners)

Notes
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(1 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Aluminum	0-1 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-1 ft	mg/kg	**Yes**	**Yes**	4.20	0.27	**Yes**	4	**Yes**
Soil	Metals	Total	Arsenic	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Barium	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-1 ft	mg/kg	**Yes**	**Yes**	2.09	0.360	**Yes**	14	**Yes**
Soil	Metals	Total	Chromium	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cobalt	0-1 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-1 ft	mg/kg	**Yes**	**Yes**	741	25.5	**Yes**	18	**Yes**
Soil	Metals	Total	Manganese	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-1 ft	mg/kg	**Yes**	**Yes**	4.15	0.0660	**Yes**	18	**Yes**
Soil	Metals	Total	Nickel	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Selenium	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Silver	0-1 ft	mg/kg	**Yes**	**Yes**	1.50	4.20	No	0	No
Soil	Metals	Total	Thallium	0-1 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-1 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-1 ft	mg/kg	**Yes**	**Yes**	635	71.7	**Yes**	18	**Yes**
Soil	Metals	Total	Aluminum	0-3 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-3 ft	mg/kg	**Yes**	**Yes**	4.20	0.27	**Yes**	6	**Yes**
Soil	Metals	Total	Arsenic	0-3 ft	mg/kg	**Yes**	**Yes**	30.1	5.40	**Yes**	5	**Yes**
Soil	Metals	Total	Barium	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-3 ft	mg/kg	**Yes**	**Yes**	3.54	0.360	**Yes**	16	**Yes**
Soil	Metals	Total	Chromium	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cobalt	0-3 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-3 ft	mg/kg	**Yes**	**Yes**	1,660	25.5	**Yes**	26	**Yes**
Soil	Metals	Total	Manganese	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-3 ft	mg/kg	**Yes**	**Yes**	4.15	0.0660	**Yes**	19	**Yes**
Soil	Metals	Total	Nickel	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Selenium	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Silver	0-3 ft	mg/kg	**Yes**	**Yes**	1.50	4.20	No	0	No
Soil	Metals	Total	Thallium	0-3 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-3 ft	mg/kg	--	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-3 ft	mg/kg	**Yes**	**Yes**	1,140	71.7	**Yes**	20	**Yes**
Soil	Metals	Total	Aluminum	0-10 ft	mg/kg	**Yes**	No	23,100	990,000	No	0	No
Soil	Metals	Total	Antimony	0-10 ft	mg/kg	**Yes**	**Yes**	8.19	410	No	0	No
Soil	Metals	Total	Arsenic	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Barium	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-10 ft	mg/kg	**Yes**	**Yes**	3.54	150	No	0	No
Soil	Metals	Total	Chromium	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(2 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Cobalt	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-10 ft	mg/kg	**Yes**	**Yes**	1,660	800	**Yes**	6	**Yes**
Soil	Metals	Total	Manganese	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-10 ft	mg/kg	**Yes**	**Yes**	4.15	93.0	No	0	No
Soil	Metals	Total	Nickel	0-10 ft	mg/kg	**Yes**	**Yes**	1,760	6,100	No	0	No
Soil	Metals	Total	Selenium	0-10 ft	mg/kg	**Yes**	**Yes**	0.879	5,100	No	0	No
Soil	Metals	Total	Silver	0-10 ft	mg/kg	**Yes**	**Yes**	1.52	1,500	No	0	No
Soil	Metals	Total	Thallium	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-10 ft	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-10 ft	mg/kg	**Yes**	**Yes**	1,140	310,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-1 ft	ug/kg	--	--	20.2	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-1 ft	ug/kg	--	--	38.0	28,000	No	0	No
Soil	Butyltins	Total	Tributyltin	0-1 ft	ug/kg	--	--	165	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-3 ft	ug/kg	--	--	20.2	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-3 ft	ug/kg	--	--	38.0	28,000	No	0	No
Soil	Butyltins	Total	Tributyltin	0-3 ft	ug/kg	--	--	165	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-10 ft	ug/kg	**Yes**	--	20.2	180,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-10 ft	ug/kg	**Yes**	--	38.0	180,000	No	0	No
Soil	Butyltins	Total	Tributyltin	0-10 ft	ug/kg	**Yes**	--	165	180,000	No	0	No
Soil	Herbicides	Total	2,4,5-T	0-1 ft	ug/kg	--	--	93.0	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	Dichloroprop	0-1 ft	ug/kg	--	--	180	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	MCPP	0-1 ft	ug/kg	--	--	14,000	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	2,4,5-T	0-3 ft	ug/kg	--	--	93.0	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	Dichloroprop	0-3 ft	ug/kg	--	--	180	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	MCPP	0-3 ft	ug/kg	--	--	14,000	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	2,4,5-T	0-10 ft	ug/kg	**Yes**	--	93.0	6,200,000	No	0	No
Soil	Herbicides	Total	Dichloroprop	0-10 ft	ug/kg	**Yes**	--	180	NV	***Yes***	--	***Yes***
Soil	Herbicides	Total	MCPP	0-10 ft	ug/kg	**Yes**	--	14,000	620,000	No	0	No
Soil	Pesticides	Total	4,4'-DDE	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDT	0-1 ft	ug/kg	**Yes**	--	28.0	21.0	**Yes**	2	**Yes**
Soil	Pesticides	Total	BHC (alpha)	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (technical)	0-1 ft	ug/kg	--	--	1,560	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan II	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Heptachlor	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDE	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDT	0-3 ft	ug/kg	**Yes**	--	28.0	21.0	**Yes**	2	**Yes**
Soil	Pesticides	Total	BHC (alpha)	0-3 ft	ug/kg	No	--	--	--	--	--	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(3 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Pesticides	Total	BHC (beta)	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (technical)	0-3 ft	ug/kg	--	--	1,560	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan II	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Heptachlor	0-3 ft	ug/kg	**Yes**	--	3.07	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDE	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDT	0-10 ft	ug/kg	**Yes**	--	28.0	7,700	No	0	No
Soil	Pesticides	Total	BHC (alpha)	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (technical)	0-10 ft	ug/kg	--	--	1,560	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan II	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Heptachlor	0-10 ft	ug/kg	**Yes**	--	3.07	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1248	0-1 ft	ug/kg	**Yes**	--	968	371	**Yes**	1	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1254	0-1 ft	ug/kg	**Yes**	--	78.6	371	No	0	No
Soil	PCB Aroclors	Total	Aroclor 1260	0-1 ft	ug/kg	**Yes**	--	660	371	**Yes**	2	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-1 ft	ug/kg	**Yes**	--	996	371	**Yes**	3	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1248	0-3 ft	ug/kg	**Yes**	--	968	371	**Yes**	1	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1254	0-3 ft	ug/kg	**Yes**	--	86.1	371	No	0	No
Soil	PCB Aroclors	Total	Aroclor 1260	0-3 ft	ug/kg	**Yes**	--	660	371	**Yes**	2	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-3 ft	ug/kg	**Yes**	--	996	371	**Yes**	3	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1248	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1254	0-10 ft	ug/kg	**Yes**	--	499	740	No	0	No
Soil	PCB Aroclors	Total	Aroclor 1260	0-10 ft	ug/kg	**Yes**	--	660	740	No	0	No
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-10 ft	ug/kg	**Yes**	--	996	740	**Yes**	1	**Yes**
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-1 ft	mg/kg	--	--	1,000	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-1 ft	mg/kg	--	--	9,450	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-3 ft	mg/kg	**Yes**	--	1,000	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-3 ft	mg/kg	**Yes**	--	9,450	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-10 ft	mg/kg	**Yes**	--	9,740	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-10 ft	mg/kg	**Yes**	--	41,900	40,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-1 ft	mg/kg	--	--	23,900	13,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-3 ft	mg/kg	--	--	23,900	13,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-10 ft	mg/kg	**Yes**	--	23,900	13,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	2-Methylnaphthalene	0-1 ft	ug/kg	**Yes**	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-1 ft	ug/kg	**Yes**	--	2,600	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-1 ft	ug/kg	**Yes**	--	78.1	23,000	No	0	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(4 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Anthracene	0-1 ft	ug/kg	**Yes**	--	2,700	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-1 ft	ug/kg	**Yes**	--	32,000	2,700	**Yes**	7	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-1 ft	ug/kg	**Yes**	--	33,000	270	**Yes**	17	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-1 ft	ug/kg	**Yes**	--	65,000	2,700	**Yes**	5	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-1 ft	ug/kg	**Yes**	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-1 ft	ug/kg	**Yes**	--	65,000	27,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-1 ft	ug/kg	--	--	14,700	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-1 ft	ug/kg	**Yes**	--	553	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-1 ft	ug/kg	**Yes**	--	21,000	4,500	**Yes**	2	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-1 ft	ug/kg	**Yes**	--	68.7	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-1 ft	ug/kg	**Yes**	--	2,650	2,260	**Yes**	1	**Yes**
Soil	SVOCs	Total	Chrysene	0-1 ft	ug/kg	**Yes**	--	32,000	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-1 ft	ug/kg	**Yes**	--	9,900	270	**Yes**	8	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-1 ft	ug/kg	**Yes**	--	810	2.00	**Yes**	11	**Yes**
Soil	SVOCs	Total	Diethyl Phthalate	0-1 ft	ug/kg	**Yes**	--	73.4	100,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-1 ft	ug/kg	**Yes**	--	1,800	450	**Yes**	1	**Yes**
Soil	SVOCs	Total	Fluoranthene	0-1 ft	ug/kg	**Yes**	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-1 ft	ug/kg	**Yes**	--	1,200	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-1 ft	ug/kg	**Yes**	--	19,000	2,700	**Yes**	5	**Yes**
Soil	SVOCs	Total	Naphthalene	0-1 ft	ug/kg	**Yes**	--	823	23,000	No	0	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-1 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-1 ft	ug/kg	**Yes**	--	201	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-1 ft	ug/kg	**Yes**	--	12,000	23,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-1 ft	ug/kg	**Yes**	--	40,000	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-1 ft	ug/kg	**Yes**	--	367,900	1,100	**Yes**	21	**Yes**
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-1 ft	ug/kg	**Yes**	--	18,674	29,000	No	0	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-3 ft	ug/kg	**Yes**	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-3 ft	ug/kg	**Yes**	--	2,600	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-3 ft	ug/kg	**Yes**	--	111	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-3 ft	ug/kg	**Yes**	--	8,440	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-3 ft	ug/kg	**Yes**	--	32,000	2,700	**Yes**	13	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-3 ft	ug/kg	**Yes**	--	34,000	270	**Yes**	23	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-3 ft	ug/kg	**Yes**	--	65,000	2,700	**Yes**	9	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-3 ft	ug/kg	**Yes**	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-3 ft	ug/kg	**Yes**	--	65,000	27,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-3 ft	ug/kg	--	--	31,300	2,700	**Yes**	4	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-3 ft	ug/kg	**Yes**	--	553	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-3 ft	ug/kg	**Yes**	--	21,000	4,500	**Yes**	2	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-3 ft	ug/kg	**Yes**	--	68.7	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-3 ft	ug/kg	**Yes**	--	2,840	2,260	**Yes**	2	**Yes**
Soil	SVOCs	Total	Chrysene	0-3 ft	ug/kg	**Yes**	--	35,300	270,000	No	0	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(5 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-3 ft	ug/kg	Yes	--	9,900	270	Yes	14	Yes
Soil	SVOCs	Total	Dibenzofuran	0-3 ft	ug/kg	Yes	--	810	2.00	Yes	13	Yes
Soil	SVOCs	Total	Diethyl Phthalate	0-3 ft	ug/kg	Yes	--	73.4	100,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-3 ft	ug/kg	Yes	--	1,800	450	Yes	1	Yes
Soil	SVOCs	Total	Fluoranthene	0-3 ft	ug/kg	Yes	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-3 ft	ug/kg	Yes	--	1,610	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-3 ft	ug/kg	Yes	--	20,000	2,700	Yes	10	Yes
Soil	SVOCs	Total	Naphthalene	0-3 ft	ug/kg	Yes	--	823	23,000	No	0	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-3 ft	ug/kg	Yes	--	201	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-3 ft	ug/kg	Yes	--	21,900	23,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-3 ft	ug/kg	Yes	--	67,100	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-3 ft	ug/kg	Yes	--	367,900	1,100	Yes	27	Yes
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-3 ft	ug/kg	Yes	--	34,767	29,000	Yes	1	Yes
Soil	SVOCs	Total	2-Methylnaphthalene	0-10 ft	ug/kg	Yes	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-10 ft	ug/kg	Yes	--	3,040	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-10 ft	ug/kg	Yes	--	111	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-10 ft	ug/kg	Yes	--	8,440	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-10 ft	ug/kg	Yes	--	32,000	2,700	Yes	22	Yes
Soil	SVOCs	Total	Benzo(a)pyrene	0-10 ft	ug/kg	Yes	--	34,000	270	Yes	33	Yes
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-10 ft	ug/kg	Yes	--	65,000	2,700	Yes	9	Yes
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-10 ft	ug/kg	Yes	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-10 ft	ug/kg	Yes	--	65,000	27,000	Yes	1	Yes
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-10 ft	ug/kg	--	--	31,300	2,700	Yes	13	Yes
Soil	SVOCs	Total	Benzoic Acid	0-10 ft	ug/kg	Yes	--	553	2,500,000,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-10 ft	ug/kg	Yes	--	21,000	150,000	No	0	No
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-10 ft	ug/kg	Yes	--	152	910,000	No	0	No
Soil	SVOCs	Total	Carbazole	0-10 ft	ug/kg	Yes	--	2,840	NV	*Yes*	--	*Yes*
Soil	SVOCs	Total	Chrysene	0-10 ft	ug/kg	Yes	--	35,300	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-10 ft	ug/kg	Yes	--	9,900	270	Yes	21	Yes
Soil	SVOCs	Total	Dibenzofuran	0-10 ft	ug/kg	Yes	--	810	1,000,000	No	0	No
Soil	SVOCs	Total	Diethyl Phthalate	0-10 ft	ug/kg	Yes	--	73.4	490,000,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-10 ft	ug/kg	Yes	--	1,800	62,000,000	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-10 ft	ug/kg	Yes	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-10 ft	ug/kg	Yes	--	1,610	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-10 ft	ug/kg	Yes	--	20,000	2,700	Yes	17	Yes
Soil	SVOCs	Total	Naphthalene	0-10 ft	ug/kg	Yes	--	1,710	23,000	No	0	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-10 ft	ug/kg	Yes	--	201	13,000	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-10 ft	ug/kg	Yes	--	21,900	23,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-10 ft	ug/kg	Yes	--	67,100	6,700,000	No	0	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-1 ft	ug/kg	--	--	14,300	200,000	No	0	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(6 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-1 ft	ug/kg	--	--	5,410	150,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-1 ft	ug/kg	--	--	12.0	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-1 ft	ug/kg	--	--	2,700	2,260	**Yes**	1	**Yes**
Soil	VOCs	Total	m,p-Xylenes	0-1 ft	ug/kg	--	--	9,800	120,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-1 ft	ug/kg	--	--	8,360	23,000	No	0	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-1 ft	ug/kg	**Yes**	--	65.0	1,600	No	0	No
Soil	VOCs	Total	Toluene	0-1 ft	ug/kg	**Yes**	--	5.30	200,000	No	0	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-3 ft	ug/kg	**Yes**	--	14,300	200,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-3 ft	ug/kg	**Yes**	--	5,410	150,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-3 ft	ug/kg	**Yes**	--	12.0	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Naphthalene	0-3 ft	ug/kg	**Yes**	--	8,360	23,000	No	0	No
Soil	VOCs	Total	Styrene	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-3 ft	ug/kg	**Yes**	--	65.0	1,600	No	0	No
Soil	VOCs	Total	Toluene	0-3 ft	ug/kg	**Yes**	--	5.30	200,000	No	0	No
Soil	VOCs	Total	Trichlorofluoromethane	0-3 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-10 ft	ug/kg	**Yes**	--	14,300	980,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-10 ft	ug/kg	**Yes**	--	5,410	150,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-10 ft	ug/kg	**Yes**	--	12.0	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-10 ft	ug/kg	**Yes**	--	2,700	12,000	No	0	No
Soil	VOCs	Total	m,p-Xylenes	0-10 ft	ug/kg	**Yes**	--	9,800	2,700,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-10 ft	ug/kg	**Yes**	--	8,360	23,000	No	0	No
Soil	VOCs	Total	o-Xylene	0-10 ft	ug/kg	**Yes**	--	4,260	19,000,000	No	0	No
Soil	VOCs	Total	Styrene	0-10 ft	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-10 ft	ug/kg	**Yes**	--	403,000	1,600	**Yes**	1	**Yes**
Soil	VOCs	Total	Toluene	0-10 ft	ug/kg	**Yes**	--	133,000	24,000,000	No	0	No
Soil	VOCs	Total	Trichlorofluoromethane	0-10 ft	ug/kg	No	--	--	--	--	--	No
Groundwater[3]	Metals	Dissolved	Arsenic	N/A	mg/L	**Yes**	**Yes**	0.0193	0.0000180	**Yes**	29	**Yes**
Groundwater[3]	Metals	Dissolved	Barium	N/A	mg/L	--	**Yes**	0.134	0.00400	**Yes**	3	**Yes**
Groundwater[3]	Metals	Dissolved	Calcium	N/A	mg/L	--	**Yes**	172	116	**Yes**	1	**Yes**
Groundwater[3]	Metals	Dissolved	Iron	N/A	mg/L	**Yes**	**Yes**	35.4	0.300	**Yes**	16	**Yes**
Groundwater[3]	Metals	Dissolved	Lead	N/A	mg/L	**Yes**	**Yes**	0.00350	0.00144	**Yes**	3	**Yes**
Groundwater[3]	Metals	Dissolved	Magnesium	N/A	mg/L	--	**Yes**	25.8	82.0	No	0	No
Groundwater[3]	Metals	Dissolved	Manganese	N/A	mg/L	**Yes**	**Yes**	5.54	0.0500	**Yes**	20	**Yes**
Groundwater[3]	Metals	Dissolved	Nickel	N/A	mg/L	--	**Yes**	0.0187	0.0340	No	0	No
Groundwater[3]	Metals	Dissolved	Potassium	N/A	mg/L	--	**Yes**	12.9	53.0	No	0	No
Groundwater[3]	Metals	Dissolved	Sodium	N/A	mg/L	--	**Yes**	740	680	**Yes**	1	**Yes**

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(7 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater[3]	Metals	Dissolved	Zinc	N/A	mg/L	--	**Yes**	0.197	0.077	**Yes**	1	**Yes**
Groundwater[3]	Metals	Total	Antimony	N/A	mg/L	--	**Yes**	0.00389	0.00560	No	0	No
Groundwater[3]	Metals	Total	Arsenic	N/A	mg/L	**Yes**	**Yes**	0.0213	0.0000180	**Yes**	43	**Yes**
Groundwater[3]	Metals	Total	Barium	N/A	mg/L	--	**Yes**	0.304	1.00	No	0	No
Groundwater[3]	Metals	Total	Beryllium	N/A	mg/L	--	**Yes**	0.000435	0.0730	No	0	No
Groundwater[3]	Metals	Total	Cadmium	N/A	mg/L	--	**Yes**	0.00560	0.0180	No	0	No
Groundwater[3]	Metals	Total	Chromium	N/A	mg/L	--	**Yes**	0.0185	55.0	No	0	No
Groundwater[3]	Metals	Total	Copper	N/A	mg/L	--	**Yes**	0.201	1.30	No	0	No
Groundwater[3]	Metals	Total	Iron	N/A	mg/L	**Yes**	**Yes**	42.9	0.300	**Yes**	34	**Yes**
Groundwater[3]	Metals	Total	Lead	N/A	mg/L	**Yes**	**Yes**	0.0782	0.0150	**Yes**	2	**Yes**
Groundwater[3]	Metals	Total	Manganese	N/A	mg/L	**Yes**	**Yes**	5.38	0.0500	**Yes**	35	**Yes**
Groundwater[3]	Metals	Total	Mercury	N/A	mg/L	**Yes**	**Yes**	0.000330	0.0110	No	0	No
Groundwater[3]	Metals	Total	Nickel	N/A	mg/L	--	**Yes**	0.117	0.610	No	0	No
Groundwater[3]	Metals	Total	Selenium	N/A	mg/L	--	**Yes**	0.0329	0.170	No	0	No
Groundwater[3]	Metals	Total	Silver	N/A	mg/L	--	**Yes**	0.000658	0.180	No	0	No
Groundwater[3]	Metals	Total	Thallium	N/A	mg/L	--	**Yes**	0.000323	0.000240	**Yes**	2	**Yes**
Groundwater[3]	Metals	Total	Zinc	N/A	mg/L	--	**Yes**	2.66	7.40	No	0	No
Groundwater[3]	Butyltins	Total	Dibutyltin	N/A	ug/L	**Yes**	--	0.447	0.0630	**Yes**	6	**Yes**
Groundwater[3]	Butyltins	Total	Monobutyltin	N/A	ug/L	**Yes**	--	0.240	0.0630	**Yes**	1	**Yes**
Groundwater[3]	Butyltins	Total	Tributyltin	N/A	ug/L	--	--	0.0601	0.0630	No	0	No
Groundwater[3]	Herbicides	Total	4-Nitrophenol	N/A	ug/L	--	--	0.840	150	No	0	No
Groundwater[3]	Herbicides	Total	Dichloroprop	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	Herbicides	Total	Pentachlorophenol	N/A	ug/L	--	--	0.112	0.270	No	0	No
Groundwater[3]	Pesticides	Total	4,4'-DDE	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	Pesticides	Total	Dieldrin	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	NWTPH-Dx	Total	Diesel Range Organics	N/A	mg/L	**Yes**	--	1.80	0.0900	**Yes**	30	**Yes**
Groundwater[3]	NWTPH-Dx	Total	Residual Range Organics	N/A	mg/L	**Yes**	--	1.90	0.290	**Yes**	12	**Yes**
Groundwater[3]	NWTPH-Gx	Total	Gasoline Range Organics	N/A	mg/L	**Yes**	--	0.430	0.100	**Yes**	5	**Yes**
Groundwater[3]	SVOCs	Total	1,4-Dichlorobenzene	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	2-Methylnaphthalene	N/A	ug/L	**Yes**	--	0.360	72.2	No	0	No
Groundwater[3]	SVOCs	Total	2-Methylphenol	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Acenaphthene	N/A	ug/L	**Yes**	--	0.239	520	No	0	No
Groundwater[3]	SVOCs	Total	Anthracene	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Benzoic Acid	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	N/A	ug/L	**Yes**	--	48.0	1.20	**Yes**	6	**Yes**
Groundwater[3]	SVOCs	Total	Diethyl Phthalate	N/A	ug/L	**Yes**	--	1.90	210	No	0	No
Groundwater[3]	SVOCs	Total	Dimethyl Phthalate	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Di-n-octyl Phthalate	N/A	ug/L	**Yes**	--	7.08	1.20	**Yes**	3	**Yes**
Groundwater[3]	SVOCs	Total	Isophorone	N/A	ug/L	**Yes**	--	0.282	35.0	No	0	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(8 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater[3]	SVOCs	Total	Naphthalene	N/A	ug/L	**Yes**	--	0.157	0.140	**Yes**	1	**Yes**
Groundwater[3]	SVOCs	Total	p-cresol (4-Methylphenol)	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Phenanthrene	N/A	ug/L	**Yes**	--	3.90	0.140	**Yes**	4	**Yes**
Groundwater[3]	SVOCs	Total	Phenol	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Pyrene	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	1,2,4-Trimethylbenzene	N/A	ug/L	**Yes**	--	5.20	7.30	No	0	No
Groundwater[3]	VOCs	Total	4-Methyl-2-pentanone (MIBK)	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Acetone	N/A	ug/L	**Yes**	--	15.4	1,500	No	0	No
Groundwater[3]	VOCs	Total	Carbon Disulfide	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Carbon Tetrachloride	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Chloroform	N/A	ug/L	**Yes**	--	3.70	0.190	**Yes**	7	**Yes**
Groundwater[3]	VOCs	Total	cis-1,2-Dichloroethene	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Ethylbenzene	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Isopropylbenzene	N/A	ug/L	**Yes**	--	4.60	7.30	No	0	No
Groundwater[3]	VOCs	Total	n-Propylbenzene	N/A	ug/L	**Yes**	--	2.00	7.30	No	0	No
Groundwater[3]	VOCs	Total	Tetrachloroethene (PCE)	N/A	ug/L	**Yes**	--	8.78	0.0930	**Yes**	13	**Yes**
Groundwater[3]	VOCs	Total	Vinyl Chloride	N/A	ug/L	**Yes**	--	0.955	0.0250	**Yes**	16	**Yes**
Seep Water[3]	Metals	Dissolved	Antimony	N/A	mg/L	--	**Yes**	0.00228	0.00560	No	0	No
Seep Water[3]	Metals	Dissolved	Arsenic	N/A	mg/L	--	No	--	--	--	--	No
Seep Water[3]	Metals	Dissolved	Barium	N/A	mg/L	--	**Yes**	0.277	0.00400	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Calcium	N/A	mg/L	--	**Yes**	76.4	116	No	0	No
Seep Water[3]	Metals	Dissolved	Copper	N/A	mg/L	--	**Yes**	0.00109	0.00580	No	0	No
Seep Water[3]	Metals	Dissolved	Iron	N/A	mg/L	--	**Yes**	3.21	0.300	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Lead	N/A	mg/L	--	**Yes**	0.0000650	0.00144	No	0	No
Seep Water[3]	Metals	Dissolved	Magnesium	N/A	mg/L	--	**Yes**	16.6	82.0	No	0	No
Seep Water[3]	Metals	Dissolved	Manganese	N/A	mg/L	--	**Yes**	1.48	0.0500	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Nickel	N/A	mg/L	--	**Yes**	0.00222	0.0340	No	0	No
Seep Water[3]	Metals	Dissolved	Potassium	N/A	mg/L	--	No	--	--	--	--	No
Seep Water[3]	Metals	Dissolved	Sodium	N/A	mg/L	--	**Yes**	19.7	680	No	0	No
Seep Water[3]	Metals	Dissolved	Zinc	N/A	mg/L	--	**Yes**	0.0856	0.077	**Yes**	1	**Yes**
Seep Water[3]	Metals	Total	Arsenic	N/A	mg/L	--	**Yes**	0.0128	0.0000180	**Yes**	4	**Yes**
Seep Water[3]	Metals	Total	Barium	N/A	mg/L	--	**Yes**	0.0742	1.00	No	0	No
Seep Water[3]	Metals	Total	Chromium	N/A	mg/L	--	No	--	--	--	--	No
Seep Water[3]	Metals	Total	Copper	N/A	mg/L	--	**Yes**	0.00272	1.30	No	0	No
Seep Water[3]	Metals	Total	Iron	N/A	mg/L	--	**Yes**	121	0.300	**Yes**	4	**Yes**
Seep Water[3]	Metals	Total	Lead	N/A	mg/L	--	**Yes**	0.0257	0.0150	**Yes**	1	**Yes**
Seep Water[3]	Metals	Total	Manganese	N/A	mg/L	--	**Yes**	3.24	0.0500	**Yes**	3	**Yes**
Seep Water[3]	Metals	Total	Mercury	N/A	mg/L	--	No	--	--	--	--	No
Seep Water[3]	Metals	Total	Nickel	N/A	mg/L	--	No	--	--	--	--	No

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(9 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?^{1}	Significantly Higher Conc in AOPC than Reference?^{2}	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Seep Water^3	Metals	Total	Selenium	N/A	mg/L	--	**Yes**	0.00111	0.170	No	0	No
Seep Water^3	NWTPH-Dx	Total	Diesel Range Organics	N/A	mg/L	--	--	0.130	0.0900	**Yes**	1	**Yes**
Seep Water^3	NWTPH-Dx	Total	Residual Range Organics	N/A	mg/L	--	--	0.130	0.290	No	0	No
Seep Water^3	SVOCs	Total	Benzoic Acid	N/A	ug/L	--	--	5.90	42.0	No	0	No
Seep Water^3	VOCs	Total	Chloroform	N/A	ug/L	--	--	2.80	0.190	**Yes**	2	**Yes**
Seep Water^3	VOCs	Total	Tetrachloroethene (PCE)	N/A	ug/L	--	--	4.40	0.0930	**Yes**	3	**Yes**
Surface Water^3	Metals	Dissolved	Arsenic	N/A	mg/L	--	--	0.00101	0.0000180	**Yes**	4	**Yes**
Surface Water^3	Metals	Dissolved	Calcium	N/A	mg/L	--	--	20.5	116	No	0	No
Surface Water^3	Metals	Dissolved	Iron	N/A	mg/L	--	--	0.00920	0.300	No	0	No
Surface Water^3	Metals	Dissolved	Lead	N/A	mg/L	--	--	0.0000160	0.00144	No	0	No
Surface Water^3	Metals	Dissolved	Magnesium	N/A	mg/L	--	--	6.33	82.0	No	0	No
Surface Water^3	Metals	Dissolved	Manganese	N/A	mg/L	--	--	0.00101	0.0500	No	0	No
Surface Water^3	Metals	Dissolved	Potassium	N/A	mg/L	--	--	1.51	53.0	No	0	No
Surface Water^3	Metals	Dissolved	Sodium	N/A	mg/L	--	--	7.90	680	No	0	No
Surface Water^3	Metals	Total	Arsenic	N/A	mg/L	--	--	0.00117	0.0000180	**Yes**	3	**Yes**
Surface Water^3	Metals	Total	Iron	N/A	mg/L	--	--	0.446	0.300	**Yes**	1	**Yes**
Surface Water^3	Metals	Total	Lead	N/A	mg/L	--	--	0.000407	0.0150	No	0	No
Surface Water^3	Metals	Total	Manganese	N/A	mg/L	--	--	0.0136	0.0500	No	0	No
Surface Water^3	NWTPH-Dx	Total	Diesel Range Organics	N/A	mg/L	--	--	0.0300	0.0900	No	0	No

Notes

(1) Only evaluated for analytes with a sample size of 20 or more. See the Data Summary for the Landfill AOPC - Appendix I, Table I-1.

(2) Only applicable to inorganics. For soils, see the statistical comparison of Site soil concentrations to Reference Area concentrations; Appendix L, Tables L-1 and L-2.
For groundwater and seep water, see Table 8-3 and Appendix L, Table L-3.

(3) The groundwater, seep water, and surface water SLVs are the lower of the Direct Contact Water SLV and the Discharge to Surface Water-Bioaccumulative SLV; see Appendix J.

Table 9-1
Preliminary-COPC Identification for Landfill AOPC Data
Bradford Island - Upland Operable Unit
(10 of 10)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?

'--' = Not evaluated
% = percent
BHC = hexachlorocyclohexane
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
NV = No Value
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
VOC = volatile organic carbon

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(1 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Aluminum	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	0.270	**Yes**	36	**Yes**
Soil	Metals	Total	Arsenic	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	25	**Yes**
Soil	Metals	Total	Barium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	0.360	**Yes**	48	**Yes**
Soil	Metals	Total	Chromium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	42	**Yes**
Soil	Metals	Total	Cobalt	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-1 ft	<250um	mg/kg	--	**Yes**	921	25.5	**Yes**	8	**Yes**
Soil	Metals	Total	Lead	0-1 ft	<2mm	mg/kg	--	**Yes**	768	25.5	**Yes**	8	**Yes**
Soil	Metals	Total	Lead	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	25.5	**Yes**	56	**Yes**
Soil	Metals	Total	Manganese	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Nickel	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	1,060	38	**Yes**	32	**Yes**
Soil	Metals	Total	Selenium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	0.520	**Yes**	17	**Yes**
Soil	Metals	Total	Silver	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	0.431	4.20	No	0	No
Soil	Metals	Total	Thallium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	71.7	**Yes**	42	**Yes**
Soil	Metals	Total	Aluminum	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	0.270	**Yes**	44	**Yes**
Soil	Metals	Total	Arsenic	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	34	**Yes**
Soil	Metals	Total	Barium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	0.360	**Yes**	58	**Yes**
Soil	Metals	Total	Chromium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	49	**Yes**
Soil	Metals	Total	Cobalt	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-3 ft	<250um	mg/kg	--	**Yes**	921	25.5	**Yes**	10	**Yes**
Soil	Metals	Total	Lead	0-3 ft	<2mm	mg/kg	--	**Yes**	768	25.5	**Yes**	9	**Yes**
Soil	Metals	Total	Lead	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	25.5	**Yes**	65	**Yes**
Soil	Metals	Total	Manganese	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Nickel	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	1,060	38	**Yes**	34	**Yes**
Soil	Metals	Total	Selenium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	0.520	**Yes**	26	**Yes**
Soil	Metals	Total	Silver	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	0.431	4.20	No	0	No
Soil	Metals	Total	Thallium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	71.7	**Yes**	47	**Yes**
Soil	Metals	Total	Aluminum	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	410	No	0	No
Soil	Metals	Total	Arsenic	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	35	**Yes**
Soil	Metals	Total	Barium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	150	No	0	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(2 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Chromium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	50	**Yes**
Soil	Metals	Total	Cobalt	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-10 ft	<250um	mg/kg	--	**Yes**	921	800	**Yes**	1	**Yes**
Soil	Metals	Total	Lead	0-10 ft	<2mm	mg/kg	--	**Yes**	768	800	No	0	No
Soil	Metals	Total	Lead	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	800	**Yes**	6	**Yes**
Soil	Metals	Total	Manganese	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Nickel	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	1,060	6,100	No	0	No
Soil	Metals	Total	Selenium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	5,100	No	0	No
Soil	Metals	Total	Silver	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	0.431	1,500	No	0	No
Soil	Metals	Total	Thallium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	310,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-1 ft	N/A	ug/kg	**Yes**	--	210	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-1 ft	N/A	ug/kg	**Yes**	--	108	28,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-1 ft	N/A	ug/kg	**Yes**	--	1,860	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-3 ft	N/A	ug/kg	**Yes**	--	210	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-3 ft	N/A	ug/kg	**Yes**	--	108	28,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-3 ft	N/A	ug/kg	**Yes**	--	1,860	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-10 ft	N/A	ug/kg	**Yes**	--	210	180,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-10 ft	N/A	ug/kg	**Yes**	--	108	180,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-10 ft	N/A	ug/kg	**Yes**	--	1,860	180,000	No	0	No
Soil	Pesticides	Total	4,4'-DDD	0-1 ft	N/A	ug/kg	**Yes**	--	0.990	21.0	No	0	No
Soil	Pesticides	Total	4,4'-DDE	0-1 ft	N/A	ug/kg	**Yes**	--	2.44	21.0	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-1 ft	N/A	ug/kg	**Yes**	--	140	21.0	**Yes**	7	**Yes**
Soil	Pesticides	Total	Aldrin	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-1 ft	N/A	ug/kg	**Yes**	--	3.03	340	No	0	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-1 ft	N/A	ug/kg	**Yes**	--	9.68	2,000	No	0	No
Soil	Pesticides	Total	Chlordane (alpha)	0-1 ft	N/A	ug/kg	--	--	1.50	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-1 ft	N/A	ug/kg	--	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-1 ft	N/A	ug/kg	**Yes**	--	0.823	4.90	No	0	No
Soil	Pesticides	Total	Endosulfan I	0-1 ft	N/A	ug/kg	**Yes**	--	6.45	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan II	0-1 ft	N/A	ug/kg	**Yes**	--	1.99	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-1 ft	N/A	ug/kg	**Yes**	--	3.30	20,000	No	0	No
Soil	Pesticides	Total	Endrin	0-1 ft	N/A	ug/kg	**Yes**	--	17.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Aldehyde	0-1 ft	N/A	ug/kg	**Yes**	--	16.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Ketone	0-1 ft	N/A	ug/kg	**Yes**	--	13.0	4.90	**Yes**	1	**Yes**
Soil	Pesticides	Total	Heptachlor	0-1 ft	N/A	ug/kg	**Yes**	--	2.90	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-1 ft	N/A	ug/kg	**Yes**	--	1.20	500,000	No	0	No
Soil	Pesticides	Total	4,4'-DDD	0-3 ft	N/A	ug/kg	**Yes**	--	0.990	21.0	No	0	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(3 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Pesticides	Total	4,4'-DDE	0-3 ft	N/A	ug/kg	**Yes**	--	2.44	21.0	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-3 ft	N/A	ug/kg	**Yes**	--	140	21.0	**Yes**	8	**Yes**
Soil	Pesticides	Total	Aldrin	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-3 ft	N/A	ug/kg	**Yes**	--	3.03	340	No	0	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-3 ft	N/A	ug/kg	**Yes**	--	9.68	2,000	No	0	No
Soil	Pesticides	Total	Chlordane (alpha)	0-3 ft	N/A	ug/kg	**Yes**	--	1.50	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-3 ft	N/A	ug/kg	**Yes**	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-3 ft	N/A	ug/kg	**Yes**	--	0.823	4.90	No	0	No
Soil	Pesticides	Total	Endosulfan I	0-3 ft	N/A	ug/kg	**Yes**	--	6.45	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan II	0-3 ft	N/A	ug/kg	**Yes**	--	1.99	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-3 ft	N/A	ug/kg	**Yes**	--	3.30	20,000	No	0	No
Soil	Pesticides	Total	Endrin	0-3 ft	N/A	ug/kg	**Yes**	--	17.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Aldehyde	0-3 ft	N/A	ug/kg	**Yes**	--	16.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Ketone	0-3 ft	N/A	ug/kg	**Yes**	--	13.0	4.90	**Yes**	1	**Yes**
Soil	Pesticides	Total	Heptachlor	0-3 ft	N/A	ug/kg	**Yes**	--	2.90	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-3 ft	N/A	ug/kg	**Yes**	--	1.20	500,000	No	0	No
Soil	Pesticides	Total	4,4'-DDD	0-10 ft	N/A	ug/kg	**Yes**	--	0.990	11,000	No	0	No
Soil	Pesticides	Total	4,4'-DDE	0-10 ft	N/A	ug/kg	**Yes**	--	2.44	7,700	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-10 ft	N/A	ug/kg	**Yes**	--	140	7,700	No	0	No
Soil	Pesticides	Total	Aldrin	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-10 ft	N/A	ug/kg	**Yes**	--	3.03	340	No	0	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-10 ft	N/A	ug/kg	**Yes**	--	9.68	2,000	No	0	No
Soil	Pesticides	Total	Chlordane (alpha)	0-10 ft	N/A	ug/kg	**Yes**	--	1.50	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-10 ft	N/A	ug/kg	**Yes**	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-10 ft	N/A	ug/kg	**Yes**	--	0.823	130	No	0	No
Soil	Pesticides	Total	Endosulfan I	0-10 ft	N/A	ug/kg	**Yes**	--	6.45	1,400,000	No	0	No
Soil	Pesticides	Total	Endosulfan II	0-10 ft	N/A	ug/kg	**Yes**	--	1.99	1,400,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-10 ft	N/A	ug/kg	**Yes**	--	3.30	1,400,000	No	0	No
Soil	Pesticides	Total	Endrin	0-10 ft	N/A	ug/kg	**Yes**	--	17.0	71,000	No	0	No
Soil	Pesticides	Total	Endrin Aldehyde	0-10 ft	N/A	ug/kg	**Yes**	--	16.0	71,000	No	0	No
Soil	Pesticides	Total	Endrin Ketone	0-10 ft	N/A	ug/kg	**Yes**	--	13.0	71,000	No	0	No
Soil	Pesticides	Total	Heptachlor	0-10 ft	N/A	ug/kg	**Yes**	--	2.90	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-10 ft	N/A	ug/kg	**Yes**	--	1.20	3,100,000	No	0	No
Soil	PCB Aroclors	Total	Aroclor 1254	0-1 ft	N/A	ug/kg	**Yes**	--	1,700	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-1 ft	N/A	ug/kg	**Yes**	--	690	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-1 ft	N/A	ug/kg	**Yes**	--	2,140	371	**Yes**	6	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1254	0-3 ft	N/A	ug/kg	**Yes**	--	1,700	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-3 ft	N/A	ug/kg	**Yes**	--	690	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-3 ft	N/A	ug/kg	**Yes**	--	2,140	371	**Yes**	6	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1254	0-10 ft	N/A	ug/kg	**Yes**	--	1,700	740	**Yes**	2	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-10 ft	N/A	ug/kg	**Yes**	--	690	740	No	0	No
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-10 ft	N/A	ug/kg	**Yes**	--	2,140	740	**Yes**	3	**Yes**

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(4 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	1,090	23,000	No	0	No
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	3.49	13,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	2,300	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	1,440	23,000	No	0	No
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	3,960	13,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	2,300	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	1,440	23,000	No	0	No
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	3,960	13,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	2,300	40,000	No	0	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	150	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-1 ft	N/A	ug/kg	**Yes**	--	470	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-1 ft	N/A	ug/kg	**Yes**	--	87.7	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	832	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	6,440	2,700	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	6,470	270	**Yes**	13	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-1 ft	N/A	ug/kg	--	--	4,100	2,700	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-1 ft	N/A	ug/kg	**Yes**	--	3,830	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-1 ft	N/A	ug/kg	--	--	1,400	27,000	No	0	No
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-1 ft	N/A	ug/kg	--	--	12,100	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-1 ft	N/A	ug/kg	**Yes**	--	980	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	260,000	4,500	**Yes**	8	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	124	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-1 ft	N/A	ug/kg	**Yes**	--	530	2,260	No	0	No
Soil	SVOCs	Total	Chrysene	0-1 ft	N/A	ug/kg	**Yes**	--	7,590	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	1,430	270	**Yes**	5	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-1 ft	N/A	ug/kg	**Yes**	--	220	2.00	**Yes**	16	**Yes**
Soil	SVOCs	Total	Diethyl Phthalate	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Dimethyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	41.0	150,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	280	450	No	0	No
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	127	450	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-1 ft	N/A	ug/kg	**Yes**	--	20,700	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-1 ft	N/A	ug/kg	**Yes**	--	462	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	3,910	2,700	**Yes**	1	**Yes**
Soil	SVOCs	Total	Naphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	227	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-1 ft	N/A	ug/kg	**Yes**	--	32.0	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-1 ft	N/A	ug/kg	**Yes**	--	4,000	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-1 ft	N/A	ug/kg	**Yes**	--	3.70	30,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	21,900	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-1 ft	N/A	ug/kg	**Yes**	--	72,270	1,100	**Yes**	15	**Yes**
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-1 ft	N/A	ug/kg	**Yes**	--	5,687	29,000	No	0	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-3 ft	N/A	ug/kg	**Yes**	--	150	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-3 ft	N/A	ug/kg	**Yes**	--	3,200	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-3 ft	N/A	ug/kg	**Yes**	--	295	23,000	No	0	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(5 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	2,040	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	12,300	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	11,700	270	**Yes**	15	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-3 ft	N/A	ug/kg	--	--	4,100	2,700	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-3 ft	N/A	ug/kg	**Yes**	--	3,830	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-3 ft	N/A	ug/kg	--	--	1,400	27,000	No	0	No
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-3 ft	N/A	ug/kg	**Yes**	--	16,300	2,700	**Yes**	4	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-3 ft	N/A	ug/kg	**Yes**	--	980	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	260,000	4,500	**Yes**	10	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	124	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-3 ft	N/A	ug/kg	**Yes**	--	530	2,260	No	0	No
Soil	SVOCs	Total	Chrysene	0-3 ft	N/A	ug/kg	**Yes**	--	12,000	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	1,430	270	**Yes**	7	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-3 ft	N/A	ug/kg	**Yes**	--	485	2.00	**Yes**	19	**Yes**
Soil	SVOCs	Total	Diethyl Phthalate	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Dimethyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	41.0	150,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	280	450	No	0	No
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	127	450	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-3 ft	N/A	ug/kg	**Yes**	--	28,600	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-3 ft	N/A	ug/kg	**Yes**	--	779	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	4,170	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Naphthalene	0-3 ft	N/A	ug/kg	**Yes**	--	256	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-3 ft	N/A	ug/kg	**Yes**	--	32.0	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-3 ft	N/A	ug/kg	**Yes**	--	6,550	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-3 ft	N/A	ug/kg	**Yes**	--	35.0	30,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	32,000	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-3 ft	N/A	ug/kg	**Yes**	--	105,200	1,100	**Yes**	19	**Yes**
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-3 ft	N/A	ug/kg	**Yes**	--	13,120	29,000	No	0	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	150	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-10 ft	N/A	ug/kg	**Yes**	--	3,200	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-10 ft	N/A	ug/kg	**Yes**	--	295	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	2,040	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	12,300	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	11,700	270	**Yes**	15	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-10 ft	N/A	ug/kg	--	--	4,100	2,700	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-10 ft	N/A	ug/kg	**Yes**	--	3,830	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-10 ft	N/A	ug/kg	--	--	1,400	27,000	No	0	No
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-10 ft	N/A	ug/kg	**Yes**	--	16,300	2,700	**Yes**	4	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-10 ft	N/A	ug/kg	**Yes**	--	980	2,500,000,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	260,000	150,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	124	910,000	No	0	No
Soil	SVOCs	Total	Carbazole	0-10 ft	N/A	ug/kg	**Yes**	--	530	NV	***Yes***	--	***Yes***

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(6 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Chrysene	0-10 ft	N/A	ug/kg	**Yes**	--	12,000	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	1,430	270	**Yes**	7	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-10 ft	N/A	ug/kg	**Yes**	--	485	1,000,000	No	0	No
Soil	SVOCs	Total	Diethyl Phthalate	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Dimethyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	41.0	150,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	280	62,000,000	No	0	No
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	127	150,000	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-10 ft	N/A	ug/kg	**Yes**	--	28,600	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-10 ft	N/A	ug/kg	**Yes**	--	779	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	4,170	2,700	**Yes**	2	**Yes**
Soil	SVOCs	Total	Naphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	256	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Phenanthrene	0-10 ft	N/A	ug/kg	**Yes**	--	6,550	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-10 ft	N/A	ug/kg	**Yes**	--	35.0	180,000,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	32,000	6,700,000	No	0	No
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-1 ft	N/A	ug/kg	**Yes**	--	0.580	38,000,000	No	0	No
Soil	VOCs	Total	1,1-Dichloroethane	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	0.523	200,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	0.125	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-1 ft	N/A	ug/kg	**Yes**	--	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-1 ft	N/A	ug/kg	**Yes**	--	8.80	1,250,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-1 ft	N/A	ug/kg	**Yes**	--	12.0	200,000	No	0	No
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-1 ft	N/A	ug/kg	**Yes**	--	1.20	1,250,000	No	0	No
Soil	VOCs	Total	Acetone	0-1 ft	N/A	ug/kg	**Yes**	--	540	1,250,000	No	0	No
Soil	VOCs	Total	Benzene	0-1 ft	N/A	ug/kg	**Yes**	--	1.20	1,200	No	0	No
Soil	VOCs	Total	Bromomethane	0-1 ft	N/A	ug/kg	**Yes**	--	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-1 ft	N/A	ug/kg	**Yes**	--	6.90	1,000,000	No	0	No
Soil	VOCs	Total	Chloroform	0-1 ft	N/A	ug/kg	**Yes**	--	19.0	410	No	0	No
Soil	VOCs	Total	Chloromethane	0-1 ft	N/A	ug/kg	**Yes**	--	0.250	300,000	No	0	No
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-1 ft	N/A	ug/kg	**Yes**	--	94.0	730,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-1 ft	N/A	ug/kg	**Yes**	--	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	0.320	2,260	No	0	No
Soil	VOCs	Total	Isopropylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-1 ft	N/A	ug/kg	**Yes**	--	0.440	120,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	1.50	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	o-Xylene	0-1 ft	N/A	ug/kg	**Yes**	--	0.180	1,000	No	0	No
Soil	VOCs	Total	sec-Butylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-1 ft	N/A	ug/kg	**Yes**	--	3.10	1,600	No	0	No
Soil	VOCs	Total	Toluene	0-1 ft	N/A	ug/kg	**Yes**	--	5.80	200,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(7 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	VOCs	Total	Trichloroethene (TCE)	0-1 ft	N/A	ug/kg	**Yes**	**--**	0.171	130	No	0	No
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1-Dichloroethane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	**--**	14,300	200,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	**--**	6,500	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-3 ft	N/A	ug/kg	**Yes**	**--**	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-3 ft	N/A	ug/kg	**Yes**	**--**	8.80	1,250,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-3 ft	N/A	ug/kg	**Yes**	**--**	161	200,000	No	0	No
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-3 ft	N/A	ug/kg	**Yes**	**--**	1.20	1,250,000	No	0	No
Soil	VOCs	Total	Acetone	0-3 ft	N/A	ug/kg	**Yes**	**--**	540	1,250,000	No	0	No
Soil	VOCs	Total	Benzene	0-3 ft	N/A	ug/kg	**Yes**	**--**	1.20	1,200	No	0	No
Soil	VOCs	Total	Bromomethane	0-3 ft	N/A	ug/kg	**Yes**	**--**	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-3 ft	N/A	ug/kg	**Yes**	**--**	6.90	1,000,000	No	0	No
Soil	VOCs	Total	Chloroform	0-3 ft	N/A	ug/kg	**Yes**	**--**	19.0	410	No	0	No
Soil	VOCs	Total	Chloromethane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-3 ft	N/A	ug/kg	**Yes**	**--**	94.0	730,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-3 ft	N/A	ug/kg	**Yes**	**--**	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	**--**	37.4	2,260	No	0	No
Soil	VOCs	Total	Isopropylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-3 ft	N/A	ug/kg	**Yes**	**--**	7,400	120,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-3 ft	N/A	ug/kg	**Yes**	**--**	19.5	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-3 ft	N/A	ug/kg	**Yes**	**--**	122	2,260	No	0	No
Soil	VOCs	Total	o-Xylene	0-3 ft	N/A	ug/kg	**Yes**	**--**	3,200	1,000	**Yes**	1	**Yes**
Soil	VOCs	Total	sec-Butylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-3 ft	N/A	ug/kg	**Yes**	**--**	420,000	1,600	**Yes**	2	**Yes**
Soil	VOCs	Total	Toluene	0-3 ft	N/A	ug/kg	**Yes**	**--**	39,000	200,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Trichloroethene (TCE)	0-3 ft	N/A	ug/kg	**Yes**	**--**	6,080	130	**Yes**	2	**Yes**
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-10 ft	N/A	ug/kg	**Yes**	**--**	0.580	38,000,000	No	0	No
Soil	VOCs	Total	1,1-Dichloroethane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	**--**	14,300	980,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	**--**	6,500	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-10 ft	N/A	ug/kg	**Yes**	**--**	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-10 ft	N/A	ug/kg	**Yes**	**--**	8.80	1,400,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-10 ft	N/A	ug/kg	**Yes**	**--**	161	NV	***Yes***	--	***Yes***
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-10 ft	N/A	ug/kg	**Yes**	**--**	1.20	53,000,000	No	0	No
Soil	VOCs	Total	Acetone	0-10 ft	N/A	ug/kg	**Yes**	**--**	540	630,000,000	No	0	No
Soil	VOCs	Total	Benzene	0-10 ft	N/A	ug/kg	**Yes**	**--**	1.20	1,200	No	0	No
Soil	VOCs	Total	Bromomethane	0-10 ft	N/A	ug/kg	**Yes**	**--**	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-10 ft	N/A	ug/kg	**Yes**	**--**	6.90	3,700,000	No	0	No
Soil	VOCs	Total	Chloroform	0-10 ft	N/A	ug/kg	**Yes**	**--**	19.0	410	No	0	No
Soil	VOCs	Total	Chloromethane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(8 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-10 ft	N/A	ug/kg	**Yes**	--	120	3,100,000	No	0	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-10 ft	N/A	ug/kg	**Yes**	--	94.0	780,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-10 ft	N/A	ug/kg	**Yes**	--	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	--	37.4	12,000	No	0	No
Soil	VOCs	Total	Isopropylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-10 ft	N/A	ug/kg	**Yes**	--	7,400	2,700,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	19.5	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-10 ft	N/A	ug/kg	**Yes**	--	122	21,000,000	No	0	No
Soil	VOCs	Total	o-Xylene	0-10 ft	N/A	ug/kg	**Yes**	--	3,200	19,000,000	No	0	No
Soil	VOCs	Total	sec-Butylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-10 ft	N/A	ug/kg	**Yes**	--	420,000	1,600	**Yes**	2	**Yes**
Soil	VOCs	Total	Toluene	0-10 ft	N/A	ug/kg	**Yes**	--	39,000	24,000,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Trichloroethene (TCE)	0-10 ft	N/A	ug/kg	**Yes**	--	6,080	130	**Yes**	2	**Yes**
Groundwater[3]	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	**Yes**	**Yes**	0.00899	0.000018	**Yes**	20	**Yes**
Groundwater[3]	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	**Yes**	44.3	116	No	0	No
Groundwater[3]	Metals	Dissolved	Iron	N/A	N/A	mg/L	**Yes**	**Yes**	0.270	0.300	No	0	No
Groundwater[3]	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	**Yes**	14.0	82.0	No	0	No
Groundwater[3]	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	No	--	--	--	--	No
Groundwater[3]	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	**Yes**	89.4	680	No	0	No
Groundwater[3]	Metals	Dissolved	Vanadium	N/A	N/A	mg/L	**Yes**	**Yes**	0.00310	0.00260	**Yes**	1	**Yes**
Groundwater[3]	Metals	Total	Arsenic	N/A	N/A	mg/L	**Yes**	**Yes**	0.0116	0.000018	**Yes**	20	**Yes**
Groundwater[3]	Metals	Total	Iron	N/A	N/A	mg/L	**Yes**	**Yes**	1.50	0.300	**Yes**	2	**Yes**
Groundwater[3]	Metals	Total	Vanadium	N/A	N/A	mg/L	**Yes**	**Yes**	0.00590	0.00260	**Yes**	1	**Yes**
Groundwater[3]	Butyltins	Total	Monobutyltin	N/A	N/A	ug/L	**Yes**	--	0.0260	0.0630	No	0	No
Groundwater[3]	NWTPH-Dx	Total	Diesel Range Organics	N/A	N/A	mg/L	**Yes**	--	0.0180	0.0900	No	0	No
Groundwater[3]	NWTPH-Gx	Total	Gasoline Range Organics	N/A	N/A	mg/L	**Yes**	--	0.0235	0.100	No	0	No
Groundwater[3]	SVOCs	Total	Benzo(b)fluoranthene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Phenanthrene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/L	**Yes**	--	1.90	11.0	No	0	No
Groundwater[3]	VOCs	Total	1,1-Dichloroethane	N/A	N/A	ug/L	**Yes**	--	5.00	2.30	**Yes**	1	**Yes**
Groundwater[3]	VOCs	Total	1,1-Dichloroethene	N/A	N/A	ug/L	**Yes**	--	2.10	25.0	No	0	No
Groundwater[3]	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/L	--	--	0.255	0.920	No	0	No
Groundwater[3]	VOCs	Total	Chloroform	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/L	**Yes**	--	660	360	**Yes**	4	**Yes**
Groundwater[3]	VOCs	Total	Dichloromethane (Methylene Chloride)	N/A	N/A	ug/L	--	--	0.175	4.40	No	0	No
Groundwater[3]	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/L	**Yes**	--	6.20	0.0930	**Yes**	16	**Yes**
Groundwater[3]	VOCs	Total	Toluene	N/A	N/A	ug/L	--	--	0.640	9.8	No	0	No
Groundwater[3]	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/L	--	--	1.70	110	No	0	No
Groundwater[3]	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/L	**Yes**	--	3.40	0.039	**Yes**	15	**Yes**
Groundwater[3]	VOCs	Total	Vinyl Chloride	N/A	N/A	ug/L	**Yes**	--	4.10	0.025	**Yes**	4	**Yes**

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(9 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	Metals	Dissolved	Aluminum	N/A	N/A	mg/L	--	--	1.37	0.0870	**Yes**	2	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Antimony	N/A	N/A	mg/L	--	--	0.00167	0.00560	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	--	--	0.00136	0.0000180	**Yes**	10	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Barium	N/A	N/A	mg/L	--	--	0.0207	0.00400	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Cadmium	N/A	N/A	mg/L	--	--	0.0000300	0.000170	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	--	34.1	116	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Chromium	N/A	N/A	mg/L	--	--	0.00429	0.0540	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Cobalt	N/A	N/A	mg/L	--	--	0.00508	0.0110	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Copper	N/A	N/A	mg/L	--	--	0.00438	0.00580	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Iron	N/A	N/A	mg/L	--	--	0.476	0.300	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Lead	N/A	N/A	mg/L	--	--	0.000378	0.00144	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	--	12.0	82.0	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Manganese	N/A	N/A	mg/L	--	--	0.587	0.0500	**Yes**	4	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Mercury	N/A	N/A	mg/L	--	--	0.0000600	0.000770	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Nickel	N/A	N/A	mg/L	--	--	0.00210	0.0340	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	--	2.21	53.0	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Selenium	N/A	N/A	mg/L	--	--	0.00130	0.00500	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Silver	N/A	N/A	mg/L	--	--	0.0000790	0.000120	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	--	47.7	680	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Thallium	N/A	N/A	mg/L	--	--	0.0000855	0.000240	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Vanadium	N/A	N/A	mg/L	--	--	0.00261	0.00260	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Zinc	N/A	N/A	mg/L	--	--	0.00348	0.077	No	0	No
Groundwater - DP[3]	Metals	Total	Aluminum	N/A	N/A	mg/L	--	--	17.9	37.0	No	0	No
Groundwater - DP[3]	Metals	Total	Antimony	N/A	N/A	mg/L	--	--	0.00157	0.00560	No	0	No
Groundwater - DP[3]	Metals	Total	Arsenic	N/A	N/A	mg/L	--	--	0.00770	0.0000180	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Total	Barium	N/A	N/A	mg/L	--	--	0.0978	1.00	No	0	No
Groundwater - DP[3]	Metals	Total	Beryllium	N/A	N/A	mg/L	--	--	0.000785	0.0730	No	0	No
Groundwater - DP[3]	Metals	Total	Calcium	N/A	N/A	mg/L	--	--	33.7	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Chromium	N/A	N/A	mg/L	--	--	0.0318	55.0	No	0	No
Groundwater - DP[3]	Metals	Total	Cobalt	N/A	N/A	mg/L	--	--	0.0131	0.0110	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Total	Copper	N/A	N/A	mg/L	--	--	0.204	1.30	No	0	No
Groundwater - DP[3]	Metals	Total	Iron	N/A	N/A	mg/L	--	--	25.9	0.300	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Total	Lead	N/A	N/A	mg/L	--	--	0.0137	0.0150	No	0	No
Groundwater - DP[3]	Metals	Total	Magnesium	N/A	N/A	mg/L	--	--	15.4	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Manganese	N/A	N/A	mg/L	--	--	0.709	0.0500	**Yes**	7	**Yes**
Groundwater - DP[3]	Metals	Total	Mercury	N/A	N/A	mg/L	--	--	0.000100	0.0110	No	0	No
Groundwater - DP[3]	Metals	Total	Nickel	N/A	N/A	mg/L	--	--	0.0214	0.610	No	0	No
Groundwater - DP[3]	Metals	Total	Potassium	N/A	N/A	mg/L	--	--	3.21	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Selenium	N/A	N/A	mg/L	--	--	0.00206	0.170	No	0	No
Groundwater - DP[3]	Metals	Total	Silver	N/A	N/A	mg/L	--	--	0.000376	0.180	No	0	No
Groundwater - DP[3]	Metals	Total	Sodium	N/A	N/A	mg/L	--	--	42.9	NV	***Yes***	--	***Yes***

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(10 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	Metals	Total	Thallium	N/A	N/A	mg/L	--	--	0.000146	0.000240	No	0	No
Groundwater - DP[3]	Metals	Total	Vanadium	N/A	N/A	mg/L	--	--	0.0776	0.00260	**Yes**	7	**Yes**
Groundwater - DP[3]	Metals	Total	Zinc	N/A	N/A	mg/L	--	--	0.0444	7.40	No	0	No
Groundwater - DP[3]	Butyltins	Total	Monobutyltin	N/A	N/A	ug/L	--	--	0.00671	0.0630	No	0	No
Groundwater - DP[3]	Butyltins	Total	Tributyltin	N/A	N/A	ug/L	--	--	0.00435	0.0630	No	0	No
Groundwater - DP[3]	Pesticides	Total	BHC (gamma) Lindane	N/A	N/A	ug/L	--	--	0.00249	0.0520	No	0	No
Groundwater - DP[3]	Pesticides	Total	Methoxychlor	N/A	N/A	ug/L	--	--	0.00521	0.0300	No	0	No
Groundwater - DP[3]	NWTPH-Dx	Total	Residual Range Organics	N/A	N/A	mg/L	--	--	0.113	0.290	No	0	No
Groundwater - DP[3]	NWTPH-Gx	Total	Gasoline Range Organics	N/A	N/A	mg/L	--	--	0.0209	0.100	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	2-Methylnaphthalene	N/A	N/A	ug/L	--	--	0.280	72.2	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Acenaphthene	N/A	N/A	ug/L	--	--	0.0348	520	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Acenaphthylene	N/A	N/A	ug/L	--	--	0.00361	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Benzo(a)pyrene	N/A	N/A	ug/L	--	--	0.00714	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Benzoic Acid	N/A	N/A	ug/L	--	--	0.317	42.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Butyl Benzyl Phthalate	N/A	N/A	ug/L	--	--	0.155	19.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Dibenz(a,h)anthracene	N/A	N/A	ug/L	--	--	0.00381	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Diethyl Phthalate	N/A	N/A	ug/L	--	--	0.101	210	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Di-n-butyl Phthalate	N/A	N/A	ug/L	--	--	0.207	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Fluorene	N/A	N/A	ug/L	--	--	0.0116	3.90	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Indeno(1,2,3-cd)pyrene	N/A	N/A	ug/L	--	--	0.00630	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Isophorone	N/A	N/A	ug/L	--	--	0.0782	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Naphthalene	N/A	N/A	ug/L	--	--	0.200	0.140	**Yes**	3	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Phenanthrene	N/A	N/A	ug/L	--	--	0.0190	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Phenol	N/A	N/A	ug/L	--	--	0.0248	110	No	0	No
Groundwater - DP[3]	SVOCs	Total	2-Methylnaphthalene	N/A	N/A	ug/L	--	--	0.153	72.2	No	0	No
Groundwater - DP[3]	SVOCs	Total	Acenaphthene	N/A	N/A	ug/L	--	--	0.0230	520	No	0	No
Groundwater - DP[3]	SVOCs	Total	Anthracene	N/A	N/A	ug/L	--	--	0.0126	13.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Benzo(a)pyrene	N/A	N/A	ug/L	--	--	0.00895	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Benzofluoranthenes, Total	N/A	N/A	ug/L	--	--	0.0173	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Benzyl Alcohol	N/A	N/A	ug/L	--	--	0.0523	8.60	No	0	No
Groundwater - DP[3]	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	N/A	N/A	ug/L	--	--	0.408	1.20	No	0	No
Groundwater - DP[3]	SVOCs	Total	Butyl Benzyl Phthalate	N/A	N/A	ug/L	--	--	0.228	19.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Dibenz(a,h)anthracene	N/A	N/A	ug/L	--	--	0.00671	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Dibenzofuran	N/A	N/A	ug/L	--	--	0.0421	3.70	No	0	No
Groundwater - DP[3]	SVOCs	Total	Di-n-butyl Phthalate	N/A	N/A	ug/L	--	--	0.239	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Fluoranthene	N/A	N/A	ug/L	--	--	0.0311	6.16	No	0	No
Groundwater - DP[3]	SVOCs	Total	Fluorene	N/A	N/A	ug/L	--	--	0.0351	3.90	No	0	No
Groundwater - DP[3]	SVOCs	Total	Indeno(1,2,3-cd)pyrene	N/A	N/A	ug/L	--	--	0.00797	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Isophorone	N/A	N/A	ug/L	--	--	0.0842	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Naphthalene	N/A	N/A	ug/L	--	--	0.0452	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Total	Phenanthrene	N/A	N/A	ug/L	--	--	0.144	0.140	**Yes**	1	**Yes**

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(11 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	SVOCs	Total	Phenol	N/A	N/A	ug/L	--	--	0.0291	110	No	0	No
Groundwater - DP[3]	SVOCs	Total	Pyrene	N/A	N/A	ug/L	--	--	0.0261	10.1	No	0	No
Groundwater - DP[3]	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/L	--	--	2.22	11.0	No	0	No
Groundwater - DP[3]	VOCs	Total	1,1-Dichloroethane	N/A	N/A	ug/L	--	--	2.52	2.30	**Yes**	1	**Yes**
Groundwater - DP[3]	VOCs	Total	1,1-Dichloroethene	N/A	N/A	ug/L	--	--	1.16	25.0	No	0	No
Groundwater - DP[3]	VOCs	Total	1,2,4-Trimethylbenzene	N/A	N/A	ug/L	--	--	0.0485	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	1,3,5-Trimethylbenzene	N/A	N/A	ug/L	--	--	0.0297	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	2,2-Dichloropropane	N/A	N/A	ug/L	--	--	0.179	0.390	No	0	No
Groundwater - DP[3]	VOCs	Total	Acetone	N/A	N/A	ug/L	--	--	3.88	1500	No	0	No
Groundwater - DP[3]	VOCs	Total	Benzene	N/A	N/A	ug/L	--	--	0.137	0.390	No	0	No
Groundwater - DP[3]	VOCs	Total	Bromoform	N/A	N/A	ug/L	--	--	0.151	4.30	No	0	No
Groundwater - DP[3]	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/L	--	--	0.0619	0.920	No	0	No
Groundwater - DP[3]	VOCs	Total	Chloroform	N/A	N/A	ug/L	--	--	0.174	0.190	No	0	No
Groundwater - DP[3]	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/L	--	--	341	360	No	0	No
Groundwater - DP[3]	VOCs	Total	Ethylbenzene	N/A	N/A	ug/L	--	--	0.0447	1.40	No	0	No
Groundwater - DP[3]	VOCs	Total	Isopropylbenzene	N/A	N/A	ug/L	--	--	0.0197	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	m,p-Xylenes	N/A	N/A	ug/L	--	--	0.132	13.0	No	0	No
Groundwater - DP[3]	VOCs	Total	Naphthalene	N/A	N/A	ug/L	--	--	0.0452	0.140	No	0	No
Groundwater - DP[3]	VOCs	Total	o-Xylene	N/A	N/A	ug/L	--	--	0.0735	350	No	0	No
Groundwater - DP[3]	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/L	--	--	54.5	0.0930	**Yes**	10	**Yes**
Groundwater - DP[3]	VOCs	Total	Toluene	N/A	N/A	ug/L	--	--	0.299	9.80	No	0	No
Groundwater - DP[3]	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/L	--	--	1.80	110	No	0	No
Groundwater - DP[3]	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/L	--	--	43.7	0.0390	**Yes**	9	**Yes**
Groundwater - DP[3]	VOCs	Total	Vinyl Chloride	N/A	N/A	ug/L	--	--	0.611	0.0250	**Yes**	2	**Yes**
Soil Gas	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/m^3	--	--	98.0	22,000,000	No	0	No
Soil Gas	VOCs	Total	1,2,4-Trimethylbenzene	N/A	N/A	ug/m^3	--	--	18,500	31,000	No	0	No
Soil Gas	VOCs	Total	1,3,5-Trimethylbenzene	N/A	N/A	ug/m^3	--	--	6,250	26,000	No	0	No
Soil Gas	VOCs	Total	1,3-Butadiene	N/A	N/A	ug/m^3	--	--	210	410	No	0	No
Soil Gas	VOCs	Total	1,4-Dioxane	N/A	N/A	ug/m^3	--	--	1.10	1,600	No	0	No
Soil Gas	VOCs	Total	2,2,4-Trimethylpentane	N/A	N/A	ug/m^3	--	--	1.80	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	2-Butanone (MEK)	N/A	N/A	ug/m^3	--	--	31.0	22,000,000	No	0	No
Soil Gas	VOCs	Total	4-Ethyltoluene	N/A	N/A	ug/m^3	--	--	9,150	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	4-Methyl-2-pentanone (MIBK)	N/A	N/A	ug/m^3	--	--	2.10	13,000,000	No	0	No
Soil Gas	VOCs	Total	Acetone	N/A	N/A	ug/m^3	--	--	97.0	140,000,000	No	0	No
Soil Gas	VOCs	Total	Benzene	N/A	N/A	ug/m^3	--	--	85.0	1,600	No	0	No
Soil Gas	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/m^3	--	--	42.0	3,100,000	No	0	No
Soil Gas	VOCs	Total	Chloroform	N/A	N/A	ug/m^3	--	--	0.750	530	No	0	No
Soil Gas	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/m^3	--	--	330	260,000	No	0	No
Soil Gas	VOCs	Total	Cyclohexane	N/A	N/A	ug/m^3	--	--	24.0	26,000,000	No	0	No
Soil Gas	VOCs	Total	Dichlorodifluoromethane	N/A	N/A	ug/m^3	--	--	3.20	880,000	No	0	No
Soil Gas	VOCs	Total	Dichloromethane (Methylene Chloride)	N/A	N/A	ug/m^3	--	--	1.80	26,000	No	0	No

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(12 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil Gas	VOCs	Total	Ethanol	N/A	N/A	ug/m^3	--	--	13.0	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	Ethylbenzene	N/A	N/A	ug/m^3	--	--	1,550	4,900	No	0	No
Soil Gas	VOCs	Total	Heptane	N/A	N/A	ug/m^3	--	--	87.0	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	Hexane	N/A	N/A	ug/m^3	--	--	110	3,100,000	No	0	No
Soil Gas	VOCs	Total	Isopropylbenzene	N/A	N/A	ug/m^3	--	--	675	1,800,000	No	0	No
Soil Gas	VOCs	Total	m,p-Xylenes	N/A	N/A	ug/m^3	--	--	5,850	440,000	No	0	No
Soil Gas	VOCs	Total	n-Propylbenzene	N/A	N/A	ug/m^3	--	--	2,300	4,400,000	No	0	No
Soil Gas	VOCs	Total	o-Xylene	N/A	N/A	ug/m^3	--	--	2,800	3,100,000	No	0	No
Soil Gas	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/m^3	--	--	34,000	2,100	**Yes**	1	**Yes**
Soil Gas	VOCs	Total	Toluene	N/A	N/A	ug/m^3	--	--	47,500	22,000,000	No	0	No
Soil Gas	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/m^3	--	--	4.00	260,000	No	0	No
Soil Gas	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/m^3	--	--	610	140	**Yes**	2	**Yes**
Soil Gas	VOCs	Total	Trichlorofluoromethane	N/A	N/A	ug/m^3	--	--	2.20	3,100,000	No	0	No

Notes

(1) Only evaluated for analytes with a sample size of 20 or more. See the Data Summary for the Sandblast Area AOPC - Appendix I, Table I-2.

(2) Only applicable to inorganics. For soils, see the statistical comparison of Site soil concentrations to Reference Area concentrations; Appendix L, Tables L-1 and L-2. For groundwater, see Table 8-3 and Appendix L, Table L-3. Direct push groundwater samples are not compared to Reference Area monitoring well data.

(3) The groundwater SLVs are the lower of the Direct Contact Water SLV and the Discharge to Surface Water-Bioaccumulative SLV; see Appendix J.

Table 9-2
Preliminary-COPC Identification for Sandblast AOPC Data
Bradford Island - Upland Operable Unit
(13 of 13)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?

(4) Total DDT is evaluated in the ERA for the Upland OU; see Section 12 and Appendix N.

'--' = Not evaluated
% = percent
BHC = hexachlorocyclohexane
DP = Direct Push
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
mm = millimeter
N/A = not applicable
NV = No Value
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
ug/m3 = micrograms per cubic meter
um = micrometer
VOC = volatile organic carbon

Table 9-3
Preliminary-COPC Identification for Pistol Range AOPC Data
Bradford Island - Upland Operable Unit
(1 of 1)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Lead	0-1.5 ft	mg/kg	**Yes**	**Yes**	1,110	25.5	**Yes**	52	**Yes**
Soil	Metals	Total	Nickel	0-1.5 ft	mg/kg	--	**Yes**	32.0	38	No	0	No
Soil	Metals	Total	Zinc	0-1.5 ft	mg/kg	--	**Yes**	199	71.7	**Yes**	10	**Yes**
Lagoon Sediment	Metals	Total	Copper	N/A	mg/kg	--	No	25.4	55.6	No	0	No
Lagoon Sediment	Metals	Total	Lead	N/A	mg/kg	--	**Yes**	33.0	35	No	0	No
Lagoon Sediment	Metals	Total	Nickel	N/A	mg/kg	--	No	15.4	21.2	No	0	No
Lagoon Sediment	Metals	Total	Zinc	N/A	mg/kg	--	**Yes**	174	123	**Yes**	5	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Copper	N/A	mg/L	--	--	0.000800	0.00900	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Nickel	N/A	mg/L	--	--	0.00390	0.0520	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Zinc	N/A	mg/L	--	--	0.00410	0.077	No	0	No
Groundwater - DP[3]	Metals	Total	Copper	N/A	mg/L	--	--	0.0548	1.30	No	0	No
Groundwater - DP[3]	Metals	Total	Lead	N/A	mg/L	--	--	0.0125	0.0150	No	0	No
Groundwater - DP[3]	Metals	Total	Nickel	N/A	mg/L	--	--	0.0501	0.610	No	0	No
Groundwater - DP[3]	Metals	Total	Zinc	N/A	mg/L	--	--	0.149	7.40	No	0	No

Notes

(1) Only evaluated for analytes with a sample size of 20 or more. See the Data Summary for the Pistol Range AOPC - Appendix I, Table I-3.

(2) Only applicable to inorganics. For soils, see the statistical comparison of Site soil concentrations to Reference Area concentrations; Appendix L, Tables L-1 and L-2.
For sediments, the maximum concentrations were compared to the maximum Reference Area sediment concentrations.
Direct push groundwater samples are not compared to Reference Area monitoring well data.

(3) The groundwater SLVs are the lower of the Direct Contact Water SLV and the Discharge to Surface Water-Bioaccumulative SLV; see Appendix J.

'--' = Not evaluated
% = percent
DP = Direct Push
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
No. = number
SLV = screening level value

Table 9-4
Preliminary-COPC Identification for Bulb Slope AOPC Data
Bradford Island - Upland Operable Unit
(1 of 1)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Lead	0-1 ft	mg/kg	--	**Yes**	597	25.5	**Yes**	11	**Yes**
Soil	Metals	Total	Mercury	0-1 ft	mg/kg	--	**Yes**	1.54	0.066	**Yes**	10	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-1 ft	ug/kg	--	--	251	371	No	0	No
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-1 ft	ug/kg	--	--	251	371	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-1 ft	mg/kg	--	--	170	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-1 ft	mg/kg	--	--	410	40,000	No	0	No

Notes

(1) Only evaluated for analytes with a sample size of 20 or more. See the Data Summary for the Bulb Slope AOPC - Appendix I, Table I-4.

(2) Only applicable to inorganics in soil. See the statistical comparison of Site soil concentrations to Reference Area concentrations; Appendix L, Tables L-1 and L-2.

'--' = Not evaluated
% = percent
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
PCB = polychlorinated biphenyl
SLV = screening level value
ug/kg = micrograms per kilogram

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(1 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?^{1}	Significantly Higher Conc in AOPC than Reference?^{2}	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Aluminum	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	0.270	**Yes**	40	**Yes**
Soil	Metals	Total	Arsenic	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	29	**Yes**
Soil	Metals	Total	Barium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	0.360	**Yes**	62	**Yes**
Soil	Metals	Total	Chromium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	50	**Yes**
Soil	Metals	Total	Cobalt	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-1 ft	<250um	mg/kg	--	**Yes**	921	25.5	**Yes**	8	**Yes**
Soil	Metals	Total	Lead	0-1 ft	<2mm	mg/kg	--	**Yes**	768	25.5	**Yes**	8	**Yes**
Soil	Metals	Total	Lead	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	25.5	**Yes**	137	**Yes**
Soil	Metals	Total	Manganese	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	4.15	0.0660	**Yes**	43	**Yes**
Soil	Metals	Total	Nickel	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	1,060	38.0	**Yes**	38	**Yes**
Soil	Metals	Total	Selenium	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	0.520	**Yes**	18	**Yes**
Soil	Metals	Total	Silver	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	1.50	4.20	No	0	No
Soil	Metals	Total	Thallium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-1 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-1 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	71.7	**Yes**	70	**Yes**
Soil	Metals	Total	Aluminum	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	0.270	**Yes**	50	**Yes**
Soil	Metals	Total	Arsenic	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	39	**Yes**
Soil	Metals	Total	Barium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	0.360	**Yes**	74	**Yes**
Soil	Metals	Total	Chromium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	59	**Yes**
Soil	Metals	Total	Cobalt	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-3 ft	<250um	mg/kg	--	**Yes**	921	25.5	**Yes**	10	**Yes**
Soil	Metals	Total	Lead	0-3 ft	<2mm	mg/kg	--	**Yes**	768	25.5	**Yes**	9	**Yes**
Soil	Metals	Total	Lead	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	25.5	**Yes**	154	**Yes**
Soil	Metals	Total	Manganese	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	4.15	0.0660	**Yes**	47	**Yes**
Soil	Metals	Total	Nickel	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	1,610	38.0	**Yes**	42	**Yes**
Soil	Metals	Total	Selenium	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	0.520	**Yes**	28	**Yes**
Soil	Metals	Total	Silver	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	1.50	4.20	No	0	No
Soil	Metals	Total	Thallium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-3 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-3 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	71.7	**Yes**	77	**Yes**
Soil	Metals	Total	Aluminum	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Antimony	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	13.7	410	No	0	No
Soil	Metals	Total	Arsenic	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	80.9	5.40	**Yes**	42	**Yes**
Soil	Metals	Total	Barium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Beryllium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Cadmium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	17.3	150	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(2 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Metals	Total	Chromium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	2,650	28.1	**Yes**	67	**Yes**
Soil	Metals	Total	Cobalt	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Copper	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Lead	0-10 ft	<250um	mg/kg	--	**Yes**	921	800	**Yes**	1	**Yes**
Soil	Metals	Total	Lead	0-10 ft	<2mm	mg/kg	--	**Yes**	768	800	No	0	No
Soil	Metals	Total	Lead	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	3,260	800	**Yes**	16	**Yes**
Soil	Metals	Total	Manganese	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Mercury	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	4.15	93.0	No	0	No
Soil	Metals	Total	Nickel	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	1,760	6,100	No	0	No
Soil	Metals	Total	Selenium	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	0.900	5,100	No	0	No
Soil	Metals	Total	Silver	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	1.52	1,500	No	0	No
Soil	Metals	Total	Thallium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Vanadium	0-10 ft	N/A	mg/kg	**Yes**	No	--	--	--	--	No
Soil	Metals	Total	Zinc	0-10 ft	N/A	mg/kg	**Yes**	**Yes**	1,160	310,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-1 ft	N/A	ug/kg	**Yes**	--	210	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-1 ft	N/A	ug/kg	**Yes**	--	108	28,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-1 ft	N/A	ug/kg	**Yes**	--	1,860	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-3 ft	N/A	ug/kg	**Yes**	--	210	28,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-3 ft	N/A	ug/kg	**Yes**	--	108	28,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-3 ft	N/A	ug/kg	**Yes**	--	1,860	28,000	No	0	No
Soil	Butyltins	Total	Dibutyltin	0-10 ft	N/A	ug/kg	**Yes**	--	210	180,000	No	0	No
Soil	Butyltins	Total	Monobutyltin	0-10 ft	N/A	ug/kg	**Yes**	--	108	180,000	No	0	No
Soil	Butyltins	Total	Tetrabutyltin	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Butyltins	Total	Tributyltin	0-10 ft	N/A	ug/kg	**Yes**	--	1,860	180,000	No	0	No
Soil	Herbicides	Total	2,4,5-T	0-1 ft	N/A	ug/kg	**Yes**	--	93.0	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	Dichloroprop	0-1 ft	N/A	ug/kg	**Yes**	--	180	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	MCPP	0-1 ft	N/A	ug/kg	**Yes**	--	14,000	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	2,4,5-T	0-3 ft	N/A	ug/kg	**Yes**	--	93.0	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	Dichloroprop	0-3 ft	N/A	ug/kg	**Yes**	--	180	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	MCPP	0-3 ft	N/A	ug/kg	**Yes**	--	14,000	21.0	**Yes**	2	**Yes**
Soil	Herbicides	Total	2,4,5-T	0-10 ft	N/A	ug/kg	**Yes**	--	93.0	6,200,000	No	0	No
Soil	Herbicides	Total	Dichloroprop	0-10 ft	N/A	ug/kg	**Yes**	--	180	NV	***Yes***	--	***Yes***
Soil	Herbicides	Total	MCPP	0-10 ft	N/A	ug/kg	**Yes**	--	14,000	620,000	No	0	No
Soil	Pesticides	Total	4,4'-DDD	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDE	0-1 ft	N/A	ug/kg	**Yes**	--	17.0	21.0	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-1 ft	N/A	ug/kg	**Yes**	--	140	21.0	**Yes**	9	**Yes**
Soil	Pesticides	Total	Aldrin	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (alpha)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-1 ft	N/A	ug/kg	**Yes**	--	4.00	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-1 ft	N/A	ug/kg	**Yes**	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (technical)	0-1 ft	N/A	ug/kg	--	--	1,560	7,200	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(3 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Pesticides	Total	Dieldrin	0-1 ft	N/A	ug/kg	**Yes**	--	2.10	4.90	No	0	No
Soil	Pesticides	Total	Endosulfan I	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan II	0-1 ft	N/A	ug/kg	**Yes**	--	8.84	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-1 ft	N/A	ug/kg	**Yes**	--	5.97	20,000	No	0	No
Soil	Pesticides	Total	Endrin	0-1 ft	N/A	ug/kg	**Yes**	--	17.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Aldehyde	0-1 ft	N/A	ug/kg	**Yes**	--	16.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Ketone	0-1 ft	N/A	ug/kg	**Yes**	--	13.0	4.90	**Yes**	1	**Yes**
Soil	Pesticides	Total	Heptachlor	0-1 ft	N/A	ug/kg	**Yes**	--	2.90	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDD	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDE	0-3 ft	N/A	ug/kg	**Yes**	--	17.0	21.0	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-3 ft	N/A	ug/kg	**Yes**	--	140	21.0	**Yes**	10	**Yes**
Soil	Pesticides	Total	Aldrin	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (alpha)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-3 ft	N/A	ug/kg	**Yes**	--	4.00	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-3 ft	N/A	ug/kg	**Yes**	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (technical)	0-3 ft	N/A	ug/kg	--	--	1,560	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan I	0-3 ft	N/A	ug/kg	**Yes**	--	6.45	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan II	0-3 ft	N/A	ug/kg	**Yes**	--	8.84	20,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-3 ft	N/A	ug/kg	**Yes**	--	5.97	20,000	No	0	No
Soil	Pesticides	Total	Endrin	0-3 ft	N/A	ug/kg	**Yes**	--	17.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Aldehyde	0-3 ft	N/A	ug/kg	**Yes**	--	16.0	4.90	**Yes**	2	**Yes**
Soil	Pesticides	Total	Endrin Ketone	0-3 ft	N/A	ug/kg	**Yes**	--	13.0	4.90	**Yes**	1	**Yes**
Soil	Pesticides	Total	Heptachlor	0-3 ft	N/A	ug/kg	**Yes**	--	3.07	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDD	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	4,4'-DDE	0-10 ft	N/A	ug/kg	**Yes**	--	17.0	7,700	No	0	No
Soil	Pesticides	Total	4,4'-DDT	0-10 ft	N/A	ug/kg	**Yes**	--	140	7,700	No	0	No
Soil	Pesticides	Total	Aldrin	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (alpha)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (beta)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (delta)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	BHC (gamma) Lindane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Chlordane (alpha)	0-10 ft	N/A	ug/kg	**Yes**	--	4.00	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (gamma)	0-10 ft	N/A	ug/kg	**Yes**	--	97.0	7,200	No	0	No
Soil	Pesticides	Total	Chlordane (technical)	0-10 ft	N/A	ug/kg	**Yes**	--	1,560	7,200	No	0	No
Soil	Pesticides	Total	Dieldrin	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Endosulfan I	0-10 ft	N/A	ug/kg	**Yes**	--	6.45	1,400,000	No	0	No
Soil	Pesticides	Total	Endosulfan II	0-10 ft	N/A	ug/kg	**Yes**	--	8.84	1,400,000	No	0	No
Soil	Pesticides	Total	Endosulfan Sulfate	0-10 ft	N/A	ug/kg	**Yes**	--	5.97	1,400,000	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(4 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	Pesticides	Total	Endrin	0-10 ft	N/A	ug/kg	**Yes**	--	17.0	71,000	No	0	No
Soil	Pesticides	Total	Endrin Aldehyde	0-10 ft	N/A	ug/kg	**Yes**	--	16.0	71,000	No	0	No
Soil	Pesticides	Total	Endrin Ketone	0-10 ft	N/A	ug/kg	**Yes**	--	13.0	71,000	No	0	No
Soil	Pesticides	Total	Heptachlor	0-10 ft	N/A	ug/kg	**Yes**	--	3.07	480	No	0	No
Soil	Pesticides	Total	Heptachlor Epoxide	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	Pesticides	Total	Methoxychlor	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1248	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1254	0-1 ft	N/A	ug/kg	**Yes**	--	1,700	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-1 ft	N/A	ug/kg	**Yes**	--	690	371	**Yes**	6	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-1 ft	N/A	ug/kg	**Yes**	--	2,140	371	**Yes**	9	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1248	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1254	0-3 ft	N/A	ug/kg	**Yes**	--	1,700	371	**Yes**	4	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-3 ft	N/A	ug/kg	**Yes**	--	690	371	**Yes**	6	**Yes**
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-3 ft	N/A	ug/kg	**Yes**	--	2,140	371	**Yes**	9	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1248	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	PCB Aroclors	Total	Aroclor 1254	0-10 ft	N/A	ug/kg	**Yes**	--	1,700	740	**Yes**	2	**Yes**
Soil	PCB Aroclors	Total	Aroclor 1260	0-10 ft	N/A	ug/kg	**Yes**	--	690	740	No	0	No
Soil	PCB Aroclors	Total	Total PCBs as Aroclors	0-10 ft	N/A	ug/kg	**Yes**	--	2,140	740	**Yes**	4	**Yes**
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	1,090	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	9,450	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	1,440	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	9,450	40,000	No	0	No
Soil	NWTPH-Dx	Total	Diesel Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	9,740	23,000	No	0	No
Soil	NWTPH-Dx	Total	Residual Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	41,900	40,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-1 ft	N/A	mg/kg	**Yes**	--	23,900	13,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-3 ft	N/A	mg/kg	**Yes**	--	23,900	13,000	**Yes**	1	**Yes**
Soil	NWTPH-Gx	Total	Gasoline Range Organics	0-10 ft	N/A	mg/kg	**Yes**	--	23,900	13,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	2-Methylnaphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-1 ft	N/A	ug/kg	**Yes**	--	2,600	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-1 ft	N/A	ug/kg	**Yes**	--	87.7	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	2,700	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	32,000	2,700	**Yes**	8	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	33,000	270	**Yes**	30	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-1 ft	N/A	ug/kg	**Yes**	--	65,000	2,700	**Yes**	6	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-1 ft	N/A	ug/kg	**Yes**	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-1 ft	N/A	ug/kg	**Yes**	--	65,000	27,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-1 ft	N/A	ug/kg	**Yes**	--	14,700	2,700	**Yes**	4	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-1 ft	N/A	ug/kg	**Yes**	--	980	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	260,000	4,500	**Yes**	10	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	124	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-1 ft	N/A	ug/kg	**Yes**	--	2,650	2,260	**Yes**	1	**Yes**
Soil	SVOCs	Total	Chrysene	0-1 ft	N/A	ug/kg	**Yes**	--	32,000	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-1 ft	N/A	ug/kg	**Yes**	--	9,900	270	**Yes**	13	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-1 ft	N/A	ug/kg	**Yes**	--	810	2.00	**Yes**	27	**Yes**
Soil	SVOCs	Total	Diethyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	73.4	100,000	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(5 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Dimethyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	41.0	150,000	No	0	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	1,800	450	**Yes**	1	**Yes**
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-1 ft	N/A	ug/kg	**Yes**	--	127	450	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-1 ft	N/A	ug/kg	**Yes**	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-1 ft	N/A	ug/kg	**Yes**	--	1,200	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	19,000	2,700	**Yes**	6	**Yes**
Soil	SVOCs	Total	Naphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	823	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-1 ft	N/A	ug/kg	**Yes**	--	201	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-1 ft	N/A	ug/kg	**Yes**	--	12,000	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-1 ft	N/A	ug/kg	No	--	3.70	30,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-1 ft	N/A	ug/kg	**Yes**	--	40,000	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-1 ft	N/A	ug/kg	**Yes**	--	367,900	1,100	**Yes**	36	**Yes**
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-1 ft	N/A	ug/kg	**Yes**	--	18,674	29,000	No	0	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-3 ft	N/A	ug/kg	**Yes**	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-3 ft	N/A	ug/kg	**Yes**	--	3,200	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-3 ft	N/A	ug/kg	**Yes**	--	295	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	8,440	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	32,000	2,700	**Yes**	15	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	34,000	270	**Yes**	38	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-3 ft	N/A	ug/kg	**Yes**	--	65,000	2,700	**Yes**	10	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-3 ft	N/A	ug/kg	**Yes**	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-3 ft	N/A	ug/kg	**Yes**	--	65,000	27,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-3 ft	N/A	ug/kg	**Yes**	--	31,300	2,700	**Yes**	8	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-3 ft	N/A	ug/kg	**Yes**	--	980	200,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	260,000	4,500	**Yes**	12	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	124	450	No	0	No
Soil	SVOCs	Total	Carbazole	0-3 ft	N/A	ug/kg	**Yes**	--	2,840	2,260	**Yes**	2	**Yes**
Soil	SVOCs	Total	Chrysene	0-3 ft	N/A	ug/kg	**Yes**	--	35,300	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-3 ft	N/A	ug/kg	**Yes**	--	9,900	270	**Yes**	21	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-3 ft	N/A	ug/kg	**Yes**	--	810	2.00	**Yes**	32	**Yes**
Soil	SVOCs	Total	Diethyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	73.4	100,000	No	0	No
Soil	SVOCs	Total	Dimethyl Phthalate	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	1,800	450	**Yes**	1	**Yes**
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-3 ft	N/A	ug/kg	**Yes**	--	127	450	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-3 ft	N/A	ug/kg	**Yes**	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-3 ft	N/A	ug/kg	**Yes**	--	1,610	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	20,000	2,700	**Yes**	12	**Yes**
Soil	SVOCs	Total	Naphthalene	0-3 ft	N/A	ug/kg	**Yes**	--	823	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-3 ft	N/A	ug/kg	**Yes**	--	201	2,100	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-3 ft	N/A	ug/kg	**Yes**	--	21,900	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-3 ft	N/A	ug/kg	**Yes**	--	35.0	30,000	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(6 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	SVOCs	Total	Pyrene	0-3 ft	N/A	ug/kg	**Yes**	--	67,100	6,700,000	No	0	No
Soil	SVOCs	Total	Total HPAHs (KM, capped)	0-3 ft	N/A	ug/kg	**Yes**	--	367,900	1,100	**Yes**	46	**Yes**
Soil	SVOCs	Total	Total LPAHs (KM, capped)	0-3 ft	N/A	ug/kg	**Yes**	--	34,767	29,000	No	1	No
Soil	SVOCs	Total	2-Methylnaphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	1,530	4,100,000	No	0	No
Soil	SVOCs	Total	Acenaphthene	0-10 ft	N/A	ug/kg	**Yes**	--	3,200	19,000,000	No	0	No
Soil	SVOCs	Total	Acenaphthylene	0-10 ft	N/A	ug/kg	**Yes**	--	295	23,000	No	0	No
Soil	SVOCs	Total	Anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	8,440	93,000,000	No	0	No
Soil	SVOCs	Total	Benzo(a)anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	32,000	2,700	**Yes**	24	**Yes**
Soil	SVOCs	Total	Benzo(a)pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	34,000	270	**Yes**	48	**Yes**
Soil	SVOCs	Total	Benzo(b)fluoranthene	0-10 ft	N/A	ug/kg	**Yes**	--	65,000	2,700	**Yes**	10	**Yes**
Soil	SVOCs	Total	Benzo(g,h,i)perylene	0-10 ft	N/A	ug/kg	**Yes**	--	18,000	27,000	No	0	No
Soil	SVOCs	Total	Benzo(k)fluoranthene	0-10 ft	N/A	ug/kg	**Yes**	--	65,000	27,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Benzofluoranthenes, Total	0-10 ft	N/A	ug/kg	**Yes**	--	31,300	2,700	**Yes**	17	**Yes**
Soil	SVOCs	Total	Benzoic Acid	0-10 ft	N/A	ug/kg	**Yes**	--	980	2,500,000,000	No	0	No
Soil	SVOCs	Total	Benzyl Alcohol	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	260,000	150,000	**Yes**	1	**Yes**
Soil	SVOCs	Total	Butyl Benzyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	152	910,000	No	0	No
Soil	SVOCs	Total	Carbazole	0-10 ft	N/A	ug/kg	**Yes**	--	2,840	NV	***Yes***	--	***Yes***
Soil	SVOCs	Total	Chrysene	0-10 ft	N/A	ug/kg	**Yes**	--	35,300	270,000	No	0	No
Soil	SVOCs	Total	Dibenz(a,h)anthracene	0-10 ft	N/A	ug/kg	**Yes**	--	9,900	270	**Yes**	28	**Yes**
Soil	SVOCs	Total	Dibenzofuran	0-10 ft	N/A	ug/kg	**Yes**	--	810	1,000,000	No	0	No
Soil	SVOCs	Total	Diethyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	73.4	490,000,000	No	0	No
Soil	SVOCs	Total	Dimethyl Phthalate	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Di-n-butyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	1,800	62,000,000	No	0	No
Soil	SVOCs	Total	Di-n-octyl Phthalate	0-10 ft	N/A	ug/kg	**Yes**	--	127	150,000	No	0	No
Soil	SVOCs	Total	Fluoranthene	0-10 ft	N/A	ug/kg	**Yes**	--	54,000	8,900,000	No	0	No
Soil	SVOCs	Total	Fluorene	0-10 ft	N/A	ug/kg	**Yes**	--	1,610	12,000,000	No	0	No
Soil	SVOCs	Total	Indeno(1,2,3-cd)pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	20,000	2,700	**Yes**	19	**Yes**
Soil	SVOCs	Total	Naphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	1,710	23,000	No	0	No
Soil	SVOCs	Total	N-Nitrosodiphenylamine	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	p-cresol (4-Methylphenol)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	SVOCs	Total	Pentachlorophenol	0-10 ft	N/A	ug/kg	**Yes**	--	201	13,000	No	0	No
Soil	SVOCs	Total	Phenanthrene	0-10 ft	N/A	ug/kg	**Yes**	--	21,900	23,000	No	0	No
Soil	SVOCs	Total	Phenol	0-10 ft	N/A	ug/kg	**Yes**	--	35.0	180,000,000	No	0	No
Soil	SVOCs	Total	Pyrene	0-10 ft	N/A	ug/kg	**Yes**	--	67,100	6,700,000	No	0	No
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1-Dichloroethane	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	14,300	200,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	5,410	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-1 ft	N/A	ug/kg	**Yes**	--	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-1 ft	N/A	ug/kg	**Yes**	--	8.80	1,250,000	No	0	No
Soil	VOCs	Total	4-Isopropyltoluene	0-1 ft	N/A	ug/kg	**Yes**	--	12.0	200,000	No	0	No
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-1 ft	N/A	ug/kg	**Yes**	--	1.20	1,250,000	No	0	No
Soil	VOCs	Total	Acetone	0-1 ft	N/A	ug/kg	**Yes**	--	540	1,250,000	No	0	No
Soil	VOCs	Total	Benzene	0-1 ft	N/A	ug/kg	**Yes**	--	1.20	1,200	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(7 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	VOCs	Total	Bromomethane	0-1 ft	N/A	ug/kg	**Yes**	--	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-1 ft	N/A	ug/kg	**Yes**	--	6.90	1,000,000	No	0	No
Soil	VOCs	Total	Chloroform	0-1 ft	N/A	ug/kg	**Yes**	--	19.0	410	No	0	No
Soil	VOCs	Total	Chloromethane	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-1 ft	N/A	ug/kg	**Yes**	--	94.0	730,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-1 ft	N/A	ug/kg	**Yes**	--	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-1 ft	N/A	ug/kg	**Yes**	--	2,700	2,260	**Yes**	1	**Yes**
Soil	VOCs	Total	Isopropylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-1 ft	N/A	ug/kg	**Yes**	--	9,800	120,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-1 ft	N/A	ug/kg	**Yes**	--	8,360	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	o-Xylene	0-1 ft	N/A	ug/kg	**Yes**	--	0.180	1,000	No	0	No
Soil	VOCs	Total	sec-Butylbenzene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Styrene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-1 ft	N/A	ug/kg	**Yes**	--	65.0	1,600	No	0	No
Soil	VOCs	Total	Toluene	0-1 ft	N/A	ug/kg	**Yes**	--	5.80	200,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Trichloroethene (TCE)	0-1 ft	N/A	ug/kg	**Yes**	--	0.171	130	No	0	No
Soil	VOCs	Total	Trichlorofluoromethane	0-1 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1-Dichloroethane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	--	14,300	200,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	--	6,500	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-3 ft	N/A	ug/kg	**Yes**	--	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	4-Isopropyltoluene	0-3 ft	N/A	ug/kg	**Yes**	--	161	200,000	No	0	No
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-3 ft	N/A	ug/kg	**Yes**	--	1.20	1,250,000	No	0	No
Soil	VOCs	Total	Acetone	0-3 ft	N/A	ug/kg	**Yes**	--	540	1,250,000	No	0	No
Soil	VOCs	Total	Benzene	0-3 ft	N/A	ug/kg	**Yes**	--	1.20	1,200	No	0	No
Soil	VOCs	Total	Bromomethane	0-3 ft	N/A	ug/kg	**Yes**	--	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-3 ft	N/A	ug/kg	**Yes**	--	6.90	1,000,000	No	0	No
Soil	VOCs	Total	Chloroform	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Chloromethane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-3 ft	N/A	ug/kg	**Yes**	--	94.0	730,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-3 ft	N/A	ug/kg	**Yes**	--	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-3 ft	N/A	ug/kg	**Yes**	--	2,700	2,260	**Yes**	1	**Yes**
Soil	VOCs	Total	Isopropylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-3 ft	N/A	ug/kg	**Yes**	--	9,800	120,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-3 ft	N/A	ug/kg	**Yes**	--	8,360	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	o-Xylene	0-3 ft	N/A	ug/kg	**Yes**	--	3,200	1,000	**Yes**	1	**Yes**

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(8 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil	VOCs	Total	sec-Butylbenzene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Styrene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-3 ft	N/A	ug/kg	**Yes**	--	420,000	1,600	**Yes**	2	**Yes**
Soil	VOCs	Total	Toluene	0-3 ft	N/A	ug/kg	**Yes**	--	39,000	200,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Trichloroethene (TCE)	0-3 ft	N/A	ug/kg	**Yes**	--	6,080	130	**Yes**	2	**Yes**
Soil	VOCs	Total	Trichlorofluoromethane	0-3 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1,1-Trichloroethane (TCA)	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,1-Dichloroethane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	1,2,4-Trimethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	--	14,300	980,000	No	0	No
Soil	VOCs	Total	1,3,5-Trimethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	--	6,500	150,000	No	0	No
Soil	VOCs	Total	1,4-Dichlorobenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	2-Butanone (MEK)	0-10 ft	N/A	ug/kg	**Yes**	--	50.0	200,000,000	No	0	No
Soil	VOCs	Total	2-Hexanone	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	4-Isopropyltoluene	0-10 ft	N/A	ug/kg	**Yes**	--	161	NV	***Yes***	--	***Yes***
Soil	VOCs	Total	4-Methyl-2-pentanone (MIBK)	0-10 ft	N/A	ug/kg	**Yes**	--	1.20	53,000,000	No	0	No
Soil	VOCs	Total	Acetone	0-10 ft	N/A	ug/kg	**Yes**	--	540	630,000,000	No	0	No
Soil	VOCs	Total	Benzene	0-10 ft	N/A	ug/kg	**Yes**	--	1.20	1,200	No	0	No
Soil	VOCs	Total	Bromomethane	0-10 ft	N/A	ug/kg	**Yes**	--	5.00	17,000	No	0	No
Soil	VOCs	Total	Carbon Disulfide	0-10 ft	N/A	ug/kg	**Yes**	--	6.90	3,700,000	No	0	No
Soil	VOCs	Total	Chloroform	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Chloromethane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	cis-1,2-Dichloroethene	0-10 ft	N/A	ug/kg	**Yes**	--	120	3,100,000	No	0	No
Soil	VOCs	Total	Dichlorodifluoromethane	0-10 ft	N/A	ug/kg	**Yes**	--	94.0	780,000	No	0	No
Soil	VOCs	Total	Dichloromethane (Methylene Chloride)	0-10 ft	N/A	ug/kg	**Yes**	--	460	20,000	No	0	No
Soil	VOCs	Total	Ethylbenzene	0-10 ft	N/A	ug/kg	**Yes**	--	2,700	12,000	No	0	No
Soil	VOCs	Total	Isopropylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	m,p-Xylenes	0-10 ft	N/A	ug/kg	**Yes**	--	9,800	2,700,000	No	0	No
Soil	VOCs	Total	Naphthalene	0-10 ft	N/A	ug/kg	**Yes**	--	8,360	23,000	No	0	No
Soil	VOCs	Total	n-Butylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	n-Propylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	o-Xylene	0-10 ft	N/A	ug/kg	**Yes**	--	4,260	19,000,000	No	0	No
Soil	VOCs	Total	sec-Butylbenzene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Styrene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Tetrachloroethene (PCE)	0-10 ft	N/A	ug/kg	**Yes**	--	420,000	1,600	**Yes**	3	**Yes**
Soil	VOCs	Total	Toluene	0-10 ft	N/A	ug/kg	**Yes**	--	133,000	24,000,000	No	0	No
Soil	VOCs	Total	trans-1,2-Dichloroethene	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Soil	VOCs	Total	Trichloroethene (TCE)	0-10 ft	N/A	ug/kg	**Yes**	--	6,080	130	**Yes**	2	**Yes**
Soil	VOCs	Total	Trichlorofluoromethane	0-10 ft	N/A	ug/kg	No	--	--	--	--	--	No
Lagoon Sediment	Metals	Total	Copper	N/A	N/A	mg/kg	--	--	25.4	55.6	No	0	No
Lagoon Sediment	Metals	Total	Lead	N/A	N/A	mg/kg	--	--	33.0	35	No	0	No
Lagoon Sediment	Metals	Total	Nickel	N/A	N/A	mg/kg	--	--	15.4	21.2	No	0	No
Lagoon Sediment	Metals	Total	Zinc	N/A	N/A	mg/kg	--	--	174	123	**Yes**	5	**Yes**
Groundwater[3]	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	**Yes**	**Yes**	0.0193	0.0000180	**Yes**	49	**Yes**
Groundwater[3]	Metals	Dissolved	Barium	N/A	N/A	mg/L	--	**Yes**	0.134	0.00400	**Yes**	3	**Yes**

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(9 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater[3]	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	**Yes**	172	116	**Yes**	1	**Yes**
Groundwater[3]	Metals	Dissolved	Iron	N/A	N/A	mg/L	**Yes**	**Yes**	35.4	0.300	**Yes**	16	**Yes**
Groundwater[3]	Metals	Dissolved	Lead	N/A	N/A	mg/L	**Yes**	**Yes**	0.00350	0.00144	**Yes**	3	**Yes**
Groundwater[3]	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	**Yes**	25.8	82.0	No	0	No
Groundwater[3]	Metals	Dissolved	Manganese	N/A	N/A	mg/L	**Yes**	**Yes**	5.55	0.0500	**Yes**	20	**Yes**
Groundwater[3]	Metals	Dissolved	Nickel	N/A	N/A	mg/L	--	**Yes**	0.0187	0.0340	No	0	No
Groundwater[3]	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	**Yes**	12.9	53.0	No	0	No
Groundwater[3]	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	**Yes**	740	680	**Yes**	1	**Yes**
Groundwater[3]	Metals	Dissolved	Vanadium	N/A	N/A	mg/L	**Yes**	**Yes**	0.00310	0.00260	**Yes**	1	**Yes**
Groundwater[3]	Metals	Dissolved	Zinc	N/A	N/A	mg/L	--	**Yes**	0.197	0.077	**Yes**	1	**Yes**
Groundwater[3]	Metals	Total	Antimony	N/A	N/A	mg/L	--	**Yes**	0.00389	0.00560	No	0	No
Groundwater[3]	Metals	Total	Arsenic	N/A	N/A	mg/L	**Yes**	**Yes**	0.0213	0.0000180	**Yes**	63	**Yes**
Groundwater[3]	Metals	Total	Barium	N/A	N/A	mg/L	--	**Yes**	0.304	1.00	No	0	No
Groundwater[3]	Metals	Total	Beryllium	N/A	N/A	mg/L	--	**Yes**	0.000435	0.0730	No	0	No
Groundwater[3]	Metals	Total	Cadmium	N/A	N/A	mg/L	--	**Yes**	0.00560	0.0180	No	0	No
Groundwater[3]	Metals	Total	Chromium	N/A	N/A	mg/L	--	**Yes**	0.0185	55.0	No	0	No
Groundwater[3]	Metals	Total	Copper	N/A	N/A	mg/L	--	**Yes**	0.201	1.30	No	0	No
Groundwater[3]	Metals	Total	Iron	N/A	N/A	mg/L	**Yes**	**Yes**	42.9	0.300	**Yes**	36	**Yes**
Groundwater[3]	Metals	Total	Lead	N/A	N/A	mg/L	**Yes**	**Yes**	0.0782	0.0150	**Yes**	2	**Yes**
Groundwater[3]	Metals	Total	Manganese	N/A	N/A	mg/L	**Yes**	**Yes**	5.39	0.0500	**Yes**	35	**Yes**
Groundwater[3]	Metals	Total	Mercury	N/A	N/A	mg/L	**Yes**	**Yes**	0.000330	0.0110	No	0	No
Groundwater[3]	Metals	Total	Nickel	N/A	N/A	mg/L	--	**Yes**	0.117	0.610	No	0	No
Groundwater[3]	Metals	Total	Selenium	N/A	N/A	mg/L	--	**Yes**	0.0329	0.170	No	0	No
Groundwater[3]	Metals	Total	Silver	N/A	N/A	mg/L	--	**Yes**	0.000658	0.180	No	0	No
Groundwater[3]	Metals	Total	Thallium	N/A	N/A	mg/L	--	**Yes**	0.000323	0.000240	**Yes**	2	**Yes**
Groundwater[3]	Metals	Total	Vanadium	N/A	N/A	mg/L	**Yes**	**Yes**	0.00590	0.00260	**Yes**	1	**Yes**
Groundwater[3]	Metals	Total	Zinc	N/A	N/A	mg/L	--	**Yes**	2.66	7.40	No	0	No
Groundwater[3]	Butyltins	Total	Dibutyltin	N/A	N/A	ug/L	**Yes**	--	0.447	0.0630	**Yes**	6	**Yes**
Groundwater[3]	Butyltins	Total	Monobutyltin	N/A	N/A	ug/L	**Yes**	--	0.240	0.0630	**Yes**	1	**Yes**
Groundwater[3]	Butyltins	Total	Tributyltin	N/A	N/A	ug/L	--	--	0.0601	0.0630	No	0	No
Groundwater[3]	Herbicides	Total	4-Nitrophenol	N/A	N/A	ug/L	--	--	0.840	150	No	0	No
Groundwater[3]	Herbicides	Total	Dichloroprop	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	Herbicides	Total	Pentachlorophenol	N/A	N/A	ug/L	--	--	0.112	0.270	No	0	No
Groundwater[3]	Pesticides	Total	4,4'-DDE	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	Pesticides	Total	Dieldrin	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	NWTPH-Dx	Total	Diesel Range Organics	N/A	N/A	mg/L	**Yes**	--	1.80	0.0900	**Yes**	30	**Yes**
Groundwater[3]	NWTPH-Dx	Total	Residual Range Organics	N/A	N/A	mg/L	**Yes**	--	1.90	0.290	**Yes**	12	**Yes**
Groundwater[3]	NWTPH-Gx	Total	Gasoline Range Organics	N/A	N/A	mg/L	**Yes**	--	0.430	0.100	**Yes**	5	**Yes**
Groundwater[3]	SVOCs	Total	1,4-Dichlorobenzene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	2-Methylnaphthalene	N/A	N/A	ug/L	**Yes**	--	0.360	72.2	No	0	No
Groundwater[3]	SVOCs	Total	2-Methylphenol	N/A	N/A	ug/L	No	--	--	--	--	--	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(10 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater[3]	SVOCs	Total	Acenaphthene	N/A	N/A	ug/L	**Yes**	--	0.239	520	No	0	No
Groundwater[3]	SVOCs	Total	Anthracene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Benzo(b)fluoranthene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Benzoic Acid	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	N/A	N/A	ug/L	**Yes**	--	48.0	1.20	**Yes**	6	**Yes**
Groundwater[3]	SVOCs	Total	Diethyl Phthalate	N/A	N/A	ug/L	**Yes**	--	1.90	210	No	0	No
Groundwater[3]	SVOCs	Total	Dimethyl Phthalate	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Di-n-octyl Phthalate	N/A	N/A	ug/L	**Yes**	--	7.08	1.20	**Yes**	3	**Yes**
Groundwater[3]	SVOCs	Total	Isophorone	N/A	N/A	ug/L	**Yes**	--	0.282	35.0	No	0	No
Groundwater[3]	SVOCs	Total	Naphthalene	N/A	N/A	ug/L	**Yes**	--	0.157	0.140	**Yes**	1	**Yes**
Groundwater[3]	SVOCs	Total	p-cresol (4-Methylphenol)	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Phenanthrene	N/A	N/A	ug/L	**Yes**	--	3.90	0.140	**Yes**	4	**Yes**
Groundwater[3]	SVOCs	Total	Phenol	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	SVOCs	Total	Pyrene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/L	**Yes**	--	1.90	11.0	No	0	No
Groundwater[3]	VOCs	Total	1,1-Dichloroethane	N/A	N/A	ug/L	**Yes**	--	5.00	2.30	**Yes**	1	**Yes**
Groundwater[3]	VOCs	Total	1,1-Dichloroethene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	1,2,4-Trimethylbenzene	N/A	N/A	ug/L	**Yes**	--	5.20	7.30	No	0	No
Groundwater[3]	VOCs	Total	4-Methyl-2-pentanone (MIBK)	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Acetone	N/A	N/A	ug/L	**Yes**	--	15.4	1500	No	0	No
Groundwater[3]	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/L	**Yes**	--	3.95	0.920	**Yes**	1	**Yes**
Groundwater[3]	VOCs	Total	Carbon Tetrachloride	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Chloroform	N/A	N/A	ug/L	**Yes**	--	3.70	0.190	**Yes**	7	**Yes**
Groundwater[3]	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/L	**Yes**	--	660	360	**Yes**	4	**Yes**
Groundwater[3]	VOCs	Total	Dichloromethane (Methylene Chloride)	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Ethylbenzene	N/A	N/A	ug/L	No	--	--	--	--	--	No
Groundwater[3]	VOCs	Total	Isopropylbenzene	N/A	N/A	ug/L	**Yes**	--	4.60	7.30	No	0	No
Groundwater[3]	VOCs	Total	n-Propylbenzene	N/A	N/A	ug/L	**Yes**	--	2.00	7.30	No	0	No
Groundwater[3]	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/L	**Yes**	--	8.78	0.0930	**Yes**	29	**Yes**
Groundwater[3]	VOCs	Total	Toluene	N/A	N/A	ug/L	**Yes**	--	0.640	9.80	No	0	No
Groundwater[3]	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/L	**Yes**	--	1.70	110	No	0	No
Groundwater[3]	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/L	**Yes**	--	3.40	0.0390	**Yes**	15	**Yes**
Groundwater[3]	VOCs	Total	Vinyl Chloride	N/A	N/A	ug/L	**Yes**	--	4.10	0.0250	**Yes**	20	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Aluminum	N/A	N/A	mg/L	--	--	1.37	0.0870	**Yes**	2	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Antimony	N/A	N/A	mg/L	--	--	0.00167	0.00560	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	--	--	0.00136	0.0000180	**Yes**	10	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Barium	N/A	N/A	mg/L	--	--	0.0207	0.00400	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Cadmium	N/A	N/A	mg/L	--	--	0.0000300	0.000170	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	--	34.1	116	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Chromium	N/A	N/A	mg/L	--	--	0.00429	0.0540	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Cobalt	N/A	N/A	mg/L	--	--	0.00508	0.0110	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
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Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	Metals	Dissolved	Copper	N/A	N/A	mg/L	--	--	0.00438	0.00580	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Iron	N/A	N/A	mg/L	--	--	0.476	0.300	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Lead	N/A	N/A	mg/L	--	--	0.000378	0.00144	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	--	12.0	82.0	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Manganese	N/A	N/A	mg/L	--	--	0.587	0.0500	**Yes**	4	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Mercury	N/A	N/A	mg/L	--	--	0.0000600	0.000770	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Nickel	N/A	N/A	mg/L	--	--	0.00390	0.0340	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	--	2.21	53.0	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Selenium	N/A	N/A	mg/L	--	--	0.00130	0.00500	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Silver	N/A	N/A	mg/L	--	--	0.0000790	0.000120	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	--	47.7	680	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Thallium	N/A	N/A	mg/L	--	--	0.0000855	0.000240	No	0	No
Groundwater - DP[3]	Metals	Dissolved	Vanadium	N/A	N/A	mg/L	--	--	0.00261	0.00260	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Dissolved	Zinc	N/A	N/A	mg/L	--	--	0.00410	0.077	No	0	No
Groundwater - DP[3]	Metals	Total	Aluminum	N/A	N/A	mg/L	--	--	17.9	37.0	No	0	No
Groundwater - DP[3]	Metals	Total	Antimony	N/A	N/A	mg/L	--	--	0.00157	0.00560	No	0	No
Groundwater - DP[3]	Metals	Total	Arsenic	N/A	N/A	mg/L	--	--	0.00770	0.0000180	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Total	Barium	N/A	N/A	mg/L	--	--	0.0978	1.00	No	0	No
Groundwater - DP[3]	Metals	Total	Beryllium	N/A	N/A	mg/L	--	--	0.000785	0.0730	No	0	No
Groundwater - DP[3]	Metals	Total	Calcium	N/A	N/A	mg/L	--	--	33.7	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Chromium	N/A	N/A	mg/L	--	--	0.0318	55.0	No	0	No
Groundwater - DP[3]	Metals	Total	Cobalt	N/A	N/A	mg/L	--	--	0.0131	0.0110	**Yes**	1	**Yes**
Groundwater - DP[3]	Metals	Total	Copper	N/A	N/A	mg/L	--	--	0.204	1.30	No	0	No
Groundwater - DP[3]	Metals	Total	Iron	N/A	N/A	mg/L	--	--	25.9	0.300	**Yes**	8	**Yes**
Groundwater - DP[3]	Metals	Total	Lead	N/A	N/A	mg/L	--	--	0.0137	0.0150	No	0	No
Groundwater - DP[3]	Metals	Total	Magnesium	N/A	N/A	mg/L	--	--	15.4	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Manganese	N/A	N/A	mg/L	--	--	0.709	0.0500	**Yes**	7	**Yes**
Groundwater - DP[3]	Metals	Total	Mercury	N/A	N/A	mg/L	--	--	0.000100	0.0110	No	0	No
Groundwater - DP[3]	Metals	Total	Nickel	N/A	N/A	mg/L	--	--	0.0501	0.610	No	0	No
Groundwater - DP[3]	Metals	Total	Potassium	N/A	N/A	mg/L	--	--	3.21	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Selenium	N/A	N/A	mg/L	--	--	0.00206	0.170	No	0	No
Groundwater - DP[3]	Metals	Total	Silver	N/A	N/A	mg/L	--	--	0.000376	0.180	No	0	No
Groundwater - DP[3]	Metals	Total	Sodium	N/A	N/A	mg/L	--	--	42.9	NV	***Yes***	--	***Yes***
Groundwater - DP[3]	Metals	Total	Thallium	N/A	N/A	mg/L	--	--	0.000146	0.000240	No	0	No
Groundwater - DP[3]	Metals	Total	Vanadium	N/A	N/A	mg/L	--	--	0.0776	0.00260	**Yes**	7	**Yes**
Groundwater - DP[3]	Metals	Total	Zinc	N/A	N/A	mg/L	--	--	0.149	7.40	No	0	No
Groundwater - DP[3]	Butyltins	Total	Monobutyltin	N/A	N/A	ug/L	--	--	0.00671	0.0630	No	0	No
Groundwater - DP[3]	Butyltins	Total	Tributyltin	N/A	N/A	ug/L	--	--	0.00435	0.0630	No	0	No
Groundwater - DP[3]	Pesticides	Total	BHC (gamma) Lindane	N/A	N/A	ug/L	--	--	0.00249	0.0520	No	0	No
Groundwater - DP[3]	Pesticides	Total	Methoxychlor	N/A	N/A	ug/L	--	--	0.00521	0.0300	No	0	No
Groundwater - DP[3]	NWTPH-Dx	Total	Residual Range Organics	N/A	N/A	mg/L	--	--	0.113	0.290	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(12 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	NWTPH-Gx	Total	Gasoline Range Organics	N/A	N/A	mg/L	--	--	0.0209	0.100	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	2-Methylnaphthalene	N/A	N/A	ug/L	--	--	0.280	72.2	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Acenaphthene	N/A	N/A	ug/L	--	--	0.0348	520	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Acenaphthylene	N/A	N/A	ug/L	--	--	0.00361	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Benzo(a)pyrene	N/A	N/A	ug/L	--	--	0.00714	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Benzoic Acid	N/A	N/A	ug/L	--	--	0.317	42.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Butyl Benzyl Phthalate	N/A	N/A	ug/L	--	--	0.155	19.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Dibenz(a,h)anthracene	N/A	N/A	ug/L	--	--	0.00381	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Diethyl Phthalate	N/A	N/A	ug/L	--	--	0.101	210	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Di-n-butyl Phthalate	N/A	N/A	ug/L	--	--	0.207	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Fluorene	N/A	N/A	ug/L	--	--	0.0116	3.90	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Indeno(1,2,3-cd)pyrene	N/A	N/A	ug/L	--	--	0.00630	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Isophorone	N/A	N/A	ug/L	--	--	0.0782	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Naphthalene	N/A	N/A	ug/L	--	--	0.200	0.140	**Yes**	3	**Yes**
Groundwater - DP[3]	SVOCs	Dissolved	Phenanthrene	N/A	N/A	ug/L	--	--	0.0190	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Dissolved	Phenol	N/A	N/A	ug/L	--	--	0.0248	110	No	0	No
Groundwater - DP[3]	SVOCs	Total	2-Methylnaphthalene	N/A	N/A	ug/L	--	--	0.153	72.2	No	0	No
Groundwater - DP[3]	SVOCs	Total	Acenaphthene	N/A	N/A	ug/L	--	--	0.0230	520	No	0	No
Groundwater - DP[3]	SVOCs	Total	Anthracene	N/A	N/A	ug/L	--	--	0.0126	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Total	Benzo(a)pyrene	N/A	N/A	ug/L	--	--	0.00895	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Benzofluoranthenes, Total	N/A	N/A	ug/L	--	--	0.0173	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Benzyl Alcohol	N/A	N/A	ug/L	--	--	0.0523	8.60	No	0	No
Groundwater - DP[3]	SVOCs	Total	Bis(2-ethylhexyl) Phthalate	N/A	N/A	ug/L	--	--	0.408	1.20	**Yes**	0	No
Groundwater - DP[3]	SVOCs	Total	Butyl Benzyl Phthalate	N/A	N/A	ug/L	--	--	0.228	19.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Dibenz(a,h)anthracene	N/A	N/A	ug/L	--	--	0.00671	0.00290	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Dibenzofuran	N/A	N/A	ug/L	--	--	0.0421	3.70	No	0	No
Groundwater - DP[3]	SVOCs	Total	Di-n-butyl Phthalate	N/A	N/A	ug/L	--	--	0.239	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Fluoranthene	N/A	N/A	ug/L	--	--	0.0311	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Fluorene	N/A	N/A	ug/L	--	--	0.0351	3.90	No	0	No
Groundwater - DP[3]	SVOCs	Total	Indeno(1,2,3-cd)pyrene	N/A	N/A	ug/L	--	--	0.00797	0.00380	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Isophorone	N/A	N/A	ug/L	--	--	0.0842	35.0	No	0	No
Groundwater - DP[3]	SVOCs	Total	Naphthalene	N/A	N/A	ug/L	--	--	0.0452	0.140	No	0	No
Groundwater - DP[3]	SVOCs	Total	Phenanthrene	N/A	N/A	ug/L	--	--	0.144	0.140	**Yes**	1	**Yes**
Groundwater - DP[3]	SVOCs	Total	Phenol	N/A	N/A	ug/L	--	--	0.0291	110	No	0	No
Groundwater - DP[3]	SVOCs	Total	Pyrene	N/A	N/A	ug/L	--	--	0.0261	10.1	No	0	No
Groundwater - DP[3]	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/L	--	--	2.23	11.0	No	0	No
Groundwater - DP[3]	VOCs	Total	1,1-Dichloroethane	N/A	N/A	ug/L	--	--	2.52	2.30	**Yes**	1	**Yes**
Groundwater - DP[3]	VOCs	Total	1,1-Dichloroethene	N/A	N/A	ug/L	--	--	1.17	25.0	No	0	No
Groundwater - DP[3]	VOCs	Total	1,2,4-Trimethylbenzene	N/A	N/A	ug/L	--	--	0.0485	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	1,3,5-Trimethylbenzene	N/A	N/A	ug/L	--	--	0.0297	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	2,2-Dichloropropane	N/A	N/A	ug/L	--	--	0.179	0.390	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(13 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Groundwater - DP[3]	VOCs	Total	Acetone	N/A	N/A	ug/L	--	--	3.88	1500	No	0	No
Groundwater - DP[3]	VOCs	Total	Benzene	N/A	N/A	ug/L	--	--	0.137	0.390	No	0	No
Groundwater - DP[3]	VOCs	Total	Bromoform	N/A	N/A	ug/L	--	--	0.151	4.30	No	0	No
Groundwater - DP[3]	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/L	--	--	0.0619	0.920	No	0	No
Groundwater - DP[3]	VOCs	Total	Chloroform	N/A	N/A	ug/L	--	--	0.174	0.190	No	0	No
Groundwater - DP[3]	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/L	--	--	341	360	No	0	No
Groundwater - DP[3]	VOCs	Total	Ethylbenzene	N/A	N/A	ug/L	--	--	0.045	1.40	No	0	No
Groundwater - DP[3]	VOCs	Total	Isopropylbenzene	N/A	N/A	ug/L	--	--	0.0197	7.30	No	0	No
Groundwater - DP[3]	VOCs	Total	m,p-Xylenes	N/A	N/A	ug/L	--	--	0.132	13.0	No	0	No
Groundwater - DP[3]	VOCs	Total	Naphthalene	N/A	N/A	ug/L	--	--	0.0452	0.140	No	0	No
Groundwater - DP[3]	VOCs	Total	o-Xylene	N/A	N/A	ug/L	--	--	0.0735	350	No	0	No
Groundwater - DP[3]	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/L	--	--	54.5	0.0930	**Yes**	10	**Yes**
Groundwater - DP[3]	VOCs	Total	Toluene	N/A	N/A	ug/L	--	--	0.299	9.80	No	0	No
Groundwater - DP[3]	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/L	--	--	1.80	110	No	0	No
Groundwater - DP[3]	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/L	--	--	43.7	0.0390	**Yes**	9	**Yes**
Groundwater - DP[3]	VOCs	Total	Vinyl Chloride	N/A	N/A	ug/L	--	--	0.611	0.0250	**Yes**	2	**Yes**
Seep Water[3]	Metals	Dissolved	Antimony	N/A	N/A	mg/L	--	--	0.00228	0.00560	No	0	No
Seep Water[3]	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	--	--	0.00100	0.0000180	**Yes**	3	**Yes**
Seep Water[3]	Metals	Dissolved	Barium	N/A	N/A	mg/L	--	--	0.277	0.00400	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	--	76.4	116	No	0	No
Seep Water[3]	Metals	Dissolved	Copper	N/A	N/A	mg/L	--	--	0.00109	0.00580	No	0	No
Seep Water[3]	Metals	Dissolved	Iron	N/A	N/A	mg/L	--	--	3.21	0.300	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Lead	N/A	N/A	mg/L	--	--	0.0000650	0.00144	No	0	No
Seep Water[3]	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	--	16.6	82.0	No	0	No
Seep Water[3]	Metals	Dissolved	Manganese	N/A	N/A	mg/L	--	--	1.48	0.0500	**Yes**	1	**Yes**
Seep Water[3]	Metals	Dissolved	Nickel	N/A	N/A	mg/L	--	--	0.00222	0.0340	No	0	No
Seep Water[3]	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	--	4.16	53.0	No	0	No
Seep Water[3]	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	--	19.7	680	No	0	No
Seep Water[3]	Metals	Dissolved	Zinc	N/A	N/A	mg/L	--	--	0.0856	0.077	**Yes**	1	**Yes**
Seep Water[3]	Metals	Total	Arsenic	N/A	N/A	mg/L	--	--	0.0128	0.0000180	**Yes**	4	**Yes**
Seep Water[3]	Metals	Total	Barium	N/A	N/A	mg/L	--	--	0.0742	1.00	No	0	No
Seep Water[3]	Metals	Total	Chromium	N/A	N/A	mg/L	--	--	0.00105	55.0	No	0	No
Seep Water[3]	Metals	Total	Copper	N/A	N/A	mg/L	--	--	0.00272	1.30	No	0	No
Seep Water[3]	Metals	Total	Iron	N/A	N/A	mg/L	--	--	121	0.300	**Yes**	4	**Yes**
Seep Water[3]	Metals	Total	Lead	N/A	N/A	mg/L	--	--	0.0257	0.0150	**Yes**	1	**Yes**
Seep Water[3]	Metals	Total	Manganese	N/A	N/A	mg/L	--	--	3.24	0.0500	**Yes**	3	**Yes**
Seep Water[3]	Metals	Total	Mercury	N/A	N/A	mg/L	--	--	0.0000300	0.0110	No	0	No
Seep Water[3]	Metals	Total	Nickel	N/A	N/A	mg/L	--	--	0.00232	0.610	No	0	No
Seep Water[3]	Metals	Total	Selenium	N/A	N/A	mg/L	--	--	0.00111	0.170	No	0	No
Seep Water[3]	NWTPH-Dx	Total	Diesel Range Organics	N/A	N/A	mg/L	--	--	0.130	0.0900	**Yes**	1	**Yes**
Seep Water[3]	NWTPH-Dx	Total	Residual Range Organics	N/A	N/A	mg/L	--	--	0.130	0.290	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(14 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?^{1}	Significantly Higher Conc in AOPC than Reference?^{2}	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Seep Water^3	SVOCs	Total	Benzoic Acid	N/A	N/A	ug/L	--	--	5.90	42.0	No	0	No
Seep Water^3	VOCs	Total	Chloroform	N/A	N/A	ug/L	--	--	2.80	0.190	**Yes**	2	**Yes**
Seep Water^3	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/L	--	--	4.40	0.0930	**Yes**	3	**Yes**
Surface Water^3	Metals	Dissolved	Arsenic	N/A	N/A	mg/L	--	--	0.00101	0.0000180	**Yes**	4	**Yes**
Surface Water^3	Metals	Dissolved	Calcium	N/A	N/A	mg/L	--	--	20.5	116	No	0	No
Surface Water^3	Metals	Dissolved	Iron	N/A	N/A	mg/L	--	--	0.00920	0.300	No	0	No
Surface Water^3	Metals	Dissolved	Lead	N/A	N/A	mg/L	--	--	0.0000160	0.00144	No	0	No
Surface Water^3	Metals	Dissolved	Magnesium	N/A	N/A	mg/L	--	--	6.33	82.0	No	0	No
Surface Water^3	Metals	Dissolved	Manganese	N/A	N/A	mg/L	--	--	0.00101	0.0500	No	0	No
Surface Water^3	Metals	Dissolved	Potassium	N/A	N/A	mg/L	--	--	1.51	53.0	No	0	No
Surface Water^3	Metals	Dissolved	Sodium	N/A	N/A	mg/L	--	--	7.90	680	No	0	No
Surface Water^3	Metals	Total	Arsenic	N/A	N/A	mg/L	--	--	0.00117	0.0000180	**Yes**	3	**Yes**
Surface Water^3	Metals	Total	Iron	N/A	N/A	mg/L	--	--	0.446	0.300	**Yes**	1	**Yes**
Surface Water^3	Metals	Total	Lead	N/A	N/A	mg/L	--	--	0.000407	0.0150	No	0	No
Surface Water^3	Metals	Total	Manganese	N/A	N/A	mg/L	--	--	0.0136	0.0500	No	0	No
Surface Water^3	NWTPH-Dx	Total	Diesel Range Organics	N/A	N/A	mg/L	--	--	0.0300	0.0900	No	0	No
Soil Gas	VOCs	Total	1,1,1-Trichloroethane (TCA)	N/A	N/A	ug/m3	--	--	98.0	22,000,000	No	0	No
Soil Gas	VOCs	Total	1,2,4-Trimethylbenzene	N/A	N/A	ug/m3	--	--	18,500	31,000	No	0	No
Soil Gas	VOCs	Total	1,3,5-Trimethylbenzene	N/A	N/A	ug/m3	--	--	6,250	26,000	No	0	No
Soil Gas	VOCs	Total	1,3-Butadiene	N/A	N/A	ug/m3	--	--	210	410	No	0	No
Soil Gas	VOCs	Total	1,4-Dioxane	N/A	N/A	ug/m3	--	--	1.10	1,600	No	0	No
Soil Gas	VOCs	Total	2,2,4-Trimethylpentane	N/A	N/A	ug/m3	--	--	1.80	NV	**Yes**	--	**Yes**
Soil Gas	VOCs	Total	2-Butanone (MEK)	N/A	N/A	ug/m3	--	--	31.0	22,000,000	No	0	No
Soil Gas	VOCs	Total	4-Ethyltoluene	N/A	N/A	ug/m3	--	--	9,150	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	4-Methyl-2-pentanone (MIBK)	N/A	N/A	ug/m3	--	--	2.10	13,000,000	No	0	No
Soil Gas	VOCs	Total	Acetone	N/A	N/A	ug/m3	--	--	97.0	140,000,000	No	0	No
Soil Gas	VOCs	Total	Benzene	N/A	N/A	ug/m3	--	--	85.0	1,600	No	0	No
Soil Gas	VOCs	Total	Carbon Disulfide	N/A	N/A	ug/m3	--	--	42.0	3,100,000	No	0	No
Soil Gas	VOCs	Total	Chloroform	N/A	N/A	ug/m3	--	--	0.750	530	No	0	No
Soil Gas	VOCs	Total	cis-1,2-Dichloroethene	N/A	N/A	ug/m3	--	--	330	260,000	No	0	No
Soil Gas	VOCs	Total	Cyclohexane	N/A	N/A	ug/m3	--	--	24.0	26,000,000	No	0	No
Soil Gas	VOCs	Total	Dichlorodifluoromethane	N/A	N/A	ug/m3	--	--	3.20	880,000	No	0	No
Soil Gas	VOCs	Total	Dichloromethane (Methylene Chloride)	N/A	N/A	ug/m3	--	--	1.80	26,000	No	0	No
Soil Gas	VOCs	Total	Ethanol	N/A	N/A	ug/m3	--	--	13.0	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	Ethylbenzene	N/A	N/A	ug/m3	--	--	1,550	4,900	No	0	No
Soil Gas	VOCs	Total	Heptane	N/A	N/A	ug/m3	--	--	87.0	NV	***Yes***	--	***Yes***
Soil Gas	VOCs	Total	Hexane	N/A	N/A	ug/m3	--	--	110	3,100,000	No	0	No
Soil Gas	VOCs	Total	Isopropylbenzene	N/A	N/A	ug/m3	--	--	675	1,800,000	No	0	No
Soil Gas	VOCs	Total	m,p-Xylenes	N/A	N/A	ug/m3	--	--	5,850	440,000	No	0	No
Soil Gas	VOCs	Total	n-Propylbenzene	N/A	N/A	ug/m3	--	--	2,300	4,400,000	No	0	No
Soil Gas	VOCs	Total	o-Xylene	N/A	N/A	ug/m3	--	--	2,800	3,100,000	No	0	No
Soil Gas	VOCs	Total	Tetrachloroethene (PCE)	N/A	N/A	ug/m3	--	--	34,000	2,100	**Yes**	1	**Yes**
Soil Gas	VOCs	Total	Toluene	N/A	N/A	ug/m3	--	--	47,500	22,000,000	No	0	No
Soil Gas	VOCs	Total	trans-1,2-Dichloroethene	N/A	N/A	ug/m3	--	--	4.00	260,000	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(15 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Soil Gas	VOCs	Total	Trichloroethene (TCE)	N/A	N/A	ug/m3	--	--	610	140	**Yes**	2	**Yes**
Soil Gas	VOCs	Total	Trichlorofluoromethane	N/A	N/A	ug/m3	--	--	2.20	3,100,000	No	0	No

Table 9-5
Preliminary-COPC Identification for Combined Data from all Four AOPCs
Bradford Island - Upland Operable Unit
(16 of 16)

Medium	Analyte Group	Total / Dissolved	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in AOPC than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?

Notes

(1) Only evaluated for analytes with a sample size of 20 or more. See the Data Summary for All Four AOPCs Combined - Appendix I, Table I-5.

(2) Only applicable to inorganics. For soils, see the statistical comparison of Site soil concentrations to Reference Area concentrations; Appendix L, Tables L-1 and L-2.
For groundwater and seep water, see Table 8-3 and Appendix L, Table L-3. Direct push groundwater samples are not compared to Reference Area monitoring well data.
(3) The groundwater, seep water, and surface water SLVs are the lower of the Direct Contact Water SLV and the Discharge to Surface Water-Bioaccumulative SLV; see Appendix J.
(4) Total DDT is evaluated in the ERA for the Upland OU; see Section 12 and Appendix N.

'--' = Not evaluated
% = percent
BHC = hexachlorocyclohexane
DP = Direct Push
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
NV = No Value
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
ug/m3 = micrograms per cubic meter

Table 9-6
Preliminary-COPC Identification for Potentially Erodible or Mass Wasting Soil
Bradford Island - Upland Operable Unit
(1 of 4)

AOPC	Medium	Analyte Group	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate	Detection Rate > 5%?[1]	Higher Conc than Reference Sediments?[2]	Max Detected Value	Selected Sediment SLV[3]	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Landfill	Soil	Metals	Aluminum	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Landfill	Soil	Metals	Arsenic	0-1 ft	N/A	mg/kg	100%	--	**Yes**	6.20	6.00	**Yes**	2	**Yes**
Landfill	Soil	Metals	Barium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Landfill	Soil	Metals	Beryllium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Landfill	Soil	Metals	Cadmium	0-1 ft	N/A	mg/kg	100%	--	**Yes**	1.70	0.674	**Yes**	4	**Yes**
Landfill	Soil	Metals	Chromium	0-1 ft	N/A	mg/kg	100%	--	**Yes**	801	37.0	**Yes**	2	**Yes**
Landfill	Soil	Metals	Cobalt	0-1 ft	N/A	mg/kg	100%	--	**Yes**	22.7	15.2	**Yes**	2	**Yes**
Landfill	Soil	Metals	Copper	0-1 ft	N/A	mg/kg	100%	--	**Yes**	60.5	55.6	**Yes**	2	**Yes**
Landfill	Soil	Metals	Lead	0-1 ft	N/A	mg/kg	100%	--	**Yes**	680	35.0	**Yes**	9	**Yes**
Landfill	Soil	Metals	Manganese	0-1 ft	N/A	mg/kg	100%	--	--	614	1100	No	0	No
Landfill	Soil	Metals	Mercury	0-1 ft	N/A	mg/kg	100%	--	**Yes**	0.320	0.214	**Yes**	3	**Yes**
Landfill	Soil	Metals	Nickel	0-1 ft	N/A	mg/kg	100%	--	**Yes**	570	21.2	**Yes**	3	**Yes**
Landfill	Soil	Metals	Selenium	0-1 ft	N/A	mg/kg	20%	--	--	0.848	NV	***Yes***	--	***Yes***
Landfill	Soil	Metals	Silver	0-1 ft	N/A	mg/kg	50%	--	--	0.500	4.50	No	0	No
Landfill	Soil	Metals	Thallium	0-1 ft	N/A	mg/kg	10%	--	**Yes**	0.378	0.354	**Yes**	1	**Yes**
Landfill	Soil	Metals	Vanadium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Landfill	Soil	Metals	Zinc	0-1 ft	N/A	mg/kg	100%	--	**Yes**	221	123	**Yes**	9	**Yes**
Landfill	Soil	Pesticides	4,4'-DDT	0-1 ft	N/A	ug/kg	70%	--	--	28.0	0.040	**Yes**	7	**Yes**
Landfill	Soil	Pesticides	Dieldrin	0-1 ft	N/A	ug/kg	10%	--	--	2.10	0.0010	**Yes**	1	**Yes**
Landfill	Soil	PCB Aroclors	Aroclor 1254	0-1 ft	N/A	ug/kg	70%	--	--	49.0	0.0480	**Yes**	7	**Yes**
Landfill	Soil	PCB Aroclors	Aroclor 1260	0-1 ft	N/A	ug/kg	90%	--	--	92.0	0.0480	**Yes**	9	**Yes**
Landfill	Soil	PCB Aroclors	Total PCBs as Aroclors	0-1 ft	N/A	ug/kg	90%	--	--	127	0.0480	**Yes**	9	**Yes**
Landfill	Soil	SVOCs	2-Methylnaphthalene	0-1 ft	N/A	ug/kg	10%	--	--	11.0	NV	***Yes***	--	***Yes***
Landfill	Soil	SVOCs	Acenaphthene	0-1 ft	N/A	ug/Kg	79%	--	--	1,160	290	**Yes**	2	**Yes**
Landfill	Soil	SVOCs	Acenaphthylene	0-1 ft	N/A	ug/kg	29%	--	--	19.0	160	No	0	No
Landfill	Soil	SVOCs	Anthracene	0-1 ft	N/A	ug/kg	93%	--	--	1,070	57	**Yes**	8	**Yes**
Landfill	Soil	SVOCs	Benzo(a)anthracene	0-1 ft	N/A	ug/kg	93%	--	--	4,500	32	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Benzo(a)pyrene	0-1 ft	N/A	ug/kg	93%	--	--	6,200	32	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Benzo(b)fluoranthene	0-1 ft	N/A	ug/kg	93%	--	--	8,200	27	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Benzo(g,h,i)perylene	0-1 ft	N/A	ug/kg	93%	--	--	3,300	300	**Yes**	8	**Yes**
Landfill	Soil	SVOCs	Benzo(k)fluoranthene	0-1 ft	N/A	ug/kg	93%	--	--	2,500	27	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Benzoic Acid	0-1 ft	N/A	ug/kg	30%	--	--	300	NV	***Yes***	--	***Yes***
Landfill	Soil	SVOCs	Benzyl Alcohol	0-1 ft	N/A	ug/kg	10%	--	--	14.0	NV	***Yes***	--	***Yes***
Landfill	Soil	SVOCs	Bis(2-ethylhexyl) Phthalate	0-1 ft	N/A	ug/kg	90%	--	--	420	750	No	0	No
Landfill	Soil	SVOCs	Carbazole	0-1 ft	N/A	ug/kg	80%	--	--	210	140	**Yes**	1	**Yes**
Landfill	Soil	SVOCs	Chrysene	0-1 ft	N/A	ug/kg	93%	--	--	5,900	57	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Dibenz(a,h)anthracene	0-1 ft	N/A	ug/kg	93%	--	--	1,000	33	**Yes**	11	**Yes**
Landfill	Soil	SVOCs	Dibenzofuran	0-1 ft	N/A	ug/kg	20%	--	--	36.0	5100	No	0	No
Landfill	Soil	SVOCs	Di-n-butyl Phthalate	0-1 ft	N/A	ug/kg	40%	--	--	1,800	110	**Yes**	1	**Yes**
Landfill	Soil	SVOCs	Fluoranthene	0-1 ft	N/A	ug/kg	93%	--	--	14,000	111	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Fluorene	0-1 ft	N/A	ug/kg	71%	--	--	510	77	**Yes**	4	**Yes**
Landfill	Soil	SVOCs	Indeno(1,2,3-cd)pyrene	0-1 ft	N/A	ug/kg	93%	--	--	4,600	17	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Naphthalene	0-1 ft	N/A	ug/kg	36%	--	--	79.0	176	No	0	No
Landfill	Soil	SVOCs	Phenanthrene	0-1 ft	N/A	ug/Kg	93%	--	--	4,200	42	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Pyrene	0-1 ft	N/A	ug/kg	93%	--	--	9,100	53	**Yes**	13	**Yes**

Table 9-6
Preliminary-COPC Identification for Potentially Erodible or Mass Wasting Soil
Bradford Island - Upland Operable Unit
(2 of 4)

AOPC	Medium	Analyte Group	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate	Detection Rate > 5%?[1]	Higher Conc than Reference Sediments?[2]	Max Detected Value	Selected Sediment SLV[3]	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Landfill	Soil	SVOCs	Total LPAHs (KM, capped)	0-1 ft	N/A	ug/kg	93%	--	**--**	7,043	76	**Yes**	13	**Yes**
Landfill	Soil	SVOCs	Total HPAHs (KM, capped)	0-1 ft	N/A	ug/kg	93%	--	**--**	55,030	193	**Yes**	13	**Yes**
Landfill	Soil	VOCs	Tetrachloroethene (PCE)	0-1 ft	N/A	ug/kg	80%	--	--	9.70	NV	*Yes*	--	*Yes*
Landfill	Soil	VOCs	Toluene	0-1 ft	N/A	ug/kg	80%	--	--	1.46	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Metals	Aluminum	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Antimony	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Arsenic	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Barium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Beryllium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Cadmium	0-1 ft	N/A	mg/kg	100%	--	**Yes**	1.06	0.674	**Yes**	1	**Yes**
Sandblast Area	Soil	Metals	Chromium	0-1 ft	N/A	mg/kg	100%	--	**Yes**	162	37.0	**Yes**	2	**Yes**
Sandblast Area	Soil	Metals	Cobalt	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Copper	0-1 ft	N/A	mg/kg	100%	--	**Yes**	71.6	55.6	**Yes**	1	**Yes**
Sandblast Area	Soil	Metals	Lead	0-1 ft	<250um	mg/kg	100%	--	**Yes**	90.8	35	**Yes**	1	**Yes**
Sandblast Area	Soil	Metals	Lead	0-1 ft	<2mm	mg/kg	100%	--	**Yes**	52.7	35	**Yes**	1	**Yes**
Sandblast Area	Soil	Metals	Lead	0-1 ft	N/A	mg/kg	100%	--	**Yes**	319	35	**Yes**	2	**Yes**
Sandblast Area	Soil	Metals	Manganese	0-1 ft	N/A	mg/kg	100%	--	--	479	1100	No	0	No
Sandblast Area	Soil	Metals	Mercury	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Nickel	0-1 ft	N/A	mg/kg	100%	--	**Yes**	74.9	21.2	**Yes**	2	**Yes**
Sandblast Area	Soil	Metals	Selenium	0-1 ft	N/A	mg/kg	100%	--	--	0.650	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Metals	Silver	0-1 ft	N/A	mg/kg	100%	--	--	0.175	4.50	No	0	No
Sandblast Area	Soil	Metals	Thallium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Vanadium	0-1 ft	N/A	mg/kg	100%	--	No	--	--	--	--	No
Sandblast Area	Soil	Metals	Zinc	0-1 ft	N/A	mg/kg	100%	--	**Yes**	203	123	**Yes**	1	**Yes**
Sandblast Area	Soil	Butyltins	Dibutyltin	0-1 ft	N/A	ug/kg	100%	--	--	9.10	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Butyltins	Monobutyltin	0-1 ft	N/A	ug/kg	100%	--	--	8.25	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Butyltins	Tributyltin	0-1 ft	N/A	ug/kg	100%	--	--	12.8	2.3	**Yes**	2	**Yes**
Sandblast Area	Soil	Pesticides	4,4'-DDE	0-1 ft	N/A	ug/kg	100%	--	--	0.440	0.0400	**Yes**	2	**Yes**
Sandblast Area	Soil	Pesticides	4,4'-DDT	0-1 ft	N/A	ug/kg	100%	--	--	10.0	0.0400	**Yes**	2	**Yes**
Sandblast Area	Soil	Pesticides	BHC (delta)	0-1 ft	N/A	ug/kg	50%	--	--	0.0780	0.900	No	0	No
Sandblast Area	Soil	Pesticides	Endosulfan II	0-1 ft	N/A	ug/kg	50%	--	--	0.240	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Pesticides	Endosulfan Sulfate	0-1 ft	N/A	ug/kg	50%	--	--	0.770	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	Pesticides	Heptachlor	0-1 ft	N/A	ug/kg	100%	--	--	0.380	10.0	No	0	No
Sandblast Area	Soil	PCB Aroclors	Aroclor 1260	0-1 ft	N/A	ug/kg	100%	--	--	67.0	0.0480	**Yes**	2	**Yes**
Sandblast Area	Soil	PCB Aroclors	Total PCBs as Aroclors	0-1 ft	N/A	ug/kg	100%	--	--	69.1	0.0480	**Yes**	2	**Yes**
Sandblast Area	Soil	NWTPH-Dx	Diesel Range Organics	0-1 ft	N/A	mg/kg	100%	--	--	69.0	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	NWTPH-Dx	Residual Range Organics	0-1 ft	N/A	mg/kg	100%	--	--	1,000	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	NWTPH-Gx	Gasoline Range Organics	0-1 ft	N/A	mg/kg	50%	--	--	3.20	NV	*Yes*	--	*Yes*
Sandblast Area	Soil	SVOCs	Acenaphthene	0-1 ft	N/A	ug/kg	100%	--	--	68.0	290	No	0	No
Sandblast Area	Soil	SVOCs	Anthracene	0-1 ft	N/A	ug/kg	100%	--	--	150	57	**Yes**	1	**Yes**
Sandblast Area	Soil	SVOCs	Benzo(a)anthracene	0-1 ft	N/A	ug/kg	100%	--	--	1,200	32	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Benzo(a)pyrene	0-1 ft	N/A	ug/kg	100%	--	--	1,000	32	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Benzo(b)fluoranthene	0-1 ft	N/A	ug/kg	100%	--	--	1,600	27	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Benzo(g,h,i)perylene	0-1 ft	N/A	ug/kg	100%	--	--	590	300	**Yes**	1	**Yes**

Table 9-6
Preliminary-COPC Identification for Potentially Erodible or Mass Wasting Soil
Bradford Island - Upland Operable Unit
(3 of 4)

AOPC	Medium	Analyte Group	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate	Detection Rate > 5%?^{1}	Higher Conc than Reference Sediments?^{2}	Max Detected Value	Selected Sediment SLV^3	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Sandblast Area	Soil	SVOCs	Benzo(k)fluoranthene	0-1 ft	N/A	ug/kg	100%	--	--	570	27	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Bis(2-ethylhexyl) Phthalate	0-1 ft	N/A	ug/kg	100%	--	--	260,000	750	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Carbazole	0-1 ft	N/A	ug/kg	100%	--	--	91.0	140	No	0	No
Sandblast Area	Soil	SVOCs	Chrysene	0-1 ft	N/A	ug/kg	100%	--	--	1,500	57	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Dibenz(a,h)anthracene	0-1 ft	N/A	ug/kg	100%	--	--	220	33	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Fluoranthene	0-1 ft	N/A	ug/kg	100%	--	--	2,100	111	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Indeno(1,2,3-cd)pyrene	0-1 ft	N/A	ug/kg	100%	--	--	690	17	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Phenanthrene	0-1 ft	N/A	ug/kg	100%	--	--	940	42	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Pyrene	0-1 ft	N/A	ug/kg	100%	--	--	1,900	53	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Total LPAHs (KM, capped)	0-1 ft	N/A	ug/kg	100%	--	--	1,356	76	**Yes**	2	**Yes**
Sandblast Area	Soil	SVOCs	Total HPAHs (KM, capped)	0-1 ft	N/A	ug/kg	100%	--	--	11,370	193	**Yes**	2	**Yes**
Sandblast Area	Soil	VOCs	1,2,4-Trimethylbenzene	0-1 ft	N/A	ug/kg	75%	--	--	0.280	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	2-Butanone (MEK)	0-1 ft	N/A	ug/kg	88%	--	--	50.0	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	2-Hexanone	0-1 ft	N/A	ug/kg	38%	--	--	8.80	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	4-Isopropyltoluene	0-1 ft	N/A	ug/kg	38%	--	--	2.50	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	4-Methyl-2-pentanone (MIBK)	0-1 ft	N/A	ug/kg	38%	--	--	1.20	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Acetone	0-1 ft	N/A	ug/kg	88%	--	--	540	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Benzene	0-1 ft	N/A	ug/kg	50%	--	--	1.00	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Bromomethane	0-1 ft	N/A	ug/kg	25%	--	--	5.00	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Carbon Disulfide	0-1 ft	N/A	ug/kg	88%	--	--	1.00	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Chloroform	0-1 ft	N/A	ug/kg	38%	--	--	19.0	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Chloromethane	0-1 ft	N/A	ug/kg	25%	--	--	0.250	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	cis-1,2-Dichloroethene	0-1 ft	N/A	ug/kg	13%	--	--	12.0	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Dichlorodifluoromethane	0-1 ft	N/A	ug/kg	13%	--	--	94.0	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Dichloromethane (Methylene Chloride)	0-1 ft	N/A	ug/kg	50%	--	--	460	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Ethylbenzene	0-1 ft	N/A	ug/kg	38%	--	--	0.200	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	m,p-Xylenes	0-1 ft	N/A	ug/kg	38%	--	--	0.360	NV	***Yes***	--	***Yes***
Sandblast Area	Soil	VOCs	Naphthalene	0-1 ft	N/A	ug/kg	25%	--	--	0.540	176	No	0	No
Sandblast Area	Soil	VOCs	Toluene	0-1 ft	N/A	ug/kg	88%	--	--	1.30	NV	***Yes***	--	***Yes***
Bulb Slope	Soil	Metals	Lead	0-1 ft	N/A	mg/kg	100%	--	**Yes**	597	35	**Yes**	11	**Yes**
Bulb Slope	Soil	Metals	Mercury	0-1 ft	N/A	mg/kg	100%	--	**Yes**	1.54	0.214	**Yes**	6	**Yes**
Bulb Slope	Soil	PCB Aroclors	Aroclor 1260	0-1 ft	N/A	ug/kg	67%	--	--	251	0.0480	**Yes**	8	**Yes**
Bulb Slope	Soil	PCB Aroclors	Total PCBs as Aroclors	0-1 ft	N/A	ug/kg	67%	--	--	251	0.0480	**Yes**	8	**Yes**
Bulb Slope	Soil	NWTPH-Dx	Diesel Range Organics	0-1 ft	N/A	mg/kg	100%	--	--	170	NV	***Yes***	--	***Yes***
Bulb Slope	Soil	NWTPH-Dx	Residual Range Organics	0-1 ft	N/A	mg/kg	100%	--	--	410	NV	***Yes***	--	***Yes***

Notes

(1) Only evaluated for analytes with a sample size of 20 or more.

(2) Only applicable to inorganics. See the comparison of potentially erodible and mass wasting soil concentrations to Reference Area sediment concentrations; Appendix L, Table L-8.

(3) Total DDT is evaluated in the ERA and HHRA for the Upland OU; see Sections 11 and 12 and Appendix O.

The subset of Landfill AOPC soil potentially suseptible to mass wasting is comprised of the following samples: BIL01USE through BIL09USE, BIL13SSI, and L-01 through L-04.

The Sandblast Area AOPC potentially erodible soil subset is comprised of the following samples: SB-EUA, SB-EUB, SB-EUA-02, SB-EUA-04, SB-EUA-06, SB-EUA-08, SB-EUB-02, SB-EUB-03, SB-EUB-12, SB-EUB-15, and SB-04.

The entire Bulb Slope AOPC is potentially suseptible to mass wasting.

Table 9-6
Preliminary-COPC Identification for Potentially Erodible or Mass Wasting Soil
Bradford Island - Upland Operable Unit
(4 of 4)

AOPC	Medium	Analyte Group	Analyte	Depth Category (Soil)	Sieve Size (Sieved Soil)	Unit	Detection Rate	Detection Rate > 5%?[1]	Higher Conc than Reference Sediments?[2]	Max Detected Value	Selected Sediment SLV[3]	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?

'--' = Not evaluated
% = percent
BHC = hexachlorocyclohexane
ft = feet
Max = maximum
mg/kg = milligrams per kilogram
N/A = not applicable
NV = No Value
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
VOC = volatile organic carbon

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(1 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV							
Soil	0-1 ft bgs	Metals	Antimony, Cadmium, Lead, Mercury, and Zinc	Antimony, Arsenic, Cadmium, Chromium, Lead, Nickel, Selenium, and Zinc	Lead and Zinc	Lead and Mercury	Antimony, Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, and Zinc
		Organotins	None	None	-	-	None
		Herbicides	2,4,5-T, Dichloroprop, and MCPP	ND	-	-	2,4,5-T, Dichloroprop, and MCPP
		Pesticides	4,4'-DDT	4,4'-DDT, Endrin, Endrin Aldehyde, and Endrin Ketone	-	-	4,4'-DDT, Endrin, Endrin Aldehyde, and Endrin Ketone
		PCBs	Aroclor 1248, Aroclor 1260, and Total PCBs as Aroclors	Arochlor 1254, Aroclor 1260, and Total PCBs as Aroclors	-	None	Aroclor 1248, Arochlor 1254, Aroclor 1260, and Total PCBs as Aroclors
		TPH	GRO	None	-	None	GRO
		PAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Total HPAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Total HPAHs	-	-	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Total HPAHs
		SVOCs	Bis(2-ethylhexyl)phthalate, Carbazole, Dibenzofuran, and Di-n-butyl phthalate	Bis(2-ethylhexyl) phthalate and Dibenzofuran	-	-	Bis(2-ethylhexyl)phthalate, Carbazole, Dibenzofuran, and Di-n-butyl phthalate
		VOCs	Ethylbenzene	None	-	-	Ethylbenzene
	0-3 ft bgs	Metals	Antimony, Arsenic, Cadmium, Lead, Mercury, and Zinc	Antimony, Arsenic, Cadmium, Chromium, Lead, Nickel, Selenium, and Zinc	(No subsurface samples)	(No subsurface samples)	Antimony, Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, and Zinc
		Organotins	None	None			None
		Herbicides	2,4,5-T, Dichloroprop, and MCPP	ND			2,4,5-T, Dichloroprop, and MCPP
		Pesticides	4,4'-DDT	4,4'-DDT, Endrin, Endrin Aldehyde, and Endrin Ketone			4,4'-DDT, Endrin, Endrin Aldehyde, and Endrin Ketone
		PCBs	Aroclor 1248, Aroclor 1260, and Total PCBs as Aroclors	Arochlor-1254, Aroclor 1260, and Total PCBs as Aroclors			Aroclor 1248, Arochlor 1254, Aroclor 1260, and Total PCBs as Aroclors
		TPH	GRO	None			GRO

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(2 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV							
Soil (Continued)	0-3 ft bgs (Continued)	PAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Total HPAHs, and Total LPAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Total HPAHs	(No subsurface samples)	(No subsurface samples)	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Total HPAHs
		SVOCs	Bis(2-ethylhexyl)phthalate Carbazole, Dibenzofuran, and Di-n-butyl phthalate	Bis(2-ethylhexyl) phthalate and Dibenzofuran			Bis(2-ethylhexyl)phthalate Carbazole, Dibenzofuran, and Di-n-butyl phthalate
		VOCs	None	o-Xylene, PCE, and TCE			Ethylbenzene, o-Xylene, PCE, and TCE
	0-10 ft bgs	Metals	Lead	Arsenic, Chromium, and Lead	(No deeper samples)	(No deeper samples)	Arsenic, Chromium, and Lead
		Organotins	None	None			None
		Herbicides	None*	ND			None*
		Pesticides	None	None			None
		PCBs	Total PCBs as Aroclors	Arochlor-1254 and Total PCBs as Aroclors			Arochlor 1254 and Total PCBs as Aroclors
		TPH	GRO and RRO	None			GRO and RRO
		PAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, and Indeno(1,2,3-cd)pyrene	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, and Indeno(1,2,3-cd)pyrene			Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzofluoranthenes (Total), Dibenz(a,h)anthracene, and Indeno(1,2,3-cd)pyrene
		SVOCs	None*	Bis(2-ethylhexyl) phthalate			Bis(2-ethylhexyl) phthalate
		VOCs	PCE	PCE and TCE			PCE and TCE

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(3 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV							
Erodible Soil	0-1 ft bgs	Metals	Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, Thallium, and Zinc	Cadmium, Chromium, Copper, Lead, Nickel, and Zinc	(Not evaluated)	Lead and Mercury	(Not evaluated)
		Organotins	-	Tributyltin		-	
		Herbicides	ND	-		-	
		Pesticides	4,4'-DDT and Dieldrin	4,4'-DDT and 4,4'-DDE		-	
		PCBs	Aroclor 1254, Aroclor 1260, and Total PCBs as Aroclors	Aroclor 1260 and Total PCBs as Aroclors		Aroclor 1260 and Total PCBs as Aroclors	
		TPH	ND	None*		None*	
		PAHs	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Phenanthrene, Pyrene, Total LPAHs, and Total HPAHs	Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, Pyrene, Total LPAHs, and Total HPAHs		-	
		SVOCs	Carbazole and Di-n-butyl Phthalate	Bis(2-ethylhexyl) phthalate		-	
		VOCs	None*	None*		-	

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(4 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV							
Groundwater		Metals (Total)	**MW:** Arsenic, Iron, Lead, Manganese, and Thallium	**MW:** Arsenic, Iron, and Vanadium **DP:** Arsenic, Cobalt, Iron, Manganese, and Vanadium	None	(No goundwater samples)	**MW:** Arsenic, Iron, Lead, Manganese, Thallium, and Vanadium **DP:** Arsenic, Cobalt, Iron, Manganese, and Vanadium
		Metals (Dissolved)	**MW:** Arsenic, Barium, Cacium, Iron, Lead, Manganese, Sodium, and Zinc	**MW:** Arsenic and Vanadium **DP:** Aluminum, Arsenic, Barium, Iron, Manganese, and Vanadium	None		**MW:** Arsenic, Barium, Cacium, Iron, Lead, Manganese, Sodium, Vanadium, and Zinc **DP:** Aluminum, Arsenic, Barium, Iron, Manganese, and Vanadium
		Organotins	**MW:** Dibutyltin and Monobutyltin	None	-		**MW:** Dibutyltin and Monobutyltin
		Herbicides	None	-	-		None
		Pesticides	None	None	-		None
		PCBs	ND	ND	-		ND
		TPH	**MW:** DRO, GRO, and RRO	None	-		**MW:** DRO, GRO, and RRO
		PAHs (Total)	**MW:** Naphthalene and Phenanthrene	**DP:** Benzo(a)pyrene, Benzofluoranthenes (Total), Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Phenanthrene	-		**MW:** Naphthalene and Phenanthrene **DP:** Benzo(a)pyrene, Benzofluoranthenes (Total), Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Phenanthrene
		PAHs (Dissolved)	-	**DP:** Benzo(a)pyrene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Naphthalene	-		**DP:** Benzo(a)pyrene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Naphthalene
		SVOCs	**MW:** Bis(2-ethylhexyl)phthalate and Di-n-octyl phthalate	None	-		**MW:** Bis(2-ethylhexyl)phthalate and Di-n-octyl phthalate
		VOCs	**MW:** Chloroform, PCE, and Vinyl Chloride	**MW:** 1,1-Dichloroethane, cis-1,2-Dichloroethene, PCE, TCE, and Vinyl Chloride **DP:** 1,1-Dichloroethane, PCE, TCE, and Vinyl Chloride	-		**MW:** 1,1-Dichloroethane, Carbon Disulfide, Chloroform, cis-1,2-Dichloroethene, PCE, TCE, and Vinyl Chloride **DP:** 1,1-Dichloroethane, PCE, TCE, and Vinyl Chloride

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(5 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV							
Seep Water		Metals (Total)	Arsenic, Iron, Lead, and Manganese	(No seep water samples)	(No seep water samples)	(No seep water samples)	Arsenic, Iron, Lead, and Manganese
		Metals (Dissolved)	Barium, Iron, Manganese, and Zinc				Barium, Iron, Manganese, and Zinc
		Organotins	ND				ND
		Herbicides	ND				ND
		Pesticides	ND				ND
		PCBs	ND				ND
		TPH	DRO				DRO
		PAHs	ND				ND
		SVOCs	None				None
		VOCs	Chloroform and PCE				Chloroform and PCE
Surface Water		Metals (Total)	Arsenic and Iron	(No surface water samples)	(No surface water samples)	(No surface water samples)	Arsenic and Iron
		Metals (Dissolved)	Arsenic				Arsenic
		Organotins	ND				ND
		Herbicides	-				-
		Pesticides	-				-
		PCBs	-				-
		TPH	None				None
		PAHs	ND				ND
		SVOCs	ND				ND
		VOCs	ND				ND
Lagoon Sediment		Metals	(No lagoon sediment)	(No lagoon sediment)	Zinc	(No lagoon sediment)	Zinc
Soil Gas		VOCs	(No soil gas samples)	PCE and TCE	(No soil gas samples)	(No soil gas samples)	PCE and TCE
Detection Frequency > 5%, Detected > Reference (Inorganics), and No SLV							
Soil	0-10 ft bgs	Herbicides	Dichloroprop	None	(No deeper samples)	(No deeper samples)	Dichloroprop
		SVOCs	Carbazole	Carbazole			Carbazole
		VOCs	None	4-Isopropyltoluene			4-Isopropyltoluene
Erodible Soil	0-1 ft bgs	Metals	Selenium	Selenium	(Not evaluated)	None	(Not evaluated)
		Organotins	-	Dibutyltin and Monobutyltin		-	
		Pesticides	None	Endosulfan II and Endosulfan Sulfate		-	
		TPH	ND	DRO, RRO, and GRO		DRO and RRO	
		PAHs	2-Methylnaphthalene	None		None	
		SVOCs	Benzoic Acid and Benzyl Alcohol	None		-	
		VOCs	PCE and Toluene	All detected VOCs except Napthalene		-	
Groundwater		Metals (Total)	None	**DP:** Calcium, Magnesium, Potassium, and Sodium	None	(No goundwater samples)	**DP:**Calcium, Magnesium, Potassium, and Sodium
Soil Gas		VOCs	(No soil gas samples)	2,2,4-Trimethylpentane, 4-Ethyltoluene, Ethanol, and Heptane	(No soil gas samples)	(No soil gas samples)	2,2,4-Trimethylpentane, 4-Ethyltoluene, Ethanol, and Heptane

Notes

Table 9-7
Upland OU Preliminary COPC Summary
Bradford Island - Upland Operable Unit
(6 of 6)

Medium	Depth Category (Soil)	Analyte Group	Landfill AOPC Preliminary COPCs	Sandblast Area AOPC Preliminary COPCs	Pistol Range AOPC Preliminary COPCs	Bulb Slope AOPC Preliminary COPCs	All Four AOPCs Combined Preliminary COPCs

* See the section of the table for COFIs retained due to lack of SLVs
"-" = Not Analyzed

COPC = contaminant of potential concern
ND = no detected

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(1 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in Forebay than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?
Surface Water - Grab	Metals	W	Dissolved		Arsenic	ug/L	--	--	0.940	0.018	**Yes**	5	**Yes**
Surface Water - Grab	Metals	W	Dissolved		Barium	ug/L	--	--	24.0	4	**Yes**	5	**Yes**
Surface Water - Grab	Metals	W	Dissolved		Beryllium	ug/L	--	--	0.00400	5.3	No	0	No
Surface Water - Grab	Metals	W	Dissolved		Cadmium	ug/L	--	--	0.0100	0.17	No	0	No
Surface Water - Grab	Metals	W	Dissolved		Copper	ug/L	--	--	0.520	5.8	No	0	No
Surface Water - Grab	Metals	W	Dissolved		Lead	ug/L	--	--	0.0360	1.44	No	0	No
Surface Water - Grab	Metals	W	Dissolved		Thallium	ug/L	--	--	0.0310	0.24	No	0	No
Surface Water - Grab	Metals	W	Dissolved		Zinc	ug/L	--	--	7.50	77	No	0	No
Surface Water - Grab	Metals	W	Total		Aluminum	ug/L	--	**Yes**	141	37000	No	0	No
Surface Water - Grab	Metals	W	Total		Arsenic	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	Metals	W	Total		Barium	ug/L	--	**Yes**	27.0	1000	No	0	No
Surface Water - Grab	Metals	W	Total		Beryllium	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	Metals	W	Total		Cadmium	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	Metals	W	Total		Copper	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	Metals	W	Total		Lead	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	Metals	W	Total		Thallium	ug/L	--	No	--	--	--	--	No
Surface Water - Grab	NWTPH-Dx	W	Dissolved		Diesel Range Organics	ug/L	--	--	46.0	90	No	0	No
Surface Water - Grab	NWTPH-Dx	W	Total		Diesel Range Organics	ug/L	--	--	15.0	90	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	-	Total PCBs As Congeners (KM, capped)	pg/L	--	--	209	64.0	**Yes**	5	**Yes**
Surface Water - XAD	PCB Congeners	W	C+F	77	3,3',4,4'-Tetrachlorobiphenyl	pg/L	--	--	0.133	5200	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	105	2,3,3',4,4'-Pentachlorobiphenyl	pg/L	--	--	0.540	5200	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	118	2,3',4,4',5-Pentachlorobiphenyl	pg/L	--	--	1.57	5200	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	pg/L	--	--	0.382	1000	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	167	2,3',4,4',5,5'-Hexachlorobiphenyl	pg/L	--	--	0.158	52000	No	0	No
Surface Water - XAD	PCB Congeners	W	C+F	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	pg/L	--	--	0.0662	5200	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Acenaphthene	ng/L	--	--	1.28	520000	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Anthracene	ng/L	--	--	0.121	13000	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Benzo(a)anthracene	ng/L	--	--	0.0600	3.80	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Benzo(b)fluoranthene	ng/L	--	--	0.0917	3.80	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Chrysene	ng/L	--	--	0.171	3.80	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Fluoranthene	ng/L	--	--	0.784	6160	No	0	No
Surface Water - XAD	SVOCs	W	C+F		Phenanthrene	ng/L	--	--	1.61	140	No	0	No
Sediment	Metals	D	Total		Aluminum	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Antimony	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Arsenic	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Barium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Beryllium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Cadmium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Chromium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Cobalt	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Copper	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Lead	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Mercury	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Nickel	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Thallium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D	Total		Vanadium	mg/kg	--	No	--	--	--	--	No

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(2 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in Forebay than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?
Sediment	Metals	D	Total		Zinc	mg/kg	--	No	--	--	--	--	No
Sediment	NWTPH-Dx	D	Total		Diesel Range Organics	mg/kg	--	--	54.0	NV	***Yes***	--	***Yes***
Sediment	NWTPH-Dx	D	Total		Residual Range Organics	mg/kg	--	--	180	NV	***Yes***	--	***Yes***
Sediment	PCB Aroclors	D	Total		Aroclor 1254	ug/kg	--	--	27.0	0.048	**Yes**	2	**Yes**
Sediment	PCB Aroclors	D	Total		Total PCBs As Aroclors	ug/kg	--	--	28.7	0.048	**Yes**	2	**Yes**
Sediment	PCB Congeners	D	Total	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	29.7	0.048	**Yes**	19	**Yes**
Sediment	PCB Congeners	D	Total	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.00709	0.0064	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	Total	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	1.08	0.021	**Yes**	7	**Yes**
Sediment	PCB Congeners	D	Total	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0603	0.021	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	Total	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	2.65	0.026	**Yes**	14	**Yes**
Sediment	PCB Congeners	D	Total	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.0363	0.026	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	Total	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.000238	6.2E-06	**Yes**	3	**Yes**
Sediment	PCB Congeners	D	Total	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	0.380	0.026	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	Total	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.113	0.026	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	Total	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.00901	0.14	No	0	No
Sediment	SVOCs	D	Total		Anthracene	ug/kg	--	--	2.70	57.0	No	0	No
Sediment	SVOCs	D	Total		Benzo(a)anthracene	ug/kg	--	--	12.0	32.0	No	0	No
Sediment	SVOCs	D	Total		Benzo(a)pyrene	ug/kg	--	--	7.50	32.0	No	0	No
Sediment	SVOCs	D	Total		Benzo(b)fluoranthene	ug/kg	--	--	9.10	27.0	No	0	No
Sediment	SVOCs	D	Total		Benzo(g,h,i)perylene	ug/kg	--	--	6.20	300	No	0	No
Sediment	SVOCs	D	Total		Benzo(k)fluoranthene	ug/kg	--	--	4.90	27.0	No	0	No
Sediment	SVOCs	D	Total		Bis(2-ethylhexyl) Phthalate	ug/kg	--	--	340	750	No	0	No
Sediment	SVOCs	D	Total		Carbazole	ug/kg	--	--	1.40	140	No	0	No
Sediment	SVOCs	D	Total		Chrysene	ug/kg	--	--	20.0	57.0	No	0	No
Sediment	SVOCs	D	Total		Fluoranthene	ug/kg	--	--	12.0	111	No	0	No
Sediment	SVOCs	D	Total		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	5.70	17.0	No	0	No
Sediment	SVOCs	D	Total		p-cresol (4-Methylphenol)	ug/kg	--	--	21.0	48.0	No	0	No
Sediment	SVOCs	D	Total		Phenanthrene	ug/kg	--	--	7.40	42.0	No	0	No
Sediment	SVOCs	D	Total		Pyrene	ug/kg	--	--	17.0	53.0	No	0	No
Sediment	SVOCs	D	Total		Total LPAH (KM, capped)	ug/kg	--	--	12.0	76.0	No	0	No
Sediment	SVOCs	D	Total		Total HPAH (KM, capped)	ug/kg	--	--	73.9	193	No	0	No
Sediment	SVOCs	D	Total		Total PAHs (KM, capped)	ug/kg	--	--	83.4	1610	No	0	No
Tissue - Crayfish	Metals	W	Total		Aluminum	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Antimony	mg/kg	--	**Yes**	0.133	NV	***Yes***	--	***Yes***
Tissue - Crayfish	Metals	W	Total		Arsenic	mg/kg	--	**Yes**	0.680	0.00076	**Yes**	17	**Yes**
Tissue - Crayfish	Metals	W	Total		Barium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Beryllium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Cadmium	mg/kg	--	No	--	--	**--**	--	No
Tissue - Crayfish	Metals	W	Total		Chromium	mg/kg	--	**Yes**	1.20	NV	***Yes***	--	***Yes***
Tissue - Crayfish	Metals	W	Total		Cobalt	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Copper	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Lead	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Mercury	mg/kg	--	**Yes**	0.0315	0.049	No	0	No
Tissue - Crayfish	Metals	W	Total		Methyl Mercury	mg/kg	--	**Yes**	0.0400	0.049	No	0	No
Tissue - Crayfish	Metals	W	Total		Nickel	mg/kg	--	**Yes**	5.35	NV	***Yes***	--	***Yes***
Tissue - Crayfish	Metals	W	Total		Thallium	mg/kg	--	No	--	--	--	--	No

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(3 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in Forebay than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?
Tissue - Crayfish	Metals	W	Total		Vanadium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W	Total		Zinc	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	PCB Congeners	W	Total	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	42.6	0.57	**Yes**	14	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.0207	0.076	No	0	No
Tissue - Crayfish	PCB Congeners	W	Total	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	--	--	0.00132	0.025	No	0	No
Tissue - Crayfish	PCB Congeners	W	Total	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	0.134	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	Total	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.804	0.25	**Yes**	3	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	14.0	0.25	**Yes**	5	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.460	0.25	**Yes**	1	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.00783	0.000076	**Yes**	7	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	3.91	0.25	**Yes**	4	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	1.53	0.25	**Yes**	3	**Yes**
Tissue - Crayfish	PCB Congeners	W	Total	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.0821	0.25	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Acenaphthene	ug/kg	--	--	0.260	15,000	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Anthracene	ug/kg	--	--	0.160	15,000	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Benzo(a)anthracene	ug/kg	--	--	0.350	1.57	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Benzo(a)pyrene	ug/kg	--	--	0.170	0.157	Yes	2	**Yes**
Tissue - Crayfish	SVOCs	W	Total		Benzo(b)fluoranthene	ug/kg	--	--	0.240	1.57	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Benzo(g,h,i)perylene	ug/kg	--	--	0.390	15.7	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Benzo(k)fluoranthene	ug/kg	--	--	0.160	15.7	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Bis(2-ethylhexyl) Phthalate	ug/kg	--	--	110	81.9	Yes	2	**Yes**
Tissue - Crayfish	SVOCs	W	Total		Chrysene	ug/kg	--	--	0.310	157	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Fluoranthene	ug/kg	--	--	0.750	19,000	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Fluorene	ug/kg	--	--	0.210	15,000	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	0.180	1.57	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Phenanthrene	ug/kg	--	--	0.860	15,000	No	0	No
Tissue - Crayfish	SVOCs	W	Total		Pyrene	ug/kg	--	--	1.20	1,000	No	0	No
Tissue - Smallmouth Bass	Metals	W	Total		Aluminum	mg/kg	--	**Yes**	15.5	NV	***Yes***	--	***Yes***
Tissue - Smallmouth Bass	Metals	W	Total		Arsenic	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Barium	mg/kg	--	**Yes**	2.64	NV	***Yes***	--	***Yes***
Tissue - Smallmouth Bass	Metals	W	Total		Beryllium	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Cadmium	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Chromium	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Cobalt	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Copper	mg/kg	--	**Yes**	1.42	NV	***Yes***	--	***Yes***
Tissue - Smallmouth Bass	Metals	W	Total		Lead	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Mercury	mg/kg	--	**Yes**	0.512	0.049	**Yes**	19	**Yes**
Tissue - Smallmouth Bass	Metals	W	Total		Nickel	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Thallium	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Vanadium	mg/kg	--	No	--	--	--	--	No
Tissue - Smallmouth Bass	Metals	W	Total		Zinc	mg/kg	--	**Yes**	18.0	NV	***Yes***	--	***Yes***
Tissue - Smallmouth Bass	PCB Aroclors	W	Total		Aroclor 1242	ug/kg	--	--	260	0.57	**Yes**	1	**Yes**
Tissue - Smallmouth Bass	PCB Aroclors	W	Total		Aroclor 1254	ug/kg	--	--	18,000	0.57	**Yes**	7	**Yes**
Tissue - Smallmouth Bass	PCB Aroclors	W	Total		Total PCBs As Aroclors	ug/kg	--	--	18,110	0.57	**Yes**	7	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	26,505	0.57	**Yes**	19	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	8.95	0.076	**Yes**	10	**Yes**

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(4 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?^{1}	Significantly Higher Conc in Forebay than Reference?^{2}	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?
Tissue - Smallmouth Bass	PCB Congeners	W	Total	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	--	--	1.19	0.025	**Yes**	1	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	1,300	0.25	**Yes**	19	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	89.8	0.25	**Yes**	12	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	3,270	0.25	**Yes**	19	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	55.3	0.25	**Yes**	9	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	3.03	0.000076	**Yes**	18	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	486	0.25	**Yes**	19	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	140	0.25	**Yes**	15	**Yes**
Tissue - Smallmouth Bass	PCB Congeners	W	Total	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	10.1	0.25	**Yes**	9	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Acenaphthene	ug/kg	--	--	1.60	15,000	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Anthracene	ug/kg	--	--	17.0	15,000	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Benzo(a)anthracene	ug/kg	--	--	17.0	1.57	Yes	2	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Benzo(a)pyrene	ug/kg	--	--	7.40	0.157	Yes	8	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Benzo(b)fluoranthene	ug/kg	--	--	4.40	1.57	Yes	5	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Benzo(g,h,i)perylene	ug/kg	--	--	3.30	15.7	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Benzo(k)fluoranthene	ug/kg	--	--	7.70	15.7	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Bis(2-ethylhexyl) Phthalate	ug/kg	--	--	1,600	81.9	Yes	7	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Butyl Benzyl Phthalate	ug/kg	--	--	440	310	Yes	1	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Chrysene	ug/kg	--	--	10.0	157	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Dibenz(a,h)anthracene	ug/kg	--	--	4.10	0.157	Yes	6	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Di-n-butyl Phthalate	ug/kg	--	--	150	626	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Fluoranthene	ug/kg	--	--	6.50	19,000	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Fluorene	ug/kg	--	--	4.70	15,000	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	6.10	1.57	Yes	5	**Yes**
Tissue - Smallmouth Bass	SVOCs	W	Total		Phenanthrene	ug/kg	--	--	5.70	15,000	No	0	No
Tissue - Smallmouth Bass	SVOCs	W	Total		Pyrene	ug/kg	--	--	7.20	1,000	No	0	No
Tissue - Clam	Metals	W	Total		Aluminum	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Antimony	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Arsenic	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Barium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Beryllium	mg/kg	--	**Yes**	0.00380	NV	***Yes***	--	***Yes***
Tissue - Clam	Metals	W	Total		Cadmium	mg/kg	--	**Yes**	0.461	0.15	**Yes**	19	**Yes**
Tissue - Clam	Metals	W	Total		Chromium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Cobalt	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Copper	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Lead	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Mercury	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Methyl Mercury	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Nickel	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Thallium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Vanadium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W	Total		Zinc	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	PCB Aroclors	W	Total		Aroclor 1254	ug/kg	--	--	120	35	**Yes**	1	**Yes**
Tissue - Clam	PCB Aroclors	W	Total		Total PCBs As Aroclors	ug/kg	--	--	120	35	**Yes**	1	**Yes**
Tissue - Clam	PCB Congeners	W	Total	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	312	35	**Yes**	5	**Yes**
Tissue - Clam	PCB Congeners	W	Total	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.0690	0.16	No	0	No

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(5 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in Forebay than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?
Tissue - Clam	PCB Congeners	W	Total	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	--	--	0.00246	0.08	No	0	No
Tissue - Clam	PCB Congeners	W	Total	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	6.20	20	No	0	No
Tissue - Clam	PCB Congeners	W	Total	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.445	20	No	0	No
Tissue - Clam	PCB Congeners	W	Total	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	64.7	20	**Yes**	1	**Yes**
Tissue - Clam	PCB Congeners	W	Total	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	1.15	20	No	0	No
Tissue - Clam	PCB Congeners	W	Total	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0110	0.0058	**Yes**	1	**Yes**
Tissue - Clam	PCB Congeners	W	Total	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	3.61	20	No	0	No
Tissue - Clam	PCB Congeners	W	Total	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	3.80	20	No	0	No
Tissue - Clam	PCB Congeners	W	Total	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.0101	20	No	0	No
Tissue - Clam	SVOCs	W	Total		Acenaphthene	ug/kg	--	--	4.10	19,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Anthracene	ug/kg	--	--	2.30	19,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Benzo(a)anthracene	ug/kg	--	--	2.10	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Benzo(a)pyrene	ug/kg	--	--	0.580	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Benzo(b)fluoranthene	ug/kg	--	--	0.950	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Benzo(g,h,i)perylene	ug/kg	--	--	0.360	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Benzo(k)fluoranthene	ug/kg	--	--	0.250	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Bis(2-ethylhexyl) Phthalate	ug/kg	--	--	890	1,760	No	0	No
Tissue - Clam	SVOCs	W	Total		Butyl Benzyl Phthalate	ug/kg	--	--	15.0	310	No	0	No
Tissue - Clam	SVOCs	W	Total		Chrysene	ug/kg	--	--	4.00	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Di-n-octyl Phthalate	ug/kg	--	--	38.0	626	No	0	No
Tissue - Clam	SVOCs	W	Total		Fluoranthene	ug/kg	--	--	16.0	19,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Fluorene	ug/kg	--	--	3.80	19,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	2.50	1,000	No	0	No
Tissue - Clam	SVOCs	W	Total		p-cresol (4-Methylphenol)	ug/kg	--	--	31.0	NV	***Yes***	--	***Yes***
Tissue - Clam	SVOCs	W	Total		Phenanthrene	ug/kg	--	--	15.0	19,000	No	0	No
Tissue - Clam	SVOCs	W	Total		Pyrene	ug/kg	--	--	6.30	1,000	No	0	No
Tissue - Sculpin	Metals	W	Total		Arsenic	mg/kg	--	No	--	--	--	--	No
Tissue - Sculpin	Metals	W	Total		Cadmium	mg/kg	--	**Yes**	0.0453	0.15	No	0	No
Tissue - Sculpin	Metals	W	Total		Lead	mg/kg	--	**Yes**	0.306	0.12	**Yes**	2	**Yes**
Tissue - Sculpin	Metals	W	Total		Mercury	mg/kg	--	**Yes**	0.308	0.074	**Yes**	13	**Yes**
Tissue - Sculpin	PCB Aroclors	W	Total		Aroclor 1254	ug/kg	--	--	1,700	35	**Yes**	3	**Yes**
Tissue - Sculpin	PCB Aroclors	W	Total		Total PCBs As Aroclors	ug/kg	--	--	1,700	35	**Yes**	3	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	4,773	35	**Yes**	9	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.443	0.16	**Yes**	1	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	--	--	0.00145	0.08	No	0	No
Tissue - Sculpin	PCB Congeners	W	Total	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	269	20	**Yes**	3	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	19.9	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	Total	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	757	20	**Yes**	3	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	11.8	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	Total	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0540	0.0058	**Yes**	9	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	118	20	**Yes**	3	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	30.8	20	**Yes**	1	**Yes**
Tissue - Sculpin	PCB Congeners	W	Total	169	3,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.00365	0.020	No	0	No
Tissue - Sculpin	PCB Congeners	W	Total	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	2.48	20	No	0	No

Table 9-8
Preliminary COPC Identification for Forebay Random Data
Bradford Island - River Operable Unit
(6 of 6)

Medium	Analyte Group	Basis	Total/ Dissolved	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Significantly Higher Conc in Forebay than Reference?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Dections > SLV	Retain as Preliminary COPC?

Notes

(1) Only evaluated for analytes with a sample size of 20 or more.

(2) Only applicable to inorganics. For sediment and tissue the statistical comparison of Forebay concentrations to Reference Area concentrations; Table 8-3 and Appendix L, Tables L-4, L-5, and L-6. For surface water, see Table 8-4.

(3) Total PCB TEQs are evaluated in the HHRA and ERA for the River OU; see Sections 11 and 12 and Appendices M and N.

'--' = Not evaluated
% = percent
D = Dry weight
Max = maximum
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
Min = minimum
ND = non-detect
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
C + F = Column and filter
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
W = Wet Weight

Table 9-9
Preliminary COPC Identification for Targeted Goose Island Data
Bradford Island - River Operable Unit
(1 of 4)

Medium	Analyte Group	Basis	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Higher Conc than Reference Area?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Sediment	Metals	D		Aluminum	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Antimony	mg/kg	--	**Yes**	0.580	3.00	No	0	No
Sediment	Metals	D		Arsenic	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Barium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Beryllium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Cadmium	mg/kg	--	**Yes**	1.17	0.674	**Yes**	2	**Yes**
Sediment	Metals	D		Chromium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Cobalt	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Copper	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Lead	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Mercury	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Nickel	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Thallium	mg/kg	--	**Yes**	0.435	0.354	**Yes**	1	**Yes**
Sediment	Metals	D		Vanadium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	D		Zinc	mg/kg	--	**Yes**	148	123	**Yes**	1	**Yes**
Sediment	NWTPH-Dx	D		Diesel Range Organics	mg/kg	--	--	53.0	NV	***Yes***	--	***Yes***
Sediment	NWTPH-Dx	D		Residual Range Organics	mg/kg	--	--	480	NV	***Yes***	--	***Yes***
Sediment	PCB Aroclors	D		Aroclor 1254	ug/kg	--	--	9.90	0.048	**Yes**	1	**Yes**
Sediment	PCB Aroclors	D		Total PCBs As Aroclors	ug/kg	--	--	12.6	0.048	**Yes**	1	**Yes**
Sediment	PCB Congeners	D	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	1.34	0.048	**Yes**	2	**Yes**
Sediment	PCB Congeners	D	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.00353	0.0064	No	0	No
Sediment	PCB Congeners	D	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	--	--	0.000135	0.0021	No	0	No
Sediment	PCB Congeners	D	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	0.0277	0.021	**Yes**	2	**Yes**
Sediment	PCB Congeners	D	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.00137	0.021	No	0	No
Sediment	PCB Congeners	D	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0695	0.026	**Yes**	2	**Yes**
Sediment	PCB Congeners	D	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.000963	0.026	No	0	No
Sediment	PCB Congeners	D	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	0.0104	0.026	No	0	No
Sediment	PCB Congeners	D	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.00402	0.026	No	0	No
Sediment	PCB Congeners	D	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.000869	0.14	No	0	No
Sediment	SVOCs	D		Benzo(a)anthracene	ug/kg	--	--	7.80	32.0	No	0	No
Sediment	SVOCs	D		Benzo(a)pyrene	ug/kg	--	--	13.0	32.0	No	0	No
Sediment	SVOCs	D		Benzo(b)fluoranthene	ug/kg	--	--	15.0	27.0	No	0	No
Sediment	SVOCs	D		Benzo(g,h,i)perylene	ug/kg	--	--	9.90	300	No	0	No
Sediment	SVOCs	D		Benzo(k)fluoranthene	ug/kg	--	--	4.10	27.0	No	0	No
Sediment	SVOCs	D		Bis(2-ethylhexyl) Phthalate	ug/kg	--	--	13.0	750	No	0	No
Sediment	SVOCs	D		Chrysene	ug/kg	--	--	11.0	57.0	No	0	No
Sediment	SVOCs	D		Di-n-butyl Phthalate	ug/kg	--	--	10.0	110	No	0	No
Sediment	SVOCs	D		Fluoranthene	ug/kg	--	--	9.60	111	No	0	No

Table 9-9
Preliminary COPC Identification for Targeted Goose Island Data
Bradford Island - River Operable Unit
(2 of 4)

Medium	Analyte Group	Basis	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Higher Conc than Reference Area?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Sediment	SVOCs	D		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	7.10	17.0	No	0	No
Sediment	SVOCs	D		p-cresol (4-Methylphenol)	ug/kg	--	--	8.50	48.0	No	0	No
Sediment	SVOCs	D		Phenanthrene	ug/kg	--	--	4.60	42.0	No	0	No
Sediment	SVOCs	D		Pyrene	ug/kg	--	--	8.80	53.0	No	0	No
Sediment	SVOCs	D		Total LPAH (KM, capped)	ug/kg	--	--	9.90	76.0	No	0	No
Sediment	SVOCs	D		Total HPAH (KM, capped)	ug/kg	--	--	89.1	193	No	0	No
Sediment	SVOCs	D		Total PAHs (KM, capped)	ug/kg	--	--	96.1	1610	No	0	No
Tissue - Crayfish	Metals	W		Aluminum	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Antimony	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Arsenic	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Barium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Beryllium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Cadmium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Chromium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Cobalt	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Copper	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Lead	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Mercury	mg/kg	--	**Yes**	0.0359	0.049	No	0	No
Tissue - Crayfish	Metals	W		Nickel	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Thallium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Vanadium	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	Metals	W		Zinc	mg/kg	--	No	--	--	--	--	No
Tissue - Crayfish	PCB Congeners	W	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	0.587	0.57	**Yes**	1	**Yes**
Tissue - Crayfish	PCB Congeners	W	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.00226	0.076	No	0	No
Tissue - Crayfish	PCB Congeners	W	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	0.00624	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.00235	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0870	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.00256	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	0.0133	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.0112	0.25	No	0	No
Tissue - Crayfish	PCB Congeners	W	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.000662	0.25	No	0	No
Tissue - Crayfish	SVOCs	W		Anthracene	ug/kg	--	--	0.430	15,000	No	0	No
Tissue - Crayfish	SVOCs	W		Benzo(b)fluoranthene	ug/kg	--	--	0.150	1.57	No	0	No
Tissue - Crayfish	SVOCs	W		Benzo(g,h,i)perylene	ug/kg	--	--	0.110	15.7	No	0	No
Tissue - Crayfish	SVOCs	W		Benzo(k)fluoranthene	ug/kg	--	--	0.110	15.7	No	0	No
Tissue - Crayfish	SVOCs	W		Fluorene	ug/kg	--	--	0.510	15,000	No	0	No
Tissue - Crayfish	SVOCs	W		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	0.150	1.57	No	0	No
Tissue - Crayfish	SVOCs	W		Phenanthrene	ug/kg	--	--	0.820	15,000	No	0	No

Table 9-9
Preliminary COPC Identification for Targeted Goose Island Data
Bradford Island - River Operable Unit
(3 of 4)

Medium	Analyte Group	Basis	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Higher Conc than Reference Area?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Tissue - Clam	Metals	W		Aluminum	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Arsenic	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Barium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Beryllium	mg/kg	--	**Yes**	0.00200	NV	***Yes***	--	***Yes***
Tissue - Clam	Metals	W		Cadmium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Chromium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Cobalt	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Copper	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Lead	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Mercury	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Nickel	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Thallium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Vanadium	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	Metals	W		Zinc	mg/kg	--	No	--	--	--	--	No
Tissue - Clam	PCB Congeners	W	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	21.4	35	No	0	No
Tissue - Clam	PCB Congeners	W	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.0337	0.16	No	0	No
Tissue - Clam	PCB Congeners	W	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	0.352	20	No	0	No
Tissue - Clam	PCB Congeners	W	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0228	20	No	0	No
Tissue - Clam	PCB Congeners	W	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	1.59	20	No	0	No
Tissue - Clam	PCB Congeners	W	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.0280	20	No	0	No
Tissue - Clam	PCB Congeners	W	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.00307	0.0058	No	0	No
Tissue - Clam	PCB Congeners	W	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	0.0969	20	No	0	No
Tissue - Clam	PCB Congeners	W	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.0925	20	No	0	No
Tissue - Clam	PCB Congeners	W	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.00157	20	No	0	No
Tissue - Clam	SVOCs	W		Acenaphthene	ug/kg	--	--	0.680	19,000	No	0	No
Tissue - Clam	SVOCs	W		Anthracene	ug/kg	--	--	1.20	19,000	No	0	No
Tissue - Clam	SVOCs	W		Benzo(a)anthracene	ug/kg	--	--	3.40	1,000	No	0	No
Tissue - Clam	SVOCs	W		Benzo(a)pyrene	ug/kg	--	--	0.750	1,000	No	0	No
Tissue - Clam	SVOCs	W		Benzo(b)fluoranthene	ug/kg	--	--	2.20	1,000	No	0	No
Tissue - Clam	SVOCs	W		Benzo(g,h,i)perylene	ug/kg	--	--	0.740	1,000	No	0	No
Tissue - Clam	SVOCs	W		Benzo(k)fluoranthene	ug/kg	--	--	1.30	1,000	No	0	No
Tissue - Clam	SVOCs	W		Chrysene	ug/kg	--	--	2.50	1,000	No	0	No
Tissue - Clam	SVOCs	W		Dibenz(a,h)anthracene	ug/kg	--	--	0.480	1,000	No	0	No
Tissue - Clam	SVOCs	W		Fluoranthene	ug/kg	--	--	18.0	19,000	No	0	No
Tissue - Clam	SVOCs	W		Fluorene	ug/kg	--	--	1.80	19,000	No	0	No
Tissue - Clam	SVOCs	W		Indeno(1,2,3-cd)pyrene	ug/kg	--	--	0.890	1,000	No	0	No
Tissue - Clam	SVOCs	W		p-cresol (4-Methylphenol)	ug/kg	--	--	29.0	NV	***Yes***	--	***Yes***
Tissue - Clam	SVOCs	W		Phenanthrene	ug/kg	--	--	10.0	19,000	No	0	No

Table 9-9
Preliminary COPC Identification for Targeted Goose Island Data
Bradford Island - River Operable Unit
(4 of 4)

Medium	Analyte Group	Basis	IUPAC #	Analyte	Unit	Detection Rate > 5%?[1]	Higher Conc than Reference Area?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Tissue - Clam	SVOCs	W		Pyrene	ug/kg	--	--	5.40	1,000	No	0	No
Tissue - Sculpin	PCB Congeners	W	-	Total PCBs As Congeners (KM, capped)	ug/kg	--	--	8.14	35	No	0	No
Tissue - Sculpin	PCB Congeners	W	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	--	--	0.00799	0.16	No	0	No
Tissue - Sculpin	PCB Congeners	W	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	--	--	0.362	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.0220	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.872	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	--	--	0.0163	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	--	--	0.00315	0.0058	No	0	No
Tissue - Sculpin	PCB Congeners	W	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	--	--	0.106	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	--	--	0.0348	20	No	0	No
Tissue - Sculpin	PCB Congeners	W	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	--	--	0.00383	20	No	0	No

Notes

(1) Only evaluated for analytes with a sample size of 20 or more.
(2) Only evaluated for inorganics, see Appendix L, Table L-7
(3) Total PCB TEQs are evaluated in the HHRA and ERA for the River OU; see Sections 11 and 12 and Appendices M and N.
All concentrations are totals.

'--' = Not evaluated
% = percent
D = Dry weight
Max = maximum
mg/kg = milligrams per kilogram
Min = minimum
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
W = Wet Weight

Table 9-10
Preliminary COPC Identification for Targeted Eagle Creek Data
Bradford Island - Upland Operable Unit
(1 of 2)

Medium	Analyte Group	Analyte	Unit	Detection Rate > 5%?[1]	Higher Conc than Reference Area?[2]	Max Detected Value	Selected SLV	Maximum Detected Value > SLV?	No. of Detections > SLV	Retain as Preliminary COPC?
Sediment	Metals	Aluminum	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Antimony	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Arsenic	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Barium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Beryllium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Chromium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Cobalt	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Copper	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Lead	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Mercury	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Nickel	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Vanadium	mg/kg	--	No	--	--	--	--	No
Sediment	Metals	Zinc	mg/kg	--	No	--	--	--	--	No
Sediment	NWTPH-Dx	Diesel Range Organics	mg/kg	--	--	13.0	NV	***Yes***	--	***Yes***
Sediment	PCB Aroclors	Aroclor 1248	ug/kg	--	--	76.0	0.048	**Yes**	1	**Yes**
Sediment	PCB Aroclors	Total PCBs As Aroclors	ug/kg	--	--	77.7	0.048	**Yes**	1	**Yes**
Sediment	SVOCs	Anthracene	ug/kg	--	--	2.60	57.0	No	0	No
Sediment	SVOCs	Benzo(a)anthracene	ug/kg	--	--	6.60	32.0	No	0	No
Sediment	SVOCs	Benzo(a)pyrene	ug/kg	--	--	7.10	32.0	No	0	No
Sediment	SVOCs	Benzo(b)fluoranthene	ug/kg	--	--	11.0	27.0	No	0	No
Sediment	SVOCs	Benzo(g,h,i)perylene	ug/kg	--	--	5.00	300	No	0	No
Sediment	SVOCs	Benzo(k)fluoranthene	ug/kg	--	--	3.40	27.0	No	0	No
Sediment	SVOCs	Carbazole	ug/kg	--	--	2.20	140	No	0	No
Sediment	SVOCs	Chrysene	ug/kg	--	--	13.0	57.0	No	0	No
Sediment	SVOCs	Fluoranthene	ug/kg	--	--	11.0	111	No	0	No
Sediment	SVOCs	Indeno(1,2,3-cd)pyrene	ug/kg	--	--	4.60	17.0	No	0	No
Sediment	SVOCs	Phenanthrene	ug/kg	--	--	6.50	42.0	No	0	No
Sediment	SVOCs	Pyrene	ug/kg	--	--	17.0	53.0	No	0	No
Sediment	SVOCs	Total LPAH (KM, capped)	ug/kg	--	--	11.8	76.0	No	0	No
Sediment	SVOCs	Total HPAH (KM, capped)	ug/kg	--	--	80.9	193	No	0	No
Sediment	SVOCs	Total PAHs (KM, capped)	ug/kg	--	--	90.8	1610	No	0	No

Table 9-10
Preliminary COPC Identification for Targeted Eagle Creek Data
Bradford Island - Upland Operable Unit
(2 of 2)

Notes
(1) Only evaluated for analytes with a sample size of 20 or more.
(2) Only evaluated for inorganics, see Appendix L, Table L-7
All concentrations are totals and in dry weight.

'--' = Not evaluated
% = percent
Max = maximum
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
Min = minimum
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
W = Wet Weight

Table 9-11
River OU Preliminary COPC Summary
Bradford Island - River Operable Unit
(1 of 2)

Medium	Analyte Group	Random Forebay Preliminary COPCs	Targeted Goose Island Preliminary COPCs	Targeted Eagle Creek Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV				
Sediment	Metals	None	Cadmium, Thallium, and Zinc	None
	TPH	None*	None*	None*
	PCB Aroclors	Aroclor 1254 and Total PCBs as Aroclors	Aroclor 1254 and Total PCBs as Aroclors	Aroclor 1248 and Total PCBs as Aroclors
	PCB Congeners	PCBs 77, 105, 114, 118, 123, 126, 156+157, and 167; and Total PCBs as Congeners	PCBs 105 and 118; and Total PCBs as Congeners	-
	PAHs	None	None	None
	SVOCs	None	None	None
Tissue-Clam	Metals	Cadmium	None*	(No clam samples)
	TPH	-	-	
	PCB Aroclors	Aroclor 1254 and Total PCBs as Aroclors	ND	
	PCB Congeners	PCBs 118 and 126; and Total PCBs as Congeners	None	
	PAHs	None	None	
	SVOCs	None*	None*	
Tissue- Crayfish	Metals	Arsenic	None	(No crayfish samples)
	TPH	-	-	
	PCB Aroclors	ND	ND	
	PCB Congeners	PCBs 114, 118, 123, 126, 156+157, and 167; and Total PCBs as Congeners	Total PCBs as Congeners	
	PAHs	Benzo(a)pyrene	None	
	SVOCs	Bis(2-ethylhexyl) Phthalate	ND	
Tissue - Sculpin	Metals	Lead and Mercury	-	(No sculpin samples)
	TPH	-	-	
	PCB Aroclors	Aroclor 1254 and Total PCBs as Aroclors	-	
	PCB Congeners	PCBs 77, 105, 118, 126, 156+157, and 167; and Total PCBs as Congeners	None	
	PAHs	-	-	
	SVOCs	-	-	

Table 9-11
River OU Preliminary COPC Summary
Bradford Island - River Operable Unit
(2 of 2)

Medium	Analyte Group	Random Forebay Preliminary COPCs	Targeted Goose Island Preliminary COPCs	Targeted Eagle Creek Preliminary COPCs
Detection Frequency > 5%, Detected > Reference (Inorganics), and Detected > SLV				
Tissue-Smallmouth Bass	Metals	Mercury	(No bass samples)	(No bass samples)
	TPH	-		
	PCB Aroclors	Aroclor 1242, Aroclor 1254, and Total PCBs as Aroclors		
	PCB Congeners	PCBs 77, 81, 105, 114, 118, 123, 126, 156+157, 167, and 189; and Total PCBs as Congeners		
	PAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, and Indeno(1,2,3-cd)pyrene		
	SVOCs	Bis(2-ethylhexyl) Phthalate and Butyl Benzyl Phthalate		
Surface Water	Metals (Total)	None	(No surface water samples)	(No surface water samples)
	Metals (Dissolved)	Arsenic and Barium		
	TPH	None		
	PCB Congeners	Total PCBs as Congeners		
	PAHs	None		
	SVOCs	-		
Detection Frequency > 5%, Detected > Reference (Inorganics), and No SLV				
Sediment	TPH	DRO and RRO	DRO and RRO	DRO
Tissue-Clam	Metals	Beryllium	Beryllium	(No clam samples)
	SVOCs	p-cresol (4-Methylphenol)	p-cresol (4-Methylphenol)	
Tissue- Crayfish	Metals	Antimony, Chromium, and Nickel	None	(No crayfish samples)
Tissue-Smallmouth Bass	Metals	Aluminum, Barium, Copper, and Zinc	(No bass samples)	(No bass samples)

* See the section of the table for COFIs retained due to lack of SLVs
"-" = Not Analyzed
ND = Not Detected

Table 9-12
Comparison of Downstream Sediment Data to SLVs and River Reference Area
Bradford Island - River Operable Unit
(1 of 2)

Analyte Group	IUPAC #	Analyte	Unit	Max Detected Value	Lower of HH and Eco Sediment SLV	Reference Area Sediment 95% UPL	No. of Detections > SLV and Ref UPL
Metals		Aluminum	mg/kg	21,600	NV	38,000	0
Metals		Antimony	mg/kg	0.400	3.00	0.427	0
Metals		Arsenic	mg/kg	5.84	6.00	5.86	0
Metals		Barium	mg/kg	172	NV	315	0
Metals		Beryllium	mg/kg	0.513	0.600	0.847	0
Metals		Cadmium	mg/kg	0.791	37.0	0.674	1
Metals		Chromium	mg/kg	29.9	37.0	28.0	0
Metals		Cobalt	mg/kg	11.5	NV	15.2	0
Metals		Copper	mg/kg	24.1	36.0	55.6	0
Metals		Lead	mg/kg	12.7	35.0	14.5	0
Metals		Mercury	mg/kg	0.136	0.200	0.214	0
Metals		Nickel	mg/kg	15.2	18.0	21.2	0
Metals		Thallium	mg/kg	0.234	NV	0.354	0
Metals		Vanadium	mg/kg	73.5	NV	70.6	1
Metals		Zinc	mg/kg	117	123	106	0
NWTPH-Dx		Diesel Range Organics	mg/kg	25.0	NV	31.7	0
NWTPH-Dx		Residual Range Organics	mg/kg	41.0	NV	100	0
PCB Congeners	-	Total PCBs As Congeners (KM, capped)	ug/kg	0.917	0.0480	0.941	0
PCB Congeners	77	3,3',4,4'-Tetrachlorobiphenyl	ug/kg	0.00201	0.00640	0.00165	0
PCB Congeners	81	3,4,4',5-Tetrachlorobiphenyl	ug/kg	0.000260	0.00210	0.000143	0
PCB Congeners	105	2,3,3',4,4'-Pentachlorobiphenyl	ug/kg	0.0197	0.0210	0.0177	0
PCB Congeners	114	2,3,4,4',5-Pentachlorobiphenyl	ug/kg	0.000957	0.0210	0.00163	0
PCB Congeners	118	2,3',4,4',5-Pentachlorobiphenyl	ug/kg	0.0456	0.0260	0.0552	0
PCB Congeners	123	2,3',4,4',5'-Pentachlorobiphenyl	ug/kg	0.000874	0.0260	0.00122	0
PCB Congeners	126	3,3',4,4',5-Pentachlorobiphenyl	ug/kg	0.000211	0.0000062	0.000337	0
PCB Congeners	156 + 157	2,3,3',4,4',5-Hexachlorobiphenyl + 2,3,3',4,4',5'-Hexachlorobiphenyl	ug/kg	0.00625	0.0260	0.00579	0
PCB Congeners	167	2,3',4,4',5,5'-Hexachlorobiphenyl	ug/kg	0.00261	0.0260	0.00384	0
PCB Congeners	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	ug/kg	0.000596	0.140	0.000573	0
SVOCs		Anthracene	ug/kg	3.10	57.0	2.30	0
SVOCs		Benzo(a)anthracene	ug/kg	12.0	32.0	10.0	0
SVOCs		Benzo(a)pyrene	ug/kg	14.0	32.0	11.0	0

Table 9-12
Comparison of Downstream Sediment Data to SLVs and River Reference Area
Bradford Island - River Operable Unit
(2 of 2)

Analyte Group	IUPAC #	Analyte	Unit	Max Detected Value	Lower of HH and Eco Sediment SLV	Reference Area Sediment 95% UPL	No. of Detections > SLV and Ref UPL
SVOCs		Benzo(b)fluoranthene	ug/kg	16.0	27.0	17.0	0
SVOCs		Benzo(g,h,i)perylene	ug/kg	6.80	300	7.90	0
SVOCs		Benzo(k)fluoranthene	ug/kg	6.50	27.0	5.00	0
SVOCs		Carbazole	ug/kg	1.60	140	1.40	0
SVOCs		Chrysene	ug/kg	18.0	57.0	9.80	0
SVOCs		Dibenz(a,h)anthracene	ug/kg	2.30	33.0	2.30	0
SVOCs		Fluoranthene	ug/kg	22.0	111	31.0	0
SVOCs		Indeno(1,2,3-cd)pyrene	ug/kg	8.20	17.0	8.80	0
SVOCs		p-cresol (4-Methylphenol)	ug/kg	130	48.0	210	0
SVOCs		Phenanthrene	ug/kg	4.90	42.0	5.90	0
SVOCs		Pyrene	ug/kg	21.0	53.0	12.7	0
SVOCs		Total LPAH (KM, capped)	ug/kg	10.7	76.0	7.30	0
SVOCs		Total HPAH (KM, capped)	ug/kg	127	193	76.0	0
SVOCs		Total PAHs (KM, capped)	ug/kg	137	1610	76.0	0

Notes

All concentrations are in dry weight and total.

% = percent
COPC = C
Max = maximum
mg/kg = milligrams per kilogram
NV = no value
No. = number
NWTPH-Dx = northwest total petroleum hydrocarbon-diesel-extended
NWTPH-Gx =northwest total petroleum hydrocarbon-gasoline-extended
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SLV = screening level value
SVOC = semi-volatile organic carbon
ug/kg = micrograms per kilogram
UPL = upper prediction limit

Table 11-1
Summary of COPCs Recommended for Risk Management - Landfill AOPC
Bradford Island - Upland Operable Unit
(1 of 1)

Media	Chemicals of Potential Concern (COPCs) (1) (2)
Soil	Arsenic
	cPAHs
	Tetrachloroethene (PCE)
	Chromium
	Lead
	PCE Degradation Products (3)
Groundwater	Arsenic
	Bis(2-ethylhexyl) Phthalate
	Chloroform
	Diesel Range Organics
	Di-n-octyl Phthalate
	Manganese
	Residual Range Organics
	Tetrachloroethene (PCE)
	Vinyl Chloride
	1,2,4-Trimethylbenzene
	Antimony
	Barium
	Gasoline Range Organics
	Zinc
	Lead
	Mercury
	Thallium
	n-Propylbenzene
	Isopropylbenzene
	Tributyltin
	PCE Degradation Products (3)
Seepwater	Arsenic
	Chloroform
	Diesel Range Organics
	Lead
	Manganese
	Tetrachloroethene (PCE)
	Antimony
	Mercury
	Residual Range Organics
	PCE Degradation Products (3)
Surface Water (at Shoreline)	Arsenic
	Lead

cPAHs = Carcinogenic polynuclear aromatic hydrocarbons

Shaded indicates COPC selection rationales were not based on C/SLV>1 (i.e., selection was due to: multi-media, C/SLV>0.1, degradation product, no SLV, etc.,)

(1) Not all COPCs apply to all receptors and exposure pathways within that medium.

(2) Additional COPCs were identified and discussed for the erodible soil/mass wasting scenarios (see Appendix O, Section 0.2.1.6)

(3) Degradation products are dichloroethenes, TCE, and vinyl chloride.

Table 11-2
Summary of COPCs Recommended for Risk Management - Sandblast Area AOPC
Bradford Island - Upland Operable Unit
(1 of 1)

Media	Chemicals of Potential Concern (COPCs) (1) (2)
Soil	Arsenic
	cPAHs
	Chromium
	Lead
	Tetrachloroethene (PCE)
	PCE Degradation Products (3)
Soil Gas	Tetrachloroethene (PCE)
	Trichloroethene (TCE)
	PCE Degradation Products (3)
Groundwater	1,1-Dichloroethane
	Arsenic
	cPAHs
	Tetrachloroethene (PCE)
	Trichloroethene (TCE)
	Vinyl Chloride
	Diesel Range Organics
	Gasoline Range Organics
	Vanadium
	PCE Degradation Products (3)

cPAHs = Carcinogenic polynuclear aromatic hydrocarbons

Shaded indicates COPC selection rationales were not based on C/SLV>1 (i.e., selection was due to: multi-media, C/SLV>0.1, degradation product, no SLV, etc.,)

(1) Not all COPCs apply to all receptors and exposure pathways within that medium.

(2) Additional COPCs were identified and discussed for the erodible soil/mass wasting scenarios (see Appendix O, Section 0.2.1.6)

(3) Degradation products are dichloroethenes, TCE, and vinyl chloride.

Table 11-3
Summary of COPCs Recommended for Risk Management - River OU
Bradford Island - River Operable Unit
(1 of 1)

Media	Chemicals of Potential Concern (COPCs) (1) (2)
Random Forebay Tissue - Crayfish	Arsenic
	Polychlorinated Biphenyls (PCBs)
Random Forebay Tissue - Small Mouth Bass	cPAHs
	Bis(2-ethylhexyl) Phthalate
	Mercury
	PCBs
	Barium
Random Forebay Sediment	PCBs
	Mercury
	Bis(2-ethylhexyl) Phthalate
Forebay Surface Water	Arsenic
	PCBs
	Aluminum
	Lead
Eagle Creek Sediment	Anthracene
	cPAHs
	Diesel Range Organics
	Fluoranthene
	Phenanthrene
	Pyrene
	PCBs
Goose Island Tissue - Crayfish	PCBs
Goose Island Sediment	PCBs
	Bis(2-ethylhexyl) Phthalate

cPAHs = Carcinogenic polynuclear aromatic hydrocarbons

Shaded indicates COPC selection rationales were not based on C/SLV>1 (i.e., selection was due to: multi-media, C/SLV>0.1, degradation product, no SLV, etc.,)

(1) Not all COPCs apply to all receptors and exposure pathways within that medium.

(2) Additional COPCs were identified and discussed for the erodible soil/mass wasting scenarios (see Appendix O, Section 0.2.1.6)

Table 12-1
Summary of CPECs Recommended for Risk Management - Upland OU
Bradford Island - Upland Operable Unit
(1 of 1)

AOPC	Medium	CPECs
Landfill	Soil	Antimony, Chromium*, Copper*, Lead, Mercury, Nickel*, and total HPAHs
Sandblast Area	Soil	Antimony, Cadmium, Chromium, Lead, Mercury*, Nickel, Bis(2-ethylhexyl) phthalate, and total HPAHs
Pistol Range	Soil	Lead
Bulb Slope	Soil	Lead, Mercury

Notes

AOPC - area of potential concern

CPEC - chemical of potential ecological concern

HPAHs - high molecular weight polycyclic aromatic hydrocarbons

* These metals were eliminated as CPECs based on the statistical background comparison, but were ultimately retained for risk management based on the additional evaluation performed in Section O.3.1.2 of Appendix O.

Note: In addition to the CPECs listed in this table, CPECs in soils identified based on the evaluation of potential transport to the River OU via mass wasting or erosion are also recommended for risk management (see Section O.3.1.5 of Appendix O).

Table 12-2
Summary of CPECs Recommended for Risk Management - River OU
Bradford Island - River Operable Unit
(1 of 1)

Data Set	Receptor Group	Medium	CPECs
Random Forebay	Benthic Community	Sediment	PCBs
	Fish and Shellfish	Clam Tissue	Cadmium
		Sculpin Tissue	Cadmium, Lead, Mercury and PCBs
		Bass Tissue	Mercury and PCBs
		Sediment	Cadmium, Lead, Mercury and PCBs
	Birds	Crayfish Tissue	PCBs
		Sculpin Tissue	Mercury and PCBs
		Bass Tissue	Mercury and PCBs
		Sediment	Mercury and PCBs
	Mammals	Sculpin Tissue	Mercury and PCBs
		Bass Tissue	Mercury and PCBs
		Sediment	Mercury and PCBs
Eagle Creek	All	Sediment	PCBs

Notes

CPECs - chemicals of potential ecological concern

PCBs - polychlorinated biphenyls (as Aroclors and 209 congeners)

Note: Although CPEC concentrations in media collected from the targeted Goose Island samples indicate acceptable risk levels, Goose Island will be maintained as part of the Forebay evaluation in the forthcoming FS in response to DEQ’s request.

APPENDIX A

DATABASE

In Separate File on this DVD

APPENDIX B

BORING LOGS

HTRW DRILLING LOG	DISTRICT Portland	HOLE NUMBER SB3
1 COMPANY NAME Tetra Tech, Inc.	2 DRILL SUBCONTRACTOR Cascade Drilling	SHEET 1 OF SHEETS 2

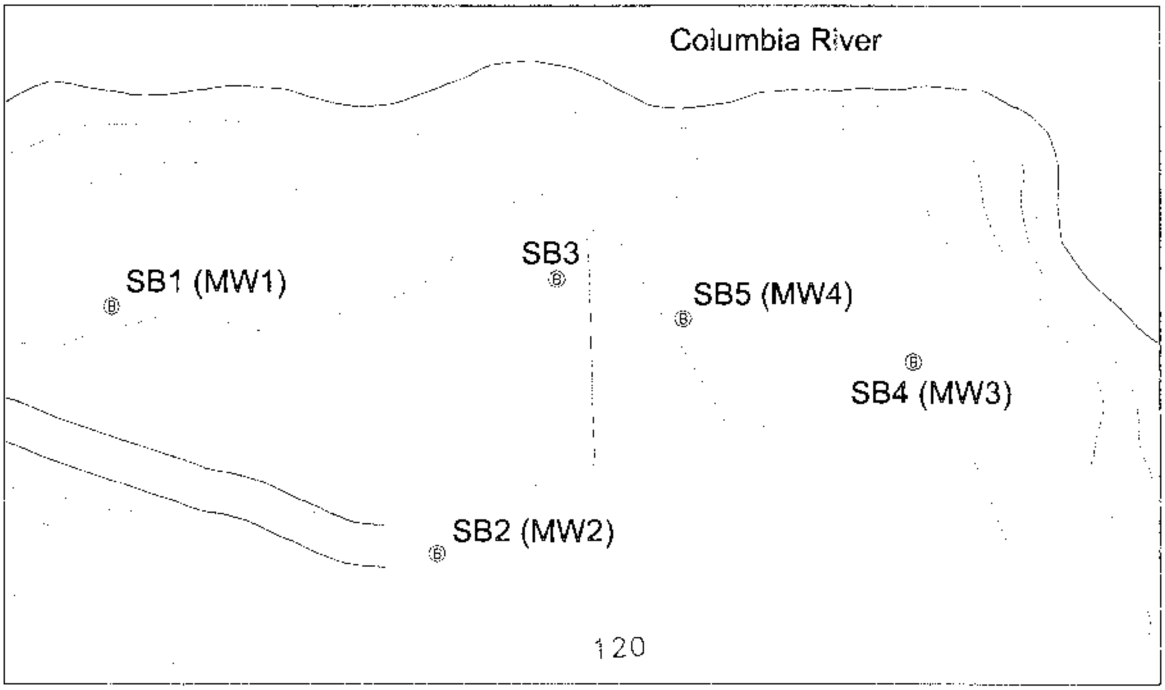
3 PROJECT USCOE Bradford Island Landfill	4 LOCATION Bradford Island Landfill
5 NAME OF DRILLER Steve Hughes	6 MANUFACTURERS DESIGNATION OF DRILL CME 75
7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 4.25" ID (9.25 OD) HAS 18" long, 2" OD split spoon sampler 140 lbs with 30-inch drop	8 HOLE LOCATION Central landfill
	9 SURFACE ELEVATION Not surveyed
	10 DATE STARTED 8/17/98 11 DATE COMPLETED 8/17/98
12 OVERBURDEN THICKNESS N/A	15 DEPTH GROUNDWATER ENCOUNTERED N/A
13 DEPTH DRILLED INTO ROCK N/A	16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED N/A
14 TOTAL DEPTH OF HOLE 7'	17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY) N/A

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES
0	--	--	0

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS/SVOCs	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR
	X			

LOCATION SKETCH/COMMENTS:



PROJECT Bradford Island	HOLE NO. SB3

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER SB3		
PROJECT Bradford Island	INSPECTOR Carlotta Cellucci	SHEET 2 OF SHEETS 2

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Grassy cover					
	1						
	2						
	3						
	4						
Basalt SW	5	Fractured basalt to contact at approximately 5.5' with well graded fine to very fine grained, moist gray sand (SW) (100% sand) dense				12 6 4	
	6						
	7	Refusal at 7' BLS					
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						

PROJECT Bradford Island	HOLD NO. SB3

ENG FORM 5056A-4, AUG 94 (Proponent: CECW-EG)

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Key to Log of Boring

Sheet 1 of 1

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, inches	Headspace PID [FID], ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop; "NA" indicates data not recorded.

6 **Recovery:** Length in inches of sample actually recovered in driven or pushed sampler; "NA" indicates data not recorded.

7 **Headspace PID/FID:** Photo-ionization/flame ionization device sample headspace reading in parts per million (ppm).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **USCS Code:** Unified Soil Classification System (USCS) group symbol code for associated soil strata.

10 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

11 **Well Completion Schematic:** Schematic of piezometer or well installation; materials are listed in header block and alongside well schematic; graphic symbols are explained below.

12 **Field Notes and Well Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Well construction materials and installation details are also listed in this column.

TYPICAL SOIL GRAPHIC SYMBOLS

▨	SAND (SP)	▨	CLAY (CL)	▥	SILT (ML)	▨	SANDSTONE
▨	SAND with silt (SP-SM)	▨	Plastic CLAY (CH)	▨	Silty CLAY (CL/ML)	▨	Rock Fragments / Gravel
▨	Silty SAND (SM)	▨	Clayey SAND (SC)	▨	Silty GRAVEL (GM)	▨	Non-soil Fill

TYPICAL WELL GRAPHIC SYMBOLS

▨	Blank well casing in concrete	▨	Blank well casing in filter sand
▨	Blank well casing in bentonite-cement slurry	▨	Slotted well casing in filter sand
▨	Blank well casing in bentonite chips	▨	Native backfill or slough

TYPICAL SAMPLER GRAPHIC SYMBOLS

◩	2-inch-OD split spoon sampler (SPT)
■	2.5-inch-OD split spoon with brass liners (modified California)
◫	Thin-walled tube sampler (Shelby tube)

OTHER GRAPHIC SYMBOLS

▽	First water encountered at time of drilling (ATD)
▼	Static water level measured in well on specified date
↓	Change in material properties within a stratum
┈	Inferred or gradational lithologic contact

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

URS Greiner Woodward Clyde

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring SB-6

Sheet 1 of 2

Date(s) Drilled	**9/29/99**	Geologist	**G. Lukert**	Reviewer	
Drilling Method	**Hollow-Stem Auger**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**19.0 feet**
Drill Bit Size/Type	**8-7/8-inch-OD auger bit**	Sampling Method	**Split spoon**	Ground Surface Elevation	**110.82 feet MSL**
Groundwater Level(s)	**14.60 feet bgs on 9/29/99**	Hammer Data	**140 lb / 30-inch drop**	Coordinates	**N 723,668.16 E 1,633,059.45**
Borehole Backfill	**Bentonite-Portland cement grout**	Comments	**Refer to site plan for location**		

Elevation feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resistance, blows / 6 in.	SAMPLES Recovery, inches	SAMPLES Headspace PID [FID], ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES
	0							Surface conditions: brown, silty SAND with rounded cobbles [Fill]	
110	1								
	2								
108	3								
		01	1-1-2	0	0.0 [0.5]		GM	Silty GRAVEL; yellowish brown (10YR 5/4), ~60% gravel, ~40% fines, some cobbles to 4 inches diameter, slightly micaceous, dry, very loose, no odor [FILL]	No recovery in driven sampler; collected sample from cuttings.
	4								
106	5								
	6								
104	7								
									Metal debris observed at 7.5 ft.
	8								
102		02	5-3-3	4	64 [32]		SM	Silty SAND with gravel; very dark gray (10YR 3/1), ~50% sand, ~40% silt, ~10% gravel, some wood debris, damp, loose, no odor [FILL]	
	9								
	10								
100	11								
	12								
98	13								

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring SB-6

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resistance, blows / 6 in.	SAMPLES Recovery, inches	SAMPLES Headspace PID [FID], ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES
	13	03	2-4-3	4	134 [105]		SM/ML	Silty SAND to sandy SILT; very dark grayish brown (10YR 3/2), some wood debris, trace gravel, wet, loose, no odor [FILL]	
	14							∇	
96	15								
	16								
94	17								
	18								
92	19							**Boring terminated at 19.0 feet bgs due to refusal**	
	20								
90	21								
	22								
88	23								
	24								
86	25								
	26								
84	27								
	28								
82	29								

Project: **Bradford Island Landfill** **Project Location:** **Bonneville Dam, Oregon** **Project Number:** **53-F0072173.02**	**Log of Boring DH-2002Z** Sheet 1 of 4

Date(s) Drilled	**Not recorded**	Geologist	**G. Lukert**	Reviewer	
Drilling Method	**Hollow-Stem Auger (0-6 ft); Mud Rotary (6-116 ft)**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**116.0 feet**
Drill Bit Size/Type	**4-7/8-inch and 3-inch tricone bits**	Sampling Method	**No samples collected**	Ground Surface Elevation	**Not available**
Groundwater Level(s)	**Not measured**	Hammer Data	**Not applicable**	Coordinates	**Not available**
Borehole Backfill	**Bentonite-Portland cement grout**	Comments	**Refer to site plan for location**		

Elevation feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resistance, blows / 6 in.	SAMPLES Recovery, inches	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	0						0-18 ft: debris, gravel, concrete fragments, wood pieces in cuttings	Started drilling with hollow-stem auger.
	5							Hit concrete with augers; switched to mud rotary drilling.
	10							
	15							
							18-60 ft: no cuttings generated	
	20							No cuttings generated.
	25							
	30							

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring DH-2002Z

Sheet 2 of 4

Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, blows / 6 in.	Recovery, inches	Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	30						18-60 ft: no cuttings generated	
	35							
	40							No cuttings generated.
	45							
	50							
	55							Borehole collapsed at 54 ft bgs. Began drilling with outer casing advanced to 60 ft. Switched to 3-inch-dia. tricone bit.
	60						60-70 ft: charred wood in cuttings	
	65							

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring DH-2002Z

Sheet 3 of 4

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
		Type Number	Sampling Resistance, blows / 6 in.	Recovery, inches	Headspace PID, ppm			
	65						60-70 ft: charred wood in cuttings	
	70						70-80 ft: basalt, some black silt in cuttings	
	75							
	80						80-116 ft: weathered basalt and quartz fragments in cuttings	
								Advanced casing to 65 ft bgs, and continued drilling with 3-inch-dia. bit.
	85							
	90							
	95							
	100							

Report: ENV_12S_CLEVELAND+/-USCS; File: BRADFORD.GPJ; 1/12/2000 DH-2002Z

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring DH-2002Z

Sheet 4 of 4

Elevation feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resistance, blows / 6 in.	SAMPLES Recovery, inches	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
							80-116 ft: weathered basalt and quartz fragments in cuttings	
	105							
	110							
	115							
							Boring terminated at 116.0 feet bgs	
	120							
	125							
	130							
	135							

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-01-05

Sheet 1 of 1

Date(s) Drilled	11/16/04 - 11/16/2004	Logged By	BPM	Checked By	JOD
Drilling Method	GeoProbe	Drill Bit Size/Type	N/A	Total Depth of Borehole	17.5 feet
Drill Rig Type	GeoProbe	Drilling Contractor	Geotech Explorations, Inc.	Approximate Surface Elevation	N/A
Groundwater Level and Date Measured	11.5 feet bgs	Sampling Method(s)	1 1/4" dia. Macrocore	Hammer Data	N/A
Borehole Backfill	Bentonite Grout	Location	Riverfront - Landfill Access Road		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0							**3" ASPHALTIC CONCRETE**	
							GP	**POORLY-GRADED GRAVEL [GP]**, gray, fine grained, angular to subangular. [FILL]	
			MC1	2.5	BKGD				
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, tan to brown, dry, loose, gravel is fine grained, subrounded to rounded, sand is medium coarse.	
	5								
			MC2	3	BKGD			*Basalt cobble at 7.5'-8.5'*	
								Graded to moist, dark brown with fine grained sand from 8.5'-9.5'	
	10								
								▽	
			MC3	3.5	BKGD			*Cobble encountered. Dry, may be pulverized by drive rod.*	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace silt, dark greenish-gray, moist, gravel is fine grained, subangular to subrounded, sand is fine grained.	
	15								
			MC4	2.5	BKGD				
								Boring terminated at a depth of 17.5 feet bgs on 11/16/04 and backfilled with bentonite grout upon completion.	
	20								
	25								

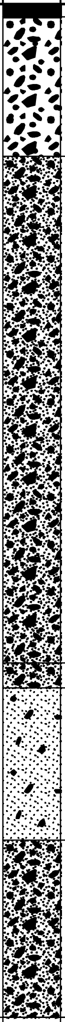
URS

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-02-05

Sheet 1 of 1

Date(s) Drilled	**11/16/04 - 11/17/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**11.3 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Riverfront - Landfill Access Road**		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0						**3" BROKEN ASPHALTIC CONCRETE**	
						GP	**POORLY-GRADED GRAVEL [GP]**, gray to tannish-brown, dry, loose, fine grained, angular to subangular, [FILL].	
			MC1	3				
						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gray to tannish-brown, moist, gravel is fine grained, angular, sand is fine to coarse grained. [FILL]	
	5							
			MC2	3				
	10							
							∇	
			MC3	3	BKGD			
						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gravel is coarse grained	
						SP	**POORLY-GRADED SAND WITH GRAVEL [SP]**, brown, sand is medium to coarse grained, gravel is fine grained, subrounded.	
	15						*Coarse basalt gravel encountered. Subrounded to subangular.*	
						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**	
			MC4	2	BKGD			
							Dark gray, medium grained sand matrix from 18'-19'. Brown to gray from 19'-20'.	
	20						Boring terminated at a depth of 20 feet bgs on 11/17/04 and backfilled with bentonite grout upon completion.	
	25							

URS

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-03-05

Sheet 1 of 1

Date(s) Drilled	**11/16/04 - 11/17/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**11.2 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Riverfront - Landfill Access Road**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0							**3" ASPHALTIC CONCRETE**	
							GP	**POORLY-GRADED GRAVEL [GP]**, gray, dry, fine grained.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gray to brown, dry, gravel is fine grained, subangular to subrounded, sand is tan, medium to coarse grained.	
			MC1	4	BKGD				
								Graded to moist.	
	5								
			MC2	3	BKGD				
								Graded to moist, dark brown with fine grained sand from 8.5'-9.5'	
								Coarse basalt gravel at 9.5'.	
	10								
								∇	
			MC3	5	BKGD				
							SP	**POORLY-GRADED SAND [SP]**, trace silt, tan to brown.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, brown to dark gray, wet, gravel is medium to coarse grained, sand is coarse grained.	
	15								
							SP	**POORLY-GRADED SAND [SP]**, trace silt, tan to orangish-brown, moist, sand is coarse grained.	
			MC4	4	BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, moist to dry.	
								2" Dry gray gravel from 18.6'-18.8'.	
	20							Boring terminated at a depth of 20 feet bgs on 11/17/04 and backfilled with bentonite grout upon completion.	
	25								

URS

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-04-05

Sheet 1 of 1

Date(s) Drilled	11/16/04 - 11/17/2004	Logged By	BPM	Checked By	JOD
Drilling Method	GeoProbe	Drill Bit Size/Type	N/A	Total Depth of Borehole	20.0 feet
Drill Rig Type	GeoProbe	Drilling Contractor	Geotech Explorations, Inc.	Approximate Surface Elevation	N/A
Groundwater Level and Date Measured	10.2 feet bgs	Sampling Method(s)	1 1/4" dia. Macrocore	Hammer Data	N/A
Borehole Backfill	Bentonite Grout	Location	Riverfront - Landfill Access Road		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0							**3" ASPHALTIC CONCRETE**	
							GP	**POORLY-GRADED GRAVEL [GP]**, gray, fine grained.	
			MC1	4	BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gravel is gray to brown, fine grained with trace coarse, sand is tan to brown, medium to coarse grained.	
	5							*Moist.*	
			MC2	3	BKGD		GP	**POORLY-GRADED GRAVEL [GP]**, dry, coarse grained.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gravel is gray to brown, fine grained with trace coarse gravel, sand is tan to brown, medium to coarse grained.	
	10							∇	
								Sand grades to orange-brown-tan, medium to fine grained.	
			MC3	5	BKGD				
	15								
			MC4	4	BKGD		SP	**POORLY-GRADED SAND WITH SILT [SP]**, trace gravel, sand is fine to medium grained.	
	20							Boring terminated at a depth of 20 feet bgs on 11/17/04 and backfilled with bentonite grout upon completion.	
	25								

Project: Bradford Island **Project Location:** Cascade Locks, Oregon **Project Number:** 25695767.00003	**Log of Boring DP-05-05** Sheet 1 of 2

Date(s) Drilled	**11/16/04 - 11/19/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**28.5 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**22.0 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, rocky field North of sandblast building.**		

Elevation, feet	Depth, feet	SAMPLES Type	 Number	 Recovery, (ft.)	 Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gray to brownish-tan, dry, loose, gravel is coarse to fine grained, sand is medium grained.	
			MC1	4	BKGD				
	5							*Moist.* *Basalt cobble encountered.*	
			MC2	2	BKGD				
								Mottled red-orange.	
	10							*Refusal/bent rod. Pulled rod and set up adjacent to borehole. Moist to wet from 10'-11', moist from 11'-12'.*	
			MC3	4.5	BKGD			*Basalt cobble encountered.*	
	15							*Dry.*	
							SP	**POORLY-GRADED SAND WITH GRAVEL [SP]**, trace silt, tan to brown, medium dense.	
			MC4	4	BKGD				
							GM	**SILTY GRAVEL WITH SAND [GM]**, greenish-gray, moist, hard, gravel is coarse to fine grained.	
							SM	**SILTY SAND [SM]**, trace gravel, olive gray to brown, moist, soft, sand is medium grained.	
	20								
							OL	**ORGANIC SANDY SILT [OL]**, trace gravel, black, wood debris, root matter. ▽	
			MC5	5	BKGD				
							SM	**SILTY SAND [SM]**, greenish-gray, moist to dry, weak to moderate cementation, sand is crystalline, white, medium to fine grained.	
							SP	**POORLY-GRADED SAND [SP]**, orange-brown to red-brown,	
	25								

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Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-05-05

Sheet 2 of 2

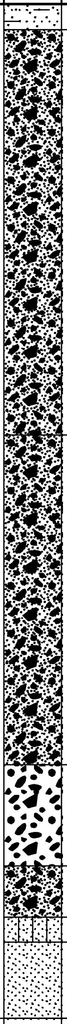
Elevation, feet	Depth, feet	SAMPLES Type	Number	Recovery, (ft.)	Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	25	▩	MC6	1	BKGD	░		moderate to strong cementation.	
								Refusal. Sample tube stuck in drive rod. Boring terminated at a depth of 28.5 feet bgs on 11/19/04 and backfilled with bentonite grout upon completion.	
	30								
	35								
	40								
	45								
	50								

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-06-05

Sheet 1 of 1

Date(s) Drilled	**11/17/04 - 11/17/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**15.0 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, rocky area North of sandblast building, adjacent to septic tank.**		



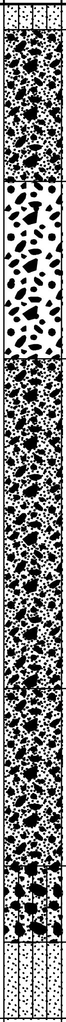
Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0							**6" SURFACE SANDY SOIL**	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace cobbles, dark brown, gravel is fine grained, angular to subangular, sand is medium to coarse. No bedding structures.	
			MC1	4	BKGD				
								Sand grades to brown, medium to fine grained.	
	5								
								Grades to gray, sand grades to medium to coarse.	
			MC2	1.5	BKGD				
								Refusal due to large cobbles. Moved drill rig 6 feet to southeast.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace cobbles, brown, gravel is fine grained, sand is medium coarse.	
								Moist.	
	10								
			MC3	5	BKGD				
	15							∇	
							GP	**POORLY-GRADED GRAVEL [GP]**, brown, saturated, loose, gravel is fine grained, rounded, sand is coarse grained.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, tannish-brown to gray, sand grades to fine grained.	
			MC4	5	BKGD				
							SM	**SILTY SAND [SM]**, black, some organics.	
							SP	**POORLY-GRADED SAND [SP]**, green, <5% organics, white, crystalline sand.	
	20							Boring terminated at a depth of 20 feet bgs on 11/17/04 and backfilled with bentonite grout upon completion.	
	25								

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-07-05

Sheet 1 of 1

Date(s) Drilled	**11/17/04 - 11/22/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**13.5 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, rocky area North of sandblast building.**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0							**SILTY SAND [SM]** trace cobbles, brown, fine grained.	
			MC1	4	BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace cobbles, tan to brown, moist, gravel is fine to coarse grained, subangular.	
	5						GP	**POORLY-GRADED GRAVEL [GP]**, gray, dry, coarse grained.	
	10		MC2 MC3	4 3	BKGD BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace silt, gray with orange mottling, moist, gravel is fine grained, sand is medium to fine grained. *Tan to brown.* *Wood debris.* *Cobbles encountered.*	∇
	15						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, wet, gravel is coarse grained, sand is medium to coarse grained.	
			MC4	5	BKGD		GM	**SILTY GRAVEL WITH SAND [GM]**, tan to brown, gravel is fine grained, rounded. *Woody debris from 18'-19'.*	
							SM	**SILTY SAND [SM]**, trace gravel, black to green, organics.	
	20							Boring terminated at a depth of 20 feet bgs on 11/22/04 and backfilled with bentonite grout upon completion.	
	25								

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Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-08-05

Sheet 1 of 1

Date(s) Drilled	**11/17/04 - 11/17/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**13.5 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, cobbly area North of sandblast building.**		

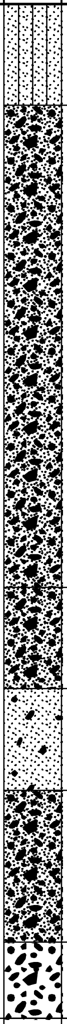
Elevation, feet	Depth, feet	SAMPLES Type	Number	Recovery, (ft.)	Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0						SM	**SILTY SAND [SM]** trace cobbles, brown, moist to wet.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, trace cobbles, dry to moist, gravel is gray to brown, fine grained, angular to subrounded, sand is tan to brown, coarse grained.	
			MC1	4	BKGD				
								Cobbles encountered.	
	5								
								Cobbles encountered.	
			MC2	4	BKGD				
								Decreasing gravel, increasing medium grained sand, moist.	
	10								
			MC3		BKGD				
								▽	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, dark gray to brown, wet, loose, gravel is coarse grained, sand is coarse grained.	
							GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, dark greenish-gray, moist, gravel is fine grained, subangular to subrounded, sand is medium to fine grained.	
	15								
			MC4		BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, reddish-gray, dry, gravel is rounded.	
							SM	**SILTY SAND [SM]**, trace organics, green, very hard, fine grained.	
	20							Boring terminated at a depth of 20 feet bgs on 11/17/04 and backfilled with bentonite grout upon completion.	
	25								

Project:	**Bradford Island**
Project Location:	**Cascade Locks, Oregon**
Project Number:	**25695767.00003**

Log of Boring DP-09-05

Sheet 1 of 1

Date(s) Drilled	**11/17/04 - 11/22/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**16 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, cobbly area at toe slope of the North side of the sandblast building.**		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0					SM	**SILTY SAND [SM]** trace gravel, brown to orange, wet.	
			MC1	5	BKGD	GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, brown to gray, dry to moist, gravel is coarse to fine grained, sand is coarse to medium grained.	
	5							
							Gravel and sand grade to fine grained.	
							3" of sand, orange to brown mottling, dry.	
			MC2	3	BKGD			
							Cobbles encountered from 8'-10', dark brown.	
	10							
							Grades to gray, gravel coarsens.	
						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, gray, dry, coarse grained.	
			MC3	5	BKGD			
						SP	**POORLY-GRADED SAND WITH GRAVEL [SP]**, tan to brown, moist to wet, loose from 13.5'-15', hard at 15'.	
	15							
						GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, tan to gray, wet, loose. ∇	
			MC4	5	BKGD			
							Cobbles encountered. Increased tan, coarse to medium sand from 18'-18.5'.	
						GP	**POORLY-GRADED GRAVEL [GP]**, dark gray.	
	20						Boring terminated at a depth of 20 feet bgs on 11/22/04 and backfilled with bentonite grout upon completion.	
	25							

Project:	**Bradford Island**
Project Location:	**Cascade Locks, Oregon**
Project Number:	**25695767.00003**

Log of Boring DP-10-05

Sheet 1 of 1

Date(s) Drilled	**11/18/04 - 11/18/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**14.0 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**8.5 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Grassy, gravelly area adjacent to hazardous material storage area.**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Recovery, (ft.)	Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0	▨	MC1	5	BKGD	▨	GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, dark brown, hard, gravel is fine to medium grained, subangular to subrounded, sand is coarse to medium grained.	
	5	▨	MC2	5	BKGD	▨			
		▨				▥	SM	**SILTY SAND [SM]**, light greenish-gray, moist to wet, medium grained.	
		▨				░	SP	**POORLY-GRADED SAND [SP]**, trace gravel, tan to greenish-gray, medium grained. *Basalt cobbles encountered.* ∇	
		▨				▨	GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, dark gray to brown, wet, loose, coarse grained.	
	10	▨	MC3	4	BKGD	▨			
		▨				░	SP	**POORLY-GRADED SAND WITH SILT AND GRAVEL [SP]**, tan to brown with orange to red mottling, hard.	
		▨						Boring terminated at a depth of 14 feet bgs on 11/18/04 and backfilled with bentonite grout upon completion.	
	15								
	20	▨	MC4	4	BKGD				
	25								

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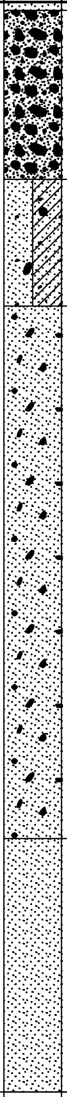
Project: Bradford Island **Project Location:** Cascade Locks, Oregon **Project Number:** 25695767.00003	**Log of Boring DP-11-05** Sheet 1 of 1

Date(s) Drilled	**11/18/04 - 11/22/2004**	Logged By	**BPM**	Checked By	**JOD**
Drilling Method	**GeoProbe**	Drill Bit Size/Type	**N/A**	Total Depth of Borehole	**21.5 feet**
Drill Rig Type	**GeoProbe**	Drilling Contractor	**Geotech Explorations, Inc.**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**8.5 feet bgs**	Sampling Method(s)	**1 1/4" dia. Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Bentonite Grout**	Location	**Hazardous Material Storage Area**		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0	▨					SP	*2" sandblast grit on ground surface.*	
		▨	MC1	5	BKGD		GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, black to gray, angular to subangular.	
		▨					SP-SM	**POORLY-GRADED SAND WITH SILT [SP-SM]**, trace gravel, tan to brown, dry to moist, loose.	
	5	▨							
		▨	MC2	2.5	BKGD		SP	**POORLY-GRADED SAND WITH GRAVEL [SP]**, brown to gray with orange to red mottling, moist to wet. *Soft from 7'-8', moist to wet.* ∇ *Soft from 8.5'-9', moist to wet.*	
	10	▨							
		▨	MC3	5	BKGD			*Increased gravel, rounded, weathered.* *Very hard, sand is medium to fine grained.*	
	15	▨						*Graded to gray.* *Wet, soft, loose, medium to coarse sand from 16'-17'.*	
		▨	MC4	5	BKGD		SP	**POORLY-GRADED SAND [SP]**, trace gravel, dark gray, hard, sand is medium to fine grained, gravel is fine grained basalt.	
	20	▨	MC5	0	BKGD				
								Refusal. Boring terminated at a depth of 21.5 feet bgs on 11/22/04 and backfilled with bentonite grout upon completion.	
	25								

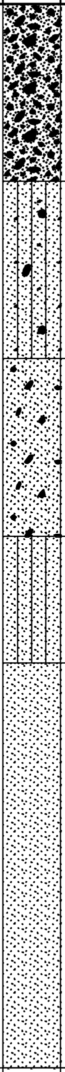
URS

Project: Bradford Island
Project Location: Cascade Locks, Oregon
Project Number: 25695767.00003

Log of Boring DP-12-05

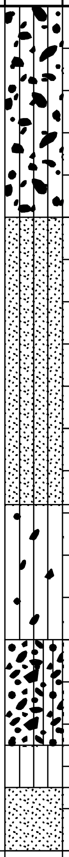
Sheet 1 of 1

Date(s) Drilled	11/18/04 - 11/22/2004	Logged By	BPM	Checked By	JOD
Drilling Method	GeoProbe	Drill Bit Size/Type	N/A	Total Depth of Borehole	21.0 feet
Drill Rig Type	GeoProbe	Drilling Contractor	Geotech Explorations, Inc.	Approximate Surface Elevation	N/A
Groundwater Level and Date Measured	7.5 feet bgs	Sampling Method(s)	1 1/4" dia. Macrocore	Hammer Data	N/A
Borehole Backfill	Bentonite Grout	Location	Hazardous Material Storage Area		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery, (ft.)	SAMPLES Headspace OVA, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0	▨					GP	**POORLY-GRADED GRAVEL WITH SAND [GP]**, black to greenish brown. Sandblast grit present to 2.5', no red or green color, medium grained. [FILL]	
			MC1	5	BKGD			*Cobbles encountered.* *Metal debris. [FILL]*	
							SM	**SILTY SAND [SM]**, trace gravel, tan to brown, dry to moist, soft, loose, fine to medium grained, no bedding structures.	
	5								
								Grades to medium dense, mottling from 6'-7.75'.	
			MC2	5	BKGD		SP	**POORLY-GRADED SAND WITH GRAVEL [SP]**, trace silt, ∇ grayish-brown, moist to wet, loose, sand is medium to coarse grained, gravel is fine grained, weathered, rounded. *Moist to wet from 7.5'-9'.*	
								Orange to red mottling.	
	10								
							SM	**SILTY SAND [SM]**, light gray with orange mottling.	
			MC3	5	BKGD				
							SP	**POORLY-GRADED SAND [SP]**, trace basalt pebbles, very hard.	
	15								
			MC4	5	BKGD				
	20								
			MC5	0	BKGD				
								Refusal. Boring terminated at a depth of 21 feet bgs on 11/22/04 and backfilled with bentonite grout upon completion.	
	25								

Project: Bradford Island - Upland OU Remedial Investigation **Project Location:** Bonneville Dam, Oregon **Project Number:** 25696931	**Log of Boring PR1** Sheet 1 of 1

Date(s) Drilled	**2/2/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**20.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**10.0 feet bgs**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0		MC1	2.25			**GRAVELLY SILT [ML]**, brown to dark brown, dry to moist, stiff, medium to fine grained gravel.	
							Cobble @ 4.5 feet bgs	
	5		MC2	1.5			**SILTY SAND WITH GRAVEL [SM]**, brown to brownish yellow, dry to moist, medium to fine grained sand, coarse gravel.	
	10						∇	
			MC3	2.5			**SILT WITH GRAVEL [ML]**, dark brown to olive gray, moist, fine to coarse gravels.	
							Becomes wet @ 14.5 feet bgs	
	15		MC4	3.5			**POORLY GRADED GRAVEL WITH SILT AND SAND [GP-GM]**, dark brown, wet, fine to medium gravel.	
							SILT [ML], yellowish brown, moist, hard.	
							POORLY GRADED SAND [SP], yellowish brown, moist, fine to medium grained.	
	20						Terminated boring at 20 feet bgs on 2/2/2009. Installed a stainless steel temporary well screen from 16 to 20 feet bgs. Collected groundwater sample: 090202-PR-PR1-16-20GW	
	25							
	30							

Project: Bradford Island - Upland OU Remedial Investigation	**Log of Boring PR2A**
Project Location: Bonneville Dam, Oregon	Sheet 1 of 1
Project Number: 25696931	

Date(s) Drilled	**2/2/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**14.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**Not Encountered**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		

		SAMPLES						
Elevation, feet	Depth, feet	Type	Number	Recovery (ft)	Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0	▨					*3" Woody debris on surface*	
		▨	MC1	2.5		▥	**SILT [ML]**, brown to dark brown, moist, stiff with some fine grained angular gravels.	
	5	▨	MC2	3.0		●	**GRAVELLY SILT WITH SAND [ML]**, brownish yellow, dry to moist, stiff, fine gravel, fine sand.	
		▨				●	**POORLY GRADED GRAVEL [GP]**, coarse subangular to angular gravel.	
	10	▨				●	**GRAVELLY SILT WITH SAND [ML]**, brownish yellow, dry to moist, stiff, fine gravel, fine sand.	
		▨	MC3	0.5		░	**POORLY GRADED SAND [SP]**, highly cemented sand, dry.	
							Terminated boring at 14 feet bgs due to refusal on 2/2/2009.	
	15							
	20							
	25							
	30							

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Project: Bradford Island - Upland OU Remedial Investigation
Project Location: Bonneville Dam, Oregon
Project Number: 25696931

Log of Boring PR2B

Sheet 1 of 1

Date(s) Drilled	**2/2/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**17.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**Not Encountered**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0		MC1	0			*No recovery 0.0-5.0 feet bgs*	
	5		MC2	2.5			**GRAVELLY SILT WITH SAND [ML]**, dark brown, moist to dry.	
							POORLY GRADED GRAVEL [GP], coarse subangular to angular gravel.	
							GRAVELLY SILT WITH SAND [ML], dark brown, moist to dry.	
	10		MC3	2.5				
	15		MC4	0.4			**POORLY GRADED SAND [SP]**, highly cemented sand, dry.	
							Terminated boring at 17 feet bgs due to refusal on 2/2/2009.	
	20							
	25							
	30							

URS

Project: Bradford Island - Upland OU Remedial Investigation
Project Location: Bonneville Dam, Oregon
Project Number: 25696931

Log of Boring PR2C

Sheet 1 of 1

Date(s) Drilled	**2/2/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**16.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**Not Encountered**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		

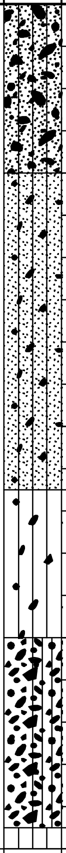
Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0	▨					**GRAVELLY SILT WITH SAND [ML]**, dark brown, dry to moist, medium to fine sand.	
		▨	MC1	2.5				
	5	▨						
		▨					**POORLY GRADED GRAVEL [GP]**, coarse subangular to angular gravel, dry to moist.	
		▨	MC2	2.0			**GRAVELLY SILT WITH SAND [ML]**, dark brown, dry to moist, medium to fine sand.	
	10	▨						
		▨	MC3	2.5				
		▨					**POORLY GRADED SAND [SP]**, brown, medium grained, dry, cemented.	
	15	▨	MC4	0				
							Terminated boring at 16 feet bgs due to refusal on 2/2/2009.	
	20							
	25							
	30							

Project: Bradford Island - Upland OU Remedial Investigation
Project Location: Bonneville Dam, Oregon
Project Number: 25696931

Log of Boring PR2D

Sheet 1 of 1

Date(s) Drilled	**2/2/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**20.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**10.9 feet bgs**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0	▨	MC1	2.5			**GRAVELLY SILT WITH SAND [ML]**, brown to dark brown, dry to moist, stiff, medium to fine sand.	
							SILTY SAND WITH GRAVEL [SM], brown, medium to fine sand, coarse gravel.	
	5	▨	MC2	2				
	10	▨					▽	
			MC3	1.0			**SILT WITH GRAVEL [ML]**, dark brown to olive gray, fine to coarse gravel.	
	15	▨	MC4	1.75			**POORLY GRADED GRAVEL WITH SILT AND SAND [GP-GM]**, dark brown, very soft, fine to medium gravel, wet.	
							SILT [ML], dark brown.	
	20						Terminate boring at 20 feet bgs on 2/2/2009. Installed a stainless steel temporary well screen from 16 to 20 feet bgs. After 10 minutes, water level probe dry. Pulled rods and inserted temporary 3/4" PVC temporary well with slotted screen (0.010 inch) from 9 to 19 feet bgs. Collected groundwater sample: 090202-PR-PR2D-9-196W.	
	25							
	30							

Project: Bradford Island - Upland OU Remedial Investigation
Project Location: Bonneville Dam, Oregon
Project Number: 25696931

Log of Boring PR2E

Sheet 1 of 1

Date(s) Drilled	2/2/2009	Logged By	N. Moody	Checked By	JOD
Drilling Method	Direct Push	Drill Bit Size/Type	Percussion Hammer	Total Depth of Borehole	25.0 feet bgs
Drill Rig Type	AMS Power Probe	Drilling Contractor	PSW	Approximate Surface Elevation	N/A
Groundwater Level and Date Measured	Not Encountered	Sampling Method(s)	2 Inch x 5 foot Macrocore	Hammer Data	N/A
Borehole Backfill	Hydrated Bentonite Chips	Location	Pistol Range		

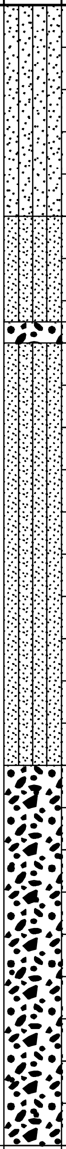
Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0	▨	MC1	2.5			**GRAVELLY SILT WITH SAND [ML]**, dark brown, dry to moist, stiff, medium to fine sand.	
		▨					**SILTY SAND WITH GRAVEL [SM]**, brown, medium to fine sand, coarse gravel.	
	5	▨	MC2	0			*No recovery 5.0-10.0 feet bgs*	
	10	▨	MC3	2.5			**SILT WITH GRAVEL [ML]**, dark brown to olive gray, dry to moist, fine to coarse gravel.	
		▨					**POORLY GRADED GRAVEL [GP]**, dry, fine to coarse gravel.	
	15	▨	MC4	2.5			**SILT [ML]**, yelowish brown, dry to moist, stiff.	
		▨					**POORLY GRADED SAND [SP]**, yellowish brown, dry, fine to medium sand.	
	20	▨	MC5	2.5				
	25						Terminate boring at 25 feet bgs on 2/2/2009 because no saturated soil encountered.	
	30							

Project:	**Bradford Island - Upland OU Remedial Investigation**
Project Location:	**Bonneville Dam, Oregon**
Project Number:	**25696931**

Log of Boring PR3A

Sheet 1 of 1

Date(s) Drilled	**1/27/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**27.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**Not Encountered**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	0	▨	MC1	1.5			**SANDY SILT [ML]**, dark brown, moist, stiff with some subangular coarse gravels.	
	5	▨	MC2	1.5			**SILTY SAND [SM]**, dark brown, moist, fine to medium grained sand.	
							POORLY GRADED GRAVEL [GP], coarse grained.	
							SILTY SAND [SM], dark brown, moist, fine to medium grained sand, some coarse gravels.	
	10	▨	MC3	1.5				
	15	▨	MC4	1.5				
							POORLY GRADED GRAVEL [GP], coarse grained.	
	20	▨	MC5	1.5				
	25						*Grades with trace silt*	
							Boring terminated at 27 feet bgs due to refusal on 1/27/2009.	
	30							

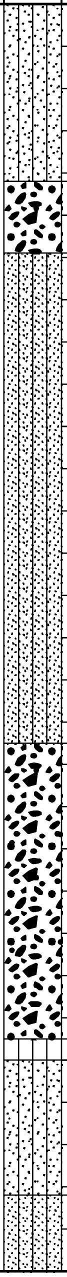
URS

Project:	**Bradford Island - Upland OU Remedial Investigation**
Project Location:	**Bonneville Dam, Oregon**
Project Number:	**25696931**

Log of Boring PR3B

Sheet 1 of 2

Date(s) Drilled	**1/27/2009**	Logged By	**N. Moody**	Checked By	**JOD**
Drilling Method	**Direct Push**	Drill Bit Size/Type	**Percussion Hammer**	Total Depth of Borehole	**40.0 feet bgs**
Drill Rig Type	**AMS Power Probe**	Drilling Contractor	**PSW**	Approximate Surface Elevation	**N/A**
Groundwater Level and Date Measured	**Not Encountered**	Sampling Method(s)	**2 Inch x 5 foot Macrocore**	Hammer Data	**N/A**
Borehole Backfill	**Hydrated Bentonite Chips**	Location	**Pistol Range**		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	SAMPLES Headspace PID, ppm	MATERIAL DESCRIPTION	REMARKS
	0					**SANDY SILT [ML]**, dark brown, moist, stiff, fine sand, trace coarse gravels.	
			MC1	3			
						POORLY GRADED GRAVEL [GP], coarse grained, subangular cobble pieces.	
	5						
						SILTY SAND [SM], dark brown, moist, stiff, trace coarse gravels.	
			MC2	3			
	10						
			MC3	0.5		*Becomes dry to moist with some fine to coarse grained gravels*	
	15						
			MC4	.25		**POORLY GRADED GRAVEL [GP]**, dark to light gray, dry to moist with trace dark brown silty sand.	
	20						
			MC5	1.5			
						SILT [ML], dark brown, wet, soft.	
	25					**SANDY SILT [ML]**, brown, moist to dry, stiff.	
			MC6	2.5			
						SILTY SAND [SM], brown, moist to dry, stiff, fine grained sand.	
	30						

URS

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Recovery (ft)	Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	30	▨						
		▨					**POORLY GRADED SAND [SP]**, dark brown, moist, medium grained sand with fine gravels.	
		▨	MC7					
		▨					*Becomes moist to wet @ 34-35 feet bgs*	
	35	▨					*Grades to fine to medium grained sand with trace fine subangular gravel*	
		▨	MC8	37.5				
	40						Terminate boring at 40 feet bgs on 1/27/2009. Installed a stainless steel temporary screen from 31 to 35 feet bgs and dry. No groundwater sample collected.	
	45							
	50							
	55							
	60							
	65							

HTRW DRILLING LOG

DISTRICT Portland		HOLE NUMBER SB1
1 COMPANY NAME Tetra Tech, Inc.	2 DRILL SUBCONTRACTOR Cascade Drilling	SHEET 1 OF SHEETS 3

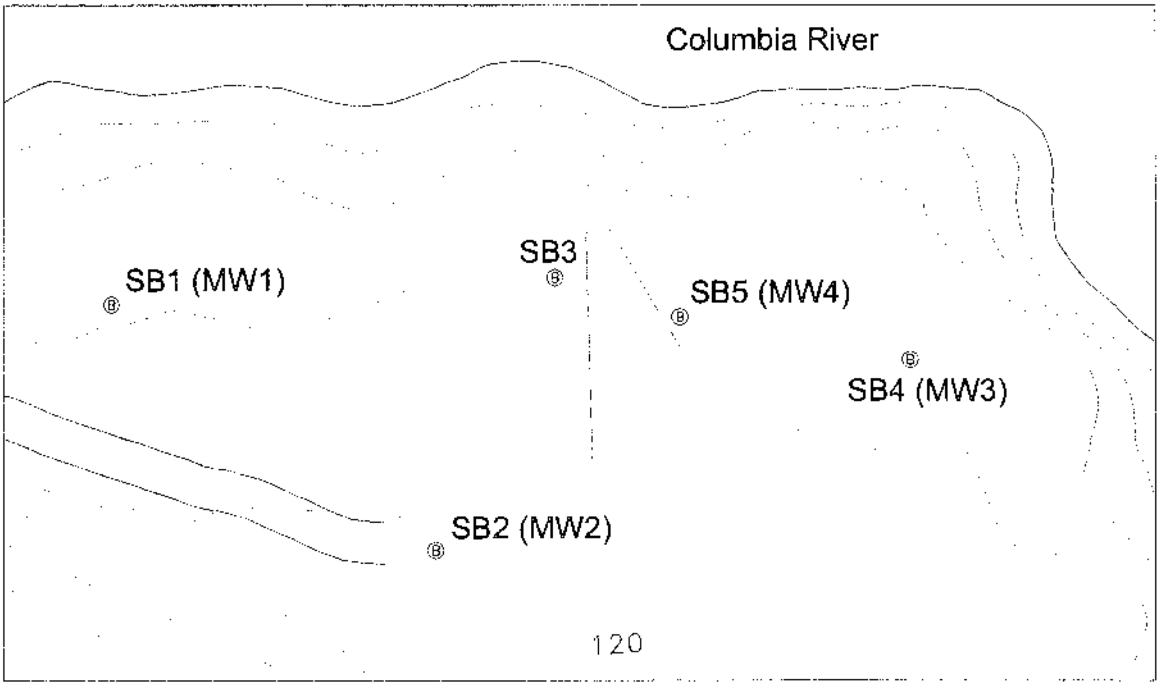
3 PROJECT USCOE Bradford Island Landfill	4 LOCATION Bradford Island Landfill
5 NAME OF DRILLER Steve Hughes	6 MANUFACTURERS DESIGNATION OF DRILL CME 75
7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 4.25" ID (9.25 OD) HSA 18" long, 2" OD split spoon sampler 140 lbs with 30-inch drop	8 HOLE LOCATION West end of landfill (723653.80 North) (1632933.91 East)
	9 SURFACE ELEVATION 102.84' (TOC = 105.50')
	10 DATE STARTED 8/17/98 — 11 DATE COMPLETED 8/17/98
12 OVERBURDEN THICKNESS 28'	15 DEPTH GROUNDWATER ENCOUNTERED No Groundwater
13 DEPTH DRILLED INTO ROCK 2' (fractured)	16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED No groundwater after >24 hours
14 TOTAL DEPTH OF HOLE 30'	17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES
0	0	0	0

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS/SVOCs	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY
	1	1	PCB – 1	Chlor herbs - 1	TPH - 1	

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR
Well installed		X		

LOCATION SKETCH/COMMENTS:



PROJECT Bradford Island	HOLE NO. SB1

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER SB1

PROJECT Bradford Island

INSPECTOR Carlotta Cellucci

SHEET 2 OF 3 SHEETS

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
ML ? ? ?	0	Grassy cover underlain by brown sandy silt with gravel (ML) (sand 10%, gravel 30%, fines 60%) loose, dry					Background PID reading = 2.8
	1						
	2						
	3						
	4						
	5	No recovery				40 50	No recovery at 5' drilled to 6' BLS
	6	No recovery (1" slough)	2.7			31 64 72	About 1" of slough in sampler at 6' BLS
ML CL	7	Dark brown clayey silt (ML) with gravel, moist, firm (gravel 5%, fines 95%) grading, to silty clay (CL) at approximately 7.5' BLS, low plasticity (95% fines, 5% gravel)	2.7			13 13 17	2' of recovery in 2.5' sampler at 7' BLS
	8						
	9						
CL	10	Same as above with areas of orange oxidation in spots grading to gray silty clay (CL) with gravel at approximately 11' BLS (95% fines, 5% gravel)	3.1			7 7 7	1.25' of recovery Background PID = 3.1
	11						
	12						
	13						Very hard at 13' BLS
	14						
	15	No recovery				86 120	No recovery
	16						Very hard at 16' BLS
SM	17	Gray silty clayey sand (SM), dry/moist, well graded, (45% fines, 55% sand) possible ash flow	2.7			28 41 60	1.25' recovery

PROJECT Bradford Island

HOLD NO. SB1

HTRW DRILLING LOG (CONTINUATION SHEET)

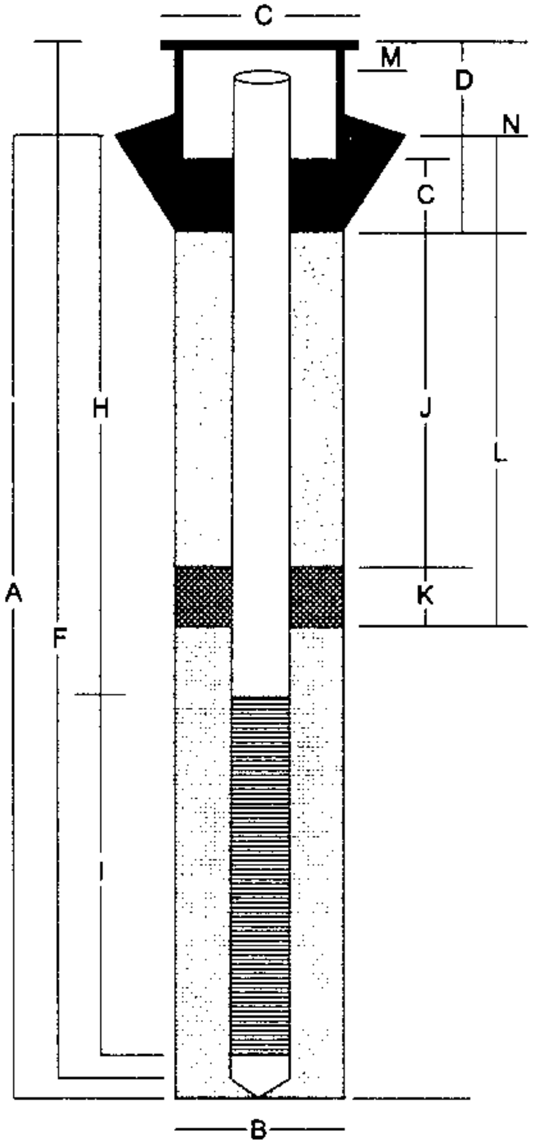
PROJECT Bradford Island	INSPECTOR Carlotta Cellucci	HOLE NUMBER SB1	SHEET 3 OF 3 SH

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	18						
	19						
ML	20	Gray gravelly, clayey silt (ML) (20% gravel, 80% fines) low plasticity, very stiff	2.3		8/17/98-BIL-SB1-SS01 (1200)	28 46 60	PID background = 2.3: 2' Recovery in 1st sampler
	21		2.7			19 46 70	3" of Recovery; 2nd sampler at 20'; PID background 2.0
	22	Same with increasing clay content (20% gravel, 80% fines) grading at 22.5' to gray silty gravelly clay (CL), low plasticity, moist, very stiff (5% gravel, 95% fines)	2.0			25 48 56	4th sampler hammered at 22' BLS Full recovery
CL	23		1.6			28 45 60	5th sampler hammered at 22.5' BLS 1.5' Recovery Background PID = 1.6
	24						
	25						
	26						
CL	27	Same as above to contact at approximately 28' with weathered rock/sand stone/ash tuff, well graded angular macrocrystalline (100% sand/crushed rock)	1.6			25 46	1.25' Recovery
Ash tuff	28						
	29	Drilled to 29.5' BLS					
	30						
	31						
	32						
	33						
	34						
	35						

PROJECT Bradford Island	HOLD NO. SB1

Above-ground Monitoring Well Construction Log

Project Name: USCOE BRADFORD ISLAND
Well No.: MW01 (SB1)
Date: 8/17/98
Project No: 10022-03
Drilling Method: HSA
Geologist: Carlotta Cellucci



A: Total Boring Depth: 30'

B: Boring Diameter: 9.25"

C: Diameter of Protective Casing: 5" ID

D: Length of Protective Casing: 5'
Type of Protective Casing: Steel monument

E: Interval of Surface Grout: 0-4'

F: Total Riser Casing Length: 31.4'
Length of Sediment Sump: 1"
Casing Type: Sch. 80, Flush threaded PVC

G: Inner Diameter: 1.62" (2" OD)

H: Depth to Screen: 20'

I: Screen Length: 10'
Screen Intrval: 20'-30'
Screen / Slot Type: 0.010" Factory slot

J: Depth to Top of Seal: 4'

K: Thickness of Seal: 13'
Type of seal material: Pure gold medium Bentonite chips

L: Depth to Top of Filter Pack: 17'
Type of Filter Pack: 20/40 Colorado silica sand

M: Top of Casing Elevation: 105.50' above msl

N: Surface Elevation: 102.84' above msl

NOTE: Well was not surged after placement of sand pack, because there was no water in the well.

HTRW DRILLING LOG

DISTRICT: Portland

HOLE NUMBER: SB2

1 COMPANY NAME: Tetra Tech, Inc.

2 DRILL SUBCONTRACTOR: Cascade Drilling

SHEET 1 OF 3 SHEETS

3 PROJECT: USCOE Bradford Island Landfill

4 LOCATION: Bradford Island Landfill

5 NAME OF DRILLER: Steve Hughes

6 MANUFACTURERS DESIGNATION OF DRILL: CME 75

7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT:
4.25" ID (9.25 OD) HSA
18" long, 2" OD split spoon sampler
140 lbs with 30-inch drop

8 HOLE LOCATION:
Pesticide wash area
(723564.81 North)
(1633051.27 East)

9 SURFACE ELEVATION: 114.21' (TOC = 116.56')

10 DATE STARTED: 8/17/98

11 DATE COMPLETED: 8/17/98

12 OVERBURDEN THICKNESS: 30'

13 DEPTH DRILLED INTO ROCK: ~2' (weathered)

14 TOTAL DEPTH OF HOLE: 32'

15 DEPTH GROUNDWATER ENCOUNTERED: No Groundwater Encountered/Dry Hole

16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 32.32 below TOC after 24 hours

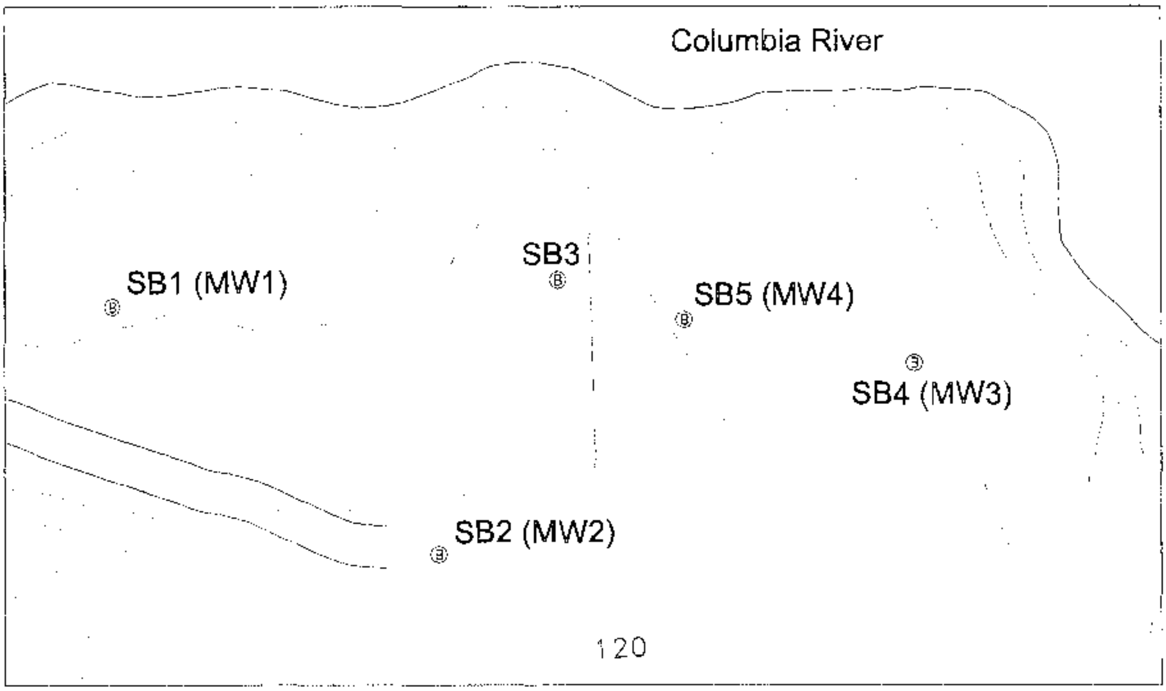
17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES
0	--	--	0

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS/SVOCs	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS:



PROJECT: Bradford Island

HOLE NO.: SB2

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER	SB2
PROJECT	Bradford Island
INSPECTOR	
SHEET 2 OF 3 SHEETS	

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Grassy cover	2.0				Background PID reading = 2.0
	1						
	2						
	3						
	4						
SM	5	Very dark gray clayey sand (SM) with gravel, well graded, moist (20% fines, 15% gravel, 65% sand), loose-firm.	0.2			28 48 56	Background PID dropped to 0.0 2' of recovery
CL	6	Contact at 6.5' BLS with brown sandy silty clay with gravel, (CL) (25% sand, 65% fines, 5% gravel) firm, moist, low plasticity					
	7						
	8						
	9						
Weathered Basalt	10	Brown sandy clay matrix with basalt fragments to cobble size, some moisture in fractures and between matrix and basalt cobbles. Cobbles are angular to subrounded (10-20% matrix, 80-90% fractured basalt)	0.0			18 26 50	1.5' recovery
	11						
	12						
	13						
	14						
Weathered Basalt	15	Same as above, gray-black fractured basalt in a brown sandy clay matrix. Sand and basalt fragments are angular to subrounded (10-20% matrix, 80-90% fractured basalt)	0.0			23 50	8" recovery
	16						
	17						

PROJECT	Bradford Island
HOLD NO.	SB2

ENG FORM 5056A-4, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT Bradford Island	INSPECTOR	HOLE NUMBER SB2 SHEET 3 OF SHEETS 3

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO (f)	BLOW COUNT (g)	REMARKS (h)
	18						
	19						
CL Weathered rock	20	Brown sandy clay with gravel (CL) (10% gravel, 20% sand, 70% fines) low plasticity, moist, firm to contact at approximately 20.5' with desiccated rock (sand with angular gravel) (5% gravel, 95% sand) moist, well graded, angular, dense (granite or macrocrystalline volcanic)	0.0 0.0			28 50	1.25' recovery
	21						
	22						
	23						
	24						
	25	Gray weathered/desiccated sand stone (ash tuff?), very dense, well graded, moist	0.0			26 50	1' + 3 " slough
	26						
	27						
	28						
	29						
Weathered rock	30	Red rhyolitic cobble underlain by gray sand/sandstone/ash tuff (weathered) well graded sandstone fragments are angular, very dense, moist	0.0			40 50	1' + 3 " slough recovery
	31						
Weathered rock	32	Gray weathered sandstone/ash tuff, fragmented Total Depth = 32'	0.0			50	6" recovery
	33						
	34						
	35						

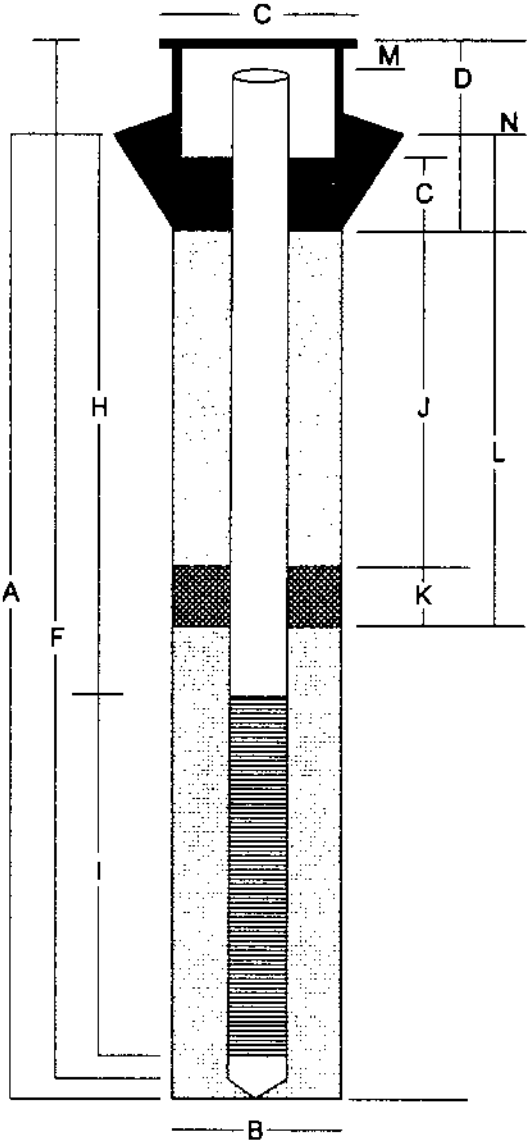
PROJECT Bradford Island	HOLD NO. SB2

Above-ground Monitoring Well Construction Log

Project Name: USCOE BRADFORD ISLAND **Well No.:** MW02 (SB2) **Date:** 8/17/98

Project No: 10022-03 **Drilling Method:** HSA

Geologist: Carlotta Cellucci



A: Total Boring Depth:	32'
B: Boring Diameter:	9.25"
C: Diameter of Protective Casing:	5" ID
D: Length of Protective Casing:	5'
Type of Protective Casing:	Steel mountment
E: Interval of Surface Grout:	0-4'
F: Total Riser Casing Length:	34.14'
Length of Sediment Sump:	1"
Casing Type:	Sch. 80, Flush threaded PVC
G: Inner Diameter:	1.62" (2" OD)
H: Depth to Screen:	22'
I: Screen Length:	10'
Screen Intrval:	22'-32'
Screen / Slot Type:	0.010" Factory slot
J: Depth to Top of Seal:	4'
K: Thickness of Seal:	16'
Type of seal material:	Pure gold medium Bentonite chips
L: Depth to Top of Filter Pack:	20'
Type of Filter Pack:	20/40 Colorado silica sand
M: Top of Casing Elevation:	116.56' above msl
N: Surface Elevation:	114.21' above msl

NOTE: Well was not surged after placement of sand pack, because there was no water in the well at that time. Well was surged by hand prior to well development.

HTRW DRILLING LOG

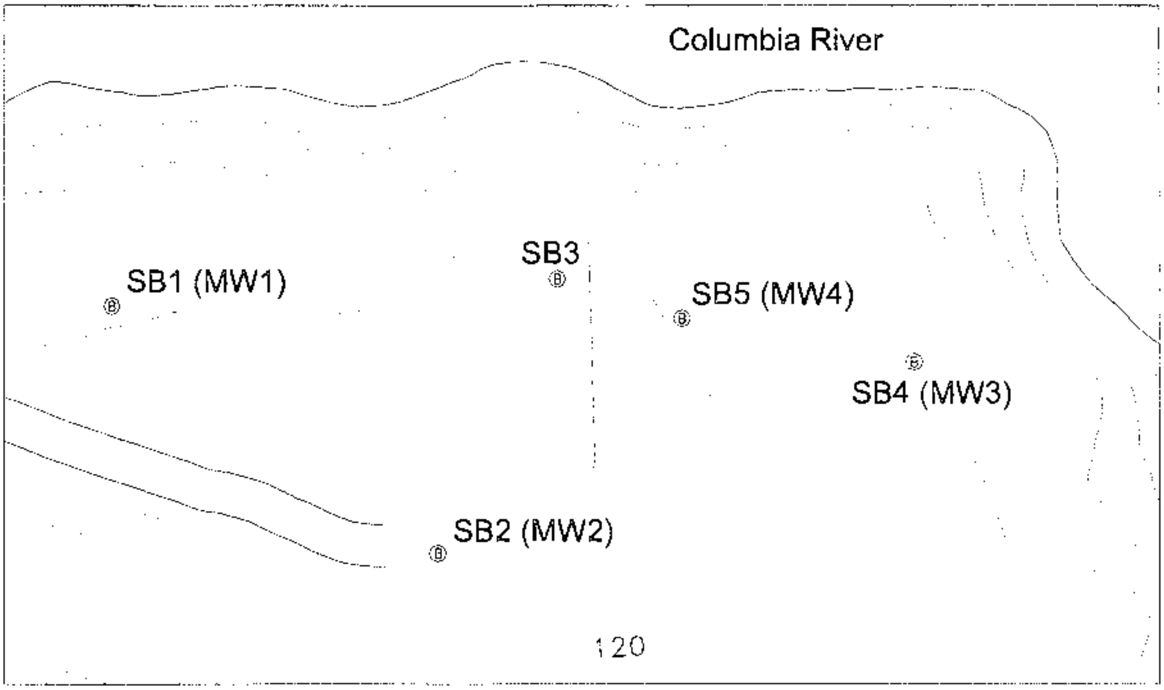
DISTRICT Portland	HOLE NUMBER SB4	
1 COMPANY NAME Tetra Tech, Inc.	2 DRILL SUBCONTRACTOR Cascade Drilling	SHEET 1 OF SHEETS 3
3 PROJECT USCOE Bradford Island Landfill	4 LOCATION Bradford Island Landfill	
5 NAME OF DRILLER Steve Hughes	6 MANUFACTURERS DESIGNATION OF DRILL CME 75	
7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 4.25" ID (9.25 OD) HSA 18" long, 2" OD split spoon sampler 140 lbs with 30-inch drop	8 HOLE LOCATION East end of Landfill (723633.77 north) (1633220.55 east)	
	9 SURFACE ELEVATION 112.99' (TOC = 115.22')	
	10 DATE STARTED 8/17/98	11 DATE COMPLETED 8/17/98
12 OVERBURDEN THICKNESS N/A	15 DEPTH GROUNDWATER ENCOUNTERED Approximately 18'	
13 DEPTH DRILLED INTO ROCK Approximately 0.5' (Fractured)	16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED 17.65 after 20 hours	
14 TOTAL DEPTH OF HOLE 21'	17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY) N/A	

18 GEOTECHNICAL SAMPLES 0	DISTURBED --	UNDISTURBED --	19 TOTAL NUMBER OF CORE BOXES 0

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC 1	METALS/SVOCs	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL X	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS:



PROJECT Bradford Island	HOLE NO. SB4

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)		HOLE NUMBER SB4
PROJECT Bradford Island	INSPECTOR Carlotta Cellucci	SHEET 2 OF SHEETS 3

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Grassy cover					
	1						
	2						
	3						
	4						
SM	5	Brown silty sand with gravel (SM) (fines 20%, gravel 5%, sand 75%) very dense, dry, well graded	0.0			50	1' of recovery
	6						
	7						
	8						
	9						
SM	10	Same as above with clay (SM) (fines 40%, gravel 5%, sand 55%) very dense, dry to moist, well graded, appaars to be weathered basalt (i.e., clayey matrix with basalt/volcanic sand and gravel)	0.0			50	6" of recovery Material packing augers had to pull augers and clean out material.
	11						
	12						
	13						
	14						
	15	No recovery				86 120	No recovery. Material packed auger and bit again at 15' BLS had to pull augers and clean out again. Drilled with center rod and plug
	16						
	17						

PROJECT Bradford Island	HOLD NO. SB4

ENG FORM 5056A-4, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT Bradford Island	INSPECTOR Carlotta Cellucci	HOLE NUMBER SB4 SHEET 3 OF 3

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO (f)	BLOW COUNT (g)	REMARKS (h)
	18						Became wet at approximately 18' BLS
	19						
Weathered rock	20	Brown weathered rock in silty sand matrix (fines 5%, sand 25%, gravel/angular rock 70%) wet, very dense, well graded	0.0		8/17/98-BIL-SB4-SS-01 (1805) VOCs only (Not submitted to the laboratory for analysis)	8 50	1' of recovery in 1st sampler
	21	second sampler driven at 20' BLS = Fractured basalt in a sand matrix with large volume of free water Refusal at 21' BLS (Hard rock)				50	3" of recovery in 2nd sampler
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

PROJECT Bradford Island	HOLD NO. SB4

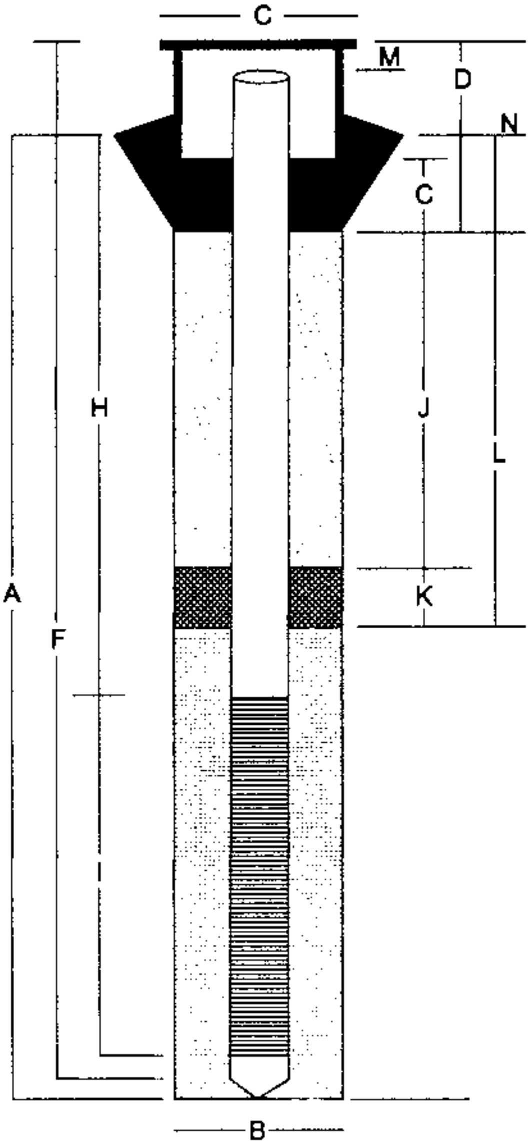
ENG FORM 5056A-4, AUG 94 (Proponent: CECW-EG)

Above-ground Monitoring Well Construction Log

Project Name: USCOE BRADFORD ISLAND **Well No.:** MW03 (SB4) **Date:** 8/17/98

Project No: 10022-05 **Drilling Method:** HSA

Geologist: Carlotta Cellucci



NOTE: After placement of sand pack, surged well for 5 minutes, Sand settled 4-inches. Replaced sand and surged again for 5 more minutes; sand did not settle.

A: Total Boring Depth: 21'

B: Boring Diameter: 9.25"

C: Diameter of Protective Casing: 5" ID

D: Length of Protective Casing: 5'
Type of Protective Casing: Steel monument

E: Interval of Surface Grout: 0-3'

F: Total Riser Casing Length: 22.57'
Length of Sediment Sump: 1"
Casing Type: Sch. 80, Flush threaded PVC

G: Inner Diameter: 1.62" (2" OD)

H: Depth to Screen: 11'

I: Screen Length: 10'
Screen Intrval: 11'-21'
Screen / Slot Type: 0.010" Factory slot

J: Depth to Top of Seal: 3'

K: Thickness of Seal: 6'
Type of seal material: Pure gold medium Bentonite chips

L: Depth to Top of Filter Pack: 9'
Type of Filter Pack: 20/40 Colorado silica sand

M: Top of Casing Elevation: 115.22' above msl

N: Surface Elevation: 112.99' above msl

HTRW DRILLING LOG

DISTRICT: Portland

HOLE NUMBER: SB5

SHEET 1 OF 3 SHEETS

1 COMPANY NAME: Tetra Tech, Inc.

2 DRILL SUBCONTRACTOR: Cascade Drilling

3 PROJECT: USCOE Bradford Island Landfill

4 LOCATION: Bradford Island Landfill

5 NAME OF DRILLER: Steve Hughes

6 MANUFACTURERS DESIGNATION OF DRILL: CME 75

7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT:
4.25" ID (9.25 OD) HSA
18" long, 2" OD split spoon sampler
140 lbs with 30-inch drop

8 HOLE LOCATION:
Northeast area of landfill
(723649.42 north)
(1633138.74 east)

9 SURFACE ELEVATION: 114.47' (TOC = 114.79')

10 DATE STARTED: 8/18/98

11 DATE COMPLETED: 8/18/98

12 OVERBURDEN THICKNESS: approximately 30'

13 DEPTH DRILLED INTO ROCK: Decompose <1'

14 TOTAL DEPTH OF HOLE: 30'

15 DEPTH GROUNDWATER ENCOUNTERED: Between 15-20' BGS

16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 17.25 after 4 hours

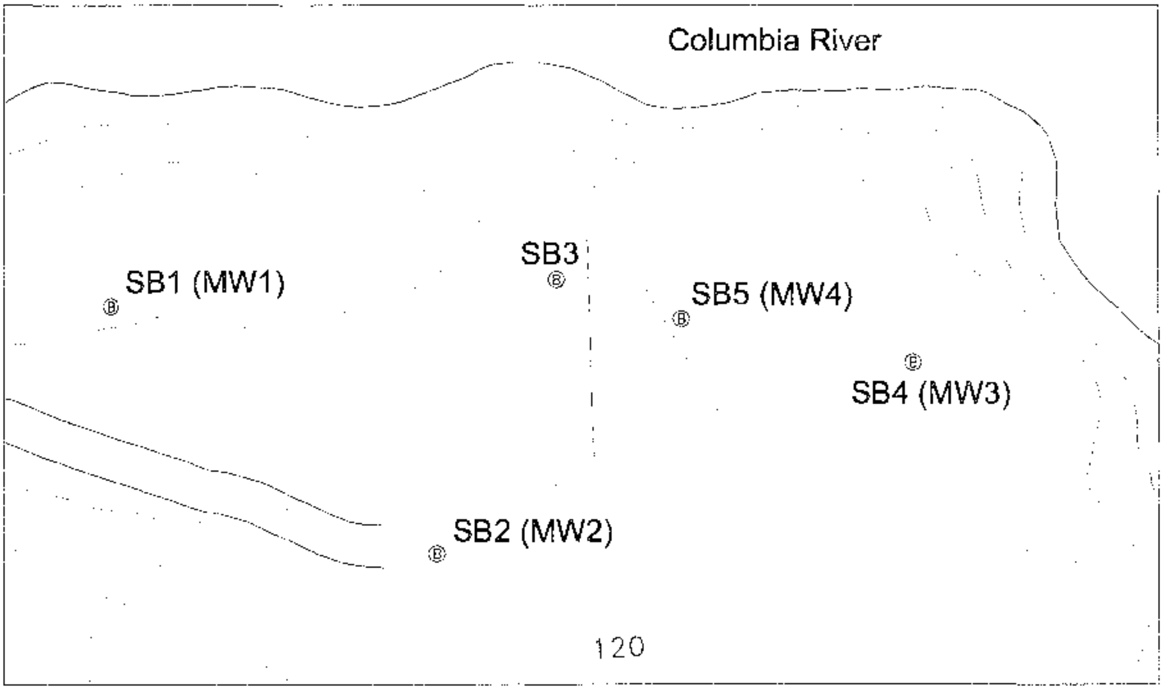
17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES
0	--	--	0

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS/SVOCs	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS:



PROJECT: Bradford Island

HOLE NO.: SB5

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER SB5

PROJECT Bradford Island

INSPECTOR Carlotta Cellucci

SHEET 2 OF SHEETS 3

ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Grassy cover					
	1						
	2						
	3						
	4						
SM	5	Brown silty sand with gravel (SM) (fines 25%, gravel 5%, sand 70%) dry to moist, dense, well graded	1.1			11 11 20	6" recovery (2" of which are slough) Background PID <1.1
	6						
	7						
	8						
	9						
SM	10	Mottled black/orange/brown silty sand (SM) with gravel (fines 10%, sand 75%, gravel 15%) moist, dense, well graded	0.4			5 5 5	6" of recovery Background PID = 0.3
	11						
	12						
	13						
	14						
	15	No recovery Sampler wet				3 6 4	No recovery
	16						
	17						

PROJECT Bradford Island

HOLD NO. SB5

ENG FORM 5056A-4, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT Bradford Island	INSPECTOR Carlotta Cellucci	HOLE NUMBER SB5	SHEET 3 OF SHEETS 3

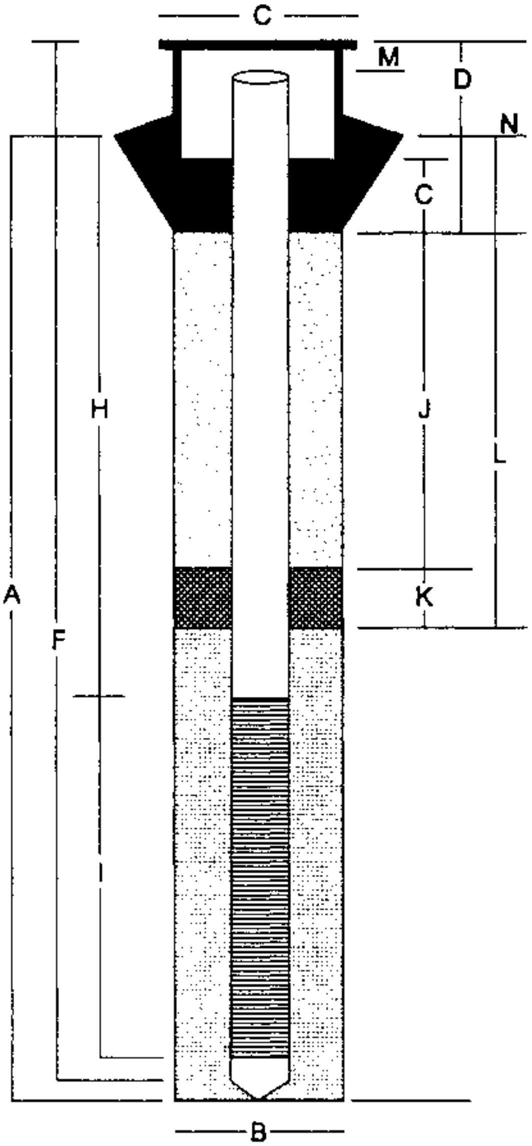
ELEV (a)	DEPTH (FEET) (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	18						
	19						
	20	No recovery				50	No recovery Background PID = 0.1
	21	Gray gravelly (fractured volcanics) clay (CL) (fines 60%, fractured rock 40%) very stiff, moist-wet, low plasticity	0.1			10 33 50	2.75' recovery
CL	22						
	23						
	24						
SM	25	Gray gravelly, clayey sand (SM) (gravel 10%, fines 10%, sand 80%) gravel = angular volcanics, sand is volcanic/angular wet, dense, well graded	1.0			50	5" recovery Background PID = 0.8
	26						
	27						
	28						
	29						
Weathered Rock	30	Gray decomposed volcanics in a gravelly clay matrix, moist, very dense, well graded, all gravel and rock is angular	0.3			31 50	2' recovery Background PID = 0.3
	31	Total Depth = 30'					
	32						
	33						
	34	**NOTE: A large piece of metal was wrapped around the augers when they were removed from the boring.**					
	35						

Above-ground Monitoring Well Construction Log

Project Name: USCOE BRADFORD ISLAND
Well No.: MW04 (SB5)
Date: 8/18/98

Project No: 10022-03
Drilling Method: HSA

Geologist: Carlotta Cellucci



A: Total Boring Depth:	30'
B: Boring Diameter:	9.25"
C: Diameter of Protective Casing:	5"
D: Length of Protective Casing:	5'
Type of Protective Casing:	Steel monument
E: Interval of Surface Grout:	0-4'
F: Total Riser Casing Length:	31.85'
Length of Sediment Sump:	1"
Casing Type:	Sch. 80, Flush threaded PVC
G: Inner Diameter:	1.62" (2" OD)
H: Depth to Screen:	10'
I: Screen Length:	20'
Screen Intrval:	10'-30'
Screen / Slot Type:	0.010" Factory slot
J: Depth to Top of Seal:	4'
K: Thickness of Seal:	4'
Type of seal material:	Pure gold medium Bentonite chips
L: Depth to Top of Filter Pack:	8'
Type of Filter Pack:	20/40 Colorado silica sand
M: Top of Casing Elevation:	114.79' above msl
N: Surface Elevation:	114.47' above msl

NOTE: After placement of sand pack, surged well for 5 minutes, Sand settled 1" inch. Replaced sand and surged again for 5 more minutes; sand did not settle.

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Key to Log of Boring

Sheet 1 of 1

		SAMPLES									
Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, inches	Headspace PID [FID], ppm	Graphic Log	Lithologic Log (USCS Code)	**MATERIAL DESCRIPTION**	Well Completion Schematic	**FIELD NOTES AND WELL DETAILS**
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop; "NA" indicates data not recorded.

6 **Recovery:** Length in inches of sample actually recovered in driven or pushed sampler; "NA" indicates data not recorded.

7 **Headspace PID/FID:** Photo-ionization/flame ionization device sample headspace reading in parts per million (ppm).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **USCS Code:** Unified Soil Classification System (USCS) group symbol code for associated soil strata.

10 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

11 **Well Completion Schematic:** Schematic of piezometer or well installation; materials are listed in header block and alongside well schematic; graphic symbols are explained below.

12 **Field Notes and Well Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Well construction materials and installation details are also listed in this column.

TYPICAL SOIL GRAPHIC SYMBOLS

░ SAND (SP)
░ SAND with silt (SP-SM)
▥ Silty SAND (SM)
▨ CLAY (CL)
▨ Plastic CLAY (CH)
▨ Clayey SAND (SC)
▥ SILT (ML)
▨ Silty CLAY (CL/ML)
● Silty GRAVEL (GM)
▒ SANDSTONE
● Rock Fragments / Gravel
☐ Non-soil Fill

TYPICAL WELL GRAPHIC SYMBOLS

▥ Blank well casing in concrete
▥ Blank well casing in bentonite-cement slurry
▥ Blank well casing in bentonite chips
▥ Blank well casing in filter sand
▤ Slotted well casing in filter sand
▒ Native backfill or slough

TYPICAL SAMPLER GRAPHIC SYMBOLS

◩ 2-inch-OD split spoon sampler (SPT)
■ 2.5-inch-OD split spoon with brass liners (modified California)
▯ Thin-walled tube sampler (Shelby tube)

OTHER GRAPHIC SYMBOLS

▽ First water encountered at time of drilling (ATD)
▼ Static water level measured in well on specified date
↓ Change in material properties within a stratum
┈ Inferred or gradational lithologic contact

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

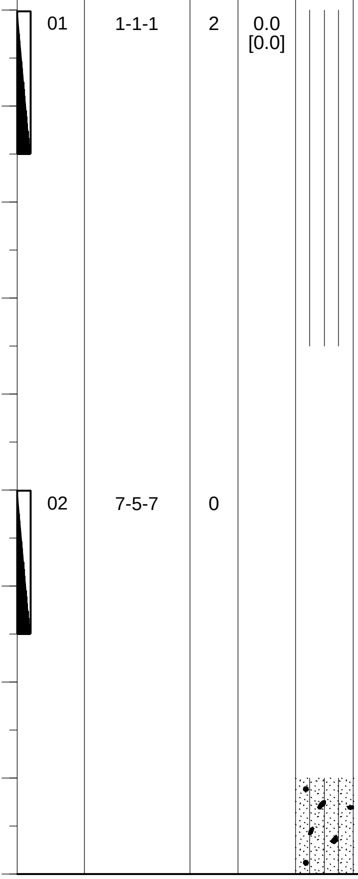
Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

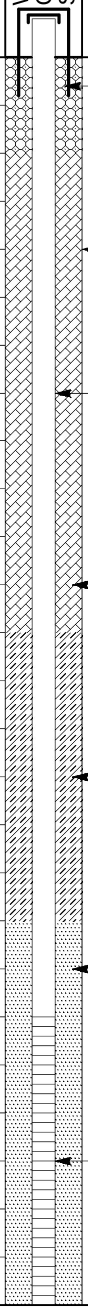
Log of Boring SB-7 (MW-5)

Sheet 1 of 3

Date(s) Drilled and Installed	**9/29/99 and 9/30/99**	Geologist	**G. Lukert**	Reviewer	
Drilling Method	**Hollow-Stem Auger**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**36.5 feet**
Sampling Method	**Split spoon**	Drill Bit Size/Type	**8-7/8-inch-OD auger bit**	Top of Casing Elevation	**114.07 feet MSL**
Size and Type of Well Casing	**1-7/8-inch-I.D. Schedule 80 PVC**	Screen Perforation	**0.010-inch slot (10-34.5 feet)**	Ground Surface Elevation	**112.36 feet MSL**
Seal or Backfill	**Bentonite-cement slurry 1-6 feet, bentonite chips 6-9 feet**	Location	**North side of landfill**	Coordinates	**N 723,665.69 E 1,633,072.42**

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance, blows / 6 in.	SAMPLES Recovery, inches	SAMPLES Headspace PID [FID], ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	0							Surface conditions: brown, silty SAND with rounded cobbles [Fill]	
112									6-3/16-in.-dia. steel casing set in concrete to 1 ft
	1								
	2								8-7/8-in.-dia. borehole (0-35 ft)
110									
	3								1-7/8-in.-I.D. blank Schedule 80 PVC casing to 10 ft
	4		01	1-1-1	2	0.0 [0.0]	ML	SILT; dark yellowish brown (10YR 3/4), trace fine sand, slightly micaceous, dry, soft, no odor [FILL]	
108									
	5								Bentonite-Portland cement slurry (1-6 ft)
	6								
106									
	7								Bentonite chips (6-9 ft)
	8								
104									
	9		02	7-5-7	0			**No recovery in sampled interval 9-10.5 feet; apparent void space 7.5-10 feet**	20/40 silica sand (9-35 ft)
	10								
102									
	11								1-7/8-in.-I.D. Schedule 80 PVC screen, 0.010-in. slot (10-35 ft)
	12								
100									
	13								





Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring SB-7 (MW-5)

Sheet 2 of 3

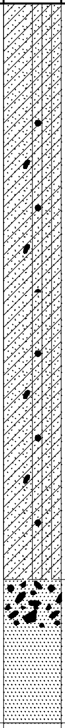
Elevation feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resistance, blows / 6 in.	SAMPLES: Recovery, inches	SAMPLES: Headspace PID [FID], ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	13								8-7/8-in.-dia. borehole (0-35 ft)
98	14		03	8-3-4	2	0.0 [0.0]	SM	Silty SAND with gravel; very dark gray (2.5Y 3/1), ~60% sand, ~30% medium plasticity silt, ~10% rounded to subrounded gravel, wet, loose, no odor [FILL]	
	15								20/40 silica sand (9-35 ft)
96	16								
	17								1-7/8-in.-I.D. Schedule 80 PVC screen, 0.010-in. slot (10-35 ft)
94	18							∇	
	19								
92	20		04	10-12-9	2	0.0 [0.0]	SM/ML	Silty SAND to sandy SILT; very dark gray (2.5Y 3/1), slightly micaceous, damp to wet, medium dense, no odor [FILL]	
	21								
90	22								
	23								
88	24		05	4-6-5	4	43 [0.0]	SM	Silty SAND; dark gray (2.5Y 4/1), trace angular volcanic gravel, wood fragments, damp to wet, medium dense	
	25								
86	26								
	27								
84	28								
	29								

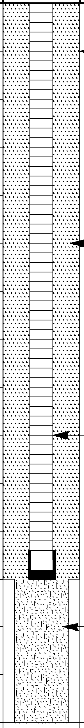
Report: ENV_12W_CLEVELAND+/-USCS_2FT/IN; File: BRADFORD.GPJ; 1/12/2000 SB-07

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

Log of Boring SB-7 (MW-5)

Sheet 3 of 3



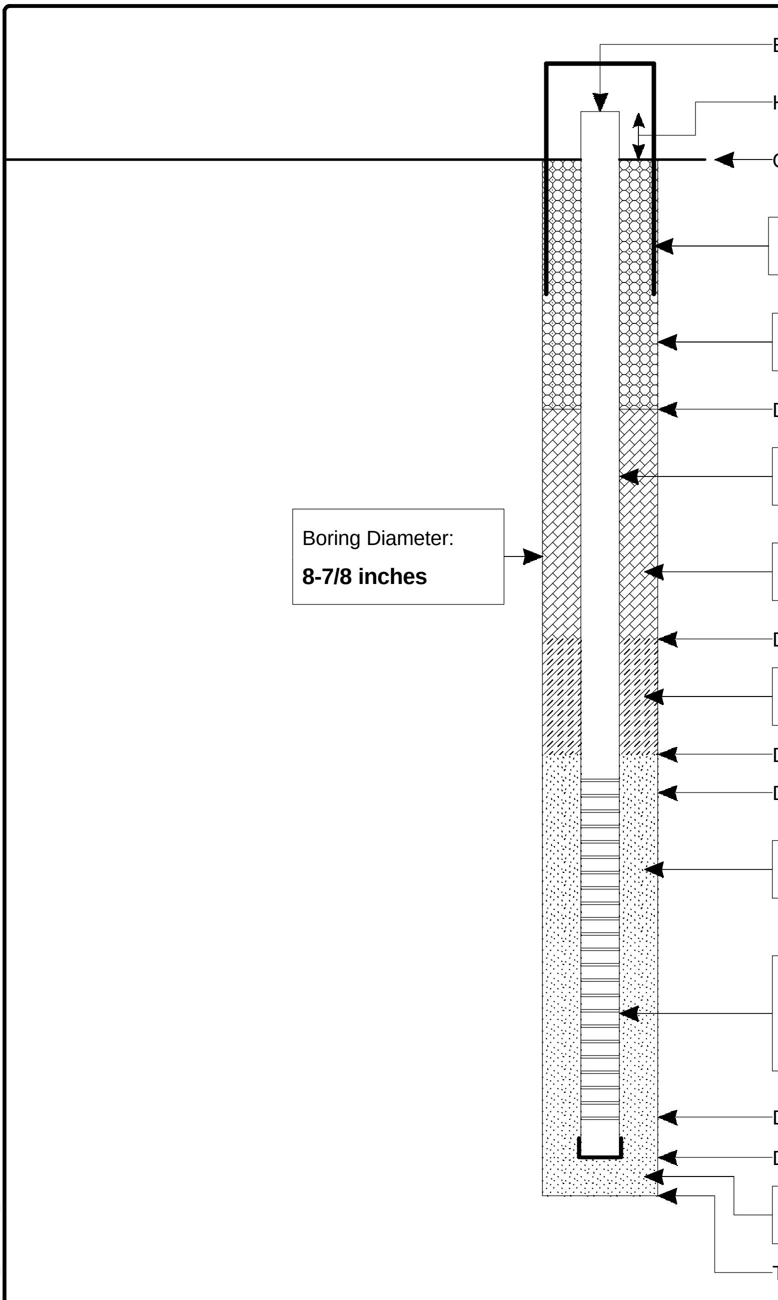


Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, blows / 6 in.	Recovery, inches	Headspace PID [FID], ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	29							8-7/8-in.-dia. borehole (0-35 ft)
82	30	06	1-2-4	18	375 [0.0]	SC	CLAYEY SAND with silt; dark gray (2.5Y 4/1), ~60% poorly graded sand, ~35% medium plasticity fines, ~5% angular gravel, wet, loose	
	31							20/40 silica sand (9-35 ft)
80	32							
	33							1-7/8-in.-I.D. Schedule 80 PVC screen, 0.010-in. slot (10-35 ft)
78	34							
	35	07	5-9-14	14	32 [0.0]	[Rock]	Weathered SANDSTONE; very dark gray (2.5Y 3/1), angular volcanic fragments (35.0-35.5 ft), trace clay, damp to wet, medium dense	Native soil (sampled interval)
76	36							
	37						**Bottom of boring at 36.5 feet bgs**	
74	38							
	39							
72	40							
	41							
70	42							
	43							
68	44							
	45							

Project: Bradford Island Landfill
Project Location: Bonneville Dam, Oregon
Project Number: 53-F0072173.02

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-5

Well Location **Boring SB-7, north side of landfill**
Date(s) Installed **9/30/99** Time **0930**
Installed By **Cascade Drilling, Inc.**
Observed By **G. Lukert**
Total Depth **36.5 feet**
Method of Installation **Hollow-stem auger**
Screened Interval **10 - 35 feet**
Completion Zone **Unconfined aquifer above slideblock**
Remarks **Well installed at coordinate location N 723,665.69 E 1,633,072.42**



Elevation of Top of Riser Pipe: **114.07 ft MSL**
Height of Riser Above Ground: **1.71 ft**
Ground Elevation: **112.36 ft MSL**
ID/Type of Surface Casing: **6-3/16-inch-dia. steel**
Type of Surface Seal: **Concrete**
Depth of Surface Seal: **1.0 ft**
ID/Type of Riser Pipe: **1-7/8-inch-I.D. Schedule 80 PVC**
Boring Diameter: **8-7/8 inches**
Type of Backfill: **Bentonite/Portland cement slurry**
Depth of Seal: **6.0 ft**
Type of Seal: **Bentonite chips**
Depth of Top of Filter Pack: **9.0 ft**
Depth of Top of Screen: **10.0 ft**
Type of Filter Pack: **20/40 silica sand**
ID/Type of Screen: **1-7/8-inch-I.D. Schedule 80 PVC**
Screen Slot Size: **0.010-inch**
Depth of Bottom of Screen: **34.5 ft**
Depth of Bottom of Plugged Blank Casing: **35.0 ft**
Type/Depth of Backfill/Seal Below Well: **Native soil (sampled interval)**
Total Depth of Boring: **36.5 ft**

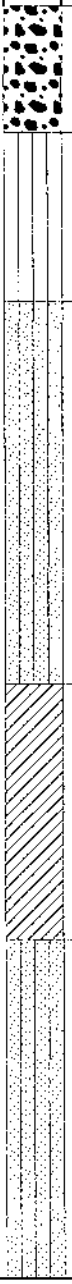
NOTE: DIAGRAM IS NOT TO SCALE

Report: ENV_WELL_CONSTR_ABOVE_GROUND; File: BRADFORD.GPJ; 1/8/00

URS Greiner Woodward Clyde

Project: Bradford Island Landfill	**Log of Boring MW-6**
Project Location: Cascade Locks, Oregon	Sheet 1 of 2
Project Number: 52-00080001.00	

Date(s) Drilled	4/22/02	Logged By	CM	Checked By	BM
Drilling Method	Air Rotary	Drill Bit Size/Type		Total Depth of Borehole	35.0 feet
Drill Rig Type		Drilling Contractor	Envlromental West	Approximate Surface Elevation	110.00' MSL
Groundwater Level and Date Measured	16.36 feet [btoc] [4/22/02]	Sampling Method(s)	Split Spoon Sampler	Hammer Data	140 lb. Automatic
Borehole Backfill	Monitoring Well Installed	Location	Bradford Island Landfill		



Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance, Blows/12 in.	SAMPLES Recovery, (feet)	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
110	0					GW	**COBBLES [GW]**, dark grey, [angular basalt, maximum size 1.0' to 2.0'], [Fill for drill rig pad].	
						ML	**CLAYEY SILT (ML)**, brown, [10YR-4/3], [trace sand], [fines medium plastic], soft, [moist], [Fill/Alluvium].	
105	5							
						SM	**SILTY SAND WITH GRAVEL [SM]**, dark yellowish brown [10YR-4/3], [well graded], [gravel maximum size 1/4", rounded to subrounded], medium dense, [wet to saturated], [Fill/Alluvium].	
100	10	▨	1	20	1.5			
95	15	▨	2	28-6"	0.0			
						CL	**SILTY CLAY [CL]**, black [10YR], [slightly plastic], [wood debris], [slight petroleum odor and sheen], soft, wet to saturated,[Fill/Alluvium]. ▽	
90	20	▨	3	25	0.2			
						SM	**SILTY SAND [SM]**, dark greenish grey [Glex 1-3/1], (trace gravel, gravel angular with a maximum size 1" and consists of siltstone], [saturated], [Weathered Slide Block].	
85	25	▨	4	9	0.2			
80	30							

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

Log of Boring MW-6

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic		REMARKS
80	30	☒	5	50-5"	.42			**SILTSTONE [SLST]**, dark olive grey [5Y-3/2], [weathered to clays and silts], [fractures], very dense, [moist to wet], [Slide Block].	▨		
75	35							Boring terminated at a depth of 35.0' [bgs] on 4/22/2002 and a monitoring well was installed upon completion.			
70	40										
65	45										
60	50										
55	55										
50	60										
45	65										

URS

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

Log of Boring MW-7

Sheet 1 of 2

Date(s) Drilled	4/22/02	Logged By	CM	Checked By	BM
Drilling Method	Air Rotary	Drill Bit Size/Type		Total Depth of Borehole	45.5 feet
Drill Rig Type		Drilling Contractor	Enviromental West	Approximate Surface Elevation	104.24' MSL
Groundwater Level and Date Measured	8.96 feet [btoc] [4/22/02]	Sampling Method(s)	Split Spoon Sampler	Hammer Data	140 lb. Automatic
Borehole Backfill	Monitoring Well Installed	Location	Bradford Island Landfill		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	0					SC	**CLAYEY SAND WITH GRAVEL [SC]**, very dark brown [7.5YR-2.5/2], [well graded sand with angular to rounded grains], loose, [damp to moist], [Fill/Alluvium].	
100						CL	**SANDY CLAY [CL]**, dark brown [10YR-3/3], [trace gravel], [plastic], [gravel had rounded to subrounded grains], soft, [moist], [Fill/Alluvium].	
	5	▨	1	16	1.5			
95							∇	
	10	▨	2	80-11"	1.33		*Grades to dark greenish grey, wet to saturated.*	
							More gravel in cuttings, gravel consists of dark grey siltstone clasts, friable.	
90								
	15	▬	3	50-1"	0.0			
						SC	**CLAYEY SAND [SC]**, dark greenish grey [Glex 1-3/1], [trace silt], [sand rounded to subrounded], [moist to wet], [Weathered Slide Block].	
85								
	20	▬	4	50-3"	.17		**SILTSTONE [SLST]**, dark greenish grey, [weathered to silts and clays in fractures of rock], [moist to wet], [Slide Block].	
80								
	25	▬	5	50-2"	.17		*Sand present in cuttings and sampler.*	
							Less sand in cuttings.	
75								
	30							

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

Log of Boring MW-7

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic		REMARKS
	30		6	90-10"	.5		GW	**GRAVELLY SAND [GW]**, dark greyish green [Glex 1-3/2], [trace clay], [gravel consists of siltstone clasts with hard angular basalt], [wet], [Slide Block].			
								SILTSTONE [SLST], dark greenish grey, [weathered to silts and clays in fractures], [moist to wet], [Slide Block].			
70											
	35		7	50-2"	0.0						
65											
	40		8	50-2"	.083			*Basalt chips in cuttings.*			
60											
	45		9	50-2"	0.0						
								Boring terminated at a depth of 45.5' [bgs] on 04/22/2002 and a monitoing well was installed upon completion.			
55											
	50										
50											
	55										
45											
	60										
40											
	65										

URS

Project:	**Bradford Island Landfill**
Project Location:	**Cascade Locks, Oregon**
Project Number:	**52-00080001.00**

Log of Boring MW-8

Sheet 1 of 2

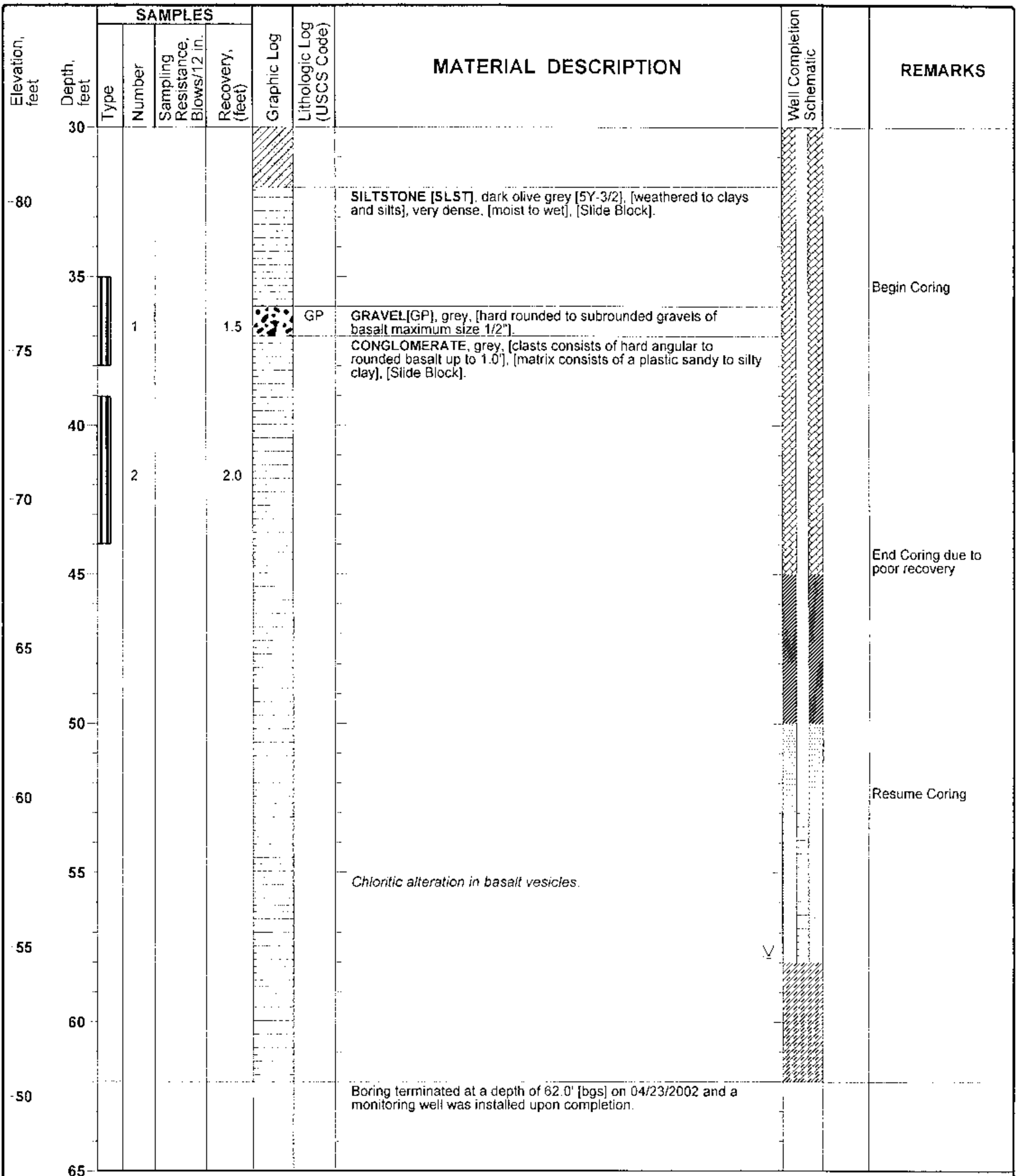
Date(s) Drilled	**4/23/02**	Logged By	**CM**	Checked By	**BM**
Drilling Method	**Air Rotary**	Drill Bit Size/Type		Total Depth of Borehole	**62.0 feet**
Drill Rig Type		Drilling Contractor	**Enviromental West**	Approximate Surface Elevation	**112.49' MSL**
Groundwater Level and Date Measured	**57.78 feet [btoc] [4/22/02]**	Sampling Method(s)	**Split Spoon Sampler**	Hammer Data	**140 lb. Automatic**
Borehole Backfill	**Monitoring Well Installed**	Location	**Bradford Island Landfill**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic		REMARKS
	0						ML	**CLAYEY SILT [ML]**, dark brownish yellow [10YR-3/4], [trace fine sand], soft, [dry to damp], [Landfill].			
110											
							SM	**SILTY SAND WITH GRAVEL [SM]**, dark brownish yellow [10YR-3/4], [gravel maximum size 1/4", rounded], [damp], [Landfill].			
	5										
105											
	10										
100											
							CL	**SILTY CLAY [CL]**, black [10YR-2/1], [wood fragments], [slight petroleum sheen and odor], soft, [wet to saturated], [Fill/Alluvium].			
	15										
95											
	20										
90											
							SM	**SILTY SAND [SM]**, dark greenish grey [Glex 1-3/1], [trace gravel, angular, maximum size 1"], [saturated], [Weathered Slide Block].			
	25										
85											
							SC	**CLAYEY SAND WITH SILT [SC]**, dark greenish grey [Glex 1-3/1], [fines medium plastic], [wet to saturated], [Weathered Slide Block].			
	30										

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

Log of Boring MW-8

Sheet 2 of 2



Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	REMARKS
	30							
80							**SILTSTONE [SLST]**, dark olive grey [5Y-3/2], [weathered to clays and silts], very dense, [moist to wet], [Slide Block].	
	35							Begin Coring
			1		1.5	GP	**GRAVEL**[GP], grey, [hard rounded to subrounded gravels of basalt maximum size 1/2"].	
75							**CONGLOMERATE**, grey, [clasts consists of hard angular to rounded basalt up to 1.0'], [matrix consists of a plastic sandy to silty clay], [Slide Block].	
	40							
			2		2.0			
70								
								End Coring due to poor recovery
	45							
65								
	50							
60								Resume Coring
	55						*Chloritic alteration in basalt vesicles.*	
55								
	60							
50							Boring terminated at a depth of 62.0' [bgs] on 04/23/2002 and a monitoring well was installed upon completion.	
	65							

Project: Bradford Island Landfill	**Log of Boring MW-9**
Project Location: Cascade Locks, Oregon	Sheet 1 of 1
Project Number: 52-00080001.00	

Date(s) Drilled	**4/23/02**	Logged By	**CM**	Checked By	**BM**
Drilling Method	**Air Rotary**	Drill Bit Size/Type		Total Depth of Borehole	**18.0 feet**
Drill Rig Type		Drilling Contractor	**Enviromental West**	Approximate Surface Elevation	**112.18' MSL**
Groundwater Level and Date Measured	**14.97 feet [btoc] [05/01/02**	Sampling Method(s)	**Split Spoon Sampler**	Hammer Data	**140 lb. Automatic**
Borehole Backfill	**Monitoring Well Installed**	Location	**Bradford Island Landfill**		

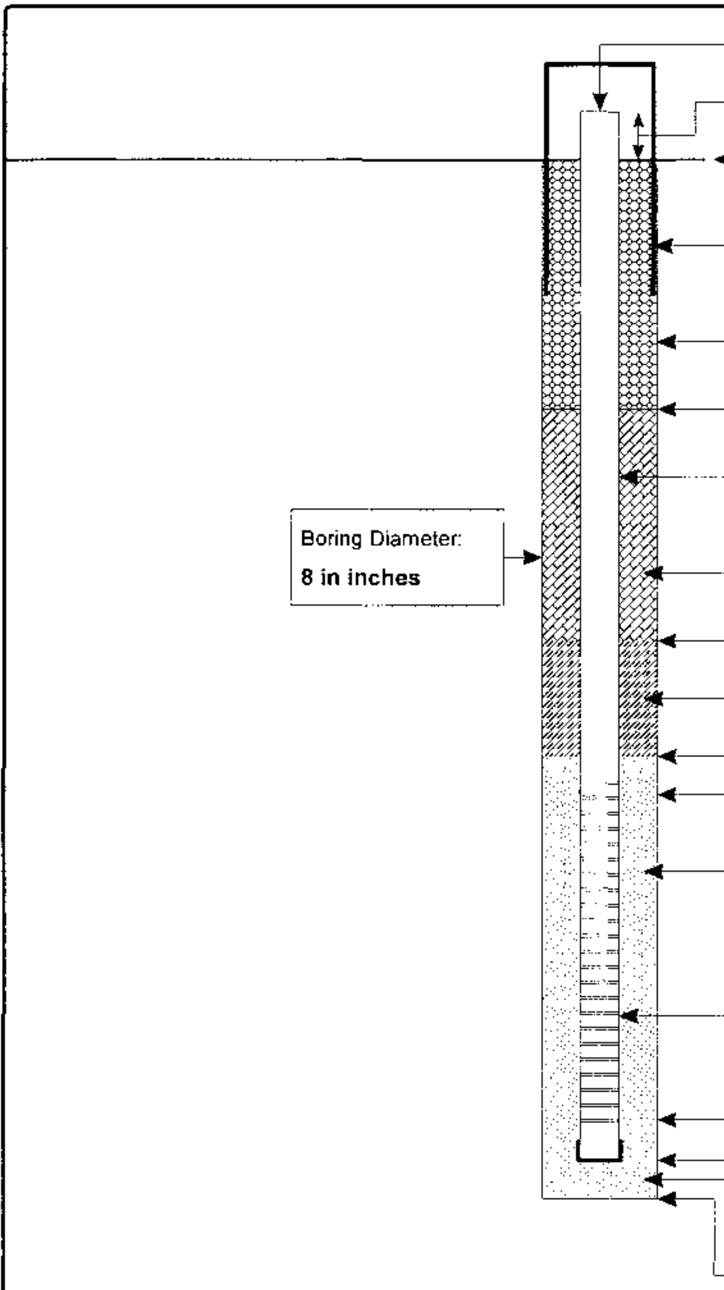
Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS
	0						GW	**WELL GRADED GRAVEL [GW]**, dark grey, some cobbles, 1-2' in diameter, angular basalt, [Fill for Drilling Pad].		
110										
	5						SC	**CLAYEY SAND WITH SILT [SC]**, dark yellowish-brown, [10YR-3/4], well graded, [rounded to sub-rounded], [wood debris], loose, [moist], [Fill/Alluvium].		
105										
	10	▨	1	50/6"	.25		SM	**SILTY SAND [SM]**, yellowish-brown, [10YR-5/4], [medium coarse sand, rounded to sub-rounded], [saturated], [Fill/Alluvium].		
100										
	15		2	50/0"	0			**SILTSTONE [SLST]**, dark olive grey [5Y-3/2], [weathered to clays and silts in fractures], very dense, [wet to saturated], [Slide Block]. ∇		
95										
								Boring terminated at a depth of 18.0' [bgs] on 04/23/2002 and a monitoring well was installed upon completion.		
	20									
90										
	25									
85										
	30									

URS

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-6

Well Location	**Bradford Island**	Date(s) Installed	**4/22/2002** Time
Installed By	**CM**	Observed By	**CM**
Total Depth	**35.0 feet**		
Method of Installation	**Air Rotary**		
Screened Interval	**25-30 ft bgs**	Completion Zone	**24-31 ft bgs**
Remarks			



Elevation of Top of Riser Pipe: **113.02**

Height of Riser Above Ground: **3.02 ft**

Ground Elevation: **110.00 ft MSL**

ID/Type of Surface Casing: **6 in Steel**

Type of Surface Seal: **Concrete**

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe: **2 in Sch. 40 PVC**

Boring Diameter: **8 in inches**

Type of Backfill: **Bentonite Grout**

Depth of Seal: **14.0 ft**

Type of Seal: **Bentonite Chips**

Depth of Top of Filter Pack: **24.0 ft**

Depth of Top of Screen: **25.0 ft**

Type of Filter Pack: **20/40 Silica Sand**

ID/Type of Screen: **2 in Sch. 40 PVC**
Screen Slot Size: **0.010 in**

Depth of Bottom of Screen: **30.0 ft**

Depth of Bottom of Plugged Blank Casing: **30.0 ft**

Type/Depth of Backfill/Seal Below Well: **Bentonite Chips/5 ft**

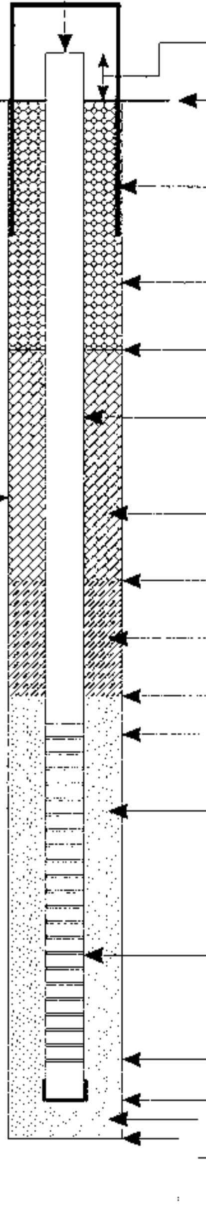
Total Depth of Boring: **35.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-7

Well Location	**Bradford Island**	Date(s) Installed **4/22/2002**	Time
Installed By **CM**	Observed By **CM**	Total Depth **45.5 feet**	
Method of Installation **Air Rotary**			
Screened Interval **5-30 ft bgs**	Completion Zone **3-32 ft bgs**		
Remarks			



Elevation of Top of Riser Pipe: **106.92**

Height of Riser Above Ground: **2.68** ft

Ground Elevation: **104.24 ft MSL**

ID/Type of Surface Casing: **6 in Steel**

Type of Surface Seal: **Concrete**

Depth of Surface Seal: **1.0** ft

ID/Type of Riser Pipe: **2 in Sch. 40 PVC**

Boring Diameter: **8 in inches**

Type of Backfill: **Bentonite Grout**

Depth of Seal: **3.0** ft

Type of Seal: **Bentonite Chips**

Depth of Top of Filter Pack: **3.0** ft

Depth of Top of Screen: **5.0** ft

Type of Filter Pack: **20/40 Silica Sand**

ID/Type of Screen: **2 in Sch. 40 PVC**
Screen Slot Size: **0.010 in**

Depth of Bottom of Screen: **30.0** ft

Depth of Bottom of Plugged Blank Casing: **30.0** ft

Type/Depth of Backfill/Seal Below Well: **Bentonite Chips/15.5 ft**

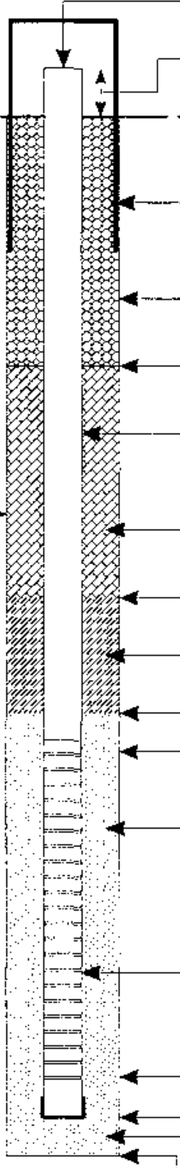
Total Depth of Boring: **45.5 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-00080001.00

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-8

Well Location	**Bradford Island**	Date(s) Installed	**4/23/2002** Time
Installed By **CM**	Observed By **CM**	Total Depth	**62.0 feet**
Method of Installation	**Air Rotary**		
Screened Interval **53-58 ft bgs**	Completion Zone **50-58 ft bgs**		
Remarks			



Elevation of Top of Riser Pipe: **115.29**

Height of Riser Above Ground: **2.80 ft**

Ground Elevation: **112.49 ft MSL**

ID/Type of Surface Casing:
6 in Steel

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Boring Diameter:
8 in inches

Type of Backfill:
Bentonite Grout

Depth of Seal: **45.0 ft**

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: **50.0 ft**

Depth of Top of Screen: **53.0 ft**

Type of Filter Pack:
20/40 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **58.0 ft**

Depth of Bottom of Plugged Blank Casing: **58.0 ft**

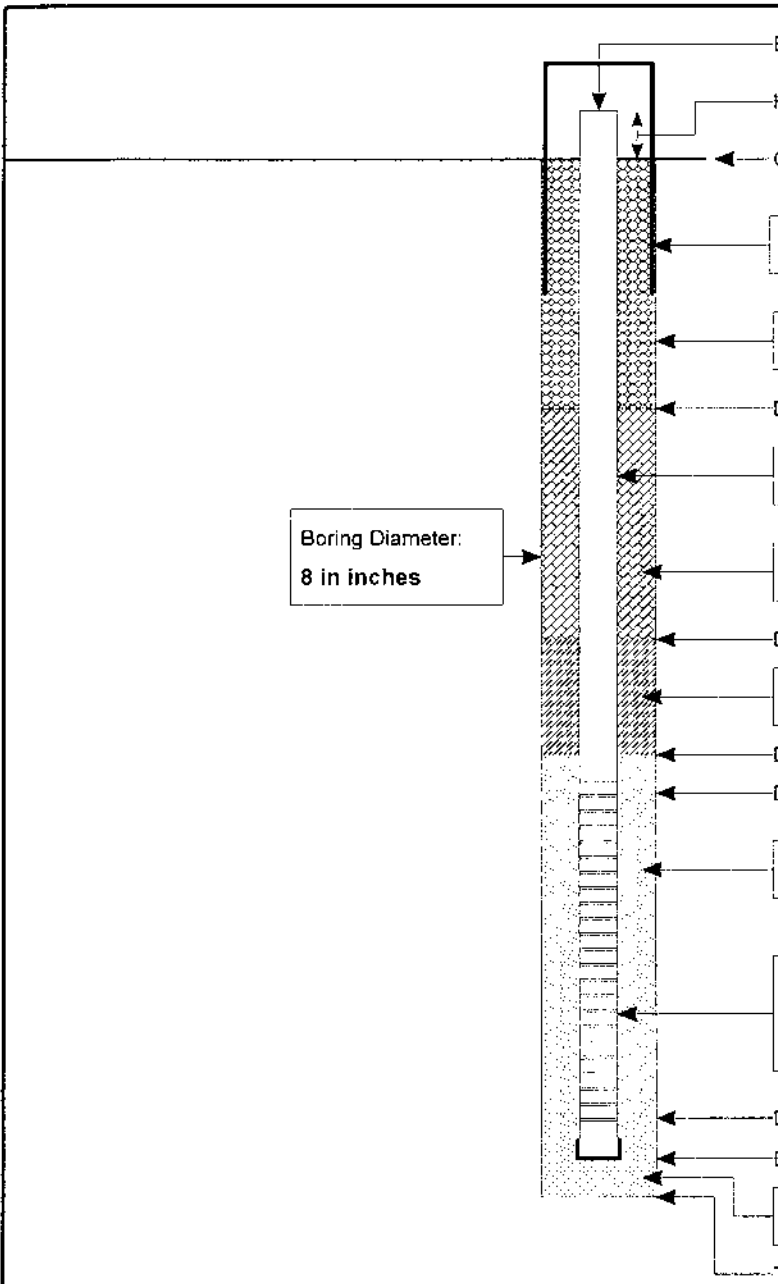
Type/Depth of Backfill/Seal Below Well:
Bentonite Chips/58-62 ft

Total Depth of Boring: **62.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island Landfill **Project Location: Cascade Locks, Oregon** **Project Number: 52-00080001.00**	**MONITORING WELL CONSTRUCTION LOG FOR WELL MW-9**

Well Location	**Bradford Island**		Date(s) Installed **4/23/2002**	Time	
Installed By	**CM**	Observed By	**CM**	Total Depth	**18.0 feet**
Method of Installation	**Air Rotary**				
Screened Interval	**10-15 ft bgs**	Completion Zone	**9-16 ft bgs**		
Remarks					



Boring Diameter:
8 in inches

Elevation of Top of Riser Pipe: **115.16**

Height of Riser Above Ground: **2.98 ft**

Ground Elevation: **112.18 ft MSL**

ID/Type of Surface Casing:
6 in Steel

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Type of Backfill:
Bentonite Grout

Depth of Seal: **7.0 ft**

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: **9.0 ft**

Depth of Top of Screen: **10.0 ft**

Type of Filter Pack:
20/40 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **15.0 ft**

Depth of Bottom of Plugged Blank Casing: **15.0 ft**

Type/Depth of Backfill/Seal Below Well:
Bentonite Chips/15-18 ft bgs

Total Depth of Boring: **18.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

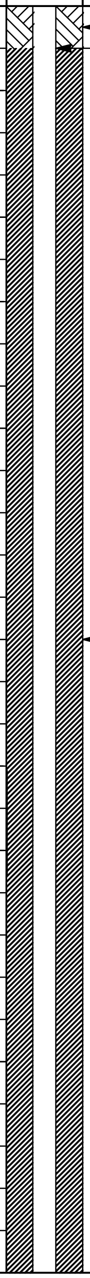
Log of Boring MW-10

Sheet 1 of 2

Date(s) Drilled and Installed	**4/3 - 4/5/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Sonic**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**57.6 ft. [bgs]**
Sampling Method	**Continuous Core**	Drill Bit Size/Type	**4 in. core with 6 in. casing**	Approximete Surface Elevation	**129.28 ft. MSL**
Drill Rig Type	**Prosonic Spider**	Groundwater Level(s)	**16.53 ft. [bgs] [4/16/08]**	Hammer Data	**n/a**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Reference Area**

Elevation feet	Depth, feet	SAMPLES Type	Number		Recovery, (feet)	Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	0							**Basalt BOULDER**, dark grey, dry, hard, fresh.	Stickup Monument Concrete 2" Schedule PVC Riser
			1		4		SM	**Silty SAND with Gravel [SM]**, brown to orange-brown, moist, loose, well-graded sand with root fragments. Moderate plasticity fines. Subrounded gravel with some hard, angular clasts, few cobbles. [Colluvium]	
	5					0.0		*Light yellow-brown, no root fragments.*	
			2		6		ML	**Sandy SILT with Gravel [ML]**, brown, medium stiff, moist, low plasticity fines. Poorly-graded fine sand. Rounded gravel with few hard, angular clasts. [Colluvium]	
	10					0.0		*Dark olive-brown, stiff, moderately plastic fines with yellow-brown, loose coarse-grained sand.*	
	15		3		10	0.2		*Increasingly fine, angular gravel, moist to wet.*	Baroid Hole Plug 3/8" Bentonite Chips [hydrated]
								Basalt BOULDER, dark grey, moist, hard, fresh.	
	20					0.0		**SILTSTONE**, greenish-grey, dry, dense, friable, moderately weathered to soft silt and clay with irregularly-spaced 1/8-in [chloritic] laminae . Fine-grained matrix with rock texture. Trace fine, angular gravel-sized basalt clasts. [Weathered Slide Block]	
	25		4		10	0.3			
								Dry to moist.	
	30								

Well Completion Schematic

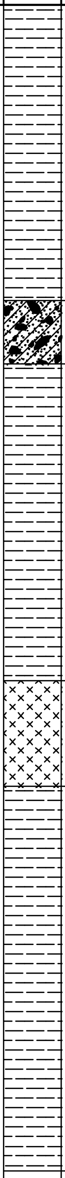


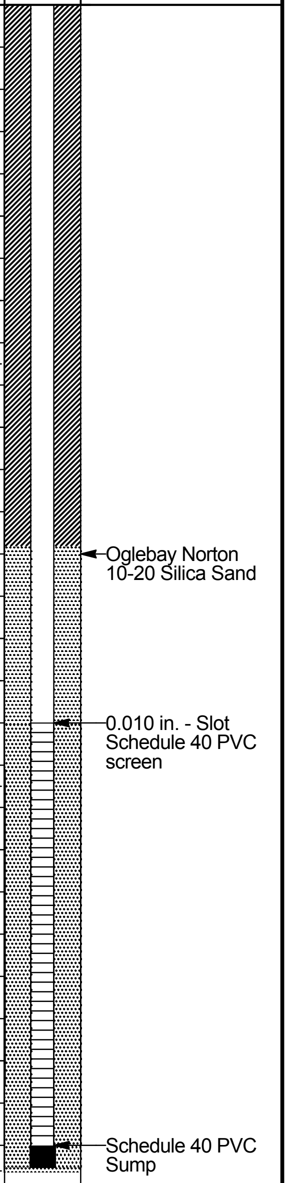
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-10

Sheet 2 of 2

Elevation feet	Depth, feet	Sample Number	Recovery, (feet)	Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	30			0.2		*Increased [chloritic] alteration throughout.*	
						As above, with dark brown moderate plasticity clay laminae, up to 1/2", increasingly soft.	
	35	5	10	0.3			
					CL	**Sandy CLAY with Gravel [CL]**, dark brown-black, wet, soft, low plasticity. Trace subangular gravel. [Weathered Slide Block]	
						SILTSTONE, dark greenish-grey, moist to wet, dense, slightly weathered to stiff silt and clay with irregularly-spaced 1/8-in [chloritic] laminae. Fine-grained matrix with rock texture. Trace fine, angular gravel-sized basalt clasts. [Slide Block]	
	40			0.6			
		6	6				Oglebay Norton 10-20 Silica Sand
	45			0.0		*Wet.*	
						Basalt BOULDER, dark grey, moist, hard, fresh.	0.010 in. - Slot Schedule 40 PVC screen
		7	4				
						SILTSTONE, dark greenish-grey, moist to wet, dense, fresh with irregularly-spaced 1/8-in [chloritic] laminae. Trace fine, angular basalt gravel clasts partially weathered to silty sand. [Slide Block]	
	50			0.1			
		8	7.6				
	55						Schedule 40 PVC Sump
						Boring terminated at a depth of 57.6' [bgs] on 4/5/2008 and a monitoring well was installed upon completion.	
	60						
	65						



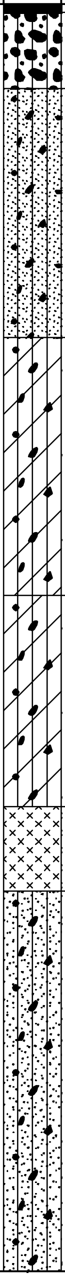


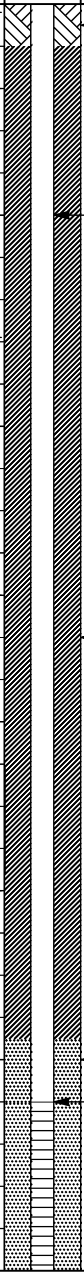
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-11

Sheet 1 of 2

Date(s) Drilled and Installed	**4/3/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Sonic**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**37.0 ft. [bgs]**
Sampling Method	**Continuous Core**	Drill Bit Size/Type	**4 in. core with 6 in. casing**	Approximete Surface Elevation	**99.45 ft. MSL**
Drill Rig Type	**Prosonic Truck Mount**	Groundwater Level(s)	**7.74 ft. [bgs] [4/15/08]**	Hammer Data	**n/a**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Sandblast Area**





Elevation feet	Depth, feet	SAMPLES Type	Number		Recovery, (feet)	Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	0							**Asphalt**	Flush to Grade Monument Concrete
							GM	**Silty GRAVEL [GM]**, dark brown, dry, rounded, well-graded gravel with few cobbles. Low plasticity, hard silt. [Colluvium]	
							SM	**Silty SAND with Gravel [SM]**, brown to yellow-brown, dry to moist, low plasticity medium stiff fines. Rounded to subangular, well-graded gravel with some cobbles. [Colluvium]	
			1		7			*Trace gravel, no cobbles.*	
	5					0.2			2" Schedule PVC Riser
							MH	**Clayey SILT with Gravel [MH]**, orange-brown, moist, high plasticity hard fines with thinly laminated 1/8" orange-brown and yellow-brown zones. Rounded well-graded gravel with some cobbles and oxidized zones surrounding some clasts. [Colluvium]	
	10		2		5	1.2		*Fewer cobbles.*	
			3		3				
							ML	**Clayey SILT with Gravel [ML]**, grey, moist, hard low plasticity fines. Rounded to subrounded gravel with some cobbles and trace well graded sand. [Weathered Slide Block]	
	15					0.3			Baroid Hole Plug 3/8" Bentonite Chips [hydrated]
			4		2				
								Increasing sand, decreasing clay.	
								Basalt BOULDER, dark grey, dry, hard and fresh.	
	20		5		6	0.1			
							ML	**Sandy SILT with Gravel [ML]**, grey, moist, stiff low plasticity fines. Poorly graded medium to fine-grained sand. Rounded gravel with few cobbles. [Weathered Slide Block]	
	25		6		4	0.2			Oglebay Norton 10-20 Silica Sand
									0.010 in. - Slot Schedule 40 PVC screen
								Wet.	
	30								

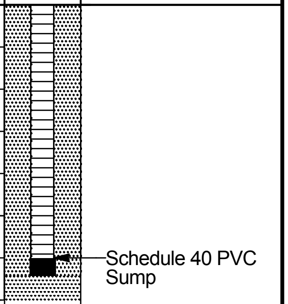
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-11

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES Type	Number		Recovery, (feet)	Headspace PID, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	30	▨	7		7	0.4			*Increasing low plasticity clay, decreasing sand.*	
	35	▨	8		3	0.0				Schedule 40 PVC Sump
	37								Boring terminated at a depth of 37' [bgs] on 4/3/2008 and a monitoring well was installed upon completion.	
	40									
	45									
	50									
	55									
	60									
	65									

Well Completion Schematic

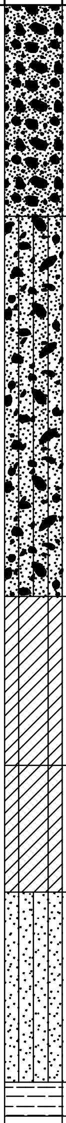


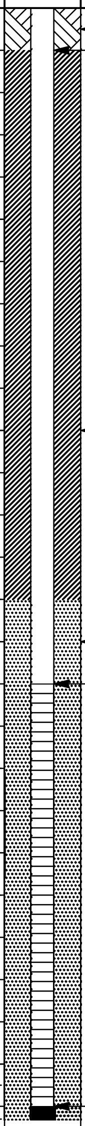
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-12

Sheet 1 of 1

Date(s) Drilled and Installed	**3/26/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Hollow Stem Auger [HSA]**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**26.5 ft. [bgs]**
Sampling Method	**Split Spoon Sampler**	Drill Bit Size/Type	**6 5/8 in. I.D. HSA with center bit**	Approximete Surface Elevation	**96.93 ft. MSL**
Drill Rig Type	**CME-75 HT**	Groundwater Level(s)	**24.08 ft. [bgs] [4/15/08]**	Hammer Data	**140 lb. , 30 in. drop automatic hammer**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Sandblast Area**





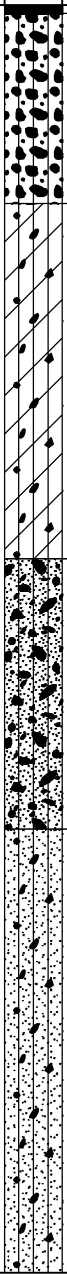
Elevation feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resistance, Blows/12 in.	SAMPLES Recovery, (feet)	SAMPLES Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	0					GW	**Sandy GRAVEL with Silt [GW]**, grey-brown, dry to moist, subrounded to rounded well-graded gravel. Loose fine sand. Low plasticity silt. [Colluvium]	Stickup Monument Concrete 2" Schedule PVC Riser
								Steel cable in auger cuttings from 4' to 5' bgs.
	5	1	61/3 in.	.5	0.2	ML	**Gravelly SILT with Sand [ML]**, brown to orange-brown, moist, low plasticity, stiff silt. Rounded to subrounded, well-graded gravel with some cobbles. Loose fine sand. [Colluvium]	
							Trace low plasticity clay.	
	10	2	10	NR	NS			Baroid Hole Plug 3/8" Bentonite Chips [hydrated]
						CL	**Silty CLAY [CL]**, grey-brown, moist, low plasticity hard fines. Some rounded gravel and cobbles. [Colluvium]	
	15	3	39	0.3	0.4			Oglebay Norton 10-20 Silica Sand 0.010 in. - Slot Schedule 40 PVC screen
						CL	**Silty CLAY [CL]**, dark grey, moist, low plasticity, stiff fines. Little subangular to subrounded gravel. [Weathered Slide Block]	
	20	4	22	0.5	0.5			
						ML	**Sandy SILT [ML]**, grey-green with yellow and grey mottling, moist, low plasticity, very stiff silt. Loose fine sand. Some angular gravel. [Weathered Slide Block]	
							Wet.	
	25	5	61/8 in.	0.3	0.2			
							SILTSTONE, dark grey, wet, slightly weathered to low plasticity silt and clay in fractures. Fine grained matrix with some subrounded to subangular gravel clasts. [Slide Block]	Schedule 40 PVC Sump
							Boring terminated at a depth of 26.3' [bgs] due to auger refusal on 3/26/2008 and a monitoring well was installed upon completion.	
	30							

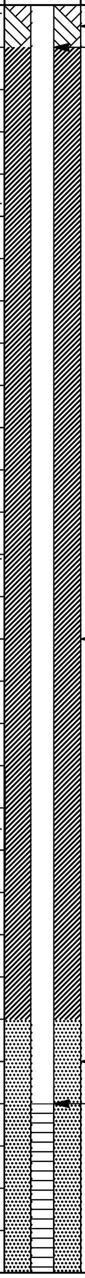
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-13

Sheet 1 of 2

Date(s) Drilled and Installed	**4/2/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Sonic**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**37.0 ft. [bgs]**
Sampling Method	**Continuous Core**	Drill Bit Size/Type	**4 in. core with 6 in. casing**	Approximete Surface Elevation	**97.82 ft. MSL**
Drill Rig Type	**Prosonic Truck Mount**	Groundwater Level(s)	**16.62 ft. [bgs] [4/14/08]**	Hammer Data	**n/a**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Sandblast Area**





Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES	SAMPLES Recovery, (feet)	SAMPLES Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	FIELD NOTES AND WELL DETAILS
	0							**Asphalt**	Flush to Grade Monument Concrete 2" Schedule PVC Riser
			1		7		GM	**Silty GRAVEL [GM]**, brown, dry to moist, rounded, well-graded gravel with some cobbles. Matrix consists of low plasticity stiff, silt with trace loose fine sand. [Colluvium] *Decreasing sand, increasing low plasticity clay, increasingly angular gravel.*	
	5					0.6	ML	**Clayey SILT with Gravel [ML]**, mottled grey, brown, and greenish-grey, moist, low plasticity, medium stiff fines. Subangular to subrounded gravel with some cobbles. Fractures in matrix are filled with yellow-brown, low plasticity clay. [Weathered Slide Block]	
	10		2		9	0.0		*Brown, subrounded to rounded gravel, green low plasticity clay on fracture surfaces.*	
	15					0.3	ML	**Gravelly SILT with Sand [ML]**, brown fines with yellow-orange sand, dry, low plasticity, hard fines. Subangular to subrounded gravel with some rounded cobbles. Loose, poorly graded, medium-fine sand. [Weathered Slide Block]	Baroid Hole Plug 3/8" Bentonite Chips [hydrated]
			3		5				
	20					0.6	ML	**Sandy SILT with Gravel [ML]**, grey to dark greenish grey, moist, low plasticity medium stiff silt. Loose, poorly graded fine sand. Subrounded to rounded gravel with some cobbles. [Weathered Slide Block]	
			4		5				
	25					0.5		*Wet.*	Oglebay Norton 10-20 Silica Sand 0.010 in. - Slot Schedule 40 PVC screen
	30								

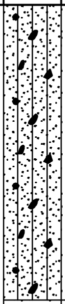
URS

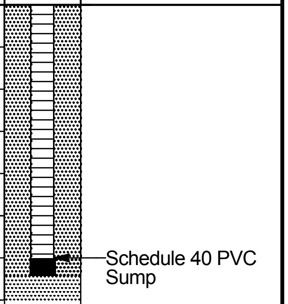
Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

Log of Boring MW-13

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES Type	Number		Recovery, (feet)	Headspace PID, ppm	Graphic Log	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
	30	▨	5		11	0.4			*As above.*		
	35					0.5					Schedule 40 PVC Sump
	37								Boring terminated at a depth of 37' [bgs] on 4/2/2008 and a monitoring well was installed upon completion.		
	40										
	45										
	50										
	55										
	60										
	65										





Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

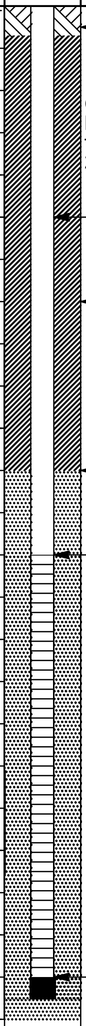
Log of Boring MW-14

Sheet 1 of 1

Date(s) Drilled and Installed	**3/25/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Hollow Stem Auger [HSA]**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**24.0 ft. [bgs]**
Sampling Method	**Split Spoon Sampler**	Drill Bit Size/Type	**6 5/8 in. I.D. HSA with center bit**	Approximete Surface Elevation	**86.84 ft. MSL**
Drill Rig Type	**CME-75 HT**	Groundwater Level(s)	**13.11 ft. [bgs] [4/14/08]**	Hammer Data	**140 lb. , 30 in. drop automatic hammer**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Sandblast Area**

Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION
	0					GW	**Asphalt**
							Sandy GRAVEL with Silt [GW], grey-brown, dry to moist, subrounded to rounded well-graded gravel with some cobbles. Matrix consists of loose fine sand and nonplastic silt. Slight solvent odor. [Colluvium]
					33.2		
						GM	**Silty GRAVEL with Clay [GM]**, grey-brown, dry to moist, subrounded, well graded gravel with some cobbles. Low plasticity stiff fines. Slight solvent odor. [Colluvium]
	5	1	13	.8	17.6		
							No odor @ 6 ft.
	10	2	5	.3	14.1	CL	**Silty CLAY with Gravel [CL]**, mottled yellow, grey, and brown, moist, low plasticity, medium stiff fines. Subrounded, well graded gravel. [Colluvium]
							Wet.
	15	3	13	.5	1.0		**SILTSTONE**, greenish-grey, wet, slightly weathered to low plasticity silt and clay. Fine-grained matrix with rock texture and some subrounded to subangular gravel-sized clasts. [Slide Block]
	20	4	7	.6	1.6	GW	**Sandy GRAVEL [GW]**, greenish-grey, wet, subrounded, well graded gravel with loose coarse sand. [Slide Block]
							SILTSTONE, greenish-grey, wet, moderately weathered to low plasticity, stiff silt and clay. Fine-grained matrix with rock texture and some subrounded to subangular gravel-sized clasts. [Slide Block]
							Boring terminated at a depth of 24' [bgs] on 3/25/2008 and a monitoring well was installed upon completion.
	25						
	30						

Well Completion Schematic



FIELD NOTES AND WELL DETAILS

Flush to Grade Monument

Concrete

Collected bag headspace sample from auger cuttings @ 2' due to odor.

2" Schedule PVC Riser

Baroid Hole Plug 3/8" Bentonite Chips [hydrated]

Oglebay Norton 10-20 Silica Sand

0.010 in. - Slot Schedule 40 PVC screen

Schedule 40 PVC Sump

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

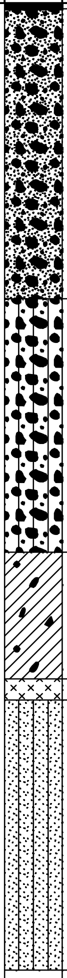
Log of Boring MW-15

Sheet 1 of 1

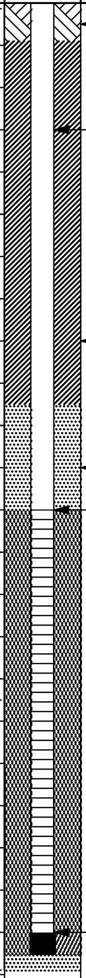
Date(s) Drilled and Installed	**3/24/2008**	Geologist	**MC**	Reviewer	**NM**
Drilling Method	**Hollow Stem Auger [HSA]**	Drilling Contractor	**Boart Longyear**	Total Depth of Borehole	**22.9 ft. [bgs]**
Sampling Method	**Split Spoon Sampler**	Drill Bit Size/Type	**6 5/8 in. I.D. HSA with center bit**	Approximete Surface Elevation	**87.09 ft. MSL**
Drill Rig Type	**CME-75 HT**	Groundwater Level(s)	**13.28 ft. [bgs] [4/14/08]**	Hammer Data	**140 lb. , 30 in. drop automatic hammer**
Borehole Backfill	**Monitoring Well Installed**	Comments	**MSL: mean sea level, bgs: below ground surface**	Location	**Bradford Island Sandblast Area**

Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, Blows/12 in.	Recovery, (feet)	Headspace PID, ppm	Lithologic Log (USCS Code)	MATERIAL DESCRIPTION
	0					GW	**Asphalt.** **Sandy Gravel with Silt [GW]**, grey-brown, dry to moist, rounded well-graded gravel with cobbles. Loose poorly-graded fine sand. Nonplastic medium stiff silt. [Colluvium]
	5	1	14	.4	1.2		*Moist.*
						GM	**Silty GRAVEL [GM]**, grey-brown, moist, rounded, well-graded gravel with few cobbles. Low plasticity stiff to very stiff silt with trace clay. [Colluvium]
	10	2	24	.5	1.0		*Wet.*
						CL	**Gravelly CLAY [CL]**, grey-brown, wet, low plasticity, hard clay with trace silt. Rounded, well graded gravel. [Weathered Slide Block]
	15	3	31	.9	0.6		**Basalt Boulder**, red-brown, wet, moderately weathered and highly fractured with low plasticity hard green clay infilling. [Weathered Slide Block]
						SM	**Silty SAND [SM]**, yellow-brown, wet, well-graded loose sand. Low plasticity soft silt. [Weathered Slide Block]
	20	4	3	.3	0.9		
							Boring terminated at a depth of 22.9' [bgs] on 3/24/2008 and a monitoring well was installed upon completion.
	25						
	30						

Graphic Log



Well Completion Schematic



FIELD NOTES AND WELL DETAILS

Flush to Grade Monument

Concrete

2" Schedule 40 PVC Riser

Baroid Hole Plug 3/8" Bentonite Chips [hydrated]

Oglebay Norton 10-20 Silica Sand

0.010 in. - Slot Schedule 40 PVC screen

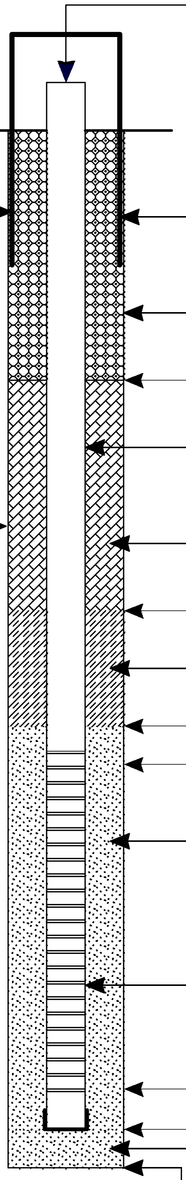
Schedule 40 PVC Sump

URS

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-10

Well Location	**Bradford Island Reference Area**			Date Completed	**4/8/2008**
Installed By	**Boart Longyear**	Observed By	**MC**	Total Depth	**57.6 ft. bgs**
Method of Installation	**Sonic**				
Screened Interval	**47-57 ft bgs**	Completion Zone	**45-57.6 ft bgs**		
Remarks					



Support Plate Elevation: **133.20 ft. MSL**

Ground Elevation: **129.28 ft. MSL**

Depth of Casing:

ID/Type of Surface Casing:
6 in Square Aluminum Stickup Monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Boring Diameter:
6 in

Type of Backfill:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Seal: **1.0 ft**

Type of Seal:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Top of Filter Pack: **43.0 ft**

Depth of Top of Screen: **47.0 ft**

Type of Filter Pack:
Oglebay Norton 10-20 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **57.0 ft**

Depth of Bottom of Plugged Blank Casing: **57.5 ft**

Type/Depth of Backfill/Seal Below Well:
none

Total Depth of Boring: **57.6 ft**

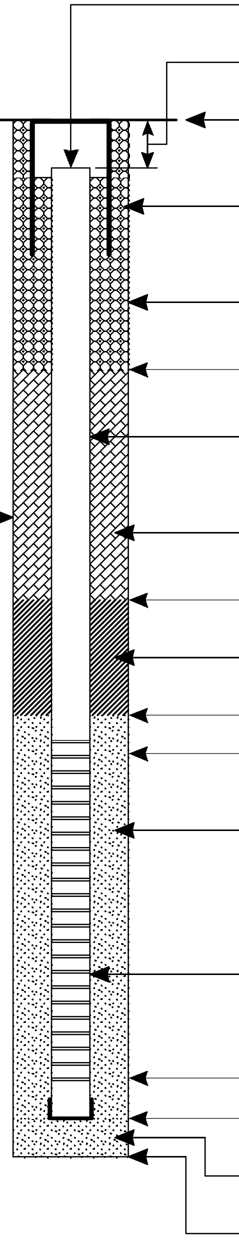
NOTE: DIAGRAM IS NOT TO SCALE

Report: PORT_ENV_WELL_ABOVE_GROUND; File: BRADISL.GPJ; 6/6/2008 MW-10

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-11

Well Location	**Bradford Island Sandblast Area**			Date(s) Installed **4/3/2008**	Time
Installed By	**Boart Longyear**	Observed By	**MC**	Total Depth (ft)	**37.0 ft. bgs**
Method of Installation	**Sonic**				
Screened Interval	**26-36 ft bgs**	Completion Zone	**26.5-37 ft bgs**		
Remarks					



Elevation of Top of Riser Pipe: **98.12 ft. MSL**

Depth of Riser Below Ground Surface: **-1.33 ft**

Ground Elevation: **99.45 ft MSL**

ID/Type of Surface Casing:
8 in Flush to Grade Monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Boring Diameter:
6 in

Type of Backfill:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Seal: **1.0 ft**

Type of Seal:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Top of Filter Pack: **24.5 ft**

Depth of Top of Screen: **26.0 ft**

Type of Filter Pack:
Oglebay Norton 10-20 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **36.0 ft**

Depth of Bottom of Plugged Blank Casing: **36.4 ft**

Type/Depth of Backfill/Seal Below Well:
none

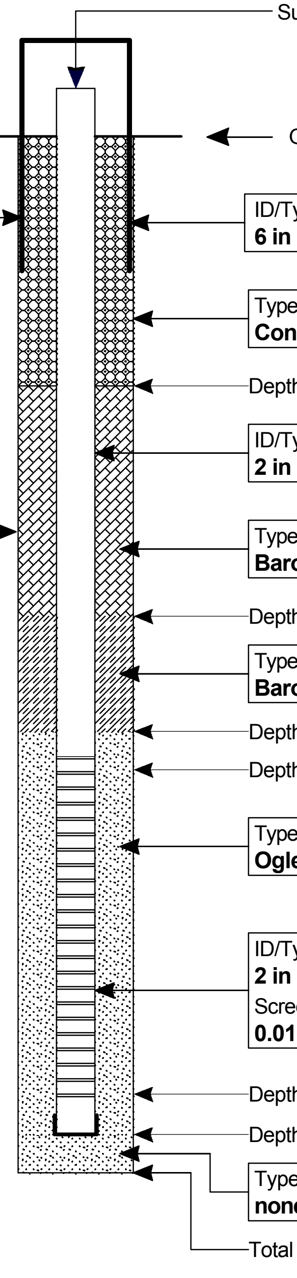
Total Depth of Boring: **37.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-12

Well Location	**Bradford Island Sandblast Area**			Date Completed	**3/26/2008**
Installed By	**Boart Longyear**	Observed By	**MC**	Total Depth	**26.5 ft. bgs**
Method of Installation	**Hollow Stem Auger**				
Screened Interval	**16-26 ft bgs**	Completion Zone	**22-26.3 ft bgs**		
Remarks					



Support Plate Elevation: **100.62 ft. MSL**

Ground Elevation: **96.93 ft. MSL**

Depth of Casing:

ID/Type of Surface Casing:
6 in Square Aluminum Stickup Monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Boring Diameter:
11 in

Type of Backfill:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Seal: **1.0 ft**

Type of Seal:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Top of Filter Pack: **14.0 ft**

Depth of Top of Screen: **16.0 ft**

Type of Filter Pack:
Oglebay Norton 10-20 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **26.0 ft**

Depth of Bottom of Plugged Blank Casing: **26.3 ft**

Type/Depth of Backfill/Seal Below Well:
none

Total Depth of Boring: **26.5 ft**

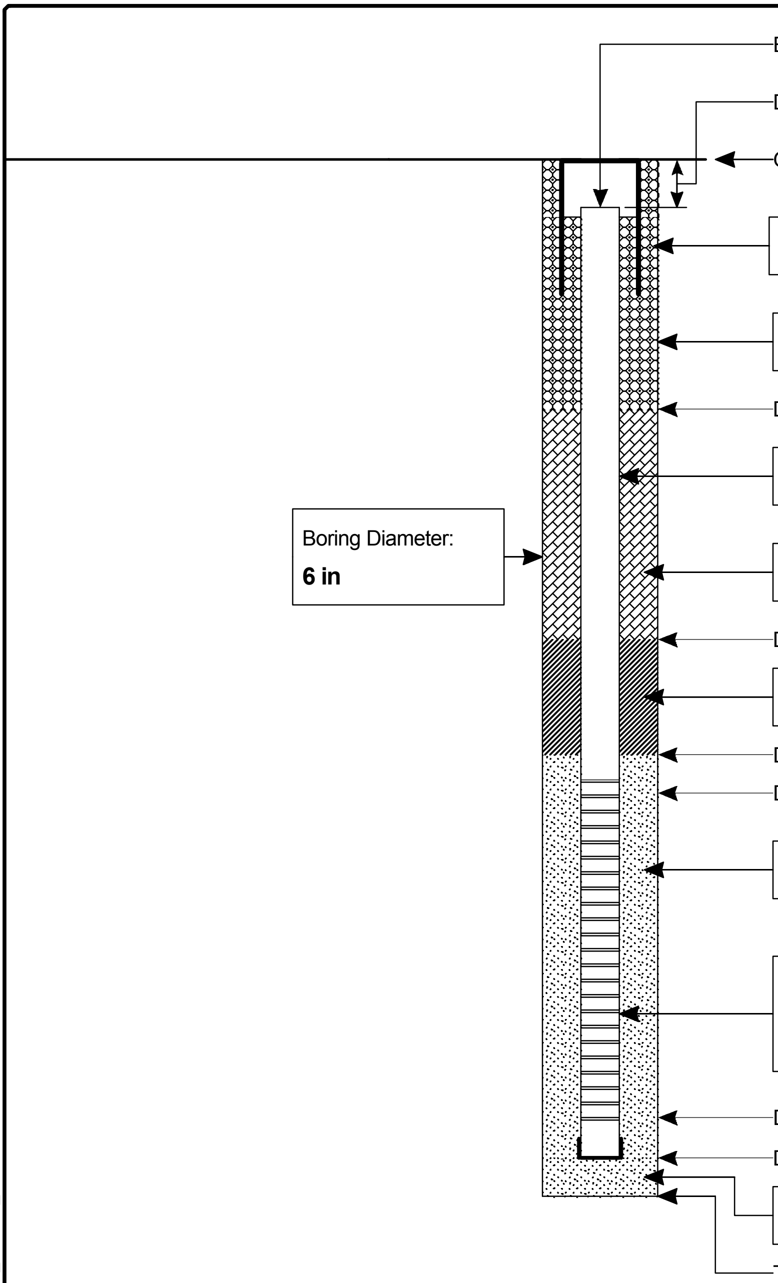
NOTE: DIAGRAM IS NOT TO SCALE

Report: PORT_ENV_WELL_ABOVE_GROUND; File: BRADISL.GPJ; 6/6/2008 MW-12

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-13

Well Location	**Bradford Island Sandblast Area**	Date(s) Installed **4/2/2008**	Time
Installed By	**Boart Longyear**	Observed By **MC**	Total Depth (ft) **37.0 ft. bgs**
Method of Installation	**Sonic**		
Screened Interval	**26-36 ft bgs**	Completion Zone **26-37 ft bgs**	
Remarks			



Elevation of Top of Riser Pipe: **97.55 ft. MSL**

Depth of Riser Below Ground Surface: **-0.27 ft**

Ground Elevation: **97.82 ft MSL**

ID/Type of Surface Casing:
8 in Flush to Grade Monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **1.0 ft**

ID/Type of Riser Pipe:
2 in Sch. 40 PVC

Boring Diameter:
6 in

Type of Backfill:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Seal: **1.0 ft**

Type of Seal:
Baroid Hole Plug 3/8 in Bentonite Chips

Depth of Top of Filter Pack: **24.0 ft**

Depth of Top of Screen: **26.0 ft**

Type of Filter Pack:
Oglebay Norton 10-20 Silica Sand

ID/Type of Screen:
2 in Sch. 40 PVC
Screen Slot Size:
0.010 in

Depth of Bottom of Screen: **36.0 ft**

Depth of Bottom of Plugged Blank Casing: **36.4 ft**

Type/Depth of Backfill/Seal Below Well:
none

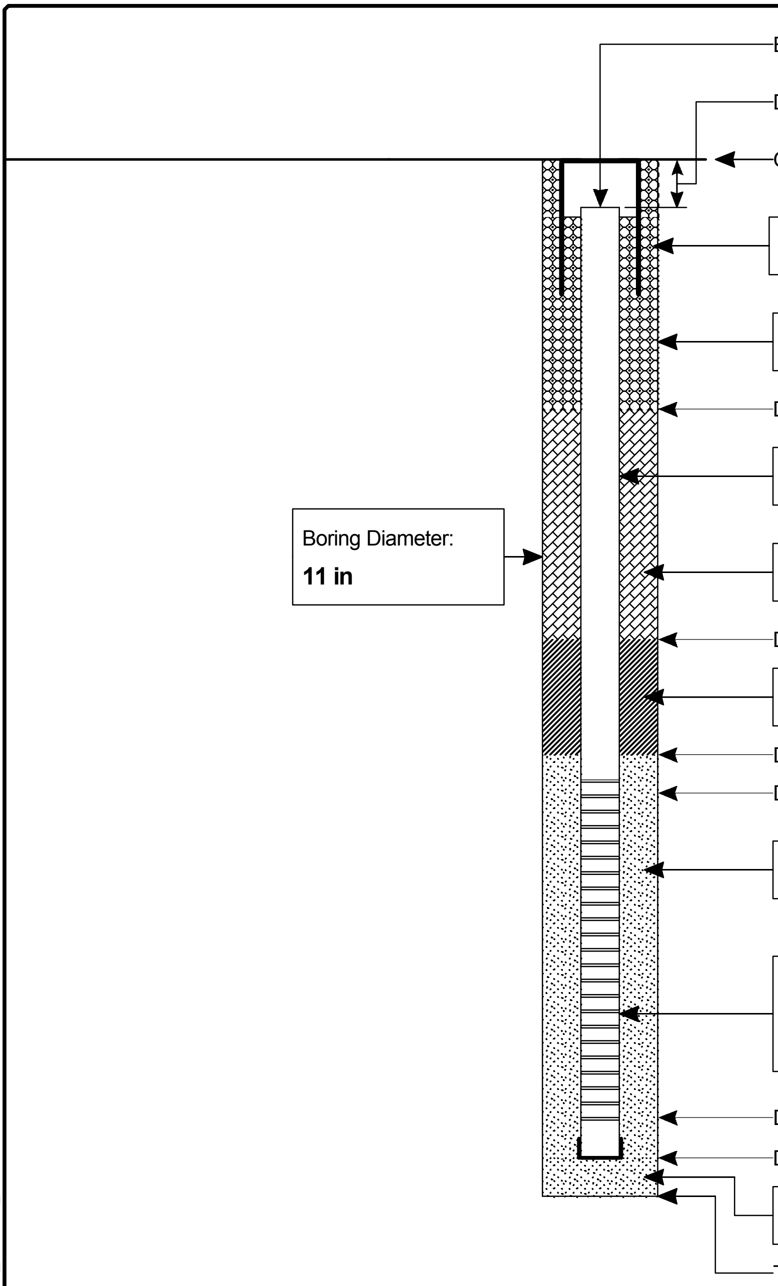
Total Depth of Boring: **37.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-14

Well Location	**Bradford Island Sandblast Area**			Date(s) Installed **3/25/2008**	Time
Installed By	**Boart Longyear**	Observed By	**MC**	Total Depth (ft)	**24.0 ft. bgs**
Method of Installation	**Hollow Stem Auger**				
Screened Interval	**13-23 ft bgs**	Completion Zone	**13-24 ft bgs**		
Remarks					



Elevation of Top of Riser Pipe: **86.67 ft. MSL**

Depth of Riser Below Ground Surface: **-0.17 ft**

Ground Elevation: **86.84 ft MSL**

ID/Type of Surface Casing: **8 in Flush to Grade Monument**

Type of Surface Seal: **Concrete**

Depth of Surface Seal: **0.7 ft**

ID/Type of Riser Pipe: **2 in Sch. 40 PVC**

Boring Diameter: **11 in**

Type of Backfill: **Baroid Hole Plug 3/8 in Bentonite Chips**

Depth of Seal: **0.7 ft**

Type of Seal: **Baroid Hole Plug 3/8 in Bentonite Chips**

Depth of Top of Filter Pack: **11.0 ft**

Depth of Top of Screen: **13.0 ft**

Type of Filter Pack: **Oglebay Norton 10-20 Silica Sand**

ID/Type of Screen: **2 in Sch. 40 PVC**
Screen Slot Size: **0.010 in**

Depth of Bottom of Screen: **23.0 ft**

Depth of Bottom of Plugged Blank Casing: **23.5 ft**

Type/Depth of Backfill/Seal Below Well: **none**

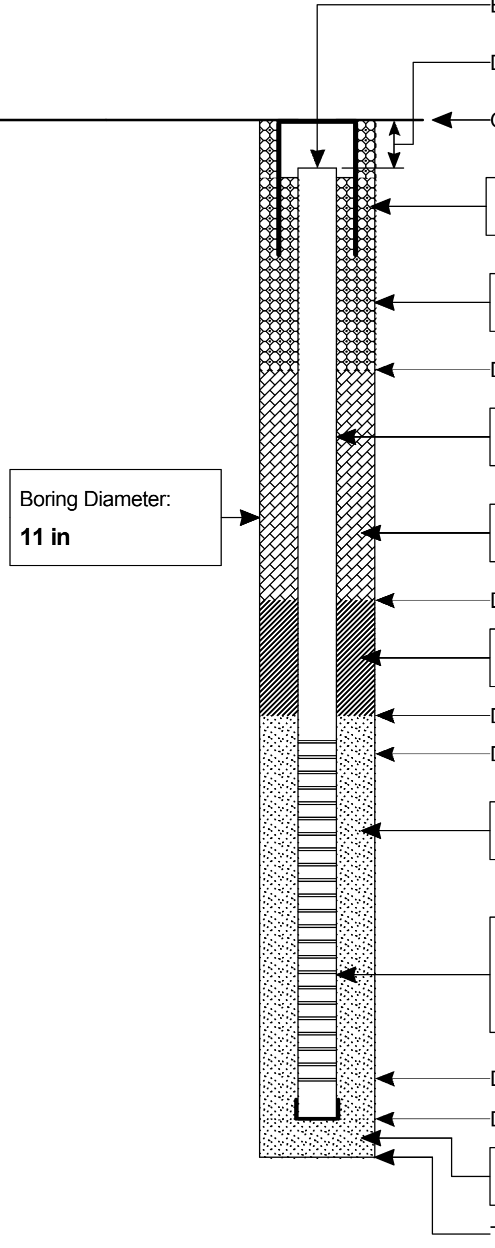
Total Depth of Boring: **24.0 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: Bradford Island
Project Location: Bonneville Dam, Oregon
Project Number: 25696679

MONITORING WELL CONSTRUCTION LOG FOR WELL MW-15

Well Location	**Bradford Island Sandblast Area**			Date(s) Installed **3/24/2008**	Time
Installed By	**Boart Longyear**	Observed By	**MC**	Total Depth (ft)	**22.9 ft. bgs**
Method of Installation	**Hollow Stem Auger**				
Screened Interval	**12-22 ft bgs**	Completion Zone	**12-23 ft bgs**		
Remarks					



Elevation of Top of Riser Pipe: **86.86 ft. MSL**

Depth of Riser Below Ground Surface: **-0.23 ft**

Ground Elevation: **87.09 ft MSL**

ID/Type of Surface Casing: **8 in Flush to Grade Monument**

Type of Surface Seal: **Concrete**

Depth of Surface Seal: **0.9 ft**

ID/Type of Riser Pipe: **2 in Sch. 40 PVC**

Boring Diameter: **11 in**

Type of Backfill: **Baroid Hole Plug 3/8 in Bentonite Chips**

Depth of Seal: **0.9 ft**

Type of Seal: **Baroid Hole Plug 3/8 in Bentonite Chips**

Depth of Top of Filter Pack: **9.5 ft**

Depth of Top of Screen: **12.0 ft**

Type of Filter Pack: **Oglebay Norton 10-20 Silica Sand**

ID/Type of Screen: **2 in Sch. 40 PVC**
Screen Slot Size: **0.010 in**

Depth of Bottom of Screen: **22.0 ft**

Depth of Bottom of Plugged Blank Casing: **22.5 ft**

Type/Depth of Backfill/Seal Below Well: **none**

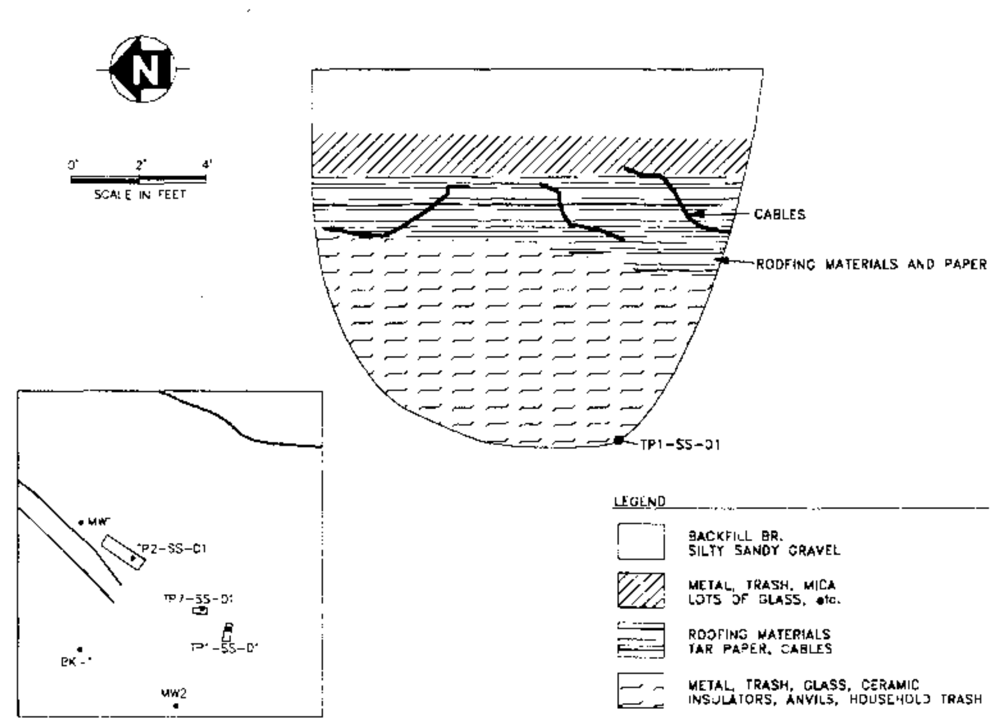
Total Depth of Boring: **22.9 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP1 Test Pit Location: North Central Landfill Page 1 of 3

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 13 X 5 X 11 deep

Associated Photographs: 1-17 through 1-25

Grab Sample No. 8-19-98-BIL-TP1-SS-01

Time/Date Collected: 0950 / 8/19/98 Depth Collected: 10' BLS Location: TP1 S/SW

PID Reading: 0.0 USCS Designation: GM Soil Color: Very Dark Brown/Black

Soil Description: Silty sandy gravel with trash (fines 10%, gravel/sand 90% - matrix of trash only) wet, loose-dense, well graded.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments: Also collected asbestos samples from material removed from TP1:
8-20-98-BIL-ASB-01 – roofing paper – black at 1415 and 8-20-98-BIL-ASB-02 – silver roofing coating/mastic at 1418

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP1
Test Pit Location: North Central Landfill
Page 2 of 3
Temperature: 60's
Wind Speed: <5 mph
Wind Direction: Variable
General Weather Conditions: Partly cloudy
Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-11' BLS
Soil Color: Brown
USCS Designation: GW
PID Reading: 3.2 (background)
Description: Brown silty, sandy, gravel (fines 10%, sand 20%, gravel 70%) dry-wet, well graded, loose-dense with trash from 2' BLS as described on page 3 attached.

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

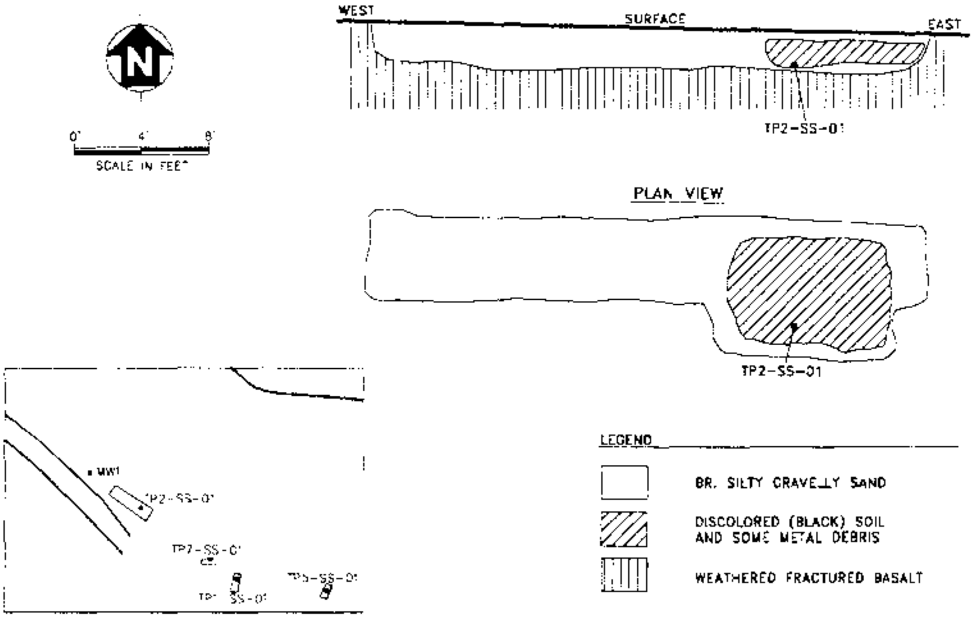
Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Feet BLS	Description	PID
2.5	Top of buried trash, mostly household with mica sheets and small books, and lots of glass fragments	(Background @ 3.2)
4	Buried cables and assorted metal	
6	Buried roofing paper and assorted metal	(Background @ 2.5)
8	Abundance of roofing paper	(Background @ 1.0)
10 to 11	Assorted metal, roofing paper, and cloth, SE corner of bucket wet Sample TP1-SS-01 bucket contained broken glass, broken pieces of ceramic insulators, rusted pieces of metal, and household trash (bottle of nail polish), metal nails	Background dropped to 0.0 0.3 0.0

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP2   Test Pit Location: West Edge of Landfill   Page 1 of 3

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 31' X 8' X 2-2.5' deep

Associated Photographs: Camera damaged, photos lost

Grab Sample No. 8-19-98-BIL-TP2-SS-01

Time/Date Collected: 1225 / 8/19/98   Depth Collected: 2' BLS   Location: TP2 East End (25' E of West end)

PID Reading: 0.0   USCS Designation: SM   Soil Color: Dark Brown

Soil Description: Dark brown silty, gravelly sand (fines 25%, gravel 30%, sand 45%) dry to moist, dense, well graded with glass fragments and small pieces of metal/nails.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP2 Test Pit Location: West Edge of Landfill Page 2 of 3

Temperature: High 60's Wind Speed: <5 mph Wind Direction: Variable

General Weather Conditions: Partly cloudy to clear Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-2.5' BLS Soil Color: Brown USCS Designation: SM

PID Reading: 0.0 Description: Brown silty, gravelly sand (fines 25%, gravel 30%, sand 45%) dry, dense, well graded.

Depth Range: >2.5' Soil Color: Dark Gray/Black USCS Designation:

PID Reading: 0.0 Description: Weathered, fractured basalt, microcrystalline, very hard

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

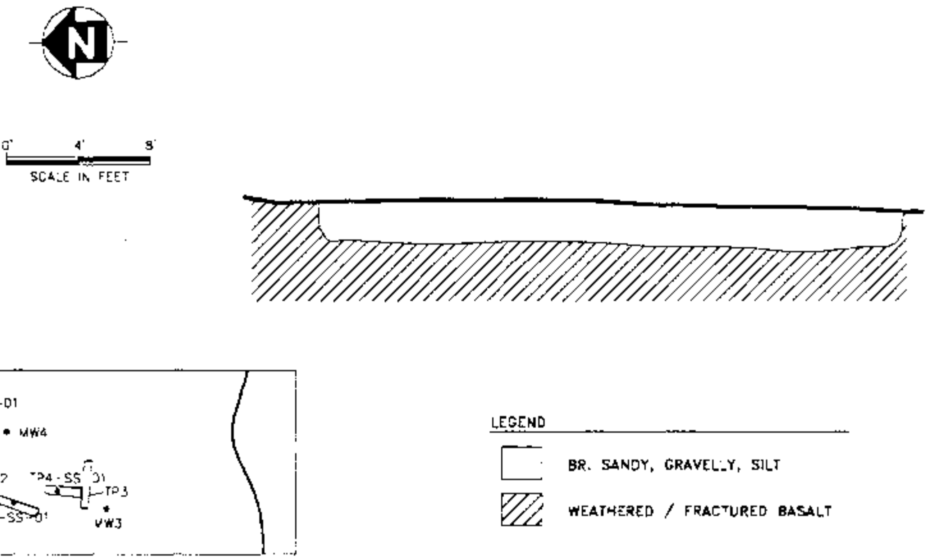
PID Reading: Description:

Feet BLS	Feet East of Western Edge	Contents	PID
2	Entire Length	Fractured basalt contact. Black, microcrystalline, very hard	0.0
1.5-2.5' contact with basalt	22' (37' from MW1) (West end of TP2 is 15' East of MW1)	Black discolored soil with some metal and cables to basalt contact at 2.5 feet BLS. (Western edge of landfill)	0.0

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP3 Test Pit Location: East end of Landfill Page 1 of 2

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 31' X 4' X 2' deep

Associated Photographs: 2-1

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP3 Test Pit Location: East end of Landfill Page 2 of 2

Temperature: 70's Wind Speed: 5 mph Wind Direction: SE

General Weather Conditions: Clear, light wind Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-2' BLS Soil Color: Brown USCS Designation: ML

PID Reading: 0.0 Description: Brown sandy gravelly silt (sand 15%, gravel 25%, fines 60%) dry, dense/firm, low plasticity.

Depth Range: >2' Soil Color: Brown/Black USCS Designation:

PID Reading: 0.0 Description: Weathered and fractured basalt

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

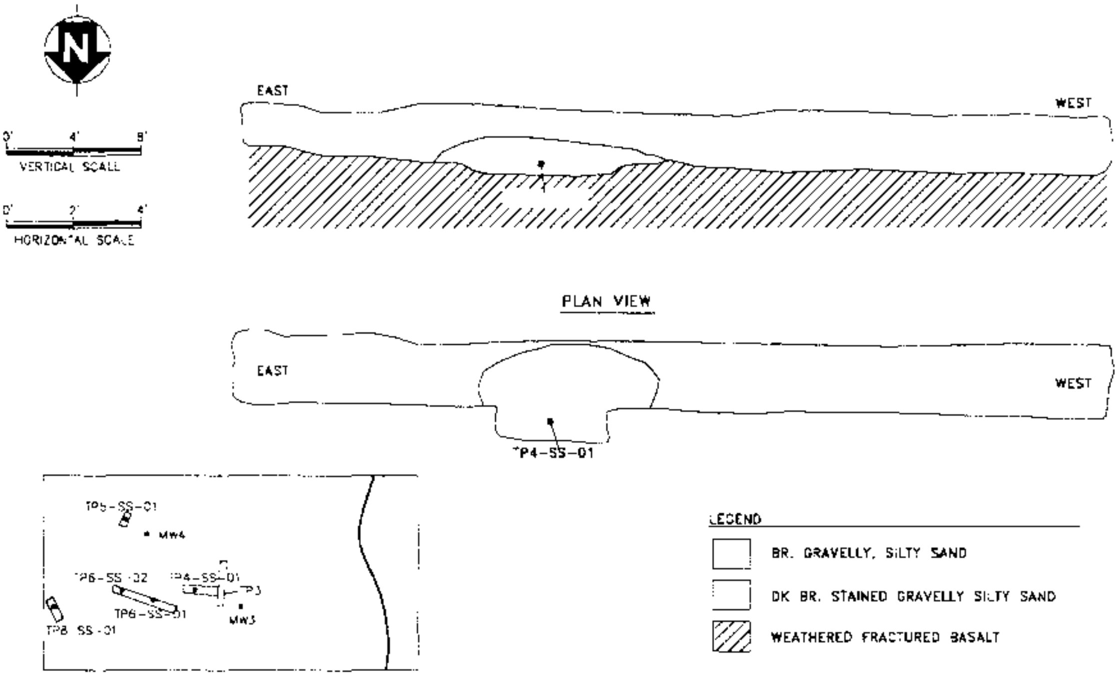
Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP4 Test Pit Location: East end of Landfill Page 1 of 2

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 24.5' X 4' X 3.7'

Associated Photographs: N/A

Grab Sample No. 8-19-98-BIL-TP4-SS-01

Time/Date Collected: 1525 / 8/19/98 Depth Collected: 3.7' Location: TP4

PID Reading: 0.0 USCS Designation: SM Soil Color: Dark Brown

Soil Description: Dark brown gravelly, silty sand (gravel 30%, fines 15%, sand 55%) dry-moist, well graded, dense.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP4 Test Pit Location: East end of Landfill Page 2 of 2

Temperature: 70's Wind Speed: <5 mph Wind Direction: Variable

General Weather Conditions: Clear, sunny Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-3' BLS Soil Color: Brown USCS Designation: SM

PID Reading: 0.0 Description: Brown gravelly, silty sand (gravel 30%, fines 15%, sand 55%) dry, well graded, dense.

Depth Range: >3' Soil Color: Dark Gray/Black USCS Designation:

PID Reading: 0.0 Description: Weathered, fractured basalt

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

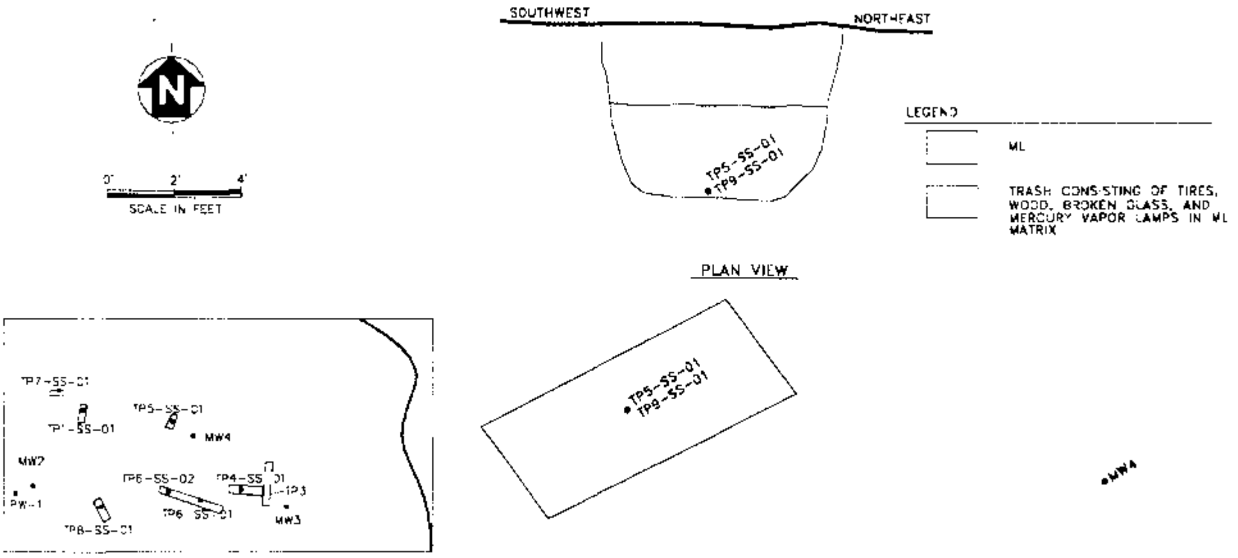
Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP5 Test Pit Location: North Central Landfill Page 1 of 3

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 7' **X** 4' **X** 5' deep

Associated Photographs: 2-2 through 2-9

Grab Sample No. 8-20-98-BIL-TP5-SS-01 / 8-20-98-BIL-TP9-SS-01

Time/Date Collected: 0855 / 8/20/98 Depth Collected: 5' BLS Location: TP5

PID Reading: 0.0 USCS Designation: ML Soil Color: Black

Soil Description: Black stained sandy, gravelly, silt (sand 10%, gravel/cobbles 25%, fines 65%), wet/saturated/oily, firm, low plasticity.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments: Collected TP5-SS-01 in duplicate; TP9-SS-01 as Blind duplicate from this test pit (0955)

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP5
Test Pit Location: North Central Landfill
Page 2 of 3
Temperature: 70's
Wind Speed: None / <5 mph
Wind Direction: Variable
General Weather Conditions: Clear to partly cloudy
Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-2.5' BLS
Soil Color: Brown
USCS Designation: ML
PID Reading: 0.0
Description: Brown sandy, gravelly silt (sand 10%, gravel/cobble 25%, fines 65%) dry, firm, low plasticity.

Depth Range: 2.5'-5' (TD)
Soil Color: Black
USCS Designation:
PID Reading: 0.0
Description: Debris in above matrix (50% debris), matrix is black and oily. Types of debris are listed in the table on page 3 of 3 below.

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

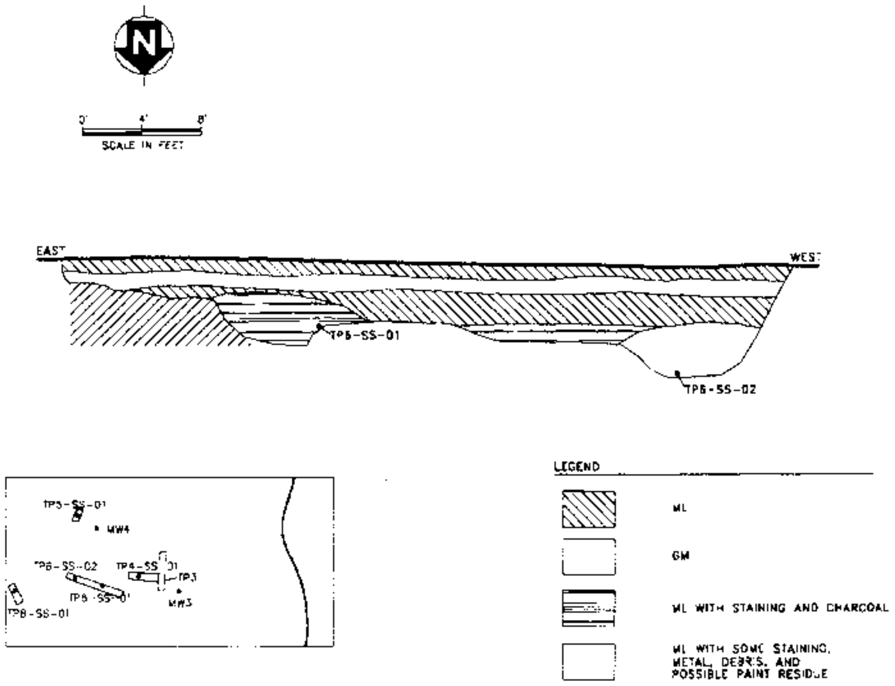
Depth Range:
Soil Color:
USCS Designation:
PID Reading:
Description:

Feet BLS	Contents	PID
2.5	Beginning of trash – tire (discolored-black soil matrix)	0.0
3.0	Wood cover underlain by lots of broken glass then more tires	0.0
5	Broken glass, mercury vapor lamps	0.0

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP6 Test Pit Location: East end of Landfill Page 1 of 2

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 47' X 4' X 1.5'-6.5' deep

Associated Photographs: 2-10 through 2-12 and 3-1 through 3-3

Grab Sample No. 8-20-98-BIL-TP6-SS-01

Time/Date Collected: 1050 / 8/20/98 Depth Collected: 4' Location: 17' west of east end TP6

PID Reading: 0.0 USCS Designation: ML Soil Color: Black/Very Dark Brown

Soil Description: Black/Very dark brown stained sandy, gravelly, silt (sand 10%, gravel 35%, fines 55%) moist, firm, well graded, low plasticity.

Grab Sample No. 8-20-98-BIL-TP6-SS-02

Time/Date Collected: 1140 / 8/20/98 Depth Collected: 6.5' Location: 40' west of east end of TP6

PID Reading: 0.0 USCS Designation: ML Soil Color: Brown/Dark Brown

Soil Description: Brown-Dark Brown, sandy, gravelly, silt (sand 20%, gravel/cobbles 15%, fines 65%) moist, firm, low plasticity with metal and possibly paint waste.

Comments: East end of TP6 is 46 feet west of monitoring well MW3

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP6 Test Pit Location: East end of Landfill Page 2 of 2

Temperature: 70's Wind Speed: 5 mph Wind Direction: South

General Weather Conditions: Partly cloudy, sunny Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-1' BLS Soil Color: Brown USCS Designation: ML

PID Reading: 0.0 Description: Brown sandy, gravelly, silt (sand 31%, gravel 25%, fines 65%), dry, firm, low plasticity.

Depth Range: 1-2' Soil Color: Brown USCS Designation: GM

PID Reading: 0.0 Description: Brown silty sandy gravel (fines 10%, sand 10%, gravel 80%) moist, firm, low plasticity.

Depth Range: 2-6.5' Soil Color: Dark Brown-Brown USCS Designation: ML

PID Reading: 0.0 Description: Dark Brown-Brown sandy gravelly silt (sand 20%, gravel/cobbles 15%, fines 65%) moist, firm, low plasticity with mica flakes, staining, with metal debris and possible paint residue 40' west of east end of TP6.

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

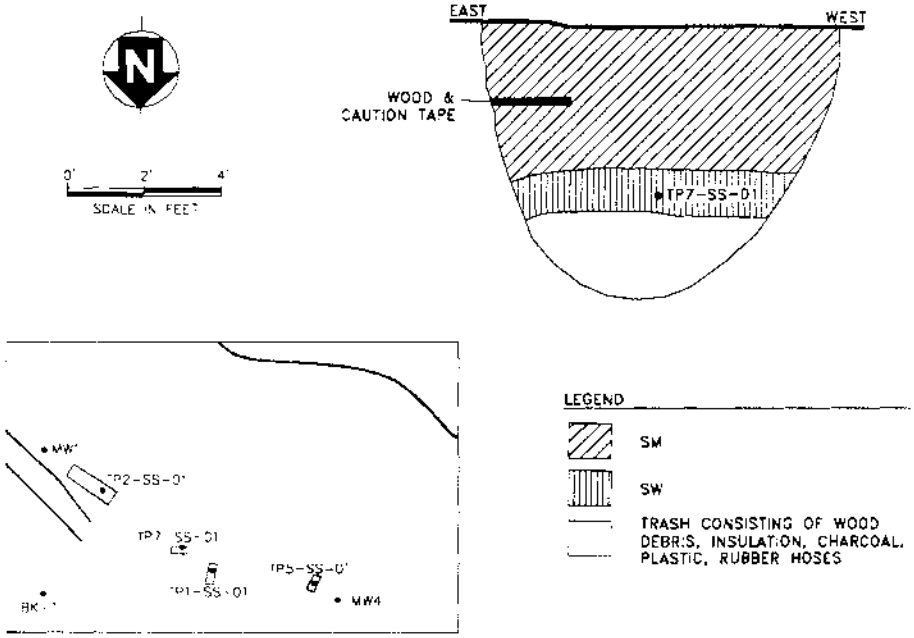
Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP7 Test Pit Location: Central Landfill Page 1 of 2

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 9' X 4' X 7' deep

Associated Photographs: 3-4 through 3-6

Grab Sample No. 8-20-98-BIL-TP7-SS-01

Time/Date Collected: 1350 / 8/20/98 Depth Collected: 4.5 Location: Central Landfill

PID Reading: 0.0 USCS Designation: SW Soil Color: Gray

Soil Description: Gray, fine grained, well graded sand (100%), moist, dense.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP7 Test Pit Location: Central Landfill Page 2 of 2

Temperature: 70's Wind Speed: <5 mph Wind Direction: SE

General Weather Conditions: Partly cloudy Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-4' BLS Soil Color: Brown USCS Designation: SM

PID Reading: 0.0 Description: Brown silty, gravelly, sand (fines 15%, gravel 25%, sand 60%) dry, well graded, dense.

Depth Range: 4'- 7' (total depth) Soil Color: Gray USCS Designation: SW

PID Reading: 0.0 Description: Gray sand, well graded, moist, dense, mixed with debris from 5-7' BLS

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

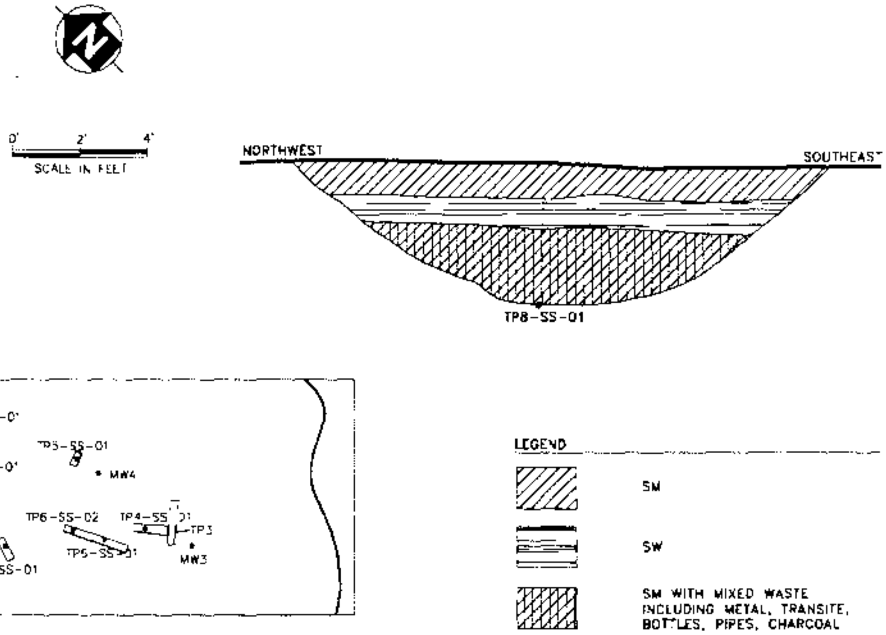
Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP8 Test Pit Location: South Central Landfill Page 1 of 2

EXCAVATION DIAGRAM



Final Test Pit Dimensions (Sq.Ft.): 15' X 4' X 4' deep

Associated Photographs: 3-7 through 3-9

Grab Sample No. 8-20-98-BIL-TP8-SS-01

Time/Date Collected: 1450 / 8/20/98 Depth Collected: 4' Location: South Central Landfill

PID Reading: 0.0 USCS Designation: SM Soil Color: Brown-Dark Brown

Soil Description: Brown-Dark Brown silty, gravelly, sand (fines 10%, gravel 30%, sand 60%) moist, dense, well graded.

Grab Sample No.

Time/Date Collected: Depth Collected: Location:

PID Reading: USCS Designation: Soil Color:

Soil Description:

Comments: Also collected asbestos sample: 8-20-98-ASB-03 – Dark gray transite collected at 1500.

Test Pit Log
Site Inspection
Former Bradford Island Landfill Site
Cascade Locks, Oregon
TC-10022-03

Test Pit No: TP8 Test Pit Location: South Central Landfill Page 2 of 2

Temperature: 70's Wind Speed: <5 mph Wind Direction: SE

General Weather Conditions: Partly cloudy Log Prepared By: Carlotta Cellucci

Soil Description

Depth Range: 0-1' BLS Soil Color: Brown USCS Designation: SM

PID Reading: 0.0 Description: Brown silty, gravelly, sand (fines 10%, gravel 25-30%, sand 60-65%) dry, well graded, dense.

Depth Range: 1-2' BLS Soil Color: Gray USCS Designation: SW

PID Reading: 0.0 Description: Gray sand (100%), well graded, dry-moist, dense.

Depth Range: 2-4' BLS Soil Color: Brown-Dark Brown USCS Designation: SM

PID Reading: 0.0 Description: Brown-Dark Brown stained silty, gravelly, sand (fines 10%, gravel/cobbles 25-30%, sand 60-65%), moist, well graded, dense with mixed waste including charcoal, metal debris and pipes, glass and bottles, and transite.

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Depth Range: Soil Color: USCS Designation:

PID Reading: Description:

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-0080001.00

Log of Test Pit
TP-1-2001

Date(s) Excavated	10/15/2001	Logged By	BPM	Checked By	BPM
Length of Excavation	60.0 feet	Width of Excavation	20.0 feet	Depth of Excavation	10.0 feet
Excavation Equipment	Kamatsu PC200	Excavation Contractor	PNE	Approximate Surface Elevation	N/A
Water Observations	N/A			Weather	N/A
Location	Gully Area			Surface Condition	Mix of Vegetative Cover, Concrete Rubble and Fill

Elevation feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0				**Poorly sorted landfill debris consisting of asphalt, wire, wire cable, metal buckets, ceramic insulators (3), sandblast grit (red & green), burned debris, scrap metal, electric motor, plastic planters, concrete rubble, hose, steel-reinforced wood planks, (3) 55-gallon drums (empty).**	
	1	✋	17			
	2	✋	18			
	3	✋	22 23			
	4	✋	13 16		*Sandblast grit (red and green) found throughout eastern 3/4 of excavation. Waste visible in all sides of excavation except the west. Possilble petroleum stained sediments on eastern half of gully. Most of landfill debris concentrated in eastern half of excavation.*	
	5	✋	19 21			
	6	✋	14			
	7					
	8	✋	15 20		**SILTY SAND [SM]**, yellowish-orange to orange brown, [with subangular to round cobbles up to 1" in size], [Fill/Alluvium].	
	9					
	10				Test Pit terminated at a depth of 10.0 feet [bgs], on 11/06/2001 and backfilled with soil cuttings upon completion.	
	11					
	12					
	13					
	14					
	15					

URS

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-0080001.00

Log of Test Pit TP-2-2001

Date(s) Excavated	10/16/2001	Logged By	BPM	Checked By	BPM
Length of Excavation	20.0 feet	Width of Excavation	20.0 feet	Depth of Excavation	10.0 feet
Excavation Equipment	Kamatsu PC200	Excavation Contractor	PNE	Approximate Surface Elevation	N/A
Water Observations	N/A			Weather	N/A
Location	MVL Area			Surface Condition	Vegetative Cover and Fill. [Planter Containers]

Elevation feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0				**BROWN SILT WITH SAND [ML].**	
	1					
	2					
	3				**BLACK SILTY SAND [SM]**, with landfill oily debris. Debris observed includes crushed glass (suspected hy-vapor lamps), and wood crates. Other lamps encountered include incandescent bulbs, vehicle headlights. Metal debris and wire found.	
	4					
	5	✋	7 8 10		*Oil odor and sheen observed on silty sand. Base of excavation is still oily. No visible fill at the base of excavation to the northwest. Fill still present to the east and south.*	
	6	✋	9			
	7				*Sandblast grit observed from ~1.0' [bgs] to the base of the excavation on the north and west sidewalls.*	
	8	✋	5 6 11 12			
	9					
	10				Test Pit terminated at a depth of 10.0 feet [bgs], on 11/06/2001 and backfilled with soil cuttings upon completion.	
	11					
	12					
	13					
	14					
	15					

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-0080001.00

Log of Test Pit TP-3-2001

Date(s) Excavated	10/17/2001	Logged By	BPM	Checked By	BPM
Length of Excavation	10.0 feet	Width of Excavation	10.0 feet	Depth of Excavation	3.0 feet
Excavation Equipment	Kamatsu PC200	Excavation Contractor	PNE	Approximate Surface Elevation	N/A
Water Observations	N/A			Weather	N/A
Location	04 Hot Spot			Surface Condition	Vegetative Cover and Fill

Elevation feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0				**Poorly sorted landfill debris consisting of treated wood (creosote odor), wire, and misc. plastic and metal debris. Sandblast grit observed in center of the excavation. Sandy gravel matrix present.**	
	1					
	2				Sandblast grit observed in test pit is interpreted as the "Hot Spot". Soil samples were collected around (not in) sandblast grit.	
	3	✋	24 25 26 27		Test Pit terminated at a deoth of 3.0 feet [bgs], on 10/17/2001 and backfilled with soil cuttings uopn completion.	
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					

Project: Bradford Island Landfill
Project Location: Cascade Locks, Oregon
Project Number: 52-0080001.00

Log of Test Pit TP-4-2001

Date(s) Excavated	10/17/2001	Logged By	BPM	Checked By	BPM
Length of Excavation	3.0 feet	Width of Excavation	3.0 feet	Depth of Excavation	3.0 feet
Excavation Equipment	Kamatsu PC200	Excavation Contractor	PNE	Approximate Surface Elevation	N/A
Water Observations	N/A			Weather	N/A
Location	MW4 Hot Spot			Surface Condition	Vegetative Cover

Elevation feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0				**POORLY GRADED GRAVEL WITH SAND [GP]**, gravel to pea size, gray and brown, no odor, hard-dense, [dry].	
	1					
					No fill (debris) observed.	
	2					
	3		30 31 32		Test Pit terminated at a depth of 3.0 feet [bgs], on 10/17/2001 and backfilled with soil cuttings upon completion.	
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					

APPENDIX C

PHOTOGRAPHIC SUMMARY

Appendix C: Photographic Log

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	Date:
1	1939

Direction Photo Taken:

N/A

Description:

July, 1939 aerial photograph of eastern portion of Bradford Island.

Photo No.	Date:
2	1948

Direction Photo Taken:

N/A

Description:

September, 1948 aerial photograph of eastern portion of Bradford Island.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
3	1954

Direction Photo Taken:

N/A

Description:

April, 1954 aerial photograph of eastern portion of Bradford Island.

Photo No.	**Date:**
4	1966

Direction Photo Taken:

N/A

Description:

June, 1966 aerial photograph of eastern portion of Bradford Island.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
7	1973

Direction Photo Taken:

N/A

Description:

May, 1973 aerial photograph of eastern portion of Bradford Island.

Photo No.	**Date:**
8	1981

Direction Photo Taken:

N/A

Description:

October, 1981 aerial photograph of eastern portion of Bradford Island.

URS

Appendix C: Photographic Log

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	Date:
9	1988

Direction Photo Taken:

N/A

Description:

1988 aerial photograph of eastern portion of Bradford Island.

Photo No.	Date:
10	1995

Direction Photo Taken:

N/A

Description:

1995, aerial photograph of eastern portion of Bradford Island.

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	Date:
11	May 2001

Direction Photo Taken:

Southeast

Description:

Landfill AOPC:
View of the Landfill AOPC at the Northeast tip of Bradford Island. Monitoring wells MW-1, MW-2, and MW-5 are visible. This photo was taken prior to the installation of monitoring wells MW-6 through MW-9.

Photo No.	Date:
12	12/11/01

Direction Photo Taken:

West

Description:

Landfill AOPC:
View of monitoring wells MW-1 through MW-5 located within the Landfill AOPC. This photo was taken prior to the installation of monitoring wells MW-6 through MW-9.

Client Name: United States Army Corps of Engineers	**Site Location:** Bonneville Lock and Dam – Oregon/Washington	**URS Project No.** 25697026

Photo No. 13

Date: Oct. 2001

Direction Photo Taken:

East

Description:

Landfill AOPC:
Mercury vapor lamp excavation done as part of the Landfill AOPC characterization in 2001.

Monitoring well MW-4

Black petroleum-stained soil.

Photo No. 14

Date: 4/30/00

Direction Photo Taken:

West

Description:

Landfill AOPC:
View of the sampling equipment used during the groundwater monitoring and sampling activities within the Landfill AOPC. The field geologist is set up at monitoring well MW-1.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
15	1/11/09

Direction Photo Taken:

N/A

Description:

Landfill AOPC:
View of one of the seep sample locations.

Photo No.	**Date:**
16	4/13/00

Direction Photo Taken:

N/A

Description:

Landfill AOPC:
View of one of the seep sample locations and the sampling equipment used to collect one of the seep samples.

Appendix C: Photographic Log

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	Date:
17	3/23/01

Direction Photo Taken:

East

Description:

Landfill AOPC:
View of the steep bank on the northeast end of Bradford Island.

Photo No.	Date:
18	3/20/08

Direction Photo Taken:

South

Description:

Reference Area:
View of the Reference Area monitoring well location (MW-10). The field personnel are standing at the approximate location of the monitoring well.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
19	11/19/01

Direction Photo Taken:

East

Description:

Sandblast Area AOPC: View of the Sandblast Building and adjacent Septic Tank Drain Field located in the grass covered area to the left of the building.

Photo No.	**Date:**
20	3/7/00

Direction Photo Taken:

West

Description:

Sandblast Area AOPC: View of the Sandblast Building in the background and the Spend Sandblast Grit Area in the foreground.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
21	3/20/08

Direction Photo Taken:

East

Description:

Sandblast Area AOPC:
View of the Spent Sandblast Grit Area east of the Sandblast Building.

Photo No.	**Date:**
22	1/11/09

Direction Photo Taken:

West

Description:

Sandblast Area AOPC:
View of the Sandblast Building in the background and the Spend Sandblast Grit Area in the foreground.

Client Name: United States Army Corps of Engineers	**Site Location:** Bonneville Lock and Dam – Oregon/Washington	**URS Project No.** 25697026

Photo No. 23 **Date:** 1/11/09

Direction Photo Taken:

East

Description:

Sandblast Area AOPC: View of the Spent Sandblast Grit Area adjacent to the Sandblast Building on the hillside above the Equipment Laydown Area

Photo No. 24 **Date:** 11/19/01

Direction Photo Taken:

N/A

Description:

Sandblast Area AOPC: View of sandblast grit observed on ground surface during site reconnaissance near the Current Hazardous Materials Storage Area.

URS

Appendix C: Photographic Log

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
25	3/7/00

Direction Photo Taken:

South

Description:

<u>Sandblast Area AOPC:</u> View of the north side of the Current Hazardous Materials Storage Area.

Photo No.	**Date:**
26	11/19/01

Direction Photo Taken:

West

Description:

<u>Sandblast Area AOPC:</u> View of the east side of the Current Hazardous Materials Storage Area.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
27	3/15/00

Direction Photo Taken:

West

Description:

Sandblast Area AOPC: View of the Equipment Laydown Area looking west along the Landfill access road.

Photo No.	**Date:**
28	1/11/09

Direction Photo Taken:

East

Description:

Sandblast Area AOPC: View of the Equipment Laydown Area looking east along the Landfill access road.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
29	03/20/09

Direction Photo Taken:

East

Description:

Sandblast Area AOPC: View of the eastern end of the Equipment Laydown Area. Locations of surface soil grab sample stations LD-09, LD-10 and LD-11 are shown with red circles. LD-10 and LD-11 were collected from stockpiled soils below plastic liner. Access road to Landfill AOPC visible in background.

Photo No.	**Date:**
30	3/18/09

Direction Photo Taken:

South

Description:

Sandblast Area AOPC: View of the Erodable Soils Area in the foreground. This temporary feature was a result of contruction activities in late 2008. The following year, this slope was naturally revegetated (see Photo 31). Monitoring well MW-12 and the Sandblast Building are visible in the background.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
31	6/30/10

Direction Photo Taken:

South

Description:

Sandblast Area AOPC: View of the vegetated slope adjacent to the Sandblast Building, which is visible in the background. The previous year, this area was unvegetated (as shown in Photo 30) due to late 2008 construction activities and identified as the Erodable Soils Area.

Photo No.	**Date:**
32	6/30/10

Direction Photo Taken:

Southeast

Description:

Sandblast Area AOPC: Closer view of the vegetated slope adjacent to the Sandblast Building. The previous year, this area was unvegetated (as shown in Photo 30) due to late 2008 construction activities.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
33	11/19/01

Direction Photo Taken:

Southeast

Description:

Sandblast Area AOPC: View of the access road to the Former Hazardous Materials Storage Area, which is visible in the background.

Photo No.	**Date:**
34	6/30/10

Direction Photo Taken:

West

Description:

Sandblast Area AOPC: View of the storage pad within the Former Hazardous Materials Storage Area

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	Date:
35	1958

Direction Photo Taken:

N/A

Description:

Pistol Range AOPC:
1958 aerial photo view of area of the Pistol Range AOPC. Vegetation along bank is well established. Photo indicates a small building and backstop in place. The Sandblast Building is visible to the north.

Photo No.	Date:
36	02/02/09

Direction Photo Taken:

East

Description:

Pistol Range AOPC:
View of the drilling subcontractor advancing drill rods at boring PR2C within the center of the Pistol Range AOPC.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
37	11/22/02

Direction Photo Taken:

Southwest

Description:

Pistol Range AOPC:
View to the southwest from the top of the backstop. The debris from the firing shed (which has collapsed) is visible in the center of the photo and an access road is visible on the left (southern portion of the Pistol Range AOPC).

38	**Date:**
	01/11/09

Direction Photo Taken:

West

Description:

Pistol Range AOPC:
View of the five sediment sample stations (circled in red) located in the lagoon adjacent to the Pistol Range AOPC.

Client Name:	Site Location:	URS Project No.
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
39	11/20/02

Direction Photo Taken:

West

Description:

Bulb Slope AOPC:
View of landfill access road and upper boundary of Bulb Slope.

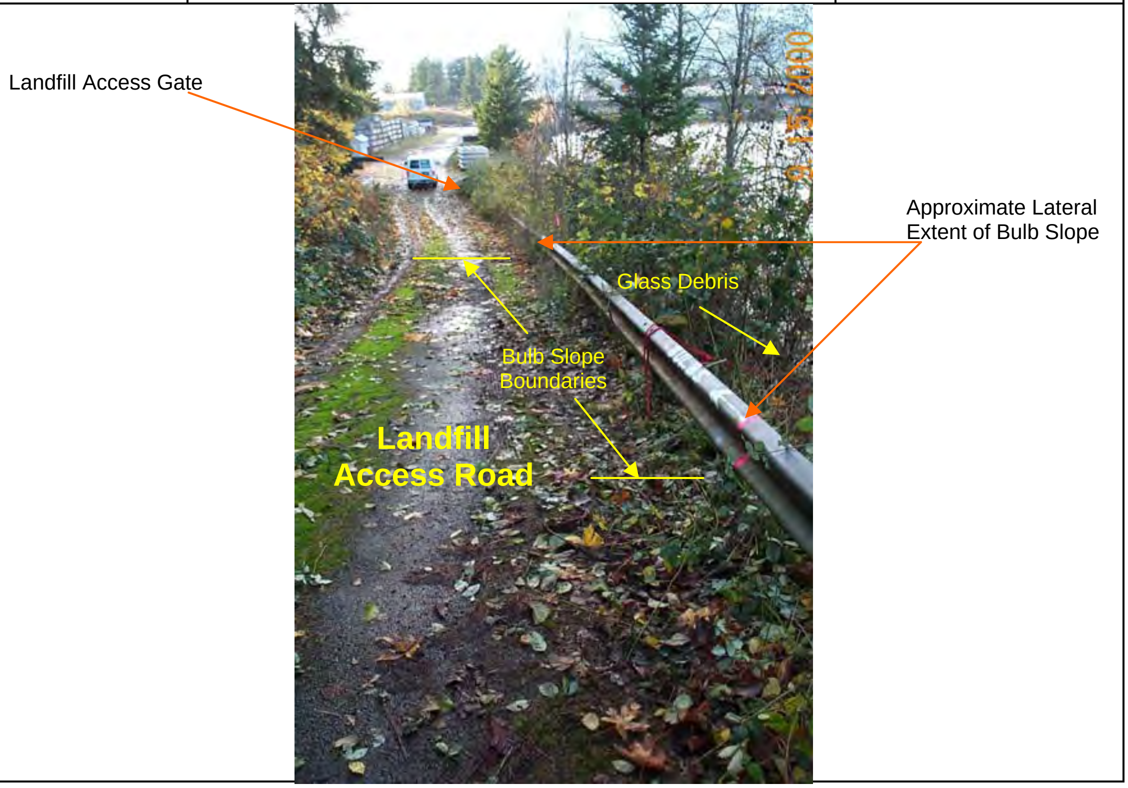


Photo No.	**Date:**
40	11/20/02

Direction Photo Taken:

South

Description:

Bulb Slope AOPC:
View of Bulb Slope AOPC just above the waterline. Concrete debris and glass debris are visible near the center of the photograph.
.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
41	12/21/00

Direction Photo Taken:

West

Description:

River OU:
View facing downstream of Bradford Island in the center and the Bonneville Dam and Spillway visible in the background on the right side.

Photo No.	**Date:**
42	2/28/02

Direction Photo Taken:

East

Description:

River OU:
View facing upstream of the barge set up during the electrical equipment removal off the northeast portion of Bradford Island. Picture Rock and Boat Rock are visible in the background.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
43	3/5/02

Direction Photo Taken:

West-Northwest

Description:

River OU:
View facing downstream of the Bonneville Dam and Spillway in the background.

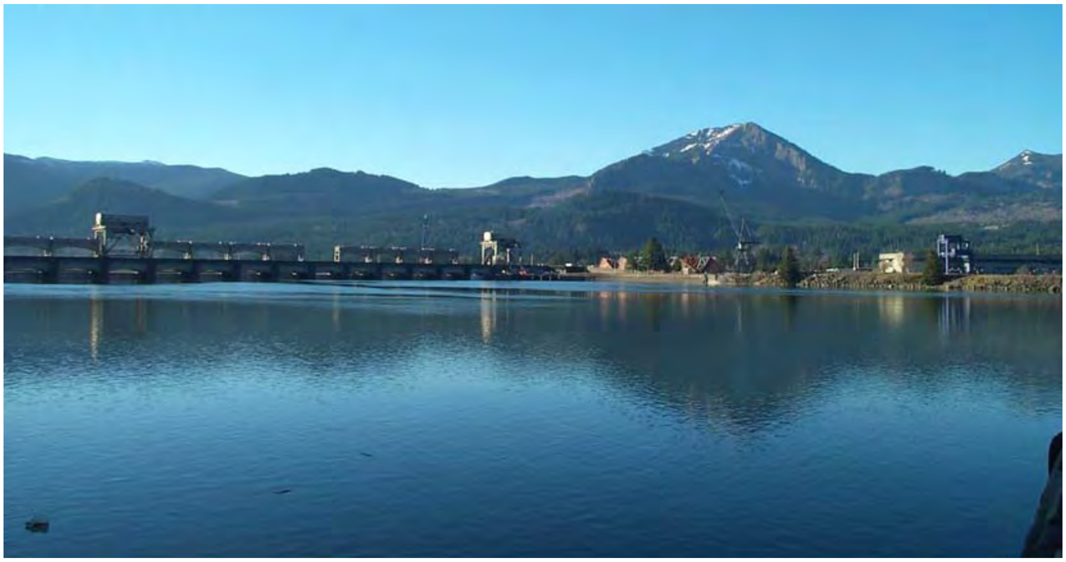


Photo No.	**Date:**
44	3/20/08

Direction Photo Taken:

West

Description:

River OU:
View downstream inside the Forebay on the south side of Bradford Island, which is not visible in this photo. The Oregon shore of the river and Interstate 84 are visible in this photo.

Client Name:	**Site Location:**	**URS Project No.**
United States Army Corps of Engineers	Bonneville Lock and Dam – Oregon/Washington	25697026

Photo No.	**Date:**
45	2/12/08

Direction Photo Taken:

East

Description:

River OU:
View upstream with the north side of Goose Island on the right side of the photo.

Photo No.	**Date:**
46	2/27/08

Direction Photo Taken:

N/A

Description:

River OU:
View of typical sediment sample collection from VanVeen sampler.

APPENDIX D

GROUNDWATER ELEVATIONS

Table D-1
Groundwater Elevations for the Landfill and Sandblast Area AOPCs and the Reference Area
Bradford Island - Upland Operable Unit
(1 of 2)

Area	Well	Measuring Date	Measuring Point Elevation (ft msl)	Depth to Water (ft btc)	Groundwater Elevation (ft msl)	Bonneville Forebay Elevation (ft msl)
Landfill AOPC	MW-1	7/12/1999	105.5	28.81	76.69	71.80
Landfill AOPC	MW-1	11/8/1999	105.5	26.5	79.00	75.00
Landfill AOPC	MW-1	1/10/2000	105.5	26.9	78.60	74.20
Landfill AOPC	MW-1	10/24/2001	105.5	7.67	97.83	74.90
Landfill AOPC	MW-1	12/6/2001	105.5	7.36	98.14	74.10
Landfill AOPC	MW-1	5/1/2002	105.5	7.93	97.57	76.00
Landfill AOPC	MW-1	4/16/2008	105.5	27.12	78.38	75.10*
Landfill AOPC	MW-1	7/14/2008	105.5	27.76	77.74	73.80
Landfill AOPC	MW-1	10/20/2008	105.5	-	78.28	76.10
Landfill AOPC	MW-1	1/12/2009	105.5	27.42	78.08	74.20
Landfill AOPC	MW-2	7/12/1999	116.56	9.05	107.51	71.80
Landfill AOPC	MW-2	11/8/1999	116.56	9.54	107.02	75.00
Landfill AOPC	MW-2	1/10/2000	116.56	8.18	108.38	74.20
Landfill AOPC	MW-2	10/24/2001	116.56	10.01	106.55	74.90
Landfill AOPC	MW-2	12/6/2001	116.56	9.21	107.35	74.10
Landfill AOPC	MW-2	5/1/2002	116.56	8.85	107.71	76.00
Landfill AOPC	MW-2	4/16/2008	116.56	10.25	106.31	75.10*
Landfill AOPC	MW-2	7/14/2008	116.56	10.1	106.46	73.80
Landfill AOPC	MW-2	10/20/2008	116.56	-	106.56	76.10
Landfill AOPC	MW-2	1/12/2009	116.56	9.44	107.12	74.20
Landfill AOPC	MW-3	7/12/1999	115.21	17.22	97.99	71.80
Landfill AOPC	MW-3	11/8/1999	115.21	15.6	99.61	75.00
Landfill AOPC	MW-3	1/10/2000	115.21	10.73	104.48	74.20
Landfill AOPC	MW-3	10/24/2001	115.21	17.43	97.78	74.90
Landfill AOPC	MW-3	12/6/2001	115.21	10.21	105.00	74.10
Landfill AOPC	MW-3	5/1/2002	115.21	14.8	100.41	76.00
Landfill AOPC	MW-3	4/17/2008	115.21	13.46	101.75	75.10*
Landfill AOPC	MW-3	7/14/2008	115.21	17.3	97.91	73.80
Landfill AOPC	MW-3	10/20/2008	115.21	-	97.16	76.10
Landfill AOPC	MW-3	1/12/2009	115.21	12.48	102.73	74.20
Landfill AOPC	MW-4	7/12/1999	114.79	16.84	97.95	71.80
Landfill AOPC	MW-4	11/8/1999	114.79	15.77	99.02	75.00
Landfill AOPC	MW-4	1/10/2000	114.79	11.75	103.04	74.20
Landfill AOPC	MW-4	10/24/2001	114.79	17.35	97.44	74.90
Landfill AOPC	MW-4	12/6/2001	114.79	11.47	103.32	74.10
Landfill AOPC	MW-4	5/1/2002	114.79	14.51	100.28	76.00
Landfill AOPC	MW-4	4/17/2008	114.79	13.36	101.43	75.10*
Landfill AOPC	MW-4	7/14/2008	114.79	16.81	97.98	73.80
Landfill AOPC	MW-4	10/20/2008	114.79	-	97.24	76.10
Landfill AOPC	MW-4	1/12/2009	114.79	12.47	102.32	74.20
Landfill AOPC	MW-5	11/8/1999	114.07	19.1	94.97	75.00
Landfill AOPC	MW-5	1/10/2000	114.07	16.47	97.6	74.20
Landfill AOPC	MW-5	10/24/2001	114.07	20.76	93.31	74.90
Landfill AOPC	MW-5	12/6/2001	114.07	16.54	97.53	74.10
Landfill AOPC	MW-5	5/1/2002	114.07	18.12	95.95	76.00
Landfill AOPC	MW-5	4/16/2008	113.9	17.24	96.83	75.10*
Landfill AOPC	MW-5	7/14/2008	113.9	19.33	94.57	73.80
Landfill AOPC	MW-5	10/20/2008	113.9	-	93.34	76.10
Landfill AOPC	MW-5	1/12/2009	113.9	16.81	97.09	74.20

Table D-1
Groundwater Elevations for the Landfill and Sandblast Area AOPCs and the Reference Area
Bradford Island - Upland Operable Unit
(2 of 2)

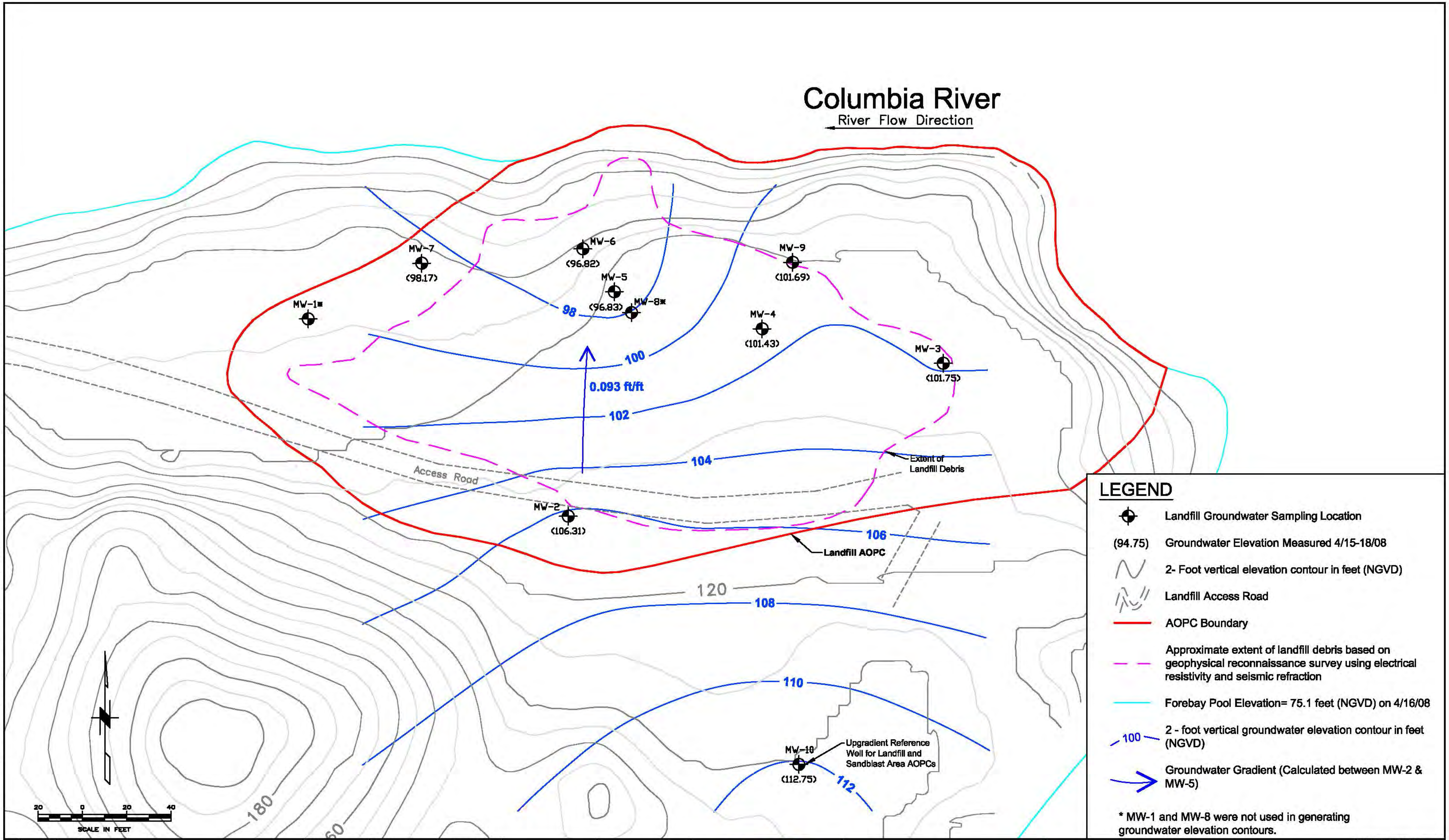
Area	Well	Measuring Date	Measuring Point Elevation (ft msl)	Depth to Water (ft btc)	Groundwater Elevation (ft msl)	Bonneville Forebay Elevation (ft msl)
Landfill AOPC	MW-6	5/1/2002	113.02	17.06	95.96	76.00
Landfill AOPC	MW-6	4/17/2008	112.8	16.2	96.82	75.10*
Landfill AOPC	MW-6	7/14/2008	112.8	18.24	94.56	73.80
Landfill AOPC	MW-6	10/20/2008	112.8	-	93.39	76.10
Landfill AOPC	MW-6	1/12/2009	112.8	15.72	97.08	74.20
Landfill AOPC	MW-7	5/1/2002	106.92	9.45	97.47	76.00
Landfill AOPC	MW-7	4/16/2008	106.73	8.75	98.17	75.10*
Landfill AOPC	MW-7	7/14/2008	106.73	9.67	97.06	73.80
Landfill AOPC	MW-7	10/20/2008	106.73	-	97.71	76.10
Landfill AOPC	MW-7	1/12/2009	106.73	8.33	98.40	74.20
Landfill AOPC	MW-8	5/1/2002	115.29	56.66	58.68	76.00
Landfill AOPC	MW-8	4/18/2008	115.13	41.63	73.66	75.10*
Landfill AOPC	MW-8	7/14/2008	115.13	26.66	88.47	73.80
Landfill AOPC	MW-8	10/20/2008	115.13	-	88.52	76.10
Landfill AOPC	MW-8	1/12/2009	115.13	25.16	89.97	74.20
Landfill AOPC	MW-9	5/1/2002	115.16	14.97	100.19	76.00
Landfill AOPC	MW-9	4/17/2008	114.98	13.47	101.69	75.10*
Landfill AOPC	MW-9	7/14/2008	114.98	15.99	98.99	73.80
Landfill AOPC	MW-9	10/20/2008	114.98	-	99.04	76.10
Landfill AOPC	MW-9	1/12/2009	114.98	12.6	102.38	74.20
Reference Area	MW-10	4/15/2008	133.2	20.45	112.75	75.10*
Reference Area	MW-10	7/14/2008	133.2	25.94	107.26	73.80
Reference Area	MW-10	10/20/2008	133.2	-	104.29	76.10
Reference Area	MW-10	1/12/2009	133.2	19.52	113.68	74.20
Sandblast Area AOPC	MW-11	4/15/2008	98.12	6.41	91.71	75.10*
Sandblast Area AOPC	MW-11	7/14/2008	98.12	8.05	90.07	73.80
Sandblast Area AOPC	MW-11	10/20/2008	98.12	-	90.72	76.10
Sandblast Area AOPC	MW-11	1/12/2009	98.12	7.06	91.06	74.20
Sandblast Area AOPC	MW-12	4/15/2008	100.62	24.08	76.54	75.10*
Sandblast Area AOPC	MW-12	7/14/2008	100.62	26.05	74.57	73.80
Sandblast Area AOPC	MW-12	10/20/2008	100.62	-	76.26	76.10
Sandblast Area AOPC	MW-12	1/12/2009	100.62	23.1	77.52	74.20
Sandblast Area AOPC	MW-13	4/14/2008	97.55	16.35	81.2	75.10*
Sandblast Area AOPC	MW-13	7/14/2008	97.55	17.08	80.47	73.80
Sandblast Area AOPC	MW-13	10/20/2008	97.55	-	80.5	76.10
Sandblast Area AOPC	MW-13	1/12/2009	97.55	15.62	81.93	74.20
Sandblast Area AOPC	MW-14	4/14/2008	86.67	12.94	73.73	75.10*
Sandblast Area AOPC	MW-14	7/14/2008	86.67	13.61	73.06	73.80
Sandblast Area AOPC	MW-14	10/20/2008	86.67	-	75.9	76.10
Sandblast Area AOPC	MW-14	1/12/2009	86.67	12.59	74.08	74.20
Sandblast Area AOPC	MW-15	4/14/2008	86.86	13.05	73.81	75.10*
Sandblast Area AOPC	MW-15	7/14/2008	86.86	13.81	73.05	73.80
Sandblast Area AOPC	MW-15	10/20/2008	86.86	-	75.96	76.10
Sandblast Area AOPC	MW-15	1/12/2009	86.86	12.76	74.1	74.20

Bonneville Forebay Elevation data from USACE (http://www.cbr.washington.edu/dart/river.html)
ft msl = feet above mean sea level
ft btc = feet below top of well casing
* = measured on April 16, 2008
"-" = Not evaluated

Table D-2
Groundwater Elevation Gradients for the Landfill andSandblast Area AOPCs
Bradford Island - Upland Operable Unit
(1 of 1)

	Landfill AOPC	Sandblast AOPC	
Date	Gradient Between MW-02 and MW-05 (north)	Gradient Between MW-11 and MW-14 (northwest)	Gradient Between MW-11 and MW-15 (north)
11/8/1999	0.118	-	-
1/10/2000	0.105	-	-
10/24/2001	0.129	-	-
12/6/2001	0.096	-	-
5/1/2002	0.115	-	-
April 2008	0.093	0.082	0.117
7/14/2008	0.116	0.078	0.111
10/20/2008	0.129	0.068	0.097
1/12/2009	0.098	0.078	0.111
Average	0.111	0.077	0.109
Avg Nov to April	0.102	0.080	0.114
Avg May to Oct	0.122	0.073	0.104

Gradient units in feet/feet (vertical/horizontal)



LEGEND

⌖	Landfill Groundwater Sampling Location
(94.75)	Groundwater Elevation Measured 4/15-18/08
∿	2- Foot vertical elevation contour in feet (NGVD)
∿	Landfill Access Road
—	AOPC Boundary
– –	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
—	Forebay Pool Elevation= 75.1 feet (NGVD) on 4/16/08
100	2 - foot vertical groundwater elevation contour in feet (NGVD)
→	Groundwater Gradient (Calculated between MW-2 & MW-5)

* MW-1 and MW-8 were not used in generating groundwater elevation contours.

No.	DATE	BY	REVISION

JOB No. 25696946	DESIGNED: LSM	PROJ. MANAGER: MP
SCALE:	DRAWN BY: SB	APPROVED BY: LSM
	CHECKED BY: LSM	DATE: JULY 2010

URS

111 SW Columbia, Suite 1500
Portland, Oregon 97201-5814
(tel) 503-222-7200
(fax) 503-222-4292
www.urscorp.com

BRADFORD ISLAND

CASCADE LOCKS, OREGON

LANDFILL AOPC

GROUNDWATER ELEVATION CONTOURS
APRIL 2008 (WET SEASON)

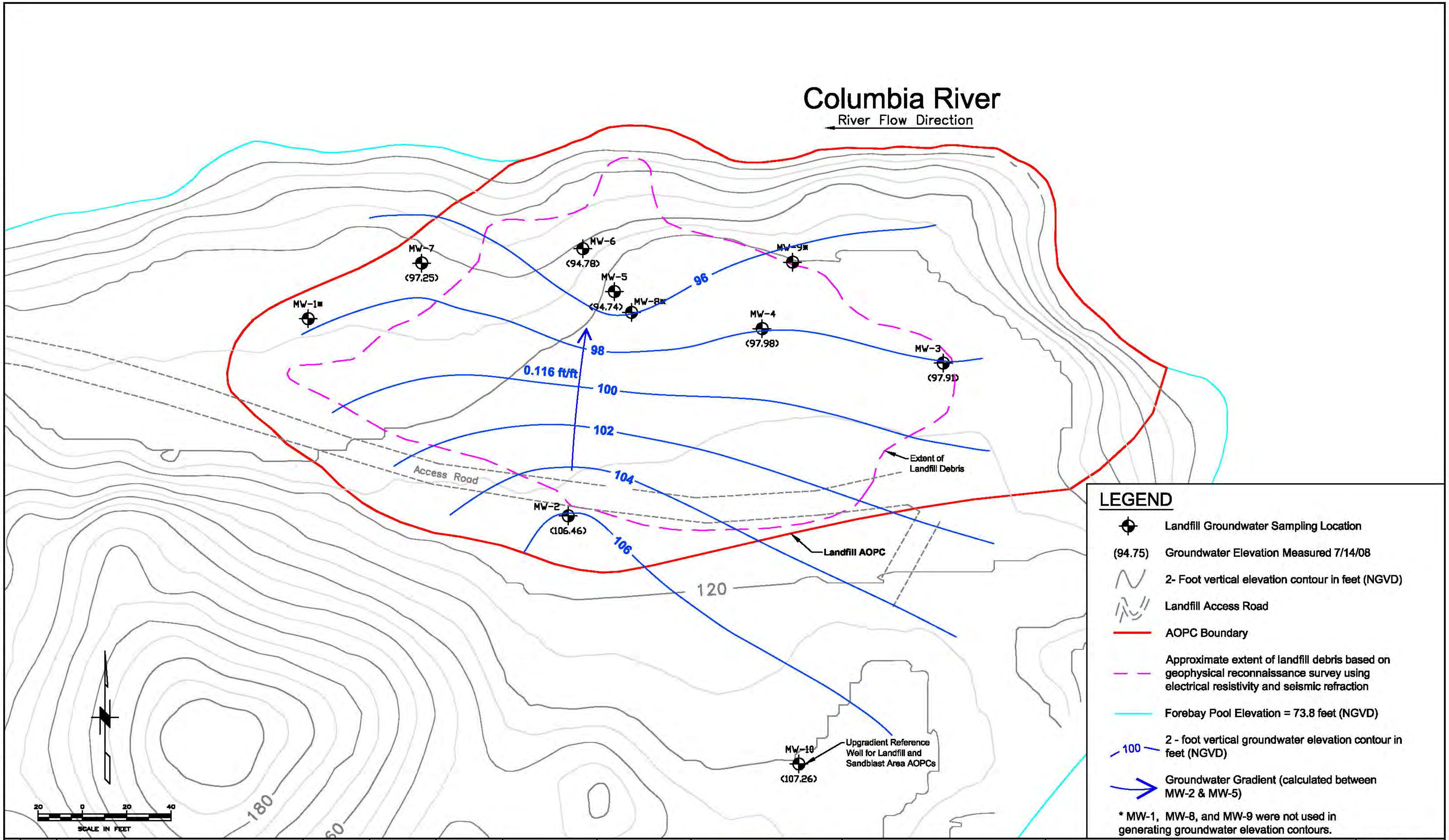
DRAWING NUMBER: FIGURE D-1

CAD FILE NUMBER: FIG D-1

SHEET: OF

REV.:

O:\25692709 USACE\53-F0072173.00 Bradford\1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-1 - April 2008 GW Elevation Contours - Landfill AOPC.dwg Aug 02, 2010 - 9:59am



No.	DATE	BY	REVISION

JOB No.: 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: SB
APPROVED BY: LSM
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DATE: JULY 2010

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BRADFORD ISLAND
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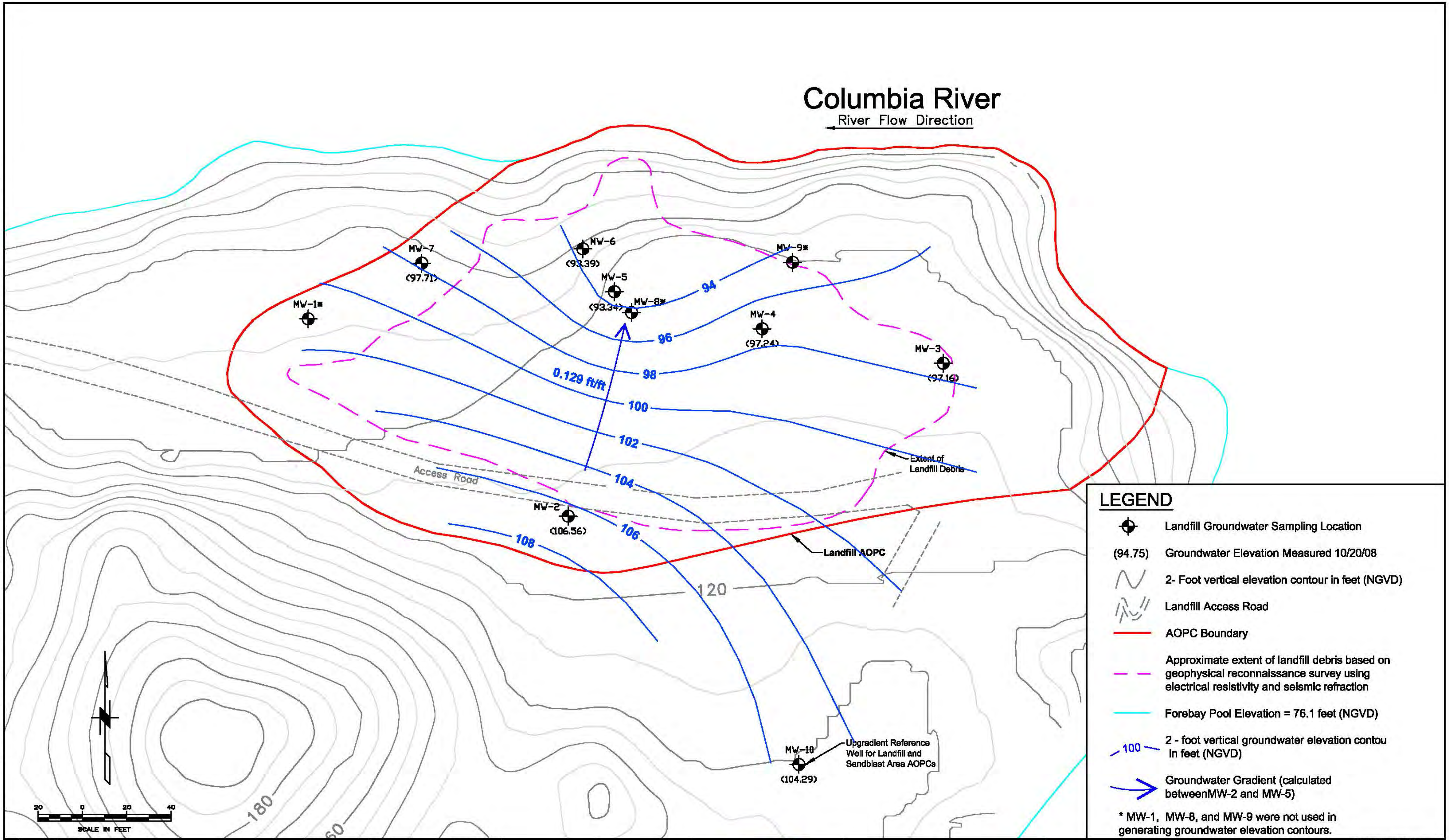
LANDFILL AOPC
GROUNDWATER ELEVATION CONTOURS
JULY 2008 (DRY SEASON)

DRAWING NUMBER: FIGURE D-2
CAD FILE NUMBER: FIG D-2
SHEET: OF
REV.:

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-2 - July 2008 GW Elevation Contours - Landfill AOPC.dwg Aug 02, 2010 - 10:01am



LEGEND

⊕	Landfill Groundwater Sampling Location
(94.75)	Groundwater Elevation Measured 10/20/08
∿	2- Foot vertical elevation contour in feet (NGVD)
∿	Landfill Access Road
—	AOPC Boundary
– –	Approximate extent of landfill debris based on geophysical reconnaissance survey using electrical resistivity and seismic refraction
—	Forebay Pool Elevation = 76.1 feet (NGVD)
100	2 - foot vertical groundwater elevation contou in feet (NGVD)
→	Groundwater Gradient (calculated betweenMW-2 and MW-5)

* MW-1, MW-8, and MW-9 were not used in generating groundwater elevation contours.

No.	DATE	BY	REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
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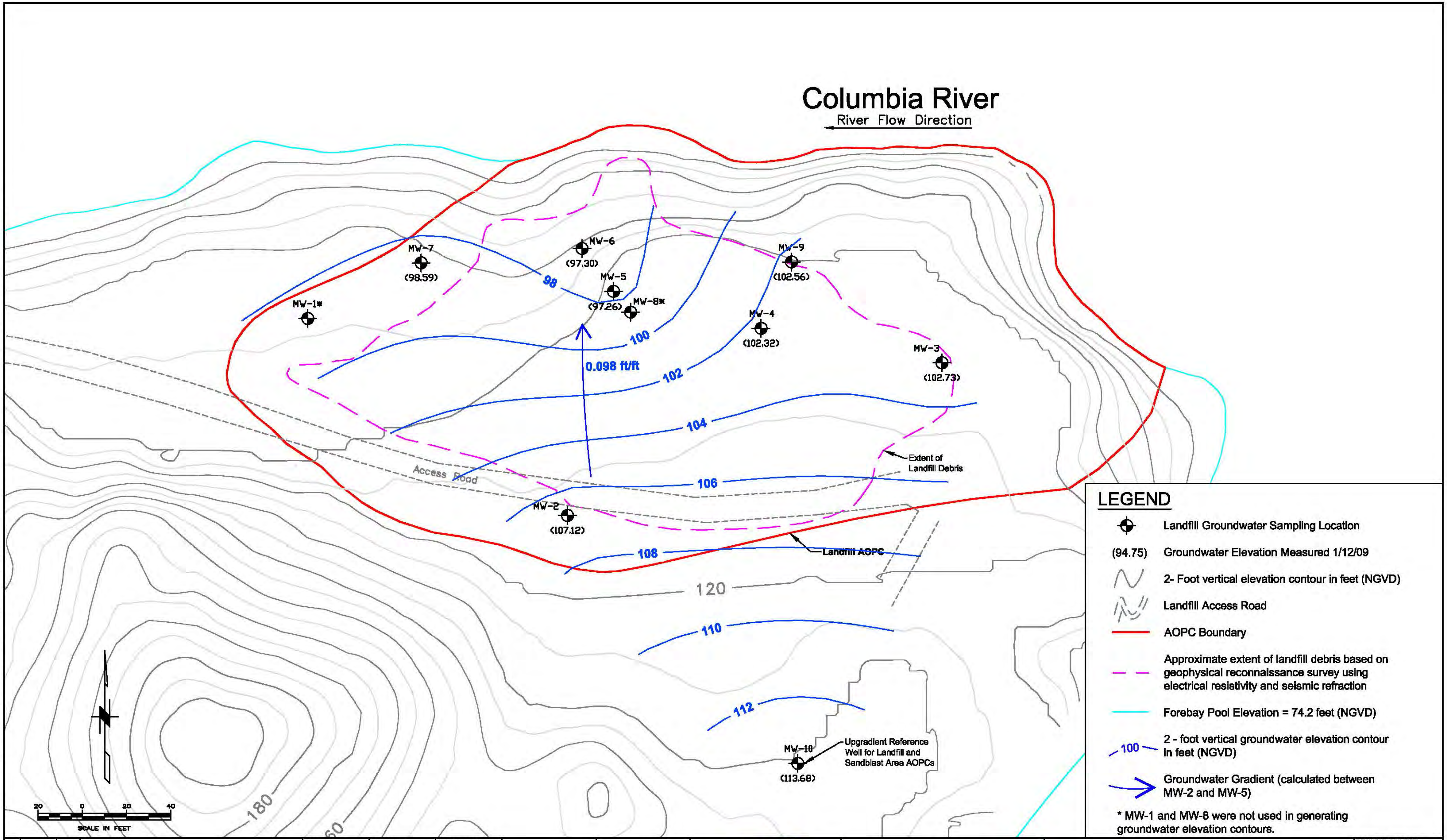
LANDFILL AOPC

GROUNDWATER ELEVATION CONTOURS
OCTOBER 2008 (DRY SEASON)

DRAWING NUMBER: FIGURE D-3
CAD FILE NUMBER: FIG D-3
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Bradford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-3 - October 2008 GW Elevation Contours - Landfill AOPC.dwg Aug 02, 2010 - 10:02am



O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-4 - January 2009 GW Elevation Contours - Landfill AOPC.dwg Aug 02, 2010 - 10:03am

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
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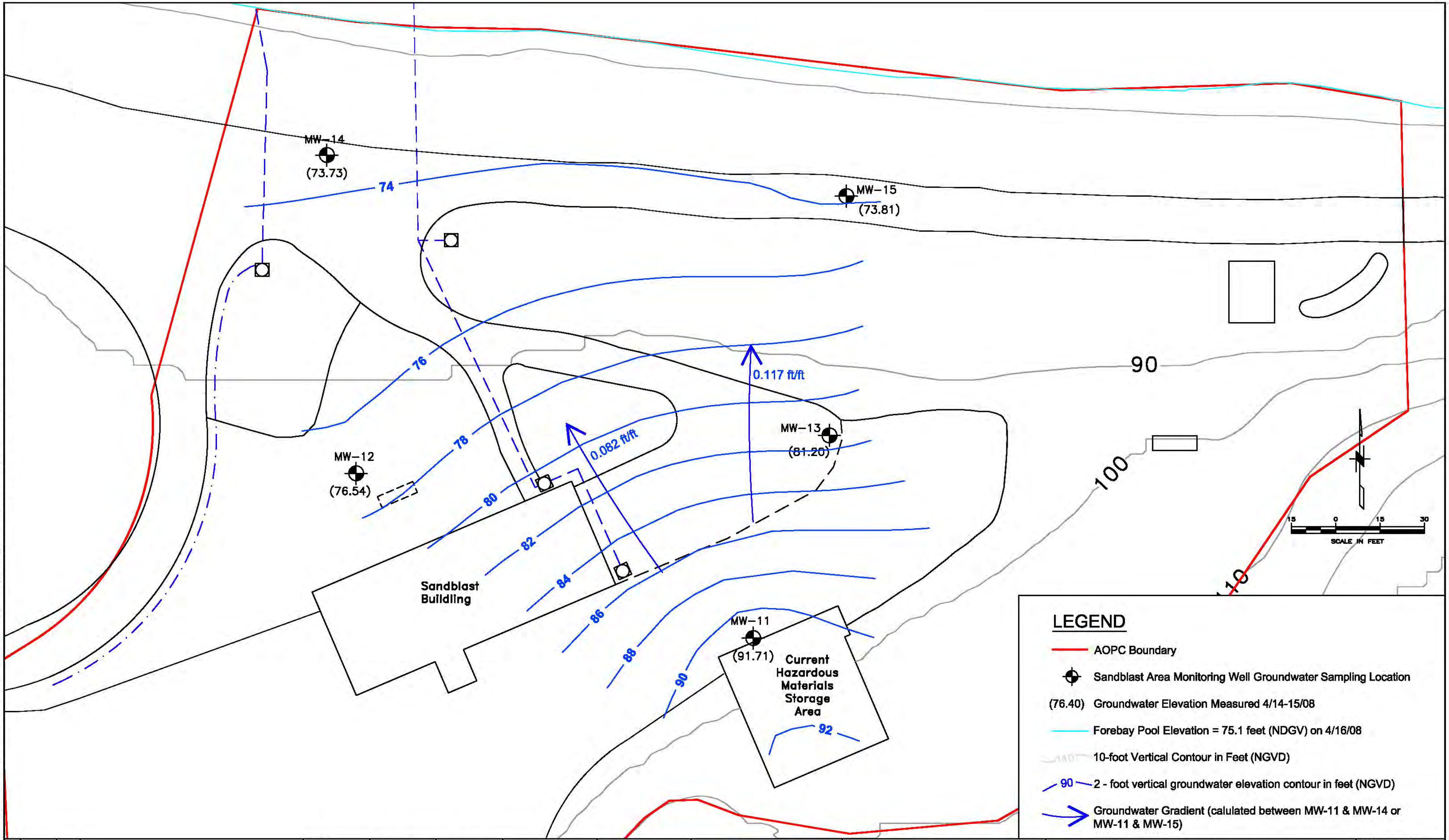
LANDFILL AOPC

GROUNDWATER ELEVATION CONTOURS
JANUARY 2009 (WET SEASON)

DRAWING NUMBER: FIGURE D-4
CAD FILE NUMBER: FIG D-4
SHEET: OF
REV.



LEGEND

AOPC Boundary

Sandblast Area Monitoring Well Groundwater Sampling Location

(76.40) Groundwater Elevation Measured 4/14-15/08

Forebay Pool Elevation = 75.1 feet (NDGV) on 4/16/08

10-foot Vertical Contour in Feet (NGVD)

90 2 - foot vertical groundwater elevation contour in feet (NGVD)

Groundwater Gradient (calulated between MW-11 & MW-14 or MW-11 & MW-15)

No.	DATE	BY	REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: JULY 2010

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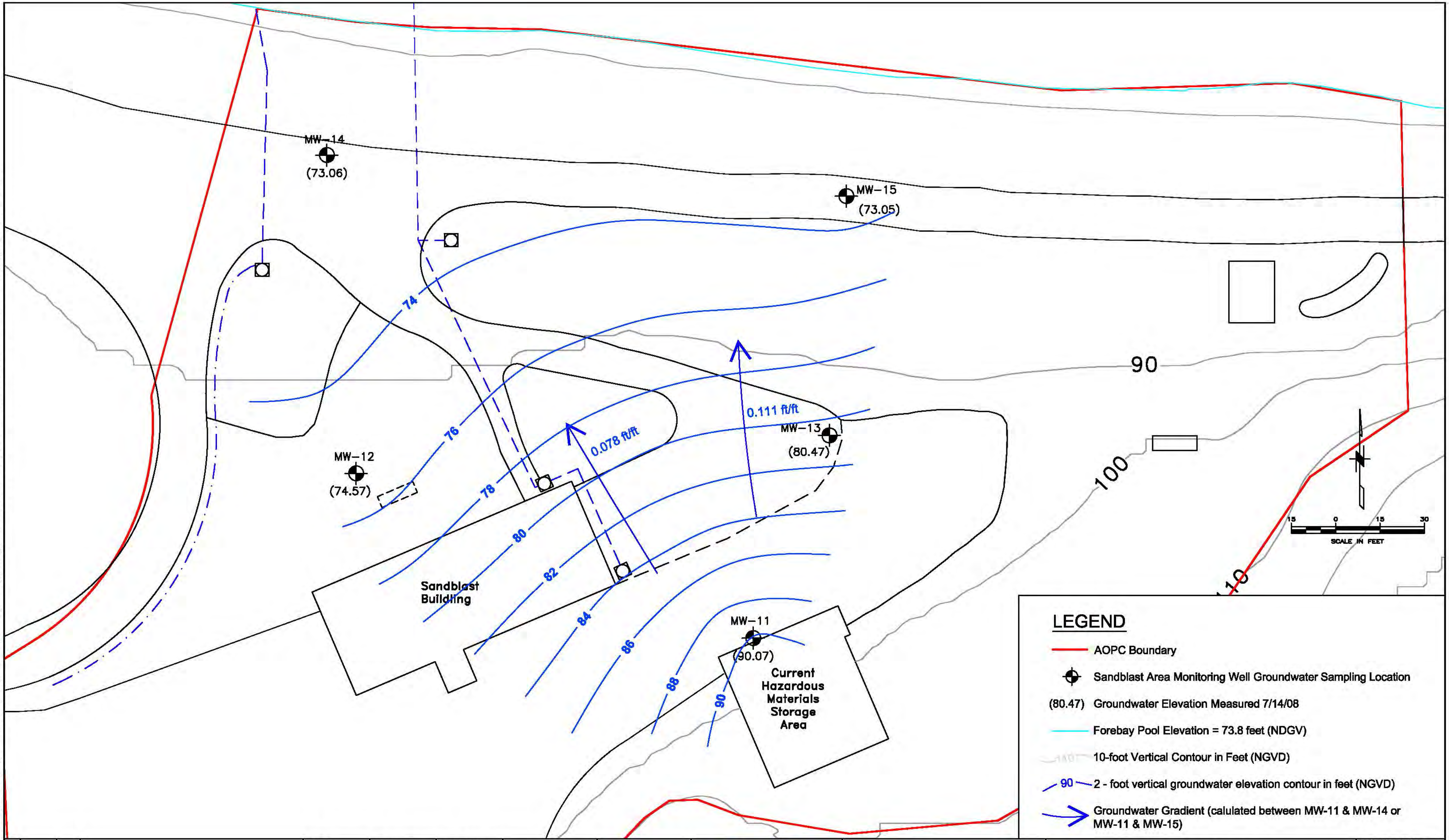
CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

GROUNDWATER ELEVATON CONTOURS
APRIL 2008 (WET SEASON)

DRAWING NUMBER: FIGURE D-5
CAD FILE NUMBER: FIG D-5
SHEET: OF
REV.

c:\25692709 USACE\53-F0072173.00 Bradford1\F.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-5 - April 2008 GW Elevation Contours - Sandblast AOPC.dwg Aug 02, 2010 - 10:07am



O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-6 – July 2008 GW Elevation Contours – Sandblast AOPC.dwg Aug 02, 2010 – 10:08am

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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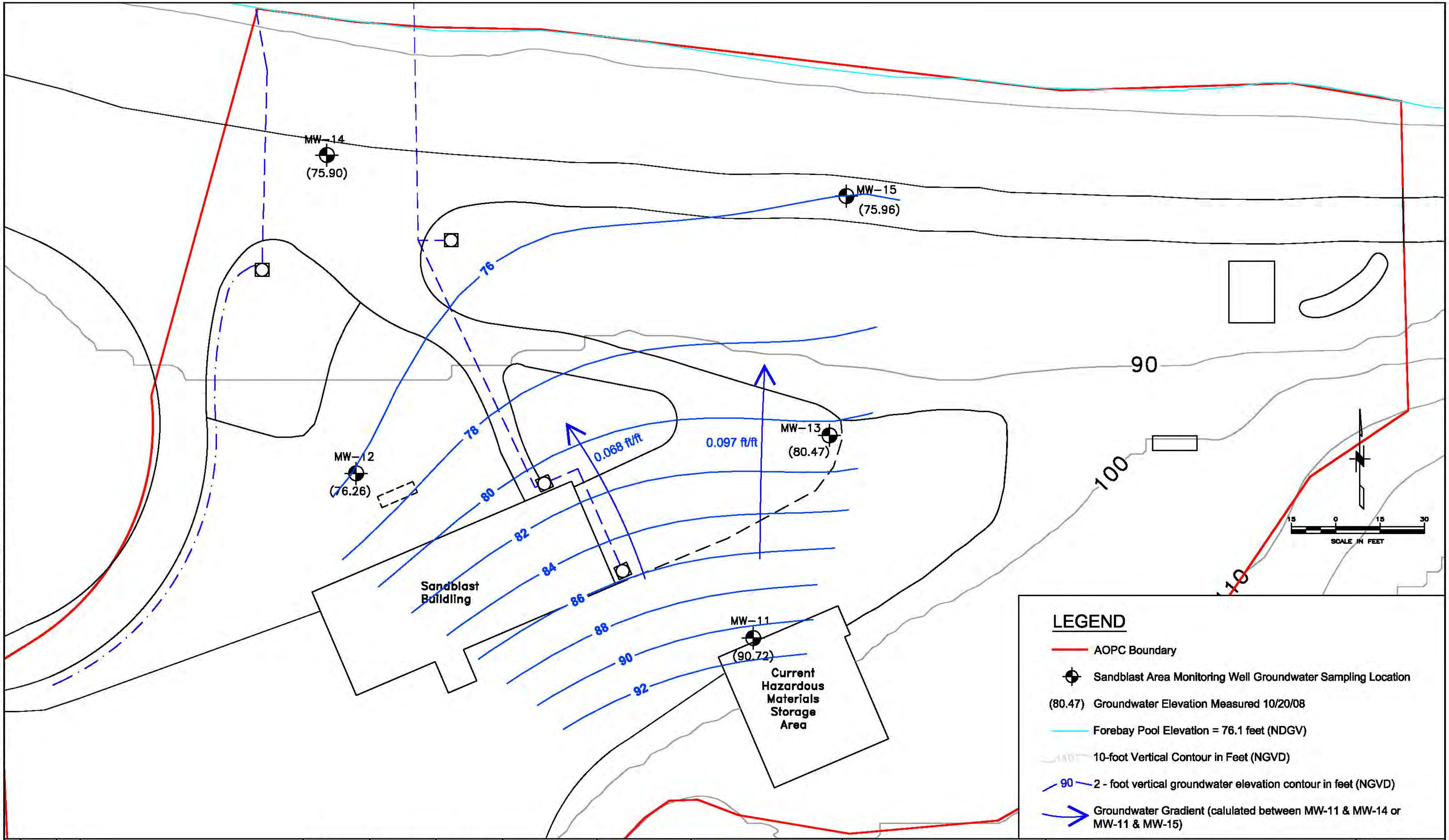
SANDBLAST AREA AOPC

GROUNDWATER ELEVATON CONTOURS
JULY 2008 (DRY SEASON)

DRAWING NUMBER: FIGURE D-6
CAD FILE NUMBER: FIG D-6
SHEET: OF
REV.



LEGEND

- AOPC Boundary
- Sandblast Area Monitoring Well Groundwater Sampling Location
- (80.47) Groundwater Elevation Measured 10/20/08
- Forebay Pool Elevation = 76.1 feet (NDGV)
- 10-foot Vertical Contour in Feet (NGVD)
- 90 2 - foot vertical groundwater elevation contour in feet (NGVD)
- Groundwater Gradient (calulated between MW-11 & MW-14 or MW-11 & MW-15)

No.	DATE	BY	REVISION

JOB No. 25696946
DESIGNED: LSM
PROJ. MANAGER: MP
SCALE:
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: JULY 2010

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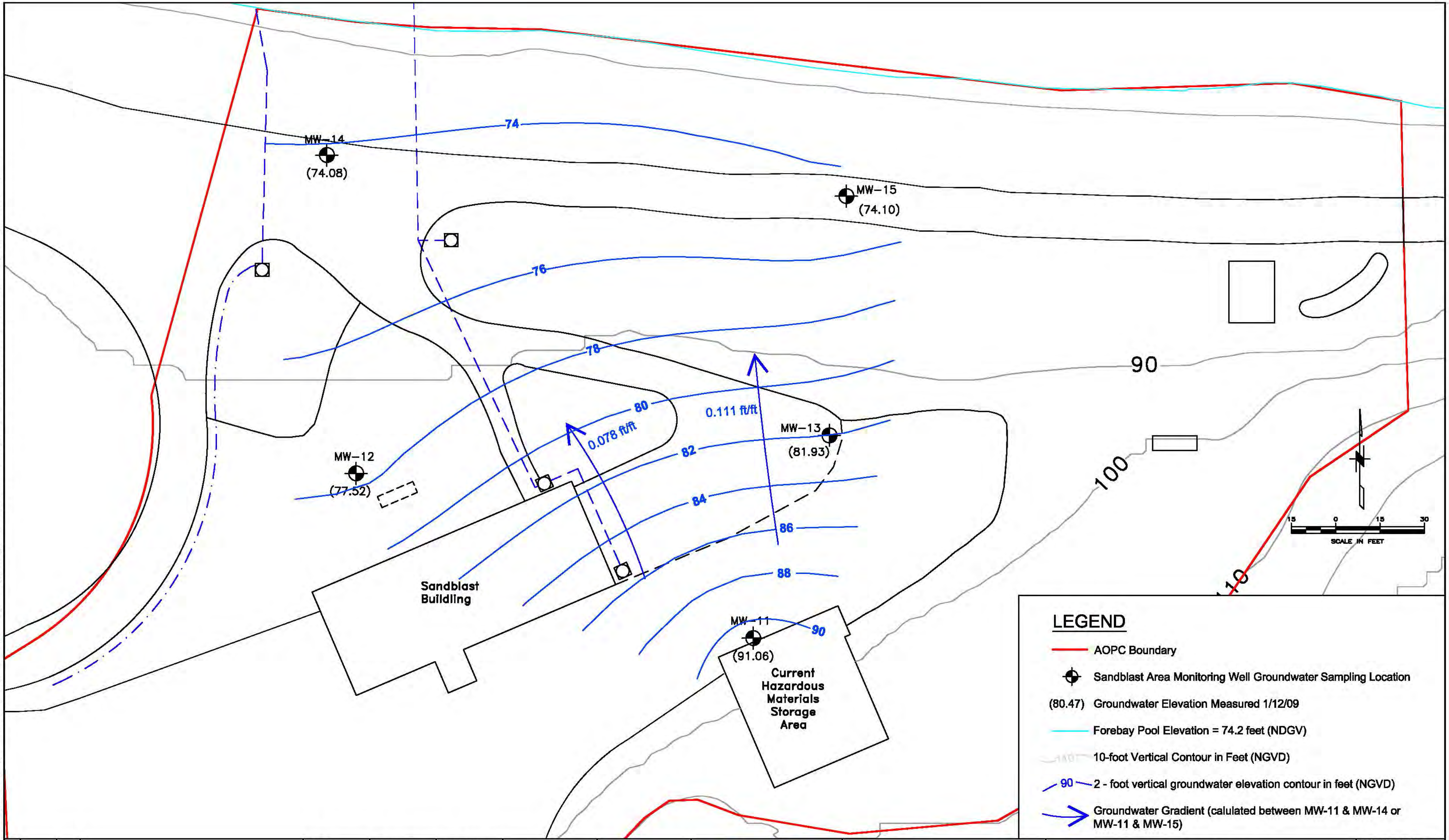
SANDBLAST AREA AOPC

GROUNDWATER ELEVATON CONTOURS
OCTOBER 2008 (DRY SEASON)

DRAWING NUMBER: FIGURE D-7
CAD FILE NUMBER: FIG D-7
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-7 - October 2008 GW Elevation Contours - Sandblast AOPC.dwg Aug 02, 2010 - 10:10am



LEGEND

🟥 AOPC Boundary

Sandblast Area Monitoring Well Groundwater Sampling Location

(80.47) Groundwater Elevation Measured 1/12/09

Forebay Pool Elevation = 74.2 feet (NDGV)

10-foot Vertical Contour in Feet (NGVD)

90 2 - foot vertical groundwater elevation contour in feet (NGVD)

Groundwater Gradient (calulated between MW-11 & MW-14 or MW-11 & MW-15)

No.	DATE	BY	REVISION

JOB No. 25696946
SCALE:
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: MP
APPROVED BY: LSM
DATE: JULY 2010

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC

GROUNDWATER ELEVATON CONTOURS
JANUARY 2009 (WET SEASON)

DRAWING NUMBER: FIGURE D-8
CAD FILE NUMBER: FIG D-8
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Ft.Worth DT-02\RI Report_Working Folder\RI Text\Figures\Appendix_D\FIG D-8 - January 2009 GW Elevation Contours - Sandblast AOPC.dwg Aug 02, 2010 - 10:11am

APPENDIX E

LABORATORY REPORTS

In Separate File on this DVD

APPENDIX F

DATA VALIDATION REPORTS

The analytical results for four water samples and one field duplicate collected July 12 and 13, 1999 at the Bradford Island landfill, were subject to a quality assurance/quality control (QA/QC) review.

This QA/QC review includes evaluation of analytical representativeness, accuracy, precision, and completeness. Representativeness is evaluated by examining chain of custody paperwork and verifying analysis was performed within allowable holding times; accuracy is evaluated using the analytical results for blanks, surrogates, matrix spikes and blank spikes; precision is evaluated by comparison of results for primary and sample duplicate analyses and laboratory duplicate analyses; and completeness is evaluated by calculating the percentage of acceptable data.

The data quality review process followed the procedures specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (EPA Guidelines) (EPA 1994).*

MultiChem Analytical Services of Renton, Washington analyzed all samples, except the QA samples sent to the USACE lab in Omaha, Nebraska. Samples were collected and analyzed according to the Sampling and Analysis Plan (URS, September 1999). Samples were analyzed for one or more of the following methods: Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc) by EPA SW-846 Method 6010/7000 Series, Semivolatile Organic Compounds by EPA SW-846 Method 8270B, Volatile Organic Compounds by EPA SW-846 Method 8260B, Organochlorinated Pesticides and Polychlorinated Biphenyls by EPA SW-846 Method 8081A/8082, Chlorinated Herbicides by EPA SW-846 Method 8151A, and Total Petroleum Hydrocarbons by NWTPH-Dx and NWTPH-Gx. Well designation, chain of custody (COC) identification (ID), and laboratory ID are cross-referenced below.

WELL DESIGNATION	COC ID	LABORATOY ID
MW - 1	990712BIL08GW	907030-1
-	Trip Blank	907030-2
MW - 2	990712BIL07GW	907023-1
-	Trip Blank	907023-2
MW - 3	990712BIL06GW	907021-1
-	Trip Blank	907021-2
MW - 4	990712BIL01GW	907021-3
-	Trip Blank	907021-4
MW – 4 field duplicate	990712BIL02GW	907021-5
-	Trip Blank	907021-6

Sample 990712BIL08GW purge water was used for analyses because the well was unable to recharge quick enough to obtain well water. There was still insufficient volume; therefore, the purge water was not analyzed for all the required methods. USACE was notified and specified which methods to analyze.

All analytical data are usable as reported. No data were rejected during this review. Analytical deviations from the reference methods are presented below. Reporting limits meet the project objectives. Compounds detected below the reporting limit but above the method detection limit are considered estimates and are qualified "J" by the laboratory.

REPRESENTATIVENESS

Chain of Custody and Holding Times

Sample custody was maintained under the chain of custody (COC) forms. Forms were signed on release and receipt of samples. Samples were properly preserved; however, 990712BIL01GW and 990712BIL02GW did not maintain pH < 2 for the metals samples due to the sample matrix. The laboratory added additional preservative to the metals samples; no data were qualified.

Samples received by the laboratory were within 4° ± 2° C except for samples 990712BIL02GW, 990712BIL07GW, and corresponding trip blanks which were received at temperatures between 7.3 and 9.5°C. Receipt temperatures were not exceedingly high; therefore, no data were qualified. Extraction and analysis holding times were met for all samples.

ACCURACY

Initial and Continuing Calibration

Initial and continuing instrument calibration verification (ICV or CCV) were analyzed at the proper frequency. Prior to samples and quality control samples being analyzed, the laboratory analyzed calibration standards at the concentrations required by the method. The continuing calibration standard acceptance criteria was reported as the average response factor (percent difference, %D) for various organic analyses or as the percent recovery (%R) for inorganic analyses. The %Ds (less than 25%) and %Rs (±15%) were within laboratory control limits with the following exceptions.

- EPA SW-846 Methods 8081A CCV for samples 990712BIL01GW, 990712BIL02GW, 990712BIL06GW, and 990712BIL07GW exceed the control limit of 25% for 4,4'-DDD and 4,4'-DDT. Sample results were non-detect; therefore, results were qualified as estimated "UJ".
- EPA SW-846 Methods 8081A CCVs for sample 990712BIL08GW exceed the control limit of 25% for alpha-BHC, dieldrin, endrin, 4,4'-DDD, 4,4'-DDT, and endrin ketone. Sample results were non-detect for the out of compliant analytes; therefore, results were qualified as estimated "UJ".

Blanks

The laboratory analyzed one method blank with each analytical batch. Five trip blanks were analyzed for EPA SW-846 Method 8260B. Frequency requirements for method and trip blanks were met. Target analytes in the method and trip blanks were below method reporting limits.

Surrogate Recovery

Surrogate recoveries (%Rs) were within project-specific control limits.

Blank Spike

Blank spikes (BS) and if required blank spike duplicates (BSD) were analyzed with each analytical batch, which meets the frequency requirement of five percent. The BS/BSD were within laboratory control limits.

Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicates (MS/MSD) were not analyzed with each analytical batch. Sufficient sample was collected for MS/MSD; however, the extra sample was extracted and analyzed as if they were primary samples in most cases. Holding times and insufficient sample volumes would not allow for re-extraction and re-analysis of these samples. USACE was notified that no MS/MSD was available. The frequency requirement of 5 percent was not met. Data was qualified and deemed acceptable based on blank spike, blanks spike duplicate, surrogate recoveries, and if available MS/MSD. The %Rs were within project-specific control limits.

PRECISION

Spike Duplicate

The laboratory analyzed blank and/or matrix spike duplicates with each analytical batch; the relative percent differences (RPDs) were within project-specific control limits.

MS/MSD and BS/BSD %Rs were within project-specific control limits or did not effect sample integrity for the out of compliant RPDs; therefore, no data were qualified.

Laboratory Duplicate

A laboratory duplicate was analyzed for the metals analyses. RPDs were within project-specific control limits.

Field Duplicate

One field duplicate was collected during the sampling event. The field duplicate RPDs were within project-specific control limits of less than 300%.

COMPLETENESS

The laboratory submitted all required deliverables for the requested analyses. The reported analytical results meet the project completeness goal of 95 percent. For all samples collected and analyzed, no data were judged to be invalid. No data were rejected, so completeness for this sampling event is 100 percent.

Based on the QA/QC review, some data were qualified as estimated ("UJ") due to analytical deviations. The following table summarizes the COC IDs and qualified results for all samples covered by this review:

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
8081A	990712BIL01GW 990712BIL02GW 990712BIL06GW 990712BIL07GW	4,4'-DDD 4,4'-DDT	UJ	CCVs
8081A	990713BIL08GW	alpha-BHC Dieldrin Endrin 4,4'-DDD 4,4'-DDT Endrin Ketone	UJ	CCVs

The analytical results for five water samples and one field duplicate collected November 8 and 9, 1999 at the Bradford Island landfill, were subject to a quality assurance/quality control (QA/QC) review.

This QA/QC review includes evaluation of analytical representativeness, accuracy, precision, and completeness. Representativeness is evaluated by examining chain of custody paperwork and verifying analysis was performed within allowable holding times; accuracy is evaluated using the analytical results for blanks, surrogates, matrix spikes and blank spikes; precision is evaluated by comparison of results for primary and sample duplicate analyses and laboratory duplicate analyses; and completeness is evaluated by calculating the percentage of acceptable data.

The data quality review process followed the procedures specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (EPA Guidelines) (EPA 1994).*

MultiChem Analytical Services of Renton, Washington analyzed all samples. Samples were collected and analyzed according to the Sampling and Analysis Plan (URS, September 1999). Samples were analyzed for one or more of the following methods: Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc) by EPA SW-846 Method 6010/7000 Series, Semivolatile Organic Compounds by EPA SW-846 Method 8270B, Volatile Organic Compounds by EPA SW-846 Method 8260B, Organochlorinated Pesticides and Polychlorinated Biphenyls by EPA SW-846 Method 8081A/8082, Chlorinated Herbicides by EPA SW-846 Method 8151A, and Total Petroleum Hydrocarbons by NWTPH-Dx and NWTPH-Gx. Well designation, chain of custody (COC) identification (ID), and laboratory ID are cross-referenced below.

WELL DESIGNATION	COC ID	LABORATORY ID
MW - 1	991108BIL14GW	911040-3
-	Trip Blank	911040-4
MW - 2	991108BIL12GW	911031-9
-	Trip Blank	911031-10
MW - 3	991108BIL11GW	911031-7
-	Trip Blank	911031-8
MW - 4	991108BIL09GW	911031-1
-	Trip Blank	911031-2
-	Trip Blank	911031-3
-	Trip Blank	911031-4
MW – 4 field duplicate	991108BIL10GW	911031-5
-	Trip Blank	911031-6
MW – 5	991109BIL13GW	911040-1
-	Trip Blank	911040-2

Sample 991109BIL14GW purge water was used for analyses because the well was unable to recharge quick enough to obtain well water. Sample 991109BIL13GW water is from a newly (1999) constructed well that has never been sampled, no previous data is available.

All analytical data are usable as reported. No data were rejected during this review. Analytical deviations from the reference methods are presented below. Reporting limits meet the project objectives. Compounds detected below the reporting limit but above the method detection limit are considered estimates and are qualified "J" by the laboratory.

REPRESENTATIVENESS

Chain of Custody and Holding Times

Sample custody was maintained under the chain of custody (COC) forms. Forms were signed on release and receipt of samples. Samples were properly preserved; however, 991108BIL09GW, 991108BIL10GW, and 991109BIL13GW did not retain pH < 2 for the metals samples due to the sample matrix. The laboratory added additional preservative to the metal samples; no data were qualified.

One VOA vial for 991108BIL14GW shattered during shipping – the VOA analysis was not effected.

Samples received by the laboratory were within 4° ± 2° C except for sample 991108BIL09GW MSD and corresponding trip blank. 991108BIL09GW MSD and its corresponding trip blank were received at a temperature of 0.9°C. Receipt temperatures were not grossly exceeded (usually defined as 2 times the criteria); therefore, no data were qualified. Extraction and analysis holding times were met for all samples except mercury and Methods 8081A/8082. Mercury was extracted 12 days after the 28 day holding time for 991108BIL09GW to 991108BIL12GW. Sample results were non-detect, no data qualified. Method 8081A/8082 samples 991108BIL09GW to 991108BIL12GW were re-extracted one day after the 7-day holding time due to low BS recoveries associated with Method 8082 analysis. All analytes were qualified as estimated ("UJ").

ACCURACY

Initial and Continuing Calibration

Initial and continuing instrument calibration verification (ICV or CCV) were analyzed at the proper frequency. Prior to samples and quality control samples being analyzed, the laboratory analyzed calibration standards at the concentrations required by the method. The continuing calibration standard acceptance criteria was reported as the average response factor (percent difference, %D) for various organic analyses or as the percent recovery (%R) for inorganic analyses. The %Ds (less than 25%) and %Rs (±15%) were within laboratory control limits with the following exceptions.

- EPA SW-846 Method 8081A CCVs for 4,4'-DDT exceeded the control limit of 25% for samples 991108BIL09GW to 991108BIL12GW, 991109BIL13GW, and 991108BIL14GW. Sample results for 4,4'-DDT were non-detect; therefore, data were qualified as estimated "UJ".

- EPA SW-846 Method 8270B CCV for pentachlorophenol exceeded the control limit of 25% for sample 991108BIL12GW. 991108BIL12GW was non-detect for pentachlorophenol; therefore, data was qualified as estimated “UJ”.
- EPA SW-846 Method 8270B CCV for fluoranthene and di-n-octylphthalate exceeded the control limit of 25% for samples 991109BIL13GW and 991108BIL14GW. Both samples were non-detect for these two analytes; therefore, data was qualified as estimated “UJ”.

Blanks

The laboratory analyzed one method blank with each analytical batch. Eight trip blanks were analyzed for EPA SW-846 Method 8260B. Frequency requirements for method and trip blanks were met. Target analytes in the method and trip blanks were below method reporting limits with the following exception. Bis (2-ethylhexyl) phthalate was detected in the method blank for EPA SW-846 Method 8270B. Sample results were below method reporting limits except for 991108BIL12GW and 991108BIL14GW. 991108BIL12GW and 991108BIL14GW results are less than 10x the blank concentration and were qualified “U”. No other samples were qualified.

Surrogate Recovery

Surrogate recoveries (%Rs) were within project-specific control limits.

Blank Spike

Blank spikes (BS) and if required blank spike duplicates (BSD) were analyzed with each analytical batch, which meets the frequency requirement of five percent. The BS/BSD were within project-specific control limits.

Matrix Spike/Matrix Spike Duplicate

Project-specific matrix spike/matrix spike duplicates (MS/MSD) were not analyzed with each analytical batch. NWTPH-Dx and Methods 8081A/8082 for laboratory ID 911040-1 and –3 did not have an MS/MSD and Mercury for 911040-1 and -3 was not a project-specific sample.

Based on *EPA Guidelines*, no action is taken on MS/MSD organic data alone; therefore, the primary sample will not be qualified due to nonconformance with the organic MS/MSD %Rs. %Rs were within project-specific control limits for the inorganic methods except for mercury. Mercury was below the control limit but between 10 – 40% for samples 991109BIL13GW and 991108BIL14GW. Associated samples were non-detect; and therefore qualified as estimated (“UJ”).

PRECISION

Spike Duplicate

The laboratory analyzed blank and/or matrix spike duplicates with each analytical batch; the relative percent differences (RPDs) were within project-specific control limits.

Laboratory Duplicate

A laboratory duplicate was analyzed for the metals analyses. RPDs were within project-specific control limits.

Field Duplicate

One field duplicate was collected during the sampling event. The field duplicate RPDs were within project-specific control limits of less than 300%.

COMPLETENESS

The laboratory submitted all required deliverables for the requested analyses. The reported analytical results meet the project completeness goal of 95 percent. For all samples collected and analyzed, no data were judged to be invalid. No data were rejected, so completeness for this sampling event is 100 percent.

Based on the QA/QC review, some data were qualified as estimated (“UJ”) due to analytical deviations with the representativeness, precision, and accuracy. Some data were qualified not detected (“U”) due to analytical deviations with accuracy. The following table summarizes the COC IDs and qualified results for all samples covered by this review:

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
7470	991109BIL13GW 991108BIL14GW	Mercury	UJ	MS/MSD Recoveries
8081A/8082	991108BIL09GW 991108BIL10GW 991108BIL11GW 991108BIL12GW	All analytes	UJ	Holding Times CCVs
8081A	991109BIL13GW 991108BIL14GW	4,4’-DDT	UJ	CCVs
8270B	991108BIL09GW 991108BIL10GW 991108BIL11GW 991109BIL13GW 991108BIL14GW	Acenaphthene Di-n-octylphthalate Pentachlorophenol	UJ	CCVs
8270B	991108BIL12GW 991108BIL14GW	Bis(2-ethylhexyl)phthalate	U	Blanks
8270B	991108BIL12GW	Pentachlorophenol	UJ	CCVs
8270B	991109BIL13GW 991108BIL14GW	Fluoranthene Di-n-octylphthalate	UJ	CCVs

The analytical results for five water samples and one field duplicate collected January 10, 2000 at the Bradford Island landfill, were subject to a quality assurance/quality control (QA/QC) review.

This QA/QC review includes evaluation of analytical representativeness, accuracy, precision, and completeness. Representativeness is evaluated by examining chain of custody paperwork and verifying analysis was performed within allowable holding times; accuracy is evaluated using the analytical results for blanks, surrogates, matrix spikes and blank spikes; precision is evaluated by comparison of results for primary and sample duplicate analyses and laboratory duplicate analyses; and completeness is evaluated by calculating the percentage of acceptable data.

The data quality review process followed the procedures specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, October 1999) and Inorganic Data Review (USEPA, February 1994).*

MultiChem Analytical Services of Renton, Washington analyzed all samples, except the QA samples sent to the USACE lab in Omaha, Nebraska. Samples were collected and analyzed according to the Sampling and Analysis Plan (URS, September 1999). Samples were analyzed for one or more of the following methods: Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc) by EPA SW-846 Method 6010/7000 Series, Semivolatile Organic Compounds by EPA SW-846 Method 8270B, Volatile Organic Compounds by EPA SW-846 Method 8260B, Organochlorinated Pesticides and Polychlorinated Biphenyls by EPA SW-846 Method 8081A/8082, Chlorinated Herbicides by EPA SW-846 Method 8151A, and Total Petroleum Hydrocarbons by NWTPH-Dx and NWTPH-Gx. Well designation, chain of custody (COC) identification (ID), and laboratory ID are cross-referenced below.

WELL DESIGNATION	COC ID	LABORATORY ID
MW – 2	000110BIL15GW	001023-1
-	Trip Blank	001023-2
MW – 4	000110BIL16GW	001023-3
-	Trip Blank	001023-4
-	Trip Blank	001023-5
-	Trip Blank	001023-6
MW – 4 field duplicate	000110BIL17GW	001023-7
-	Trip Blank	001023-8
MW – 3	000110BIL18GW	001023-9
-	Trip Blank	001023-10
MW – 5	000110BIL19GW	001023-11
-	Trip Blank	001023-12
MW – 1	000110BIL20GW	001023-13
-	Trip Blank	001023-14

All analytical data are usable as reported. No data were rejected during this review. Analytical deviations from the reference methods are presented below. The reporting limits for some analytes differed slightly from those listed in the Quality Assurance Plan (QAP, URS, September 1999). In general, the reported values were lower than those listed in the QAP and/or any applicable ARARs, and therefore the reporting limits meet the project objectives. Compounds detected below the reporting limit but above the method detection limit are considered estimates and are qualified "J" by the laboratory.

REPRESENTATIVENESS

Chain of Custody and Holding Times

Sample custody was maintained under the chain of custody (COC) forms. Forms were signed on release and receipt of samples. Samples were properly preserved, except for the following (since temperatures are a function of preservation).

Sample 000110BIL19GW and the corresponding trip blank were received by the laboratory within 4° ± 2° C. All other samples and trip blanks were received at temperatures below 2.0°C; no samples were received frozen. Receipt temperatures were not grossly exceeded (usually defined as 2 times the criteria); therefore, no data were qualified.

Extraction and analysis holding times were met for all samples.

ACCURACY

Initial and Continuing Calibration

Initial and continuing instrument calibration verification (ICV or CCV) were analyzed at the proper frequency. Prior to samples and quality control samples being analyzed, the laboratory analyzed calibration standards at the concentrations required by the method. The continuing calibration standard acceptance criteria was reported as the response factor percent difference (%D) for various organic analyses or as the percent recovery (%R) for inorganic analyses. Except where noted below, the %Ds and %Rs were within the method control limits and USEPA validation criteria.

- EPA SW-846 Method 8260B CCVs for acetone and/or 2-butanone exceeded the EPA control limit of 25% for all samples. All associated sample results for acetone and/or 2-butanone were non-detect; therefore, data were qualified as estimated "UJ".
- EPA SW-846 Method 8270C CCVs for aniline, bis(2-chloroisopropyl)ether, hexachlorocyclopentadiene, 4-nitroaniline, benzidine, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene exceeded the EPA control limit of 25% for all samples. All sample results for these compounds were non-detect; therefore, data were qualified as estimated "UJ".

- EPA SW-846 Method 8151A CCVs for Dalapon, MCPA, 2,4-D, Silvex, Dicamba, MCPP, 2,4,5-TP, and Dichlorprop exceeded the method control limit of 15%D for all samples (note: there is no specific EPA validation criteria for chlorinated herbicides; therefore, method control limits were used). The average %D for all compounds also exceeded the method control limit of 15%. All sample results for these compounds were non-detect; therefore, data were qualified as estimated "UJ".
- EPA SW-846 Method 7740A CCV for selenium exceeded the EPA upper control limit of 110% for sample 000110BIL20GW. The sample result for this compound was qualified as estimated "J". Selenium was not detected in the remaining samples; therefore, no qualification of the data was necessary.
- EPA SW-846 Method 6010B/7000A CCVs for lead and silver exceeded the EPA upper control limit of 110% for all samples. These analytes were not detected in the samples; therefore, no qualification of the data was necessary.

Blanks

The laboratory analyzed one method blank with each analytical batch. Eight trip blanks were analyzed for EPA SW-846 Method 8260B. Frequency requirements for method and trip blanks were met. Target analytes in the method and trip blanks were below method reporting limits.

Bis(2-ethylhexyl)phthalate and diethylphthalate were detected in the EPA SW-846 Method 8270C blank at concentrations of 0.59 ug/L and 0.15 ug/L, respectively. As stated, these values were below the reporting limits. EPA validation criteria require that sample concentrations of common laboratory contaminants (including bis(2-ethylhexyl)phthalate and diethylphthalate) less than ten times the associated blank concentration be qualified as non-detect "U". Bis(2-ethylhexyl)phthalate was detected in samples 000110BIL16GW, 000110BIL17GW, 000110BIL18GW, and 000110BIL19GW at concentrations less than ten times the associated blank concentration; therefore, the reported sample results were raised to the reporting limit and qualified as non-detect "U". Bis(2-ethylhexyl)phthalate was also detected in samples 000110BIL15GW and 000110BIL20GW. However, the concentrations in these samples were greater than ten times the associated blank value; therefore, no qualification of the data was necessary. Diethylphthalate was detected in samples 000110BIL15GW and 000110BIL20GW at concentrations less than ten times the associated blank concentration; therefore, the reported sample results were raised to the reporting limit and qualified as non-detect "U".

Surrogate Recovery

The recoveries of tetrachloro-m-xylene (TCX) were below the project-specific control limits for the EPA SW-846 Method 8081A/8082 method blank (pesticide/PCB) and laboratory control sample (pesticide only) associated with all of the samples. The recoveries for this surrogate were within the control limits in all of the samples, and no pesticides or PCBs were detected in the samples. Therefore, no qualification was made to the data. However, the recovery of decachlorobiphenyl (DCB) was below the control limits in the EPA SW-846 Method

8081A/8082 analysis of sample 000110BIL19. Sample results were non-detect; therefore, all results from this analysis were qualified as estimated "UJ".

All other surrogate recoveries for all fractions were within project-specific control limits.

Blank Spike

Blank spikes (BS) were analyzed with each analytical batch, which meets the frequency requirement of five percent.

The EPA SW-846 Method 8081A BS recoveries for gamma-BHC, heptachlor, and aldrin were below the project-specific control limits. However, the matrix spike/matrix spike duplicate recoveries were within the control limits, and these compounds were not detected in the samples. Therefore, no qualifications were made to the data.

The EPA SW-846 Method 8082 BS control limits reported by the laboratory were not those listed in the approved QAP. However, the QAP indicated that the control limits specified were only advisory, due to lack of sufficient data. Statistically-based control limits would be developed when sufficient data were available. All EPA SW-846 Method 8082 BS results were within the control limits reported by the laboratory.

The EPA SW-846 Method 8151A BS recoveries of Dalapon and Dinoseb were below the project-specific control limits. All sample results for Dalapon were previously qualified for CCV control limit exceedances; therefore, no further qualification of the data was necessary. In addition to low BS recovery, the matrix spike/matrix spike duplicate (MS/MSD) recoveries of Dinoseb were below the project-specific control limits. Based on the intent of EPA validation guidelines, the non-detect results for Dinoseb were qualified as estimated "UJ".

The EPA SW-846 Method 8151A BS recovery of 2,4,5-T was above the project-specific control limits. However, this compound was not detected in the associated samples, and no qualification was made to the data.

The BS recoveries for all other parameters were within project-specific control limits.

Matrix Spike/Matrix Spike Duplicate

Based on EPA Guidelines, no action is taken on MS/MSD organic data alone. However, used in conjunction with the BS results, and exercising professional judgement, the results for Dinoseb were qualified as estimated "UJ" in the EPA SW-846 Method 8151A analyses of all samples (see discussion in BS section above).

The percent recoveries for all other parameters were within project-specific control limits.

PRECISION

Spike Duplicate

The laboratory analyzed matrix spike duplicates with each analytical batch for the organic fractions. The MS/MSD relative percent differences (RPDs) for 4-nitrophenol and pentachlorophenol (EPA SW-846 Method 8270C) and for Dinoseb (EPA SW-846 Method

8151A) were outside the project-specific control limits. However, there are no EPA validation criteria for RPDs, and no qualification was made to the data. All other RPDs were within project-specific control limits

Laboratory Duplicate

A laboratory duplicate was analyzed for the metals analyses. RPDs were within project-specific control limits.

Field Duplicate

One field duplicate was collected during the sampling event. The field duplicate RPDs were within project-specific control limits of less than 300%.

COMPLETENESS

The laboratory submitted all required deliverables for the requested analyses. The reported analytical results meet the project completeness goal of 95 percent. For all samples collected and analyzed, no data were judged to be invalid. No data were rejected, so completeness for this sampling event is 100 percent.

Based on the QA/QC review, some data were qualified as estimate (“UJ”) due to analytical deviations with the representativeness, precision, and accuracy. The following table summarizes the sample IDs and qualified results for all samples covered by this review:

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
8260B	000110BIL15GW 000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW 000110BIL20GW Trip Blanks (All 8)	Acetone	UJ	CCVs
8260B	000110BIL15GW 000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW 000110BIL20GW Trip Blanks (1 of 8)	2-Butanone	UJ	CCVs

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
8270C	000110BIL15GW 000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW 000110BIL20GW	Aniline Bis(2-chloroisopropyl)ether Hexachlorocyclopentadiene 4-Nitroaniline Benzidine Indeno(1,2,3-cd)pyrene Benzo(g,h,i)perylene	UJ	CCVs
8270C	000110BIL15GW 000110BIL20GW	Diethylphthalate	U	Method Blank
8270C	000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW	Bis(2-ethylhexyl)phthalate	U	Method Blank
8081A/8082	000110BIL19GW	All Pesticides/PCBs	UJ	Surrogates
8151A	000110BIL15GW 000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW 000110BIL20GW	Dinoseb	UJ	BS/MS/MSD
8151A	000110BIL15GW 000110BIL16GW 000110BIL17GW 000110BIL18GW 000110BIL19GW 000110BIL20GW	Dalapon MCPA 2,4-D Silvex 2,4,5-T Dicamba MCPP Dichlorprop	UJ	CCVs
7740A	000110BIL20GW	Selenium	J	CCV

The analytical results for one groundwater seep plus field duplicate, one surface soil plus one field duplicate and two trip blanks were collected April 13, 2000 at the Bradford Island landfill, were subject to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of analytical representativeness, accuracy, precision, and completeness. Representativeness is evaluated by examining chain-of-custody paperwork, verifying analysis was performed within allowable holding times, and comparing total versus dissolved analytes for metals analyses. Accuracy is evaluated using the analytical results for blanks, surrogates, internal standards, matrix spikes and laboratory control samples. Precision is evaluated by comparison of results for primary and sample duplicate analyses and laboratory duplicate analyses. Completeness is evaluated by calculating the percentage of acceptable data.

The data quality review process followed the procedures specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, October 1999) and Inorganic Data Review (USEPA, February 1994).*

North Creek Analytical (NCA) of Bothell, Washington analyzed the samples for volatiles, semivolatiles, pesticides/PCBs and metals, while Columbia Analytical Services, Inc. (CAS) of Kelso, Washington analyzed the samples for herbicides, NWTPH-Gx and NWTPH-Dx. Samples were collected and analyzed according to the Sampling and Analysis Plan (URSGWC, September 1999). Samples were analyzed for one or more of the following methods: Total/Dissolved/Leachable Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc) by EPA SW-846 Methods 1312/6010B/6020/7000A Series, Semivolatile Organic Compounds (SVOC) by EPA SW-846 Method 8270C, Volatile Organic Compounds (VOC) by EPA SW-846 Method 8260B, Organochlorinated Pesticides and Polychlorinated Biphenyls (PCBs) by EPA SW-846 Methods 8081A/8082, Chlorinated Herbicides by EPA SW-846 Method 8151A, and Total Petroleum Hydrocarbons by NWTPH-Dx and NWTPH-Gx. Field sample identifications (IDs) and laboratory IDs are cross-referenced below.

FIELD ID	LABORATORY ID	
	NCA	CAS
000413BIL21GW	BOD0283-01	K2002774-001
000413BIL22GW	BOD0283-02	K2002774-002
Trip Blank	BOD0283-03	K2002774-003
000413BIL13SS	BOD0284-01	K2002774-004
000413BIL14SS	BOD0284-02	K2002774-005

All analytical data are usable as reported, except for those results, which were rejected due to severe QC outliers. Analytical deviations requiring data validation qualification from the reference methods are presented below. The reporting limits for some analytes differed slightly from those listed in the Quality Assurance Project Plan (QAPP, URSGWC, September 1999). In general, the reported values were lower than those listed in the QAPP and/or any applicable ARARs.

The soil reporting limits for VOC analyses from the April 2000 sampling event are several orders of magnitude greater than previous sampling events. This was due to the use of methanol preservation/medium level analysis techniques. Therefore, the VOC reporting limits for soils exceed project-specific action levels for several compounds (i.e., 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2,3-trichloropropane, 1,2-dibromoethane, 1,2-dichloroethane, bromodichloromethane, methylene chloride and vinyl chloride).

The laboratories do not report any values between the method detection limits and the method reporting limits. These values are typically qualified "J" and considered estimated. Also, the reported soil detection limits are on a wet-weight basis, rather than on a dry-weight basis. Therefore, the reported soil detection limits should be considered low-biased.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

Sample custody was maintained under the chain-of-custody (COC) forms, and was properly executed upon during sample transfer. Samples were properly preserved and received intact at the laboratories.

Extraction and analysis holding times were met for all samples.

Total versus Dissolved Concentrations

The dissolved metals concentrations were greater than their respective total concentrations for the following samples.

Field ID	Metal	Total Concentration	Dissolved Concentration
000413BIL21GW	Barium	71.4 µg/L	90.4 µg/L
	Manganese	1460 µg/L	1530 µg/L
	Zinc	<10.0 µg/L	<10.0 µg/L
000413BIL22GW	Antimony	<1.0 µg/L	2.28 µg/L
	Barium	77.0 µg/L	464 µg/L
	Zinc	<10.0 µg/L	85.6 µg/L

Since EPA Guidelines do not have any criteria for total versus dissolved concentration evaluation, no further qualifications were required.

ACCURACY

Initial and Continuing Calibration

Initial and continuing instrument calibration verifications (ICV or CCV) were analyzed at the proper frequency. Prior to field and QC sample analysis, the laboratories analyzed calibration standards at the concentrations required by the method. The ICV and CCV standard acceptance criteria was reported as the response factor relative percent difference (%RSD) and percent difference (%D), respectively, for various organic analyses or as the percent recovery (%R) for inorganic analyses. Except where noted below, the %RSDs, %Ds and %Rs were within the method control limits and USEPA validation criteria.

- EPA SW-846 Method 8260B CCV for 2,2-dichloropropane, toluene, dichlordifluoroethane, 1,2-dibromo-3-chloropropane and naphthalene exceeded the EPA QC limit of 25% for the soil samples. All associated sample results for these compounds were non-detect; therefore, data were qualified as estimated “UJ”.
- EPA SW-846 Method 8260B CCV for acetone, 2-butanone, 2-hexanone and 4-methyl-2-pentanone exceeded the EPA QC limit of 25% for trip blank sample. Since these compounds were non-detect, the data were qualified as estimated “UJ”.
- EPA SW-846 Method 8260B CCV for acetone and methylene chloride exceeded the EPA QC limit of 25% for groundwater seep samples. Since these compounds were non-detect in the associated samples, the data were qualified as estimated “UJ”.
- EPA SW-846 Method 8270C CCV for 2-nitrophenol, 4-chloroaniline, hexachlorocyclopentadiene, 2,4-dinitrophenol, 2,4-dinitrotoluene, 4,6-dinitro-2-methylphenol, carbazole and 3,3’-dichlorobenzidine exceeded the EPA QC limit of 25% for the soil samples. All sample results for these compounds were non-detect; therefore, data were qualified as estimated “UJ”.
- EPA SW-846 Method 8081A CCV percent breakdown of endrin exceeded the QC limit of 15% for the groundwater seep samples. Since endrin and its associated breakdown products (i.e., endrin aldehyde and endrin ketone) were not detected in the aqueous samples, no qualification of the data was necessary.

Blanks

The laboratories analyzed one method/preparation blank with each analytical batch. One trip blank was analyzed for EPA SW-846 Method 8260B and one for NWTPH-Gx. Frequency requirements for method/preparation and trip blanks were met. No target analytes were detected in the method/preparation and trip blanks, except where noted below.

Tetrachloroethene was detected in the EPA SW-846 Method 8260B trip blank at a concentration of 5.94 ug/L. Since this compound was not detected in the groundwater seep samples, no further qualifications were required.

Bis(2-ethylhexyl)phthalate was detected in the EPA SW-846 Method 8270C soil blank at a concentration of 113 μg/kg. EPA validation criteria require that sample concentrations of common laboratory contaminants (including bis(2-ethylhexyl)phthalate) less than ten times the associated blank concentration be qualified as non-detect "U". Bis(2-ethylhexyl)phthalate was detected in sample 000413BIL13SS at a concentrations less than ten times the associated blank concentration; therefore, the reported sample result was qualified as non-detect "U".

Iron was detected in the EPA SW-846 Method 6010B soil blank at a concentration of 0.368 mg/kg, and in samples 000413BIL21GW and 000413BIL22GW. However, the concentrations in these samples were greater than ten times the associated blank value; therefore, no qualification of the data was necessary.

Surrogate Recovery

The recovery of 1,2-dichloroethane-d_4 for the trip blank, soil sample 000413BIL13SS, soil method blank, aqueous/soil laboratory control samples (LCS) and soil matrix spike/matrix spike duplicate (MS/MSD) was below EPA SW-846 Method 8260B QC limits. It appears the surrogate outliers may be due to laboratory QA problems, rather than matrix interference. The VOC results for the trip blank and soil sample 000413BIL13SS were qualified as estimated "J"/"UJ".

The recoveries of nitrobenzene-d_5, 2-fluorobiphenyl and/or terphenyl-d_{14} for the groundwater seep sample 000413BIL21GW, aqueous LCS and aqueous MS were below EPA SW-846 Method 8270C QC limits. The SVOC base neutral results for groundwater seep sample 000413BIL21GW were qualified as estimated "J"/"UJ".

All other surrogate recoveries for all fractions were within project-specific control limits.

Internal Standard Recovery

The recovery of perylene-d_{12} for groundwater seep sample 000413BIL22GW and soil sample 000413BIL14SS was severely below (i.e., <10%) EPA SW-846 Method 8270C QC limits. The associated compounds for these two samples were rejected ("R") since they were non-detect. The samples were reanalyzed with similar results, which substantiates matrix interference. However, the laboratory did not report the reanalysis data.

All other internal standard recoveries for all fractions were within project-specific control limits.

Laboratory Control Sample

Laboratory control samples (LCS) were analyzed with each analytical batch, which meets the frequency requirement of five percent.

- The EPA SW-846 Method 8260B soil LCS recovery of 1,1-dichloroethene was below the project-specific QC limits. In addition to low LCS recovery, the soil MS/MSD recoveries of 1,1-dichloroethene were also below the project-specific QC limits. Based on the intent of EPA validation guidelines, the non-detect results for 1,1-dichloroethene were qualified as estimated "UJ" in soil sample 000413BIL14SS. The 1,1-dichloroethene result for soil sample

000413BIL13SS was previously qualified for a surrogate QC limit exceedance; therefore, no further qualification for this sample was necessary.

- The EPA SW-846 Method 8270CB aqueous LCS recoveries of acenaphthene, 2-chlorophenol, phenol and pyrene were below the project-specific QC limits. In addition to low LCS recoveries, the aqueous MS/MSD recoveries of pyrene were also below the project-specific QC limits. Based on the intent of EPA validation guidelines, only the non-detect results for pyrene were qualified as estimated "UJ" in the groundwater seep samples.
- The EPA SW-846 Method 8270CB soil LCS recoveries of acenaphthene and 2-chlorophenol were below the project-specific QC limits. However, the soil MS/MSD recoveries were within the project-specific QC limits, and these compounds were not detected in the samples. Therefore, no qualifications were made to the data.

The LCS recoveries for all other parameters were within project-specific control limits.

Matrix Spike/Matrix Spike Duplicate

Based on EPA Guidelines, no action is taken on MS/MSD organic data alone. However, used in conjunction with the LCS results, and exercising professional judgement, the soil results for 1,1-dichloroethene and the aqueous results for pyrene were qualified as estimated "UJ" in the EPA SW-846 Methods 8260B and 8270C analyses of all applicable samples (see discussion in LCS section above).

- As for inorganic analyses, MS/MSD exceedances require further qualification without review of other QC results. The EPA SW-846 Method 6020 aqueous recovery for dissolved manganese was below the project-specific QC limits. The results for groundwater seep samples were qualified as estimated "J".
- The EPA SW-846 Method 6020 soil MS/MSD recoveries of copper, nickel and selenium were below the project-specific QC limits. The results for soil samples were qualified as estimated "J". In addition, the soil antimony recoveries were 0% percent, therefore, the antimony results were qualified as rejected ("R"). The iron, manganese and barium recoveries were diluted out due to high levels in the parent sample (i.e., parent sample concentration greater than 4 times in the spike level), and require no further qualification.

The percent recoveries for all other parameters were within project-specific control limits.

PRECISION

Spike Duplicate

The laboratory analyzed matrix spike duplicates with each analytical batch for the organic and inorganic fractions. The aqueous MS/MSD relative percent differences (RPDs) for acenaphthalene, 4-nitrophenol, 2,4-dinitrotoluene, 4,6-dinitro-2-methylphenol, n-nitrosodi-n-propylamine and pyrene (EPA SW-846 Method 8270C) were outside the project-specific control limits. However, there are no EPA validation criteria for organic RPDs, and no qualification was made to the groundwater seep data.

The aqueous RPD for manganese, and the soil RPD for copper and nickel (EPA SW-846 Method 6020) were outside the project-specific control limits. However, since these metal results were previously qualified as estimated, as noted above, no further qualification was necessary.

All other RPDs were within project-specific control limits.

Laboratory Duplicate

No laboratory duplicates were analyzed for the metals analyses. Instead, the laboratory analyzed MSDs, which supplemented laboratory duplicate analyses. The results for the MSDs were evaluated for precision, as noted above.

Field Duplicate

Two field duplicates were collected during this sampling event, one for each matrix. The field duplicate RPDs were within project-specific control limits of less than 300% for aqueous samples and less than 500% for soil samples.

COMPLETENESS

The laboratory submitted all required deliverables for the requested analyses. The total number of compounds/analytes expected is 394. A total of 14 compounds/analytes were rejected due to severe QC outliers, as noted above. The reported analytical results did not meet the project completeness goal of 98 percent, but did meet the analytical method percent completeness goal of 95 percent. For all samples collected and analyzed, the total completeness for this sampling event is 96 percent [(394-14)/394 x 100).

Of particular note, NCA did not report the following compounds, which were reported during previous investigations: 2-chlorovinyl vinyl ether (aqueous) and vinyl acetate (aqueous and soil) (Method 8260B); benzidine (soil) and n-nitrosodimethylamine (soil) (Method 8270C); and endrin ketone (aqueous and soil) (Method 8081A). This variance was not accounted for in the percent completeness tabulation.

Based on the QA/QC review, some data were qualified as estimate (“UJ”) and rejected (“R”) due to analytical deviations with the representativeness, precision, and accuracy. The following table summarizes the sample IDs and qualified results for all samples covered by this review:

METHOD	FIELD ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS

METHOD	FIELD ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
8260B	000413BIL21GW 000413BIL22GW	Acetone Methylene Chloride	UJ	CCVs
8260B	000413BIL13SS Trip Blank	All Target Compounds	UJ	Surrogates
8260B	000413BIL13SS 000413BIL14SS	1,1-Dichloroethene	UJ	LCS/MS/MSDs
8260B	000413BIL13SS 000413BIL14SS	2,2-dichloropropane toluene dichlordifluoroethane 1,2-dibromo-3-chloropropane naphthalene	UJ	CCVs
8260B	Trip Blank	Acetone 2-Butanone 2-Hexanone 4-Methyl-2-pentanone	UJ	CCVs
8270C	000413BIL21GW	All Base Neutral Compounds	UJ	Surrogates
8270C	000413BIL22GW 000413BIL14SS	Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R	Internal Standards
8270C	000413BIL13SS 000413BIL14SS	2-nitrophenol 4-chloroaniline hexachlorocyclopentadiene 2,4-dinitrophenol 2,4-dinitrotoluene 4,6-dinitro-2-methylphenol carbazole 3,3'-dichlorobenzidine	UJ	CCVs
8270C	000413BIL21GW 000413BIL22GW	Pyrene	UJ	LCS/MS/MSDs
8270C	000413BIL13SS	bis(2-Ethylhexyl)phthalate	U	Method Blank
6020	000413BIL21GW 000413BIL22GW	Dissolved Manganese	J	MS/MSD
6020	000413BIL13SS 000413BIL14SS	Copper Nickel Selenium	J	MS/MSD
6020	000413BIL13SS 000413BIL14SS	Antimony	R	MS/MSD

Quality Assurance/Quality Control Review of Laboratory Analytical Data
Surface Soil Samples – September 20-21, 1999 - Bradford Island Landfill

The analytical results for ten surface soil samples and one field duplicate collected September 20 and 21, 1999 at the Bradford Island landfill were subject to a quality assurance/quality control (QA/QC) review.

This QA/QC review includes evaluation of analytical representativeness, accuracy, precision, and completeness. Representativeness is evaluated by examining chain of custody paperwork and verifying analysis was performed within allowable holding times; accuracy is evaluated using the analytical results for blanks, surrogates, matrix spikes and blank spikes; precision is evaluated by comparison of results for primary and sample duplicate analyses and laboratory duplicate analyses; and completeness is evaluated by calculating the percentage of acceptable data.

The data quality review process followed the procedures specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (EPA Guidelines) (EPA 1994).*

MultiChem Analytical Services of Renton, Washington analyzed all samples, except the QA samples sent to the USACE lab in Omaha, Nebraska. Samples were collected and analyzed according to the Sampling and Analysis Plan (URS, September 1999). Samples were analyzed for one or more of the following analyses: Moisture by CLP SOW ILM04.0, Total and Synthetic Precipitation Leaching Procedure (SPLP) Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc) by EPA SW-846 Method 6010/7000 Series, Semivolatile Organic Compounds by EPA SW-846 Method 8270B, Volatile Organic Compounds by EPA SW-846 Method 8260B, Organochlorinated Pesticides and Polychlorinated Biphenyls by EPA SW-846 Method 8081A/8082, Chlorinated Herbicides by EPA SW-846 Method 8151A, and Total Petroleum Hydrocarbons by NWTPH-HCID followed by NWTPH-Dx and NWTPH-Gx/BETX, if required. Site designation, chain of custody (COC) identification (ID), and laboratory ID are cross-referenced below.

SITE DESIGNATION	COC ID	LABORATORY ID
NW Corner Pesticide Pad	990920BIL01SS	909048-1
NE Corner Pesticide Pad	990920BIL02SS	909048-2
Test Pit 8	990920BIL03SS	909048-3
Test Pit 7	990920BIL04SS	909048-4
Test Pit 1	990920BIL05SS	909048-5
Test Pit 5	990920BIL06SS	909048-6
Test Pit 5 field duplicate	990920BIL08SS	909048-7
Between Test Pits 1 & 8	990920BIL09SS	909048-8
E of Test Pit 8	990920BIL10SS	909048-9
W of Test Pit 7	990920BIL11SS	909048-10
NW of MW – 3	990920BIL12SS	909048-11

All analytical data are usable as reported. No data were rejected during this review. Analytical deviations from the reference methods are presented below. Reporting limits meet the project objectives. Compounds detected below the reporting limit but above the method detection limit are considered estimates and are qualified "J" by the laboratory.

REPRESENTATIVENESS

Chain of Custody and Holding Times

Sample custody was maintained under the chain of custody (COC) forms. Forms were signed on release and receipt of samples.

Samples received by the laboratory were within 4° ± 2° C. Extracting and analyses holding times were met for all samples with the following exception. Samples 990920BIL01SS to 990920BIL06SS and samples 990920BIL08SS to 990920BIL12SS were re-extracted 25 days after the recommended holding time for Method 8082 due the blank spike recoveries being below laboratory recovery limits. Sample results were non-detect for 990920BIL09SS to 990920BIL12SS and therefore qualified as estimated "UJ". Samples 990920BIL01SS to 990920BIL06SS and sample 990920BIL08SS were non-detect for all analytes except Aroclor 1260; therefore, the non-detects were qualified as estimated "UJ" and the Aroclor 1260 results were qualified estimated "J".

ACCURACY

Review of Initial and Continuing Calibration

Initial and continuing instrument calibration verification (ICV or CCV) were analyzed at the proper frequency. Prior to samples and quality control samples being analyzed, the laboratory analyzed calibration standards at the concentrations required by the method. The continuing calibration standard acceptance criteria was reported as the average response factor (percent difference, %D) for various organic analyses or as the percent recovery (%R) for inorganic analyses. The %Ds (less than 25%) and %Rs (±15%) were within laboratory control limits with the following exceptions.

- EPA SW-846 Method 7740 ending CCV for samples 990920BIL05SS, 990920BIL09SS, 990920BIL10SS, and 990920BIL12SS was below required control limit; however, the CCV fell between 75 – 89% range. Sample results were non-detect; therefore, results were qualified as estimated ("UJ").
- EPA SW-846 Method 8081A CCVs for samples 990920BIL01SS to 990920BIL06SS exceeded the control limit of 25% for alpha-BHC, gamma-BHC, heptachlor, and delta-BHC. Sample results were non-detect and therefore qualified as estimated "UJ".
- EPA SW-846 Method 8081A CCVs for samples 990920BIL08SS to 990920BIL12SS exceeded the control limit of 25% for alpha-BHC and 4,4'-DDT. Sample results were non-detect and therefore qualified as estimated "UJ".

- EPA SW-846 Method 8082 CCV for samples 990920BIL01SS to 990920BIL06SS and samples 990920BIL08SS to 990920BIL12SS exceeded the control limit of 25% for Aroclor 1260. Sample results were non-detect for 990920BIL09SS to 990920BIL12SS and therefore qualified as estimated “UJ”. Samples 990920BIL01SS to 990920BIL06SS and sample 990920BIL08SS were non-detect for all analytes except Aroclor 1260; therefore, the non-detects were qualified as estimated “UJ” and the Aroclor 1260 results were qualified estimated “J”.
- EPA SW-846 Method 8270B for samples 990920BIL03SS and 990920BIL05SS exceeded the control limit of 25% for di-n-octylphthalate. Samples were non-detect and therefore qualified as estimated “UJ”.

Review of Blanks

The laboratory analyzed one method blank for each analytical batch. No rinse or trip blanks were required for this sampling round. Frequency requirements for method blanks were met. Target analytes in the method blanks were below method reporting limits.

Surrogate Recovery Review

Surrogate recoveries were within project-specific control limits with the following exceptions.

- EPA SW-846 Method 8082 surrogate recoveries for samples 990920BIL06SS, 990920BIL08SS, and 990920BIL09SS were below surrogate control limits for decachlorobiphenyl. Samples 990920BIL06SS and 990920BIL08SS were non-detect and therefore qualified as estimated “UJ”. Sample 990920BIL09SS was non-detect for all analytes except Aroclor 1260. Non-detects were qualified as estimated “UJ” and Aroclor 1260 was qualified as estimate “J”.
- EPA SW-846 Method 8260B surrogate recoveries for samples 990920BIL03SS, 990921BIL12SS, and samples 990920BIL08SS to 990920BIL10SS exceeded the upper surrogate control limits for bromofluorobenzene. Samples were qualified as estimated “UJ” for non-detects and “J” for detected analytes.

Blank Spike Review

Blank spikes (BS) and if required blank spike duplicates (BSD) were analyzed with each analytical batch, which meets the frequency of five percent. The BS/BSD recoveries were within project-specific control limits with the following exceptions. Methods 8081A, 8151A, and 8270B had BS recoveries that exceeded the upper control limits. However, the associated samples were all non-detect; therefore, no data were qualified.

Matrix Spike/Matrix Spike Duplicate Review

Project-specific matrix spike/matrix spike duplicates (MS/MSD) were analyzed with each analytical batch, which meets the frequency of five percent.

Based on *EPA* Guidelines, no action is taken on MS/MSD organic data alone; therefore, the primary sample will not be qualified due to nonconformance with the organic MS/MSD %Rs. The %Rs were within project-specific control limits for the inorganic methods with the following exceptions.

- EPA SW-846 Method 6010 Copper and Lead were outside the control limits for the MS. A post digest spike was analyzed for copper and lead; recoveries were within required control limits. Copper and Lead were detected for all samples; therefore, samples were qualified as estimated (“J”).
- EPA SW-846 Method 6010 SPLP Iron exceeded the upper control limits for the MS. A post digest spike was analyzed; iron recovery was within required control limits. Iron was detected for all samples; therefore, samples were qualified as estimated (“J”).

PRECISION

Spike Duplicate Review

The laboratory analyzed blank and/or matrix spike duplicates with each analytical batch; the relative percent differences (RPDs) were within project-specific control limits.

Laboratory Duplicate Review

A laboratory was analyzed for the metal analyses. RPDs were within project-specific control limits with the following exception.

SAMPLE ID	METHOD	ANALYTE	RESULT %RPD	QC LIMIT %RPD
990920BIL06SS	6010	Copper	34.4	20

- Results from a duplicate analysis fell outside the appropriate fixed control window for copper. All associated samples were detected; therefore, the samples were qualified as estimated (“J”).

Serial Dilutions Review

One serial dilution was performed on this sample delivery group. The serial dilution was within the control limits of 10% with the following exceptions.

SAMPLE ID	METHOD	ANALYTE	RESULT %RPD	QC LIMIT %RPD
990920BIL06SS	6010	Lead	13.9	10
		Zinc	11.2	

- All associated samples were detected for Lead and Zinc; therefore, the associated data were qualified as estimated (“J”).

Field Duplicate Review

One field duplicate was collected during the sampling event. The field duplicate RPDs were within project-specific control limit or less than 500%.

COMPLETENESS

The laboratory reported all requested analyses and the laboratory report is complete. The project completeness goal is 95 percent. For all samples collected and analyzed, no data were judged to be invalid. No data were rejected, so completeness for this sampling event is 100 percent.

The following table summarizes the sample IDs and qualified results for all samples covered by this review:

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
7740	990920BIL05SS 990920BIL09SS 990920BIL10SS 990920BIL12SS	Selenium	UJ	CCV
6010	990920BIL01SS 990920BIL02SS 990920BIL03SS 990920BIL04SS 990920BIL05SS 990920BIL06SS 990920BIL08SS 990920BIL09SS 990920BIL10SS 990920BIL11SS 990920BIL12SS	Copper, Lead, Zinc	J	Matrix Spike, Laboratory Duplicate, Serial Dilution
6010 SPLP	990920BIL01SS 990920BIL02SS 990920BIL03SS 990920BIL04SS 990920BIL05SS 990920BIL06SS 990920BIL08SS 990920BIL09SS 990920BIL10SS 990920BIL11SS 990920BIL12SS	Iron	J	Matrix Spike
8081A	990920BIL01SS	alpha-BHC	UJ	CCV

METHOD	COC ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
	990920BIL02SS 990920BIL03SS 990920BIL04SS 990920BIL05SS 990920BIL06SS	gamma-BHC Heptachlor delta-BHC		
8081A	990920BIL08SS 990920BIL09SS 990920BIL10SS 990920BIL11SS 990920BIL12SS	alpha-BHC 4,4’-DDT	UJ	CCV
8082	990920BIL01SS 990920BIL02SS 990920BIL03SS 990920BIL04SS 990920BIL05SS 990920BIL06SS 990920BIL08SS	Aroclor 1016	UJ	Holding Time, CCVs, Surrogates
		Aroclor 1221	UJ	
		Aroclor 1232	UJ	
		Aroclor 1242	UJ	
		Aroclor 1248	UJ	
		Aroclor 1254	UJ	
		Aroclor 1260	J	
8082	990920BIL09SS 990920BIL10SS 990920BIL11SS 990920BIL12SS	Aroclor 1016	UJ	Holding Time, CCVs, Surrogates
		Aroclor 1221	UJ	
		Aroclor 1232	UJ	
		Aroclor 1242	UJ	
		Aroclor 1248	UJ	
		Aroclor 1254	UJ	
		Aroclor 1260	UJ	
8260B	990920BIL03SS	All analytes except Tetrachloroethene	UJ	Surrogates
		Tetrachloroethene	J	
	990920BIL08SS	All analytes	UJ	
	990920BIL09SS			
	990920BIL10SS			
	990920BIL12SS			
8270B	990920BIL03SS	Di-n-octylphthalate	UJ	CCVs
	990920BIL05SS			

Forty-eight soil samples, six soil duplicate samples, one trip blank, and one equipment rinsate were collected by URS on December 4, 2001 through December 6, 2001 at the Bradford Island site in Cascade Locks, Oregon as part of the Bradford Island Preliminary Assessment and Site Investigation. The analytical results for the soil samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (degree to which the sample represents the environmental condition), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). This review addresses only those problems that affect data usability

The data quality review process followed the procedures outlined in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, October 1999) and *Inorganic Data Review* (USEPA, February 1994), where applicable. No raw data were reviewed and no results were recalculated.

Samples were collected according to the Sampling and Analysis Plan (SAP) for the Bradford Island Landfill Phase II supplemental site investigation (URS, 2001). Severn Trent Laboratories – Seattle, Inc., (STL) (formerly Sound Analytical Resources, Inc.) located in Tacoma, Washington analyzed the samples for the following parameters:

Method	Analytical Parameter
8260B	Volatile Organic Compounds (VOCs)
8270C	Semivolatile Organic Compounds (SVOCs)
8081A	Organochlorinated Pesticides
8082	Polychlorinated Biphenyls (PCBs)
8151A	Chlorinated Herbicides
6010B/6020	Metals
7470A/7471A	Mercury
North West (NW) TPH-Dx	Total Petroleum Hydrocarbons – Diesel Range (TPH-Dx)
Krone (GC/MS) (1)	Organotin compounds

[1] The method is an Ion Trap GC/MS method for organotin compound analysis developed for the Puget Sound Estuary Program.

Table 1 summarizes the sample locations and analyses. Table 2 summarizes qualifiers added to the data. Final sample results and qualifiers are presented in the analytical tables in the Bradford Island Preliminary Assessment and Site Investigation Report.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within 4°C± 2°C and all samples were analyzed within the technical and contracted holding time.

STL misidentified several samples during the log in process. All samples with “DSA” in their designation were logged in as “DSH”. In addition, the following misidentifications were made:

Laboratory Identification	Correct Identification
01120**4**TRA15SS	01120**6**TRA15SS
01120**4**TRA16SS	01120**6**TRA16SS
01120**5**SBB22SS	01120**6**SBB22SS
01120**5**SBB23SBG	01120**6**SBB23SBG
01120**5**SBB24SBG	01120**6**SBB24SBG
01120**4DSH**20SS	01120**5SBB**20SS

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per method requirements. Target compounds were detected in the method blanks for SVOC and metals analyses as follows:

- Antimony was detected in the method blanks for sample batches SP127 and SP128. Associated samples with concentrations less than five times the method blank concentration were qualified non-detect at the reported value (U) (Table 2).
- Di-n-butylphthalate and bis(2-ethylhexyl)phthalate were detected in both SVOC method blanks. Associated sample results that were less than ten times the blank concentration were qualified U at the reported quantitation level (Table 2).

One equipment rinsate blank was collected in conjunction with the sandblast building samples and was analyzed for metals, NWTPH-Dx, PCBs, and organotin compounds. The equipment rinsate blank contained TPH-Dx (1.87 mg/L), motor oil (1.99 mg/L), and copper (0.366 mg/L). The equipment rinsate blank also contained eight other metals (barium, calcium, manganese, zinc, antimony, lead, selenium, silver) at concentrations less than the PQL but greater than the method detection limit. The remaining samples were collected with dedicated equipment; therefore, an equipment blank was not collected in conjunction with the transformer release area or the drum storage area.

One trip blank was analyzed for VOCs. Methylene chloride was detected at 0.292 µg/L and styrene was detected at 0.113 µg/L in the trip blank.

Sample results were not qualified due to equipment rinsate or trip blank contamination.

ACCURACY

Tuning

The instrument tuning frequency and performance were acceptable for all GC/MS analyses (VOCs, SVOCs, organotin compounds).

Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the methods. Initial calibrations (ICAL) and continuing calibrations (CCAL) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Relative response factors (RRF) were greater than the minimum acceptance limit (0.05) and percent relative standard deviation (%RSD) values were less than the upper acceptance limits except for the following:

- The %RSD for bromomethane and chloroethane in the soil VOC ICAL exceeded the 30% QC limit. All positive sample results associated with the noncompliant standards were qualified as estimated (J). No qualifiers were applied to the compounds reported as undetected.
- The soil VOC CCAL exhibited a percent difference (%D) greater than the QC limit of 25% for 2-hexanone. In addition, the CCAL %D for carbon disulfide, chloromethane, bromomethane, chloroethane, and trichlorofluoromethane in the medium-level analysis of sample 011205SBB20SS were greater than 25%. All sample results associated with the noncompliant standards were qualified as estimated (J/UJ).
- The %RSD for nitrobenzene, benzoic acid, 2,4-dinitrophenol, di-n-butylphthalate, and n-nitrosodimethylamine in the SVOC ICAL exceeded the 30% QC limit. All positive sample results associated with the noncompliant standards were qualified as estimated (J). No qualifiers were applied to the compounds reported as undetected.
- The SVOC CCAL exhibited a %D greater than 25% for bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether, hexachlorocyclopentadiene, 2,6-dinitrotoluene, di-n-butylphthalate, benzidine, pentachlorophenol, and 2,4,6-trichlorophenol. All sample results associated with the noncompliant standards were qualified as estimated (J/UJ).

- The pesticide CCAL exhibited a %D greater than the QC limit of 15% for delta-BHC and endrin. All sample results associated with the noncompliant standards were qualified as estimated (J/UJ).

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Several surrogate outliers were noted in the VOC, SVOC, and organotin compound analyses as follows:

- Dibromofluoromethane surrogate recovery for the VOC analysis of the trip blank was greater than the laboratory QC limit. VOCs detected in this sample were qualified as estimated (J) with a potential high bias. No qualifiers were applied to the compounds reported as undetected.
- Several surrogate outliers were noted in the SVOC analyses. No qualifiers were assigned in cases where only one outlier per fraction was noted except for sample 011204DSA13SS. The percent recovery (% Rec) of phenol-d_5 in sample 011204DSA13SS was 0%. All detected acid compounds were qualified as estimated (J) with a potential low bias and the reporting limits for undetected acid compounds were rejected (R).
- The recoveries of two of the three SVOC acid surrogates were lower than the laboratory performance-based criteria in samples 011204DSA10SS and 011204DSA14SS. All acid compounds were qualified as estimated (J/UJ) with a potential low bias.
- The recoveries of two of the three SVOC acid surrogates were lower than the laboratory performance-based criteria and the % Rec for one base/neutral surrogate was 0% in sample 011205SBB20SS. All detected compounds were qualified as estimated (J) with a potential low bias and the reporting limits for undetected compounds were rejected (R).
- The recovery of tripentyltin in the organotin compound analysis of sample 011205SBB18SBG was greater than the QC limit. Detected compounds were qualified as estimated (J) with a potential high bias. No qualifiers were applied to the compounds reported as undetected.
- The recovery of tripentyltin in the organotin compound analyses of samples 011205SBB15SBG and 011205SBB21SS was 0%. All detected compounds were qualified as estimated (J) with a potential low bias and the reporting limits for undetected compounds were rejected (R).

- The recovery of the pesticide surrogate for sample 011204DSA12SS was greater than the laboratory performance-based criteria. Detected compounds were qualified as estimated (J) with a potential high bias. No qualifiers were applied to the compounds reported as undetected.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. STL analyzed at least one LCS and one MS/MSD (or one MS and one sample duplicate for metals analyses) for each analysis and for each batch per method requirements. Data were evaluated for % Rec of target compounds based on the project-specific QC limits established in the Management Plan.

QC for all LCS was within limits. QC for MS/MSD was within limits with the following exceptions:

- The recoveries of aluminum, chromium, iron, lead, magnesium, and manganese from the MS sample for batch SP227; the recoveries of aluminum and manganese from the MS sample for batch SP228; and the recovery of lead from the MS sample for batch SP229 were greater than 125 percent. Detected concentrations of these metals in their respective sample batches were qualified (J) with a potential high bias.
- The laboratory duplicate relative percent difference (RPD) values for chromium, magnesium, and nickel for batch SP227, aluminum, calcium, magnesium, manganese, and zinc for batch SP228, and the potassium for Batch 229 were greater than 35 percent. Detected concentrations of these metals in their respective sample batches were qualified (J).

PRECISION

Second Column Confirmation

Second column confirmation was performed for all PCB and pesticide results. All PCB sample analyses exhibited an RPD $\leq$ 40%. Second column confirmation for pesticide analyses exceeded 40% RPD for compounds in several samples. The method specifies that the higher of the two results should be reported, however for some compounds, the lower value was reported without explanation. These results were previously qualified as estimated (J) because the sample results were below the laboratory's practical quantitation limit (PQL); therefore, the results were not further qualified.

Duplicate Review

Six field duplicates were collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. The RPD for primary and field duplicate samples was was calculated when sample results were greater than 5 times the reporting limit. Reported concentrations for duplicate pairs are presented in Table 3 through Table 8. No data were qualified based on field duplicate precision. In general, duplicate precision was acceptable (±50%) with the exception of SVOCs for duplicate samples 011204DSA12SS/011204DSA14SS and metals for duplicate samples 011204TRA06SS/011204TRA08SS. QC exceedances are likely due to the following:

- High levels of target analytes in samples, which require secondary dilutions to bring the concentrations within the linear range of calibration. High dilution factors tend to cause RPD inaccuracies and also result in diluting out the MS analytes.
- Sample heterogeneity
- Primary and field duplicate results at or near the limit of detection tend to have RPDs outside QC limits.

COMPARABILITY

Compound Identification

For most samples, the detected concentrations of TPH-Dx and/or motor oil did “not appear to be typical product.” Positive detections of TPH-Dx and/or motor oil were reported for only fourteen of fifty-four samples. Qualitative observations were noted on the laboratory report forms.

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific DQOs. Occasionally analyte PQLs were above levels specified in the QAPP. In all cases the method detection limit was below the specified levels. The laboratory reported all detections under the PQL and qualified those results as estimated (J) because the analyte concentrations were less than the lowest calibration standard.

The dilution factors listed on the STL report forms are based on the final volume of the sample or sample extract. They are not a true dilution factor because they do not account for the initial sample aliquot. In addition, a smaller volume of sample or additional dilution of a sample extract was sometimes required in order to bring the sample concentrations within the linear range of calibration. STL combines results for various dilutions on a single report form for each sample. Dilution factors for individual analytes are listed adjacent to the corresponding analyte and are designated "D" (such as D20 or D10). The samples that required dilution due to elevated concentrations did not meet the requested reporting limits; however, data are not qualified based on high analyte concentrations that require dilution.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Based on the QA/QC review, the following sample data were qualified as rejected (R):

- All undetected SVOC compounds in sample 011205SBB20SS
- All undetected SVOC acid fraction compounds in sample 011204DSABSS
- All organotin compounds in samples 011205SBB155BG and 011205SBB21SS.

Completeness for the site investigation is greater than 99 percent based on rejection of 4 out of 442 analyses.

Table 1

SAMPLE LOCATION AND ANALYSES SUMMARY

Sample Number (Lab Sample ID)	Sample Date	Lab ID	Site Location	Method Analyses
011204TRA01SS	12-04-01	1	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA02SS	12-04-01	7	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA03SS	12-04-01	2	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA04SS	12-04-01	8	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA05SS	12-04-01	4	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA06SS	12-04-01	9	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA07SS	12-04-01	3	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA08SS	12-04-01	10	Duplicate of 011204TRA06SS	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA09SS	12-04-01	6	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA10SS	12-04-01	5	Duplicate of 011204TRA09SS	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA11SS	12-04-01	11	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA12SS	12-04-01	12	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA13SS	12-04-01	14	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204TRA14SS	12-06-01	13	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011206TRA15SS	12-06-01	15	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)

Sample Number (Lab Sample ID)	Sample Date	Lab ID	Site Location	Method Analyses
011206TRA16SS	12-04-01	16	Transformer Release Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011204DSA01SS	12-04-01	18	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA02SS	12-04-01	20	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA03SS	12-04-01	17	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA04SS	12-04-01	19	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA05SS	12-04-01	21	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA06SS	12-04-01	22	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA07SS	12-04-01	23	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA08SS	12-04-01	24	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA09SS	12-04-01	25	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA10SS	12-04-01	26	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
011204DSA11SS	12-04-01	27	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx; Krone GC/MS (organotin)
011204DSA12SS	12-04-01	29	Drum Storage Area	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx

Sample Number (Lab Sample ID)	Sample Date	Lab ID	Site Location	Method Analyses
011204DSA13SS	12-04-01	28	Duplicate of 011204DSA11SS	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Gx/Dx
011204DSA14SS	12-06-01	30	Duplicate of 011204DSA12SS	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides);NWTPH-Gx/Dx
Trip Blank-01	12-05-01	32		8260B (VOC)
011205SBB01SBG	12-05-01	33	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB02SBG	12-05-01	34	Duplicate of 011205SBB01SBG	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB03SBG	12-05-01	35	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB04SBG	12-05-01	36	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB05SBG	12-05-01	37	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB06SBG	12-05-01	38	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB07SBG	12-05-01	39	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB08SBG	12-05-01	40	Duplicate of 011205SBB07SBG	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB09SBG	12-05-01	41	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB10SBG	12-05-01	42	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB11SBG	12-05-01	43	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB12SBG	12-05-01	44	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB13SBG	12-05-01	45	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)

Sample Number (Lab Sample ID)	Sample Date	Lab ID	Site Location	Method Analyses
011205SBB14SBG	12-05-01	46	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB15SBG	12-05-01	47	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB16SBG	12-05-01	48	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB17SBG	12-05-01	49	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB18SBG	12-05-01	50	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB19SS	12-05-01	51	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB20SS	12-05-01	31	Sandblast Grit Building Area (Laboratory Identified as 011204DHS20SS)	6010B/6020, 7471A (metals);8260B (VOC); 8270C (SVOC); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011205SBB21SS	12-06-01	52	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
SBB Equipment Blank	12-06-01	53	Water	6010B/6020, 7470A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011206SBB22SS	12-06-01	54	Sandblast Grit Building Area	6010B/7000, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011206SBB23SBG	12-06-01	55	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)
011206SBB24SBG	12-06-01	56	Sandblast Grit Building Area	6010B/6020, 7471A (metals); 8082 (PCBs); NWTPH-Dx; Krone GC/MS (organotin)

TABLE 2

SUMMARY OF DATA QUALIFICATION

QUALIFIED SAMPLE ID[1]	QUALIFIED ANALYTE(S)	QUALIFIER	ANALYTICAL DEVIATIONS
VOC (8260B) - water			
Trip Blank	All detected compounds	J	Surrogate recovery
VOC (8260B) – soil			
All samples analyzed for VOC (except 011205SBB20SS)	Bromomethane Chloroethane	J	ICAL RSD ≥ 30%
	2-hexanone	J/UJ	Low level CCAL %D ≥ 25%
011205SBB20SS	Carbon disulfide Chloromethane Bromomethane Chloroethane Trichlorofluoromethane	J/UJ	Medium level CCAL %D ≥ 25%
SVOC (8270C)			
All samples analyzed for SVOC	Nitrobenzene Benzoic acid 2,4-Dinitrophenol di-n-Butylphthalate n-Nitrosodimethylamine	J	ICAL RSD ≥ 30%
All samples analyzed for SVOC	bis(2-Chloroethyl)ether bis(2-Chloroisopropyl)ether Hexachlorocyclopentadiene 2,6-Dinitrotoluene Di-n-butylphthalate Benzidine Pentachlorophenol 2,4,6-Trichlorophenol	J/UJ (low bias)	CCAL %D ≥ 25%
011204DSA01SS 011204DSA02SS 011204DSA03SS 011204DSA04SS 011204DSA05SS 011204DSA06SS 011204DSA07SS 011204DSA08SS 011204DSA09SS 011204DSA11SS 011204DSA12SS 011204DSA13SS	Di-n-butylphthalate	U (at the PQL) if < PQL UJ (at the reported concentration) if > PQL	Compound detected at < 10X method blank concentration

QUALIFIED SAMPLE ID[1]	QUALIFIED ANALYTE(S)	QUALIFIER	ANALYTICAL DEVIATIONS
011204DSA01SS 011204DSA02SS 011204DSA03SS 011204DSA04SS 011204DSA06SS 011204DSA07SS 011204DSA08SS 011204DSA09SS 011204DSA10SS 011204DSA14SS	bis(2-Ethylhexyl)phthalate	if < PQL, U (at the PQL) if > PQL, UJ (at the reported concentration)	Compound detected at < 10X method blank concentration
011205SBB20SS	All compounds	J/R (low bias)	Low surrogate recovery and 2 surrogate recoveries <10%
011204DSA13SS	All acid compounds	J/R (low bias)	Surrogate recovery <10%
011204DSA10SS 011204DSA14SS	All acid compounds	J/UJ (low bias)	Low surrogate recovery
Pesticides (8081)			
011204DSA01SS 011204DSA02SS 011204DSA03SS 011204DSA04SS 011204DSA05SS	Delta-BHC Endrin	J/UJ	CCAL ≥ 15% D
011204DSA12SS	All detected compounds	J (high bias)	High surrogate recovery
Organotin (Krone GC/MS)			
011205SBB15SBG 011205SBB21SS	All compounds	J/R (low bias)	Surrogate recovery <10%
011205SBB18SBG	All detected compounds	J (high bias)	High surrogate recovery
Metals (6010B)[2]			
All soil samples (Batch SP227)	Chromium, Iron , Magnesium, Manganese, Aluminum	J (high bias)	MS recovery > 125%
All soil samples (Batch SP228)	Aluminum, Manganese		
All soil samples (Batch SP227)	Chromium, Manganese, Nickel	J	Duplicate RPD ≥ 35%
All soil samples (Batch SP228)	Aluminum, Calcium, Magnesium, Manganese, Zinc		
All soil samples (Batch SP229)	Potassium		
Metals (6020)[2]			
011204TRA02SS 011204TRA12SS 011204TRA15SS 011204TRA16SS 011204DSA03SS	Antimony (Batch SP 127)	U	Compound detected at ≤ 5X method blank concentration

QUALIFIED SAMPLE ID[1]	QUALIFIED ANALYTE(S)	QUALIFIER	ANALYTICAL DEVIATIONS
011204DSA01SS 011204DSA02SS 011204DSA06SS 011204DSA07SS 011204DSA08SS 011204DSA09SS 011204DSA10SS 011204DSA12SS 011204DSA14SS 011205SBB01SBG 011205SBB02SBG 011205SBB04SBG 011205SBB05SBG 011205SSBB20SS	Antimony (Batch SP 128)	U	Compound detected at ≤ 5X method blank concentration
All soil samples (Batch SP227)	Lead (224%)	J	MS recovery > 125%
All soil samples (Batch SP229)	Lead (284%)		
Mercury (7470A/7471A)	None	None	None
PCBs (8082)	None	None	None
Herbicides (8151A)	None	None	None
NWTPH-Gasoline Mod.	None	None	None
NWTPH-Diesel Mod.	None	None	None

Notes:

[1] Methods taken from *Northwest Total Petroleum Hydrocarbons* and *SW-846 EPA Test Methods for Evaluating Solid Waste*

[2] Sample batches for metals analyses contain the following samples (refer to Table):

SP227	1-17
SP228	18-31, 33, 34, 36, 37
SP229	35, 38, 39-52, 54-56
TP224	53

CCAL – continuing calibration verification
ICAL – initial calibration
ID - identification
J - The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the | sample.
% D = percent difference
% Rec – percent recovery
MS– matrix spike
PQL – practical quantitation limit
R - The analyte results are rejected due to serious deficiencies in the ability to analyze the sample and meet the quality control criteria. The presence or absence of the analyte cannot be verified.
RPD – relative percent difference
RSD – relative standard deviation
U – Undetected at the PQL
UJ – estimated PQL

Table 3
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204TRA10SS (102666-5) Primary Sample	011204TRA09SS (102666-6) Duplicate Sample	RPD (%)[2]
Metals (mg/Kg)					
Aluminum	45.4	47.5	7,710	10,100	**26.8**
Antimony	3.4	3.56	9.08	2.39 J	nc
Arsenic	1.13	1.19	13.5	10.5	**25**
Barium	1.13	1.19	80.1	92.2	**14.1**
Beryllium	0.454	0.475	0.454 U	0.241 J	nc
Cadmium	0.567	0.594	1.6	1.92	nc
Calcium	227	238	4,380	4,840	**10.0**
Chromium	2.27	2.38	249	160	**43.5**
Cobalt	1.13	1.19	13.3	15.1	**12.7**
Copper	2.27	2.38	69.6	66.9	**4.0**
Iron	22.7	23.8	30,100	31,800	**5.5**
Lead	0.567	0.594	550	544	**1.1**
Magnesium	227	238	9,860	9,860	**0**
Manganese	1.13	1.19	531	675	**23.9**
Mercury	0.0475	0.0363	0.0542	0.0802	nc
Nickel	2.27	2.38	117	76.4	**42.0**
Potassium	454	475	350 J	421 J	nc
Selenium	3.4	3.56	3.4 U	0.649 J	nc
Silver	0.567	0.594	0.155 J	0.178 J	nc
Thallium	0.567	0.594	0.0782 J	0.0962 J	nc
Vanadium	1.13	1.19	44.5	52	**15.5**
Zinc	2.27	2.38	238	279	**15.9**
PCBs (µg/Kg)					
Aroclor 1260	12.1	12	36.2	17.3	nc
TPH-Dx (mg/Kg)					
#2 Diesel	29.6	29.6	16.1 J	16.1 J	nc
Motor Oil	59.2	59.2	129	150	nc

[1] - samples were not analyzed for VOCs, SVOCs, herbicides, pesticides, or TPH-gasoline fraction. Organotin compounds were not detected in the sample or duplicate sample above the PQL

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(µg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Table 4
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204TRA06SS (102666-9) Primary Sample	011204TRA08SS (102666-10) Duplicate Sample	RPD (%)[2]
Metals (mg/Kg)					
Aluminum	41.6	42	1,840	1,990	**7.8**
Antimony	3.12	3.15	1.59 J	2.69 J	nc
Arsenic	1.04	1.05	5.86	13.6	**79.6**
Barium	1.04	1.05	43.8	36.4	**18.5**
Cadmium	0.52	0.525	1.08	1.45	nc
Calcium	208	210	3,120	2,400	**26.1**
Chromium	2.08	2.1	394	642	**47.9**
Cobalt	1.04	1.05	10.1	13.3	**27.4**
Copper	2.08	2.1	75.7	117	**42.9**
Iron	20.8	21	23,900	44,900	**61.1**
Lead	0.52	0.525	190	355	**60.6**
Magnesium	208	210	13,000	18,600	**35.4**
Manganese	1.04	1.05	311	540	**53.8**
Mercury	0.046	0.0428	0.046 U	0.044	nc
Nickel	2.08	2.1	190	334	**55.0**
Potassium	416	420	147 J	142 J	nc
Selenium	3.12	3.15	0.403 J	3.15 U	nc
Silver	0.52	0.525	0.111 J	0.108 J	nc
Vanadium	1.04	1.5	22.9	25	**8.8**
Zinc	2.08	2.1	122	228	**60.6**
Organotin (μg/Kg)					
Tributyltin	2.83	2.71	2.83 U	427	nc
Dibutyltin	2.13	2.03	2.13U	44.8	nc
Monobutyltin	2.83	2.71	2.83 U	10.5	nc
PCBs (μg/Kg)					
Aroclor 1260	11.1	11.7	61.9	69.6	**11.7**
TPH-Dx (mg/Kg)					
#2 Diesel	27.8	27.9	44.7	34.7	nc
Motor Oil	55.7	55.9	336	266	**23.3**

[1] - samples were not analyzed for VOCs, SVOCs, herbicides, pesticides, or TPH-gasoline fraction

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(μg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Table 5
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204DSA11SS (102666-27) Primary Sample	011204DSA13SS (102666-28) Duplicate Sample	RPD (%)[2]
Semivolatile Organic Compounds (μg/Kg)					
Naphthalene	14.4	12.7	24.4	29.3	nc
2-Methylnaphthalene	14.4	12.7	14.4 U	22.9	nc
Acenaphthylene	14.4	12.7	25.9	29.3	nc
Acenaphthene	14.4	12.7	105	158	40.3
Dibenzofuran	144	127	28.7 J	42 J	nc
Fluorene	14.4	12.7	86.2	103	17.8
Phenanthrene	14.4	12.7	938	1,170	22.0
Anthracene	14.4	12.7	269	339	23.0
Di-n-butylphthalate	718	637	816	383 J	nc
Fluoranthene	14.4	12.7	2,070	2,510	19.2
Pyrene	14.4	12.7	2,260	2,700	17.7
Butylbenzylphthalate	144	127	132 J	117 J	nc
Benzo(a)anthracene	28.7	25.5	1,460	1,820	22.0
Chrysene	28.7	25.5	1,460	1,820	22.0
bis(2-Ethylhexyl)phthalate	359	318	18,500	21,700	15.9
Benzofluoranthenes	28.7	25.5	2,540	3,130	20.8
Benzo(a)pyrene	14.4	12.7	1,730	2,360	30.8
Indeno(1,2,3-cd)pyrene	14.4	12.7	895	1,100	20.6
Dibenz(a,h)anthracene	14.4	12.7	363	472	26.1
Benzo(g,h,i)perylene	14.4	12.7	879	1,150	26.7
Carbazole	359	318	138 J	176 J	nc
Metals (mg/Kg)					
Aluminum	43.8	41.7	4,410	5,010	12.7
Antimony	3.28	3.13	4.37	5.78	nc
Arsenic	1.09	1.04	34.3	51.1	39.3
Barium	1.09	1.04	57.4	64.5	11.7
Cadmium	0.547	0.521	1.34	1.5	nc
Calcium	219	208	6,870	7,760	12.2
Chromium	2.19	2.08	1,310	1,420	8.1
Cobalt	1.09	1.04	22.3	25.1	11.8
Copper	2.19	2.08	159	157	1.3
Iron	21.9	20.8	37,400	43,500	15.1
Lead	0.547	0.521	288	399	32.3
Magnesium	219	208	40,200	44,300	9.7
Manganese	1.09	1.04	672	750	11.0
Mercury	0.0381	0.037	0.106	0.0576	nc
Nickel	2.19	2.08	431	522	19.1
Potassium	438	417	423 J	528	nc
Silver	0.547	0.521	0.22 J	0.208 J	nc
Thallium	0.547	0.521	0.547 U	0.0771 J	nc
Vanadium	1.09	1.04	26.9	34	23.3

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204DSA11SS (102666-27) Primary Sample	011204DSA13SS (102666-28) Duplicate Sample	RPD (%)[2]
Zinc	2.19	2.08	497	607	19.9
Pesticides (µg/Kg)					
Endosulfan II	3.97	4.39	3.97 U	0.96 J	nc
Endrin Ketone	3.97	4.39	2.53 J	4.39 U	nc
Organotin (µg/Kg)					
Tributyltin	2.52	2.74	480	338	34.7
Dibutyltin	1.89	2.06	79	69.6	12.7
Monobutyltin	2.52	2.74	51.8	59.3	13.5
PCBs (µg/Kg)					
Aroclor 1260	11	11.6	22.2	19.9	nc
TPH-Dx (mg/Kg)					
#2 Diesel	27.9	28.1	42	140	nc
Motor Oil	55.8	56.2	266	490	59.3

[1] – No TPH-gasoline fraction, VOCs, or herbicides were detected in the samples
[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.
(µg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Table 6
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204DSA12SS (102666-29) Primary Sample	011204DSA14SS (012666-30) Duplicate Sample	RPD (%)[2]
Semivolatile Organic Compounds (µg/Kg)					
Naphthalene	1.59	15	158	296	**60.8**
2-Methylnaphthalene	1.59	15	114	186	**48.0**
Acenaphthylene	1.59	15	49.4	126	**87.3**
Acenaphthene	1.59	15	366	573	**44.1**
Dibenzofuran	15.9	150	103	179	**53.9**
Fluorene	1.59	15	334	591	**55.6**
Phenanthrene	1.59	15	2,790	3,250	**15.2**
Anthracene	1.59	15	693	951	**31.4**
Di-n-butylphthalate	79.5	750	193	750 U	nc
Fluoranthene	1.59	15	2,460	2,760	**11.5**
Pyrene	1.59	15	3,190	3,780	**16.9**
Butylbenzylphthalate	15.9	150	15.7 J	150 U	nc
Benzo(a)anthracene	3.18	30	1,160	1,490	**24.9**
Chrysene	3.18	30	1,590	1,650	**3.7**
bis(2-Ethylhexyl)phthalate	39.7	375	1,500	440	**109**
Di-n-octylphthalate	15.9	150	31	150 U	nc
Benzofluoranthenes	3.18	30	1,870	1,830	**2.2**
Benzo(a)pyrene	1.59	15	1,530	1,630	**6.3**
Indeno(1,2,3-cd)pyrene	1.59	15	547	546	**0.2**
Dibenz(a,h)anthracene	1.59	15	1.59 U	216	nc
Benzo(g,h,i)perylene	1.59	15	572	545	**4.8**
Carbazole	39.7	375	213	267 J	nc
Metals (mg/Kg)					
Aluminum	43.5	42.2	10,400	8,280	**22.7**
Antimony	3.27	3.17	1.21 J	1.26 J	nc
Arsenic	1.09	1.06	6.14	7.83	**24.2**
Barium	1.09	1.06	89	75.7	**16.2**
Beryllium	0.435	0.422	0.24 J	0.231 J	nc
Cadmium	0.544	0.528	1.31	1.14	nc
Calcium	218	211	4,770	4,450	**6.9**
Chromium	2.18	2.11	44.4	53.2	**18.0**
Cobalt	1.09	1.06	12.7	12.4	**2.4**
Copper	2.18	2.11	41.1	44.6	**8.2**
Iron	21.8	21.1	21,800	22,500	**3.2**
Lead	0.544	0.528	151	137	**9.7**
Magnesium	218	211	5,500	5,700	**3.6**
Manganese	1.09	1.06	457	471	**3.0**
Mercury	0.0402	0.036	0.0297 J	0.048	nc
Nickel	2.18	2.11	34.5	32.1	**7.2**
Potassium	435	422	720	648	**10.5**
Selenium	3.27	3.17	3.27 U	0.424 J	nc

Compound/Analyte[1]	Primary PQL	Dup. PQL	011204DSA12SS (102666-29) Primary Sample	011204DSA14SS (012666-30) Duplicate Sample	RPD (%)[2]
Silver	0.544	0.528	0.151 J	0.174 J	nc
Thallium	0.544	0.528	0.102 J	0.0918 J	nc
Vanadium	1.09	1.06	56	49.1	**13.1**
Zinc	2.18	2.11	90.5	103	**12.9**
Pesticides (μg/Kg)					
4,4'-DDE	2.32	2.25	2.58	2.3	nc
4,4'-DDT	2.32	2.25	26.4	17.9	**38.4**
Endrin Ketone	2.32	2.25	4.58	2.64	nc
Organotin (μg/Kg)					
Tributyltin	2.52	2.74	480	338	**34.7**
Dibutyltin	1.89	2.06	79	69.6	**12.7**
Monobutyltin	2.52	2.74	51.8	59.3	**13.5**
PCB (μg/Kg)					
Aroclor 1260	11.4	11.4	8.67 J	7.92 J	nc
TPH-Dx (mg/Kg)					
#2 Diesel	29.3	28.6	43.9	58.7	nc
Motor Oil	58.6	57.3	102	127	nc

[1] - no TPH-gasoline fraction, VOCs, or herbicides were detected in the samples

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(μg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Table 7
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	**Primary PQL**	**Dup. PQL**	**011205SBB01SBG (102666-33) Primary Sample**	**011205SBB02SBG (102666-34) Duplicate Sample**	**RPD (%)**[2]
Metals (mg/Kg)					
Aluminum	42.1	49.6	2,310	2,610	**12.2**
Antimony	3.16	3.72	1.35 J	0.788 J	nc
Arsenic	1.05	1.24	1.9	2.84	nc
Barium	1.05	1.24	21.3	23.5	**9.8**
Cadmium	0.527	0.62	0.705	0.728	nc
Calcium	211	248	1,730	1,950	**12.0**
Chromium	2.11	2.48	1,130	1,300	**14.0**
Cobalt	1.05	1.24	25.6	24.3	**5.2**
Copper	2.11	2.48	27	37.3	**32.0**
Iron	21.1	24.8	30,700	33,900	**9.9**
Lead	0.527	0.62	120	127	**5.7**
Magnesium	211	248	40,300	46,700	**14.7**
Manganese	1.05	1.24	481	537	**11.0**
Nickel	2.11	2.48	1,080	950	**12.8**
Potassium	421	496	138 J	138 J	nc
Silver	0.527	0.62	0.059 J	0.0744 J	nc
Thallium	0.527	0.62	0.0622 J	0.62 U	nc
Vanadium	1.05	1.24	21.4	20.7	**3.3**
Zinc	2.11	2.48	74.9	93.3	**21.9**
PCBs (µg/Kg)					
Aroclor 1260	11.7	12	7.24 J	5.63 J	nc
TPH-Dx (mg/Kg)					
#2 Diesel	29	29.4	61	127	nc
Motor Oil	58.1	58.7	358	417	**15.2**

[1] - samples were not analyzed for VOCs, SVOCs, herbicides, pesticides, or TPH-gasoline fraction. Organotin compounds were not detected in the sample or duplicate sample above the PQL

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(µg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Table 8
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	011205SBB07SBG (102666-39) Primary Sample	011205SBB08SBG (102666-40) Duplicate Sample	RPD (%)[2]
Metals (mg/Kg)					
Aluminum	54.9	45.6	7,350	7,890	**7.1**
Antimony	4.12	3.42	3.12 J	2.08 J	nc
Arsenic	1.37	1.14	4.6	5.64	nc
Barium	1.37	1.14	70.2	71.5	**1.8**
Beryllium	0.549	0.456	0.549 U	0.218 J	nc
Cadmium	0.687	0.571	1.1	0.979	nc
Calcium	275	228	5,470	4,640	**16.4**
Chromium	2.75	2.28	127	126	**0.8**
Cobalt	1.37	1.14	12.3	11.5	**6.7**
Copper	2.75	2.28	56.2	56.1	**0.2**
Iron	27.5	22.8	21,900	21,700	**0.9**
Lead	0.687	0.571	124	114	**8.4**
Magnesium	275	228	6,340	6,010	**5.3**
Manganese	1.37	1.14	407	376	**7.9**
Mercury	0.0476	0.0466	0.0476 U	0.0461 J	nc
Nickel	2.75	2.28	107	80.6	**28.1**
Potassium	549	456	554	647	nc
Selenium	4.12	3.42	0.674 J	0.637 J	nc
Silver	0.687	0.571	0.155 J	0.13 J	nc
Thallium	0.687	0.571	0.111 J	0.0913 J	nc
Vanadium	1.37	1.14	45	50.4	**11.3**
Zinc	2.75	2.28	109	105	**3.7**
PCBs (μg/Kg)					
Aroclor 1260	13.4	13	3.32 J	8.25 J	nc
TPH-Dx (mg/Kg)					
#2 Diesel	35.3	31.6	20.7 J	23.5 J	nc
Motor Oil	70.5	63.3	93.5	118	nc

[1] - samples were not analyzed for VOCs, SVOCs, herbicides, pesticides, or TPH-gasoline fraction. Organotin compounds were not detected in the sample or duplicate sample above the PQL

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(μg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range

Nine primary soil samples and one field duplicate sample were collected by URS Corporation (URS) on November 20, 2002 at the Bradford Island site in Cascade Locks, Oregon as part of the Bradford Island Bulb Slope Investigation. The analytical results were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness, accuracy, field and analytical precision, comparability, and completeness. Representativeness refers to the degree to which sample data accurately and precisely describe the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions, and in part, is evaluated by examining chain-of-custody documentation and verifying that sample analyses were performed within allowable holding times. Accuracy is evaluated by assessing the analytical results for blanks, surrogates, matrix spike/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCS) to determine analytical bias. Precision is evaluated by comparison of results for primary, field duplicate, and laboratory duplicate analyses. Comparability is a qualitative objective of the data, expressing confidence with which one data set can be compared with another. Completeness is evaluated by calculating the percentage of acceptable data. This review addresses only those problems that potentially affect data usability.

The data quality review process followed the procedures outlined in the *United States Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, October 1999) and *Inorganic Data Review* (USEPA, February 1994), where applicable. No raw data were reviewed and no results were recalculated.

Samples were collected according to the Sampling and Analysis Plan (SAP) for the Bradford Island Landfill Phase II Supplemental Site Investigation (URS, 2001) and the Bulb Slope Investigation Phase II Supplemental Site Investigation Sampling and Analysis Plan Addendum (URS, 2002). Analytical Resource, Incorporated (ARI) of Tukwila, Washington analyzed the samples for the following parameters:

Method	Analytical Parameter
USEPA SW-846 6010B	Total Lead
USEPA SW-846 7471A	Total Mercury
USEPA SW-846 8082	Polychlorinated biphenyls (PCBs)
NWTPH-Dx	Diesel and Heavy Oil Range Organics
USEPA SW-846 9060M	Total Organic Carbon (TOC)

The laboratory sample group associated with this review is EZ88. Final sample results are presented in the analytical tables in the main body of the report. No data required qualification.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed and dated upon release and receipt. The following was noted by the laboratory upon sample receipt:

- The metals sample container for sample 021120BSC01SS and the diesel sample container for sample 021120BSC08SS arrived at the laboratory with broken lids. The containers were individually sealed in ziplock bags and the lids were replaced by the laboratory upon receipt. Data were not qualified.

All coolers were submitted at temperatures within 4°C± 2°C and all samples were analyzed within the technical and contractual holding time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analytical batch, per method requirements. Target compounds were not detected in the method blanks.

Equipment rinsate blanks were not collected for the sampling conducted at the Bulb Slope area because the samples were collected using dedicated sampling equipment.

ACCURACY

Surrogate Recovery Review

Samples analyzed for organics were spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Surrogate recoveries were within project-specific quality control criteria.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. ARI analyzed at least one LCS and one MS/MSD (or one MS and matrix duplicate for metals analyses) for each analysis and for each batch, per method requirements. Data were evaluated for percent recovery of target compounds based on the project-specific QC limits. All LCS and MS/MSD results were within project-specific control limits.

PRECISION

Laboratory Duplicate Review

One site-specific laboratory duplicate (i.e., matrix duplicate) was analyzed for metals per analytical batch. The relative percent differences (RPDs) were with project-specific control limits.

Field Duplicate Review

One field duplicate was collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. The RPD for primary and field duplicate samples was calculated when sample results were greater than 5 times the reporting limit. Field duplicate precision was acceptable (i.e., within ±50% RPD) with the exception listed in the table below.

SAMPLE ID/ DUPLICATE ID	ANALYTE	PRIMARY RESULT	DUPLICATE RESULT	RELATIVE PERCENT DIFFERENCE
021120BSC02SS/ 021120BSC03SS	Diesel Range Organics	24 mg/kg	12 mg/kg	67%

Data were not qualified as a result of this apparent sample heterogeneity.

COMPARABILITY

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific DQOs. The laboratory attained all requested reporting limits with the following exceptions. Analysis of PCB Aroclor 1254 for samples 021120BSA04SS and 021120BSB06SS exhibited elevated reporting limits of 54 μg/kg and 33 μg/kg, respectively, due to background interference. The requested reporting limit was 20 μg/kg. In both bases the method detection limit was below the specified level. Data were not qualified.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal of 100 percent was attained because no data were rejected.

Sixty-two primary soil samples, two primary wood samples, eight soil duplicate samples, and four equipment rinsates were collected by URS Corporation (URS) on November 19 and 21, 2002 at the Bradford Island site in Cascade Locks, Oregon as part of the Bradford Island Preliminary Assessment and Site Investigation at the former pistol range area. The analytical results were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness, accuracy, field and analytical precision, comparability, and completeness. Representativeness refers to the degree to which sample data accurately and precisely describe the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions, and in part, is evaluated by examining chain-of-custody documentation and verifying that sample analyses were performed within allowable holding times. Accuracy is evaluated by assessing the analytical results for blanks, surrogates, matrix spike/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCS) to determine analytical bias. Precision is evaluated by comparison of results for primary, field duplicate, and laboratory duplicate analyses. Comparability is a qualitative objective of the data, expressing confidence with which one data set can be compared with another. Completeness is evaluated by calculating the percentage of acceptable data. This review addresses only those problems that potentially affect data usability.

The data quality review process followed the procedures outlined in the *United States Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, October 1999) and *Inorganic Data Review* (USEPA, February 1994), where applicable. No raw data were reviewed and no results were recalculated.

Samples were collected according to the Sampling and Analysis Plan (SAP) for the Bradford Island Landfill Phase II Supplemental Site Investigation (URS, 2001). Analytical Resources, Incorporated (ARI) of Tukwila, Washington analyzed the samples for the following parameters:

Method	Analytical Parameter
USEPA SW-846 8270C	Pentachlorophenol
USEPA SW-846 6010B	Total Metals – Lead, Copper, Zinc, Nickel, Arsenic, Selenium, Antimony
USEPA SW-846 7470A/7471A	Total Mercury
USEPA SW-846 1311/6010B	TCLP Lead

Laboratory sample groups associated with this review are EZ89, EZ90, EZ91, FA19, and FA20. Final sample results and associated qualifiers are presented in the analytical tables in the main body of the report. Table 1 summarizes the qualifiers added to the data as a result of the data review.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed and dated upon release and receipt with the following two exceptions.

- Page 2 of the COC form associated with sample group FA20 was not dated upon release. However, page 1 (associated with sample group FA19) was dated upon release on November 24, 2002. Both COC pages were signed and dated upon receipt at the laboratory on November 26, 2002. Data were not qualified as a result of this nonconformance.
- Page 3 of the COC form associated with sample group EZ91 was not signed upon receipt by the laboratory for samples collected on November 19, 2002. However, pages 1 and 2 (associated with sample groups EZ89 and EZ90, respectively), were signed upon receipt and dated on November 22, 2002. In addition, the laboratory cooler receipt form for sample group EZ91 was signed and dated on November 22, 2002. Data were not qualified as a result of this nonconformance.

The following sample identification discrepancy was noted by the laboratory during the sample log-in process.

- Two samples were mislabeled on the COC form. The samples labeled 021121PFR74SS and 021121PFR75SS on the COC were labeled 021121PFR74WD and 021121PFR75WD on the sample containers. The laboratory used the correct sample IDs as listed on the sample containers. Data were not qualified as a result of this discrepancy.

All coolers were submitted at temperatures within 4°C± 2°C and all samples were analyzed within the technical and contractual holding time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analytical batch, per method requirements. One target compounds was detected in one of the method blanks as follows:

- Zinc was detected in the method blank associated with rinsate blanks in sample group EZ91. Associated samples were non-detect for zinc. No data were qualified.

Four equipment rinsate blanks were collected in conjunction with the soil sampling at the pistol range and were analyzed for total metals (copper, lead, mercury, nickel, and zinc). These analytes were not detected in the rinsate blanks.

Equipment rinsate blanks were not collected for the wood sampling conducted at the pistol range area because the samples were collected using dedicated equipment.

ACCURACY

Surrogate Recovery Review

Each sample analyzed for pentachlorophenol was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Surrogate recoveries were within project-specific criteria.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. ARI analyzed at least one LCS and one MS/MSD (or one MS and one matrix duplicate for metals analyses) for each analysis and for each batch per method requirements with one exception. An MS/MSD was not analyzed for the two wood samples, 021121PFR74WD and 021121PFR75WD, due to limited sample volume. All other QC was within control limits; data were not qualified.

Data were evaluated for percent recovery of target compounds based on the project-specific criteria. All LCS and MS/MSD results were within project-specific control limits with the following exception.

- The matrix spike recovery of antimony for sample 021121PFR51SS was below the project-specific criteria of 75% to 125% at 54.5%. Associated sample results were non-detect for antimony and were qualified as estimated and flagged with a "UJ".

PRECISION

Laboratory Duplicate Review

One site specific laboratory duplicate was analyzed for metals per analytical batch. The relative percent differences (RPDs) were with project-specific control limits with one exception.

- The laboratory duplicate analysis of nickel for sample 021119PFR10SS exhibited an RPD above the project-specific control limit of 25%, at 37%. Associated sample results were qualified as estimated and flagged with a "J".
- The laboratory duplicate analysis of copper for sample 021121PFR51SS exhibited an RPD above the project-specific control limit of 25%, at 31.4%. Associated sample results were qualified as estimated and flagged with a "J".

Field Duplicate Review

Eight field duplicates were collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. The RPD for primary and field duplicate samples was calculated when sample results were greater than 5 times the reporting limit. Field duplicate precision was acceptable (i.e., within ±50% RPD).

COMPARABILITY

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific DQOs. All reporting limits are below selected benchmark values.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal of 100 percent was attained because no data were rejected.

Based on the QA/QC review, some sample results were qualified as estimated and flagged with a ‘J’. Qualified data are summarized in Table 1.

TABLE 1

SUMMARY OF DATA QUALIFICATION

QUALIFIED SAMPLE ID	QUALIFIED ANALYTE(S)	QUALIFIER	ANALYTICAL DEVIATIONS
Metals			
021119PFR01SS 021119PFR02SS 021119PFR03SS 021119PFR04SS 021119PFR05SS 021119PFR06SS 021119PFR07SS 021119PFR08SS 021119PFR09SS 021119PFR10SS	Nickel	J	Laboratory Duplicate RPD ≥ 25%
021121PFR03SS 021121PFR48SS 021121PFR49SS 021121PFR50SS 021121PFR51SS	Copper	J	Laboratory Duplicate RPD ≥ 25%
021121PFR03SS 021121PFR48SS 021121PFR49SS 021121PFR50SS 021121PFR51SS	Antimony	UJ	Matrix Spike Recovery < 75%

Notes:
J - The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.
UJ – The analyte was not detected. The reported quantitation limit is an estimate.
RPD – relative percent difference

Eight groundwater samples, one duplicate sample, and two trip blanks were collected by URS on May 1, 2002 through May 3, 2002 at the Bradford Island Landfill in Cascade Locks, Oregon as part of the Bradford Island Site Characterization. The analytical results for the groundwater samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (degree to which the sample represents the environmental condition), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). This review addresses only those problems that affect, or could potentially affect, data usability.

The data quality review process followed the procedures outlined in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, October 1999) and *Inorganic Data Review* (USEPA, February 1994), where applicable. Raw data were not reviewed (with the exception of internal standards) and results were not recalculated.

Samples were collected according to the Sampling and Analysis Plan (SAP) for the Bradford Island Landfill Site Characterization (URS, 2001). Severn Trent Laboratories – Seattle, Inc., (STL) (formerly Sound Analytical Resources, Inc.) located in Tacoma, Washington analyzed the samples for the following parameters:

Method	Analytical Parameter
8260B	Volatile Organic Compounds (VOCs)
8270C	Semivolatile Organic Compounds (SVOCs)
8081A	Chlorinated Pesticides
8082	Polychlorinated Biphenyls (PCBs)
8151A by GC/MS	Chlorinated Herbicides
6010B/6020	Metals
7470A	Mercury
Northwest (NW) TPH-Gx and Dx	Total Petroleum Hydrocarbons (TPH) – Gasoline Range (Gx) and Diesel Range (Dx)
Krone (GC/MS) (1)	Organotin compounds

[1] The method is an Ion Trap GC/MS method for organotin compound analysis developed for the Puget Sound Estuary Program.

Table 1 summarizes the sample locations and analyses. Table 2 summarizes qualifiers added to the data. Final sample results and qualifiers are presented in the analytical tables in the Bradford Island Preliminary Assessment and Site Investigation Report.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that the samples were maintained under chain of custody and the COC forms were signed upon release and receipt. All coolers were submitted at temperatures within 4°C± 2°C and all samples were analyzed within the technical and contracted holding times.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per method requirements. Target compounds were detected in the method blanks for SVOC and metals analyses as follows:

- Antimony, barium, chromium, copper, lead, manganese, nickel, silver, and zinc were detected in the method blanks for samples analyzed by Method 6020 (ICP-MS). Associated samples with detected analyte concentrations less than five times the analyte concentrations in the method blank were qualified non-detect (U) at the reported value as shown in Table 2.
- Di-n-octylphthalate was detected in the SVOC method blank. Di-n-octylphtalate was also detected in three samples, but at concentrations that were greater than ten times the blank concentration; therefore, no data required qualification (Table 2).

The samples were collected with dedicated equipment; therefore, an equipment blank was not required.

Two trip blanks were analyzed for VOCs. Acetone was detected at 2.99 µg/L in one trip blank. Acetone was also detected in two (020503BIL09GW, 020503BIL10GW) of the five samples associated with this trip blank at concentrations less than 10 times the trip blank concentration. Primary samples are not qualified based on trip blank concentrations because the effect of trip blank contaminant concentrations on primary sample concentrations is unknown.

ACCURACY

Tuning

The instrument tuning frequency and performance were acceptable for all GC/MS analyses (VOCs, SVOCs, organotin compounds, and herbicides).

Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the methods. Initial calibrations (ICAL) and continuing calibrations (CCAL) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. RRF were greater than the minimum acceptance limit (0.05) and percent relative standard deviation (%RSD) values were less than the upper acceptance limits except for the following:

- The RRF for 2-butanone in the VOC ICAL and CCAL was less than 0.05. 2-Butanone was qualified as estimated (J) in samples when it was detected and rejected (R) in samples when it was not detected.

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Surrogate outliers were noted in the SVOC, pesticide, and organotin compound analyses as follows:

- Surrogate recoveries did not meet QC criteria for several samples analyzed for SVOCs. No qualifiers were assigned in cases where only one outlier per fraction was noted. In sample 020501BIL01GW the recoveries of two surrogates, nitrobenzene-d5 (48.5%) and 2-fluorobiphenyl (40.6%), were lower than the QC limits (50% and 55% respectively). All detected base-neutral compounds were qualified as estimated (J) with a potential low bias and all undetected base-neutral compounds were qualified UJ.
- The recovery of tripentyltin (161%) in the organotin compound analysis of sample 020501BIL03GW was greater than the QC limit (144%). Detected compounds were qualified as estimated (J) with a potential high bias. No qualifiers were applied to the compounds reported as undetected, per the validation guidelines.
- The recoveries of tetrachloro-m-xylene in the pesticides analyses of seven samples were less than the laboratory performance-based criteria; however, no pesticide compounds were detected in these seven samples. Based on low surrogate recovery,

pesticide compounds were qualified as undetected estimated (UJ) with a potentially low bias.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. STL analyzed at least one LCS and one MS/MSD (or one MS and one sample duplicate for metals analyses) for each analysis and for each batch per method requirements. Data were evaluated for percent recovery of target compounds based on the project-specific QC limits established in the Sampling and Analysis Plan.

QC for all LCS was within limits. QC for MS/MSD was within limits with the following exception:

- Recoveries of two SVOCs (phenol and 4-nitrophenol) were 0% in the MS of sample 020503BIL08GW and only slightly above 10% in the MSD. Phenol was detected in the parent sample and is qualified as estimated (J). 4-nitrophenol was undetected in the parent sample and is qualified as rejected (R).

PRECISION

Second Column Confirmation

Second column confirmation was performed for all PCB and pesticide analyses. No PCBs were detected in the samples. Two pesticide compounds were detected in one sample (020502BIL05GW). Second column confirmation exceeded 40% RPD for these two compounds; therefore the results were qualified as estimated (J).

Duplicate Review

One field duplicate was collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. The RPD for primary and field duplicate samples was calculated only when sample results were greater than 5 times the reporting limit because analytes detected at less than 5 times the reporting limit are expected to have higher RPD values. Reported concentrations for duplicate pairs are presented in Table 3. Duplicate precision was acceptable (±50%) and no data were qualified.

COMPARABILITY

Compound Identification

According to the laboratory, the detected concentrations of TPH-Dx and/or motor oil in some samples did “not appear to be typical product.” Qualitative observations were noted on the laboratory report forms with an “X” qualifier.

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific DQOs. Occasionally analyte PQLs were above the regulatory levels specified in the Sampling Plan. In all cases the method detection limit was below the specified levels. The laboratory reported all detections under the PQL and qualified those results as estimated (J) because the analyte concentrations were less than the lowest calibration standard.

SVOC concentrations for samples 020501BIL04GW, 020503BIL07GW, and 020503BIL08GW were reported from ten-fold dilutions due to high concentrations of phthalate esters and non-target analytes.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete with the exception of CCAL summary sheets for SVOC analysis. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. The following compound data were qualified as rejected (R):

- Undetected 2-butanone in all samples analyzed for VOCs
- Undetected 4-nitrophenol in sample 020503BIL08GW.

Completeness for the site investigation is approximately 100 percent based on the QA/QC review and satisfactory completion of 96 sample analyses.

OVERALL ASSESSMENT

All deliverables required by the project are present and the data packages are complete. All performance indicators reviewed are within specified limits with the exceptions indicated in the review report. Data qualifiers were applied to VOCs, SVOCs, pesticides, organotin compounds, and metals. Data for analyses of herbicides, PCBs, NWTPH-Gx, NWTPH-Dx, mercury, and iron are acceptable as reported. Overall, the data quality is sufficient for the intended purposes.

Table 1
SAMPLE LOCATION AND ANALYSES SUMMARY

Sample Number (Lab Sample ID)	Sample Date(s)	Lab ID	Site Location	Analytical Method
020501BIL01GW	5-01-02	105682-2 105690-1	MW-8	6010B/6020, 7470A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Gx/Dx
020501BIL02GW	5-01-02, 5-02-02	105682-4 105690-2 105690-3	MW-1	
020501BIL03GW	5-01-02	105682-1	MW-2	
020501BIL04GW	5-01-02, 5-02-02 5-03-02	106682-3 105681-2 105681-3 105722-4	MW-9	6010B/6020, 7470A (metals); 8260B (VOC); 8270C (SVOC);); NWTPH-Gx/Dx
020502BIL05GW	5-02-02	105682-6 105681-1	MW-3	6010B/6020, 7470A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Gx/Dx
020503BIL06GW	5-03-02	105727-2 105725-3	MW-4	
020503BIL07GW	5-03-02	105727-1 105725-2	MW-4 Field Duplicate	
020503BIL08GW	5-03-02	105721-1 105725-4 105724-1	MW-6	
020503BIL08GW MS/MSD	5-03-02	105721-1 105725-4 105724-1	MW-6 MS/MSD	6010B/6020, 7470A (metals); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Dx
020503BIL09GW	5-03-02	105725-5 105722-1	MW-5	6010B/6020, 7470A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Gx/Dx
020503BIL09GW MS/MSD	5-03-02	105725-5 105722-1	MW-5 MS/MSD	8260B (VOC): NWTPH-Gx
020503BIL10GW	5-03-02	105725-1	MW-7	6010B/6020, 7470A (metals);8260B (VOC); 8270C (SVOC); 8081A (pesticides); 8082 (PCBs); 8151A (herbicides); organotin, NWTPH-Gx/Dx
Trip Blank	5-03-02	105682-5	Trip Blank	8260B (VOC)
Trip Blank	5-04-02	105725-6	Trip Blank	8260B (VOC)

Table 2
SUMMARY OF DATA QUALIFICATION

QUALIFIED SAMPLE ID[1]	QUALIFIED ANALYTE(S)	QUALIFIER	ANALYTICAL DEVIATIONS
VOC (8260B)			
020501BIL01GW 020501BIL02GW 020501BIL03GW 020501BIL04GW 020502BIL05GW 020503BIL06GW 020503BIL07GW 020501BIL08GW 020503BIL09GW	2-Butanone	R (undetected)	ICAL RRF <0.05 CCAL RRF < 0.05
SVOC (8270C)			
020501BIL01GW	All base-neutral compounds	J/UJ (low bias)	Two low surrogate recoveries, (base-neutral fraction)
020501BIL08GW	Phenol	J (detected) R (undetected)	Matrix spike recovery 0% and low matrix spike duplicate recovery
	4-Nitrophenol		
Pesticides (8081)			
020501BIL01GW 020501BIL02GW 020501BIL03GW 020503BIL06GW 020503BIL07GW 020503BIL08GW 020503BIL09GW	All pesticide compounds	UJ (low bias)	Low surrogate recovery
020502BIL05GW	4,4'-DDE Dieldrin	J	Second column confirmation RPD ≥ 40%
Organotin (Krone GC/MS)			
020501BIL03GW	Monobutyltin Dibutyltin Tributyltin Tetrabutyltin	J detects (high bias)	High surrogate recovery
Metals (6020)			
020501BIL03GW	Silver	U at the reported concentration	Analyte detected at ≤ 5X method blank concentration
020501BIL04GW			
020502BIL05GW	Antimony, chromium, lead, silver		
020503BIL09GW	Chromium, lead, silver		

Notes:

[1] Methods taken from *Northwest Total Petroleum Hydrocarbons* and *SW-846 EPA Test Methods for Evaluating Solid Waste*

CCAL- continuing calibration verification
ICAL - initial calibration
ID - identification
J - The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.
% D = percent difference
% Rec - percent recovery
MS - matrix spike
PQL - practical quantitation limit
R - The analyte results are rejected due to serious deficiencies in the ability to analyze the sample and meet the quality control criteria. The presence or absence of the analyte cannot be verified.
RPD - relative percent difference
RSD - relative standard deviation
U - Undetected at the PQL
UJ - estimated PQL

Table 3
SUMMARY OF FIELD DUPLICATE PRECISION

Compound/Analyte[1]	Primary PQL	Dup. PQL	020503BIL06GW (105725/105727) Primary Sample	020503BIL07GW (105725/105727) Duplicate Sample	RPD (%)[2]
Volatile Organic Compounds (µg/L)					
Chloroform	1		1.69	1.86	nc
Semivolatile Organic Compounds (µg/L)					
Naphthalene	0.01	0.104	0.04	ND	nc
2-Methylnaphthalene	0.1	1.04	0.0316 J	0.434	nc
Phenanthrene	0.01	0.104	ND	0.211	nc
Diethylphthalate	0.1	1.04	0.192	ND	nc
bis(2-Ethylhexyl)phthalate	0.1	1.04	ND	1.79	nc
Di-n-octylphthalate	0.1	1.04	ND	2.85	nc
Metals (mg/L)					
Antimony	0.003		0.0037	0.0041	nc
Arsenic	0.001		0.0031	0.0018	nc
Barium	0.001		0.3	0.31	**3.3**
Beryllium	0.0005		0.00024 J	0.00029 J	nc
Cadmium	0.0005		0.0046	0.0047	**2.2**
Chromium	0.001		0.0055	0.0065	**17**
Copper	0.001		0.18	0.23	**24**
Iron	0.05		11.4	13	**13**
Lead	0.005		0.073	0.083	**13**
Manganese	0.001		0.32	0.34	**4.9**
Nickel	0.001		0.11	0.12	**8.7**
Silver	0.0001		0.00059	0.00072	**20**
Thallium	0.0005		0.00020 J	0.00019 J	nc
Zinc	0.003		1.72	1.77	**2.9**
TPH-Dx (mg/L)					
#2 Diesel	0.2		0.51 X	0.46 X	nc
Motor Oil	0.4		0.8 X	0.7 X	nc

[1] – No target compounds were detected in samples 020503BIL06GW and 020503BIL07GW for five analyses: TPH-gasoline fraction, organotin compounds, pesticides, PCBs, and herbicides

[2] – relative percent difference (RPD) was not calculated for analytes detected at less than 5X the PQL.

(µg/Kg) - micrograms per liter
mg/Kg – milligrams per liter
(%) - percent
PCBs – polychlorinated biphenyls
PQL - practical quantitation limits
nc – not calculated
TPH-Dx – total petroleum hydrocarbons-diesel range
X – Contaminant does not appear to be “typical” product

Twenty-nine primary soil samples and three field duplicates were collected by URS on October 15, 16 and 17, 2001 during the Bradford Island Phase II Supplemental Site Investigation in Cascade Locks, Oregon. The analytical results were subject to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (degree to which the sample represents the environmental condition), accuracy (spike and/or standard % recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). This report addresses only those problems that affect data usability. Validated sample results are presented in the analytical tables in the Bradford Island Site Characterization.

The data quality review process followed the procedures outlined in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, October 1999) and *Inorganic Data Review* (USEPA, February 1994).

Samples were collected according to the Bradford Island Site Characterization Sampling and Analysis Plan (SAP) (URS, 2001). Severn Trent Laboratory-Seattle, Inc. (formerly know as Sound Analytical Service, Inc.) of Tacoma, Washington analyzed for the following parameters:

Method	Analytical Parameter
8082	Polychlorinated Biphenyls (PCBs)
8081	Chlorinated Pesticides
8151A	Chlorinated Herbicides
8260B	Volatile Organic Compounds (VOCs)
8270C	Semivolatile Organic Compounds (SVOCs)
6010B/6020	Metals[1]
7471A	Mercury
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons – Gasoline Range Organics
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons – Diesel and Heavy Oil Range Organics
Krone (GC/MS) [2]	Butyltins

[1] Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Ni, Na, Pb, Sb, Se, Tl, Va, Zn
[2] The method is an Ion Trap GC/MS method for organotin analysis developed for the Puget Sound Estuary Program.

The sample locations and analyses are summarized in Table 1. The Oregon Department of Environmental Quality (DEQ) requested additional analyses for the samples collected at the Mercury Vapor Lamp Removal area and for Investigation Derived Waste samples after the SAP was finalized. Additional analyses conducted at the request of DEQ are highlighted in Table 1.

Table 2 summarizes qualifiers added to the data.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within 4°C± 2°C. Samples were analyzed within the technical and contracted holding time (14 days) except for the undiluted VOC analyses of 011015BIL01IDW, 011015BIL02IDW, and 011015BIL04IDW which were analyzed one day out of hold time. Samples were extracted within the 14-day hold time; therefore, the sample results were not qualified.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per method requirements. Target compounds were detected in the method blanks for VOC and SVOC analyses as follows:

- The VOC analysis exhibited methylene chloride, bromomethane, and naphthalene method blank contamination. Associated samples were non-detect for bromomethane; therefore, the sample results were not qualified for this analyte. The associated sample results less than five times the naphthalene or ten times the methylene chloride blank contamination were qualified non-detect (U) at the appropriate quantitation level.
- The SVOC analysis exhibited di-n-butylphthalate method blank contamination. The associated sample results less than ten times the di-n-butylphthalate were qualified non-detect (U) at the appropriate quantitation level.

A trip blank was not analyzed. No data were qualified based on this field QC nonconformance.

The samples were collected with dedicated sampling equipment; therefore, it was not necessary to collect rinse blanks.

ACCURACY

Instrument Calibration

The laboratory performed initial multi-point calibrations for all target and surrogate compounds as required. Initial calibrations (ICAL) and continuing calibrations (CCAL) were analyzed at the proper frequency as required by the methods. Response factors (RFs) and relative response factors (RRF) were greater than the minimum acceptance limit (0.05), and percent relative standard deviations (%RSD) and percent differences (%Ds) were within control limits except for the following:

- The VOC CCAL conducted on 10/30/01 exhibited a percent difference (%D) greater than the 25% limit for bromomethane, acetone, vinyl acetate, 1,2,4-trichlorobenzene, and naphthalene. All associated sample results were non-detect and were qualified as estimated (UJ).
- The VOC CCAL conducted on 10/25/01 exhibited a %D greater than the 25% limit for bromomethane. The associated sample result was non-detect; therefore, the result was qualified as estimated (UJ).
- The VOC CCAL conducted on 10/28/01 exhibited a %D greater than the 25% limit for bromomethane, trichloroethene, 2-hexanone, and naphthalene. The associated sample result was non-detect; therefore, the results were qualified as estimated (UJ).
- The SVOC ICAL conducted on 10/18/01 exhibited %RSDs greater than the 30% limit for benzoic acid, 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, and n-nitrosodimethylamine. All associated sample results were non-detect; therefore, no qualifiers were applied.
- The SVOC ICAL conducted on 10/25/01 exhibited %RSDs greater than the 30% limit for bis(2-ethylhexyl)phthalate, n-nitrosodimethylamine, and benzidine. All associated sample results for the affected analytes were quantified from a prior ICAL conducted at a lower dilution. No qualifiers were applied.
- The SVOC CCAL conducted on 10/18/01 exhibited RFs <0.05 for the following analytes: benzoic acid, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, and n-nitrosodimethylamine. Analyte results were non-detect in associated samples and were rejected (R). The same CCAL exhibited %Ds greater than the 25% limit for 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitiro-2-methylphenol, di-n-octylphthalate, n-nitrosodimethylamine, benzidine, bis(2-ethylhexyl)phthalate, benzofluoroanthenes, and carbazole. Associated sample results were qualified as estimated (J/UJ).
- The SVOC CCAL conducted on 10/25/01 exhibited %Ds greater than the 25% limit for benzyl alcohol, 2,6-dinitrotoluene, 3-nitroaniline, 2,4-dinitrophenol, 4-nitrophenol, 4-nitroaniline, 4,6-dinitro-2-methylphenol, di-n-butylphthalate, 3’3-dichlorobenzidine, di-n-octylphthalate, n-nitrosodimethylamine, and benzidine. Associated sample results were qualified as estimated (J/UJ).
- The SVOC CCAL conducted on 10/25/01 exhibited %Ds greater than the 25% limit for benzyl alcohol, 3,4-methylphenol, hexachlorocyclopentadiene, bis(2-ethylhexyl)phthalate, and n-nitrosodimethylamine. The associated sample result was non-detect; therefore, the results were qualified as estimated (UJ).
- The SVOC CCAL conducted on 10/25/01 exhibited %Ds greater than the 25% limit for benzyl alcohol, 3,4-methylphenol, hexachlorocyclopentadiene, 2-chloronaphthalene,

chrysene, n-nitrosodimethylamine, carbazole, and benzidine. This calibration affected only the 100-times dilution for chrysene for sample 011016BIL18SS. The analyte result was qualified as estimated (J).

- The pesticide CCAL conducted on 10/25/01 exhibited %Ds greater the 15% limit for endrin aldehyde and methoxychlor on the second column. Associated samples were non-detect for these analytes; therefore, the sample results were not qualified.

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Several surrogate outliers were noted in the NWTPH-Gx, butyltin, and pesticide analyses as follows:

- The SVOC analysis of sample 011015BIL04IDW exhibited zero surrogate recovery for nitrobenzene-d5. All detected base/neutral samples were qualified as estimated (J) and all non-detect base/neutral samples were rejected (R).
- The NWTPH-Gx analysis of samples 011015BIL04IDW and 011017BIL29IDW exhibited elevated surrogate %R (>130%) for bromofluorobenzene, indicating a potential high bias. The sample result was qualified as estimated (J).
- The butyltin analysis of samples 011016BIL12SS, 011016BIL09SS, 011016BIL20SS, and 011016BIL21SS exhibited elevated surrogate %R (> 120%), indicating a potential high bias. Sample results were non-detect; therefore, results were not qualified.
- The butyltin analysis of sample 011016BIL07SS exhibited 0 surrogate %R. Sample results were non-detect and were rejected (R).
- The pesticide analysis of 011016BIL19SS exhibited elevated %R for surrogate decachlorobiphenyl (>140%), indicating a potential high bias. Sample results were non-detect; therefore, results were not qualified.

Laboratory Control Sample and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recovery the target compounds from the sample matrix. The laboratory analyzed at least one LCS and one MS/MSD (or one MS and one sample duplicate for metals analyses) for each analysis and for each batch per method requirements. Data were evaluated for %R of target compounds based on the project-specific QC limits.

QC for all LCS' were within control limits. QC for MS/MSDs were within control limits with the following exceptions:

- The VOC MS/MSD analysis of parent sample 011016BIL22SS exhibited spike %Rs below criteria (70-130%). The associated LCS %Rs were within criteria; therefore, the parent sample results were not qualified.
- The SVOC MS/MSD analysis of parent samples 011015BIL03IDW and 011016BIL22SS exhibited spike %Rs above and below the criteria and RPDs above the criteria (45-135% and 60%, respectively). The associated LCS %Rs were within criteria; therefore, the parent sample results were not qualified.
- The butyltin MS/MSD analysis of parent samples 011015BIL03IDW and 011016BIL22SS exhibited spike %Rs below criteria for dibutyltin (30-120%). The associated LCS %Rs were within criteria; therefore, sample results were not qualified.
- The butyltin MS/MSD analysis of parent sample 011016BIL11SS exhibited zero spike %R for dibutyltin and monobutyltin due to a 200-fold dilution. The associated LCS %Rs were within criteria; therefore, the parent sample results were not qualified
- The PCB MS analysis of parent sample 011015BIL01IDW exhibited spike %R above the criteria (40-140%) while the MS/MSD analysis of parent sample 011017BIL28IDW exhibited spike %R below the criteria. The associated LCS %Rs were within criteria; therefore, sample results were not qualified.
- The NWTPH-Gx MS analysis of parent sample 011015BIL04IDW exhibited zero spike %R, while the MSD analysis exhibited 20 spike %R. The MS/MSD analysis of parent sample 011017BIL28IDW exhibited zero spike %R. Both parent samples exhibited gasoline concentrations more than ten times the spike amount. The associated LCS %Rs were within criteria; therefore, the parent sample result was not qualified.
- The metals MS analysis exhibited spike %R outside the criteria (75-125%) for copper, lead, manganese, and zinc for parent sample 011017BIL24SS and for nickel for parent sample 011016BIL22SS. Associated samples were qualified as estimated (J).

PRECISION

Second Column Confirmation

Second column confirmation was performed for all PCB and pesticide results. The higher of the two results was reported, per method requirements. Analytes exhibiting an RPD > 40% between columns results were qualified as estimated (J). Affected samples and analytes are listed in Table 2.

Duplicate Review

Laboratory Duplicates

Laboratory duplicates were analyzed to establish laboratory analytical precision. All laboratory duplicate results exhibited RPDs within QC limits with the following two exceptions:

- The NWTPH-Dx laboratory duplicate analysis of sample 011016BIL22SS exhibited an elevated RPD (59%) for motor oil range organics. The parent sample result was qualified as estimated (J).
- The laboratory duplicate analysis of sample 011017BIL29IDW for mercury and of sample 01101622SS for barium exhibited RPDs above the control limit of 25%. The parent and associated sample results were qualified as estimated (J).

Field Duplicates

Three field duplicates were collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. The RPD was calculated only when sample results were greater than 5 times the reporting limit. Duplicate pairs that exhibit RPDs above control limits are presented in the table below. No data were qualified based on field duplicate precision.

ANALYTE	UNITS	PRIMARY RESULT	DUPLICATE RESULT	RELATIVE PERCENT DIFFERENCE
011016BIL11SS/011016BIL12SS				
Antimony	mg/Kg	**2.55**	**11.6**	128%
Arsenic	mg/Kg	**4.69**	**9.56**	68%
Chromium	mg/Kg	**24.8**	**75.3**	101%
Copper	mg/Kg	**63.5**	**134**	71%
Lead	mg/Kg	**245**	**922**	116%
011016BIL22SS/011016BIL23SS				
Manganese	mg/Kg	**2520**	**905**	94%
PCB-Aroclor 1254	µg/Kg	**86.1**	**14**	144%
PCB-Aroclor 1260	µg/Kg	**64.5**	**118**	59%
Dibenz(a,h)anthracene	µg/Kg	**573**	14.8 U	190%
Indeno(1,2,3-cd)pyrene	µg/Kg	**3660**	**405**	160%
011017BIL24SS/011017BIL25SS				
Lead	mg/Kg	**815**	**413**	65%

COMPARABILITY

Compound Identification

The diesel range organics analysis was noted to exhibit ‘non-typical’ elution patterns by the laboratory for several samples. Qualitative observations were noted on the laboratory report forms and on the Analytical Results Summary Tables in the main body of the report.

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific Data Quality Objectives. Occasionally analyte practical quantitation limits (PQLs) were above levels specified in the QAPP. The laboratory reported all detections under the PQL and qualified those results as estimated (J) because the analyte concentrations were less than the lowest calibration standard.

Occasionally, a smaller volume of sample or additional dilution of a sample extract was required in order to bring the sample concentrations within the linear range of calibration. Because the samples required dilution, they did not meet the requested reporting limits. All data are acceptable based on high analyte concentrations in these samples.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were adequate for data review. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Based on the QA/QC review three analyses were rejected out of 186 analyses. Project completeness is 98 percent.

Table 1

Sample Location and Analyses Summary

Site Location	Sample IDs	Analyses
Gully Area Investigation	011016BIL13SS 011016BIL14SS 011016BIL15SS 011016BIL16SS 011016BIL17SS 011016BIL18SS 011016BIL19SS 011016BIL20SS 011016BIL21SS 011016BIL22SS 011016BIL23SS	6010B/6020/7471[1], 8260B, 8270C, 8081A, 8082, 8151A, NWTPH-Gx, NWTPH-Dx, Krone (GC-MS)[2]
Mercury Vapor Lamps Removal	011016BIL05SS 011016BIL06SS 011016BIL07SS 011016BIL08SS 011016BIL09SS 011016BIL10SS 011016BIL11SS 011016BIL12SS	NWTPH-Dx, 6010B/6020/7471[1], 8082, Krone (GC-MS)[2]
Hot Spot Analysis	011017BIL24SS 011017BIL25SS 011017BIL26SS 011017BIL27SS 011017BIL30SS 011017BIL31SS 011017BIL32SS	6010B[3]
Investigation Derived Waste (Mercury and Gully Area)	011015BIL01IDW 011015BIL02IDW 011015BIL03IDW 011015BIL04IDW 011017BIL28IDW 011017BIL29IDW	1311/6010B/6020/74741[4], 8260B, 8082, NWTPH-Gx, NWTPH-Dx, 8270C, Krone (GC-MS)[2]

Note:
[1] Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Ni, Na, Pb, Sb, Se, Tl, Va, Zn
[2] The method is an Ion Trap GC/MS method for organotin analysis developed for the Puget Sound Estuary Program.
[3] Pb (total)
[4] RCRA 8
Highlighted analyses indicate analyses added at the request of DEQ after the Field Sampling Plan was finalized.

TABLE 2

SUMMARY OF DATA QUALIFICATION

SAMPLE ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
Volatile Organic Compounds (8260B)			
011015BIL04IDW 011017BIL28IDW 011017BIL29IDW	Bromomethane	UJ	CCAL %D>25%
011015BIL01IDW 011015BIL02IDW 011015BIL03IDW 011016BIL13SS 011016BIL14SS 011016BIL15SS 011016BIL16SS 011016BIL17SS 011016BIL18SS 011016BIL20SS 011016BIL21SS 011016BIL22SS 011016BIL23SS	Bromomethane Acetone Vinyl acetate 1,2,4-Trichlorobenzene Naphthalene	UJ	CCAL %D>25%
011016BIL19SS	Bromomethane Trichloroethene 2-Hexanone Naphthalene	UJ	CCAL %D>25%
011015BIL01IDW 011015BIL02IDW 011015BIL03IDW 011016BIL13SS 011016BIL14SS 011016BIL15SS 011016BIL16SS 011016BIL17SS 011016BIL18SS 011016BIL19SS 011016BIL20SS 011016BIL21SS 011016BIL23SS	Methylene chloride	U	Method blank contamination
011016BIL19SS	Naphthalene	UJ	Method blank contamination (and CCAL %D>25%)

SAMPLE ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
Semivolatile Organic Compounds (8270C)			
011015BIL01IDW 011015BIL02IDW 011015BIL03IDW 011015BIL04IDW	Benzoic acid 2,4-Dinitrophenol 4,6-Dinitro-2-methylphenol N-Nitrosodimethylamine	R	CCAL RF <0.05
011015BIL01IDW 011015BIL02IDW 011015BIL03IDW	Di-n-Octylphthalate Bis(2-Ethylhexyl)phthalate Benzofluoranthenes Carbazole Benzidine	J/UJ	CCAL %D>25%
011015BIL04IDW	4-Nitrophenol	UJ	CCAL %D>25%
011016BIL18SS	Chrysene	J	CCAL %D>25%
011016BIL13SS 011016BIL14SS 011016BIL15SS 011016BIL18SS 011016BIL19SS 011016BIL20SS 011016BIL21SS 011016BIL22SS 011016BIL23SS	Benzyl alcohol 2,6-Dinitritoluene 3-Nitroaniline 2,4-Dinitrophenol 4-Nitrophenol 4-Nitroaniline 4,6-Dinitro-2-methylphenol Di-n-butylphthalate 3'3'-Dichlorobenzidine Di-n-octylphthalate N-Nitrosodimethylamine Benzidine	J/UJ	CCAL %D>25%
011016BIL16SS 011016BIL17SS	Benzyl alcohol 2,6-Dinitritoluene 3-Nitroaniline 2,4-Dinitrophenol 4-Nitrophenol 4-Nitroaniline 4,6-Dinitro-2-methylphenol 3'3'-Dichlorobenzidine Di-n-octylphthalate N-Nitrosodimethylamine Benzidine	J/UJ	CCAL %D>25%
011016BIL16SS 011016BIL17SS	Di-n-butylphthalate	UJ	Method blank contamination and CCAL %D>25%
011017BIL28IDW 011017BIL29IDW	Benzyl alcohol 3,4-Methylphenol Hexachlorocyclopentadiene Bis(2-ethylhexyl)phthalate N-Nitrosodimethylamine	UJ	CCAL %D>25%
011015BIL04IDW	Base/Neutral Detected Analytes	J	Base/Neutral Surrogate %R = 0
011015BIL04IDW	Base/Neutral Non-detect Analytes	R	Base/Neutral Surrogate %R = 0

SAMPLE ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
Gasoline Range Organics (NWTPH-Gx)			
011015BIL04IDW 011017BIL29IDW	Gasoline Range Organics	J	Surrogate %R>130
Diesel and Motor Oil Range Organics (NWTPH-Dx)			
011016BIL22SS	Motor Oil Range Organics	J	Laboratory duplicate RPD>50
Butyltins by GC/MS			
011016BIL07SS	Mono-, Di-, Tri-, Tetrabutyltin	R	Zero Surrogate %R
Pesticides (8081)			
011016BIL16SS 011016BIL18SS 011016BIL21SS 011016BIL22SS 011016BIL23SS	Chlordane	J	Second column confirmation RPD>40%
011016BIL17SS	Endosulfan II Endosulfan sulfate	J	Second column confirmation RPD>40%
Metals (6020/6010B/7470A)			
011016BIL05SS 011016BIL06SS 011016BIL07SS 011016BIL08SS 011016BIL09SS 011016BIL10SS 011016BIL11SS 011016BIL12SS 011016BIL13SS 011016BIL14SS 011016BIL15SS 011016BIL16SS 011016BIL17SS 011016BIL18SS 011016BIL19SS 011016BIL20SS 011016BIL21SS 011016BIL22SS 011016BIL23SS	Copper Nickel Manganese Zinc	J	MS %R <75%
	Lead	J	MS %R>125%
	Barium	J	Laboratory duplicate RPD>25%
011016BIL24SS 011016BIL25SS 011016BIL26SS 011016BIL27SS 011016BIL30SS 011016BIL31SS 011016BIL32SS	Lead	J	MS %R>125%

SAMPLE ID	ANALYTE	QUALIFIER	ANALYTICAL DEVIATIONS
011017BIL28IDW 011017BIL29IDW	Mercury	J	Laboratory duplicate RPD>25%

CCAL – continuing calibration verification
ICAL – initial calibration
ID- identification
J – The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.
% D – percent difference
% R – percent recovery
MS – matrix spike
R – The analyte results are rejected due to serious deficiencies in the ability to analyze the sample and meet the quality control criteria. The presence or absence of the analyte cannot be verified.
RF – response factor
RPD – relative percent difference
RSD – relative standard deviation
U – undetected at the quantitation limit
UJ – estimated quantitation limit

Some samples reported in the 2004 Lanfill Site Characterization Report were collected as samples of Ivestigation-Derived Waste ("IDW samples"). The soil from these stockpiles were returned to their respective excavations rather than shipped as waste. The names of these samples have been changed to reflect this status.

(Original Name)/New Name

(011015BIL01IDW)/011015BIL01TPG
(011015BIL02IDW)/011015BIL02TPG
(011015BIL03IDW)/011015BIL03TPG
(011015BIL04IDW)/011015BIL04TPG
(011017BIL28IDW)/011017BIL28TPM
(011017BIL29IDW)/011017BIL29TPM

Twenty-five soil samples, twelve groundwater samples, three sandblast grit samples, one blow-down water sample, one waste material sample, three soil duplicate samples, two groundwater duplicate samples, one sandblast grit duplicate sample, one blow-down water duplicate sample, seven trip blanks, and three equipment rinsates were collected by URS on November 16, 2004 through November 29, 2004 at the Bradford Island site in Cascade Locks, Oregon as part of the Phase II Supplemental Site Inspection Sandblast Area Investigation. Samples were collected according to the Sampling and Analysis Plan (SAP) for the Bradford Island Landfill Phase II supplemental site investigation (URS, 2001) and addendum (October 29, 2004). Samples were submitted to Severn Trent Laboratories – Seattle, Inc., (STL) located in Tacoma, Washington and analyzed for one or more of the following parameters in general accordance with the methods indicated:

Method	Analytical Parameter
EPA 8260B	Volatile Organic Compounds (VOCs)
EPA 8270C	Total and Dissolved Semivolatile Organic Compounds (SVOCs)
EPA 8081A	Chlorinated Pesticides
EPA 8082	Polychlorinated Biphenyls (PCBs)
EPA 6010B/6020/SPLP (1312)/TCLP (1311)	Total and Dissolved Metals[1]
EPA 7470A/7471A	Total and Dissolved Mercury
NWTPH-Gx (Ecology)	Total Petroleum Hydrocarbons – Gasoline Range (TPH-Gx)
NWTPH-Dx (Ecology)	Total Petroleum Hydrocarbons – Diesel and Motor Oil Range (TPH-Dx)
Krone (GC/MS)[2]	Butyltin compounds (Selected samples for SPLP Butyltins)
EPA 9060 mod.[3]	Total Organic Carbon (TOC)
EPA 160.2	Total Suspended Solids (TSS)
ASTM D422[3]	Grain Size Distribution/Particle Size

[1] Metals list: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Ni, Na, Pb, Sb, Se, Tl, V, Zn
TCLP and SPLP analyses only for Pb and Cr

[2] Ion trap full scan GC/MS method for butyltin compound analysis developed for the Puget Sound Estuary Program (PSEP)

[3] Soil TOC and grain size analyses performed by STL Burlington, Vermont

Table G-1 summarizes the sample locations and requested analyses. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (degree to which the sample represents the environmental condition), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed in each laboratory report submitted: proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification and correctness of calculated results. The data review process for this investigation followed the procedures in EPA's *Contract Laboratory Program National Functional Guidelines (USEPA NFGs) for Organic Data Review (USEPA, October 1999)* and *USEPA NFGs for Inorganic Data Review (USEPA, July 2002)* modified for (in order of priority) the requirements of the investigation-specific criteria (Quality Assurance Project Plan - QAPP), the USACE *Requirements for the Preparation of Sampling and Analysis Plans,* EM 200-1-3, February 2001, Appendix I (Shell), and the USEPA SW-846 analytical methods used. A summary of qualifiers assigned to results in this investigation is included in Table G-2 on the attached compact disc. For ease of reference between the data review and other SSI documents the samples are represented in Table G-2 by their laboratory ID and the ID assigned in the field. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. The level of estimation has not been quantified; reasons for qualification should be considered before use of the data in any calculation or numerical comparison.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR – Do Not Report. Multiple results from different analytical dates and/or dilutions. Value from another analysis should be used.

Final sample results and qualifiers are presented in the analytical tables in the SSI.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. With the exception of one cooler associated with laboratory sample delivery group (SDG) 124993 (1.4°C) and one cooler associated with SDG 124945 (0.2°C), all coolers were submitted at temperatures within the USEPA-recommended range of 4°C±2°C. Data were not qualified based on cooler temperatures. All samples were analyzed within the technical and contracted holding time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per method requirements. Qualification of samples due to method blank contamination followed guidelines set forth in the USEPA NFGs. For organic analyses, sample results less than five times (5x) the method blank concentration (less than 10x in instances of common laboratory contaminants) and between the method detection limit (MDL) and practical quantitation limit (PQL) were flagged as non-detect (U) at the PQL. When sample results were less than 5x the blank concentration (less than 10x for common laboratory contaminants) but above the PQL, the reported result was qualified as non-detect (U) at the reported result. Target compounds detected in the method blanks but reported as not detected in the associated samples were not qualified.

Target compounds were detected in the method blanks for VOC analyses as follows:

- Acetone, chloroform, benzene, toluene, ethylbenzene, m&p-xylene, o-xylene, styrene, and 1,2,4-trimethylbenzene were detected in the method blank for analytical batch VOA1042. All blank contamination was less than the criteria set forth in the USACE Shell guidance (ie, ½ the reporting limit) with the exception of acetone contamination at 12.5 ug/L. The laboratory noted that the acetone contamination was likely a result of the sodium bisulfate preservative used for the soil samples. Associated results for chloroform, benzene, toluene, ethylbenzene, m&p-xylene, o-xylene, styrene, and/or 1,2,4-trimethylbenzene in soil samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, and 124993-20 less than 5x the method blank concentration were qualified as non-detect at the reported value (U) or the PQL based on the guidelines previously described. Associated acetone detections less than 10x the method blank concentrations were qualified as non-detect (U).
- Bromomethane, 1,2-dichloropropane, chlorobenzene, bromoform, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and naphthalene were detected in the method blank for analytical batch VOA1050 at levels less than one half the reporting limit. Associated results for bromomethane, 1,2-dichloropropane, chlorobenzene, bromoform, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and/or naphthalene in water samples 124945-01, 124945-04, 124993-08, 124993-09, 124993-10, 124993-11, 124993-12, 124993-13, 124993-14, 124993-15, and 124993-16 with concentrations less than five times the method blank concentrations were qualified as non-detect at the reported value (U) or the PQL based on the guidelines previously described.
- Bromomethane, chlorobenzene, 1,2,3-trichlorobenzene, and naphthalene were detected in the method blank for analytical batch VOA1051 at levels less than one half the reporting limit. As cis-1,2-dichloroethene was the only compound reported from the dilutions of samples 124993-14 and 124993-15, data for these two samples were not qualified based on these method blank results. Associated results for bromomethane, chlorobenzene, 1,2,3-trichlorobenzene, and/or naphthalene in water samples 125010-01, 125010-02,

125010-03, 125010-04, 125010-05, and 125059-11 with concentrations less than five times the method blank concentrations were qualified as non-detect at the reported value (U) or the PQL based on the guidelines previously described.

- Chloromethane and naphthalene were detected in the method blank for analytical batch VOA1052 at levels less than half the reporting limit. Associated results for chloromethane and/or naphthalene in water samples 125060-01, 125060-02, 125060-09, 125060-10, 125060-11, and 125060-12 with concentrations less than 5x the method blank concentrations were qualified as non-detect at the reported value (U) or the PQL based on the guidelines previously described.
- Bromomethane, acetone, methylene chloride, 2-butanone, benzene, toluene, ethylbenzene, m,p-xylene, o-xylene, and styrene were detected in the method blank for analytical batch VOA1056. All blank contamination was at levels less than half the reporting limit with the exception of bromomethane at 0.585J ug/L, acetone at 60.9 ug/L, methylene chloride at 1.99 ug/L, and 2-butanone at 5.1 ug/L. The laboratory noted that the acetone, methylene chloride and 2-butanone contamination was likely due to the sodium bisulfate preservative used for the soil sample vials. Associated results in soil samples 125059-08, 125059-10, 125059-12, 125059-13, 125059-14, 125059-15, 125059-16, 125060-03, 125060-04, 125060-05, 125060-06, and 125060-08 with concentrations less than 5x (bromomethane, benzene, toluene, ethylbenzene, m,p-xylene, o-xylene, and/or styrene) or 10x (acetone, methylene chloride, and 2-butanone) the blank concentration were qualified as non-detect at the reported value (U) or the PQL based on the guidelines previously described.
- Methylene chloride and naphthalene were detected in the method blank for analytical batch VOA1057 at levels less than half the reporting limit. As trichloroethene, tetrachloroethene, and 1,2,4-trimethylbenzene were the only compounds reported for the dilution of sample 125059-08, data were not qualified based on these method blank results.

Per the laboratory, the glassware used for soil and water VOC analyses is certified to be free of contamination at concentrations 1.0 ug/L or 1.0 ug/kg; however, the MDLs for a number of compounds fall below these levels. In addition, the laboratory indicated that the sodium bisulfate used for soil VOC preservation may have contributed to the contamination seen in the above-referenced blanks. The USACE 'Shell' requires that all equipment used reflect the measurement accuracy required to meet project data quality objectives. The laboratory reported detections that fell between the MDL and the PQL and qualified these values as estimated (J). As previously stated, analytes detected in samples between the MDL and PQL that were also detected in the method blank were qualified as not detected at the PQL if the sample concentration was less than 5x (10x for common laboratory contaminants) the blank concentration.

Target compounds were detected in the method blanks for total and dissolved SVOC analyses as follows:

- Di-n-butylphthalate and butylbenzylphthalate were detected in the method blank for analytical batch SS1281 at levels less than one half the reporting limit. The associated di-n-butylphthalate and/or butylbenzylphthalate results in soil samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, and 124993-20 less than 10x the method blank contamination were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- Phenol, di-n-butylphthalate, and butylbenzylphthalate were detected in the method blank for analytical batch SW1036. The di-n-butylphthalate and butylbenzylphthalate contamination of 0.151 ug/L and 0.198 ug/L were greater than one half the respective reporting limits of 0.2 and 0.3 ug/L. The phenol contamination of 0.0184 ug/L was less than half of the reporting limit. The associated phenol, di-n-butylphthalate, and/or butylbenzylphthalate results in water samples 125010-01 (total and dissolved) and 125010-02 (total and dissolved) less than 5x (phenol) or 10x (di-n-butylphthalate and butylbenzylphthalate) the method blank concentration were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- Di-n-butylphthalate was detected in the method blank for analytical batch SW1040 at 0.15 ug/l, greater than one half the reporting limit of 0.2 ug/L. The associated total di-n-butylphthalate water results in samples 125059-06, 125060-01, 125060-02, 125060-10, and 125060-11 less than 10x the method blank concentration were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- Di-n-butylphthalate and butylbenzylphthalate were detected in the method blank for analytical batch SS1285 at levels of 6.38 ug/L and 2.54 ug/L, respectively. The di-n-butylphthalate contamination was greater than one half the reporting limit of 10 ug/L. The associated di-n-butylphthalate and/or butylbenzylphthalate results in soil samples 125059-08, 125059-10, 125059-12, 125059-13, 125059-14, 125060-03, 125060-05, 125060-06, and 125060-08 with concentrations less than 10x the method blank concentration were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.

Target compounds were detected in the method blanks for pesticide analyses as follows:

- Endosulfan II was detected in the method blank for analytical batch PW0293 at 0.00169 ug/L, greater than half the reporting limit of 0.002. Second column confirmation was performed with a relative percent difference (RPD) <40%. Associated results for endosulfan II in water samples 124993-14 and 124993-15 less than 5x the method blank concentration were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- β-BHC was detected in the method blank for analytical batch PE1799 at 1.55 ug/kg, a level greater than one half the reporting limit of 1 ug/kg. Second column confirmation was performed with an RPD<40%. Associated results for β-BHC in soil samples 125059-12, 125059-13, 125059-14, and 125059-15 with concentrations less than five

times the method blank contamination were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.

Target compounds were detected in the method blanks for petroleum hydrocarbon analyses as follows:

- Gasoline-range hydrocarbons were detected in the method blanks for analytical batches GB4028, GB4029, and GB4030 at levels less than one half the reporting limit. Associated gasoline-range hydrocarbon results in soil samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-18, 124993-19, 124993-20, 125059-10, 125059-12, 125059-13, 125059-14, 125059-15, 125059-16, 125060-03, 125060-08, and water samples 125060-10 and 125060-11 with concentrations less than 5x the method blank concentrations were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.

For metals analyses, sample results less than 10x the method blank concentration and between the method detection limit (MDL) and practical quantitation limit (PQL) were flagged as non-detect (U) at the PQL. Sample results less than 10x the blank concentration but above the PQL were qualified as estimated (J). Target compounds detected in the method blanks but reported as not detected in the associated samples were not qualified. Target compounds were detected in the method blanks for metals analyses as follows:

- Antimony, aluminum, barium, chromium, copper, lead, manganese, sodium, and/or zinc were detected in one or more method blanks associated with the soil samples. With one exception, these metals were either reported as not detected or detected at concentrations greater than 10x the respective method blank concentrations in associated samples and the results were not qualified. The result for sodium in soil sample 125059-13 was qualified as estimated (J).
- Antimony, aluminum, barium, calcium, chromium, copper, lead, manganese, nickel, vanadium, and/or zinc were detected in one or more method blanks associated with the water samples (total and dissolved). Associated results for antimony, calcium, copper, lead, manganese, nickel, vanadium, and/or zinc in water samples 124945-01 (dissolved), 124993-08 (total and dissolved), 124993-09 (total and dissolved), 124993-10 (total and dissolved), 124993-11 (total and dissolved), 124993-13 (dissolved), 124993-14 (total and dissolved), 124993-15 (total and dissolved), 125010-01 (total and dissolved), 125010-02 (total and dissolved), 125059-05 (dissolved), 125060-01 (total), 125060-02 (total), 125060-05 (total), 125060-10 (total), and 125082-01 (total) with concentrations less than 10x the method blank concentrations but greater than the PQL were qualified as estimated (J). Sample results between the MDL and PQL were qualified as non-detect (U) at the PQL. Associated results for aluminum, barium, and chromium were not qualified.

Two equipment rinsate blanks were collected on November 23, 2004 in conjunction with the sandblast area investigation, a hand auger rinsate and a pickaxe rinsate sample. Both rinsate samples were analyzed for VOCs, SVOCs, NWTPH-Gx, NWTPH-Dx, and total organic carbon. The pickaxe rinsate was also analyzed for PCBs, pesticides, and butyltins. The hand auger rinsate was analyzed for total metals. A sample for the metals analyses associated with the hand auger was also collected on November 29, 2004. The hand auger was used in the collection of samples 125059-07, 125059-08, 125059-09, 125059-10, 125060-05, 125060-06, 125060-07, and 125060-08. The pickaxe was used in the collection of samples 125059-12, 125059-13, 125059-14, 125059-15, 125060-03, and 125060-04. The remaining samples were collected with dedicated equipment; therefore, an equipment blank was not collected for these samples. Several target analytes were detected in the equipment rinsates; however, all associated sample detections were either previously qualified or the sample concentrations were greater than five times the equipment rinsate concentrations. No data were qualified based on the equipment rinsate results.

Seven trip blanks were analyzed for VOCs. Target compounds were detected in the trip blanks as follows:

- Chloromethane, bromomethane, carbon disulfide, methylene chloride, and naphthalene were detected in trip blank #2715. The results for bromomethane and naphthalene were previously qualified as not detected based on method blank contamination. Samples 125010-01, 125010-02, 125010-04, and 125010-05 with concentrations less than 5x (chloromethane and carbon disulfide) or 10x (methylene chloride) the trip blank concentrations were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- Chloromethane, bromomethane, carbon disulfide, methylene chloride, and cis-1,2-dichloroethene were detected in trip blank #2716. The result for bromomethane in this trip blank was previously qualified as not detected based on the method blank result. Samples 124993-13, 124993-14, 124993-15, 124993-17, 124993-18, 124993-19, and 124993-20 with concentrations less than 5x (chloromethane, carbon disulfide, and cis-1,2-dichloroethene) or 10x (methylene chloride) the method blank concentrations were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.
- Chloromethane, bromomethane, carbon disulfide, methylene chloride, toluene, ethylbenzene, isopropylbenzene, 1,2,4-trimethylbenzene, n-butylbenzene, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and naphthalene were detected in trip blank #2717. The results for bromomethane, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and naphthalene were previously qualified as not detected in this trip blank based on the associated method blank results. Samples 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-08, 124993-09, 124993-10, and 124993-11 with concentrations less than 5x (chloromethane, carbon disulfide, toluene, ethylbenzene, isopropylbenzene, 1,2,4-trimethylbenzene, n-butylbenzene, and 1,2-dichlorobenzene) and 10x (methylene chloride) the trip blank concentrations were qualified as non-detect (U) at the reported value or the PQL based on the guidelines previously described.

- Chloromethane, bromomethane, methylene chloride, bromoform, and naphthalene were detected in trip blank #2718 (124945-04). Bromomethane, bromoform, and naphthalene were previously qualified as not detected in this trip blank based on the associated method blank. Chloromethane and methylene chloride were either reported as not detected or detected at concentrations more than 10x the trip blank concentration in the associated samples and were not qualified based on the trip blank results.
- Bromomethane, carbon disulfide, methylene chloride, chloroform, benzene, toluene, ethylbenzene, m&p-xylene, 1,2,4-trimethylbenzene, 1,2,4-trichlorobenzene, and naphthalene were detected in trip blank #2718 (125059-11). The results for bromomethane and naphthalene were previously qualified as not detected based on the associated method blank results. The concentrations of carbon disulfide in samples 125059-08 and 125059-16 were less than 5x the trip blank concentration; therefore the results for carbon disulfide in these samples were qualified as non-detect (U) at the reported results. Methylene chloride, chloroform, benzene, toluene, ethylbenzene, m&p-xylene, 1,2,4-trimethylbenzene, and 1,2,4-trichlorobenzene were either not detected or detected at concentrations greater than 5x the trip blank concentration in the associated samples and were not qualified.
- Two trip blanks were submitted with laboratory SDG 125060 and identified as 125060-09 and 125060-12. Chloromethane was detected in trip blanks 125060-09 and 125060-12; however, these results were previously qualified as not detected based on the associated method blank results. No associated sample results were qualified based on these trip blank results.

ACCURACY

Tuning

The instrument tuning frequency and performance were acceptable for all GC/MS analyses (VOCs, SVOCs, and butyltin compounds).

Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICAL) and continuing calibrations (CCAL) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Instrument calibrations were acceptable for VOC analyses with the following exceptions:

- The percent recovery for bromomethane in the second VOC continuing calibration analyzed on November 22, 2004 was below the method QC limits of 80-120%. The results for bromomethane in samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, and 124993-20 were qualified as estimated (J or UJ).

- The percent recovery for bromomethane in the VOC continuing calibration analyzed on November 29, 2004 exceeded the method QC limits of 80-120%. Bromomethane was either not detected or previously qualified as not detected based on other QC issues detailed in this report in samples 124945-01, 124945-04, 124993-08, 124993-09, 124993-10, 124993-11, 124993-12, 124993-13, 124993-14, 124993-15, and 124993-16 and the results were not qualified based on the continuing calibration result.
- The percent recoveries for bromomethane and vinyl acetate in the VOC continuing calibration analyzed on November 30, 2004 exceeded the method QC limits of 80-120%. Bromomethane and vinyl acetate were not reported from the dilutions of samples 124993-14 and 124993-15 and the results were not qualified based on these continuing calibration results. Bromomethane and vinyl acetate were either not detected or previously qualified as not detected based on other QC issues detailed in this report in samples 125010-01, 125010-02, 125010-03, 125010-04, 125010-05, and 125059-11 and the results were not qualified based on these continuing calibration results.
- The percent recoveries for bromomethane, vinyl acetate, and 2,2-dichloropropane in the VOC continuing calibration analyzed on December 1, 2004 were outside the method QC limits of 80-120%. The results for vinyl acetate and 2,2-dichloropropane in samples 125060-01, 125060-02, 125060-09, 125060-10, 125060-11, and 125060-12 were qualified as estimated (J or UJ). As the percent recovery for bromomethane exceeded the method limit and bromomethane was reported as not detected in the associated samples, the results for bromomethane were not qualified based on this continuing calibration.
- The percent recoveries for bromomethane, bromoform, and 1,2-dibromo-3-chloropropane in the VOC continuing calibration analyzed on December 3, 2004 were outside the method QC limits of 80-120%. The results for bromoform and 1,2-dibromo-3-chloropropane in samples 125059-08, 125059-10, 125059-12, 125059-13, 125059-14, 125059-15, 125059-16, 125060-03, 125060-04, 125060-05, 125060-06, and 125060-08 were qualified as estimated (J or UJ). As the percent recovery for bromomethane exceeded the method limit and bromomethane was reported as not detected in the associated samples, the results for bromomethane were not qualified based on this continuing calibration.
- The percent recoveries for hexane, vinyl acetate, and hexachlorobutadiene in the VOC continuing calibration analyzed on December 6, 2004 were outside the method QC limits of 80-120%. Hexane, vinyl acetate, and hexachlorobutadiene were not reported from the dilution of sample 125059-08 and the results were not qualified based on these continuing calibration results.

Instrument calibrations were acceptable for SVOC analyses with the following exceptions:

- The percent relative standard deviations (%RSDs) for n-nitrosodimethylamine, nitrobenzene, benzoic acid, 2,4-dinitrotoluene, 4-nitrophenol, and diethylphthalate exceeded the method limit of 15% in the SVOC initial calibration analyzed on November 15, 2004. Results reported as detected for the above-referenced compounds in samples 124945-01 (total and dissolved), 124993-08 (total and dissolved), 124993-09 (total and dissolved), 124993-10 (total and dissolved), 124993-11 (total and dissolved), 124993-13 (total and dissolved), 124993-14 (total and dissolved), 124993-15 (total and dissolved), 125059-06 (total), 125060-01 (total), 125060-02 (total), and 125060-10 (total) were qualified as estimated (J). Results for the above-referenced compounds reported as not detected were not qualified.

- The %RSDs for hexachloroethane, benzoic acid, 4-chloroaniline, 2-methylnaphthalene, 2,6-dinitrotoluene, 3-nitroaniline, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, 2,4,6-tribromophenol, and butylbenzylphthalate exceeded the method limit of 15% in the SVOC initial calibration analyzed on November 16, 2004. Results reported as detected for the above-referenced compounds in samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, 124993-20, 125059-08, 125059-10, 125059-12, 125059-13, 125059-14, 125059-16, 125059-17, 125060-03, 125060-04, 125060-05, 125060-06, and 125060-08 were qualified as estimated (J). Results for the above-referenced compounds reported as not detected were not qualified.
- The %RSDs for n-nitrosodimethylamine, pyridine, 3&4-methylphenol, benzoic acid, 4-chloroaniline, 4-chloro-3-methylphenol, 2,4-dinitrophenol, 4-nitrophenol, 4-nitroaniline, 4,6-dimitro-2-methylphenol, n-nitrosodiphenylamine, di-n-butylphthalate, benzidine, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate exceeded the method limit of 15% in the second SVOC initial calibration analyzed on November 16, 2004. These compounds were not reported from the 10x dilution of sample 125059-08 and were not qualified based on this continuing calibration. Results reported as detected for the above-referenced compounds in samples 125010-01 (total and dissolved), 125010-02 (total and dissolved), 125010-05 (total), and 125059-15 were qualified as estimated (J). Results for the above-referenced compounds reported as not detected were not qualified.
- The percent recoveries for n-nitrosodimethylamine, benzidine, butylbenzylphthalate, and indeno(1,2,3-c,d)pyrene in the SVOC continuing calibration analyzed on November 23, 2004 were outside the method QC limits of 80-120%. The results for n-nitrosodimethylamine, benzidine, and indeno(1,2,3-c,d)pyrene were qualified as estimated (J or UJ) in samples 124945-01 (total and dissolved), 124993-08 (total and dissolved), 124993-09 (total and dissolved), 124993-10 (total and dissolved), 124993-11 (total and dissolved), 124993-13 (total and dissolved), 124993-14 (total and dissolved), and 124993-15 (total and dissolved). As the percent recovery for butylbenzylphthalate exceeded the method limit, results reported as detected were qualified as estimated (J) in the above-referenced samples. Results reported as not detected for butylbenzylphthalate were not qualified.
- The percent recoveries for n-nitrosodimethylamine, bis(2-chloroisopropyl)ether, 3&4-methylphenol, 2,4-dimethylphenol, and 4-nitroaniline in the SVOC continuing calibration analyzed on November 24, 2004 were outside the method QC limits of 80-120%. The results for 2,4-dimethylphenol and 4-nitroaniline were qualified as estimated (J or UJ) in samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, and 124993-20. As the percent recoveries for n-nitrosodimethylamine, bis(2-chloroisopropyl)ether, and 3&4-methylphenol exceeded the method limit and these compounds were not detected in the above-referenced samples, results for n-nitrosodimethylamine, bis(2-chloroisopropyl)ether, and 3&4-methylphenol in the associated samples were not qualified.

- The percent recoveries for benzyl alcohol, 4-chloroaniline, hexachlorocyclopentadiene, and 4-nitrophenol in the second SVOC continuing calibration analyzed on November 24, 2004 were outside the method QC limits of 80-120%. The results for 4-chloroaniline and hexachlorocyclopentadiene were qualified as estimated (J or UJ) in samples 125010-01 (total and dissolved), 125010-02 (total and dissolved), and 125010-05 (total). As the percent recoveries for benzyl alcohol and 4-nitrophenol exceeded the method limit and these compounds were not detected in the above-referenced samples, results for benzyl alcohol and 4-nitrophenol in the associated samples were not qualified.
- The percent recoveries for 2,4-dimethylphenol, bis(2-chloroethoxy)methane, 4-chloroaniline, 2,4,6-trichlorophenol, di-n-butylphthalate, butylbenzylphthalate, benzo(a)anthracene, 3,3'-dichlorobenzidine, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene in the SVOC continuing calibration analyzed on November 30, 2004 were outside the method QC limits of 80-120%. The results for 2,4-dimethylphenol, bis(2-chloroethoxy)methane, and di-n-butylphthalate were qualified as estimated (J or UJ) in samples 125059-10, 125059-12, 125059-13, 125059-14, 125059-16, 125059-17, 125060-03, 125060-04, 125060-05, 125060-06, and 125060-08. As the percent recoveries for 4-chloroaniline, 2,4,6-trichlorophenol, butylbenzylphthalate, benzo(a)anthracene, 3,3'-dichlorobenzidine, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene exceeded the method limit, results reported as detected were qualified as estimated (J) in the above-referenced samples. Results reported as not detected for 4-chloroaniline, 2,4,6-trichlorophenol, butylbenzylphthalate, benzo(a)anthracene, 3,3'-dichlorobenzidine, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene were not qualified.
- The percent recoveries for hexachlorocyclopentadiene, phenanthrene, di-n-butylphthalate, benzidine, butylbenzylphthalate, and 3,3'-dichlorobenzidine in the second SVOC continuing calibration analyzed on November 30, 2004 were outside the method QC limits of 80-120%. The results for hexachlorocyclopentadiene and benzidine were qualified as estimated (J or UJ) in samples 125059-06, 125060-01, 125060-02, 125060-10, and 125060-11. As the percent recoveries for phenanthrene, di-n-butylphthalate, butylbenzylphthalate, and 3,3'-dichlorobenzidine exceeded the method limit, results reported as detected were qualified as estimated (J) in the above-referenced samples. Results reported as not detected for phenanthrene, di-n-butylphthalate, butylbenzylphthalate, and 3,3'-dichlorobenzidine were not qualified.
- The percent recoveries for n-nitrosodimethylamine, bis(2-chloroethoxy)ether, bis(2-chloroisopropyl)ether, 1,2,4-trichlorobenzene, pyrene, and benzidine in the SVOC continuing calibration analyzed on December 2, 2004 were outside the method QC limits of 80-120%. n-Nitrosodimethylamine, bis(2-chloroethoxy)ether, bis(2-chloroisopropyl)ether, 1,2,4-trichlorobenzene, and benzidine were not reported from the 100x dilution of sample 125059-08 and the results for these compounds were not qualified based on the continuing calibration results. The result for pyrene in the 100x dilution of sample 125059-08 is qualified as estimated (J) based on the continuing calibration.
- The percent recoveries for benzyl alcohol, n-nitrosodi-n-propylamine, 2,4-dimethyphenol, benzoic acid, 4-nitrophenol, diethylphthalate, 4-nitroaniline, and di-n-

butylphthalate in the SVOC continuing calibration analyzed on December 7, 2004 were outside the method QC limits of 80-120%. As the above referenced compounds were not reported from the dilutions of samples 125059-08 (10x), 125059-15 (10x), and 125059-17 (100x), the results were not qualified in these samples based on the continuing calibration.

Instrument calibrations were acceptable for pesticide analyses with the following exceptions:

- The percent recoveries for 4,4'-DDT and decachlorobiphenyl (DCBP) on the primary column and DCBP on the secondary column were outside the method QC limits of 85-115% in the pesticide continuing calibration analyzed on November 19, 2004. The percent recoveries for 4,4'-DDT and methoxychlor on the primary column were outside the method QC limits of 85-115% in the continuing calibration analyzed on November 20, 2004. Data were not qualified for the surrogate DCBP based on continuing calibration results. As 4,4'-DDT and methoxychlor were reported from the column which exhibited acceptable results, associated sample data were not qualified for these compounds based on the continuing calibration.
- The percent recoveries for 4,4'-DDT, endosulfan sulfate, and DCBP on the primary column and DCBP on the secondary column were outside the method QC limits of 85-115% in the pesticide continuing calibration analyzed on December 2, 2004. The percent recoveries for 4,4'-DDT on the primary column and heptachlor and 4,4'-DDT on the secondary column were outside the method QC limits of 85-115% in the second continuing calibration analyzed on December 2, 2004. Data were not qualified for the surrogate, DCBP, based on continuing calibration results. As endosulfan sulfate and heptachlor were reported from the column, which exhibited acceptable results, associated sample data were not qualified for these compounds based on the continuing calibration. As the percent recoveries for 4,4'-DDT exceeded the method limit and 4,4'-DDT was reported as not detected in the associated samples, results for 4,4'-DDT in samples 125010-01, 125010-02, and 125060-11 were not qualified.
- The percent recoveries for heptachlor on the primary column and heptachlor and 4,4'-DDD on the secondary column were outside the method QC limits of 85-115% in the pesticide continuing calibration analyzed on December 9, 2004. The percent recoveries for heptachlor and 4,4'-DDD on the primary column and heptachlor on the secondary column were outside the method QC limits of 85-115% in the continuing calibration analyzed on December 10, 2004. As 4,4'-DDD was reported from the column which exhibited acceptable results, associated sample data were not qualified for 4,4'-DDD based on the continuing calibration. As the percent recoveries for heptachlor exceeded the method limit and heptachlor was reported as not detected in the associated samples, the results for heptachlor in samples 125060-03, 125060-04, 125060-05, and 125060-06 were not qualified.

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Surrogate recoveries were evaluated using control limits as specified in the QAPP (Table 3-1).

Surrogate recoveries were acceptable for VOC analyses with the following exceptions:

- The percent recovery for trifluorotoluene at 55.2% in the VOC analysis of sample 124945-01 was below the QAPP limits of 75-125%. The results for all VOCs in sample 124945-01 were qualified as estimated (J or UJ).

Surrogate recoveries were acceptable for SVOC analyses with the following exceptions:

- Two or more acid fraction surrogates in the SVOC analyses were below the QAPP limits of 45-135% as shown below. All samples had one or more non-compliant recoveries less than 10%. Due to potential low bias indicated by the percent recovery of one or more acid fraction surrogates being below 10%, associated sample results for acid fraction SVOC analytes were qualified as estimated (J); associated non-detects were rejected (R).

Sample ID	2-Fluorophenol	Phenol – d5	Nitrobenzene – d5	2-Fluorobiphenyl	2,4,6-Tribromophenol	p-Terphenyl-d14
	Acid	Acid	Base/Neutral	Base/Neutral	Acid	Base/Neutral
124945-01 (Diss.)	0%	1.21%	OK	OK	0%	OK
124993-08 (Diss.)	34.3%	9.2%	OK	OK	OK	OK
124993-09 (Total)	6.45%	11.9%	OK	OK	9.67%	OK
124993-10 (Total)	4.24%	9.76%	OK	OK	5.69%	OK
124993-11 (Total)	1.97%	8.3%	OK	OK	2.01%	OK
124993-11 (Diss.)	4.11%	7.02%	OK	OK	5.61%	OK
124993-13 (Diss.)	15.7%	1.3%	OK	OK	OK	OK
124993-14 (Total)	0%	1.39%	OK	OK	0%	OK
124993-14 (Diss.)	1.63%	0%	OK	OK	10.5%	OK
124993-15 (Total)	0%	0.914%	OK	OK	0%	OK
124993-15 (Diss.)	2.79%	1.77%	OK	OK	15.2%	OK
125010-01 (Diss.)	22.8%	2.92%	OK	OK	OK	OK

- Two or more acid fraction surrogates in the SVOC analyses were below the QAPP limits of 45-135%. Associated sample results for acid fraction SVOC analytes were qualified as estimated (J or UJ).

Sample ID	2-Fluorophenol	Phenol – d5	Nitrobenzene – d5	2-Fluorobiphenyl	2,4,6-Tribromophenol	p-Terphenyl-d14
	Acid	Acid	Base/Neutral	Base/Neutral	Acid	Base/Neutral
124945-01 (Total)	17.6%	17.2%	OK	OK	39.3%	OK
124993-08 (Total)	24.4%	19.3%	OK	OK	OK	OK
124993-09 (Diss.)	26.3%	12.4%	OK	OK	OK	OK

124993-10 (Diss.)	30.6%	16.8%	OK	OK	OK	OK
124993-13 (Total)	23.6%	16.1%	OK	OK	OK	OK
125010-01 (Total)	22.4%	14.8%	OK	OK	OK	OK
125010-02 (Total)	21.4%	11.7%	OK	OK	OK	OK
125010-02 (Diss.)	28.7%	16.2%	OK	OK	OK	OK
125059-06 (Total)	10.5%	11.2%	OK	OK	36.5%	OK
125060-01 (Total)	28.4%	16.2%	OK	OK	OK	OK
125060-02 (Total)	43.7%	25.7%	OK	OK	OK	OK

- Two or more acid fraction and two or more base-neutral fraction surrogates in the SVOC analysis of sample 125010-05 were below the QAPP limits of 45-135%. Non-compliant acid fraction surrogate recoveries included 2-Fluorophenol at 20.3%, Phenol-d5 at 13.7%, and 2,4,6-Tribromophenol at 33.8%. Non-compliant base/neutral fraction surrogate recoveries include Nitrobenzene-d5 at 35.6% and 2-Fluorobiphenyl at 38.1%. The results for all SVOC compounds in sample 125010-05 were qualified as estimated (J or UJ).
- The percent recoveries for two base-neutral surrogates exceeded the QAPP limits of 45-135% in the SVOC analysis of sample 125059-17. Non-compliant recoveries include Nitrobenzene-d5 at 145% and p-Terphenyl-d14 at 156%. Results reported as detected were qualified as estimated (J) in sample 125059-17. Results reported as not detected were not qualified.
- The percent recoveries of one or more surrogates were outside the QAPP limits of 45-135%. One surrogate from each fraction (base-neutral and acid) is allowed to be non-compliant. As only one surrogate was outside the control limits for each fraction, data were not qualified based on surrogate recoveries in these samples.

Sample ID	2-Fluorophenol	Phenol – d5	Nitrobenzene – d5	2-Fluorobiphenyl	2,4,6-Tribromophenol	p-Terphenyl-d14
	Acid	Acid	Base/Neutral	Base/Neutral	Acid	Base/Neutral
125059-08 (Total)	247%	OK	3100%	OK	OK	OK
125059-10 (Total)	OK	OK	OK	OK	OK	144%
125059-15 (Total)	OK	OK	OK	OK	148%	155%
125059-16 (Total)	OK	OK	145%	OK	139%	OK
125060-03 (Total)	OK	153%	OK	OK	OK	OK
125060-08 (Total)	OK	168%	OK	OK	OK	138%
125060-10 (Total)	OK	40.2%	OK	OK	OK	OK
125060-11 (Total)	OK	43.9%	OK	OK	OK	OK

Surrogate recoveries were acceptable for butyltin analyses with the following exceptions:

- The percent recoveries for tripentyl tin exceeded the QAPP limits of 30-120% in samples 124993-02 at 150%, 124993-03 at 156%, 124993-04 at 156%, 124993-06 at 137%, 124993-07 at 135%, 124993-08 at 133%, 124993-09 at 133%, 124993-10 at 127%, 124993-11 at 132%, 125059-02 at 144%, 125059-03 at 127%, 125059-04 at 146%, 125059-12 at 129%, 125059-13 at 146%, 125059-14 at 142%, 125059-15 at 131%, 125059-16 at 150%, 125059-17 at 154%, 125060-04 at 154%, and 125060-06 at 140%. Results reported as detected were qualified as estimated (J) in the associated samples. Results reported as not detected were not qualified.

Surrogate recoveries were acceptable for PCB analyses with the following exceptions:

- The percent recoveries for DCBP exceeded the QAPP control limits of 30-130% for the PCB analyses of groundwater samples 124993-09 at 142%, 124993-10 at 145%, 124993-14 at 132%, 124993-15 at 137%, 125010-01 at 134%, and 125010-02 at 143%. As the alternate surrogate, tetrachlorometaxylene, was compliant and all PCB results for these samples were non-detect, data were not qualified in these samples based on the elevated DCBP recoveries.

Surrogate recoveries were acceptable for NWTPH-Gx analyses with the following exceptions:

- The percent recovery for bromofluorobenzene in sample 125060-06 exceeded the QAPP limits of 70-130% at 145%. As the percent recoveries for the alternate surrogates, trifluorotoluene, 1-chloro-3-fluorobenzene, and pentafluorobenzene, were acceptable, data were not qualified in this sample based on the bromofluorobenzene percent recovery.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. STL analyzed at least one LCS and one MS/MSD (or one MS and one sample duplicate for metals analyses) for each analysis and for each batch per method requirements. LCS and MS/MSD recoveries were evaluated using control limits as specified in the QAPP (Table 3-1).

LCS recoveries were acceptable for SVOC analyses with the following exceptions:

- The percent recoveries for phenol of 31.1% and 31.2% and pentachlorophenol (PCP) of 38.6% and 31.4% in the LCS and LCSD and 4-nitrophenol of 44.7% in the LCS for SVOC (total and dissolved) analytical batch SW1034 were below the QAPP limits of 45-135%. As the percent recovery in the LCSD and the RPD for the LCS/LCSD pair were acceptable, data were not qualified for 4-nitrophenol based on the LCS result. The results for phenol and PCP in samples 124945-01 (total and dissolved), 124993-08 (total and dissolved), 124993-09 (total and dissolved), 124993-10 (total and dissolved), 124993-11 (total and dissolved), 124993-13 (total and dissolved), 124993-14 (total and dissolved), and 124993-15 (total and dissolved) were previously qualified based on surrogate recoveries.

- The percent recoveries for pyrene of 152% in the LCS and phenol of 14% and 17.1% and n-nitrosodi-n-propylamine of 146% and 142% in the LCS and LCSD for analytical batch SW1036 were outside the QAPP limits of 45-135%. As the percent recovery in the LCSD and the RPD for the LCS/LCSD pair were acceptable, data were not qualified for pyrene based on the LCS result. Phenol and n-nitrosodi-n-propylamine were either not detected or qualified as not detected in the associated samples based on other QC issues detailed in this report; therefore, the results for phenol and n-nitrosodi-n-propylamine were not qualified based on the LCS/LCSD results.
- The percent recoveries for n-nitrosodi-n-propylamine of 137% and 4-chloro-3-methylphenol of 143% in the LCSD for SVOC analytical batch SW1040 exceeded the QAPP limits of 45-135%. As the percent recoveries in the LCS and the RPD for the LCS/LCSD pair were acceptable, associated sample data were not qualified for these compounds.
- The percent recoveries for PCP of 35.9% and 21.4% in the LCS and LCSD for SVOC analytical batch SS1281 were below the QAPP limits of 45-135%. In addition, the 51% RPD for the LCS/LCSD pair for PCP exceeded the QAPP limits of 50%. The results for PCP in samples 124945-03, 124993-02, 124993-03, 124993-04, 124993-06, 124993-07, 124993-17, 124993-18, 124993-19, and 124993-20 were qualified as estimated (J or UJ).
- The 52% RPD for PCP for the LCS/LCSD pair for SVOC analytical batch SS1285 exceeded the QAPP limit of 50%. As the percent recoveries for PCP in the LCS and LCSD were acceptable, associated data were not qualified based on the RPD.

MS/MSD recoveries were acceptable for SVOC analyses with the following exceptions:

- The percent recoveries for 1,2,4-trichlorobenzene of 36.5% in the MS and 1,4-dichlorobenzene of 40.8% and 36.6% in the MS and MSD were below the QAPP limits of 45-135% in the SVOC MS/MSD performed on sample 124993-07. As the percent recoveries in the MSD and the RPDs for the MS/MSD pair were acceptable, data were not qualified for 1,2,4-trichlorobenzene based on the MS result. The result for 1,4-dichlorobenzene in sample 124993-07 was qualified as estimated (UJ).
- The percent recoveries for n-nitrosodi-n-propylamine (total only) of 35.2% in the MS, 4-chloro-3-methylphenol (total and dissolved) of 19.2% and 26.7% in the MSD, phenol of 17.6% and 5.6%, 2-chlorophenol (total) of 38.7% and 6.5%, 2-chlorophenol (dissolved) of 5.62% and 11.4%, 4-nitrophenol (total) of 16.1% and 0%, 4-nitrophenol (dissolved) of 4.1% and 4.35%, and PCP (total) of 15.9% and 0%, PCP (dissolved) of 0% and 0% in the MS and MSD were below the QAPP limits of 45-135% in the SVOC (total and dissolved) MS/MSD performed on sample 124993-11. The results for all acid fraction SVOCs in sample 124993-11 were previously rejected based on surrogate recoveries and

do not require further qualification. The result for n-nitrosodi-n-propylamine (total) in sample 124993-11 was qualified as estimated (UJ).

- The percent recoveries for 1,4-dichlorobenzene of 25.4% and 29%, 1,2,4-trichlorobenzene of 23.5% and 26%, and 2,4-dinitrotoluene of 42.2% and 41% in the MS and MSD were below the QAPP limits of 45-135% in the SVOC MS/MSD performed on sample 124993-20. The results for 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and 2,4-dinitrotoluene in sample 124993-20 were qualified as estimated (UJ).
- The percent recoveries for 1,4-dichlorobenzene of 39.8% in the MS and phenol of 9.76% and 10.8%, 2-chlorophenol of 30.4% and 29.3%, 1,2,4-trichlorobenzene of 42% and 43.8%, 4-chloro-3-methylphenol of 37.5% and 35.8%, and PCP of 25.6% and 26.7% in the MS and MSD were below the QAPP limits of 45-135% in the SVOC (total and dissolved) MS/MSD performed on sample 125010-02. As the percent recovery in the MSD and the RPD for the MS/MSD pair were acceptable, data were not qualified for 1,4-dichlorobenzene (total or dissolved) based on the MS result. The results (total and dissolved) for phenol, 2-chlorophenol, 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, and PCP in sample 125010-02 were qualified as estimated (J or UJ).
- The percent recoveries for n-nitrosodi-n-propylamine of 153% in the MS and acenaphthene of 4250% and 31.2% and pyrene of 9190% and 0% in the MS and MSD were outside the QAPP limits of 45-135% in the SVOC MS/MSD performed on sample 125059-15. 4-Nitrophenol, 2,4-dinitrotoluene, and PCP were not recovered from the MS and MSD and 4-chloro-3-methylphenol was not recovered from the MSD due to high concentrations of TPH compounds in sample 125059-15. As the percent recovery in the MSD and the RPD pair were acceptable, data were not qualified for n-nitrosodi-n-propylamine based on the MS result. As the parent sample concentration for acenaphthene was more than 4x the spike concentration, data were not qualified for acenaphthene based on the MS/MSD results. The results for 4-nitrophenol, 2,4-dinitrotoluene, PCP, and 4-chloro-3-methylphenol in sample 125059-15 were qualified as estimated (UJ).
- The percent recoveries for 4-nitrophenol of 24.8% in the MSD and phenol of 17.3% and 18% in the MS and MSD were below the QAPP limits of 45-135% in the SVOC MS/MSD performed on sample 125060-01. In addition, the RPD of 63% for the MS/MSD pair for 4-nitrophenol exceeded the QAPP limit of 60%. The results for 4-nitrophenol and phenol in sample 125060-01 were previously qualified based on surrogate recoveries and do not require further qualification.

MS/MSD recoveries were acceptable for NWTPH-Gx analyses with the following exceptions:

- The percent recovery of 64.5% for gasoline was below the QAPP limits of 70-130% in the NWTPH-Gx MS performed on sample 125010-02. In addition, the RPD of 38% for the MS/MSD pair exceeded the QAPP limit of 30%. The result for gasoline-range hydrocarbons in sample 125010-02 was qualified as estimated (UJ).

MS/MSD recoveries were acceptable for NWTPH-Dx analyses with the following exceptions:

- Diesel-range and heavy oil-range hydrocarbons were not recovered from the NWTPH-Dx MS/MSD performed on sample 125059-15. The sample results for diesel-range and heavy oil-range hydrocarbons in the parent sample were between two and four times the spike concentration; therefore, the results for diesel-range and heavy oil-range hydrocarbons in sample 125059-15 were qualified as estimated (J).

MS/Duplicate recoveries were acceptable for metals analyses with the following exceptions:

- The percent recovery of 184% for chromium exceeded the QAPP limits of 75-125% in the MS performed on sample 124945-03. The result for chromium in sample 124945-03 was qualified as estimated (J).
- The percent recovery for copper of 72% was below the QAPP limits of 75-125% in the MS performed on sample 124993-07. The percent recovery for sodium of 60% was below the QAPP limits of 75-125% in the MS performed on sample 124993-20. The results for copper and sodium in samples 124993-07 and 124993-20 were qualified as estimated (J). The area where the samples were collected consists of fill material; therefore, the remaining samples associated with this laboratory analytical batch were not deemed to be sufficiently similar to require qualification based on matrix spike recovery.

PRECISION

Second Column Confirmation

Second column confirmation was performed for all PCB and pesticide analyses. All PCB results reported as detected exhibited a relative percent difference (RPD) less than 40%. The laboratory flagged pesticide results with a 'C2' to indicate that the second column confirmation resulted in RPDs greater than 40%. The results for one or more pesticides in samples 124993-14, 124993-15, 125010-02, 125059-15, 125059-16, 125060-03, and 125060-06 were flagged with a 'C2' by the laboratory and are qualified as estimated (J).

Duplicate Review

Three soil field duplicate samples, two groundwater duplicate samples, one blow-down water sample, and one sandblast grit sample were collected to verify acceptable field sampling techniques and the representativeness of the sample aliquots. In addition, the laboratory performed in-house duplicate analyses for many samples. The RPD for field duplicate samples was calculated when sample results were greater than 5x the reporting limit. Reported concentrations for field duplicate pairs are presented in Tables G-3 through G-9. In general, field duplicate precision was within the QAPP limits of ±50% with the following exceptions:

- The RPDs for the parent sample/field duplicate pair exceeded the QAPP limits for samples 124993-03 and 124993-04 for cobalt, vanadium, arsenic, and chromium. The results for cobalt, vanadium, arsenic, and chromium were qualified as estimated (J) in samples 124993-03 and 124993-04.

- The RPDs for the parent sample/field duplicate pair exceeded the QAPP limits for samples 124993-14 and 124993-15 for TSS. The results for TSS in samples 124993-14 and 124993-15 were qualified as estimated (J).
- The RPDs for the parent sample/field duplicate pair exceeded the QAPP limits for samples 125059-12 and 125059-13 for phenanthrene and pyrene. The results for phenanthrene and pyrene were qualified as estimated (J) in samples 125059-12 and 125059-13.

Laboratory duplicate precision was acceptable with the following exceptions:

- The RPD for gasoline-range hydrocarbons exceeded the QAPP limit of 30% in the laboratory duplicate performed on sample 125059-08. The result for gasoline-range hydrocarbons in sample 125059-08 was qualified as estimated (J).
- The RPD for sodium exceeded the QAPP limit of 25% in the laboratory duplicate performed on sample 124993-07. The result for sodium in sample 124993-07 was qualified as estimated (J).
- The RPD for iron exceeded the QAPP limit of 25% in the laboratory duplicate performed on sample 125059-15. The result for iron was qualified as estimated (J) in sample 125059-15. The samples of this QC batch were not deemed to be sufficiently similar for a matrix-wide qualification.

COMPARABILITY

Compound Identification

The laboratory flagged the diesel-range hydrocarbon results for samples 125059-08, 125059-12, and 125059-16 with a 'X1' indicating that the diesel-range results may be due to overlap from heavy oil range hydrocarbons. The laboratory flagged the diesel-range and heavy oil-range hydrocarbon results for sample 125059-15 with an 'X2' to indicate that the elution pattern for these compounds does not match the standard pattern. Qualitative observations were noted on the laboratory report forms.

Reporting Limits

The sensitivity (i.e., reporting limits) of the analytical methods is driven by the project specific DQOs. Analyte PQLs exceeded levels specified in the QAPP for one or more compounds in one or more samples. In all cases the method detection limit was below the specified levels. The laboratory reported all detections between the MDL and PQL and qualified those results as estimated (J).

Samples 124993-14, 124993-15, and 125059-08 required dilution to quantitate cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and/or 1,2,4-trimethylbenzene within the linear range of the instrument. Sample results which exceeded the calibration range of the instrument were flagged ‘E’ by the laboratory and have been qualified with the flag ‘DNR’ for Do Not Report. As the reporting limits were lower for the undiluted analyses, results for compounds that were not flagged ‘E’ by the laboratory in the undiluted analyses of samples 124993-14, 124993-15, and 125059-08 are qualified ‘DNR’ for the diluted analysis.

The result for cis-1,2-dichloroethene in sample 125010-05 was flagged with an ‘E’ by the laboratory to indicate that the result exceeded the linear range of the instrument. Typically, the ‘E’-flagged result would be qualified ‘DNR’ and the dilution result reported; however, the laboratory did not have sufficient sample volume to perform a dilution on this sample. The result for cis-1,2-dichloroethene in sample 125010-05 is therefore qualified as estimated and flagged ‘J’ based on the linear range exceedance.

STL combines results for various dilutions on a single report form for each sample. Dilution factors for individual analytes are listed adjacent to the corresponding analyte and are designated “D” (such as D10 or D100). The samples that required dilution due to elevated concentrations did not meet the requested reporting limits; however, data are not qualified based on high analyte concentrations that require dilution.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Some data were qualified as estimated (J) and some as non-detect (U). Some data were also rejected (R). A summary of qualifiers can be found in Table G-2. Completeness for the site investigation is greater than 95 percent based on rejection of 334 out of 7713 analytes.

Table G-1

SAMPLE LOCATION AND ANALYSES SUMMARY

Sample Number	Sample Date	Lab ID	Site Location	Method Analyses
041116SGA01GW	11-16-04	124945-01	Sandblast Area	VOCs, SVOCs (Total and Dissolved), Butyltins, PCBs, Metals (Total and Dissolved), TOC, TSS
041116SGA01SS	11-16-04	124945-02	Former Septic System	Hold
041116SGA02SS	11-16-04	124945-03	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total), Butyltins, Pesticides, PCBs, Metals (total)
Trip Blank #2718		124945-04		VOCs
041117SGA03SS	11-17-04	124993-01	Former Septic System	Hold
041117SGA04SS	11-17-04	124993-02	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041117SGA05SS	11-17-04	124993-03	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041117SGA06SS (Field Duplicate of 041117SGA05SS)	11-17-04	124993-04	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041117SGA07SS	11-17-04	124993-05	Former Septic System	Hold
041117SGA08SS	11-17-04	124993-06	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041117SGA09SS	11-17-04	124993-07	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041117SGA02GW	11-17-04	124993-08	Sandblast Area	VOCs, SVOCs (Total and Dissolved), Butyltins, PCBs, Metals (Total and Dissolved), TOC, TSS
041117SGA03GW	11-17-04	124993-09	Sandblast Area	VOCs, SVOCs (Total and Dissolved), Butyltins, PCBs, Metals (Total and Dissolved), TOC, TSS
041117SGA04GW (Field Duplicate of 041117SGA03GW)	11-17-04	124993-10	Sandblast Area	VOCs, SVOCs (Total and Dissolved), Butyltins, PCBs, Metals (Total and Dissolved), TOC, TSS
041117SGA05GW	11-17-04	124993-11	Sandblast Area	VOCs, SVOCs (Total and Dissolved), Butyltins, PCBs, Metals (Total and Dissolved), TOC, TSS
Trip Blank #2717	11-17-04	124993-12		VOCs
041118SGA06GW	11-18-04	124993-13	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total and Dissolved), Metals (Total and Dissolved), TOC, TSS
041118SGA07GW	11-18-04	124993-14	Former Septic Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total and Dissolved), Pesticides, PCBs, Metals (Total and Dissolved), TOC, TSS
041118SGA08GW (Field Duplicate of 041118SGA07GW)	11-18-04	124993-15	Former Septic Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total and Dissolved), Pesticides, PCBs, Metals (Total and Dissolved), TOC, TSS
Trip Blank #2716	11-18-04	124993-16		VOCs
041118SGA10SS	11-18-04	124993-17	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals

Sample Number	Sample Date	Lab ID	Site Location	Method Analyses
041118SGA11SS	11-18-04	124993-18	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals
041118SGA12SS (Field Duplicate of 041118SGA11SS)	11-18-04	124993-19	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals
041118SGA13SS	11-18-04	124993-20	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals
041119SGA09GW	11-19-04	125010-01	Former Septic System	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total and Dissolved), Pesticides, PCBs, Metals (Total and Dissolved), TOC, TSS
041119SGA10GW	11-19-04	125010-02		NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs (Total and Dissolved), Pesticides, PCBs, Metals (Total and Dissolved), TOC, TSS
Trip Blank #2715	11-19-04	125010-03		NWTPH-Gx, VOCs
041119SGA11GW	11-19-04	125010-04	Hazardous Materials Storage Area	NWTPH-Gx, VOCs, TSS
041119SGA12GW	11-19-04	125010-05	Hazardous Materials Storage Area	NWTPH-Gx, VOCs, SVOCs, Metals (Total and Dissolved), TSS
041122SGA24SG	11-22-04	125059-01	Sandblast Area	Butyltins, SPLP Butyltins, Metals, TCLP/SPLP Metals
041122SGA25SG	11-22-04	125059-02	Sandblast Area	Butyltins, SPLP Butyltins, Metals, TCLP/SPLP Metals
041122SGA26SG (Field Duplicate of 041122SGA25SG)	11-22-04	125059-03	Sandblast Area	Butyltins, SPLP Butyltins, Metals, TCLP/SPLP Metals
041122SGA27SG	11-22-04	125059-04	Sandblast Area	Butyltins, SPLP Butyltins, Metals, TCLP/SPLP Metals
041122SGA11GW	11-22-04	125059-05	Hazardous Materials Storage Area	Metals (Total and Dissolved)
041122SGA12GW	11-22-04	125059-06	Hazardous Materials Storage Area	SVOCs
041122SGA20SS	11-22-04	125059-07		Hold
041122SGA21SS	11-22-04	125059-08		NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals (Total)
041122SGA22SS	11-22-04	125059-09		Hold
041122SGA23SS	11-22-04	125059-10		NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals (Total)
TB#2718		125059-11		VOCs
041122SGA14SS	11-22-04	125059-12	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041122SGA15SS (Field Duplicate of 041122SGA14SS)	11-22-04	125059-13	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041122SGA16SS	11-22-04	125059-14	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041122SGA17SS	11-22-04	125059-15	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041122SGA18SS	11-22-04	125059-16	Catch Basin	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041122SGA19SS	11-22-04	125059-17	Catch Basin	SVOCs, Butyltins, PCBs, Metals
041123SGA13BDW	11-23-04	125060-01	Sandblast Area	VOCs, SVOCs, Metals

Sample Number	Sample Date	Lab ID	Site Location	Method Analyses
041123SGA14BDW (Field Duplicate of 041123SGA13BDW)	11-23-04	125060-02	Sandblast Area	VOCs, SVOCs, Metals
041123SGA28SS	11-23-04	125060-03	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041123SGA29SS	11-23-04	125060-04	Sandblast Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041123SGA30SS	11-23-04	125060-05	Burn Pit Waste Sample	VOCs, SVOCs, Pesticides, PCBs, Metals
041123SGA31SS	11-23-04	125060-06	Burn Pit Soil Sample	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, Metals
041123SGA32SS	11-23-04	125060-07	Hazardous Materials Storage Area	Hold
041123SGA33SS	11-23-04	125060-08	Hazardous Materials Storage Area	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals
Trip Blank		125060-09		VOCs
041123SGA15ERW	11-23-04	125060-10	Equipment Rinsate – Hand Auger	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Metals (Total), TOC
041123SGA16ERW	11-23-04	125060-11	Equipment Rinsate - Pickaxe	NWTPH-Gx, NWTPH-Dx, VOCs, SVOCs, Butyltins, Pesticides, PCBs, TOC
Trip Blank		125060-12		VOCs
041129SGA15ERW	11-29-04	125082-01	Equipment Rinsate – Hand Auger	Metals

Table G-3
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	124993-09 041117SGA03GW	124993-10 041117SGA04GW	RPD	Qualification
TSS	None				
VOCs	2,2-Dichloropropane	0.106	0.128	NA	None
	cis-1,2-DCE	0.835	0.849	NA	None
	1,1,1-Trichloroethene	0.0711	0.0691	NA	None
	Trichloroethene	0.345	0.339	NA	None
	Tetrachloroethene	1.16	1.12	NA	None
SVOCs	Naphthalene	0.0254	0.248	NA	None
	2-Methylnaphthalene	0.0208	0.064	NA	None
	Phenanthrene	0.0042	0.0158	NA	None
	Di-n-butylphthalate	0.148	0.151	NA	None
	Butylbenzylphthalate	0.12	0.109	NA	None
Dissolved SVOCs	Phenol	0.0181	0.0202	NA	None
	Naphthalene	0.0257	0.0433	NA	None
	2-Methylnaphthalene	0.0171	0.0181	NA	None
	Fluorene	0.00472	0.00835	NA	None
	Phenanthrene	0.00691	0.0153	NA	None
	Di-n-butylphthalate	0.162	0.191	NA	None
	Butylbenzylphthalate	0.168	0.141	NA	None
Total Metals	Al	0.114	0.0734	NA	None
	Ca	25	24.7	1.21	None
	Fe	0.0838	0.085	NA	None
	Mg	5.83	5.84	0.17	None
	K	0.921	0.911	NA	None
	Na	6.39	6.5	1.71	None
	V	0.00266	0.00219	NA	None
	As	0.000506	0.00145	NA	None
	Sb	0.000525	0.000426	NA	None
	Ba	0.00375	0.00376	0.27	None
	Cr	0.00496	0.00434	13.33	None
	Cu	0.00136	0.0014	NA	None
	Mn	0.00208	0.00211	NA	None
	Se	0.00103	0.00114	NA	None
	Zn	0.00349	0.0043	NA	None

Table G-3
SUMMARY OF FIELD DUPLICATE PRECISION (continued)

ANALYSIS	ANALYTE	124993-09	124993-10	RPD	Qualification
Dissolved Metals	Ca	25.5	25.2	1.18	None
	Mg	6.11	6	1.82	None
	K	0.71	0.729	NA	None
	Na	7.13	7.14	0.14	None
	V	0.00154	0.00136	NA	None
	Ar	0.00117	0.00112	NA	None
	Sb	0.00025	0.000344	NA	None
	Ba	0.00352	0.00352	0.00	None
	Cr	0.00168	0.00201	NA	None
	Cu	0.000782	0.000825	NA	None
	Mn	0.000576	0.00284	NA	None
	Se	0.000662	0.000532	NA	None
	Ag	0.000027	0.000026	NA	None
TOC	TOC	1.88	1.1	NA	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.

NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for butyltins and PCBs because target analytes were not detected in the parent sample and/or field duplicate.

Table G-4
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	124993-14 041118SGA07GW	124993-15 041118SGA08GW	RPD	Qualification
TSS	TSS	28	16	54.55	J
VOCs	1,1-Dichloroethene	1.2	1.13	NA	None
	trans-1,2-Dichloroethene	2.06	1.54	NA	None
	1,1-Dichloroethane	2.58	2.45	NA	None
	Chloroform	0.0979	0.0834	NA	None
	cis-1,2-Dichloroethene	335	347	3.52	None
	1,1,1-Trichloroethane	2.35	2.1	NA	None
	Benzene	0.0624	0.0618	NA	None
	Trichloroethene	2.26	1.98	NA	None
	Toluene	0.3	0.297	NA	None
	Tetrachloroethene	3.77	3.62	NA	None
	Ethylbenzene	0.0377	0.0429	NA	None
	m,p-xylene	0.088	0.0766	NA	None
	o-xylene	0.0275	0.0333	NA	None
SVOCs	Phenanthrene	0.0127	0.00883	NA	None
	Di-n-butylphthalate	0.162	0.149	NA	None
	butylbenzylphthalate	0.151	0.126	NA	None
Dissolved SVOCs	Naphthalene	0.0353	0.0255	NA	None
	Di-n-butylphthalate	0.171	0.143	NA	None
	butylbenzylphthalate	0.142	0.131	NA	None
Pesticides	Lindane	0.000863	0.000997	NA	None
Total Metals	Al	0.285	0.274	NA	None
	Ca	32.4	33.3	2.74	None
	Co	0.00373	0.00377	NA	None
	Fe	0.541	0.551	1.83	None
	Mg	10.3	10.5	1.92	None
	Ni	0.00331	0.00323	NA	None
	K	1.49	1.59	6.49	None
	Na	10.7	10.8	0.93	None
	V	0.00179	0.00236	NA	None
	Ba	0.0243	0.0254	NA	None
	Cr	0.00574	0.00374	42.19	None
	Cu	0.00253	0.00256	1.18	None
	Mn	0.687	0.73	6.07	None
	Se	0.00165	0.00174	NA	None
	Ag	0.00002	0.000019	NA	None
	Tl	0.000087	0.000084	NA	None
	Zn	0.00533	0.00504	NA	None

Table G-4
SUMMARY OF FIELD DUPLICATE PRECISION (continued)

ANALYSIS	ANALYTE	124993-14	124993-15	RPD	Qualification
Dissolved Metals	Ca	27.5	31.8	14.50	None
	Co	0.0031	0.0062	NA	None
	Fe	0.0905	0.119	NA	None
	Mg	8.84	10.1	13.31	None
	Ni	0.00169	0.00251	NA	None
	K	1.03	1.2	15.25	None
	Na	11.3	12.1	6.84	None
	As	0.0007	0.0007	NA	None
	Sb	0.000152	0.000266	NA	None
	Ba	0.0199	0.0214	7.26	None
	Cr	0.00291	0.00295	1.37	None
	Cu	0.000875	0.00104	NA	None
	Mn	0.527	0.647	20.44	None
	Se	0.00114	0.00135	NA	None
	Ag	0.000028	0.000025	NA	None
	Tl	0.000085	0.000086	NA	None
TOC	TOC	2.34	2.47	5.41	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.

NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for NWTPH-Gx, NWTPH-Dx, and PCBs because target analytes were not detected in the parent sample and/or field duplicate.

Table G-5
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	124993-03 041117SGA05SS	124993-04 041117SGA06SS	RPD	Qualification
VOCs	Dichlorodifluoromethane	0.664	0.27	NA	None
	Trichloroethene	0.189	0.11	NA	None
SVOCs	bis(2-Ethylhexyl)phthalate	210	83.1	NA	None
Butyltins	Dibutyltin	25.8	7.32	NA	None
	Monobutyltin	9.38	5.48	NA	None
Total Metals	Al	12500	10600	16.45	None
	Ca	7500	6810	9.64	None
	Co	21	10	70.97	J
	Fe	27000	20600	26.89	None
	Mg	7270	6990	3.93	None
	Ni	27.1	16.3	49.77	None
	K	626	642	2.52	None
	V	73.3	42.4	53.41	J
	As	14.2	5.45	89.06	J
	Sb	0.638	0.228	NA	None
	Ba	93.6	89.4	4.59	None
	Be	0.411	0.349	NA	None
	Cr	28.1	14.5	63.85	J
	Cu	57.3	46.5	20.81	None
	Pb	8.15	5.12	45.67	None
	Mn	535	343	43.74	None
	Se	0.956	0.247	NA	None
	Ag	0.204	0.111	NA	None
	Tl	0.227	0.132	NA	None
	Zn	61.2	45.4	29.64	None
	Hg	0.0798	0.0289	NA	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit

NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for NWTPH-Gx, NWTPH-Dx, pesticides, and PCBs because target analytes were not detected in both the parent sample and field duplicate.

Table G-6
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	124993-18 041118SGA11SS	124993-19 041118SGA12SS	RPD	Qualification
VOCs	Dichlorodifluoromethane	0.0866	0.0814	NA	None
	cis-1,2-DCE	67.8	49.1	31.99	None
	Benzene	0.482	0.529	NA	None
	Trichloroethene	29.7	19.2	42.94	None
	Tetrachloroethene	64.4	43.5	38.74	None
SVOCs	bis(2-Ethylhexyl)phthalate	133	17	NA	None
Total Metals	Al	14900	12300	19.12	None
	Ca	4550	3310	31.55	None
	Co	12.6	16.5	26.80	None
	Fe	23600	20800	12.61	None
	Mg	5920	4330	31.02	None
	Ni	15	15.8	5.19	None
	K	774	635	19.73	None
	V	67.7	62.2	8.47	None
	As	3.13	4.23	29.89	None
	Sb	0.219	0.217	NA	None
	Ba	103	98.9	4.06	None
	Be	0.376	0.365	NA	None
	Cr	19.5	20.7	5.97	None
	Cu	33.2	26.8	21.33	None
	Pb	5.46	5.01	8.60	None
	Mn	338	484	35.52	None
	Se	0.314	0.333	NA	None
	Ag	0.134	0.154	NA	None
	Tl	0.105	0.165	NA	None
	Zn	45.2	44.5	1.56	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.

NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for NWTPH-Gx and NWTPH-Dx because target analytes were not detected in both the parent sample and field duplicate.

Table G-7
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	125060-01 041123SGA13BDW	125060-02 041123SGA14BDW	RPD	Qualification
VOCs	Chloroform	0.333	0.341	NA	None
	Bromodichloromethane	0.473	0.403	NA	None
	Dibromochloromethane	0.41	0.396	NA	None
	Bromoform	0.62	0.776	NA	None
SVOCs	Benzyl Alcohol	0.0478	0.107	NA	None
	Butylbenzylphthalate	0.119	0.2	NA	None
Total Metals	Antimony	0.000112	0.000139	NA	None
	Barium	0.0022	0.00213	NA	None
	Chromium	0.00561	0.0061	NA	None
	Copper	0.0398	0.0383	3.84	None
	Selenium	0.00065	0.000693	NA	None
	Silver	0.000023	0.00027	NA	None
	Zinc	0.0888	0.0913	2.78	None
	Aluminum	0.012	0.0117	NA	None
	Calcium	10.1	10.1	0.00	None
	Magnesium	3.6	3.59	NA	None
	Potassium	2.31	2.32	NA	None
	Sodium	6.95	7.26	4.36	None
	Vanadium	0.00284	0.00308	NA	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.
NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Table G-8
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	125059-12 041122SGA14SS	125059-13 041122SGA15SS	RPD	Qualification
VOCs	Trichloroethene	0.209	0.133	NA	None
	1,3,5-trimethylbenzene	0.107	0.0787	NA	None
SVOCs	Benzoic Acid	101	115	NA	None
	Acenaphthene	14.4	7.48	NA	None
	Fluorene	8.19	8.87	52.60	None
	Phenanthrene	146	85.2	52.6	J
	Fluoranthene	261	175	39.45	None
	Pyrene	501	232	73.40	J
	Benzo(a)anthracene	210	156	29.51	None
	Chrysene	250	199	22.72	None
	bis(2-ethylhexyl)phthalate	1180	889	28.13	None
	Benzofluoranthenes	327	252	25.91	None
	Benzo(a)pyrene	191	128	39.50	None
	Indeno(1,2,3-cd)pyrene	89.9	77.3	15.07	None
	Benzo(g,h,i)perylene	99.5	89.6	10.47	None
Pesticides	4,4'-DDT	5.58	4.95	NA	None
Dx	Diesel	33.9	15.5	NA	None
	Motor oil	300	132	NA	None
Total Metals	Al	13100	9680	30.03	None
	Ca	7200	5290	30.58	None
	Co	17	14.7	14.51	None
	Fe	30300	26600	13.01	None
	Mg	9040	6660	30.32	None
	Ni	22.3	18	21.34	None
	K	847	726	15.38	None
	V	63.2	54.6	14.60	None
	As	4.78	4.1	15.32	None
	Ba	111	89.5	NA	None
	Be	0.337	0.27	NA	None
	Cr	20	18.6	7.25	None
	Cu	52.7	42.4	21.66	None
	Pb	103	152	38.43	None
	Se	0.262	0.282	NA	None
	Mn	596	512	15.16	None
	Ag	0.124	0.122	NA	None
	Tl	0.123	0.109	NA	None
	Zn	86.8	89.1	2.62	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.

NA – Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for NWTPH-Gx, butyltins and PCBs because target analytes were not detected in both the parent sample and field duplicate.

Table G-9
SUMMARY OF FIELD DUPLICATE PRECISION

ANALYSIS	ANALYTE	125059-02 041122SGA25SG	125059-03 041122SGA26SG	RPD	Qualification
Total Metals	Cr	2190	2420	9.98	None
	Pb	65.8	70.9	7.46	None
TCLP Metals	Cr	0.085	0.0841	1.06	None
	Pb	0.0622	0.0481	25.57	None
SPLP Metals	Pb	0.0677	0.0698	3.05	None
	Cr	0.0771	0.0686	11.67	None
Butyltins	Tributyltin	1.79	3.27	NA	None

Note: Field duplicate RPDs calculated only when detections present in both the primary and duplicate samples and concentrations are greater than 5x the reporting limit.

NA - Not Applicable. Reported sample results were less than 5x the reporting limit.

Field duplicate RPDs were not calculated for SPLP butyltins because target analytes were not detected in both the parent sample and field duplicate.

On April 10, 2007, Kitia Chambers (USACE) and Brian McNamara (URS) collected nine soil samples from Bradford Island to aid in the characterization of soil that potentially may become mobile. The soil samples were submitted to Analytical Resources Incorporated (ARI), located in Tukwila, Washington. Table 1 summarizes the URS and ARI sample IDs. The following is a list of the analyses performed on each soil sample in general accordance with the methods.

Method	Analytical Parameter
EPA 8082-M	Polychlorinated Biphenyls (PCBs) Aroclors
EPA 8270D	Semivolatile Organic Compounds (SVOCs)
EPA 6010B/200.8	Total Metals[1]
EPA 7471A	Total Mercury
EPA 8081A	Organochlorine Pesticides

[1] Metals include Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc

The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed in each laboratory report submitted: laboratory case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The data review process for this investigation followed the most conservative criteria available in the following documents:

- Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006 (DoD, January 2006)
- EPA Test Methods for Evaluating Solid Waste (SW-846), Methods for Chemical Analysis of Water and Wastes
- EPA's Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review (USEPA, October 1999)
- EPA NFGs for Inorganic Data Review (USEPA, October 2004)

A summary of qualifiers assigned to results in this investigation is included in Table 2. For ease of reference the samples are represented in Table 2 by their laboratory ID and the ID assigned in the field. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. The samples were submitted to the laboratory in two coolers. The cooler temperatures upon receipt exceeded the EPA-recommended range of 4°C± 2°C at 6.5°C and 10°C. Analytical results were not estimated based on the short duration of temperature exceedance. Samples were shipped on ice overnight via FedEx and were immediately placed in storage at 4°C upon receipt at the laboratory. All samples were analyzed within the technical and contracted holding time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per method requirements. Qualification of samples due to method or field blank contamination followed guidelines set forth in the EPA NFGs.

Sample results less than five times (5x) the method blank or field blank concentration and between the method detection limit (MDL) and method reporting limit (MRL) were flagged as non-detect ‘U’ at the MRL. When sample results were less than 5x the blank concentration but above the MRL, the reported result was qualified as non-detect ‘U’. Target compounds detected in the method or field blanks but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified.

All analytical tests indicate non-detects for method blanks with the following exceptions:

- ARI assigned ‘B’ flags to bis(2-ethylhexyl phthalate) analytical results for all soil samples. The ‘B’ flag is used by the laboratory to indicate this analyte were detected in the method blank. All reported bis(2-ethylhexyl phthalate) results were above 5x the method blank concentration, therefore the associate results were not qualified,.
- Aluminum, Calcium and Zinc were detected in the associated method blank. The sample results for these metals were greater than 5x the method blank concentrations, thus data were not qualified based on the method blank results.

ACCURACY

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample.

Surrogate recoveries were acceptable for all analyses with the following exceptions:

- SVOC surrogate d4-1,2-dichlorobenzene was outside the DoD recovery control limits of 45-95% for samples 070410BIL06SS-DL and 070410BIL08SS-DL, with 43.7% and 42.7% respectively. Two or more surrogate recoveries within either the acid or base fraction need to exceed the control criteria before the data is considered estimated and a qualifier is applied. Analytical results were not qualified based on this single surrogate recovery, all other surrogate recoveries were within control limits.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. ARI analyzed at least one LCS and one MS/MSD for each analysis and for each batch per method requirements.

LCS recoveries were acceptable for all analytical tests.

Sample 070410BIL09SS was used as MS/MSD for all analyses. The MS/MSD recoveries were acceptable for all analytical analyses with the following exceptions:

- The percent recovery for Pyrene in the MSD was 42.65 below the DoD control limits of 45-125%. The relative percent difference (RPD) for Pyrene in the MS/MSD pair was 40.1% above the DoD control limit of 30%. Pyrene in sample 070410BIL09SS was flagged ‘J’ based on MSD and RPD results.

- The percent recoveries for the following metals in the MS/MSD exceeded the DoD control limits of 80-120%. The following metals in the associated samples were flagged 'J/UJ' based on MS/MSD recoveries. Table 2 lists the specific flags applied to each analytical result.

	MS (%)	MSD (%)
Aluminum	79.7	40.2
Antimony	2.7	3.0
Cobalt	79.8	78.4
Iron	319	0.0
Lead	60.4	42.6
Manganese	62.3	74.0

PRECISION

Duplicate Review

Field duplicates were not collected as part of this sampling event. Laboratory precision was assessed through MS/MSD analyses. Laboratory duplicate precision was acceptable with the exceptions as stated above.

COMPARABILITY

Compound Identification

During analysis of PCB congeners for sample 070410BIL03SS a 'P' flag was applied to some Aroclor 1260 results. The 'P' flag is used by ARI to indicate the Aroclor was identified by both chromatographic columns but the quantification differed by more than 40%. As confirmed by Sue Dunihoo of ARI via a telephone conversation, the more conservative or higher Aroclor concentration is reported. The sample result for Aroclor 1260 in 070410BIL03SS was estimated and flagged 'J' based on sample quantification.

Additional Laboratory Flags

Analytical results were flagged 'E' by the laboratory to indicate that the analyte response was above the valid instrument calibration range have been qualified as Do Not Report 'DNR'. Sample results for these analytes from re-analysis of diluted samples were also reported and are usable.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Some data were qualified as estimated

'J' and some as non-detect 'U/UJ'. A summary of qualifiers can be found in Table 2. Completeness for the site investigation was 100%.

REFERENCES

DoD 2006. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

USEPA, 1998, Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), 3rd Ed., September 1986: Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995, Final Update IIIB, April 1998, Final Update IIIB, June 2005.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for In Organic Data Review. October 2004.

Table 1
Sample Location and Analyses Summary

URS Sample ID	Sample Matrix	Sample Date	Lab ID	Method Analyses
070410BIL01SS	Soil	4/10/2007	KU44A	Metals[1], SVOCs, PCB (Aroclors), Organochlorine Pesticides
070410BIL02SS			KU44B	
070410BIL03SS			KU44C	
070410BIL04SS			KU44D	
070410BIL05SS			KU44E	
070410BIL06SS			KU44F	
070410BIL07SS			KU44G	
070410BIL08SS			KU44H	
070410BIL09SS			KU44I	

[1] Metals include Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc

Table 2
SUMMARY OF QUALIFICATIONS

URS Sample ID	Lab ID	Analyte	Qualifier	Rational
070410BIL01SS	KU44A	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
070410BIL02SS	KU44B	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
070410BIL03SS	KU44C	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
		Aroclor 1260	J	2nd Column Quantification
070410BIL04SS	KU44D	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
070410BIL05SS	KU44E	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
070410BIL06SS	KU44F	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	
070410BIL07SS	KU44G	Aluminum	J	MS/MSD recovery
		Antimony	UJ	
		Cobalt	J	
		Iron	J	
		Lead	J	
		Manganese	J	

URS Sample ID	Lab ID	Analyte	Qualifier	Rational
070410BIL08SS	KU44H	Aluminum Antimony Cobalt Iron Lead Manganese	J UJ J J J J	MS/MSD recovery
070410BIL09SS	KU44I	Pyrene	J	MSD recovery
		Aluminum Antimony Cobalt Iron Lead Manganese	J UJ J J J J	MS/MSD recovery

UPLAND OPERABLE UNIT REMEDIAL INVESTIGATION

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

1ST QUARTER UPLAND SAMPLING EVENT – APRIL 2008

JULY 2008

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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1.0 Executive Summary

The overall assessment of the 1st quarter groundwater, surface water and seep sample results show the quality of the data is acceptable to support project objectives. The contracted laboratory provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated and flagged with a 'J' or 'UJ'. Some data were qualified as not detected and flagged with a 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the attached report.

2.0 Project Description

URS collected 18 groundwater samples (15 primary and three field duplicates), two seep samples, two surface water samples and one rinsate blank during the first quarter upland sampling event on Bradford Island. Samples were collected from April 14 through April 18, 2008. Table 1 summarizes the sample location, media, URS and laboratory identification numbers and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *Draft: Upland Operable Unit Remedial Investigation* (URS 2008). All water samples were submitted to Columbia Analytical Services (CAS) located in Kelso, WA and logged in by the laboratory under four CAS sample delivery groups (K0803288, K0803320, K0803393, and K0803410). The following table lists the parameters analyzed on one or more of the samples. Table 1 summarizes the specific requested analyses for each media by URS and laboratory identification numbers. (Note: ammonia was inadvertently included on the URS COC and was analyzed by CAS; ammonia results are included in this report but are not listed in the QAPP.)

Method	Analytical Parameter
EPA 8260B	VOCs
EPA 8270C	SVOCs
EPA 6000 series	Metals
Krone (Krone 1998)	Butyltins
Total Petroleum Hydrocarbons (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel Range (NWTPH-Dx) NWTPH – Gasoline Range (NWTPH-Gx)
SM 5310C	Total Organic Carbon (TOC)
SM 5310C	Dissolved Organic Carbon (DOC)

Method	Analytical Parameter
EPA 300.0	Dissolved Anions (Bromide, Chloride, Fluoride, and/or Sulfate)
EPA 353.3	Nitrate/Nitrite
EPA 2320B	Alkalinity (Carbonate and/or Bicarbonate)
SM 4500-NH3 E	Dissolved Ammonia

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: initial and continuing calibrations, primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2008). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006) and the above-listed methods and the following EPA guidance documents in that order; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004). Project-specific QC criteria are listed in the QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and are not included in Table 2 for simplicity. These 'J' qualifiers are included in the database and are included in the data tables in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

The COC forms indicate that samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt with the exception of the COC form associated with sample delivery group K0803393. A URS signature was missing on this form; however, all samples arrived intact at CAS. Data were not qualified based on missing signature. All samples were released by URS to a CAS courier and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below, with the exception of two coolers associated with sample delivery group K0803393. These coolers were logged in at temperatures of 6.5°C and 6.1°C, respectively. Data were not qualified based on these slight temperature deviations.

The TPH samples were preserved with hydrochloric acid (HCl) to extend sample holding time from 7 days (listed in QAPP) to 14 days as described in TPH-Gx and TPH-Dx methods. All samples were analyzed within the technical and contracted holding time.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Instrument calibrations were acceptable for all sample analyses.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Qualification of samples due to method, rinsate, or trip blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results less than ten times (10x) the associated blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a 'U' at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a 'U'. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. All analytical tests indicate non-detects for method blanks with the following exceptions:

Rinsate Blank:

One rinsate blank was collected by running laboratory-provided deionized water through the *Monsoon* submersible pump used to sample well MW-8 (all other wells were sampled using dedicated tubing and a peristaltic pump). Sulfate, DOC, TOC, total iron, total and dissolved lead, dissolved arsenic, total and dissolved magnesium and dissolved sodium, and di-n-butyl tin were detected in the rinsate blank at concentrations above the MDLs and below the MRLs. All detected sample results for MW-8 were greater than 10x (inorganic constituents) and 5x (organic constituents) the concentrations detected in the rinsate blank; therefore, results were not qualified based on the rinsate blank detections.

Trip Blank:

VOCs and TPH-Gx samples were sent to CAS in three separate submittals which resulted in four sample delivery groups K0803288, K0803320, K0803393 and K0803410. A trip blank was included in only one of these submittals (K0803393) and inadvertently omitted in the other two. The sample team was made aware that trip blanks are required for all samples being analyzed for VOCs per QAPP requirements. Trip blanks will be included in all future submittals with VOC and/or TPH-Gx analyses. The trip blank submitted with K0803393 was non-detect for all VOCs and TPH-Gx. Samples were not qualified based on the trip blank.

Method and Calibration Blanks (Inorganics)

- Aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead and silver were detected in the method blank associated with total metals in sample delivery group K0803320 at concentrations above the MDL and below the MRL. Additionally, aluminum, cadmium, cobalt, copper and silver were detected in the calibration blanks bracketing the samples in this delivery group, indicting a possible instrument contamination and not a preparatory contamination. Detected total metals results for the above-listed metals were greater than 10x the method blank concentrations with the exception of a few metals in samples K0803320-001 and K0803320-002. These results were qualified as not detected and flagged 'U' using the criteria described above. (See Table 2).

- Cobalt, copper, sodium and zinc were detected in the method blank associated with dissolved metals in sample delivery group K0803320 at concentrations above the MDL and below the MRL. Additionally, aluminum, cadmium, cobalt, copper and silver were detected in the calibration blanks bracketing the samples in this delivery group, indicting a possible instrument contamination and not a preparatory contamination. Detected dissolved metals results for the above-listed metals were greater than 10x the method blank concentrations with the exception of a few metals in samples K0803320-001 and K0803320-002. These results were qualified as not detected and flagged 'U' using the criteria described above. (See Table 2).
- Arsenic and iron were detected in the method blank associated with total metals and arsenic and sodium were detected in the method blank associated with dissolved metals in sample delivery group K0803410. Additionally, arsenic, lead, magnesium and sodium were detected in the calibration blanks bracketing the samples in this delivery group, indicting a possible instrument contamination and not a preparatory contamination. All detected sample results were greater than 10x the blank concentrations except arsenic in samples K0803410-002 (total), K0803410-003 (dissolved), K0803410-004 (total), K0803410-004 (dissolved), and K0803410-005 (total), lead in sample K0803410-003 (total), and magnesium in samples K0803410-003 (total) and K0803410-005 (total). Results for these samples were qualified as not detected and flagged 'U' using the criteria described above (see Table 2).
- Iron was detected in the method blank associated with the total metals in sample delivery group K0803288 at a concentration above the MDL and below the MRL. Concentrations for total iron in samples K0803288-001 and K0803288-006 were less than 10x the method blank concentration and were qualified as not detected and flagged 'U' at the reported concentration as described above.
- Sodium was detected in the method blank associated with the dissolved metals in sample delivery group K0803288 at a concentration below the MRL. All sample results were greater than 10x this concentration; therefore, data were not qualified based on this method blank detection.
- Dissolved ammonia was detected in the method blank and continuing calibration blank at concentrations above the MDL and below the MRL in the sample delivery groups K0803410 and K0803393. All sample results were greater than 10x the blank

concentrations with the exception of dissolved ammonia in samples K0803410-003, K0803410-004, K0803410-005, K0803393-001, K0803393-002, K0803393-007, K0803393-009 and K0803393-010 which were qualified as not detected and flagged ‘U’ at the MRL.

- Dissolved chloride and dissolved fluoride were detected in continuing calibration blanks bracketing samples in delivery groups K0803410 and K0803393. All associated sample results were greater than 10x the calibration blank concentrations with the exception of dissolved fluoride in sample K0803393-006. Fluoride in this sample was qualified as not detected and flagged ‘U’ at the MRL.
- Arsenic was detected in the continuing calibration blanks bracketing samples in delivery group K0803393. All detected sample results were greater than 10x the blank concentrations with the exceptions of arsenic in samples K0803393-006 (dissolved) and K0803393-007 (dissolved). The dissolved arsenic results for these samples were qualified as not detected and flagged ‘U’ at the MRL.
- Magnesium was detected in the method blank associated with total and dissolved metals in sample delivery group K0803393 at a concentration above the MDL but below the MRL. All detected sample results were more than 10x the blank concentration with the exceptions of K0803393-001 (total), K0803393-001 (dissolved), K0803393-002 (total), and K0803393-006 (total). Magnesium results for these samples were qualified as not detected and flagged ‘U’ using the criteria described above (see Table 2).

Method Blanks (Organics)

- Diesel range organics (DRO) and residual range organics (RRO) were detected in the TPH-Dx method blank (extraction lot KWG0803683) associated with sample delivery groups K0803320, K0803288 and K0803393 at concentrations above the MDLs and below the MRLs. All detected sample results were greater than 5x the blank concentrations with the exception of RRO and DRO in samples K0803393-002, K0803393-004, K0803393-005, K0803393-006, K0803393-007, K0803393-009 and K0803393-010, RRO in samples K0803288-005 and K0803393-008, and DRO in sample K0803288-006. These results were qualified as not detected and flagged ‘U’ at the MRL as indicated in Table 2.
- The VOC method blank associated with sample delivery group K0803288 (extraction batch KWG0803826) had detections of carbon disulfide, methylene chloride, 1,2,3-trichlorobenzene, naphthalene and hexachlorobutadiene at concentrations above the MDLs and below the MRLs. All VOCs were included in this extraction lot with the exception of methylene chloride. Associated sample results were non-detect for carbon disulfide, 1,2,3-trichlorobenzene, naphthalene and hexachlorobutadiene with the exception of carbon disulfide results which were qualified as not detected and flagged

'U' at the MRL as described above (see Table 2 for details). Methylene chloride was detected in laboratory batches KWG0803826 and KWG083972. Methylene chloride was not detected in these method blanks and no qualification was required.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, SVOCs were qualified if two or more surrogate recoveries for a given fraction exceeded DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery exceeded DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- The percent recovery for the SVOC surrogate 2-fluorobiphenyl was below the lower DoD QSM control limit of 50% at 49% in the MS sample associated with sample delivery group K0803320. Recoveries of 2-fluorobiphenyl in the associated QC samples (method blank, LCS and MSD) were acceptable, indicating the analytical batch was in control. Additionally, the surrogate recoveries were in control within the associated parent sample. Sample results were not qualified based on surrogate recoveries in the MS.
- One SVOC surrogate, 2,4,6-tribromophenol, was below the lower DoD QSM control limit of 40% at 36% in sample K0803410-004. Recoveries of the four other SVOC surrogates within this sample were acceptable; therefore, results were not qualified based on the low 2,4,6-tribromophenol recovery in this sample.

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exceptions:

- The SVOC MS/MSD performed on sample K0803320-001 had percent recoveries of 1,4-dichlorobenzene below the lower DoD QSM limit of 30% at 27% and 29%, respectively. Results for 1,4-dichlorobenzene were non-detect in this sample. The associated LCS and calibration standards indicate that the analytical batch was in control. Results for 1,4-dichlorobenzene were qualified and flagged ‘UJ’ based on bias low MS/MSD recoveries.

- The nitrate/nitrite MS/MSD pair performed on sample K0803393-003 had recoveries below the CAS derived control limit of 90% at 81% and 83%, respectively. The LCS recovery was in control suggesting the analytical batch was in control. Nitrate/nitrite results in the parent sample (K0803393-003) were qualified as estimated and flagged ‘UJ’.
- The dissolved organic carbon (DOC) MS performed on sample K0803393-003 had a recovery above the CAS derived control limit of 156% at 206%. The LCS recovery was in control suggesting the analytical batch was in control. DOC in sample K0803393-003 was qualified as estimated and flagged ‘J’ due to bias high MS recovery.

4.6 Duplicate Review

Field duplicates are used to evaluate the variability associated with sample collection. Relative percent difference (RPD) calculations were performed on the analytical results from the three field duplicates associated with sample locations MW-7, MW-10 and MW-11, and identified as MW-22, MW-21, and MW-20, respectively. Specific field duplicate precision control limits were not defined in the QAPP; however, all field duplicate results were below the DoD QSM laboratory precision control of 30%, with the following exception:

- The RPD for carbonate results in the MW-11 duplicate pair exceeded the 30% criteria at 74%. Both the parent (K0803288-004) and the field duplicate (K0803288-005) were qualified as estimated and flagged ‘J’.
- The RPD for total lead in the MW-10 duplicate pair exceeded an RPD of 30% with 47%. Both the parent (K0803320-001) and the field duplicate (K0803320-002) results for total lead were previously qualified as estimated and flagged ‘U’ based on blank detections, further qualification was not neccessary.

To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. No samples were qualified based exclusively on laboratory duplicate precision.

4.7 Compound Quantification

- DOC results associated with samples K0803288-002, K0803288-005, K0803393-004, K0803393-007, K0803393-009, K0803393-010, K0803410-002, and K0803410-005 were slightly higher than the TOC results. The samples were field filtered. The discrepancy could be due to sample heterogeneity or introduction of organic carbon into the sample by the sample filtration process. The DOC results for these samples were qualified as estimated and flagged 'J' due to potential high bias. Currently, approximately 100mL of sample water is passed through the filters prior to sample collection; this volume will be increased in future sampling events to decrease the likelihood of TOC introduction by the sample filtration process.

- CAS assigned 'L' and/or 'Y' flags in reporting RRO and DRO sample results for samples K0803393-003, K0803393-007, and K0803393-008 to indicate that the chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents ('L') or the elution pattern does not match the calibration standard ('Y'). Further qualification was not necessary.

4.8 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a 'J'. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report but are not included in Table 2 of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a 'J' or a 'UJ'. Some data were qualified as not detected and flagged with a 'U.' A summary of qualifiers can be found in Table 2.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of usable results/total reported results) x100

  = *(1,156 compliant / 1,156 total results)* = 100%

  All samples results are considered usable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = *(1,083 compliant / 1,156 total results) = 94%*

  Data were qualified non-detect and flagged 'U' and some were qualified as estimated and flagged 'J' or 'UJ.' Data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

= (1,156 compliant /1,156 total results) = 100%

All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = (23 compliant / 23 total results) = 100%

  All samples collected and submitted to CAS for analysis had acceptable results.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Krone 1998. Krone, C.A. et al, A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound, Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1998.

URS 2008. Quality Assurance Project Plan, *Draft: Upland Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. May 2008.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

TABLES

UPLAND OPERABLE UNIT REMEDIAL INVESTIGATION

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

2ND QUARTER UPLAND SAMPLING EVENT – JULY 2008

OCTOBER 2008

Prepared by:
URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the 2nd quarter groundwater results show the quality of the data is acceptable to support project objectives. Seeps were dry at the time of sample collection and therefore seeps and the associated surface water were not collected during this sampling event. The contracted laboratory provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated and flagged with a 'J' or 'UJ'. Some data were qualified as not detected and flagged with a 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the attached report.

2.0 Project Description

URS collected 17 groundwater samples (14 primary and three field duplicates), one rinsate blank, and five trip blanks during the second quarter upland sampling event on Bradford Island. Samples were collected from July 14 through July 18, 2008. Table 1 summarizes the sample stations, URS and laboratory identification numbers and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *Draft: Upland Operable Unit Remedial Investigation* (URS 2008). All water samples were submitted to Columbia Analytical Services (CAS) located in Kelso, Washington and logged in by the laboratory under three CAS sample delivery groups (K0806414, K0806516 and K0806519). The following table lists the parameters analyzed on one or more of the samples.

Method	Analytical Parameter
EPA 8260B	VOCs
EPA 8270C	SVOCs
EPA 6000 series	Metals
Krone (Krone 1998)	Butyltins
Total Petroleum Hydrocarbons (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel Range (DRO) and Residual Range (RRO) (NWTPH-Dx) NWTPH – Gasoline Range (GRO) (NWTPH-Gx)

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: initial and continuing calibration verification (6000/7000 series), instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2008). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above-listed methods, and the following EPA guidance documents; EPA’s *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA’s *NFGs for Inorganic Data Review* (USEPA 2004) in that order. Project-specific QC criteria are listed in the QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged ‘J’ by CAS and for simplicity are not included in Table 2 unless otherwise qualified based on quality control issues identified in this report. The ‘J’ qualifiers assigned to results reported between the MDL and MRL are included in the database and are included in the data tables in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

The COC forms indicate that samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt. Three separate COCs are associated with sample delivery group K0806516; however, two of these were inadvertently left out of the laboratory data package. These COCs have been added as an addendum to the end of the package. All samples were released by URS to a CAS courier and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature range of 6°C or below.

The TPH samples were preserved with hydrochloric acid (HCl) to extend sample holding time from 7 days (listed in QAPP) to 14 days as described in the NWTPH-Gx and NWTPH-Dx methods. All samples were analyzed within the technical and contracted holding time with the following exceptions:

- The extraction of butyltins for samples K0806516-007, K0806516-008, K0806516-009 and K0806516-0010 were performed 28 days past the recommended 7 day hold time. This was due to a laboratory tracking error, this error has been remedied and should not occur in the future. The analytical results for butyltins for these samples have been estimated and flagged ‘J’ due to potential low bias from possible sample degradation.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Instrument calibrations were acceptable for all sample analyses.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Qualification of samples due to method, rinsate, or trip blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results and common organic laboratory contaminates less than ten times (10x) the associated blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified.

Rinsate Blanks

One rinsate blank was collected by running laboratory-provided deionized water through the *Monsoon* submersible pump used to sample well MW-01 (all other wells were sampled using dedicated tubing and a peristaltic pump). Chloroform, 1,4-dichlorobenzene, total magnesium, DRO, and RRO were detected in the rinsate blank at concentrations above the MDLs and below the MRLs. All detected sample results for MW-01 were greater than 10x (inorganic constituents) and 5x (organic constituents) the concentrations detected in the rinsate blank.

Trip Blanks

VOCs and GRO samples were submitted to CAS in five separate submittals, which resulted in five trip blanks. All trip blanks were non-detect for all VOCs and GRO with the following exceptions:

- GRO and chloroform were detected above the MDL and below the MRL in trip blank 080718TB (K0806516-013) associated with sample delivery group K0806516. GRO and chloroform in the associated sample K0806516-012 and the associated method blank were both reported as non-detect. GRO and chloroform results were not qualified based on trip blank detections. *(Note: The COC showing this trip blank and the associated sample was inadvertently missing from the original laboratory data report and is added as an addendum to the data package K0806516).*

Method and Calibration Blanks (Inorganics)

- Vanadium was detected in the method blank associated with sample delivery group K0806414 at the MDL. All detected vanadium results were greater than 10x the method blank concentration with the exceptions of samples K0806414-001, K0806414-001 (dissolved), K0806414-002, K0806414-002 (dissolved), and K0806414-007 (dissolved). Vanadium was qualified as not detected and flagged ‘U’ at the MRL for these samples (See Table 2).
- Thallium and zinc were detected at or above the MDL but below the MRL in the method blank associated with sample delivery group K0806519. Additionally, antimony, lead, nickel, silver and thallium were detected above the MDL but below the MRL in the calibration blanks bracketing the samples in this delivery group indicating possible instrument contamination and not preparatory contamination. Detected results for the above-listed metals were greater than 10x the blank concentrations with the exceptions of lead in samples K0806519-001 (dissolved) and K0806519-002 (dissolved), and thallium

in sample K0806519-001. These results were qualified as not detected and flagged ‘U’ using the criteria described above. (see Table 2).

- Iron was detected above the MDL but below the MRL in the method blank associated with sample delivery group K0806516. Additionally, lead was detected above the MDL but below the MRL in the calibration blanks bracketing the samples in this delivery group indicating possible instrument contamination and not preparatory contamination. Detected results for iron and lead not exceeding 10x the blank were qualified as non-detect and flagged ‘U’ using the criteria described above. The specific sample results are listed in Table 2.

Method Blanks (Organics)

- DRO and RRO reported in sample delivery group K0806414 were reported from two extraction lots. The method blank associated with extraction lot KWG0806857 had detections of DRO and RRO above the MDLs and below the MRLs. The method blank associated with the extraction lot KWG0806970 had detections of RRO above the MDLs and below the MRLs. All detected sample results were greater than 5x the blank concentrations with the exception of DRO and RRO in samples K0806414-001 through K0806414-004 and RRO in samples K0806414-006 and K0806414-007. These results were qualified as not detected and flagged ‘U’ at the MRL as indicated in Table 2.
- DRO and RRO were detected above the MDLs and below the MRLs in the method blank associated with sample delivery group K0806516. All detected sample results were greater than 5x the blank concentration with the exception of DRO and RRO in samples K0806516-005, K0806516-007, K0806516-008, K0806516-009 and RRO in samples K0806516-001 and K0806516-010. These results were qualified as not detected and flagged ‘U’ at the MRL.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, SVOCs were qualified if two or more surrogate recoveries for a given fraction were outside DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery was outside DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- The percent recovery for the VOC surrogate toluene-d8 in one of the method blanks associated with sample delivery group K0806414 was above the upper control limit of 120% at 121%. No analytes were detected in the method blank and all other surrogates were in control for the primary samples and the associated QC samples. Data were not qualified based on this surrogate recovery exceedance in the method blank.

- The percent recovery for the SVOC surrogate 2-fluorobiphenyl was below the lower DoD QSM control limit of 50% at 43% for sample K0806516-001. Recoveries of four other SVOC surrogates within this sample were acceptable; therefore, results were not qualified based on the low 2-fluorobiphenyl recovery in this sample.

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exception:

- The MS/MSD performed on sample K0806516-002 had recoveries for iron and manganese below the DoD QSM control limit of 80%; however, sample concentrations for these analytes were greater than 4x the spike concentrations. Additionally, post-spike recoveries were in control. Data were not qualified based on MS/MSD recoveries.

4.6 Duplicate Review

Field duplicates are used to evaluate the variability associated with sample collection. Relative percent difference (RPD) calculations were performed on the analytical results from the three field duplicates associated with sample locations MW-06, MW-10 and MW-13, and identified as MW-21, MW-22, and MW-23, respectively. Specific field duplicate precision control limits were not defined in the QAPP; however, all field duplicate results were below the DoD QSM laboratory precision control of 30%.

To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. RPD precision was within project-specific control limits with the following exception:

- The n-butyltin RPD for the LSC/LCSD pair in extraction lot KWG0806964 and associated with sample delivery groups K0806414 and K0806516 exceeded the 30% laboratory criterion at 34%. The LCS and LCSD percent recoveries meet the laboratory-specific criterion for n-butyltin (DoD QSM criterion not available). Two of the three LCS control parameters were within the control limits; therefore, data were not qualified based the elevated RPD.

4.7 Compound Quantification

- CAS assigned ‘L’ and/or ‘Y’ flags in reporting RRO and DRO sample results for samples K0806516-001, K0806516-002, K0806516-003, and K0806516-004 to indicate that the chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents (‘L’) or the elution pattern does not match the calibration standard (‘Y’). Further qualification was not necessary.
- CAS assigned ‘O’ and/or ‘H’ flags in reporting RRO and DRO sample results for samples K0806516-009 and K0806516-010 to indicate that the chromatographic fingerprint of the sample resembles a petroleum product, but the pattern indicates the presence of more heavier molecular weight constituents than the calibration standard (H) and the chromatographic fingerprint resembles an oil but does not match the calibration standard (O). Further qualification of the data was necessary.

4.8 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a ‘J’. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report but are not included in Table 2 of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a ‘J’ or a ‘UJ’. Some data were qualified as not detected and flagged with a ‘U.’ A summary of qualifiers can be found in Table 2.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of usable results/total reported results) x100

  = *(357 compliant / 357 total results)* = 100%

  All samples results are considered usable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = *(304 compliant / 357 total results) = 85%*

Data were qualified non-detect and flagged ‘U’ and some were qualified as estimated and flagged ‘J’ or ‘UJ.’ Data qualified ‘J’ due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = (348 compliant /357 total results) = 97%

  All samples analyzed met laboratory contract requirements with the exception of the above-mentioned holding time exceedance for butyltins in sample delivery group K0806516.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = (17 compliant / 17 total results) = 100%

  All samples collected and submitted to CAS for analysis had acceptable results.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Krone 1998. Krone, C.A. et al, A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound, Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1998.

URS 2008. Quality Assurance Project Plan, *Draft: Upland Operable Unit Remedial Investigation,* Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. May 2008.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

Tables

UPLAND OPERABLE UNIT REMEDIAL INVESTIGATION

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

3RD QUARTER UPLAND SAMPLING EVENT – OCTOBER 2008

JANUARY 2008

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the third quarter groundwater results show the quality of the data is acceptable to support project objectives. Seeps were dry at the time of sample collection and therefore seep samples and the associated surface water samples were not collected during this sampling event. The contracted laboratory provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated and flagged with a 'J' or 'UJ'. Some data were qualified as not detected and flagged with a 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the attached report.

2.0 Project Description

URS collected 18 groundwater samples (14 primary and 3 field duplicates), 1 rinsate blank, and 2 trip blanks during the third quarter upland sampling event on Bradford Island. Additionally, MW-12 was sampled using Teflon tubing in addition to the standard high density polyethylene (HDPE) tubing (see Section 4.6). Samples were collected from October 20 through October 24, 2008. Table 1 summarizes the sample stations, URS and laboratory identification numbers, and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *Upland Operable Unit Remedial Investigation* (URS 2008). All water samples were submitted to Columbia Analytical Services (CAS) located in Kelso, Washington and logged in by the laboratory under three CAS sample delivery groups (SDGs, K0810359, K0810410, and K0810448). The following table lists the parameters analyzed on one or more of the samples.

Method	Analytical Parameter
EPA 8260B	VOCs
EPA 8270C	SVOCs
EPA 6000 series	Metals (total and dissolved)[1]
Krone (Krone 1998)	Butyltins
Total Petroleum Hydrocarbons (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel Range (DRO) and Residual Range (RRO) (NWTPH-Dx) NWTPH – Gasoline Range (GRO) (NWTPH-Gx)

[1] One or more of the following metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: initial and continuing calibration verification (6000 series methods), instrument calibration, and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2008). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above-listed methods, and the following EPA guidance documents, as applicable; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004) in that order. Project-specific QC criteria are listed in the QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and for simplicity these 'J' flags are not included in Table 2 unless the analytical result was otherwise qualified based on quality control issues identified in this report. The 'J' qualifiers assigned to results reported between the MDL and MRL are included in the database and are included in the data tables in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

The COC forms indicate that samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt. All samples were released by URS to a CAS courier and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature range of 6°C or below.

Sample 081021MW12T was mislabeled on the COC as 081021MWGWT. The sample name was corrected and the results are reported under sample ID 081021MW12T.

The TPH samples were preserved with hydrochloric acid (HCl) to extend sample holding time from 7 days (listed in QAPP) to 14 days as described in the NWTPH-Gx and NWTPH-Dx methods. All samples were analyzed within the technical and contracted holding times.

All samples were received with adequate sample volume with the following exception:

- Due to insufficient groundwater in monitoring well 1 (MW-01), adequate sample volume to analyze all constituents was not collected; therefore, GRO, VOCs and total metals were given priority. Dissolved metals, butyltins, and SVOCs were not analyzed due to insufficient sample volume.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Instrument calibrations were acceptable for all sample analyses with the following exception:

- Butlytins are analyzed using dual columns for confirmation. The result for tri-n-propyltin on the confirmation column was outside the laboratory-specific calibration criterion of 20% (at 23%) for the continuing calibration associated with data packages K0810359 and K0810410. Similarly, tri-n-propyltin and di-n-butyltin were outside the laboratory-specific criteria of 20% (at 23% and 22%, respectively) on the confirmation column in the continuing calibration associated with data package K0810448. The associated results were reported from the column with acceptable continuing calibration results. Qualification of the data was not necessary.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Qualification of samples due to method, rinsate, or trip blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results and common organic laboratory contaminates less than ten times (10x) the associated blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a 'U' at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a 'U'. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified.

Method and Calibration Blanks (Inorganics)

- Iron was detected above the MDL but below the MRL in the calibration blanks bracketing the samples in delivery group K0810359, indicating possible instrument contamination and not preparatory contamination. Detected results for iron not exceeding 10x the blank concentration were qualified as non-detect and flagged 'U' using the criteria described above. The specific sample results are listed in Table 2.

- Chromium, manganese and zinc were detected at or above the MDL but below the MRL in one of the method blanks associated with sample delivery group K8010410. Additionally, antimony, chromium, lead, and silver were detected above the MDL but below the MRL in the calibration blanks bracketing the samples in this delivery group, indicating possible instrument contamination and not preparatory contamination. Detected results for above-listed metals not exceeding 10x the blank were qualified as non-detect and flagged 'U' using the criteria described above. The specific sample results are listed in Table 2.

Method Blanks (Organics)

- RRO was detected above the MDL and below the MRL in the method blanks associated with sample delivery groups K0810410 and K0810448. All detected sample results were greater than 5x the blank concentration with the exception of RRO in samples K0810410-001, K0810410-002, K0810410-003, K0810410-004, K0810410-006 and K08010448-

002. These results were qualified as not detected and flagged ‘U’ at the MRL as indicated in Table 2.

Rinsate Blanks

One rinsate blank was collected by running laboratory-provided deionized water through the *Monsoon* submersible pump used to sample monitoring wells MW-01, MW-08 and MW-10 (all other wells were sampled using dedicated tubing and a peristaltic pump). Manganese and RRO were detected in the rinsate blank, but were qualified as non-detect based on the associated method blank and/or calibration blank detections (as stated above and listed in Table 2). Iron and phenanthrene were detected in the rinsate blank. All detected sample results for the above-listed wells were greater than 10x (inorganic constituents) and 5x (organic constituents) the concentrations detected in the rinsate blank, with the exception of iron in sample MW-08 (K0810448-001) which was flagged non-detect (see Table 2).

Trip Blanks

VOCs and GRO samples were submitted to CAS in five separate submittals which resulted in five trip blanks. All trip blanks were non-detect for VOCs and GRO.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, SVOCs were qualified if two or more surrogate recoveries for a given fraction were outside DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery was outside DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- SVOCs were extracted and analyzed in two extraction lots (KWG081159 and KWG0811464) associated with sample delivery groups K0810410 and K0810448. The percent recovery for 2-fluorobiphenyl in samples K0810410-001, K0810410-002, K0810410-004, K0810410-005, K0810448-001 and K0810448-003 associated with extraction lot KWG081159 were below the lower DoD QSM control limit of 50% with a range of 42% to 47%. Recoveries of the four other SVOC surrogates for the above-listed samples were acceptable; therefore, results were not qualified based on the low 2-fluorobiphenyl recovery in these samples. (Note: surrogate 2-fluorobiphenyl is most closely associated with 1,4-dichlorobenzene, see discussion below in Section 4.5 for qualification of 1,4-dichlorobenzene sample results).

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exception:

- As mentioned above, SVOCs associated with sample delivery groups K0810410 and K0810448 were extracted and analyzed in two extraction lots, KWG081159 and KWG0811464. The recoveries of the SVOC surrogate 1,4-dichlorobenzene in the MS and MSD performed on sample K0810410-005 (extraction lot KWG081159) were below the lower DoD QSM control limit of 30% at 26% and 22%, respectively. Additionally, the LCS recovery in extraction lot KWG081159 was below the lower DoD QSM control limit of 30% at 27%. As stated in the case narrative and based on conversations with CAS, there appears to be a slight low bias for 1,4-dichlorobenzene for samples in extraction lot KWG081159. All sample results for 1,4-dichlorobenzene in this extraction lot were reported as non-detect. These results were qualified as estimated and flagged 'UJ' due to potential low bias, see Table 2.

4.6 Duplicate Review

Field duplicates are used to evaluate the variability associated with sample collection. Relative percent difference (RPD) calculations were performed on the analytical results from the three field duplicates associated with sample locations MW-06, MW-10 and MW-11, and identified as MW-26, MW-20, and MW-21, respectively. Specific field duplicate precision control limits were not defined in the QAPP; however, all field duplicate results were below the DoD QSM laboratory precision control of 30%, with the following exception:

- The RPD results for the parent sample/field duplicate pair MW-10/MW-20 for total chromium, total iron and total zinc exceeded the control limit of 30% at 43%, 47% and 49%, respectively. Total chromium, total iron and total zinc results were qualified and flagged 'J' based on field duplicate precision.
-

To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. RPD precision was within project-specific control limits with the following exception:

- The n-butyltin RPD for the MS/MSD pair associated with sample delivery group K08010359 exceeded the 30% laboratory criterion at 38%. The MS, MSD and LCS percent recoveries meet the laboratory-specific criterion for n-butyltin (DoD QSM criterion not available). Two of the three MS control parameters were within the control limits; therefore, data were not qualified based the elevated RPD.

Per the request of the USACE chemist, one monitoring well (MW-12) was sampled using Teflon tubing in addition to the standard HDPE tubing to evaluate whether HDPE could preferentially be adsorbing organics compounds. Relative percent difference (RPD) calculations were performed on the MW-12 sample results from the HDPE and Teflon tubing. All RPD calculations were below the above-mentioned 30% control limit with the following exceptions:

- The RPD for dissolved vanadium was 38%. The dissolved vanadium result for the Teflon tubing appeared to have a slight low bias in comparison to the HDPE. Both the HDPE and Teflon results for vanadium are reported in the attached data tables, data were not qualified based on RPD value.
- The RPDs for total and dissolved iron were 159% and 161%, respectively. Both results are reported in the attached data tables, data were not qualified based on RPD values.

4.7 Compound Quantification

- CAS assigned ‘L’ and/or ‘Y’ flags in reporting RRO and/or DRO sample results for samples K0810410-003, K0810410-004, K0810410-005, K0810410-006, K0810448-001 and K0810448-004 to indicate that the chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents (‘L’) or the elution pattern does not match the calibration standard (‘Y’). Further qualification was not necessary.
- CAS assigned a ‘Z’ flag in reporting RRO and DRO sample results for sample K0810448-003 to indicate the chromatographic fingerprint of the sample does not resemble a petroleum product. Further qualification was not necessary.

4.8 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a ‘J’. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report but are not included in Table 2 of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a ‘J’ or a ‘UJ’. Some data were qualified as not detected and flagged with a ‘U.’ A summary of qualifiers can be found in Table 2.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of usable results/total reported results) x100

  = *(502 compliant / 502 total results)* = 100%

  All samples results are considered usable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = *(462 compliant / 502 total results) = 92%*

  Data were qualified non-detect and flagged ‘U’ and some were qualified as estimated and flagged ‘J’ or ‘UJ.’ Data qualified ‘J’ due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = *(502 compliant / 502 total results)* = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = *(17 compliant / 17 total results)* = 100%

  All samples collected and submitted to CAS for analysis had acceptable results.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Krone 1998. Krone, C.A. et al, A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound, Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1998.

URS 2008. Quality Assurance Project Plan, *Upland Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. October 2008.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

Washington State Department of Ecology (Ecology), 1997, Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997.

UPLAND OPERABLE UNIT REMEDIAL INVESTIGATION

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

4TH QUARTER UPLAND SAMPLING EVENT – JANUARY 2009

MARCH 2009

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the fourth quarter groundwater results show the quality of the data is acceptable to support project objectives. The contracted laboratory provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated and flagged with a 'J' or 'UJ'. Some data were qualified as not detected and flagged with a 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the attached report.

2.0 Project Description

URS collected 18 groundwater samples (15 primary and 3 field duplicates), 2 seep water samples, 2 surface water samples, 1 rinsate blank, and 4 trip blanks during the fourth quarter upland sampling event on Bradford Island. Samples were collected from January 11 through January 15, 2009. Table 1 summarizes the sample stations, URS and laboratory identification numbers, and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *Upland Operable Unit Remedial Investigation* (URS 2008). All water samples were submitted to Columbia Analytical Services (CAS) located in Kelso, Washington and logged in by the laboratory under four CAS sample delivery groups (SDGs, K0900280, K0900315, K0900316, and K0900366). The following table lists the parameters analyzed on one or more of the samples.

Method	Analytical Parameter
EPA 8260B	VOCs
EPA 8270C	SVOCs
EPA 6000 series	Metals (total and dissolved)[1]
Krone (Krone 1998)	Butyltins
Total Petroleum Hydrocarbons (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel Range (DRO) and Residual Range (RRO) (NWTPH-Dx) NWTPH – Gasoline Range (GRO) (NWTPH-Gx)

[1] One or more of the following metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: initial and continuing calibration verification (6000 series methods), instrument calibration, and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2008). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above-listed methods, and the following EPA guidance documents, as applicable; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004) in that order. Project-specific QC criteria are listed in the QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and for simplicity these 'J' flags are not included in Table 2 unless the analytical result was otherwise qualified based on quality control issues identified in this report. The 'J' qualifiers assigned to results reported between the MDL and MRL are included in the database and are included in the data tables in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

The project-specific analyte lists for metals, VOCs and SVOCs for monitoring wells MW-1 through MW-9 and MW-11 through MW-14 were misidentified on the associated COC forms. This was discovered and corrected during the sample confirmation process; all samples were analyzed for the appropriate analytes.

COC forms indicated samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt with the following exceptions:

- The COC form associated with SDG K0900280 was signed but the date and time were inadvertently omitted. The COC form associated with SDG K0900315 relinquished on January 13 was not signed by URS. All subsequent courier and laboratory signatures with date and time are included. All samples were received intact by the laboratory. Data were not qualified.
- One 500 milliliter (mL) glass amber sample container for sample 090111S2SW (SDG K0900280) was missing a sample label. Through process of elimination CAS determined the proper sample identification. Data were not qualified.

All samples were released by URS to a CAS courier and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature range of 6°C or below. All samples were analyzed within the technical and contracted holding times.

All samples were received with adequate sample volume with the following exception:

- Due to insufficient groundwater in monitoring well 1 (MW-01), adequate sample volume to analyze all constituents could not be collected. Therefore, NWTPH-Gx, VOCs and metals were given priority. Butyltins, NWTPH-Dx and SVOCs were not analyzed due to insufficient sample volume.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Instrument calibrations were acceptable for all sample analyses with the following exception:

- Butlytins are analyzed using dual columns for confirmation. Continuing calibration results for the confirmation column in analysis lot KWG0900568 were outside the laboratory-specific calibration criterion of 20% for n-butyltin and tri-n-propyltin. Results ranged from a percent difference of 25% to 35% for the post sample continuing calibration in this analysis lot. The samples analyzed in the analysis lot were K0900280-001, K0900280-002, K0900280-003, K0900280-004, K0900315-001, K0900315-002, K0900315-003, K0900315-004 and K0900315-005. The primary calibration results prior to sample analysis were in control. All associated results were reported from the column with acceptable continuing calibration results. Qualification of the data was not necessary. (Note: the original case narrative for data package K0900316 inadvertently stated samples associated with this SDG were analyzed in the analysis lot KWG0900568. This error was detected during the data review and an addendum narrative was issued by CAS correcting the error.)

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Qualification of samples due to method, rinsate, or trip blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results and common organic laboratory contaminates less than ten times (10x) the associated blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified.

Method and Calibration Blanks (Inorganics)

- Manganese was detected above the MDL but below the MRL in the method blank in delivery group K0900280. Detected results for manganese not exceeding 10x the blank concentration were qualified as non-detect and flagged ‘U’ using the criteria described above. The specific sample results are listed in Table 2.

- Cadmium was detected at or above the MDL but below the MRL in the method blank associated with sample delivery group K0900366. Detected results not exceeding 10x the blank concentration of cadmium were qualified as non-detect and flagged ‘U’ using the criteria described above. Specific sample results are listed in Table 2.
- Two method blanks were analyzed with the metals in SDG K0900316, one was non-detect for all project specific metals, the second had a detection of arsenic at the MDL. Detected results for arsenic not exceeding 10x the blank concentration were qualified as non-detect and flagged ‘U’ using the criteria described above. The specific sample results are listed in Table 2.
- Iron and antimony were detected above the MDL but below the MRL in the calibration blanks bracketing the samples in SDGs K0900280 and K0900366, indicating possible instrument contamination and not preparatory contamination. Detected results for iron and antimony not exceeding 10x the blank concentration were qualified as non-detect and flagged ‘U’ using the criteria described above. The specific sample results are listed in Table 2.
- Iron, lead and manganese were detected above the MDL but below the MRL in the calibration blanks bracketing the samples in SDG K0900316. Detected results for iron, lead and manganese not exceeding 10x the blank concentration were qualified as non-detect and flagged ‘U’ using the criteria described above. The specific sample results are listed in Table 2.

Method Blanks (Organics)

- RRO was detected above the MDL and below the MRL in the method blanks associated with SDGs K0900280 and K0900315. These results were qualified as not detected and flagged ‘U’ at the MRL, using the criteria described above. Specific sample results are listed in Table 2.

Rinsate Blanks

One rinsate blank was collected by running laboratory-provided deionized water through the *Grundfos* submersible pump used to sample monitoring wells MW-01 and MW-08 (all other wells were sampled using dedicated tubing and a peristaltic pump). Analytical results for the rinsate blank were non-detect with the following exceptions:

- Iron, lead and manganese were detected at concentrations above the MDL and below the MRL, but were qualified as non-detect based on the associated method blank and/or calibration blank detections (as stated above and listed in Table 2).

- GRO was detected above the MDL and below the MRL. GRO analytical results for both MW-01 and MW-08 were non-detect; therefore, qualification of the data was not necessary.
- Phenol was detected above the MDL and below the MRL. Only MW-08 was analyzed for SVOCs. The phenol result for MW-08 was non-detect. Therefore, qualification of the data was not necessary.

Trip Blanks

VOCs and GRO samples were submitted to CAS under four independent submittals which resulted in four trip blanks. All analytical results for trip blanks were non-detect for VOCs and GRO.

Trip blank TB5 is associated with samples submitted to CAS on January 13, 2008. This trip blank was delivered to CAS in a cooler containing VOC and TPH-Gx sample containers associated with SDGs K0900315 and K0900316. This trip blank is listed on COC forms associated with both SDGs. The trip blank was analyzed once and reported in both SDGs. The same is true for trip blank TB 4 associated with samples from both SDGs delivered to CAS on January 14, 2009.

Both trip blanks TB4 and TB5 consisted of a single vial. The single vial for each sample was initially analyzed for GRO. After analysis, the remaining volume was analyzed for VOCs, however the vial used for VOC analysis contained headspace. Therefore, the VOC data is considered qualitative and flagged 'UJ', due to the headspace in the sample container prior to analysis. This problem has been remedied and all future sampling events will include adequate number of sample vials to complete requested analyses. It was not deemed necessary to qualify the analytical results of the primary samples.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. SVOCs contain acid and base/neutral components. When more than one surrogate per fraction (acid or base/neutral) were spiked in the sample, SVOCs were qualified if two or more surrogate recoveries for a given fraction were outside DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery was outside DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses.

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exception:

- The recovery of calcium within the MS performed on sample K0900366-001 was below the DOD QSM lower control limit of 80% at 74%. The associated MSD and RPD were within the control limits. The LCS and post spike recoveries were in control, indicating the analytical batch was in control. Because two of three matrix spike control parameters (MSD and RPD) were within the DOD QSM control limits the associated calcium analytical results were not qualified.

4.6 Duplicate Review

Field duplicates are used to evaluate the variability associated with sample collection. Relative percent difference (RPD) calculations were performed on the analytical results from the three field duplicates associated with sample locations MW-06, MW-10 and MW-11, and identified as MW-26, MW-20, and MW-21, respectively. Specific field duplicate precision control limits were not defined in the QAPP; however, all field duplicate results were below the DoD QSM laboratory precision control of 30%. To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. RPD precision was within project-specific control limits.

4.7 Compound Quantification

- CAS assigned ‘L’ and/or ‘Y’ flags in reporting RRO and/or DRO sample results for samples K0900316-006, K0900316-007, K0900316-008, K0900316-009, and K0900316-010 to indicate that the chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents (‘L’) or the elution pattern does not match the calibration standard (‘Y’). Further qualification was not necessary.
- CAS assigned a ‘Z’ flag in reporting RRO and DRO sample results for sample K0900280-003 to indicate the chromatographic fingerprint of the sample does not resemble a petroleum product. Further qualification was not necessary.

4.8 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a 'J'. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report but are not included in Table 2 of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a 'J' or a 'UJ'. Some data were qualified as not detected and flagged with a 'U.' A summary of qualifiers can be found in Table 2.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 15% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of usable results/total reported results) x100

  = *(527 compliant / 527 total results)* = 100%

  All samples results are considered usable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = (474 compliant / 527 total results) = 90%

  Some data were qualified non-detect and flagged 'U' and some were qualified as estimated and flagged 'J' or 'UJ.' Data qualified 'J' due to detections between the MDL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = *(527 compliant / 527 total results)* = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = *(22 compliant / 22 total results)* = 100%

  All samples collected and submitted to CAS for analysis had acceptable results.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final

Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Krone 1998. Krone, C.A. et al, A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound, Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1998.

URS 2008. Quality Assurance Project Plan, *Upland Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. October 2008.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

Washington State Department of Ecology (Ecology), 1997, Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997.

UPLAND OPERABLE UNIT REMEDIAL INVESTIGATION

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

UPLAND OPERABLE UNIT SAMPLING – JANUARY-MARCH 2009

JUNE 2009

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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1.0 Executive Summary

The overall assessment of the sampling results show the quality of the data is acceptable to support project objectives. The contracted laboratory provided all requested analyses and the delivered data reports were complete. Some data were qualified as estimated and flagged with a ‘J’ or ‘UJ’. Some data were qualified as not detected and flagged with a ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the attached report.

2.0 Project Description

URS collected soil, sediment, groundwater and soil gas from one or more of the four project-identified areas of potential concern (AOPCs) and the Reference Area. Quality control (QC) samples including field duplicates, rinsate blanks, and trip blanks were submitted when applicable with samples from each AOPC. Table 1 details the primary and quality control (QC) samples collected from each AOPC including URS and laboratory identification numbers, and requested analyses. Samples were collected on non-consecutive days between January 11 and March 20, 2009.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *Upland Operable Unit Remedial Investigation* (URS 2008). Deviations from the QAPP (i.e. sample number and volume collected at each pre-determined location) are addressed in *Upland Operable Unit Data Gap Sampling* (URS 2009). All samples with the exception of the soil gas samples were submitted to Columbia Analytical Services (CAS) of Kelso, Washington and logged in under eight CAS sample delivery groups (SDGs, K0900272, K0900738, K0900782, K0900814, K0900927, K0902453, K0902454, K0902472 and K0902475).

Soil gas samples were submitted to AirToxics, Ltd. of Folsom, CA and assigned the SDG number 0901593R1. Soil gas results are reported in two different units within the laboratory data deliverable: parts per billion by volume (ppbv) and micrograms per cubic meter (ug/m^3). For brevity, the sample results will be reported and/or evaluated in this report in units of ug/m^3. Soil gas canisters were cleaned prior to shipment using AirToxics proprietary in-house Standard Operating Procedure (SOP). All canisters used during this sampling event (with the exception of the field blank canister) were certified clean using a batch certification process, in which a subset of the canisters (10%) cleaned by the process are evaluated by GC/MS analysis to certify the cleaning process. The field blank canister, however, was evaluated by GC/MS individually prior to shipment.

The following table lists the parameters analyzed on one or more of the samples.

Method	Analytical Parameter
EPA 8260B EPA TO-15	VOCs – Solid and Water Matrices VOCs – Soil Gas Matrix
EPA 8270C	SVOCs
EPA 6000 series	Metals (total and dissolved)[1]
Plumb (Plumb 1981) EPA 415.1	Total Organic Carbon (TOC) – Solid Matrices TOC – Water Matrices
PSEP (PSEP 1996)	Grain Size
SM2540C/D	Total Dissolved Solids (TDS)/ Total Suspended Solids (TSS)

[1] One or more of the following metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc.

The soil samples collected from the Sandblast Area AOPC were prepared and analyzed by CAS. Specific details on laboratory sample preparation were not included in the QAPP. The methodology detailed below was deemed appropriate after consultation between URS and Lynda Huckestein at CAS. The soil from the Sandblast Area AOPC was submitted for lead analysis in a single laboratory-provided 16 ounce glass container. It was believed that inadequate sample volume would be obtained for lead analysis if the samples were not dried prior to sieving. Drying at 60°C was suggested by CAS based on historic data for lead analysis on oven dried soil samples and is sufficient to remove water from the sample, while not compromising the lead concentrations. Therefore, a portion of the soil sample was removed from the container, dried at 60 degrees Celsius (°C) and split into equal fractions. One fraction was sieved using a 2 millimeter (2mm) mesh sieve, the other using a 250 micron mesh sieve. Due to the sampling methodology (i.e. drying the soil prior to sieving), the analytical results for these samples are reported in dry weight only.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods), and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 20% or greater of the data: initial and continuing calibration verification (6000 series methods), instrument calibration, and verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2008). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above-listed methods, and the following EPA guidance documents, as applicable; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 2008) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004) in that order. Project-specific QC criteria are listed in the QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and for simplicity these 'J' flags are not included in Table 2 unless the analytical result was otherwise qualified based on quality control issues identified in this report. The 'J' qualifiers assigned to results reported between the MDL and MRL are included in the database and are included in the data tables in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U – The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J – The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. .
- UJ – The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R – The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR – Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

COC forms indicated samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt. All samples with the exception of soil gas were released by URS to a CAS courier and were received and logged in by the laboratory on the same day. All coolers were submitted to CAS at temperatures within the EPA-recommended temperature range of 6°C or below. The soil gas canisters were shipped at ambient temperatures to AirToxics per method guidelines. All samples were analyzed within the technical and contracted holding times. All samples were received with adequate sample volume.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods. Instrument calibrations were acceptable for all sample analyses.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Qualification of samples due to method, rinsate, or trip blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x), and inorganic sample results and common organic laboratory contaminates less than ten times (10x) the associated blank concentration, and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified.

Method and Calibration Blanks (Inorganics)

- Copper was detected above the MDL but below the MRL in the method blank associated with SDG K0900272. Thallium was detected above the MDL but below the MRL in the method blank in SDG K0900782. All associated detected results for copper in SDG K0900272 and thallium in SDG K0900782 exceeded 10x the associated blank concentrations; therefore, no qualification was necessary.
- Copper was detected above the MDL but below the MRL in the method blank associated with SDG K0900927. All associated detected results for copper in SDG K0900927 were more than 10x the associated blank concentrations with the exception of sample

K0900927-004. The result for total copper in K0900927-004 was qualified as non-detect and flagged 'U' at the reporting limit using the criteria above.

- Calcium, iron, magnesium, selenium and/or thallium were detected at concentrations above the MDL but below the MRL in one or more continuing calibration blanks bracketing samples associated with SDG K0900782. Lead was detected at concentrations above the MDL but below the MRL in one or more continuing calibration blanks bracketing samples associated with SDG K0900927. Detections in the calibration blanks indicate possible instrument contamination and not laboratory preparatory contamination. Detected results for calcium, iron, magnesium, selenium and thallium in samples associated with SDG K0900782 and lead in samples associated with SDG K0900927 not exceeding 10x the blank concentration were qualified as non-detect and flagged 'U' using the criteria above. The specific results are listed in Table 2.
- Antimony, calcium, chromium, nickel and zinc were detected above the MDL and below the MRL in the method blank associated with SDG K0902453. Barium, calcium and thallium were detected in the continuing calibration blanks bracketing samples associated with SDG K0902453. Detections in the calibration blanks indicate possible instrument contamination and not laboratory preparatory contamination. Detected results for antimony, barium, calcium, chromium, nickel, thallium and zinc in samples associated with SDG K0902453 not exceeding 10x the blank concentration were qualified as non-detect and flagged 'U' using the criteria above. The specific results are listed in Table 2.

Method Blanks (Organics)

- Phenanthrene and chrysene were detected at concentrations above the MDL, but below the MRL in the method blank associated with SDG K0900814. All detected concentrations for these analytes in the associated samples were greater than 5x the blank concentration; therefore, qualification of the data was not necessary.
- The following TO-15 constituents were found in the AirToxics laboratory blank at concentration above the MDL, but below the MRL; acetone, carbon disulfide, methylene chloride, 2,2,4-trimethylpentane, 1,4-dioxane, trans-1,3-dichloropropene, 1,2-dibromoethane, 1,1,2,2-tetrachloroethane, 1,3-dichlorobenze, 1,4-dichlorobenze, alpha-chlorotoluene, and 1,2-dichlorobenze. Detected results for these analytes not exceeding 5x the blank concentration were qualified as non-detect and flagged 'U' using the criteria above. The specific results are listed in Table 2.

Rinsate Blanks

A total of four rinsate samples were collected during soil and sediment collection from the Reference Area, the Sandblast AOPC and the Pistol Range AOPC, as listed in Table 1. The sampling procedures for the rinsate samples are described in the sampling methodology sections of the *Upland Operable Unit Data Gap Sampling* (URS 2009) and for brevity will not be reiterated in this report. Analytical results for the four rinsate samples were non-detect with the following exceptions.

Pistol Range AOPC Rinsate Samples

- Copper, nickel, zinc were detected in the rinsate blank sample K0900272-007 at concentrations above the MDL but below the MRL. All associated samples (Pistol Range AOPC lagoon sediments) had detections of copper, nickel and zinc at concentrations greater than 10x the rinsate blank concentrations, therefore qualification of the data was not necessary.
- Copper and lead were detected in the rinsate blank sample K0900927-004 at concentrations above the MDL but below the MRL. Both copper and lead in the associated samples were already qualified non-detect based on the associated method blank and continuing calibration blank detections as stated above; therefore, qualification of the data was not necessary.

Reference Area Rinsate Sample

- Aluminum, barium, iron, manganese and mercury were detected in the rinsate sample K0900782-016 above the MDL, but below the MRL and copper, nickel and zinc were detected above the MRL. Aluminum and mercury in the associated samples were qualified as non-detect based on associated method blank detections. All associated samples (Reference Area sediments) had detections of barium, iron, manganese, mercury, copper, nickel, and zinc at concentrations greater than 10x the rinsate blank concentrations; therefore, qualification of the data was not necessary.

Trip Blank

One trip blank (K0900814-010) was collected per QAPP guidance with the Landfill AOPC soil samples (SDG K0900814). The trip blank was submitted and analyzed for project-specific VOCs. All VOCs were reported as not detected; therefore, qualification of the data was not necessary.

Field Blank

One field blank was collected per QAPP guidance as part of the soil gas sampling in the Sandblast AOPC. The field blank sample was collected by drawing laboratory-supplied inert gas (nitrogen) through a clean laboratory-provided sampling manifold and into a 1 liter sample canister. As stated above, the field blank canister was individually certified clean prior to shipment from the laboratory, all TO-15 analytes were reported to be non-detect at the MRL during this certification process. All TO-15 analytes were non-detect in the field blank, with the exception of heptane and toluene which were reported at concentrations above the MDL, but below the MRL. Detected results for heptane and toluene not exceeding 5x the blank concentration were qualified as non-detect and flagged ‘U’ using the criteria above. The specific results are listed in Table 2.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, SVOCs were qualified if two or more surrogate recoveries for a given fraction were outside DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery was outside DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses, with the following exceptions:

- The percent recoveries of the VOC surrogate 1,2-dichloroethane-d4, exceeded the DOD QSM upper control limit of 123% for all VOC samples in SDG K0900814. Surrogate recoveries ranged from 128% to 143%. The remaining three VOC surrogates were within control limits. The project-specific analyte list for VOCs only consists of three analytes, tetrachloroethene (PCE), toluene and o-xylene. All detected concentrations for VOCs in SDG K0900814 were qualified based on the bias high surrogate recovery and flagged ‘J’. VOCs not detected were not qualified.
- The SVOC surrogate fluorene-d10 had recoveries below the lower DOD QSM control limit of 60% in samples K0900814-001 (47%), K0900814-003 (45%), and K0900814-006 (57%). Additionally, SVOC surrogate fluoranthene-d10 had a recovery of 48% in sample K0900814-003, which was below the lower DOD QSM criteria of 60%. Surrogate recoveries were acceptable in the associated QC samples (i.e. method blank, LCS and LCSD) indicating analytical batch was in control. Following the EPA NFGs, only those samples with two or more surrogates (within the same fraction) out of specifications are qualified as estimated. Therefore, all SVOC analytical results for K0900814-003 were qualified ‘J/UJ’, based on the low surrogate recoveries. (Note: The only SVOCs analyzed were PAHs and therefore, all analytes and the associated surrogates are within the same base/neutral fraction.)

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory’s day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exception:

- The percent recoveries of zinc in the MS (138%) and MSD (157%) performed on sample K0900272-002 were above the DOD QSM upper control limit of 120%. The LCS and post-digestion spike recoveries were in control, indicating the analytical batch was in control. Zinc analytical results for the primary sample K0900272-002 and the field duplicate were flagged ‘J’ to indicate potential high bias due to the sample matrix. The other sediment samples collected from the Pistol Range AOPC lagoon were deemed a similar matrix based on available data and were therefore qualified as estimated and flagged ‘J’ also.

- The percent recoveries of antimony in the MS (47.2%) and MSD (42.8%) performed on sample K0900782-006 were below the DOD QSM lower control limit of 75%. The LCS and post-digestion spike recoveries were in control indicating the analytical batch was in control. The other samples collected from the Reference Area were deemed of a similar matrix based on available data, and therefore all analytical results for antimony were qualified as estimated and flagged ‘J/UJ’ to indicate potential bias due to the sample matrix.
- The percent recovery of zinc in the MSD performed on sample K0900782-006 (79%) was below the DOD QSM lower control limit of 80%. The associated MS and RPD were within the control limits. The LCS and post-digestion spike recoveries were in control indicating the analytical batch was in control. Because two of three matrix spike control parameters (MS and RPD) were within the DOD QSM control limits, the associated zinc analytical results were not qualified.
- The percent recovery of copper in the MS performed on sample K0900927-001 (78%) was below the DOD QSM lower control limit of 80%. The associated MSD and RPD were within the control limits. The LCS and post-digestion spike recoveries were in control, indicating the analytical batch was in control. Because two of three matrix spike control parameters (MSD and RPD) were within the DOD QSM control limits, the associated copper analytical results were not qualified.
- The MS and MSD percent recoveries for aluminum, chromium, iron, lead and manganese were outside the DoD QSM control limits of 80-120% in the MS/MSD performed on sample K0902454-002 and associated with samples in SDGs K0902453 and K0902454. However, the concentrations of these analytes in the primary sample (K0902454-002) were greater than 4x the spike concentrations; therefore, analytical results were not qualified based on MS/MSD recoveries. Recoveries of the following analytes were also outside the DoD QSM control criteria of 80-120% and the RPD criteria of 20% in the same MS/MSD sample:

	MS (%)	MSD(%)	RPD (%)
Antimony	34.7	37.5	--
Nickel	243	--	97
Zinc	130	79.7	48

The post-digestion spike and LCS recoveries were in control indicating the analytical batch was in control. Sample results for antimony, nickel and zinc in the primary sample (K0902454-002) were estimate and flagged ‘J’ due to MS/MSD recoveries. The other samples within the same analytical batch were deemed to be different, therefore qualification was not needed.

- The percent recoveries of all project-specific SVOCs were outside control limits for the MS/MSD performed on sample K0900814-006. However, the MS/MSD results are not applicable because the samples results for all spikes compounds in K0900814-006 are greater than 4x the spike concentration. In addition, all associated QC samples (i.e LCS, LCSD) were in control indicating analytical batch was in control. Data were not qualified based on MS/MSD recoveries.

4.6 Duplicate Review

Field duplicates are used to evaluate the variability associated with sample collection. Relative percent difference (RPD) calculations were performed on the analytical results from the seven field duplicates shown in Table 1. For the soil gas field duplicate, the primary and duplicate sample canisters were filled concurrently. A more in-depth description of all the field duplicate collection methodologies is included in the *Upland Operable Data Gap Unit Sampling* (URS 2009). Specific field duplicate precision control limits were not defined in the QAPP. Field duplicate precision criteria was evaluated at 30% for waters and 50% for solid matrices. All field duplicate results were below these criteria with the following exceptions:

- RPDs calculated on the primary soil sample (K0900814-007) and the associated field duplicate (K0900814-009) collected from the Landfill AOPC were above the 50% control limit for all project-specific SVOCs. The calculated RPD ranged from 59% to 160%. All SVOCs in samples K0900814-007 and K0900814-009 were qualified and flagged ‘J’ due to field duplicate precision.
- RPDs calculated on the primary sediment sample (K0900272-003) and the associated field duplicate (K0900272-006) collected from the Pistol Range AOPC lagoon were above the 50% control limit for TOC. The calculated RPD was 72%. TOC results for K0900272-003 and K0900272-006 were qualified and flagged ‘J’ due to field duplicate precision.
- RPDs calculated on the primary groundwater sample (K0900927-002) and the associated field duplicate (K0900927-003) collected from the Pistol Range AOPC temporary groundwater wells were above the 30% control limit for total copper (92%), total lead (92%), total nickel (97%), total zinc (97%), dissolved lead (60%) and total suspended solids (199%). The above-listed analytes were qualified and flagged ‘J’ due to field duplicate precision.

To evaluate laboratory precision, CAS performed laboratory duplicate analyses as discussed above. RPD precision was within project-specific control limits with the following exceptions:

- RPDs calculated for the laboratory duplicate performed on the soil sample (K0902454-002) were above the DoD QSM control laboratory precision control limit of 20% for chromium (60.6%) and nickel (60.5%). The laboratory noted in the case narrative that this particular sample had small rocks which make complete homogenization difficult. Chromium and nickel were qualified as estimated and flagged 'J' due to laboratory precision in sample K0902454-002.

4.7 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a 'J'. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report but are not included in Table 2 of this Quality Control Summary Report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a 'J' or a 'UJ'. Some data were qualified as not detected and flagged with a 'U.' A summary of qualifiers can be found in Table 2.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 15% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of usable results/total reported results) x100

  = *(5,314 compliant / 5,314 total results)* = 100%

  All samples results are considered usable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = (5,224 compliant / 5,314 total results) = 98%

  Some data were qualified as non-detect and flagged 'U' and some were qualified as estimated and flagged 'J' or 'UJ.' Data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (contract compliant results/total reported results) x100

  = *(111 compliant / 111 total results)* = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(samples collected/planned samples) x100

  = *(110 compliant / 111 total results)* = 99%

All planned samples were collected with the exception of one soil gas sample due to shallow groundwater at the time of sampling (this is discussed in detail in the sampling report [URS 2009]).

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Plumb 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, R.H. Plumb, prepared by USEPA and USACE, May 1981.

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2008. Quality Assurance Project Plan, *Upland Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. October 2008.

URS 2009. Technical Memorandum, *Upland Operable Unit Data Gap Sampling – January/March 2009*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. March 2009.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 2008. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. June 2008.

Table 1
Sampling ID and Analysis Summary
Quality Control Summary Report for Analytical Chemistry
Upland Operable Unit Sampling Event - January/March 2009

						Analytes												
Location	**Matrix**	**URS ID**	**Laboratory ID**	**QA/QC Samples**	**Date Collected**	**VOCs**	**SVOCs**	**PCBs (Aroclors)**	**Pesticides**	**Total Metals**	**Dissolved Metals**	**Total Lead (only)**	**TPH-Gx**	**TPH-Dx**	**Butyltins**	**TOC**	**Grain Size**	**TSS/TDS**
Reference Area	Surface Soil (Grab)	090128-R-R1-0-0.5So	K0900782-001	-	1/28/09		X			X						X	X	
		090128-R-R2-0-0.5So	K0900782-002	-	1/28/09		X			X						X	X	
		090128-R-R3-0-0.5So	K0900782-003	-	1/28/09		X			X						X	X	
		090128-R-R4-0-0.5So	K0900782-004	-	1/28/09		X			X						X	X	
		090128-R-R5-0-0.5So	K0900782-005	-	1/28/09		X			X						X	X	
		090128-R-R6-0-0.5So	K0900782-006	MS/MSD	1/28/09		X			X						X	X	
		090128-R-R7-0-0.5So	K0900782-007	Primary	1/28/09		X			X						X	X	
		090128-R-R15-0-0.5So	*K0900782-008*	*Duplicate*	1/28/09		X			X						X	X	
		090128-R-R8-0-0.5So	K0900782-009	-	1/28/09		X			X						X	X	
		090128-R-R9-0-0.5So	K0900782-010	-	1/28/09		X			X						X	X	
		090128-R-R10-0-0.5So	K0900782-011	-	1/28/09		X			X						X	X	
		090128-R-R11-0-0.5So	K0900782-012	-	1/28/09		X			X						X	X	
		090128-R-R12-0-0.5So	K0900782-013	-	1/28/09		X			X						X	X	
		090128-R-R13-0-0.5So	K0900782-014	-	1/28/09		X			X						X	X	
		090128-R-R14-0-0.5So	K0900782-015	-	1/28/09		X			X						X	X	
	Water	090128-R-Rinsate	K0900782-016	Rinsate	1/28/09		X			X						X		
Landfill AOPC	Soil (Grab)	090129-L-L1-0-1So	K0900814-001	-	1/29/09	X	X											
		090129-L-L1-1-3So	K0900814-002	-	1/29/09	X	X											
		090129-L-L2-0-1So	K0900814-003	-	1/29/09	X	X											
		090129-L-L2-1-3So	K0900814-004	-	1/29/09	X	X											
		090129-L-L3-0-1So	K0900814-005	-	1/29/09	X	X											
		090129-L-L3-1-3So	K0900814-006	MS/MSD	1/29/09	X	X											
		090129-L-L4-0-1So	K0900814-007	Primary	1/29/09	X	X											
		090129-L-L4-1-3So	K0900814-008	-	1/29/09	X	X											
		090129-L-L5-0-1So	*K0900814-009*	*Duplicate*	1/29/09	X	X											
	Water	Trip Blank	K0900814-010	Trip Blank	1/29/09	X												
Sandblast Area AOPC	Soil (Grab)	090127-SB-SB1-0-1So	K0900738-001	-	1/27/09							X						
		090127-SB-SB1-0-1So (<2mm)	K0900738-002	-	1/27/09							X						
		090127-SB-SB1-0-1So (<250um)	K0900738-003	-	1/27/09							X						
		090127-SB-SB1-1-3So	K0900738-004	-	1/27/09							X						
		090127-SB-SB1-1-3So (<2mm)	K0900738-005	-	1/27/09							X						
		090127-SB-SB1-1-3So (<250um)	K0900738-006	-	1/27/09							X						
		090127-SB-SB2-0-1So	K0900738-007	-	1/27/09							X						
		090127-SB-SB2-0-1So (<2mm)	K0900738-008	-	1/27/09							X						
		090127-SB-SB2-0-1So (<250um)	K0900738-009	-	1/27/09							X						
		090127-SB-SB2-1-3So	K0900738-010	-	1/27/09							X						
		090127-SB-SB2-1-3So (<2mm)	K0900738-011	-	1/27/09							X						
		090127-SB-SB2-1-3So (<250um)	K0900738-012	-	1/27/09							X						
		090127-SB-SB3-0-1So	K0900738-013	-	1/27/09							X						
		090127-SB-SB3-0-1So (<2mm)	K0900738-014	-	1/27/09							X						
		090127-SB-SB3-0-1So (<250um)	K0900738-015	-	1/27/09							X						
		090127-SB-SB3-1-3So	K0900738-016	-	1/27/09							X						
		090127-SB-SB3-1-3So (<2mm)	K0900738-017	-	1/27/09							X						
		090127-SB-SB3-1-3So (<250um)	K0900738-018	-	1/27/09							X						
		090127-SB-SB4-0-1So	K0900738-019	-	1/27/09							X						
		090127-SB-SB4-0-1So (<2mm)	K0900738-020	-	1/27/09							X						
		090127-SB-SB4-0-1So (<250um)	K0900738-021	-	1/27/09							X						
		090127-SB-SB4-1-3So	K0900738-022	-	1/27/09							X						
		090127-SB-SB4-1-3So (<2mm)	K0900738-023	-	1/27/09							X						
		090127-SB-SB4-1-3So (<250um)	K0900738-024	-	1/27/09							X						
		090127-SB-SB5-0-1So	K0900738-025	-	1/27/09							X						
		090127-SB-SB5-0-1So (<2mm)	K0900738-026	-	1/27/09							X						
		090127-SB-SB5-0-1So (<250um)	K0900738-027	-	1/27/09							X						
		090127-SB-SB5-1-3So	K0900738-028	MS/MSD	1/27/09							X						
		090127-SB-SB5-1-3So (<2mm)	K0900738-029		1/27/09							X						
		090127-SB-SB5-1-3So (<250um)	K0900738-030		1/27/09							X						
		090127-SB-SB6-0-1So	K0900738-031	Primary	1/27/09							X						
		090127-SB-SB6-0-1So (<2mm)	K0900738-032	Primary	1/27/09							X						
		090127-SB-SB6-0-1So (<250um)	K0900738-033	Primary	1/27/09							X						
		090127-SB-SB6-1-3So	K0900738-034	-	1/27/09							X						
		090127-SB-SB6-1-3So (<2mm)	K0900738-035	-	1/27/09							X						
		090127-SB-SB6-1-3So (<250um)	K0900738-036	-	1/27/09							X						
		090127-SB-SB15-0-1So	*K0900738-049*	*Duplicate*	1/27/09							X						
		090127-SB-SB15-0-1So (<2mm)	*K0900738-050*	*Duplicate*	1/27/09							X						
		090127-SB-SB15-0-1So (<250um)	*K0900738-051*	*Duplicate*	1/27/09							X						
		090127-SB-SB7-0-1So	K0900738-037	-	1/27/09							X						
		090127-SB-SB7-0-1So (<2mm)	K0900738-038	-	1/27/09							X						
		090127-SB-SB7-0-1So (<250um)	K0900738-039	-	1/27/09							X						
		090127-SB-SB7-1-3So	K0900738-040	-	1/27/09							X						
		090127-SB-SB7-1-3So (<2mm)	K0900738-041	-	1/27/09							X						
		090127-SB-SB7-1-3So (<250um)	K0900738-042	-	1/27/09							X						

Table 1
Sampling ID and Analysis Summary
Quality Control Summary Report for Analytical Chemistry
Upland Operable Unit Sampling Event - January/March 2009

Location	Matrix	URS ID	Laboratory ID	QA/QC Samples	Date Collected	Analytes												
						VOCs	SVOCs	PCBs (Aroclors)	Pesticides	Total Metals	Dissolved Metals	Total Lead (only)	TPH-Gx	TPH-Dx	Butyltins	TOC	Grain Size	TSS/TDS
Sandblast Area AOPC *(continued)*	Soil (Grab)	090127-SB-SB8-0-1So	K0900738-043	-	1/27/09							X						
		090127-SB-SB8-0-1So (<2mm)	K0900738-044	-	1/27/09							X						
		090127-SB-SB8-0-1So (<250um)	K0900738-045	-	1/27/09							X						
		090127-SB-SB8-1-3So	K0900738-046	-	1/27/09							X						
		090127-SB-SB8-1-3So (<2mm)	K0900738-047	-	1/27/09							X						
		090127-SB-SB8-1-3So (<250um)	K0900738-048	-	1/27/09							X						
	Water	090127-SB-Rinsate	K0900738-052	Rinsate	1/27/09							X						
	Soil Gas	090126-SB-SB10-3.5-4SG	0901593R1-01A	-	1/26/09	X												
		090126-SB-SB11-3.5-4SG	0901593R1-02A	-	1/26/09	X												
		090126-SB-SB12-3.5-4SG	0901593R1-03A	Primary	1/26/09	X												
		090126-SB-SB13-3.5-4SG	0901593R1-04A	-	1/26/09	X												
		090126-SB-SB14-3.5-4SG	0901593R1-05A	-	1/26/09	X												
		090126-SB-SB16-3.5-4SG	*0901593R1-06A*	*Duplicate*	1/26/09	X												
		090126-SB-SB17-3.5-4SG	0901593R1-07A	Field Blank	1/26/09	X												
	Laydown Area Test Pits Soil (Grab)	090320-LD-4So-0-1	K0902475-001	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-4So-1-3	K0902475-002	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-1So-0-1	K0902475-003	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-1So-1-3	K0902475-004	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-2So-0-1	K0902475-005	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-2So-1-3	K0902475-006	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-3So-0-1	K0902475-007	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-3So-1-3	K0902475-008	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-5So-0-1	K0902475-009	-	3/20/09	X	X	X	X	X			X	X	X	X		
		090320-LD-5So-1-3	K0902475-010	-	3/20/09	X	X	X	X	X			X	X	X	X		
	Water	090320-Rinsate	K0902472-001	-	3/20/09		X	X	X	X				X		X		
	Laydown Area Surface Soil Soil (Grab)	090319-LD-6-So	K0902453-001	-	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-7-So	K0902453-002	-	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-8-So	K0902453-003	-	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-9-So	K0902453-004	-	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-10-So	K0902453-005	-	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-11-So	K0902453-006	Primary	3/19/09	X	X	X	X	X			X	X	X	X		
		090319-LD-21-So	*K0902453-007*	*Duplicate*	3/19/09	X	X	X	X	X			X	X	X	X		
Pistol Range AOPC	Groundwater (Grab)	090202-PR-PR1-16-20GW	K0900927-001	-	2/2/09					X	X							X
		090202-PR-PR2D-9-19GW	K0900927-002	Primary	2/2/09					X	X							X
		090202-PR-PR4-9-19GW	*K0900927-003*	*Duplicate*	2/2/09					X	X							X
	Water	090202-PR-Rinsate	K0900927-004	Rinsate	2/2/09					X	X							X
	Sediment (Grab)	090111-PR4-0-1SD	K0900272-001	-	1/11/09					X						X	X	
		090111-PR5-0-1SD	K0900272-002	-	1/11/09					X						X	X	
		090111-PR6-0-1SD	K0900272-003	Primary	1/11/09					X						X	X	
		090111-PR7-0-1SD	K0900272-004	-	1/11/09					X						X	X	
		090111-PR8-0-1SD	K0900272-005	-	1/11/09					X						X	X	
		090111-PR9-0-1SD	*K0900272-006*	*Duplicate*	1/11/09					X						X	X	
	Water	090111-PR-SD-Rinsate	K0900272-007	Rinsate	1/11/09					X						X		
Erodable Unit Analytical Data is included in Attachment E of Sampling Report																		
Erodable Unit	Soil (Grab)	090318-SB-EUA-So	K0902454-001	-	3/18/09		X	X	X	X				X	X		X	
		090318-SB-EUB-So	K0902454-002	-	3/18/09		X	X	X	X				X	X		X	
		090318-SB-EUC-So	K0902454-003	-	3/18/09		X	X	X	X				X	X		X	
		090318-SB-EUA-2So	K0902454-004	-	3/18/09	X							X					
		090318-SB-EUA-4So	K0902454-005	-	3/18/09	X							X					
		090318-SB-EUA-6So	K0902454-006	-	3/18/09	X							X					
		090318-SB-EUA-8So	K0902454-007	-	3/18/09	X							X					
		090318-SB-EUB-2So	K0902454-008	-	3/18/09	X							X					
		090318-SB-EUB-3So	K0902454-009	-	3/18/09	X							X					
		090318-SB-EUB-12So	K0902454-010	-	3/18/09	X							X					
		090318-SB-EUB-15So	K0902454-011	-	3/18/09	X							X					
		090319-LF-EUA-So	K0902454-012	-	3/18/09												X	
		090319-PR-EUA-So	K0902454-013	-	3/19/09												X	
		090319-PR-EUB-So	K0902454-014	-	3/19/09												X	

Notes:
AOPC = area of potential concern
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
TOC = total organic carbon
TSS/TDS = total suspended solids / total dissolved solids
🟨 = primary and *field duplicate* samples
- = not applicable
X = Analyzed

Table 2
Qualifier Summary
Quality Control Summary Report for Analytical Chemistry
Upland Operable Unit Sampling Event - January/March 2009

URS ID	CAS ID	Analyte	Qualifiers	Rationale
Reference Area				
090128-R-R3-0-0.5So	K0900782-003	thallium	0.100U	continuing calibration blank detection
090128-R-R5-0-0.5So	K0900782-005		0.103U	
090128-R-R10-0-0.5So	K0900782-011		0.098U	
090128-R-R12-0-0.5So	K0900782-013		0.042U	
090128-R-R13-0-0.5So	K0900782-014		0.093U	
090128-R-R14-0-0.5So	K0900782-015		0.081U	
090128-R-R1-0-0.5So	K0900782-001	antimony	J/UJ	bias low MS/MSD recoveries
090128-R-R2-0-0.5So	K0900782-002			
090128-R-R3-0-0.5So	K0900782-003			
090128-R-R4-0-0.5So	K0900782-004			
090128-R-R5-0-0.5So	K0900782-005			
090128-R-R6-0-0.5So	K0900782-006			
090128-R-R7-0-0.5So	K0900782-007 (primary)			
090128-R-R15-0-0.5So	K0900782-008 (duplicate)			
090128-R-R8-0-0.5So	K0900782-009			
090128-R-R9-0-0.5So	K0900782-010			
090128-R-R10-0-0.5So	K0900782-011			
090128-R-R11-0-0.5So	K0900782-012			
090128-R-R12-0-0.5So	K0900782-013			
090128-R-R13-0-0.5So	K0900782-014			
090128-R-R14-0-0.5So	K0900782-015			
Landfill AOPC				
090129-L-L2-0-1So	K0900814-003	SVOCs	J	bias low surrogate recoveries
090129-L-L4-0-1So	K0900814-007 (primary)	SVOCs	J	field duplicate precision
090129-L-L5-0-1So	K0900814-009 (duplicate)			
090129-L-L1-0-1So	K0900814-001	VOCs	J	bias low surroage recovery
090129-L-L1-1-3So	K0900814-002			
090129-L-L2-0-1So	K0900814-003			
090129-L-L2-1-3So	K0900814-004			
090129-L-L3-0-1So	K0900814-005			
090129-L-L3-1-3So	K0900814-006			
090129-L-L4-0-1So	K0900814-007			
090129-L-L4-1-3So	K0900814-008			
090129-L-L5-0-1So	K0900814-009			
Trip Blank	K0900814-010			
Sandblast Area AOPC				
090127-SB-Rinsate	K0900927-004	copper	0.11U	method blank detection(s)
090126-SB-SB10-3.5-4G	0901593R1-01A	carbon disulfide	4.7U	
090126-SB-SB11-3.5-4SG	0901593R1-02A	acetone	21U	
090319-LD-6So	K0902453-001	antimony	0.36U	
090319-LD-8So	K0902453-003		0.16U	
090319-LD-9So	K0902453-004		0.17U	
090126-SB-SB11-3.5-4SG	0901593R1-02A	heptane	9.0U	field blank detection(s)
Pistol Range AOPC				
090202-PR-PR1-16-20GW	K0900927-001 Diss	lead	0.020U	continuing calibration blank detection(s)
090202-PR-PR2D-9-19GW	K0900927-002 Diss		0.020U	
090202-PR-PR4-9-19GW	K0900927-003 Diss		0.020U	
090202-PR-Rinsate	K0900927-004		0.020U	
090111-PR6-0-1SD	K0900272-003 (primary)	TOC	J	field duplicate precision
090111-PR9-0-1SD	K0900272-006 (duplicate)			
090202-PR-PR2D-9-19-GW	K0900927-002	total lead, total nickel, total zinc	J	
		TSS	UJ	
090202-PR-PR4-9-19-GW	K0900927-003	total lead, total nickel, total zinc, TSS	J	
090111-PR4-0-1SD	K0900272-001	zinc	J	bias high MS/MSD recoveries
090111-PR5-0-1SD	K0900272-002			
090111-PR6-0-1SD	K0900272-003			
090111-PR7-0-1SD	K0900272-004			
090111-PR8-0-1SD	K0900272-005			
090111-PR9-0-1SD	K0900272-006			
Erodable Unit (Analytical Data is included in Attachment E of Sampling Report)				
090318-SB-EUB-So	K0902454-002	antimony	J	MS/MSD recoveries
		nickel		
		zinc		
	K0902454-002	nickel	J	laboratory duplicate precision
		chromium		

Notes:
Diss = field filtered dissolved phase
MS/MSD = Matrix Spike/Matrix Spike Duplicate
soil gas concentrations are in units of micrograms per cubic meter (ug/m3).
TSS = total suspended solids

URS retrieved twenty-two fish from the USACE storage facility near Bonneville Dam on September 20, 2007. The samples included nineteen smallmouth bass and three large-scale sucker. The three large-scale sucker were composited into one sample. Fish were captured from the Bonneville Dam forebay and vicinity under the supervision of the USACE in 2006 and 2007 and archived frozen by USACE until they were provided to URS for laboratory analysis. Table 1 summarizes the sample IDs, capture date and requested analyses. Whole-body fish samples were homogenized using an industrial blender by Columbia Analytical Services (CAS), located in Kelso Washington. An aliquot of the homogenized tissue was sent to Axys Analytical Services Ltd located in Sidney, British Columbia (Axys) to perform the PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*. The Axys analytical data reports include a listing of Axys Method 1668A modifications.

The following table lists the parameters analyzed on one or more of the samples. Table 1 summarizes the samples by URS and laboratory IDs.

Method	Analytical Parameter
EPA 1668A	Polychlorinated Biphenyls (PCBs) - Congeners
EPA 8082M	Polychlorinated Biphenyls (PCBs) - Aroclors
EPA 8270C SIM	Semi-Volatile Organic Compounds (SVOCs)
6000/7000 Series	Metals
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry	Percent Solids

Analyses were performed in general accordance with the referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 10% of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data review process for this investigation followed the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP) (USACE 2007). Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (NFGs) for Organic Data Review (USEPA 1999),* and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB data (USEPA 1995)* as appropriate for the methods performed. The non-congener data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD QSM, 2006) and the above listed methods and the following EPA guidance documents in that order; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review (USEPA, October 1999)*, EPA's *NFGs for Inorganic Data Review (USEPA, October 2004)* and *EPA Region 10 SOP for the Validation of Method 1668 Toxic, Dioxin-like, PCB data (USEPA 1995)*. Project-specific QC criteria are listed in the above mentioned QAPP. A summary of qualifiers assigned to results in this investigation as part of this review is included in Table 2. Samples are referenced by both by their URS sample identification assigned in the field as well as the laboratory identification. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the **E**stimated **M**aximum **P**otential **C**oncentration of the analyte in the sample used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

Multiple dilutions were required by Axys for most tissue samples and various extraction sample sizes were necessary for some tissue samples in order to reach appropriate concentration levels for analysis by Method 1668A. Axys indicated which congeners exceeded instrument calibration range in undiluted or less diluted samples in the analytical report. Only congeners exceeding instrument calibration range were reported from the more diluted analyses.

Additionally, as part of the electronic data deliverable, Axys only reported one result per congener per sample, selecting results from more diluted analyses to replace results exceeding calibration range in the less diluted analyses.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms from URS to CAS indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended range of 4°C± 2°C. Data were not qualified based on cooler temperatures. USACE provided temperature logger data showing samples were maintained frozen between sample collection and URS receipt. USACE was made aware of the hold time exceedances detailed below and advised URS to proceed with the sample analysis despite these issues.

The chain-of-custody (COC) forms from CAS to Axys indicate that samples were maintained under COC and forms were signed upon release and receipt. The condition of samples upon receipt by Axys was appropriate and all samples listed on COC were present and analyzed with one exception. For samples reported in data package DPWG24485, two sample jars were labeled with the same client ID of 060815402SB and a jar listed as 0608403SB on the COC was missing. Axys contacted URS, and URS was able to identify which jar was sample ID 060815403SB using other identification labels on the jars. Jar number K0708602-016 was sample ID 060815402SB and logged in as Axys ID L10448-16, and jar number K0708602-017 was sample ID 060815403SB and logged in as Axys ID L10448-17. Because all samples listed on the COC were present and analyzed, data qualification based on sample custody was not considered necessary.

All coolers were received by the Axys laboratory at temperatures within the EPA-recommended range of less than 6 degrees Celsius (°C). Samples were kept frozen at -20°C prior to extraction and analysis.

Samples were analyzed outside of the technical hold time as detailed below:

- PCB (as congeners or Aroclors) hold times are one year from sampling date for fish tissue if frozen. All samples were analyzed outside this hold time with the exception of sample 070505LS. PCB Aroclors were only analyzed for 070505LS, therefore no qualification is necessary. All PCB congener sample results with the exception of 070505LS were qualified as estimated and flagged 'J' due to hold time.
- SVOC hold time is one year from sampling data for tissue if frozen. The hold time was exceeded for all samples except 070505LS by a maximum of five months. All SVOC sample results with the exception of 070505LS were qualified as estimated and flagged 'J/UJ' due to hold time.

- The hold time for inorganic mercury is 28 days for frozen solid matrixes. All samples were analyzed from six months to 17 months. The mercury data was not rejected based on hold time due to the fact that it is believed that a large percentage of the mercury in these samples is in the form of methyl mercury due to the higher tropic level of the sample. The short hold time for inorganic mercury is due to the loss of analyte from evaporation; however, methyl mercury is more resistant to loss via evaporation. Methyl mercury was not specifically analyzed in these samples nor are there specific hold times for methyl mercury listed in QSM DoD. All mercury results are qualified as estimated and flagged ‘J’. The end user should be aware of the potential low bias of the mercury results due to hold time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each batch, per QAPP requirements. Qualification of samples due to method or field blank contamination followed guidelines set forth in the EPA NFGs.

Non-congener Results

For non-congener organic analyses, sample results less than five times (5x) the associated method blank or field blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were flagged as non-detect ‘U’ at the MRL. When sample results were less than 5x the blank concentration but above the MRL, the reported result was qualified as non-detect ‘U’ (10x for common laboratory contaminants). Target compounds detected in the method or field blanks but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Field blanks were not collected during this sampling event.

All analytical tests indicate non-detects for method blanks with the following exceptions:

- Di-n-butyl phthalate was detected in the two method blanks associated will all samples. For those samples with results less than 10x the associated method blank detection, the reported di-n-butyl phthalate concentration was qualified non-detect and flagged ‘U’. Results for the following four samples were estimated and flagged: 060605101SB (K0708602-002), 060605202SB (K0708602-005), 060605208SB (K0708602-010) and 060606103SB (K0708602-013). Those samples that were reported as non-detect for di-n-butyl phthalate were not qualified.

Congener Results

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated method blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified.

Method 1668A stipulates using a method blank as similar to the matrix as possible. Method blanks were prepared using corn oil to approximate the lipid content of the tissue matrices. Method blank analytical results were non-detects with the exception of some PCB congeners in the method blanks associated with the tissue samples. Table 2 indicates the results that were qualified non-detect based on method blank concentrations.

ACCURACY

Instrument Calibration

Non-congener Results

Initial calibrations (ICALs) and continuing calibrations (CCALs) were reviewed for all analyses. The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. ICALs and CCALs were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Instrument calibrations were acceptable for all analyses performed with the following exceptions:

- The ICAL performed on the SVOCs had %RSD recoveries slightly higher than the laboratory set limit of 15%: benzyl butyl phthalate (15.5%), bis(2-ethylhexyl) phthalate (16.3%) and di-n-octyl phthalate (18.3%). However, these analytes were within the 20% mean RSD limit set by the EPA method and the 20% limit set by DoD QSM (Box 52). Therefore, no further action was deemed necessary for these analytes.

Congener Results

Initial calibrations (ICALs) and continuing calibration verifications (CCVs) were reviewed for PCB congener analyses. The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at the appropriate concentrations required by EPA Method 1668A. All calibration compounds analyzed associated with the tissue samples meet the acceptance criteria as listed in the method.

Labeled Internal Standard Recovery Review (congener analysis only)

PCB congener samples were spiked with labeled internal standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against recovery standards added after extraction to evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards is compared with the limits set forth in EPA Method 1668A.

PCB congener samples reported in data package DPWG24485 (Table 1) were spiked with labeled quantification standards prior to extraction. PCB congener samples reported in data package DPWG24050 (Table 1) were spiked with labeled quantification standards into the raw sample extracts after splitting rather than to the tissue subsamples prior to extraction. The data for these samples (samples reported in data package DPWG24050) are therefore recovery-corrected for possible losses during cleanup, but not for any possible losses sustained during extraction. Efficient extraction was however demonstrated by monitoring the recoveries of the labeled extraction standards. Internal standard recoveries were acceptable for the tissue sample analyses performed.

Cleanup standards are added prior to cleanup and quantitated using injection standards added just prior to analysis. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

Surrogate Recovery Review (non-congener analysis only)

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample.

Surrogate recoveries were acceptable for all analytes with the following exceptions:

- The surrogate percent recoveries in sample 060605101SB (K0708602-002) for fluorene-d10 and fluoranthene-d10 were slightly below the lower control limit of 60% at 59% and 58%, respectively. Recoveries within the LCS/LCSD for these analytes were in control, indicating the QC batch was in control. Sample results for all SVOCs in this sample were previously qualified ‘J/UJ’ due to hold time, further qualifications are deemed unnecessary.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCSs) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD were analyzed for each batch per method requirements. MS/MSD samples are not required for PCB congener analysis, also ongoing precision and recovery (OPR) samples are used in place of LCS to monitor laboratory performance.

LCS, OPR and MS/MSD recoveries were acceptable for all analytical tests with the following exceptions:

- The typical LCS for metals was replaced by using two tissue standard reference materials (SRM) containing metals. The recovery of nickel in SRM Dolt-3 was slightly above the upper SRM limit. All other QC criteria were in control for nickel, including nickel recovery in the second SRM; therefore, data were not flagged based on the one SRM result.
- The MS for metals was performed on project sample 060605203SB (K0708602-006). Recovery of aluminum, lead and nickel were below the lower control limit. The post-spike, SRMs and a second MS performed on 070505LS (K0708602-020) were all within control limits, indicating the laboratory analysis was in control and that matrix inference with these analytes may account for the lower recovery in sample 060605203SB.

Aluminum, lead and nickel results were estimated and flagged 'J' in sample 060605203SB.

- PCB-Aroclor MS/MSD recoveries for Aroclor 1016 and 1260 were outside control limits due to elevated concentrations of Aroclor 1254 in the MS sample. The MS/MSD was performed on a project sample, however on a clam tissue matrix. Data was not qualified based on MS/MSD recoveries due to differences in sample matrix. This problem will be remedied in the future all MS/MSD samples will be performed on not only project-specific samples but samples of similar tissue matrices (i.e fish vs. clam tissue). The LCS and other QC samples within the analytical batch were in control, indicating the batch was in control.
- MS/MSD recoveries for 4-methylphenol, di-n-butyl phthalate and di-n-octyl phthalate in QC batch KWG0711371 were above the upper control limits. Sample results for all SVOCs associated with this analytical batch were previously qualified 'J/UJ' due to hold time, further qualifications are deemed unnecessary.
- LCS/LCSD recoveries in analytical batch KWG0711371 were slightly above the upper control limit of 115% for carbazole with 119% and 117%, respectively and above the control limit of 110% for di-n-butyl phthalate with 114% and 120%, respectively. All other laboratory-specific QC parameters were within control for these analytes. Again, sample results for all SVOCs associated with this analytical batch were previously qualified 'J/UJ' due to hold time, further qualifications are deemed unnecessary.
- LCS/LCSD recoveries in analytical batch KWG0711938, associated with sample 060605208SB (K0708602-010), were below the lower control limit of 40% for 4-methylphenol with 11% and 13%, respectively. The sample result was non-detect for this analyte in this sample. This does indicate a low bias in this analytical sample for this analyte, the end user should consider this in the data evaluation. Again, sample results for all SVOCs associated with this analytical batch were previously qualified 'J/UJ' due to hold time, further qualifications are deemed unnecessary.

PRECISION

Duplicate Review

Field duplicates were not collected for this sampling event due to the nature of sample matrix. Laboratory precision on the site matrix was evaluated based on the laboratory duplicate analyses and RPD results for MSD and LCSD analyses.

Laboratory duplicate precision was acceptable with the following exceptions:

- The RPD for aluminum exceeded the limit of 25% in the laboratory duplicate performed on sample 070505LS (K078602-020) with 26%. Results for aluminum in sample 070505LS were estimated and qualified 'J' due to hold RPD precision.

COMPARABILITY

Comparability is the qualitative parameter expressing confidence with which one data set can be compared with another. Comparability of data is attained by following established sampling protocol and method procedures for sample collection and analysis, respectively. The sample results from this sampling event are comparable to other sampling events because of the use of standard techniques to collect representative samples, consistent application of analytical method protocols, and reporting analytical results with appropriate units and reporting limits.

Compound Quantification

Congener results were reported on a wet weight basis without accounting for percent moisture or percent lipids. Homologue totals were obtained by summing the concentration of all detected congeners at each level of chlorination. Toxic Equivalents (TEQs) were calculated using World Health Organization 2005 Toxicity Equivalence Factors. Chromatographic peaks that did not meet the method ion abundance ratio criteria were not included in the homologue totals or TEQ calculations.

The area response of PCB 118 in samples 060605200SB and 060605205SB (Axys ID L10448-3 and L10448-8 from data package DPWG24050) was slightly above the calibrated linear range of the instrument after the extract dilution. As other congeners have a response in this range, the quantification of the data is not considered affected and further dilutions were not taken.

Due to the levels found for PCB 52, 101, and 138 in sample 060605209SB (Axys ID L10448-11 from data package DPWG24050), the standards used to quantify the surrogates (labeled PCB 52, 101, and 138) are elevated. This results in an apparent low recovery of the labeled compounds used for quantification. However, the target (native) congener quantification is not affected.

Sample 060605209SB (Axys ID L10448-11 from data package DPWG24050) required a higher-level dilution for congeners exceeding instrument calibration range such that the sample was refortified with labeled quantification standards (indicated by the “NK” suffix added to the Axys ID. Consequently, affected congener results (reported from Axys ID L10448-11NK) are not recovery corrected for losses during extraction and chromatographic cleanup.

Samples 060815403SB and 060815405SB (Axys IDs L10448-17 and L10448-18 from data package DPWG24485) required a higher-level dilution for congeners exceeding instrument calibration range such that the sample was refortified with labeled quantification standards (indicated by the “NK” suffix added to the Axys ID. Consequently, affected congener results (reported from Axys ID L10448-11NK) are not recovery corrected for losses during extraction and chromatographic cleanup.

Results for sample 060815403SB (Axys ID L10448-17 from data package DPWG24485) still exceeded calibration after several dilutions and the sample was re-extracted using a smaller sample size (2 grams) to account for the high level PCB congeners. The re-extraction was analyzed on February 2, 2008 for all PCB congeners exceeding the instrument calibration range for analysis of the initial sample extract. Results for this analysis were reported in data package DPWG24605 on February 21, 2008. Axys analytical reports indicated which PCB congeners were to be reported from the various dilutions and analyses performed on sample 060815403SB (Axys ID L10448-17) to yield acceptable results within the instrument calibration range.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If detector response varies concentrations can be biased high or low based on the variations in detector sensitivity.

During congener analysis, PFK (perfluororkerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of co-eluting interferences or decreased sensitivity. No PCB congener results were qualified due to lock mass variations.

As detailed in Table 2, some congener and homologue total results were qualified as non-detect due to method blank contamination. Results were qualified as non-detect at the reported concentrations; therefore, these non-detect results have elevated detection limits which should be considered by the data user as part of evaluating the data for end-use objectives.

Compound Identification

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but were more than 15% different from the theoretical ion abundance criterion set by EPA Method 1668A are flagged in the laboratory report with a ‘K’ flag. Those results flagged ‘K’ with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged ‘J-EMPC’ during this review. If the analyte result was previously qualified ‘U’ by method blank detection, the result retained the ‘U’ qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). Due to the volume of the J-EMPC qualifiers, they are not tabulated in this report; however, the database has been updated and the flags will appear in any future data tables that are created from the project database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. A summary of qualifiers can be found in Tables 2 and 3. Completeness for the site investigation was 100%.

REFERENCES

DOD QSM 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation, Bradford Island*, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

USEPA 1995. U.S. Environmental Protection Agency (USEPA) Region 10 SOP for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

Table 1
Sample Location and Analyses Summary

URS Sample ID	Sample Collection Date	CAS ID	Method Analyses
060605100SB	June 5, 2006	K0708602-001	SVOCs and Metals
060605101SB		K0708602-002	
060605200SB		K0708602-003	
060605201SB		K0708602-004	
060605202SB		K0708602-005	
060605203SB		K0708602-006	
060605204SB		K0708602-007	
060605205SB		K0708602-008	
060605207SB		K0708602-009	
060605208SB		K0708602-010	
060605209SB		K0708602-011	
060606102SB		K0708602-012	
060606103SB		K0708602-013	
060606104SB		K0708602-014	
060606210SB		K0708602-015	
060815402SB	August 15, 2006	K0708602-016	
060815403SB		K0708602-017	
060815405SB		K0708602-018	
060816406SB		K0708602-019	
070505LS	May 5, 2007	K0708602-020	SVOCs, Metals and PCB (as Aroclors and congeners)

URS ID	Sample Collection Date	Axys ID	Axys Data Package
060605100SB	June 5, 2006	L10448-1	DPWG24050 (PCB Congeners by Method 1668A)
060605101SB		L10448-2	
060605200SB		L10448-3	
060605201SB		L10448-4	
060605202SB		L10448-5	
060605203SB		L10448-6	
060605204SB		L10448-7	
060605205SB		L10448-8	
060605207SB		L10448-9	
060605208SB		L10448-10	
060605209SB		L10448-11	
060605102SB		L10448-12	
060605103SB		L10448-13	
060605104SB		L10448-14	DPWG24485 (PCB Congeners by Method 1668A)
060605210SB		L10448-15	
060815402SB	August 15, 2006	L10448-16	
060815403SB		L10448-17	
060815405SB		L10448-18	
060815406SB		L10448-19	
070505LS	May 5, 2007	L10448-20	

Table 2
Summary of Qualifiers (non-congener data only)

LAB ID	URS ID	ANALYTE	QUALIFIER	RATIONAL
060605100SB	K0708602-001	SVOCs PCB congeners	J/UJ	Hold Time
060605101SB	K0708602-002			
060605200SB	K0708602-003			
060605201SB	K0708602-004			
060605202SB	K0708602-005			
060605203SB	K0708602-006			
060605204SB	K0708602-007			
060605205SB	K0708602-008			
060605207SB	K0708602-009			
060605208SB	K0708602-010			
060605209SB	K0708602-011			
060606102SB	K0708602-012			
060606103SB	K0708602-013			
060606104SB	K0708602-014			
060606210SB	K0708602-015			
060815402SB	K0708602-016			
060815403SB	K0708602-017			
060815405SB	K0708602-018			
060816406SB	K0708602-019			
060605100SB	K0708602-001	Mercury	J/UJ	Hold Time
060605101SB	K0708602-002			
060605200SB	K0708602-003			
060605201SB	K0708602-004			
060605202SB	K0708602-005			
060605203SB	K0708602-006			
060605204SB	K0708602-007			
060605205SB	K0708602-008			
060605207SB	K0708602-009			
060605208SB	K0708602-010			
060605209SB	K0708602-011			
060606102SB	K0708602-012			
060606103SB	K0708602-013			
060606104SB	K0708602-014			
060606210SB	K0708602-015			
060815402SB	K0708602-016			
060815403SB	K0708602-017			
060815405SB	K0708602-018			
060816406SB	K0708602-019			
070505LS	K0708602-020			
060605203SB	K0708602-006	aluminum lead nickel	J	MS recoveries
060605101SB	K0708602-002	di-n-butyl phthalate	U	Method Blank Detection
060605202SB	K0708602-005			
060605208SB	K0708602-010			
060606103SB	K0708602-013			
070505LS	K0708602-020	aluminum	J	RPD

Table 3

Method Blank Qualifiers Assigned During Data Review (PCB Congeners)

Congener IUPAC #	Co-elutors	060605100SB[1]	060605101SB[1]	060605200SB[1]	060605201SB[1]	060605202SB[1]	060605203SB[1]	060605204SB[1]	060605205SB[1]	060605207SB[1]	060605208SB[1]
PCB001		0.186U			0.234U	0.189U		0.309U		0.243U	0.293U
PCB003		0.144U	0.437U	0.438U	0.125U	0.154U	0.378U	0.271U	0.442U	0.241U	0.253U
Homologue Totals											
Mono-chlorinated		0.33U			0.363U						

Table 3 cont.

Congener IUPAC #	Co-elutors	060605209SB[1]	060605102SB[1]	060605103SB[1]	060605104SB[2]	060605210SB[2]	060815402SB[2]	060815403SB[2]	060815405SB[2]	060815406SB[2]	070505LS[2]
PCB001					0.235U	0.194U				0.226U	
PCB003				0.328U	0.237U	0.263U			0.535U	0.279U	0.482U

Notes:

[1] Based on method blank results reported in data package DPWG24050.

[2] Based on method blank results reported in data package DPWG24485.

Concentrations reported in units of pg/g wet weight

URS collected five clam (*corbicula fluminea*) samples and six sediment samples, including one field duplicate for each matrix from the Columbia River near Bradford Island on September 25 through 27, 2007. Samples were collected according to the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial* (URS, 2007). Table 1 summarizes the sample locations, media, and requested analyses. Clams were shucked by URS personnel prior to submittal to the analytical laboratory. Clam tissue and sediment were analyzed by Columbia Analytical Services (CAS), located in Kelso, Washington. Tissue samples were stored frozen upon receipt by CAS and homogenized using a mechanical mixer prior to testing. Sediment samples were stored at 4°C prior to homogenization and analysis. Aliquots of each sample are archived in freezer storage at the CAS Kelso facility for potential future analysis. Analyses were performed in general accordance with the methods listed below. The specific analyses for each media and sample are provided in Table 1.

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 6000/7000 series	Metals
EPA 1630 – Modified	Methyl Mercury (Tissue only)
EPA 8270C-SIM	Semi-Volatile Organic Compounds (SVOCs)
TPH-Dx (Ecology 1997)	Northwest Total Petroleum Hydrocarbons Diesel Fraction (NWTPH-Dx)
Plumb (Plumb 1981)	Total Organic Carbon
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry (Tissue) Gravimetric (Sediment)	Percent Solids
PSEP (PSEP 1996)	Grain Size

Analyses were performed in general accordance with the referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed in each laboratory report submitted: compliance with the QAPP, chain of custody (COC), case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 10% of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the criteria contained in the DoD QSM (DoD QSM, January 2006), the above listed methods and the following EPA guidance documents in that order; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review (USEPA, October 1999),* EPA's *NFGs for Inorganic Data Review (USEPA, October 2004).* A summary of qualifiers assigned to results in this investigation is included in Table 2. For ease of reference, the samples are represented in Table 2 by both the URS sample identification and the laboratory identification. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

REPRESENTATIVENESS

Chain-of-Custody and Holding Times

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended range of 4°C± 2°C, with the exception of two coolers, one containing the clam tissue samples recorded at -0.6°C and one containing two sediment samples recorded at -0.8°C. Data were not qualified based on cooler temperatures.

Sediment samples were stored at 4°C and tissue samples were stored frozen at -20°C prior to homogenization. An aliquot of each sample is archived in freezer storage for potential future analysis. Tissue samples were removed from the freezer, homogenized and returned to the freezer and kept frozen prior to anlayis. Hold times were calculated to account for the fact that the tissue was frozen prior to analysis with the exception that mercury and methyl mercury holding times were based on a 28 day hold time regardless of freezer storage. All samples were analyzed within the technical and contracted holding time with the following exceptions:

- The hold time was exceeded for the methyl mercury analysis in the tissue samples. Samples were analyzed up to 9 days past the recommended 28 day hold time from sampling to analysis. All methyl mercury results were estimated and flagged ‘J’ due to analysis outside of hold time.
- The frozen archived (-20°C) sediment samples were analyzed for TPH-Dx, TOC and grain size. Typically samples are not frozen prior to grain size analysis, however the freeze-thaw effects are considered to be minimal and the grain size results are used in a qualitative manor for this investigation. Additionally, the laboratory reextracted and reanalyzed sediment samples for 4-methylphenol, anthracene and benzo(a)pyrene using the frozen sediment previously archived. Sample results from the archived frozen sediment were not qualified based on hold time.

Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per DoD QSM requirements. Qualification of samples due to method or field blank contamination followed guidelines set forth in the EPA NFGs.

For organic and inorganic analyses, sample results less than five times (5x) the method blank or field blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were flagged as non-detect ‘U’ at the MRL. When sample results were less than 5x the blank concentration but above the MRL, the reported result was qualified as non-detect ‘U’. Target compounds detected in the method or field blanks but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified.

All analytical results were non-detect for method blank analyses or all target compounds reported had concentrations greater than 5x the reported blank concentration; therefore data were not qualified based on method blank results.

ACCURACY

Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the DoD QSM. Instrument calibrations were acceptable for all analyses performed.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCSs) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch was performed per DoD QSM requirements. LCS and MS/MSD recoveries were compared against project-specific control limits outlined in the QAPP and were acceptable for all analytical tests with the following exceptions:

Sediment Samples

- LCS/LCSD recoveries associated with sediment samples K0708772-001 through -006 were outside the project-specific control limits for 4-methylphenol, anthracene and benzo(a)pyrene. After consultation with CAS, it was discovered there was an a problem with an extraction solvent used during the GPC cleanup. A new solvent lot was purchased and additional QC checks were performed by CAS as described in the case narrative attached to data delieverable K0712241. CAS confirmed that no other samples were effected by the solvent. An aliquot of each of the frozen archived sediment samples was reextracted and reanalyzed for the above listed SVOCs under work order number (K0712241). The LCS results for the reanalyzed samples were within the control limits. The initial results were qualified and flagged 'DNR' and the results from the reanalysis were reported.

- MS/MSD recoveries in the QC batch associated with sediment samples K0708772-001 through -006 were outside the project-specific control limits for 4-methylphenol, anthracene and benzo(a)pyrene similar to the associated LCS/LCSD. As detailed above, the samples were reextracted and reanalyzed. The reanalysis results were within the control limits. The original data was flagged 'DNR' and the reanalysis results were reported.

- MS/MSD recoveries for the parent sediment sample (K0708772-001) were below the lower project-specific control limit of 45% for bis(2-ethylhexyl)phthalate with MS and MSD recoveries of 2% and 18%, respectively. The associated LCS/LCSD results were within control limits, indicating the analytical batch was in control. Normally, for low MS/MSD recoveries only the parent sample is qualified, however due to the nature of the recoveries all samples in the matrix were was qualified and flagged 'J/UJ' due to low matrix spike recoveries (shown in Table 2).

- MS/MSD recoveries were below the lower control limit of 80% for antimony in the parent sample K0708772-006 with recoveries of 37% and 33%, respectively. The LCS and post-spike recovery for antimony were in control indicating the analytical batch was in control, therefore a matrix interference may be the cause for low recoveries of antimony. Antimony results were estimated and flagged 'J' in the parent sample (K0708772-006). Zinc and vanadium had recoveries slightly below the lower control of 80% for either the MS or MSD in the MS/MSD pair; zinc (MS:78%, MSD:80%) and vanadium (MS:81% and MSD:79%). The LCS recoveries for both analytes were in control indicating the analytical batch was in control, neither zinc or vanadium results were estimated based on MS/MSD recoveries.

Tissue Samples

- MS/MSD recoveries were above the control limits for tissue in the parent sample (K0708865-003) for the following Aroclors:

	MS(%)	MSD(%)	Control Limits(%)
Aroclor 1016	171	148	40-140
Aroclor 1260	196	200	60-130

  Recoveries for Aroclors 1016 and 1260 in the sample are likely biased high due to the presence of an elevated concentration of Aroclor 1254. Aroclors 1016 and 1260 were not detected in the associated samples (K0708865-001 through -005), therefore data was not estimated based on MS/MSD recoveries.

- MS/MSD recoveries for anthracene in the parent sample (K0708865-003) were below the lower control limit of 55% for tissue with recoveries of 46% and 45%, respectively. The LCS recovery was in control indicating the analytical batch was in control. Anthracene was estimated and flagged 'UJ' in the parent sample.

- MS/MSD recoveries in the parent sample (K0708865-003) were above the upper control limits for bis(2-ethylhexyl)phthalate, di-n-octyl phthalate and di-n-butyl phthalate. The LCS recoveries were in control indicating the analytical batch was in control. All sample results were non-detect for these three analytes in the parent sample with the exception of di-n-butyl phthalate for samples K0708865-001, -002 and -004. Non-detect sample results were not estimated based on MS/MSD recoveries and samples results reported above the MRL (as listed above) were estimated and flagged 'J' for di-n-butyl phthalate.

- MS recoveries in the parent sample (K0708865-003) associated with samples K0708865-001 through -005 were below the lower control limit of 80% for antimony and mercury with recoveries of 73% and 76%, respectively. Antimony and mercury results were estimated and flagged 'J' in the parent sample.

Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample.

Surrogate recoveries were acceptable with the following exceptions:

- The SVOC surrogate phenol-d6 recovery in samples K0708772-001 and -005 was below the lower DoD QSM control limit of 45% with 31% and 35%, respectively. Phenol-d6 is a surrogate for the acid fraction. The only acid fraction target compound, 4-methylphenol, was reported from another analytical batch after reextraction and reanalysis due to a problem that occurred during sample cleanup with the original analytical batch. The surrogate recoveries were acceptable in the reanalysis therefore, further action was not necessary.

PRECISION

Duplicate Review

One field duplicate sample was collected for both sediment and clam matrices to verify acceptable field sampling techniques and the representativeness of the sample aliquots. In addition the laboratory tested precision by analyzing both MSD and LCSD samples. The RPD for field duplicate samples was calculated when both sample results were greater than 5x the reporting limit.

- Laboratory duplicate precision was acceptable for both sediment and clam tissue matrices.
- Field duplicate precision was within the control limits outlined within QAPP with the exception of the following metals within the sediment matrix. The RPD for these metals exceeded the 25% control limit:

	Primary (mg/kg)	Field Duplicate (mg/kg)	RPD
Aluminum	12,000	15,900	28.0
Cadmium	0.365	0.851	79.9
Copper	32.1	24.2	28.1
Lead	14.6	22.1	40.9
Mercury	0.118	0.065	57.9
Thallium	0.218	0.124	55.0

The primary sample (K0708772-003) and the field duplicate (K0708772-005) for sample results listed above were qualified as estimated and flagged 'J'.

COMPARABILITY

Reporting Limits

The laboratory reported sample results between the MRL and MDL. Results reported between the MDL and MRL are reported as estimated and are flagged 'J'.

COMPLETENESS

The laboratory reported all requested analyses and the deliverable data reports were complete. Completeness is defined as the percentage of usable data out of the total amount of data generated. The project completeness goal is 100 percent. Some data were qualified as estimated 'J' or 'UJ'. A summary of qualifiers can be found in Table 2. Completeness for the site investigation was 100%.

REFERENCES

Plumb 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, R.H.Plumb, prepared by USEPA and USACE, May, 1981.

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2007. Quality Assurance Project Plan, River Operable Unit Remedial Investigation, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

EPA 1998. Method 1630: Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry. August 1998.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

DOD QSM 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Table 1
Sample Location and Analyses Summary

Pre-Removal Area	URS ID	Lab ID	Collection Date	Method Analyses
Clam Tissue				
1	070926A1TC	K0708865-002	9/26/2007	PCBs (as Aroclors), Metals and SVOCs
1 (duplicate)	070926A7TC	K0708865-001	9/26/2007	
2	070926A2TC	K0708865-003	9/26/2007	
3	070927A3TC	K0708865-004	9/27/2007	
5	070925A5TC	K0708865-005	9/25/2007	PCBs (as Aroclors), Methyl Mercury, Metals and %lipids[1]
Sediment				
1	070926A1SD	K0708772-004 K0712241-004 K0800426-004	9/26/07	PCBs (as Aroclors), Metals, SVOCs, TPH-Dx, TOC, Grain Size
2	070926A2SD	K0708772-003 K0712241-003 K0800426-003	9/26/07	
2 (duplicate)	070926A6 SD	K0708772-005 K0712241-005 K0800426-005	9/26/07	
3	070927A3SD	K0708772-006 K0712241-006 K0800426-006	9/27/07	
4	070925A4SD	K0708772-001 K0712241-001 K0800426-001	9/25/07	
5	070925A5SD	K0708772-002 K0712241-002 K0800426-002	9/25/07	

Notes:
[1] Not enough tissue volume was collected to analyze SVOCs.
Data Package K0708772 = PCB Aroclors, Metals, and SVOCs
Data Package K0712241 = reanalysis of SVOCs
Data Package K0800426 = Grain Size, TOC and TPH-Dx

Table 2
Summary of Qualifications

LAB ID	URS ID	ANALYTE	QUALIFIER	RATIONAL
Clam Tissue				
K0708865-001 K0708865-002 K0708865-003 K0708865-004 K0708865-005	070926A7TC 070926A1TC 070926A2TC 070927A3TC 070925A5TC	methyl mercury	J	hold time exceeded
K0708865-003	070926A2TC	anthracene antimony mercury	J UJ J	MS/MSD recoveries
K0708865-001 K0708865-002 K0708865-004	070926A7TC 070926A1TC 070927A3TC	di-n-butyl phthalate	J	MS/MSD recoveries
Sediment				
K0708772-006	070927A3SD	antimony	J	MS/MSD recoveries
K0708772-001 K0708772-002 K0708772-003 K0708772-004 K0708772-005 K0708772-006	070925A4SD 070925A5SD 070926A2SD 070926A1SD 070926A6SD 070927A3SD	4-methylphenol anthracene benzo(a)pyrene	DNR	LCS recoveries (data reported from reanalysis)
K0708772-001 K0708772-002 K0708772-003 K0708772-004 K0708772-005 K0708772-006	070925A4SD 070925A5SD 070926A2SD 070926A1SD 070926A6SD 070927A3SD	bis(2-ethylhexyl)phthalate	J/UJ	MS/MSD recoveries
K0708772-003 K0708772-005	070926A2SD 070926A6SD	aluminum cadmium copper lead mercury thallium	J	RPD (field duplicate)

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

REFERENCE AREA SMALLMOUTH BASS COLLECTED MAY 2008 AND AROCLORS FOR FOREBAY AND REFERENCE AREA SMALLMOUTH BASS COLLECTED FROM JUNE 2006 TO NOVEMBER 2007

OCTOBER 2008

Prepared by:
URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the smallmouth bass sample results shows the quality of the data is acceptable to support project objectives. The contracted laboratory provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged 'J' or 'J-EMPC'. Some data were qualified as not detected and flagged 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report. Refer to Section 4.0 of this report for a listing of qualifier definitions. The end user should be aware of the potential low bias of the mercury and Aroclor results due to hold time exceedances (as discussed in Section 4.1). Additionally, the identification and quantification of individual Aroclors may be subjective due to pattern degradation within the sample matrix (see Section 4.8).

2.0 Project Description

A total of 38 smallmouth bass were collected from both the forebay and reference area from June 2006 through May 2008 in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. These bass were submitted for chemical analysis in three separate groups, based on collection date. Table 1 summarizes the URS and analytical laboratory identification numbers, capture date, length, weight, and requested analyses for each smallmouth bass collected within these three groups.

The most recent smallmouth bass sample collection was conducted between May 17 and May 21, 2008. Twelve smallmouth bass were captured from the project defined reference area under the supervision of the United States Army Corp of Engineers (USACE), and stored at a USACE storage facility frozen. URS retrieved these twelve smallmouth bass from the USACE storage facility near Bonneville Dam on June 16, 2008 and submitted them for analysis (as described below).

Additionally, the twenty-six previously analyzed smallmouth bass from the forebay and reference area were authorized for PCB Aroclor analysis. Previous analytical results for these bass are reported in the *Forebay Fish Analyses and Summary Report*, March 10, 2008 and the *Reference Area Smallmouth Bass Collected October/November 2007 Analysis and Summary*, July 29, 2008 (URS 2008a and URS 2008c). Table 1 summarizes analytes previously analyzed and reported. Only the most recent Aroclor analytical results are included in this report.

3.0 Sampling and Analytical Procedures

Samples were analyzed according to the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP) (URS 2007). The twelve reference area bass collected in May 2008 were submitted to Columbia Analytical Services (CAS) located in Kelso, Washington on June 17, 2008 for homogenization and analysis. Whole-body fish samples were homogenized using an industrial blender, then stored frozen by CAS. An aliquot of the homogenized tissue was sent to Axys Analytical Services Ltd. (Axys) to perform the PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*. The Axys analytical data report includes a listing of the Axys Method 1668A modifications.

The twenty-six smallmouth bass previously submitted to CAS in two separate shipments were received on September 21, 2007 and February 12, 2008. Whole-body fish were homogenized using an industrial blender and then archived frozen by CAS.

The following table lists the parameters analyzed for one or more of the samples. Table 1 summarizes the specific requested analyses for each sample by URS and laboratory identification numbers. (Note: Semi-Volatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs) were both performed using Selective Ion Monitoring (SIM), but analyzed separately for tissue matrices and as such, discussed separately in this report).

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 1668A	PCBs as congeners
EPA 6000/7000 series	Metals
EPA 8270C-SIM	Semi-Volatile Organic Compounds (SVOCs)
EPA 8270C-SIM	Polycyclic Aromatic Hydrocarbons (PAHs)
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry	Percent Solids

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed for 15% or greater of the data: primary and secondary column verification, initial and continuing instrument calibrations and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA 2005) and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data* (USEPA 1995) as appropriate for method performed. In the case of disagreement between the guidance documents and the analytical method, method criteria were utilized for data review. The SVOC and metals results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above listed methods, and EPA's *NFGs for Organic Data Review(USEPA 1999), and the NFGs for Inorganic Data Review* (USEPA 2004), in that order of precedence. Project-specific QC criteria are listed in the above mentioned QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2 and Table 3. Samples are listed by their URS sample identification assigned in the field as well as the laboratory identification. CAS was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and are not included in Table 2. These 'J' qualifiers are included in the database and are included in the data tables included in the main body of this report. Congeners are reported using sample-specific detection limits. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample - used only for PCB congener results.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

Note: Data package K0805513, provided from CAS, has an addendum reporting the corrected dry weight concentrations for sample K0805513-015. Data package K0805409, also from CAS, has an addendum containing the missing COC form. Data package DPW26477, from Axys, has an addendum containing a corrected case narrative. Each of these addendums are attached to the final data reports and the corrections if applicable have been made to the database and the data tables within the body of this report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Non-congener Results

Twenty-six archived bass were submitted as whole fish samples to CAS on September 21, 2007 and February 12, 2008. CAS stored all tissues samples frozen at -20°C until homogenization and analysis. As reported previously, the chain-of-custody (COC) forms indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below.

URS submitted twelve additional whole fish tissue samples to CAS on June 17, 2008. CAS stored all tissue samples frozen at -20°C until homogenization and analysis. The COC forms indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. The COC form for sample delivery group K0805409 indicated Ti (titanium) instead of TI (thallium), this was corrected and thallium was analyzed. PAHs were not specifically indicated on the COC for sample delivery group K0805409, as noted previously PAHs and SVOCs are analyzed separately only for tissue matrices; for project consistency both PAHs and SVOCs are represented as SVOCs on all project COC forms. Additionally, Aroclors were requested via email after the initial submission of the COC and therefore are not indicated on the COC form. All requested analyses (either on the COC or via email) were reported in sample delivery group K0805409.

All coolers were submitted at temperatures within the EPA-recommended temperature range of 6°C or below with the exception of one color temperature reading of 6.6°C. However, the temperature blanks within the cooler were between 0.5°C and 1.1°C therefore no data qualification was necessary. Data were not qualified based on sample receipt or COC forms.

All samples were analyzed within technical and contracted holding times with the following exceptions:

- Forebay bass collected June 5 and 6, 2006 and August 15 and 16, 2006 exceeded the 1 year holding time for PCB Aroclors (as specified in the QAPP), by 14 months and 12 months, respectively. As a result, all forebay smallmouth bass results have been qualified as estimated and flagged ‘J/UJ’ due to holding time exceedances (Table 2). It should be noted that these results may be biased low due to sample degradation. (*Note: The date of sample collection is incorrectly reported in the data package (K0805513) as June 5 and August 16, 2007 and it should be June 5 and August 16, 2006*).

- The 28-day hold time for mercury was exceeded for samples K0805409-001 through K0805409-005 by 22 days. Samples K0805409-006 through K0805409-012 exceeded holding time by 18 days. All twelve of these mercury sample results were flagged 'J/UJ' due to hold time exceedance (Table 2). The data were not rejected due to holding time; however, the end user should be aware of the potential low bias of the mercury results due to sample degradation.

Congener Results

The chain-of-custody (COC) forms from CAS to Axys indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. The condition and temperature of the samples upon receipt by Axys was appropriate and all samples listed on the COC form were present. Data were not qualified based COC and sample shipment procedures.

All samples were analyzed within the technical and contracted holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Non-congener Results

Instrument calibrations were acceptable for all sample analyses performed.

Congener Results

ICALs and continuing calibration verifications (CCVs) were reviewed for PCB congener analyses. The laboratory performed initial multipoint calibrations for all target and standard compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. Calibration compounds met the acceptance criteria as listed in the method with the following exception:

- The 12-hour CCV bracketing the diluted extract for sample 080517R13SB (L11390-4W) was not acceptable due to a power issue with the instrument during the analysis of the CCV, therefore analytical results for this CCV have been omitted from the report. The initial CCV bracketing this sample (L11390-4W) was analyzed on 8/26/08 at 9:44am and the subsequent successful CCV was analyzed on 8/27/08 at 8:44am (23hrs later), both met acceptance criteria. The laboratory deemed there was no adverse affect to the sample (L11390-4W) and therefore it was not reanalyzed. The only congener reported from the diluted extract of sample L11390-4W was PCB 118, all other congeners were reported from the original (undiluted extract). Results for PCB 118 in this sample were not qualified due to the omission of the 12-hour CCV.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Initial calibration and continuing calibration blanks are also analyzed when appropriate per analytical method (i.e 6000/7000 series metal analyses) to check for laboratory contamination and instrument bias. Field blanks were not collected as part of this analytical program. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs.

Non-congener Results

Non-congener organic sample results less than five times (5x) and inorganic sample results (or common laboratory organic contaminates such as phthalates) less than ten times (10x) the blank concentration and between the method detection limit (MDL) and the MRL were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x for inorganics and phthalates) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, the above-noted guidelines were applied using the wet weight results and any qualifiers assigned were also assigned to the dry weight results.

All analytical tests indicate non-detects for all method blanks with the following exceptions:

- Nickel and zinc were detected in the method blank and nickel, chromium, thallium, and cobalt were detected in bracketing continuing calibration blanks associated with samples in CAS delivery group K0805409. All blank concentrations were above the MDL but below the MRL. All detected results for the above-listed metals were greater than 10x the associated blank concentrations. Metal analytical results were not qualified based on blank detections.

Congener Results

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as EMPCs were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using corn oil to approximate the lipid content of the samples.

The method blank associated with fish tissue samples had only low levels of few PCB congeners. No sample results were qualified based on method blank concentrations.

4.4 Surrogate Recovery Review (non-congener analyses only)

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, PAHs and/or SVOCs were qualified if two or more surrogate recoveries for a given fraction were outside DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery was outside DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- Dilutions performed on samples K0805513-011 and K0805513-017 resulted in surrogate concentrations above the MDL, but below the MRL. The surrogate recoveries were in control, data were not qualified based on surrogate criteria.
- The PAH surrogate recovery for Fluorene-d10 in sample 080521R15SB was below the DoD QSM control limit of 60% with a recovery of 59%. Because the other two surrogates were in control, no data were qualified.

4.5 Labeled Internal Standard Recovery Review (congener analysis only)

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency, which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narrative. All recoveries were acceptable with the following exception:

- The percent recoveries of ^{13}C-labeled PCB 1 and ^{13}C-labeled PCB 4 in sample L11390-3 were below the Axys control limits of 15% and 30%, with recoveries of 10.5% and 17.5%, respectively. Both PCB 1 and PCB 4 have chemically identical isotopic labeled standards. Given that isotopic dilution calculations produce recovery corrected quantitation results, only the non-chemically identical PCB congeners, quantitated using these labeled standards were estimated based on these internal standard recoveries. Associated analytical results for PCB 2, and PCB 5 through 14 for sample L11390-3 were qualified ‘J/UJ’.

Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

4.6 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD were performed for each non-congener analysis and for each batch per method requirements.

Non-congener Results

LCS/LCSD and MS/MSD recoveries were acceptable for all non-congener analytical tests with the following exceptions:

- Recoveries of the MS/MSD sample K0805513-013 for Aroclor 1016 (142%/140%) and Aroclor 1260 (190%/188%) were at or above the DoD QSM upper control limits of 140% and 130% for Aroclor 1016 and Aroclor 1260, respectively. CAS reported that this was due to non-target compounds contributing to the MS concentration. The associated QC samples (LCS/LCSD) were in control indicating that the analytical batch was in control. All Aroclor results from the parent sample, K0805513-013, were reported as non-detect. Aroclor results were not qualified based on potential high bias MS/MSD recoveries. However, all Aroclor results for this sample were previously qualified as estimated 'J/UJ' due to hold time exceedance, Section 4.1.
- Similarly, MS/MSD recoveries for Aroclor 1260 (637%/574%) were above the upper control limit for sample K0805513-018, due to an apparent matrix interference. The associated QC samples (LCS/LCSD) were in control indicating that the analytical batch was in control. The Aroclor 1260 result from the parent sample, K0805513-013 was reported as non-detect. Therefore, the Aroclor 1260 result for parent sample, K0805513-013 was not qualified based on potential high bias MS/MSD recoveries. The Aroclor results for this sample were previously qualified as estimated 'J/UJ' due to hold time exceedance, Section 4.1.
- The percent recoveries for the mercury MS and MSD performed on sample K0805409-004 were below DoD QSM criteria of 80% with recoveries of 70% and 72%, respectively. The recovery of mercury in the standard reference material (SRM) analysis was in control, indicating the analytical batch was in control and the low recovery may have been due to matrix interference. As a result, all associated mercury results within the sample delivery group K0805409 were qualified as estimated 'J/UJ' reflecting the potential low bias.
- The percent recovery for benzo(a)pyrene in the PAH LCS was 115%. This was above the DoD QSM upper control limit of 110%. The expected bias direction is high and none of the samples contained a detectable concentration of this analyte; therefore, no data were qualified.

Congener Results

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, Ongoing Precision and Recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using corn oil to approximate the lipid content of the samples. OPR recoveries were acceptable for congener analyses.

- The 23.8 percent recovery of ^{13}C-labeled PCB 4 (PCB 4L) in the OPR was below the Axys control limit of 30%. All unlabeled congeners were within control limits for the OPR, including PCB 4. Additionally the labeled and non-labeled standards had acceptable recoveries in the method blank (corn oil) and project samples, with the one exception stated above in section 4.5. Analytical results were not qualified as estimated based on the low recovery of PCB 4L within the OPR.

4.7 Duplicate Review

Non-congener Results

Field duplicates were not collected during this sampling event. To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. All duplicate analyses where within relative percent difference criteria. No samples were qualified exclusively on duplicate precision exceedances.

Congener Results

Axys performed a laboratory duplicate analysis on sample L11390-4. For these analytical results greater than 5x the sample specific detection limit and not reported as Estimated Maximum Potential Concentrations (EMPCs), the relative percent difference for individual congeners on average was less than 10%, indicating good analytical precision. The detailed evaluation can be found within the Axys analytical report.

4.8 Compound Quantification

Non-congener Results

All second column confirmations performed by CAS using Method 8082 were acceptable with the following exceptions:

- The second column confirmation criterion of a Relative Percent Difference (RPD) less than or equal to 40% was exceeded for Aroclor 1242 results in samples K0805513-016, K0805513-021, K0805513-026 and K0805409-001. For these samples, the lower Aroclor 1242 value was reported because of an apparent interference that produced the higher value. The Aroclor 1242 results for samples K0805513-016, K0805513-021, K0805513-026, and K0805409-001 were qualified as estimated, ‘J/UJ’ due to second column confirmation precision exceedance.

- Aroclors 1242 and 1254 exceeded the second column confirmation criterion of 40% for sample K0805409-004. For reasons discussed above, results for Aroclors 1242 and 1254 for sample K0805409-004 were qualified as estimated, and flagged 'J/UJ' due to second column confirmation exceedance.
- CAS reported that samples associated with sample delivery groups K0805409 and K0805513 "*appear to have been subjected to environmental stresses…causing pattern degradation and changing peak ratios. When pattern degradation occurs, correct identification and quantitative analysis of the individual Aroclors can be subjective*." "*Aroclor 1254 and Aroclor 1242 were difficult to differentiate and their assignment may be incorrect.*" The data user should consider this when examining Aroclor results from these deliverables. All Aroclor 1242 and 1254 analytical results for sample delivery groups K0805409 and K0805513 were qualified 'J/UJ' based on pattern recognition.

Congener Results

Samples L11390-1, L11390-4, L11390-5, L11390-9, L11390-7, L11390-10, L11390-11 and L11390-12 were diluted and reanalyzed to bring area responses of some target congeners within the linear calibration range of the instrument. Only the affected target compounds are reported from the reanalysis. Relevant concentrations from both the undiluted and diluted analytical results are reported within the data deliverable. The reanalysis results are identified with a sample ID suffix of 'W' or 'Wi' within the report.

Sample L11390-8 was reanalyzed to confirm possible instrumental carry-over. The initial analysis was deemed affected by carry-over and therefore only the reanalysis results were reported.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass was acceptable with the following exceptions:

- The lock mass signal had a small deflection at the retention time associated with the coelution PCB 86/87/97/108/119/125 for all samples within the Axys sample delivery group. Samples L11390-1 through L11390-6, and L11390-8 and L11390-10 demonstrated a drop in lock mass greater than 20% affecting these congeners. Similar deflections were not seen in the associated QC samples; therefore, due the frequency and repeated shape of the deviation, the cause is thought to be due to a matrix interference within these samples. The chromatograms for the diluted analyses for these samples showed a decrease in the lock mass deflection or none at all, pointing to a matrix interference that may be overcome by dilution. After a telephone conversation with the project manager at Axys, it was discovered that the analytical results from the diluted analyses (where the deflection was not present) and undiluted analyses (where the deflection was present) were within 10-15% (i.e. within applicable analytical precision). These samples were not reanalyzed and the concentrations were reported from the undiluted analyses. Results for the coelution PCB 86/87/97/108/119/125 were estimated and flagged 'J', due to potential low bias from lock mass deviation. It should be noted that together these congeners only represent 1% to 3% of the total PCB concentration.

4.9 Target Compound Identification

Non-congener Results

- Two standard reference materials (SRM) were analyzed for metals. All recoveries were within CAS control limits.

Congener Results

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but differ by more than 15% from the theoretical ion abundance criterion set by EPA Method 1668A were flagged in the laboratory report with a 'K' flag. Those results flagged 'K' with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). These EMPC flags are listed in Table 3, appear within the data tables in the main body of this deliverable, and have been entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

Additionally, the flag 'C' was used in Table 3 to indicate co-eluting PCB isomers for this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification as part of this data review.

4.10 Reporting Limits

If sample concentrations were detected below the MRL but above the MDL, they were qualified as estimated by the laboratory and flagged with a 'J'. All laboratory J-flagged results are considered estimates. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report.

Several Aroclor results have elevated MDL and MRLs due to matrix interferences. These results were not qualified during this review, but should be considered as part of data use by the end users.

The dry weight basis Aroclor results for sample K0805513-015 were originally reported as non-detect with MDL and MRL of 98,000 ug/kg. CAS was contacted and stated that this was due to a reporting error. CAS reissued the results for sample K0805513-015. All results are still non-detect but the MDL and MRL are now reported as wet-weight basis results to be consistent with other sample results.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. Some data were qualified as estimated 'J' or 'J-EMPC' and some as non-detect 'U'. A summary of qualifiers can be found in Tables 2 and 3. A completeness summary follows; congener completeness was calculated using 209 congener results, considering coeluting congeners.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  All samples results are considered useable

  Non-congener = (774 compliant / 774 total results) = 100%

  Congener = (1,908 compliant / 1,908 total results) = 100%

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  Non-congener = (553 compliant / 774 total results) = 71%

  Data were qualified as estimated 'J', in particular a significant portion of the Aroclor data were qualified and estimated 'J' due to hold time exceedances and Aroclor pattern recognition. Non-congener data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

  Congener = (1,838 compliant / 1,908 total results) = 96%

  Congener data were qualified as estimated and flagged 'J' or 'J-EMPC' and some qualified non-detect and flagged 'U'.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  Non-congener = *(591 compliant /774 total results) = 76*%

  Congener = *(1,891 compliant /1,908 total results) = 99*%

All samples analyzed met laboratory contract requirements with the exception of the samples analyzed outside of the 28 day hold time for mercury and the 1 year hold time for PCB Aroclors. Due to the nature of the sampling event, samples were not received by CAS or authorized for analysis until after the hold time expired.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

Non-congener = *(12 compliant / 12 total results) =100*%

Congener = *(12 compliant / 12 total results) =100*%

All smallmouth bass samples collected in May 2008 and submitted to CAS for analysis had a complete set of results. All samples had sufficient sample volume to analyze the full analyte list as detailed in the QAPP. Field completeness for the other smallmouth bass is documented with the reporting of the original data set.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Ecology 1997. Washington State Department of Ecology, *Analytical Methods for Petroleum Hydrocarbons*, Publication ECY 97-602, June 1997.

Ecology 2008. Washington State Department of Ecology, *The Development of Sediment Sampling and Analysis Plan, Publication* 03-09-043, February 2008.

Plumb 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, R.H. Plumb, prepared by USEPA and USACE, May 1981.

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

URS 2008a. *Forebay Fish Analyses and Summary Report,* Bradford Island Remedial Investigation, March 10, 2008.

URS 2008b. Memorandum: *Post-Removal Sample Collection*, Bradford Island Disposal Site, Bonneville Dam Forebay – Cascade Locks, Oregon, May 12, 2008.

URS 2008c. *Reference Area Smallmouth Bass Collected October/November 2007 Analysis and Summary,* Bradford Island Remedial Investigation, July 29, 2008.

USEPA 1995. EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 2005. Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

Table 1. Sample Identification and Analysis Summary
Forebay and Reference Area Smallmouth Bass
Collected June 2006 through May 2008

Quality Control Summary Report for Analytical Chemistry

						Anaytes					
URS ID	Length (mm)	Weight (grams)	Collection Date	CAS ID	Axys ID (congeners)	PCB (Aroclors)	PCB (Congeners) (Axys Analytical)	PAHs	SVOCs	Metals	%Solids
Forebay collected June/August 2006 (19 smallmouth bass)											
060605100SB	270	255	6/5/06	K0805513-001	--	X	--	--	--	--	--
060605101SB	330	730	6/5/06	K0805513-002	--	X	--	--	--	--	--
060605200SB	270	226	6/5/06	K0805513-003	--	X	--	--	--	--	--
060605201SB	299	397	6/5/06	K0805513-004	--	X	--	--	--	--	--
060605202SB	300	539	6/5/06	K0805513-005	--	X	--	--	--	--	--
060605203SB	476	1502	6/5/06	K0805513-006	--	X	--	--	--	--	--
060605204SB	343	652	6/5/06	K0805513-007	--	X	--	--	--	--	--
060605205SB	394	850	6/5/06	K0805513-008	--	X	--	--	--	--	--
060605207SB	330	369	6/5/06	K0805513-009	--	X	--	--	--	--	--
060605208SB	419	1191	6/5/06	K0805513-010	--	X	--	--	--	--	--
060605209SB	381	680	6/5/06	K0805513-011	--	X	--	--	--	--	--
060606102SB	265	387	6/6/06	K0805513-012	--	X	--	--	--	--	--
060606103SB	411	1074	6/6/06	K0805513-013	--	X	--	--	--	--	--
060606104SB	380	719	6/6/06	K0805513-014	--	X	--	--	--	--	--
060606210SB	298	284	6/6/06	K0805513-015	--	X	--	--	--	--	--
060815402SB	406	1063	8/15/06	K0805513-016	--	X	--	--	--	--	--
060815403SB	273	284	8/15/06	K0805513-017	--	X	--	--	--	--	--
060815405SB	406	964	8/15/06	K0805513-018	--	X	--	--	--	--	--
060816406SB	314	369	8/16/06	K0805513-019	--	X	--	--	--	--	--
Reference Area collected in October/November 2007 (7 smallmouth bass)											
071027R01SB	380	820	10/27/07	K0805513-020	--	X	--	--	--	--	--
071027R02SB	360	802	10/27/07	K0805513-021	--	X	--	--	--	--	--
071027R03SB	325	548	10/27/07	K0805513-022	--	X	--	--	--	--	--
071027R04SB	370	906	10/27/07	K0805513-023	--	X	--	--	--	--	--
071027R05SB	350	646	10/27/07	K0805513-024	--	X	--	--	--	--	--
071027R06SB	330	501	10/27/07	K0805513-025	--	X	--	--	--	--	--
071115R07SB	425	964	11/15/07	K0805513-026	--	X	--	--	--	--	--
Reference Area collected May 2008 (12 smallmouth bass)											
080517R10SB	394	986	5/17/08	K0805409-001	L11390-1	X	X	X	X	X	X
080517R11SB	343	646	5/17/08	K0805409-002	L11390-2	X	X	X	X	X	X
080517R12SB	305	336	5/17/08	K0805409-003	L11390-3	X	X	X	X	X	X
080517R13SB	419	1140	5/17/08	K0805409-004	L11390-4	X	X	X	X	X	X
080517R14SB	330	530	5/17/08	K0805409-005	L11390-5	X	X	X	X	X	X
080521R15SB	330	587	5/21/08	K0805409-006	L11390-6	X	X	X	X	X	X
080521R16SB	356	622	5/21/08	K0805409-007	L11390-7	X	X	X	X	X	X
080521R17SB	343	647	5/21/08	K0805409-008	L11390-8	X	X	X	X	X	X
080521R18SB	394	1124	5/21/08	K0805409-009	L11390-9	X	X	X	X	X	X
080521R19SB	406	936	5/21/08	K0805409-010	L11390-10	X	X	X	X	X	X
080521R20SB	330	640	5/21/08	K0805409-011	L11390-11	X	X	X	X	X	X
080521R21SB	305	442	5/21/08	K0805409-012	L11390-12	X	X	X	X	X	X

Notes:

CAS - Columbia Analytical Services
Axys - Axys Analytical Services, Ltd.
ID - Identification
mm - millimeter
PAHs - Polynuclear Aromatic Hydrocarbons
PCB - Polychlorinated Biphenyl
SVOCs - Semivolatile Organic Compound
-- previously reported, not included in this quality control summary report.

Table 2. Non-congener Qualifier Summary
Forebay and Reference Area Smallmouth Bass

Quality Control Summary Report for Analytical Chemistry

Laboratory ID	URS ID	Analyte	Qualifier	Rational
K0805513-001	060605100SB	Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260 Aroclor 1262 Aroclor 1268	J/UJ	hold time
K0805513-002	060605101SB			
K0805513-003	060605200SB			
K0805513-004	060605201SB			
K0805513-005	060605202SB			
K0805513-006	060605203SB			
K0805513-007	060605204SB			
K0805513-008	060605205SB			
K0805513-009	060605207SB			
K0805513-010	060605208SB			
K0805513-011	060605209SB			
K0805513-012	060606102SB			
K0805513-013	060606103SB			
K0805513-014	060606104SB			
K0805513-015	060606210SB			
K0805513-016	060815402SB			
K0805513-017	060815403SB			
K0805513-018	060815405SB			
K0805513-019	060816406SB			
K0805409-001	080517R10SB	mercury	J	hold time and MS/MSD recoveries
K0805409-002	080517R11SB			
K0805409-003	080517R12SB			
K0805409-004	080517R13SB			
K0805409-005	080517R14SB			
K0805409-006	080521R15SB			
K0805409-007	080521R16SB			
K0805409-008	080521R17SB			
K0805409-009	080521R18SB			
K0805409-010	080521R19SB			
K0805409-011	080521R20SB			
K0805409-012	080521R21SB			
K0805513-016	060815402SB	Aroclor 1242	J	secondary column confirmation
K0805513-021	071027R02SB			
K0805513-026	071115R07SB			
K0805409-001	080517R10SB			
K0805409-004	080517R13SB	Aroclor 1242 Aroclor 1254		
K0805513-001	060605100SB	Aroclor 1242 Aroclor 1254	J/UJ	Aroclor pattern recognition
K0805513-002	060605101SB			
K0805513-003	060605200SB			
K0805513-004	060605201SB			
K0805513-005	060605202SB			
K0805513-006	060605203SB			
K0805513-007	060605204SB			
K0805513-008	060605205SB			
K0805513-009	060605207SB			
K0805513-010	060605208SB			
K0805513-011	060605209SB			
K0805513-012	060606102SB			

Table 2. Non-congener Qualifier Summary
Forebay and Reference Area Smallmouth Bass

Quality Control Summary Report for Analytical Chemistry

Laboratory ID	URS ID	Analyte	Qualifier	Rational
K0805513-013	060606103SB	Aroclor 1242 Aroclor 1254	J/UJ	Aroclor pattern recognition
K0805513-014	060606104SB			
K0805513-015	060606210SB			
K0805513-016	060815402SB			
K0805513-017	060815403SB			
K0805513-018	060815405SB			
K0805513-019	060816406SB			
K0805513-020	071027R01SB			
K0805513-021	071027R02SB			
K0805513-022	071027R03SB			
K0805513-023	071027R04SB			
K0805513-024	071027R05SB			
K0805513-025	071027R06SB			
K0805513-026	071115R07SB			
K0805409-001	080517R10SB			
K0805409-002	080517R11SB			
K0805409-003	080517R12SB			
K0805409-004	080517R13SB			
K0805409-005	080517R14SB			
K0805409-006	080521R15SB			
K0805409-007	080521R16SB			
K0805409-008	080521R17SB			
K0805409-009	080521R18SB			
K0805409-010	080521R19SB			
K0805409-011	080521R20SB			
K0805409-012	080521R21SB			

Note:

Not included are J flags indicating detections above the method detection limit (MDL) and below the method reporting limit (MRL). These are included in the data tables associated with this report and the project database.

Table 3a
Reference Area Smallmouth Bass Collected May 2008 PCB Congener Analysis Results
Lab Sample ID's L10448-1 through L10448-7
Quality Control Summary Report for Analytical Chemistry

IUPAC #	COELUTING CONGENERS[1]	080517R10 L11390-1	Lab Qualifier	URS Review Qualifier	080517R11 L11390-2	Lab Qualifier	URS Review Qualifier	080517R12 L11390-3	Lab Qualifier	URS Review Qualifier	080517R13 L11390-4	Lab Qualifier	URS Review Qualifier	080517R14 L11390-5	Lab Qualifier	URS Review Qualifier	080521R15 L11390-6	Lab Qualifier	URS Review Qualifier	080521R16 L11390-7	Lab Qualifier	URS Review Qualifier
1		1.05			0.452	K	J-EMPC	0.43	K	J-EMPC	0.626			0.476	K	J-EMPC	0.403			0.566	K	J-EMPC
2		1.66			1.11			0.666		J	1.34			0.904			0.694			0.522		
3		0.748			0.488			0.34	K	J-EMPC	0.617			0.342	K	J-EMPC	0.398	K	J-EMPC	0.391	K	J-EMPC
4		9.61			3.81			2.37			3.55			3.44			3.34			2.23		
5		0.462			0.234	U		0.255	U	UJ	0.208			0.184	U		0.153	K	J-EMPC	0.261	U	
6		5.37			1.99			1.02		J	2.12			1.76			1.73			1.68		
7		1.04			0.466			0.236	U	UJ	0.561			0.436			0.421			0.339		
8		22.7			10.4			4.91		J	9.98			7.37			8.61			6.55		
9		1.84			0.652			0.294	K	J-EMPC	0.718			0.577			0.514			0.528		
10		0.377	K	J-EMPC	0.217	U		0.238	U	UJ	0.141	U		0.163	U		0.125	U		0.231	U	
11		342			377			173		J	320			223			206			75.5		
12	12 + 13	0.177	C U		0.228	C U		0.25	C U	UJ	0.153	C U		0.178	C U		3.04	C K	J-EMPC	0.251	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12			C12	
14		0.17	U		0.219	U		0.239	U	UJ	0.151	U		0.176	U		0.134	U		0.248	U	
15		4.92			2.91			1.41			3.45			2.07			3.5			1.75		
16		31			13.3			7.42			22.5			8.8			9.25			7.26		
17		86			19.3			10.8			52.3			12.2			12.9			11.7		
18	18 + 30	131	C		43.8	C		22	C		96	C		28	C		26	C		24.6	C	
19		6.14			3.23			1.84			3.46			2.23			2.62			1.87		
20	20 + 28	1020	C		215	C		150	C		666	C		128	C		173	C		186	C	
21	21 + 33	152	C		42.8	C		30.2	C		125	C		22.7	C		29.2	C		34.9	C	
22		212			51			30.9			115			27.2			39.3			36.4		
23		0.775			0.197			0.172	K	J-EMPC	0.68			0.151			0.124	K	J-EMPC	0.149		
24		2.68			0.691			0.405	K	J-EMPC	1.45			0.427	K	J-EMPC	0.427			0.399		
25		37.9			7.91			5.36			18.3			3.44			7.01			23		
26	26 + 29	110	C		23.6	C		16	C		80	C		12.6	C		18.7	C		47.1	C	
27		6.74			2.85			1.85			6.12			2			1.87			1.64		
28	20 + 28		C20			C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18			C18	
31		596			125			78.9			338			59.7			94.4			99.6		
32		34.1			6.56			4.23			24.6			3.78			4.69			10.3		
33	21 + 33		C21			C21			C21			C21			C21			C21			C21	
34		1.8			0.507			0.497			1.44			0.326			0.501	K	J-EMPC	1.27		
35		0.163	U		0.127	K	J-EMPC	0.0726	U		0.118	U		0.0499	U		0.048	U		0.0832	U	
36		0.142	U		0.0498	U		0.0635	U		0.101	U		0.0484	U		0.048	U		0.0714	U	
37		28.1			20			7			26.8			11.5			17.6			16.5		
38		1.17			0.243	K	J-EMPC	0.247	K	J-EMPC	0.476			0.101	K	J-EMPC	0.154	K	J-EMPC	0.356	K	J-EMPC
39		7.43			1.95			1.45			6.04			0.998			1.49			2.02		
40	40 + 41 + 71	220	C		66.9	C		62.2	C		225	C		30	C		54.2	C		126	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40			C40	
42		239			55			46.1			187			24.9			46			97.4		
43		38.4			8.38			8.71			31.2			5.23			5.3			9.49		
44	44 + 47 + 65	1090	C		271	C		260	C		824	C		182	C		270	C		781	C	
45	45 + 51	58.4	C		15.8	C		13.2	C		49.1	C		8.2	C		12.8	C		22.8	C	
46		9.01			3.98			2.53			10.8			1.93			3.65			5.61		
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44			C44	
48		178			42.4			35			166			24.1			30.1			39.8		
49	49 + 69	866	C		203	C		192	C		657	C		113	C		218	C		697	C	
50	50 + 53	24.2	C		12.6	C		10	C		38.3	C		6.37	C		11.5	C		29.8	C	
51	45 + 51		C45			C45			C45			C45			C45			C45			C45	
52		1280			402			384			1140			304			438			1090		
53	50 + 53		C50			C50			C50			C50			C50			C50			C50	
54		0.37	K	J-EMPC	0.28			0.194			0.643			0.177			0.428			0.98		
55		0.249	U		0.406	U		0.485	U		0.228	U		0.136	U		0.208	U		0.333	U	
56		109			80.9			53.2			135			35			87.3			206		
57		8.57			2.09			2.15			5.13			1.61			2.5			7.77		
58		3.69			1.87			2.09			2.98			0.93			2.04			5.14		
59	59 + 62 + 75	107	C		25.4	C		23.3	C		81	C		14.5	C		23.4	C		35.3	C	
60		325			123			116			209			110			145			332		
61	61 + 70 + 74 + 76	2130	C		848	C		756	C		1690	C		664	C		974	C		4660	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59			C59	
63		101			29.5			34			63.3			39.1			35.6			184		
64		554			147			121			427			83.5			136			190		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44			C44	
66		1590			534			601			1040			670			679			3880		
67		29.1			9.61			8.65			18.4			5.21			9.34			25.7		
68		16.3			7.78			9.79			13.8			9.84			9.61			69.5		
69	49 + 69		C49			C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40			C40	
72		22.7			8.21			8.94			18.2			7.29			12.8			55.4		
73		0.0486	U		0.0495	U		0.0484	U		0.0492	U		0.0484	U		0.048	U		0.0491	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61			C61	
77		75.4			36.2			43.6			70.1			54.8			49.3			172		
78		0.238	U		0.389	U		0.465	U		0.229	U		0.137	U		0.209	U		0.334	U	
79		17.1			13.4			11.8			27			8.15			15.2			247		
80		2.3			0.818			0.948			1.32			1			0.862			0.286	U	
81		5.52			2.56			2.63			3.26			2.63			2.35			15.9		
82		55.2			57			44.9			131			16.7			68.4			751		
83	83 + 99	5090	C		1410	C		1530	C		2670	C		1730	C		1800	C		23200	C D	
84		122			120			93.5			279			47.6			144			511		
85	85 + 116 + 117	1420	C		393	C		423	C		752	C		465	C		533	C		5890	C D	
86	86 + 87 + 97 + 108 + 119 + 125	1310	C G	J	758	C G	J	674	C G	J	1560	C G	J	441	C G	J	939	C G	J	10500	C D	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86			C86	
88	88 + 91	174	C		117	C		113	C		288	C		51.7	C		138	C		838	C	
89		3.79			3.01			2.84			6.39			1.16			3.3			5.9		
90	90 + 101 + 113	3510	C		1730	C		1670	C		3490	C		1180	C		2090	C		17900	C D	
91	88 + 91		C88			C88			C88			C88			C88			C88			C88	
92		812			353			342			665			278			429			2210		
93	93 + 95 + 98 + 100 + 102	979	C		563	C		552	C		1320	C		354	C		672	C		3370	C	
94		2.17			1.84			1.87			4.3			0.492			1.63			3.4		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93			C93	
96		4.25			1.79			1.8			6.05			1.2			2.02			4.83		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93			C93	
103		14.1			9.48			10.8			21.8			3.76			11			47.8		
104		0.261	K	J-EMPC	0.163	K	J-EMPC	0.237			0.42			0.0808	U		0.22			0.223	K	J-EMPC
105		3500			940			1000			1910			1370			1310			23400	D	
106		0.874	U		0.583	U		0.544	U		0.304	U		0.436	U		0.316	U		1.96	U	
107	107 + 124	132	C		71	C		62.2	C		128	C		57.7	C		90	C		1540	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86			C86	
109		677			223			285			408			373			308			6030	D	
110	110 + 115	2460	C		1400	C		1230	C		2960	C		807	C		1770	C		10600	C D	
111		9.55			3.48			5.06			5.82			5.29			4.35			10.7		
112		0.147	U		0.387	U		0.531	U		0.246	U		0.314	U		0.382	U		0.181	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90			C90	
114		272			59.9			80.2			123			145			87.2			2910		
115	110 + 115		C110			C110			C110			C110			C110			C110			C110	

Table 3a
Reference Area Smallmouth Bass Collected May 2008 PCB Congener Analysis Results
Lab Sample ID's L10448-1 through L10448-7
Quality Control Summary Report for Analytical Chemistry

IUPAC #	COELUTING CONGENERS[1]	080517R10 L11390-1	Lab Qualifier	URS Review Qualifier	080517R11 L11390-2	Lab Qualifier	URS Review Qualifier	080517R12 L11390-3	Lab Qualifier	URS Review Qualifier	080517R13 L11390-4	Lab Qualifier	URS Review Qualifier	080517R14 L11390-5	Lab Qualifier	URS Review Qualifier	080521R15 L11390-6	Lab Qualifier	URS Review Qualifier	080521R16 L11390-7	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85			C85	
118		11800	D		2580			3630			4850	D		6210	D		3740			98600	D	
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86			C86	
120		57.3			17			24.2			29.3			29.9			21.9			57.7		
121		4.77			1.76			2.26			3.49			1.67			2.21			2.34		
122		7.66			12.1			5.37			22.8			6.75			15.3			234		
123		148			43			55.3			81.1			104			60.6			1830		
124	107 + 124		C107			C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86			C86	
126		25.9			6.03			9.55			12.6			14.3			9.45			74.6		
127		0.9	U		0.6	U		0.561	U		0.326	U		0.469	U		0.339	U		2.1	U	
128	128 + 166	2400	C		545	C		551	C		1060	C		702	C		720	C		7850	C	
129	129 + 138 + 160 + 163	15500	C D		4390	C		5020	C		7510	C		6520	C		5160	C		66800	C D	
130		405			265			246			459			225			298			3900		
131		13.7			17.9			11.3			36.5			4.6			20.5			261		
132		378			406			324			922			167			532			3600		
133		280			87.2			105			163			134			105			804		
134	134 + 143	84.4	C		80	C		65.9	C		176	C		36.7	C		94.8	C		718	C	
135	135 + 151 + 154	1690	C		834	C		814	C		1590	C		648	C		936	C		2980	C	
136		178			119			116			274			74.2			140			558		
137		720			104			151			245			275			164			8560		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129			C129	
139	139 + 140	258	C		59.3	C		62.5	C		123	C		70.5	C		73.9	C		771	C	
140	139 + 140		C139			C139			C139			C139			C139			C139			C139	
141		660			191			225			432			182			244			3540		
142		0.798	U		0.703	U		0.731	U		0.625	U		0.628	U		0.484	U		2.21	U	
143	134 + 143		C134			C134			C134			C134			C134			C134			C134	
144		98.1			73.8			65.3			153			40.2			83.9			755		
145		0.0486	U		0.296	K	J-EMPC	0.235	K	J-EMPC	0.737			0.0484	U		0.283	K	J-EMPC	1.08		
146		2380			811			1080			1420			1550	D		924			11400	D	
147	147 + 149	1340	C		1470	C		1250	C		3160	C		640	C		1720	C		13000	C D	
148		12.3			7.27			8.56			13.9			4.53			7.54			12.8		
149	147 + 149		C147			C147			C147			C147			C147			C147			C147	
150		2.54			3.48			4.18			7.6			1.22			3.59			11.4		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135			C135	
152		3.06			1.08			1.18			2.32			0.993			1.28			4.3		
153	153 + 168	18200	C D		4080	C		5650	C		7260	C		9040	C D		5090	C		69500	C D	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135			C135	
155		15.2			4.36			4.97			7.66			6.33			4.8			3.55		
156	156 + 157	1890	C		290	C		430	C		638	C		882	C		447	C		20000	C D	
157	156 + 157		C156			C156			C156			C156			C156			C156			C156	
158		1420			328			302			616			402			406			4520		
159		14.1			10.9			10.6			19			7.57			11.4			71.6		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129			C129	
161		0.574	U		0.506	U		0.525	U		0.44	U		0.442	U		0.341	U		1.55	U	
162		77.3			14.6			21			28.7			35.3			19			442		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129			C129	
164		228			115			130			232			97.1			145			2010		
165		11.3			3.51			5.19			6.6			5.19			4.18			12.9		
166	128 + 166		C128			C128			C128			C128			C128			C128			C128	
167		571			117			211			242			380			180			6540	D	
168	153 + 168		C153			C153			C153			C153			C153			C153			C153	
169		8.12	U		1.3	U		1.86	U		2.79	U		3.07	U		1.54	U		6.62	U	
170		2180			370			459			693			831			480			7510		
171	171 + 173	966	C		214	C		201	C		380	C		305	C		246	C		1020	C	
172		305			75.7			86.3			138			114			86.5			869		
173	171 + 173		C171			C171			C171			C171			C171			C171			C171	
174		231			198			194			375			121			212			1480		
175		58.6			25.8			27.6			46.7			28.3			27.7			142		
176		40.1			48.5			34.3			97.9			19			54.9			134		
177		633			496			437			829			417			512			2030		
178		848			275			283			470			338			307			584		
179		411			250			215			478			154			264			271		
180	180 + 193	6100	C D		1060	C		1550	C		1900	C		3000	C		1300	C		15600	C D	
181		45.2			6.76			9.23			12.9			15.7			9.11			258		
182		20.5			4.59			6.47			8.23			6.95			5.64			27.5		
183	183 + 185	2010	C		483	C		547	C		857	C		759	C		542	C		2520	C	
184		21.4			4.25			5.8			8.47			7.07			5			4.75		
185	183 + 185		C183			C183			C183			C183			C183			C183			C183	
186		0.0631	U		0.0495	U		0.0484	U		0.063	U		0.0484	U		0.0597	U		0.0594	U	
187		3880			1680			2180			2730			2640			1750			6820	D	
188		9.74			4.19			5.68			7.24			6.31			4.57			10.8		
189		102			14.7			21.7			31.3			44.4			19.7			532		
190		912			169			198			292			411			209			1520		
191		121			20.1			27.2			36			48.3			25.3			308		
192		0.0715	U		0.0495	U		0.0484	U		0.072	U		0.05	U		0.0682	U		0.0679	U	
193	180 + 193		C180			C180			C180			C180			C180			C180			C180	
194		661			133			153			244			344			163			1150		
195		510			97			97.8			177			219			105			385		
196		424			78.2			101			148			189			93.1			478		
197	197 + 200	85.6	C		27	C		25	C		52	C		31.1	C		27	C		57.7	C	
198	198 + 199	582	C		228	C		241	C		420	C		348	C		263	C		1020	C	
199	198 + 199		C198			C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197			C197	
201		127			42.6			53.9			87.4			71			46.1			113		
202		485			143			121			265			186			161			191		
203		1170			221			229			367			443			255			621		
204		1.66			0.365			0.472			0.738			0.657			0.459			0.633		
205		58.1			12.5			12.2			23.1			23.2			13.7			43.2		
206		357			86.2			77			137			131			96.9			245		
207		75.1			14.6			17.6			25.7			31.7			16.4			45.4		
208		90.6			37.3			32.8			60.2			44.9			37.9			71.8		
209		153			45.7			41.5			67.6			65			38.1			65.6		

Notes:

All results are in units of pg/g (picograms/gram)

C = Concentration represents coeluting congeners.
D = (Laboratory Qualifer) Analyte reported from a dilution.
J = The reported concentration is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = (Laboratory Qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
U = The analyte was not detected above the reported sample specific reporting limit.
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3b
Reference Area Smallmouth Bass Collected May 2008 PCB Congener Analysis Results
Lab Sample ID's L10448-8 through L10448-14
Quality Control Summary Report for Analytical Chemistry

IUPAC #	COELUTING CONGENERS[1]	080521R17 L11390-8	Lab Qualifier	URS Review Qualifier	080521R18 L11390-9	Lab Qualifier	URS Review Qualifier	080521R19 L11390-10	Lab Qualifier	URS Review Qualifier	080521R20 L11390-11	Lab Qualifier	URS Review Qualifier	080521R21 L11390-12	Lab Qualifier	URS Review Qualifier	WG25830-101 Method Blank	Lab Qualifier
1		0.444			0.471	D		0.655	K D	J-EMPC	0.661	K D	J-EMPC	0.345	D		0.101	K
2		0.89			0.582	K D	J-EMPC	0.715	D		0.89	D		0.397	D		0.056	K
3		0.513			0.43	K D	J-EMPC	0.58	D		0.534	D		0.489	D		0.201	K
4		3.63			3.48	D		4.84	D		3.9	D		2.68	D		0.345	U
5		0.191			0.366	U D		0.213	U D		0.511	U D		0.34	U D		0.225	U
6		1.75			1.88	D		3.08	D		1.64	D		1.56	D		0.202	U
7		0.406			0.335	D		0.633	D		0.448	U D		0.35	D		0.209	U
8		8.9			7.56	D		11.5	D		8.04	D		8.52	D		0.187	U
9		0.611			0.476	D		0.689	D		0.44	U D		0.451	D		0.202	U
10		0.141			0.307	U D		0.179	U D		0.427	U D		0.284	U D		0.21	U
11		475			117	D		416	D		298	D		117	D		1.08	K
12	12 + 13	0.156	C U		0.358	C U D		0.209	C U D		0.499	C U D		0.332	C U D		0.22	C U
13	12 + 13		C12			C12			C12			C12			C12			C12
14		0.148	U		0.339	U D		0.198	U D		0.473	U D		0.315	U D		0.211	U
15		3.19			1.9	D		4.86	D		3.21	D		2.39	D		0.251	U
16		11.4			9.53	D		12.8	D		12.5	D		10	D		0.135	
17		15.7			13.8	D		18.7	D		16.3	D		14.2	D		0.133	K
18	18 + 30	34.6	C		30.1	C D		40.3	C D		35.9	C D		29.1	C D		0.303	C K
19		2.88			2.37	D		3.26	D		2.76	D		2.44	D		0.087	K
20	20 + 28	175	C		169	C D		193	C D		164	C D		139	C D		0.434	C
21	21 + 33	36.8	C		34.4	C D		43.2	C D		35	C D		30.2	C D		0.222	C
22		42.8			33.8	D		46.5	D		38.9	D		32.7	D		0.168	
23		0.148			0.214	D		0.172	U D		0.18	U D		0.145	U D		0.05	U
24		0.594	K	J-EMPC	0.409	K D	J-EMPC	0.688	D		0.138	U D		0.662	K D	J-EMPC	0.05	U
25		9.4			7.34	D		9.7	D		6.17	D		6.02	D		0.05	U
26	26 + 29	22.3	C		19.3	C D		23.3	C D		18.4	C D		16.2	C D		0.087	C K
27		2.76			2.43	D		3.03	D		3.11	D		2.31	D		0.05	U
28	20 + 28		C20			C20			C20			C20			C20			C20
29	26 + 29		C26			C26			C26			C26			C26			C26
30	18 + 30		C18			C18			C18			C18			C18			C18
31		101			82.5	D		110	D		84.5	D		81.7	D		0.304	K
32		4.44			4.63	D		6.09	D		3.91	D		5.54	D		0.091	K
33	21 + 33		C21			C21			C21			C21			C21			C21
34		0.566			0.729	D		0.627	D		0.555	K D	J-EMPC	0.353	K D	J-EMPC	0.05	U
35		0.107	U		0.203	U D		0.203	U D		0.213	U D		0.172	U D		0.05	U
36		0.0919	U		0.176	U D		0.175	U D		0.184	U D		0.148	U D		0.05	U
37		18.8			10	D		21	D		13.4	D		14	D		0.109	
38		0.261	K	J-EMPC	0.18	U D		0.251	K D	J-EMPC	0.188	U D		0.152	U D		0.05	U
39		1.68			1.51	D		2.03	D		1.75	D		0.15	U D		0.05	U
40	40 + 41 + 71	68.7	C		60	C D		90.6	C D		61.2	C D		65.1	C D		0.166	C
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40
42		57.1			53.5	D		74.7	D		58	D		47.3	D		0.071	K
43		8.9			10.9	D		12.8	D		10.7	D		7.92	D		0.05	U
44	44 + 47 + 65	326	C		350	C D		432	C D		327	C D		300	C D		0.441	C
45	45 + 51	15.4	C		9.12	C K D	J-EMPC	21.3	C D		13	C D		15.2	C D		0.08	C K
46		4.01			2.93	D		4.92	D		3.37	D		3.51	D		0.05	U
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44
48		38.1			39.8	D		53.4	D		44.5	D		32.9	D		0.071	
49	49 + 69	259	C		278	C D		342	C D		219	C D		248	C D		0.211	C
50	50 + 53	14.7	C		12.3	C D		19.8	C D		12.6	C D		13.2	C D		0.056	C K
51	45 + 51		C45			C45			C45			C45			C45			C45
52		495			544	D		658	D		520	D		487	D		0.556	
53	50 + 53		C50			C50			C50			C50			C50			C50
54		0.318			0.298	D		0.425	K D	J-EMPC	0.207	D		0.376	D		0.05	U
55		0.204	U		0.393	U D		0.393	U D		0.389	U D		0.326	U D		0.0731	U
56		112			73.3	D		128	D		74.8	D		88.8	D		0.073	
57		2.59			2.6	D		3.15	D		2.12	D		2.88	D		0.069	U
58		3.12			2.38	D		3.12	D		2.27	D		2.53	D		0.0721	U
59	59 + 62 + 75	28.2	C		31.7	C D		38.4	C D		30	C D		26	C D		0.05	C U
60		143			193	D		212	D		152	D		142	D		0.093	K
61	61 + 70 + 74 + 76	992	C		1120	C D		1390	C D		905	C D		1010	C D		0.451	C K
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59
63		32.7			47.2	D		48.6	D		35.8	D		36.1	D		0.0666	U
64		151			158	D		204	D		156	D		146	D		0.106	
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44
66		642			942	D		907	D		686	D		638	D		0.226	
67		10.6			9.5	D		15.6	D		8.27	D		10.7	D		0.0609	U
68		10.9			10.8	D		13.4	D		8.27	D		10.5	D		0.0651	U
69	49 + 69		C49			C49			C49			C49			C49			C49
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40
72		13.8			13.9	D		17.5	D		10.4	D		13.2	D		0.0645	U
73		0.0526	U		0.0707	U D		0.076	U D		0.111	U D		0.0875	U D		0.05	U
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61
77		53.7			59.7	D		70.1	D		52.8	D		49.7	D		0.072	U
78		0.208	U		0.401	U D		0.401	U D		0.396	U D		0.333	U D		0.0701	U
79		22			19.3	D		29.7	D		21.7	D		21.5	D		0.057	U
80		0.177	U		0.341	U D		0.341	U D		0.337	U D		1.19	D		0.0647	U
81		3.4			4.06	D		3.76	D		2.02	D		3.11	D		0.0696	U
82		86.3			79.6	D		125	D		58.9	D		93.5	D		0.05	U
83	83 + 99	1780	C		2600	C D		3010	C D		1980	C D		2330	C D		0.271	C
84		149			126	D		240	D		125	D		177	D		0.127	
85	85 + 116 + 117	554	C		829	C D		902	C D		632	C D		654	C D		0.112	C
86	86 + 87 + 97 + 108 + 119 + 125	1100	C G	J	1170	C D		1730	C D G	J	1050	C D		1370	C D		0.397	C
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86
88	88 + 91	155	C		137	C D		253	C D		131	C D		196	C D		0.069	C
89		3.32			3.75	D		5.15	D		2.88	D		4.12	D		0.05	U
90	90 + 101 + 113	2320	C		2470	C D		3810	C D		2280	C D		2800	C D		0.526	C K
91	88 + 91		C88			C88			C88			C88			C88			C88
92		448			523	D		751	D		471	D		586	D		0.082	K
93	93 + 95 + 98 + 100 + 102	702	C		733	C D		1150	C D		694	C D		848	C D		0.463	C
94		2.08			1.47	D		3.51	D		1.31	D		2.9	D		0.05	U
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93
96		2.3			2.37	D		3.37	D		2.24	D		2.62	K D	J-EMPC	0.05	U
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93
99	83 + 99		C83			C83			C83			C83			C83			C83
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93
103		12.7			12.1	D		22.1	D		10.1	D		16.8	D		0.05	U
104		0.231			0.23	D		0.408	K D	J-EMPC	0.245	U D		0.343	K D	J-EMPC	0.05	U
105		1320			2000	D		2090	D		1440	D		1680	D		0.291	
106		0.536	U		1.18	U D		0.686	U D		0.786	U D		0.548	U D		0.05	U
107	107 + 124	91.4	C		90.9	C D		141	C D		81.9	C D		118	C D		0.05	C U
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86
109		290			443	D		522	D		362	D		382	D		0.05	U
110	110 + 115	1960	C		2040	C D		2910	C D		1890	C D		2320	C D		0.498	C K
111		4.28			6.68	K D	J-EMPC	8.35	D		4	D		5.35	D		0.05	U
112		0.561	U		0.801	U D		0.217	U D		0.366	U D		0.439	U D		0.05	U
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90
114		82.6			132	D		137	D		97.1	D		106	D		0.109	K
115	110 + 115		C110			C110			C110			C110			C110			C110

Table 3b
Reference Area Smallmouth Bass Collected May 2008 PCB Congener Analysis Results
Lab Sample ID's L10448-8 through L10448-14
Quality Control Summary Report for Analytical Chemistry

IUPAC #	COELUTING CONGENERS[1]	080521R17 L11390-8	Lab Qualifier	URS Review Qualifier	080521R18 L11390-9	Lab Qualifier	URS Review Qualifier	080521R19 L11390-10	Lab Qualifier	URS Review Qualifier	080521R20 L11390-11	Lab Qualifier	URS Review Qualifier	080521R21 L11390-12	Lab Qualifier	URS Review Qualifier	WG25830-101 Method Blank	Lab Qualifier
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85
118		3650			5970	D		5350	D		4780	D		4460	D		0.617	
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86
120		22			32.8	D		37.4	D		28.1	D		27	D		0.05	U
121		2.3			2.98	D		4.51	D		2.56	D		2.73	D		0.05	U
122		19.8			10.3	D		28.4	D		9.82	D		20.6	D		0.05	U
123		64.8			84	D		80.2	D		76.1	D		69.1	D		0.051	
124	107 + 124		C107			C107			C107			C107			C107			C107
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86
126		9.01			13.4	D		12.9	D		10.7	D		8.65	D		0.05	K
127		0.575	U		1.27	U D		0.735	U D		0.843	U D		0.587	U D		0.05	U
128	128 + 166	727	C		1120	C D		1250	C D		849	C D		912	C D		0.122	C
129	129 + 138 + 160 + 163	5450	C		7870	C D		9990	C D		6720	C D		6760	C D		0.679	C K
130		292			296	D		570	D		303	D		407	D		0.052	
131		19.5			15	D		38.7	D		14.7	D		27.5	D		0.05	U
132		476			394	D		867	D		411	D		640	D		0.16	K
133		92.1			145	D		194	D		128	D		131	D		0.05	U
134	134 + 143	87.3	C		80.1	C D		176	C D		85.1	C D		117	C D		0.05	C U
135	135 + 151 + 154	914	C		1070	C D		1870	C D		1110	C D		1270	C D		0.159	C K
136		133			137	D		254	D		151	D		197	D		0.063	
137		171			299	D		271	D		203	D		218	D		0.05	K
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129
139	139 + 140	68.1	C		108	C D		136	C D		87	C D		96.9	C D		0.05	C U
140	139 + 140		C139			C139			C139			C139			C139			C139
141		288			420	D		484	D		313	D		351	D		0.122	
142		0.792	U		0.955	U D		1.19	U D		1.32	U D		0.984	U D		0.05	U
143	134 + 143		C134			C134			C134			C134			C134			C134
144		84.1			83.6	D		174	D		85.6	D		123	D		0.05	U
145		0.379			0.206	D		0.571	K D	J-EMPC	0.405	K D	J-EMPC	0.443	K D	J-EMPC	0.05	U
146		899			1320	D		1790	D		1210	D		1230	D		0.129	K
147	147 + 149	1610	C		1310	C D		3260	C D		1440	C D		2140	C D		0.317	C
148		7.57			8.46	D		17.6	D		8	D		11.2	D		0.05	U
149	147 + 149		C147			C147			C147			C147			C147			C147
150		3.71			2.87	D		9.05	D		3.21	D		5.99	D		0.05	U
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135
152		1.24			1.5	D		2.29	D		1.57	D		1.75	K D	J-EMPC	0.05	U
153	153 + 168	4850	C		8170	C D		9180	C D		7410	C D		5650	C D		0.609	C
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135
155		4.6			7.9	D		10.2	D		7.21	D		6.63	D		0.05	U
156	156 + 157	420	C		786	C D		714	C D		557	C D		544	C D		0.244	C
157	156 + 157		C156			C156			C156			C156			C156			C156
158		412			606	D		798	D		490	D		557	D		0.096	K
159		14.3			13.3	D		25.2	D		14.1	K D	J-EMPC	15.4	D		0.05	U
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129
161		0.555	U		0.67	U D		0.836	U D		0.928	U D		0.69	U D		0.05	U
162		20			36	D		38.6	D		27.9	D		23.5	D		0.05	U
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129
164		143			169	D		228	D		167	D		185	D		0.05	U
165		3.83			6.28	D		8.53	D		4.82	D		4.99	K D	J-EMPC	0.05	U
166	128 + 166		C128			C128			C128			C128			C128			C128
167		175			286	D		242	D		276	D		198	D		0.09	K
168	153 + 168		C153			C153			C153			C153			C153			C153
169		2.16	U		4.82	U D		5.96	U D		3.56	U D		2.1	U D		0.072	K
170		491			866	D		887	D		636	D		522	D		0.187	
171	171 + 173	245	C		389	C D		548	C D		345	C D		311	C D		0.091	C K
172		98			159	D		193	D		115	D		101	D		0.05	U
173	171 + 173		C171			C171			C171			C171			C171			C171
174		242			220	D		447	D		235	D		270	D		0.072	K
175		29.3			36	D		71.5	D		37.1	D		39.4	D		0.05	U
176		50.4			37.4	D		124	D		45.7	D		76.9	D		0.05	U
177		503			462	D		1220	D		550	D		675	D		0.07	
178		291			422	D		683	D		419	D		384	D		0.05	U
179		244			243	D		549	D		315	D		348	D		0.056	
180	180 + 193	1380	C		2670	C D		2870	C D		2110	C D		1460	C D		0.26	C
181		10			16.8	D		18.8	D		14.4	D		12	D		0.05	U
182		7.89			13.4	D		15.8	D		10.7	D		9.23	D		0.05	U
183	183 + 185	583	C		904	C D		1290	C D		843	C D		700	C D		0.091	C
184		4.51			8.34	D		10.9	D		8.55	D		6.7	D		0.05	U
185	183 + 185		C183			C183			C183			C183			C183			C183
186		0.0919	U		0.126	U D		0.158	U D		0.187	U D		0.175	U D		0.05	U
187		1800			2510	D		4090	D		2650	D		2330	D		0.142	K
188		4.36			6.67	D		10.1	D		6.91	D		6.04	D		0.05	U
189		20.9			38.6	D		37.5	D		29.5	D		20.5	D		0.088	K
190		217			381	D		431	D		345	D		243	D		0.05	U
191		28.4			52	D		59.5	D		42.3	D		31.9	D		0.05	U
192		0.119	U		0.163	U D		0.205	U D		0.242	U D		0.226	U D		0.05	U
193	180 + 193		C180			C180			C180			C180			C180			C180
194		157			285	D		289	D		204	D		134	D		0.058	
195		91.8			172	D		195	D		146	D		97.2	D		0.05	U
196		97.1			187	D		193	D		147	D		96.2	D		0.05	U
197	197 + 200	28.7	C		39.2	C D		64.3	C D		35.1	C D		35.1	C D		0.05	C U
198	198 + 199	277	C		465	C D		532	C D		315	C D		248	C D		0.068	C
199	198 + 199		C198			C198			C198			C198			C198			C198
200	197 + 200		C197			C197			C197			C197			C197			C197
201		43.6			66.9	D		110	D		67.6	D		55.1	D		0.05	U
202		144			232	D		348	D		198	D		166	D		0.05	U
203		252			468	D		506	D		364	D		234	D		0.053	
204		0.427			1.06	D		0.932	K D	J-EMPC	0.54	D		0.491	K D	J-EMPC	0.05	U
205		13.8			22.9	D		28.6	D		19.2	D		13.4	D		0.064	
206		94.4			185	D		171	D		107	D		70.8	D		0.201	U
207		14.9			34.4	D		30.8	D		23.3	D		15.2	D		0.157	U
208		37			65.3	D		73	D		38.9	D		31	D		0.156	U
209		43.1			67.2	D		77.6	D		52.2	D		31.7	D		0.137	K

Notes:

All results are in units of pg/g (picograms/gram)

C = Concentration represents coeluting congeners.

D = (Laboratory Qualifer) Analyte reported from a dilution.

J = The reported concentration is an estimate.

J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

K = (Laboratory Qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

PCBs = Polychlorinated Biphenyls

U = The analyte was not detected above the reported sample specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

SEDIMENT – FEBRUARY/MARCH 2008 SAMPLING EVENT

JULY 2008

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the sediment sample results shows the quality of the data is acceptable to support project objectives. The contracted laboratory provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged ‘J’ or ‘UJ’. Some data were qualified as not detected and flagged ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the River Operable Unit Remedial Investigation Report.

2.0 Project Description

URS collected and authorized analysis of 45 sediment samples during the remedial investigation near Bradford Island at Bonneville Dam between February 11 and March 20, 2008. Table 1 summarizes the sample locations, media, URS and analytical laboratory identification numbers and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial Investigation* (URS 2007). Deviations from the QAPP (i.e. number and volume per each pre-determined sample location) are addressed in the Post-Removal Sample Collection Memorandum (URS 2008). Deviations in sample locations and sample size do not affect data usability. All sediment samples were submitted to Columbia Analytical Services (CAS) located in Kelso, WA and were assigned to one of three CAS sample delivery group identification numbers (K0801328, K0801769, or K0802371). Not all samples logged in under these sample delivery groups were authorized for analysis (i.e only samples meeting project criteria were selected for analysis). Sediment was submitted in laboratory-provided 8oz glass containers, and each sample consisted of two to ten sample containers depending on availability of sample media at each location. CAS composited and homogenized all sample containers from each location using a mechanical mixer prior to subaliquoting for individual analyses. The remaining sediment is archived (frozen to -20°C) at CAS for potential future analyses.

The following table lists the parameters analyzed on one or more of the samples. Table 1 summarizes the specific requested analyses for each sample by URS and laboratory identification numbers.

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 6000/7000 series	Metals
EPA 8270C	Semi-Volatile Organic Compounds (SVOCs)
NWTPH-Dx (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel and Residual Range (NWTPH-Dx)

Method	Analytical Parameter
Plumb (Plumb 1981)	Total Organic Carbon (TOC)
Gravimetric (EPA 1983)	Percent Solids
PSEP (PSEP 1996)	Grain Size

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed for 15% or greater of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2007). The data results were reviewed in accordance with the criteria specified in the DoD QSM (DoD 2006), the above-listed methods, and the following EPA guidance documents in that order; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004). Project-specific QC criteria are listed in the QAPP (URS 2007).

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and are not included in Table 2 for simplicity. These 'J' qualifiers are included in the database and are included in the data tables included in the main body of this report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

URS frequently submitted sediment samples to CAS throughout the six-week collection period. CAS archived all sample sediment by freezing to -20°C until authorization was given by URS to begin homogenization and analysis. The chain-of-custody (COC) forms indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. All samples were sent via CAS courier in wet ice and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below. Due to the length of the sampling event (six weeks) and the multitude of COC forms for sediment, CAS has included COC forms for the entire sampling event but not in every deliverable, therefore the COC forms must be evaluated concurrently for the three sediment sample delivery groups. Additionally, one of the COC forms associated with sample delivery group K0802371 was inadvertently left out, URS received this COC form from CAS as part of the sample confirmation and it is acceptable. It has been included as an addendum to the original K0802371 data deliverable.

The sample dates for the following three samples were misreported within the data reports, listed below and in Table 1 are the correct sample collection dates.

- K0801328-003 – February 11, 2008
- K0802371-015 – March 11, 2008
- K0802371-016 – March 11, 2008

Holding times listed in the QAPP were not explicit in specifying times for samples archived frozen with the exception of PCBs. Holding times listed in the Washington State Department of Ecology's document *The Development of Sediment Sampling and Analysis Plans* (Ecology 2008) were used for comparison (as shown below).

Analytical Parameter	Hold Time (Table 10, Ecology 2008)
Polychlorinated Biphenyls (PCBs)	1 year (Frozen, -18°C) (as reported in QAPP)
Metals Mercury	1 year (Frozen, -18°C) 28 days (Frozen, -18°C)
Semi-Volatile Organic Compounds (SVOCs)	1 year (Frozen, -18°C)
Northwest Total Petroleum Hydrocarbons – Diesel Range (NWTPH-Dx)	6 months (Frozen, -18°C)
Total Organic Carbon (TOC)	6 months (Frozen, -18°C)
Percent Solids	6 months (Frozen, -18°C)
Grain Size	6 months (4°C) (as reported in QAPP)

All sediment samples were analyzed within the above-listed holding times with the following exception:

- The 28-day hold time for mercury was exceeded for sample K0801328-003 by one day and sample K0802371-009 by three days. These sample results were flagged ‘J’ due to hold time exceedance.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Instrument calibrations were acceptable for all sample analyses performed with the following exception:

- One of the five CCALs for Aroclor 1016 measured on the confirmation column exceeded the DoD QSM percent difference (%D) limits of ± 20% in the ICAL value at 21%. The CCAL for the primary column and the remaining four CCALs (primary and confirmation columns) were acceptable. Aroclor 1016 was not detected in any associated project samples in this sequence. No qualifiers were assigned to the data based on this ICAL.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per QAPP requirements. Field blanks were not collected as part of this analytical program. Qualification of samples due to method blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results (or common laboratory organic contaminates such as phthalates) less than ten times (10x) the method blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a 'U' at the MRL. When sample results were less than 5x (or 10x for phthalates) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged 'U'. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, the above-noted guidelines were applied using the wet weight results and any qualifiers assigned were also assigned to the dry weight results. All analytes were reported as not detected in the associated method blanks with the following exceptions:

- Residual range organics (RRO) were detected in the method blank associated with sample delivery group K0802371. All associated sample results were detected at concentrations less than 5x the method blank concentration and between the MRL and MDL and were flagged 'U' at the MRL.

- Di-n-butyl phthalate, butyl benzyl phthalate and bis(2-ethylhexyl) phthalate were detected in the method blanks associated with sample delivery groups K0802371 and K0801328. All samples had at least one of these phthalates detected at concentrations less than 10x the method blank concentrations. The associated results were flagged 'U' according to the criteria outlined above (see Table 2 for specific analytes in each sample).

- Metals (aluminum, cadmium, cobalt, copper, lead, thallium) were detected at concentrations between the MDL and the MRL in the method blank associated with sample delivery group K0802371. All sample results were greater than 10x the method blank concentrations with the exceptions of cadmium in samples K0802371-005, K0802371-007, K0802371-008 and K0802371-010 and thallium in samples K0802371-002, K0802371-005, K0802371-006, K0802371-007 and K0802371-008, K0802371-010 and K0802371-013. These results were flagged 'U' according to the criteria outlined above (see Table 2).

- Copper was detected in the method blank associated with sample delivery group K0801328 at a concentration between the MDL and the MRL. All sample results were more than 10x the method blank concentration; therefore, data were not qualified based on this method blank detection.

- Aluminum and thallium were detected in the method blank associated with sample delivery group K0801769. Thallium was detected at a concentration between the MDL and the MRL and aluminum was detected at a concentration above the MRL. All sample concentrations were more than 10x the method blank concentration; therefore, data were not qualified based on this method blank detection.

- TPH results associated with sample delivery group K0801769 were analyzed in two extraction batches. Method blanks associated with both extraction batches had detections between the MDLs and the MRLs. Extraction batch KWG0803324 had a detection of diesel range organics (DRO). All associated DRO results were more than 5x the method blank concentration; therefore, data were not qualified based on this method blank detection. Extraction batch KWG0803155 had a detection of residual range organics (RRO). Samples K0801769-009, K0801769-011, K0801769-023, K0801769-029, and K0801769-030 had RRO concentrations less than 5x the method blank concentration and were flagged 'U' at the respective MRLs.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, PAHs and/or SVOCs were qualified if two or more surrogate recoveries for a given fraction exceeded DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery exceeded DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- The SVOC surrogate recovery for 2-fluorobiphenyl in sample K0801769-018 was below the lower DoD QSM limit of 45% at 39%. While above the lower control limits, surrogate recoveries for phenol-d6 and nitrobenzene-d5 were comparatively low with recoveries of 43% and 41% respectively, in this sample. All detected SVOC results in sample K0801769-018 were previously flagged 'J' by the laboratory due to detections between the MDL and the MRL. All SVOCs reported as not detected in this sample were qualified as estimated and flagged 'UJ' based on low recoveries for three of the four surrogate compounds. These low recoveries appear to be isolated within this single sample.

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD were performed for each analysis and for each batch per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exceptions:

- The percent recoveries for antimony in all three of the of the MS/MSD pairs associated with the three sample delivery groups were below lower DoD QSM control limit of 80%.
    - K0802371-001: MS/MSD = 44% and 30%, respectively.
    - K0801328-004: MS/MSD = 36.5% and 40.7%, respectively.
    - K0801769-021: MS/MSD = 41.5% and 43.3%, respectively.

  All associated LCS and post-digestion spike recoveries indicate analytical batches were in control. All associated antimony results were reported at concentrations between the MDL and the MRL and are flagged 'J.' Further qualification is not required; however, the antimony concentrations represented in these samples are potentially biased low.

- The percent recovery for aluminum in the MS performed on sample K0801769-21 exceeded DoD QSM criteria; however, the aluminum concentration in this sample was greater than 4x the spike concentration, thereby preventing accurate evaluation of the spike recovery. The data were not qualified based on MS recoveries for aluminum.

- The percent recoveries for mercury and vanadium in the MSD performed on sample K0801769-21 exceeded DoD QSM criteria. The percent recoveries in the MS and post-digestion spike and the relative percent differences (RPDs) for the MS/MSD pair were within acceptance criteria. The samples were not qualified based on these MSD recoveries.

- The percent recoveries for many SVOCs in the MS performed on sample K0802371-013 were low. The percent recoveries in the MSD were all within control limits; however, due to the low MS recoveries, the RPDs for the MS/MSD pair are above the DoD QSM control limit. The MS recovery losses appear to be isolated to this single MS and appear to be an error in the MS sampling and not a matrix interference because the MSD recoveries are acceptable for sample K0802371-013. Data was not qualified based on the MS or RPD recoveries.

- The percent recoveries for acenaphthene, fluorene, anthracene, and fluoranthene were below the DoD QSM lower limits in the MS performed on sample K0801769-021. The percent recoveries in the MSD and RPDs for MS/MSD pair were within the control limits. Fluorene and fluoranthene also had low recoveries in the associated LCS (as stated below). Only fluorene and fluoranthene were qualified and flagged 'UJ' in sample K0801769-021 based on the low MS recoveries and low LCS recoveries for this QC batch. Acenaphthene and anthracene were not qualified solely on MS recoveries.

- The LCS associated with K0801769 had percent recoveries below the DoD QSM lower limits for fluorene, di-n-butyl phthalate and fluoranthene. The results for these analytes were qualified as estimated and flagged 'J' or 'UJ' for all samples in sample delivery group K0801769 unless previously qualified as estimated based on reported concentrations between the associated MDLs and MRLs.

4.6 Duplicate Review

Field duplicates were not collected during this sampling event due to the statistical nature of the sampling event (as discussed in detail in the QAPP). To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. All values were acceptable with the following exceptions:

- The RPD for bis(2-ethylhexyl) phthalate for the MS/MSD pair performed on sample K0801769-021 was outside the 30% control limit at 62%. This analyte was previously qualified as estimated and flagged with a ‘J’ due to the concentration between the MDL and the MRL. Further qualification is not required based on the RPD.
- The RPDs for pyrene and indeno(1,2,3-cd)pyrene for the LCS/LCSD pair associated with sample delivery group K0801769 were above the 30% DoD QSM control limit at 36% and 32%, respectively. All associated detections for pyrene in this sample delivery group with the exception of K0801769-029 were previously flagged ‘J’ due to detections between the MDL and the MRL. Further qualification of these results was unnecessary. The result for pyrene in sample K0801769 -029 was qualified as estimated and flagged ‘J’. All reported concentrations for indeno(1,2,3-cd)pyrene were likewise previously qualified as estimated and flagged with a ‘J’ due to detections between the MDL and the MRL. Results reported as not detected were qualified as estimated and flagged ‘UJ’.

4.7 Compound Quantification

All second column confirmation performed by CAS on Method 8082 were acceptable.

4.8 Reporting Limits

If sample concentrations were detected below the MRL but above the MDL, they were qualified as estimated by the laboratory and flagged with a ‘J’. All laboratory J-flagged results are considered estimates. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a ‘J’ or a ‘UJ.’ Some laboratory data was qualified as not detected and flagged with a ‘U’. A summary of qualifiers can be found in Table 2.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  = *(2,315 compliant / 2,315 total results)* = 100%

  All samples results are considered useable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = *(2162 compliant / 2,315 total results) = 93%*

  Data were qualified non-detect ‘U’ and some as estimated ‘UJ’ or ‘J’. Data qualified ‘J’ due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = *(2,313 compliant /2,315 total results) = 99*%

  All samples analyzed met laboratory contract requirements with the exception of two samples analyzed outside of the 28 day hold time for mercury. Due to the staged sampling event, sample authorization was not given to CAS until a few days prior to the hold time expiration for these samples.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = *(45 compliant / 45 total results) =100*%

  All samples collected and submitted to CAS for analysis had a complete set of results. All samples had sufficient sample volume to analyze the full analyte list as detailed in the QAPP.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Ecology 1997. Washington State Department of Ecology, *Analytical Methods for Petroleum Hydrocarbons*, Publication ECY 97-602, June 1997.

Ecology 2008. Washington State Department of Ecology, *The Development of Sediment Sampling and Analysis Plan, Publication* 03-09-043, February 2008.

Plumb 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, R.H. Plumb, prepared by USEPA and USACE, May 1981.

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2008. Memorandum: *Post-Removal Sample Collection*, Bradford Island Disposal Site, Bonneville Dam Forebay – Cascade Locks, Oregon May 12, 2008

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

TABLES

Table 1. Sediment Sample ID and Analysis Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station	URS ID	DATE COLLECTED	CAS ID	Anaytes						
				PCB (Aroclors)	SVOCs	Metals	TPH-Dx	%Solids	TOC	Grain Size
Sediment - Forebay										
4	08022604SD	26-Feb	K0801328-022	X	X	X	X	X	X	X
7	08021507SD	15-Feb	K0801328-007	X	X	X	X	X	X	X
8	08021508SD	15-Feb	K0801328-009	X	X	X	X	X	X	X
9	08021409SD	14-Feb	K0801328-004	X	X	X	X	X	X	X
10	08021410SD	14-Feb	K0801328-005	X	X	X	X	X	X	X
11	08021411SD	14-Feb	K0801328-006	X	X	X	X	X	X	X
15	08022115SD	21-Feb	K0801328-012	X	X	X	X	X	X	X
16	08022116SD	21-Feb	K0801328-013	X	X	X	X	X	X	X
17	08022117SD	21-Feb	K0801328-011	X	X	X	X	X	X	X
18	08021118SD	11-Feb	K0801328-003	X	X	X	X	X	X	X
21	08021221SD	12-Feb	K0801328-002	X	X	X	X	X	X	X
5	08031905SD	19-Mar	K0802371-005	X	X	X	X	X	X	X
6	08031806SD	18-Mar	K0802371-006	X	X	X	X	X	X	X
13	08031713SD	17-Mar	K0802371-001	X	X	X	X	X	X	X
14	08031814SD	18-Mar	K0802371-004	X	X	X	X	X	X	X
65	08022965SD	29-Feb	K0802371-009	X	X	X	X	X	X	X
67	08030367SD	3-Mar	K0802371-010	X	X	X	X	X	X	X
88	08031788SD	17-Mar	K0802371-003	X	X	X	X	X	X	X
89	08031789SD	17-Mar	K0802371-002	X	X	X	X	X	X	X
Sediment - Reference Area										
22	08030522SD	5-Mar	K0801769-010	X	X	X	X	X	X	X
24	08030524SD	5-Mar	K0801769-011	X	X	X	X	X	X	X
26	08030426SD	4-Mar	K0801769-005	X	X	X	X	X	X	X
27	08030427SD	4-Mar	K0801769-006	X	X	X	X	X	X	X
28	08030428SD	4-Mar	K0801769-007	X	X	X	X	X	X	X
29	08022229SD	22-Feb	K0801769-021	X	X	X	X	X	X	X
34	08022534SD	25-Feb	K0801769-024	X	X	X	X	X	X	X
35	08022535SD	25-Feb	K0801769-023	X	X	X	X	X	X	X
36	08022536SD	25-Feb	K0801769-022	X	X	X	X	X	X	X
37	08022637SD	26-Feb	K0801769-025	X	X	X	X	X	X	X
38	08022738SD	27-Feb	K0801769-026	X	X	X	X	X	X	X
39	08022739SD	27-Feb	K0801769-027	X	X	X	X	X	X	X
40	08022740SD	27-Feb	K0801769-028	X	X	X	X	X	X	X
41	08022741SD	27-Feb	K0801769-029	X	X	X	X	X	X	X
42	08022742SD	27-Feb	K0801769-030	X	X	X	X	X	X	X
85	08030685SD	6-Mar	K0801769-017	X	X	X	X	X	X	X
86	08030686SD	6-Mar	K0801769-009	X	X	X	X	X	X	X
87	08030687SD	6-Mar	K0801769-018	X	X	X	X	X	X	X
Sediment - Downstream										
46	08031046SD	10-Mar	K0802371-011	X	X	X	X	X	X	X
47	08031047SD	10-Mar	K0802371-012	X	X	X	X	X	X	X
48	08031048SD	10-Mar	K0802371-013	X	X	X	X	X	X	X
49	08031049SD	10-Mar	K0802371-014	X	X	X	X	X	X	X
50	08031150SD	11-Mar	K0802371-015	X	X	X	X	X	X	X
51	08031151SD	11-Mar	K0802371-016	X	X	X	X	X	X	X
Sediment - Eagle Creek										
43	08032043SD	20-Mar	K0802371-007	X	X	X	X	X	X	X
44	08032044SD	20-Mar	K0802371-008	X	X	X	X	X	X	X

Table 2. Sediment Qualifer Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

CAS ID	URS ID	Station Number	Analyte	Qualifer	Rational
K0801328-003	08021118SD	18	mercury	J	Hold time
K0802371-009	08022965SD	65			
K0802371-005	08031905SD	5	cadmium	0.121U	MB detection
K0802371-007	08032043SD	43		0.75U	
K0802371-008	08032044SD	44		0.131U	
K0802371-010	08030367SD	67		0.115U	
K0802371-002	08031789SD	89	thallium	0.113U	MB detection
K0802371-005	08031905SD	5		0.108U	
K0802371-006	08031806SD	6		0.132U	
K0802371-007	08032043SD	43		0.156U	
K0802371-008	08032044SD	44		0.122U	
K0802371-010	08030367SD	67		0.130U	
K0802371-013	08031048SD	48		0.122U	
K0802371-002	08031789SD	89	di-n-butyl phthalate butyl benzyl phthalate bis (2-ethylhexyl) phthalate	14U 9.8U 200U	MB detection
K0802371-003	08031788SD	88		14U 9.8U 200U	
K0802371-004	08031814SD	14		10U 7.3U 150U	
K0802371-005	08031905SD	5		11U 7.2U 150U	
K0802371-006	08031806SD	6		6.8U 6.8U 140U	
K0802371-007	08032043SD	43		6.8U 6.8U 140U	
K0802371-008	08032044SD	44		7.7U 6.9U 140U	
K0802371-010	08030367SD	67		8.3U 7.3U 150U	
K0802371-014	08031049SD	49		7.0U 6.8U 140U	
K0802371-001	08031713SD	13	di-n-butyl phthalate bis (2-ethylhexyl) phthalate	11U 160U	MB detection
K0802371-009	08022965SD	65		6.9U 140U	
K0802371-011	08031046SD	46		7.9U 150U	
K0802371-012	08031047SD	47		7.6U 140U	

Table 2. Sediment Qualifer Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

CAS ID	URS ID	Station Number	Analyte	Qualifer	Rational
K0802371-013	08031048SD	48	di-n-butyl phthalate bis (2-ethylhexyl) phthalate	10U 140U	MB detection
K0802371-015	08031150SD	50		5.6U 120U	
K0802371-016	08031151SD	51		6.8U 140U	
K0801328-002	08021221SD	21		10U 200U	
K0801328-003	08021118SD	18		10U 200U	
K0801328-004	08021409SD	9		9.9U 200U	
K0801328-005	08021410SD	10		9.9U 200U	
K0801328-006	08021411SD	11		10U 200U	
K0801328-007	08021507SD	7		9.9U 200U	
K0801328-009	08021508SD	8		9.8U 200U	
K0801328-011	08022117SD	17		10U 200U	
K0801328-012	08022115SD	15	di-n-butyl phthalate	10U	MB detection
K0801328-013	08022116SD	16		9.9U	
K0801328-022	08022604SD	4		10U	
K0802371-001	08031713SD	13	Residual Range Organics (RRO)	180U	MB detection
K0802371-002	08031789SD	89		150U	
K0802371-003	08031788SD	88		130U	
K0802371-004	08031814SD	14		140U	
K0802371-005	08031905SD	5		140U	
K0802371-006	08031806SD	6		150U	
K0802371-007	08032043SD	43		150U	
K0802371-008	08032044SD	44		150U	
K0802371-009	08022965SD	65		150U	
K0802371-010	08030367SD	67		140U	
K0802371-011	08031046SD	46		140U	
K0802371-012	08031047SD	47		140U	
K0802371-013	08031048SD	48		150U	
K0802371-014	08031049SD	49		150U	
K0802371-015	08031150SD	50		180U	
K0802371-016	08031151SD	51		150U	
K0801769-009	08030686SD	86		180U	
K0801769-011	08030524SD	24		180U	
K0801769-023	08022535SD	35		160U	
K0801769-029	08022741SD	41		150U	
K0801769-030	08022742SD	42		150U	
K0801769-018	08030687SD	87	SVOCs	J/UJ	Surrogate Recovery

Table 2. Sediment Qualifer Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

CAS ID	URS ID	Station Number	Analyte	Qualifer	Rational
K0801769-021	08022229SD	29	fluorene fluoranthene	J/UJ	MS recovery
K0801769-005	08030426SD	26	fluorene di-n-butyl phthalate fluoranthene	J/UJ	LCS recovery
K0801769-006	08030427SD	27			
K0801769-007	08030428SD	28			
K0801769-009	08030686SD	86			
K0801769-010	08030522SD	22			
K0801769-011	08030524SD	24			
K0801769-017	08030685SD	85			
K0801769-018	08030687SD	87			
K0801769-021	08022229SD	29			
K0801769-022	08022536SD	36			
K0801769-023	08022535SD	35			
K0801769-024	08022534SD	34			
K0801769-025	08022637SD	37			
K0801769-026	08022738SD	38			
K0801769-027	08022739SD	39			
K0801769-028	08022740SD	40			
K0801769-029	08022741SD	41			
K0801769-030	08022742SD	42			
K0801769-029	08022741SD	41	Pyrene	J	LCS/LCSD RPD
K0801769-009	08030686SD	86	indeno(1,2,3-cd) pyrene	UJ	LCS/LCSD RPD
K0801769-010	08030522SD	22			
K0801769-011	08030524SD	24			
K0801769-017	08030685SD	85			
K0801769-021	08022229SD	29			
K0801769-024	08022534SD	34			
K0801769-027	08022739SD	39			
K0801769-028	08022740SD	40			
K0801769-030	08022742SD	42			

Notes:
Not included are laboratory-assigned J flags indicating detections above the MDL and below the MRL.
Concentrations are reported in dry wet.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

CLAM AND CRAYFISH TISSUE – FEBRUARY/MARCH 2008 SAMPLING EVENT

JULY 2008

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the tissue sample results shows the quality of the data is acceptable to support project objectives. The contracted laboratories provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated and flagged with a 'J' or 'UJ'. Some data were qualified as not detected and flagged with a 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the River Operable Unit Remedial Investigation Report.

2.0 Project Description

URS collected and authorized analysis of 36 crayfish and 37 clam samples (for a total of 73 tissue samples) during the remedial investigation near Bradford Island at Bonneville Dam between February 11 and March 19, 2008. Table 1 summarizes the sample locations, media, URS and analytical laboratory identification numbers, and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial Investigation* (URS 2007). Deviations from the sampling collection (i.e. number and volume per each pre-determined sample location) are addressed in the Post-Removal Sample Collection Memorandum (URS 2008). Deviations in sample locations and sample size do not affect data usability. Three crayfish samples (08021902CF, 08022003CF and 080314105CF) had insufficient sample volume to complete SVOC and PAH analyses as indicated in Table 1. The remaining 70 tissue samples had sufficient volume to analyze those analytes listed in the QAPP.

All samples were submitted to Columbia Analytical Services (CAS) located in Kelso, WA and logged in by the laboratory under five CAS sample delivery groups (K0801325, K0801458, K0801772, K0802375 and K0802503). Not all samples logged in under these sample delivery groups were authorized for analysis (i.e only tissue samples meeting project criteria were selected for analysis). The following table lists the parameters analyzed on one or more of the samples. Table 1 summarizes the specific analyses requested for each sample by URS and the corresponding laboratory identification numbers. (Note: SVOCs and PAHs were analyzed separately for tissue matrices and are discussed separately in this report).

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 6000/7000 series	Metals

Method	Analytical Parameter
EPA 1631-Modified	Methyl Mercury
EPA 8270C-SIM	Semi-Volatile Organic Compounds (SVOCs)
EPA 8270C-SIM	Polynuclear Aromatic Hydrocarbons (PAHs)
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry	Percent Solids

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable. The data were reviewed in accordance with the QAPP (URS 2007). The data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006) and the above-listed methods and the following EPA guidance documents in that order; EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Organic Data Review* (USEPA 1999) and EPA's *NFGs for Inorganic Data Review* (USEPA 2004). Project-specific QC criteria are listed in the above-mentioned QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are represented by their URS sample identification assigned in the field as well as the laboratory identification. The laboratory was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS and are not included in Table 2 for simplicity. These 'J' qualifiers are included in the database and are included in the data tables included in the main body of the remedial investigation report. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Clam samples were stored on ice prior to shucking by URS and then archived by freezing to -20°C in laboratory-provided 16oz glass containers prior submission to CAS. Crayfish were euthanized by freezing, and then they were weighed and measured prior to submission to CAS in laboratory-provided 16oz glass containers. URS frequently submitted both clam and crayfish samples to CAS throughout the six-week collection period. CAS archived all sample tissue frozen (-20°C) until authorization was given by URS to begin homogenization and analysis.

The chain-of-custody (COC) forms indicate that samples were maintained under chain-of-custody protocols and forms were signed upon release and receipt. All samples were sent via CAS courier in wet ice and were received and logged in by the laboratory on the same day. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below.

All samples were analyzed within the technical and contracted holding time with the following exceptions:

- The QAPP specified hold time is 28 days (frozen) for both mercury and methyl mercury. The short hold time of 28 days for inorganic mercury is due to the loss of analyte from evaporation. The DoD QSM does not stipulate hold times for methyl mercury; therefore, 28 days was selected as a conservative value for the QAPP. CAS lyophilizes (freeze dries) a portion of all tissue samples for mercury, methyl mercury and percent solid analyses. All tissue samples were freeze-dried prior to the typical 28 day hold time. The DoD QSM does not stipulate hold times for samples preserved by freeze drying. However, EPA Method 1631 *(Total Mercury in Tissue, Sludge, Sediment and Soil by Acid Digestion)* states freeze dried tissue can be stored unrefrigerated in a low-mercury atmosphere for a maximum of 1 year. There is no specific hold time guidance for methyl mercury analysis on freeze dried samples; however, the 1 year hold time stated above was deemed appropriate for methyl mercury as well. Tissue samples were not flagged based on hold time due to the samples being freeze dried prior to analysis.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Instrument calibrations were acceptable for all tissue sample analyses performed with the following exception:

- The ICAL for di-n-octyl phthalate exceeded the individual DoD QSM relative standard deviation (RSD) limit of ≤ 15% at 17.5%. The alternate criteria presented both in the DoD QSM (p.139) and EPA guidance was met. Additionally, the CCALs for this analyte were within the control limits. No qualification was assigned to the data based on this ICAL.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each analytical batch, per QAPP requirements. Field blanks were not collected as part of this analytical program. Qualification of samples due to method blank contamination followed guidelines set forth in the EPA NFGs.

Organic sample results less than five times (5x) and inorganic sample results (or common laboratory organic contaminates such as phthalates) less than ten times (x10) the method blank concentration and between the method detection limit (MDL) and the method reporting limit (MRL) were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged with a ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, these guidelines were applied using wet weight results and any flags applied were also applied to the dry weight results. All analytical tests indicate non-detects for method blanks with the following exceptions:

Clams

- Di-n-butyl phthalate was detected in the method blanks associated with sample delivery groups K0801325 and K0801772 at a concentration above the MRL (K0801325) and at a concentration below the MRL (K0801772). Samples K0801325-002, K0801325-006, K0801772-015, and K0801772-016 had results for di-n-butyl phthalate less than 10x the method blank concentration and were between the MDL and the MRL. These results were qualified as not detected and flagged 'U' at the MRL.

- PAHs in sample delivery group K0802503 were reextracted due to low surrogate recoveries (discussed below). The method blank associated with the reextraction (laboratory batch KWG0803570) had low-level detections for anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3,-cd)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene. The concentrations for the above-noted PAHs in the samples associated with this method blank (all samples in sample delivery group K0802503 and samples K0801772-010 and K0801772-020 (reextracts)) were greater than 5x the method blank concentrations, with the exception a few analytes in samples K0802503-002 and K0802503-005 (see Table 2). The results for PAHs with concentrations less than 5x the method blank concentrations in samples K0802503-002 and K0802503-005 are qualified as not detected and flagged with a 'U'.

Crayfish

- Mercury was detected in the method blank associated with sample delivery group K0802375 at a concentration above the MDL, but below the MRL. All sample results were greater than 10x this concentration; therefore, data were not qualified based on this method blank detection.

- Di-n-butyl phthalate was detected in the method blank associated with sample delivery group K0801458 at a concentration above the MRL. Samples K0801458-003, K0801458-004, K0801458-008, K0801458-010, K0801458-012, K0801458-015 and K0801458-016 had concentrations for di-n-butyl phthalate less than 10x the method blank concentration and were qualified as not detected and flagged 'U' as described above and as indicated in Table 2.

- Di-n-butyl phthalate was detected in the method blank associated with sample delivery group K0802375 at a concentration below the MRL. Samples K0802375-003, K0802375-007, K0802375-008, K0802375-010, K0802375-012 through K0802375-018, K0802375-024 and K0802375-025 had concentrations for di-n-butyl phthalate less than

10x the method blank concentration and were qualified as not detected and flagged ‘U’ as described above and as indicated in Table 2.

- Fluoranthene, pyrene and benzo(g,h,i)perylene were detected in the method blank associated with sample delivery group K0802375 at concentrations between the MDL and the MRL. All associated sample results for these analytes were reported at concentrations between the MDL and the MRL; therefore, results less than 5x the method blank concentration were qualified as not detected and flagged ‘U’ at the MRL (see Table 2 for specifics).

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. As noted above, PAHs and SVOCs were analyzed separately for all tissue matrices and both analyses utilized three surrogates. When more than one surrogate per fraction (acid or base/neutral) was spiked in the sample, PAHs and/or SVOCs were qualified if two or more surrogate recoveries for a given fraction exceeded DoD QSM sample criteria. When only one surrogate per fraction was spiked, all sample results associated with that fraction were qualified when the surrogate recovery exceeded DoD QSM sample criteria. Surrogate recoveries were acceptable for all analyses with the following exceptions:

Clams

- The percent recoveries for PAH surrogates fluorene-d10 and fluoranthene-d10 were below the lower DoD QSM control limit of 60% for some samples in extraction batch KWG0803121 associated with sample delivery group K0801772 (as shown below).

	fluorene-d10	fluoranthene-d10
K0801772-004	52	56
K0801772-010	34	32
K0801772-019	48	53
K0801772-020	36	44

  PAHs in this sample delivery group were reported from a combination of an undiluted analysis and a 5x dilution and the surrogates fluorene-d10 and fluoranthene-d10 for those above-listed samples were outside control limits for both runs (those shown above are from the full-strength run). All PAHs for these samples were qualified and flagged ‘J/UJ’ based on surrogate recoveries.

- The PAH surrogate recoveries associated with sample delivery group K0802503 were below the DoD QSM control limits (extraction batch KWG0803122). The entire analytical batch was reextracted for PAHs under extraction batch KWG0803570. All results were reported from the secondary analysis; therefore, the original results were flagged ‘DNR’. All surrogate recoveries in the secondary analysis were acceptable with the exception of fluorene-d10 and fluoranthene-d10 in sample K0802503-004 which had recoveries below the lower DoD QSM control limit of 60%. Results for sample K0802503-004 were reported from a combination of an undiluted analysis and a 5x dilution. The surrogate fluorene-d10 was below the lower control limit in both runs and fluoranthene-d10 was below the limit in the 5x dilution (most PAHs are reported from the 5x dilution). All PAH sample results were flagged ‘UJ/J’ for sample K0802503-004 based on surrogate recoveries.

- The percent recovery for the PAH surrogates fluoranthene-d10 and terphenyl-d14 in sample K0801325-012 were below the lower DoD QSM limits of 60% and 30% with recoveries of 59% and 24%, respectively. All PAHs in sample K0801325-012 were flagged ‘J/UJ’ to indicate potential low bias.

4.5 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory’s day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch were analyzed per method requirements.

LCS/LCSD and MS/MSD recoveries were acceptable for all analytical tests with the following exceptions:

Clams

- The MS/MSD performed on sample K0802503-005 had percent recoveries above DoD QSM limits for di-n-octyl phthalate and di-n-butyl phthalate. Both analytes were non-detect in the parent sample. The associated LCS and calibration standards indicate that the analytical batch was in control. Therefore, results for di-n-octyl phthalate and di-n-butyl phthalate were not qualified based on MS/MSD recoveries.
- The MSD percent recovery for sample K0802503-005 was below the DoD QSM control limit of 45% for bis(2-ethylhexyl) phthalate at 43%. Additionally, the RPD for the MS/MSD pair was above the 30% control limit at 33%. The associated MS, LCS and calibration standards indicate that the analytical batch was in control. The sample result for bis(2-ethylhexyl) phthalate was qualified as estimated and flagged ‘J’ in sample K0802503-005 due to the MSD and RPD results.
- MS/MSD percent recoveries were above the upper control limits for di-n-butyl phthalate and di-n-octyl phthalate in the MS/MSD performed on sample K0801772-007. The associated phthalates were non-detect in the parent sample. The associated MS, LCS and

calibration standards indicate that the analytical batch was in control. Analytical results for K0801772-007 were not qualified based on potential bias high MS recoveries.

- MS/MSD percent recoveries were above the upper control limit for di-n-butyl phthalate, butyl benzyl phthalate, bis(2-ethylhexyl) phthalate, and di-n-octyl phthalate in the MS/MSD performed on sample K0801325-005. The associated phthalates were non-detect in the parent sample with the exception of bis(2-ethylhexyl)phthalate which was previously qualified ‘J’ by the laboratory due to sample results being between the MRL and the MDL. No further qualification was necessary.
- LCS/LCSD percent recoveries associated with sample delivery group K0801325 were above the upper control limit for di-n-butyl phthalate, butyl benzyl phthalate, and di-n-octyl phthalate. The associated phthalates were not detected above the MRL in the associated samples. There were detections reported between the MDL and the MRL for di-n-butyl phthalate in samples K0801325-002 and K0801325-006; however, these detections were previously flagged ‘J’ by the laboratory. Further estimation of the data due to the potential high bias based on the LCS/LCSD recoveries was not necessary.

Crayfish

- MS/MSDs for copper were analyzed on four crayfish samples (two each from sample delivery groups K0802375 and K0801458). Either one or both of the MS/MSD recoveries in each of the four pairs were below the DoD QSM lower control limit of 80%, with values ranging from 58.5% to 77.4%. Associated QA/QC including LCS, SRM, post-spike and calibration standards indicate that the analytical batch was in control. All copper results in the crayfish samples were flagged ‘J’ to indicate the potential low bias in this matrix.
- An MS/MSD for aluminum was analyzed in sample K0802375-005 and had recoveries below the DoD limit of 80% at 67.8% and 62.2%, respectively. An MS/MSD analyzed for mercury in sample K0802375-007 had recoveries below the DoD QSM limit of 80% at 66.4% and 73.8%, respectively. Associated QA/QC including LCS, SRM, post-digestion spike and calibration standards indicate that the analytical batches were in control. MS/MSDs analyzed in similar crayfish matrixes were within control limits; therefore, only the parent samples were flagged ‘J’ to indicate potential low bias for aluminum and mercury in these samples.
- An MS/MSD analyzed for lead in sample K0801458-020 had percent recoveries below the DoD QSM limit of 80% at 73.2% and 75.2%, respectively. Associated QA/QC including LCS, SRM, post-digestion spike and calibration standards indicate that the analytical batch was in control. MS/MSDs analyzed in similar crayfish matrixes were within control limits, therefore only the parent sample was flagged ‘J’ to indicate potential low bias for lead in this sample.

- The MSD performed on sample K0802375-007 had percent recoveries below the DoD QSM limit of 80% for aluminum at 64.3% and copper at 65.9%. The MS, RPD and other QA/QC criteria were in control for this sample. The sample results were not flagged based solely on the MSD percent recoveries for aluminum and copper.
- The MS performed on sample K0802375-008 had a percent recovery below the DoD QSM limit of 80% for lead at 77.6% and the MS performed on sample K0802375-013 had a percent recovery below the lower limit of 80% for zinc at 72.9%. The MSDs, RPDs, and other QA/QC criteria were in control for these samples. The sample results were not flagged based solely on the MS percent recoveries.
- The percent recovery for lead in one of the standard reference material (SRM) samples (N.R.C.C Dorm-2) was slightly above the CAS control limits of 0.091 mg/kg with a concentration of 0.095 mg/kg in sample delivery group K0801458. The associated QA/QC samples including SRM (N.R.C.C. Tort-2) and the LCS indicate the analysis was in control. Data were not qualified based on the SRM recovery.

4.6 Duplicate Review

Field duplicates were not collected during this sampling event due to the statistical nature of the sampling event (as discussed in detail in the QAPP). To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. No samples were qualified based exclusively on duplicate precision.

4.7 Compound Quantification

Clam and Crayfish

- During the second column confirmation performed by CAS on Method 8082, the sample results for K0802503-001, K0802503-006, and K0801325-010 exceeded the confirmation column agreement criterion of RPD < 40% for Aroclor 1254 and were flagged ‘P’ by the laboratory. The lower of the results from the analyses on the two columns was selected for reporting due to the apparent interferences observed in the chromatogram for the column with the higher concentration. The sample results for Aroclor 1254 were qualified as estimated and flagged ‘J’ in the above listed samples.
- Two SRM samples were used to evaluate copper. One SRM (N.R.C.C Dorm-2) associated with sample delivery group K0801772 was above the CAS control limit (i.e. 3.23 mg/kg versus the control of 3.00 mg/kg). The concentration of copper in this SRM is near the sensitivity limit of the instrument. The LCS, MS, calibrations and the second SRM (31.2 mg/kg) were within control limits. Samples were not qualified due to the SRM recovery.

4.8 Reporting Limits

If sample results were detected at concentrations below the MRL but above the MDL, they were identified by the laboratory and flagged with a 'J'. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some data were qualified as estimated and flagged with a 'J' or a 'UJ'. Some data were qualified as not detected and flagged with a 'U.' A summary of qualifiers can be found in Table 2.

Samples K0801772-010 and K0801772-020 were reextracted and reanalyzed in extraction lot KWG0803570. The primary results were flagged 'DNR' and data were reported from the reextracted analyses.

The electronic and .pdf versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  = *(3,371 compliant / 3,371 total results)* = 100%

  All samples results are considered usable. In the case of the few samples reextracted and reanalyzed, the original samples flagged 'DNR' were not included in these calculations.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = (3,174 compliant / 3,371 total results) = 94%

  Data were qualified non-detect and flagged 'U' and some as estimated and flagged 'J' or 'UJ.' Data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = (3,371 compliant /3,371 total results) = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = *(70 compliant / 73 total results)* = 96%

All samples collected and submitted to CAS for analysis had acceptable results with the exception of the 3 crayfish samples which had inadequate sample volume for the SVOC analyses.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2008. Memorandum: *Post-Removal Sample Collection*, Bradford Island Disposal Site, Bonneville Dam Forebay – Cascade Locks, Oregon May 12, 2008

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

TABLES

Table 1. Clam and Crayfish Sample ID and Analysis Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	DATE COLLECTED	CAS ID	Anaytes						
				PCB (Aroclors)	SVOCs	PAHs	Metals	Methyl Mercury	%Lipids	%Solids
Clam - Forebay										
4	08022604TC	19-Feb	K0801325-010	X	X	X	X	X	X	X
7	08021507TC	15-Feb	K0801325-004	X	X	X	X	X	X	X
8	08021508TC	15-Feb	K0801325-005	X	X	X	X	X	X	X
9	08021409TC	14-Feb	K0801325-006	X	X	X	X	X	X	X
10	08021410TC	14-Feb	K0801325-008	X	X	X	X	X	X	X
11	08021411TC	14-Feb	K0801325-007	X	X	X	X	X	X	X
15	08022115TC	21-Feb	K0801325-012	X	X	X	X	X	X	X
16	08022116TC	21-Feb	K0801325-013	X	X	X	X	X	X	X
17	08022117TC	21-Feb	K0801325-014	X	X	X	X	X	X	X
18	08021118TC	11-Feb	K0801325-003	X	X	X	X	X	X	X
21	08021221TC	12-Feb	K0801325-002	X	X	X	X	X	X	X
5	08031905TC	19-Mar	K0802503-006	X	X	X	X	X	X	X
6	08031806TC	18-Mar	K0802503-001	X	X	X	X	X	X	X
13	08031713TC	17-Mar	K0802503-002	X	X	X	X	X	X	X
14	08031814TC	14-Mar	K0802503-003	X	X	X	X	X	X	X
65	08022965TC	29-Feb	K0802503-008	X	X	X	X	X	X	X
67	08030367TC	3-Mar	K0802503-007	X	X	X	X	X	X	X
88	08031788TC	17-Mar	K0802503-004	X	X	X	X	X	X	X
89	08031789TC	17-Mar	K0802503-005	X	X	X	X	X	X	X
Clam - Reference Area										
22	08030522TC	5-Mar	K0801772-012	X	X	X	X	X	X	X
24	08030524TC	5-Mar	K0801772-011	X	X	X	X	X	X	X
26	08030427TC	4-Mar	K0801772-018	X	X	X	X	X	X	X
27	08030426TC	4-Mar	K0801772-019	X	X	X	X	X	X	X
28	08030428TC	4-Mar	K0801772-014	X	X	X	X	X	X	X
29	08022229TC	22-Feb	K0801772-020	X	X	X	X	X	X	X
34	08022534TC	25-Feb	K0801772-021	X	X	X	X	X	X	X
35	08022535TC	25-Feb	K0801772-001	X	X	X	X	X	X	X
36	08022536TC	25-Feb	K0801772-002	X	X	X	X	X	X	X
37	08022637TC	26-Feb	K0801772-003	X	X	X	X	X	X	X
38	08022738TC	27-Feb	K0801772-004	X	X	X	X	X	X	X
39	08022739TC	27-Feb	K0801772-005	X	X	X	X	X	X	X
40	08022740TC	27-Feb	K0801772-006	X	X	X	X	X	X	X
41	08022741TC	27-Feb	K0801772-007	X	X	X	X	X	X	X
42	08022742TC	27-Feb	K0801772-010	X	X	X	X	X	X	X
85	08030685TC	6-Mar	K0801772-015	X	X	X	X	X	X	X
86	08030686TC	6-Mar	K0801772-016	X	X	X	X	X	X	X
87	08030687TC	6-Mar	K0801772-017	X	X	X	X	X	X	X
Crayfish - Forebay										
1	08021901CF	19-Feb	K0801458-005	X	X	X	X	X	X	X
2	08021902CF	19-Feb	K0801458-006	X	🟨	🟨	X	X	X	X
3	08022003CF	20-Feb	K0801458-007	X	🟨	🟨	X	X	X	X
4	08021904CF	19-Feb	K0801458-008	X	X	X	X	X	X	X
5	08021505CF	15-Feb	K0801458-009	X	X	X	X	X	X	X

Table 1. Clam and Crayfish Sample ID and Analysis Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

				Anaytes						
Station Number	**URS ID**	**DATE COLLECTED**	**CAS ID**	**PCB (Aroclors)**	**SVOCs**	**PAHs**	**Metals**	**Methyl Mercury**	**%Lipids**	**%Solids**
6	08021406CF	14-Feb	K0801458-001	X	X	X	X	X	X	X
7	08021407CF	14-Feb	K0801458-003	X	X	X	X	X	X	X
8	08021408CF	14-Feb	K0801458-002	X	X	X	X	X	X	X
13	08021413CF	14-Feb	K0801458-004	X	X	X	X	X	X	X
14	08022014CF	20-Feb	K0801458-010	X	X	X	X	X	X	X
15	08021915CF	19-Feb	K0801458-011	X	X	X	X	X	X	X
16	08022216CF	22-Feb	K0801458-020	X	X	X	X	X	X	X
17	08021917CF	19-Feb	K0801458-012	X	X	X	X	X	X	X
18	08021918CF	19-Feb	K0801458-013	X	X	X	X	X	X	X
19	08021919CF	19-Feb	K0801458-014	X	X	X	X	X	X	X
20	08021920CF	19-Feb	K0801458-015	X	X	X	X	X	X	X
21	08021921CF	19-Feb	K0801458-016	X	X	X	X	X	X	X
Crayfish - Reference Area										
22	08022622CF	19-Feb	K0802375-024	X	X	X	X	X	X	X
33	08022233CF	19-Feb	K0802375-025	X	X	X	X	X	X	X
38	08021838CF	20-Feb	K0802375-003	X	X	X	X	X	X	X
42	08022842CF	19-Feb	K0802375-004	X	X	X	X	X	X	X
72	08030372CF	15-Feb	K0802375-005	X	X	X	X	X	X	X
73	08030373CF	14-Feb	K0802375-006	X	X	X	X	X	X	X
74	08030374CF	14-Feb	K0802375-007	X	X	X	X	X	X	X
75	08030375CF	14-Feb	K0802375-008	X	X	X	X	X	X	X
76	08030376CF	14-Feb	K0802375-009	X	X	X	X	X	X	X
78	08030378CF	20-Feb	K0802375-010	X	X	X	X	X	X	X
79	08030379CF	19-Feb	K0802375-011	X	X	X	X	X	X	X
82	08030382CF	22-Feb	K0802375-012	X	X	X	X	X	X	X
90	08031290CF	19-Feb	K0802375-013	X	X	X	X	X	X	X
91	08031291CF	19-Feb	K0802375-014	X	X	X	X	X	X	X
92	08031292CF	19-Feb	K0802375-015	X	X	X	X	X	X	X
94	08031294CF	12-Mar	K0802375-016	X	X	X	X	X	X	X
98	08031298CF	12-Mar	K0802375-017	X	X	X	X	X	X	X
100	080312100CF	19-Feb	K0802375-018	X	X	X	X	X	X	X
105	080314105CF	19-Feb	K0802375-019	X	🟨	🟨	X	X	X	X

Notes:

SVOCs and PAHs are analyzed separately for tissue matrices.

🟨 = insufficient tissue volume to analyze SVOCs and PAHs

Table 2. Clam and Crayfish Qualifer Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	CAS ID	Analyte	Qualifer	Rational
Clam					
21	08021221TC	K0801325-002	di-n-butyl phthalate	40U	MB detection
9	08021409TC	K0801325-006		56U	
85	08030685TC	K0801772-015		35U	
86	08030686TC	K0801772-016		38U	
89	08031789TC	K0802503-005	benzo(b)fluoranthene	0.74U	MB detection
			benzo(k)fluoranthene	0.58U	
			benzo(a)pyrene	0.86U	
			indeno(1,2,3-cd)pyrene	0.26U	
			dibenzo(a,h)anthracene	0.11U	
			benzo(g,h,i)perylene	0.38U	
13	08031713TC	K0802503-002	benzo(g,h,i)perylene	0.56U	MB detection
38	08022738TC	K0801772-004	acenapthene fluorene phenanthrene anthracene fluoranthene pyrene benzo(a)anthracene chrysene benzo(a)fluoranthene benzo(k)fluoranthene benzo(a)pyrene indeno(1,2,3-cd)pyrene dibenzo(a,h)anthracene benzo(g,h,i)perylene	J/UJ	PAH surrogate recovery *(fluorene-d10 and fluoranthene-d10)*
42	08022742TC	K0801772-010			
27	08030426TC	K0801772-019			
29	08022229TC	K0801772-020			
88	08031788TC	K0802503-004			
15	08022115TC	K0801325-012	PAHs (see list above)	J/UJ	PAH surrogate recovery *(fluorene-d10 and terphenyl-d14)*
4	08022604TC	K0801325-010	Aroclor 1254	J	second column confirmation
5	08031905TC	K0802503-006			
6	08031806TC	K0802503-001			
89	08031789TC	K0802503-005	bis(2-ethylhexyl) phthalate	J	MSD and RPD recoveries
42	08022742TC	K0801772-010	PAHs	DNR	Report data from reextraction
29	08022229TC	K0801772-020			
PAH results in K0802503					
Crayfish					
4	08021904CF	K0801458-008	di-n-butyl phthalate	180U	MB detection
7	08021407CF	K0801458-003		58U	
13	08021413CF	K0801458-004		39U	
14	08022014CF	K0801458-010		48U	
20	08021920CF	K0801458-015		37U	
21	08021921CF	K0801458-016		38U	
17	08021917CF	K0801458-012		76U	
38	08021838CF	K0802375-003		92U	
74	08030374CF	K0802375-007		110U	
75	08030375CF	K0802375-008		79U	
78	08030378CF	K0802375-010		45U	
82	08030382CF	K0802375-012		70U	
90	08031290CF	K0802375-013		73U	
91	08031291CF	K0802375-014		40U	
92	08031292CF	K0802375-015		38U	
94	08031294CF	K0802375-016		55U	
98	08031298CF	K0802375-017		57U	
100	080312100CF	K0802375-018		39U	
22	08022622CF	K0802375-024		80U	
33	08022233CF	K0802375-025		50U	
22	08022622CF	K0802375-024	fluoranthene	0.49U	MB detection
33	08022233CF	K0802375-025	pyrene		
38	08021838CF	K0802375-003	fluoranthene pyrene	0.50U	
42	08022842CF	K0802375-004			
91	08031291CF	K0802375-014			
92	08031292CF	K0802375-015			
94	08031294CF	K0802375-016			
73	08030373CF	K0802375-006			

Table 2. Clam and Crayfish Qualifer Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	CAS ID	Analyte	Qualifer	Rational
72	08030372CF	K0802375-005	fluoranthene pyrene benzo(g,h,i)perylene	0.48U	MB detection
74	08030374CF	K0802375-007	fluoranthene pyrene benzo(g,h,i)perylene	0.50U	
75	0803075CF	K0802375-008	fluoranthene pyrene	0.48U	
76	08030376CF	K0802375-009	fluoranthene pyrene	0.49U	
78	08030378CF	K0802375-010			
79	08030379CF	K0802375-011			
82	08030382CF	K0802375-012			
90	08031290CF	K0802375-013	fluoranthene pyrene	0.45U	
98	08031298CF	K0802375-017	fluoranthene pyrene benzo(g,h,i)perylene	0.49U	
100	080312100CF	K0802375-018	fluoranthene pyrene	0.49U	
1	08021901CF	K0801458-005	copper	J	MS/MSD recoveries
2	08021902CF	K0801458-006			
3	08022003CF	K0801458-007			
4	08021904CF	K0801458-008			
5	08021505CF	K0801458-009			
6	08021406CF	K0801458-001			
7	08021407CF	K0801458-003			
8	08021408CF	K0801458-002			
13	08021413CF	K0801458-004			
14	08022014CF	K0801458-010			
15	08021915CF	K0801458-011			
16	08022216CF	K0801458-020			
17	08021917CF	K0801458-012			
18	08021918CF	K0801458-013			
19	08021919CF	K0801458-014			
20	08021920CF	K0801458-015			
21	08021921CF	K0801458-016			
22	08022622CF	K0802375-024			
33	08022233CF	K0802375-025			
38	08021838CF	K0802375-003			
42	08022842CF	K0802375-004			
72	08030372CF	K0802375-005			
73	08030373CF	K0802375-006			
74	08030374CF	K0802375-007			
75	08030375CF	K0802375-008			
76	08030376CF	K0802375-009			
78	08030378CF	K0802375-010			
79	08030379CF	K0802375-011			
82	08030382CF	K0802375-012			
90	08031290CF	K0802375-013			
91	08031291CF	K0802375-014			
92	08031292CF	K0802375-015			
94	08031294CF	K0802375-016			
98	08031298CF	K0802375-017			
100	080312100CF	K0802375-018			
105	080314105CF	K0802375-019			
16	08022216CF	K0801458-020	lead	J	MS/MSD recoveries
72	08030372CF	K0802375-005	aluminum		
74	08030374CF	K0802375-007	mercury		

Notes:

Not included are laboratory-assigned J flags indicating detections above the MDL and below the MRL.

Concentrations are reported in weight wet.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

WATER – FEBRUARY/MARCH 2008 SAMPLING EVENT

JULY 2008

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the grab water and high volume water sample results shows the quality of the data is acceptable to support project objectives. The contracted laboratories provided all requested analyses and delivered data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of the River Operable Unit Remedial Investigation Report.

2.0 Project Description

URS collected and authorized analysis of 11 grab water samples (10 primary and one field duplicate) and 11 high volume water samples (10 primary and one field blank) during the remedial investigation near Bradford Island at Bonneville Dam between February 11 and March 20, 2008. Tables 1 summarizes the sample location, media, URS and laboratory identification numbers and the requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial Investigation* (URS 2007). Deviations from the QAPP protocol were not necessary, specific details of the sample collection are addressed in the Post-Removal Sample Collection Memorandum (URS 2008). Briefly, high-volume water samples were collected using an Infiltrex 300 Organic Sampling System (Infiltrex) supplied by Axys Environmental Systems in Sidney, British Columbia, Canada. Water is pumped in series through a wound-glass filter to remove particulate-bound analytes, and through a column packed with macroreticular porous resin (XAD resin) where dissolved-phase analytes are absorbed. During this field effort, approximately 600 liters of water were filtered for each sample. The filter and column at each sample location were analyzed separately to represent the particulate and dissolved phase of the water column. Flow rate was measured both on the Infiltrex’s internal digital flow meter and verified periodically by hand using a graduated cylinder and a stopwatch. The reported concentrations are calculated using the total volume from the digital flow meter. Additionally, grab water samples were collected at each sample station using a peristaltic pump and dedicated tubing.

All Infiltrex samples were submitted to Axys Analytical Services, Ltd. Located in Sidney, British Columbia (Axys) for analysis. Grab water samples were sent to Columbia Analytical Services (CAS) located in Kelso, WA. Axys uses specialized methods to analyze PAHs and phthalate esters, these methods are modeled after EPA Method 1668A, in that target concentrations are determined by a either isotope dilution or isotopically labeled internal standards using high resolution gas chromatography/low resolution mass spectroscopy (HRGC/LRMS). Sample-specific detection limits are also calculated similar to EPA 1668A.

Axys provides details about these methods in the case narratives within the data deliverables. The PAH and phthalate ester data qualifiers applied during this review are similar to those applied to the congener data.

The following table lists the parameters analyzed on one or more of the samples. Axys was not able to analyze for two analytes in the project-specific SVOC list (carbazole and p-cresol), the remaining four analytes in the project-specific SVOC list were phthalate esters and therefore, Axys refers to the SVOCs as phthalates esters in the reporting of the data. For clarity, the SVOCs are referred to as phthalate esters in this report. Table 1 summarizes the specific requested analyses for each media by URS and laboratory identification numbers.

Method	Analytical Parameter
EPA 1668A (Axys MLA-010) – HRGC/HRMS	Polychlorinated Biphenyls (PCBs) – Congeners
Axys MLA-021 – HRGC/LRMS	Polycyclic Aromatic Hydrocarbons (PAHs)
Axys MLA-027 – HRGC/LRMS	SVOCs (Phthalate Esters)
NWTPH-Dx (Ecology 1997)	Northwest Total Petroleum Hydrocarbons – Diesel Range (NWTPH-Dx)
415.1	Total Organic Carbon (TOC)
415.1	Dissolved Organic Carbon (DOC)
EPA 300.0	Chloride, Sulfate
EPA 353.2	Nitrate/Nitrite

HR – High Resolution
LR – Low Resolution
GC – Gas Chromatography
MS – Mass Spectrometry

4.0 Data Validation

Analyses were performed in general accordance with the above reference methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items will be reviewed on 15% or greater of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable.

The data were reviewed in accordance with the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial Investigation* (URS 2007). Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (September 2005) and EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like*. For the specialized PAH and phthalate ester method developed by Axys, laboratory derived quality criteria in conjunction with the above listed guidance were used in this review.

All remaining non-congener data results were reviewed in accordance with the criteria contained in the DoD QSM (DoD QSM, 2006) and the above listed methods and the following EPA guidance documents in that order; EPA's *NFGs for Organic Data Review (USEPA 1999)* and EPA's *NFGs for Inorganic Data Review (USEPA 2004)*. Project-specific QC criteria are listed in the above mentioned QAPP. A summary of qualifiers assigned to results in this investigation as part of this review is included in Table 2. Samples are referenced by both by their URS sample identification assigned in the field as well as the laboratory identification. CAS was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS Kelso and are not included in Table 2. Non-detect values for PCBs, PAHs and SVOCs (phthalate esters) as analyzed by Axys are reported at their respective sample-specific detection limits as discussed above. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the **E**stimated **M**aximum **P**otential **C**oncentration of the analyte in the sample used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Grab Water Samples

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt, with the exception of one COC form associated with sample delivery group K0802104. This COC form was not signed by URS upon release to the sample courier, the sample courier did sign the COC and all samples arrived intact at the laboratory. Data within this sample delivery group were not qualified based on missing COC signature.

All samples were sent via CAS courier in wet ice and were received and logged in the same day. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below. Data were not qualified based COC or cooler temperature.

The QAPP stated unpreserved sample containers would be used for TPH samples, however HCl preserved containers were used to extend the holding time from 7 to 14 days per guidance from the NWTPH method. All water samples were analyzed within the technical and contracted holding times.

Infiltrex Samples

Infiltrex columns and filters were stored at or below 6°C by URS until the completion of the last Infiltrex sampling event. All Infiltrex samples were shipped with gel ice packs via FedEx to Axys on March 17, 2008. The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody, and forms were signed upon release and receipt. All Infiltrex samples were analyzed within the technical holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICAL) and continuing calibrations (CCAL) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Grab Water

Instrument calibrations were acceptable for all samples analyses performed.

Infiltrex (congeners)

Initial calibrations (ICALs) and continuing calibration verifications (CCVs) were reviewed for PCB congener analyses. The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at the appropriate concentrations required by EPA Method 1668A. All calibration compounds analyzed associated with the Infiltrex samples meet the acceptance criteria as listed in Method 1668A.

Infiltrex (PAHs and phthalate esters)

ICAL and CCVs were reviewed for PAHs and phthalate esters. Similar to Method 1668A the ICAL is performed using a series of solutions including the suite of labeled surrogates and recovery standards that encompass the working concentration range of the instrument. CCVs are analyzed bracketing the samples as well as once every twelve hours. All calibration compounds analyzed associated with the Infiltrex samples meet Axys derived acceptance criteria.

Labeled Internal Standard Recovery Review (Infiltrex samples only)

PCB congeners

PCB congener samples were spiked with labeled internal standards prior to extraction or cleanup. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against labeled injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards is compared with the limits set forth in EPA Method 1668A. All recoveries were acceptable.

Cleanup standards are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

PAHs and phthalate esters

Similar to the above mentioned Method 1668A, labeled standards are spiked into the sample prior to the beginning of analysis. These labeled standards (called ‘surrogates’ within the Axys data packages) are deuterated versions of the PAH and phthalate ester parent analytes. All samples are recovery-corrected based on the concentration of these labeled standards. The percent recovery of these deuterated standards were within Axys derived control limits with the following exceptions:

- d4-dimethyl phthalate associated with sample L10998-4 was below the Axys control limit of 40% with 33.5%. As stated above all results are recovery corrected, therefore the results for dimethyl phthalate were not flagged based this labeled standard recovery.

Cleanup standards are not used for PAH and phthalate ester analysis.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank for each analysis and for each batch, per QAPP requirements. Qualification of samples due to method or field blank contamination followed guidelines set forth in the EPA NFGs .

Grab Water

For organic and inorganic analyses, sample results less than five times (5x) (or 10x for phthalates) the method blank or field blank concentration and between the method detection limit (MDL) and the method reporting limits (MRL) were flagged as non-detect ‘U’ at the MRL. When sample results were less than 5x (or 10x for phthalates) the blank concentration but above the MRL, the reported result was qualified as non-detect ‘U’. Target compounds detected in the method but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. For inorganic analyses initial and continuing calibration blanks were examined in addition to the standard method blank samples. Field blanks were not collected for the grab water during this sampling event. All analytical tests indicate non-detects for method blanks with the following exceptions:

- Chloride was detected in the method blank below the MRL in sample delivery group K0801765. All sample results were above 5x the method blank concentration therefore, data were not qualified based on this method blank detection.

- Arsenic, beryllium, copper and thallium were detected in the continuing calibration blank (CCB) below the MRLs in sample delivery group K0801765. All associated detected results were greater than 10x the CCB concentrations with the exception of arsenic in samples K0801765-003 Diss and K0801765-005 Diss, cadmium in samples K0801765-003 and K0801765-005 and thallium in samples K0801765-001, K0801765-001 Diss, K0801765-003, K0801765-003 Diss, K0801765-005 and K0801765-005 Diss. Results for these samples were flagged ‘U’ following guidance described above.

- Aluminum, antimony, mercury and nickel were detected below the MRLs in the method blank and beryllium was detected below the MRL in the continuing calibration blank in sample delivery group K0801289. All associated detected results were greater than 10x the MB concentrations with the exception of aluminum in sample K0801289-001, K0801289-001 Diss, K0801289-002 and K0801289-002 Diss, results for aluminum were flagged ‘U’ at the MRL.

- Antimony and mercury were detected below the MRLs in the method blank in sample delivery group K0801530. All samples results were non-detect for mercury. All associated detected results for antimony were below the MRL and above the MDL. Detected results for antimony for samples K0801530-005, K0801530-005 Diss and K0801530–009 were flagged ‘U’ at the MRL.

- Residual Range Organics (RRO) were detected below the MRL in the method blank in sample delivery groups K0801289 and K0801530. Samples results detected below 5x the MB concentration and below the MRL and were flagged 'U' at the MRL.
- Arsenic, beryllium, cadmium, copper and thallium were detected in the continuing calibration blank (CCB) below the MRLs in sample delivery group K0802104. All associated detected results were greater than 10x the CCB concentrations with the exception of arsenic in samples K0802104-001 and K0802104-001 Diss, cadmium in sample K0802104-001 and thallium in sample K0802104-001. Results for these samples were flagged ‘U’ as described above.

Infiltrex

Sample results that were reported as detected at a concentration less than five times (5x) (or 10x for phthalates) the associated method blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x (or 10x for phthalates) the laboratory or field blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified.

Method 1668A stipulates using a method blank as similar to the sample matrix as possible. Method blanks were prepared using clean filters and XAD resin. Method blank analytical results were non-detects with the exception of some PCB congeners and phthalate esters.

A field blank was collected on the Infiltrex to measure background levels of chemicals of potential concern in the atmosphere, instrument tubing and XAD column and filters. The field blank was collected by pumping laboratory provided deionized (6 liters) water through the Infiltrex system. Field blank analytical results were non-detects with the exception of some PCB congeners, PAHs and phthalate esters.

The sample concentrations in the data deliverables are reported as picograms per liter (pg/L) or absolute picograms measured divided by volume (in liters) pumped through the Infiltrex system. Since the volume of each sample varies and the method blank and field blank do not have comparable volumes to the samples, both the blank comparisons were performed using the absolute picograms concentrations. Picograms concentrations were calculated by multiplying the total volume (in liters) by the reported concentration in pg/L. Tables 4 and 5 indicate the results that were qualified non-detect ‘U’ based on method blank and field blank concentrations.

4.4 Surrogate Recovery Review

Each sample analyzed for organic compounds other than the HRGC/HRMS and HRGC/LRMS analyses was spiked with surrogates (system monitoring compounds) prior to extraction. Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- Surrogates o-terphenyl and n-triacontane in the LCS standard for NWTPH in sample delivery group K0802104 had recoveries above control limits of 150% with 152% and

155% respectively. All samples were non-detect, therefore data were not qualified based on the potential high bias indicated by the recoveries of the surrogates.

- Surrogate recoveries for o-terphenyl and n-triacontane in the LCS associated with the NWTPH analysis for sample delivery group K0801289 were below the lower control limits of 50%. The duplicate LCS and all other surrogate recoveries within project samples were within the control limits, the bias low recoveries appears to be isolated to the single LCS sample, data were not qualified based on surrogate recoveries in the LCS.

4.5 Infiltrex Sampling Recovery Standards

Analytes can both adsorb and desorb from the XAD resin during the high volume sampling process. In order to understand analyte retention on the XAD resin during sampling, labeled standards are spiked onto the Infiltrex columns prior to sample collection. Axys spiked carbon-13 labeled PCBs (PCB 31, PCB 95 and PCB 153) as well as deuterated anthracene (d10-anthracene) onto the Infiltrex columns prior to shipment to URS. High recoveries of these labeled standards suggest little to no net loss of adsorbed analytes on the XAD column during this sampling event. The recoveries of these analytes shown in Table 6 and are presented in the Axys data deliverables as ‘client standards’.

4.6 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy of the analysis for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD for each analysis and for each batch per method requirements. MS/MSD samples are not required for PCB congener analysis and not used for PAHs and phthalate esters as analyzed per Axys method. Ongoing precision and recovery (OPR) samples are used in place of LCS to monitor laboratory performance.

LCS, OPR and MS/MSD recoveries were acceptable for all analytical tests with the following exceptions:

- The LCS associated with the NWTPH-Dx analysis in sample delivery group K0801269 had low surrogate recoveries as discussed above. LCS recoveries for this LCS sample were also low. The low recoveries appear to be isolated with the LCS, the duplicate LCS recoveries were within control limits and the associated surrogates in the samples were acceptable. NWTPH-Dx results were not considered to need qualification as estimated based on the LCS recoveries.
- OPR recovery of acenaphthene was over the Axys derived control limit of 130% with 152% in DPW25236, all associated sample results for acenaphthene in the XAD filters were non-detect. Therefore, data was not qualified based on the potential high bias indicated by the high OPR recovery.

4.7 Duplicate Review

A field duplicate was collected at one grab water sampling location by simultaneously filling duplicate sets of laboratory-provided sample containers to verify acceptable field sampling techniques and representativeness of sample aliquots to the medium sampled. Field duplicates were not collected for the Infiltrex samples. The RPD for field duplicates was calculated when both sample results were greater than 5x the reporting limit. Field duplicate precision was acceptable.

To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. All values were expectable with the following exceptions:

- As previously discussed the LCS for NWTPH-Dx in sample delivery group K0801289 had low recoveries, resulting in RPD values for the LCS/LSCD pair being outside the control limits. The data were not considered to need qualification as estimated due to the LCS recoveries and likewise the RPD values for the reasons described above under LCS evaluation.

4.8 Compound Quantification

As detailed in Table 2, some congener results were qualified as non-detect due to method blank contamination. Results were qualified as non-detect at the MRL; therefore, these non-detect results do not have elevated detection limits which should be considered by the data user as part of evaluating the data for end-use objectives.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. A slight deviation was seen in the lock mass spectra associated with the mono-chlorinated PCBs in the XAD filter samples (DPWG25357). This deviation in lock mass did not effect the quantification of the target PCBs. No congener results were qualified based on lock mass variations.

4.9 Compound Identification

Ion abundance ratios are used to identify PCB congeners, PAHs and phthalate esters. Results that met all other qualitative identification criteria but were more than 15% different from the theoretical ion abundance criterion for PCBs as set by EPA Method 1668A are flagged in the laboratory report with a ‘K’ flag. PAHs and phthalate esters with relative ion abundance ratios greater than 20% different from the opening calibration values are flagged 'K'. Those results flagged 'K' with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). J-EMPC qualifiers are shown in Tables 4 and 5, the database has been updated and the flags will appear in any future data tables that are created from the project database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

4.9 Reporting Limits

If sample concentrations were detected below the MRL but above the MDL, they were identified by CAS and flagged estimated, 'J'. This laboratory flag was carried over to a "J" as the URS Review Qualifier and is recorded in the database and in the data tables included in the main body of this report.

5.0 Completeness

The laboratory reported all requested analyses and the deliverable data reports were complete. Some results were considered to be estimated and were qualified 'J', 'J-EMPC' and others were considered non-detects, 'U', based on blank contamination. A summary of qualifiers can be found in Tables 2 through 5.

The electronic and pdf versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to the associated laboratory and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  = *(5,742 compliant / 5,742 total results)* = 100%

  All samples results are considered useable.
- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = *(4,732 compliant / 5,742 total results) = 82%*

  Data were qualified non-detect 'U' and some as estimated 'J' of 'J-EMPC'. Data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = (5,742 compliant /5,742 total results) = 99%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  11 grab water + 22 Infiltrex = 33 samples collected

  =(33 compliant / 33 total results) =100%

  All samples collected and submitted to CAS and Axys for analysis had a complete set of results. All samples had sufficient sample volume to analyze the full analyte list as detailed in the QAPP.

6.0 References

Axys MLA–027. *Determination of Polycyclic Aromatic Hydrocarbons (PAHs), Alkylated PAH and Alkanes in Sediment, Tissue, Water, Hexane Extracts, XAD Resin and Filter Samples by GC/MS*. MSU-009 Rev 3. November 27, 2007.

Axys MLA–021. *Determination of Phthalate Esters in Sediment, Tissue, Water, Hexane Extracts, XAD Resin and Filter Samples by GC/MS*. MSU-009 Rev 8. December 17, 2007.

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

Ecology 1997. Washington State Department of Ecology, *Analytical Methods for Petroleum Hydrocarbons*, Publication ECY 97-602, June 1997.

URS 2008. Memorandum: *Post-Removal Sample Collection*, Bradford Island Disposal Site, Bonneville Dam Forebay – Cascade Locks, Oregon May 12, 2008

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 2005. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 1999. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

USEPA 1995. U.S. Environmental Protection Agency (USEPA) Region 10 for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

TABLES

Table 1. Infiltrex Water Sample ID and Analysis Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	Date Collected	Axys ID (Filter)	Axys ID (Column)	PCB (congeners)	PAHs	SVOCs (Phthalate Esters)
52	08021252XAD	12-Feb-08	L11001-1	L10998-1	X	X	X
53	08022453XAD	24-Feb-08	L11001-2	L10998-2	X	X	X
54	08021354XAD	13-Feb-08	L11001-3	L10998-3	X	X	X
55	08022555XAD	25-Feb-08	L11001-4	L10998-4	X	X	X
56	08022156XAD	21-Feb-08	L11001-5	L10998-5	X	X	X
57	08022757XAD	27-Feb-08	L11001-6	L10998-6	X	X	X
58	08030758XAD	7-Mar-08	L11001-7	L10998-7	X	X	X
59	08022959XAD	29-Feb-08	L11001-8	L10998-8	X	X	X
60	08030460XAD	4-Mar-08	L11001-9	L10998-9	X	X	X
61	08030661XAD	6-Mar-08	L11001-10	L10998-10	X	X	X
Field Blank	080306FBXAD	6-Mar-08	L11001-11	L10998-11	X	X	X

Notes:
Columns and filters analyzed separately.

Axys Data Package Identification Numbers
(Axys reported the four phthalates separately from the PAHs)

DPWG25235	PAHs - Column Phase
DPWG25236	PAHs - Filter Phase
DPWG25265	SVOCs (Phthalate Esters) - Filter Phase
DPWG25339	SVOCs (Phthalate Esters) - Column Phase
DPWG25357	Congeners - Filter Phase
DPWG25531	Congeners - Column Phase
DPWG25552	Reanalysis of Ester - Column Phase

Table 2. Grab Water Sample ID and Analysis Summary

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	Date Collected	CAS ID	Analytes						
				Metals (Total)	Metals (Dissolved)	TPH-Dx (Total)	TPH-Dx (Dissolved)	Anions (Chloride, Sulfate, Nitrate/Nitrite)	TOC	DOC
52	08021252SW	12-Feb-08	K0801289-001	X		X		X	X	
	08021252SW-F		K0801289-001 Diss		X		X			X
53	08022453SW	24-Feb-08	K0801530-003	X		X		X	X	
	08022453SW-F		K0801530-003 Diss		X		X			X
54	08021354SW	13-Feb-08	K0801289-002	X		X		X	X	
	08021354SW-F		K0801289-002 Diss		X		X			X
55	08022555SW	25-Feb-08	K0801530-005	X		X		X	X	
	08022555SW-F		K0801530-005 Diss		X		X			X
56	08022156SW	21-Feb-08	K0801530-001	X		X		X	X	
	08022156SW-F		K0801530-001 Diss		X		X			X
57	08022757SW	27-Feb-08	K0801530-009	X		X		X	X	
	08022757SW-F		K0801530-009 Diss		X		X			X
58	08030758SW	7-Mar-08	K0802104-001	X		X		X	X	
	08030758SW-F		K0802104-001 Diss		X		X			X
59	08022959SW	29-Feb-08	K0801765-001	X		X		X	X	
	08022959SW-F		K0801765-001 Diss		X		X			X
60	08030460SW	4-Mar-08	K0801765-003	X		X		X	X	
	08030460SW-F		K0801765-003 Diss		X		X			X
61	08030661SW	6-Mar-08	K0801765-005	X		X		X	X	
	08030661SW-F		K0801765-005 Diss		X		X			X
62	08022762SW	27-Feb-08	K0801530-007	X		X		X	X	
(duplicate of 57)	08022762SW-F		K0801530-007 Diss		X		X			X

Table 3. Summary of Qualifiers for Grab Water Samples

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

CAS ID	URS ID	Analyte	Qualifier	Rational
K0801289-001	08021252SW	aluminum	145U	method blank detection
K0801289-001 Diss	08021252SW-F		50U	
K0801289-002	08021354SW		152U	
K0801289-002 Diss	08021354SW-F		50U	
K0801530-005	08022555SW	antimony	50U	
K0801530-005 Diss	08022555SW-F		50U	
K0801530-009	08022757SW		50U	
K0801289-001	08021252SW	residual range organics (RRO)	110U	
K0801289-001 Diss	08021252SW-F		120U	
K0801289-002	08021354SW		110U	
K0801289-002 Diss	08021354SW-F		120U	
K0801530-001 Diss	08022156SW-F		100U	
K0801530-003	08022453SW		100U	
K0801530-005	08022555SW		100U	
K0801530-005 Diss	08022555SW-F		100U	
K0801530-007	08022762SW		100U	
K0801530-007 Diss	08022762SW-F		100U	
K0801530-009	08022757SW		100U	
K0801530-009 Diss	08022757SW-F		100U	
K0801765-003 Diss	0803060SW-F	arsenic	1.10U	continuing calibration blank detection
K0801765-005 Diss	08030661SW-F		1.14U	
K0802104-001	08030758SW		1.05U	
K0802104-001 Diss	08030758SW-F		1.15U	
K0801765-003	0803060SW	cadmium	0.020U	
K0801765-005	08030661SW		0.020U	
K0802104-001	08030758SW		0.020U	
K0801765-001	08022959SW	thallium	0.037U	
K0801765-001 Diss	08022959SW-F		0.024U	
K0801765-003	0803060SW		0.024U	
K0801765-003 Diss	0803060SW-F		0.020U	
K0801765-005	08030661SW		0.027U	
K0801765-005 Diss	08030661SW-F		0.020U	
K0802104-001	08030758SW		0.020U	

Table 4. Summary of Qualifers for Infiltrex Samples (PAHs and Phthalate Esters)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

		Parameter	Polynuclear Aromatic Hydrocarbons (PAHs) (units = ng/L or ppt)																								Phthalate Esters (units = ng/L or ppt)							
		Method	Axys Labs Method MLA-021																								Axys Labs Method MLA-027							
Sample Station	URS ID	Lab ID	**Acenaphthene** Lab Qualifer	URS Review Qualifer	**Anthracene** Lab Qualifer	URS Review Qualifer	**Benz(a)anthracene** Lab Qualifer	URS Review Qualifer	**Benzo(a)pyrene** Lab Qualifer	URS Review Qualifer	**Benzo(b)fluoranthene** Lab Qualifer	URS Review Qualifer	**Benzo(g,h,i)perylene** Lab Qualifer	URS Review Qualifer	**Benzo(j,k)flouranthenes** Lab Qualifer	URS Review Qualifer	**Chrysene** Lab Qualifer	URS Review Qualifer	**Dibenz(a,h)anthracene** Lab Qualifer	URS Review Qualifer	**Fluoranthene** Lab Qualifer	URS Review Qualifer	**Indeno(1,2,3-cd)pyrene** Lab Qualifer	URS Review Qualifer	**Phenanthrene** Lab Qualifer	URS Review Qualifer	**Bis(2-ethylhexyl) Phthalate** Lab Qualifer	URS Review Qualifer	**Butyl Benzyl Phthalate** Lab Qualifer	URS Review Qualifer	**Di-n-butyl Phthalate** Lab Qualifer	URS Review Qualifer	**Di-n-octyl Phthalate** Lab Qualifer	URS Review Qualifer
Column Fraction																																		
P52	08021252X	L10998-1	**0.706**		**0.08 K**	U	0.01 U		0.02 U		0.02 U		0.01 U		0.02 U		**0.05**		0.02 U		**0.52**	U	0.01 U		**1.39**		**11.8**	U	**0.42**	U	**1.97**	U	**0.31 K**	U
P53	08022453X	L10998-2	**1.12**		**0.08 K**	U	**0.01 K**	**J-EMPC**	0.02 U		0.01 U		0.01 U		0.02 U		**0.04**		0.02 U		**0.54**	U	0.01 U		**1.27**		**10.5**	U	**0.32**	U	**0.8**	U	**0.15**	U
P54	08021354X	L10998-3	**0.894**		**0.06 K**	U	**0.01**		0.03 U		0.02 U		0.01 U		0.02 U		**0.05**		0.01 U		**0.56**	U	0.01 U		**1.5**		**8.77**	U	**2.29 K**	U	**0.93**	U	**0.85**	U
P55	08022555X	L10998-4	**1.26**		**0.1 K**	U	**0.02**		0.02 U		0.01 U		0.02 U		0.01 U		**0.05**		0.02 U		**0.56**	U	0.02 U		**1.28**		**7.92**	U	**0.27**	U	**0.57**	U	**0.13**	U
P56	08022156X	L10998-5	**1.03**		**0.08 K**	U	**0.01**		0.01 U		**0.01 K**	**J-EMPC**	0.02 U		0.01 U		**0.05**		0.01 U		**0.57**	U	0.02 U		**1.39**		**6.52**	U	**0.26**	U	**0.56**	U	**0.11**	U
P57	08022757X	L10998-6	**1.28**		**0.08 K**	U	**0.01 K**	**J-EMPC**	0.02 U		0.01 U		0.02 U		0.01 U		**0.04**		0.02 U		**0.49**	U	0.02 U		**1.26**		**17**	U	**0.45**	U	**0.66**	U	**0.19**	U
P58	08030758X	L10998-7	**0.862**		**0.07 K**	U	0.02 U		0.01 U		0.01 U		0.01 U		0.01 U		**0.05**		0.02 U		**0.59**	U	0.01 U		**1.2**		**15.5**	U	**0.50**	U	**0.73**	U	**0.20**	U
P59	08022959X	L10998-8	**2.41**		**0.13 K**	U	**0.02**		0.02 U		0.01 U		0.01 U		0.02 U		**0.05**		0.02 U		**0.63**		0.02 U		**1.52**		**9.13**	U	**0.32**	U	**0.64 K**	U	**0.16 K**	U
P60	08030460X	L10998-9	**1.57**		**0.08 K**	U	**0.02**		0.02 U		0.01 U		0.02 U		0.01 U		**0.07**		0.01 U		**0.63**		0.02 U		**1.46**		**5.77**	U	**0.30**	U	**0.63**	U	**0.10 K**	U
P61	08030661X	L10998-10	**0.971**		**0.06 K**	U	**0.01**		0.01 U		0.01 U		0.02 U		0.01 U		**0.06**		0.02 U		**0.62**		0.02 U		**1.23**		**8.37**	U	**0.26**	U	**0.52**	U	**0.09**	U
Filter Fraction																																		
P52	08021252X	L11001-1	0.0329 U		**0.03**		**0.05 K**	U	**0.04**	U	**0.07**		**0.04**	U	**0.04**	U	**0.08**	U	0.02 U		**0.14**		**0.05 K**	U	**0.09**	U	**4.51**	U	**0.20**	U	**0.27**	U	**0.25 K**	U
53	08022453X	L11001-2	0.0282 U		**0.03**		**0.03**	U	0.05 U		**0.03**	U	0.02 U		**0.03**	U	**0.06**	U	0.03 U		**0.12**		**0.03 K**	U	**0.11**	U	**3.74**	U	**0.16**	U	**0.28**	U	**0.1 K**	U
54	08021354X	L11001-3	0.015 U		**0.03**		**0.05**	U	**0.05**	U	**0.08 K**	**J-EMPC**	**0.05**	U	**0.05**	U	**0.11**		0.04 U		**0.19**		**0.04 K**	U	**0.11**	U	**4.63**	U	**0.16**	U	**0.25**	U	**0.16 K**	U
55	08022555X	L11001-4	0.0191 U		**0.02**		**0.03**	U	**0.02 K**	U	**0.04**	U	**0.03 K**	U	**0.04**	U	**0.07**	U	0.02 U		**0.11**		**0.03 K**	U	**0.07**	U	**3.47**	U	**0.15**	U	**0.2**	U	**0.21 K**	U
56	08022156X	L11001-5	0.0275 U		**0.03**		**0.05**	U	**0.06 K**	U	**0.08**		**0.04 K**	U	**0.04**	U	**0.13**		0.02 U		**0.21**		**0.04 K**	U	**0.19**		**3.41**	U	**0.18**	U	**0.3**	U	**0.14**	U
57	08022757X	L11001-6	0.0161 U		**0.01**		**0.02**	U	**0.02**	U	**0.02**	U	**0.03 K**	U	**0.02**	U	**0.05**	U	0.02 U		**0.08**	U	**0.03 K**	U	**0.06**	U	**2.76**	U	**0.20**	U	**0.29**	U	**0.13 K**	U
58	08030758X	L11001-7	0.0262 U		**0.02**		**0.02**	U	0.02 U		**0.02 K**	U	0.02 U		**0.02**	U	**0.06**	U	0.03 U		**0.10**		0.02 U		**0.09**	U	**6.76**	U	**5.47 K**	U	**0.55**	U	**1.1 K**	U
59	08022959X	L11001-8	0.0213 U		**0.02**		**0.03**	U	**0.03 K**	U	**0.03 K**	U	**0.02 K**	U	**0.03**	U	**0.07**	U	0.02 U		**0.13**		0.01 U		**0.07**	U	**2.75**	U	**0.16**	U	**0.24**	U	**0.12 K**	U
60	08030460X	L11001-9	0.0328 U		**0.02**		**0.04**	U	**0.04**	U	**0.06**		**0.03 K**	U	**0.03**	U	**0.08**	U	0.02 U		**0.14**		**0.03 K**	U	**0.11**	U	**13**	U	**0.45 K**	U	**0.6**	U	**0.29 K**	U
61	08030661X	L11001-10	0.0141 U		**0.02**		**0.04**	U	**0.04**	U	**0.05**		**0.04 K**	U	**0.06**	U	**0.09**	U	0.02 U		**0.16**		**0.04 K**	U	**0.11**	U	**5.01**	U	**0.40 K**	U	**0.32**	U	**0.18 K**	U

Notes:

J = The reported value is an estimate.

J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

K = Peak detected but did not meet quantification criteria; the reported value may be interpreted as an 'estimated' maximum possible concentration.

NE = Not Established

ng/L = nanogram per Liter

ppt = parts per trillion

U = The analyte was not detected above the reported MRL.

UJ = The analyte was not detected. The reported sample quanitification limit is an estimate.

Table 5a. Summary of Qualifiers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08021252XAD L10998-1 (Column)	Lab Qualifier	URS Review Qualifier	08021354XAD L10998-3 (Column)	Lab Qualifier	URS Review Qualifier	08022156XAD L10998-5 (Column)	Lab Qualifier	URS Review Qualifier	08022453XAD L10998-2 (Column)	Lab Qualifier	URS Review Qualifier
1		0.385			0.267			0.211			0.191		
2		0.371			0.293			0.282			0.27		
3		0.324			0.249			0.192		U	0.162		U
4		0.369			0.42			0.496			0.409		
5		0.014	K	J-EMPC	0.012			0.02			0.022		
6		0.101			0.109			0.127			0.115		
7		0.036		U	0.033		U	0.038		U	0.031		U
8		0.416			0.487			0.487			0.518		
9		0.029		U	0.039			0.045			0.039		
10		0.015	K	J-EMPC	0.021			0.021	K	J-EMPC	0.017		
11		83.5			82.4			125			137		
12	12 + 13	0.0091	C U		0.0049	C U		0.0052	C U		0.0051	C U	
13	12 + 13		C12			C12			C12			C12	
14		0.009			0.008			0.009	K	J-EMPC	0.01		
15		0.654			0.531			0.275		U	0.741		
16		0.261			0.279			0.287			0.287		
17		0.24			0.253			0.292			0.267		
18	18 + 30	0.588	C		0.64	C		0.666	C		0.637	C	
19		0.097			0.101			0.106			0.1		
20	20 + 28	0.67	C		0.656	C		0.717	C		0.741	C	
21	21 + 33	0.269	C		0.257	C		0.283	C		0.3	C	
22		0.25			0.235			0.268			0.271		
23		0.006	K	U	0.0038	U		0.004		U	0.003	K	U
24		0.015	K	J-EMPC	0.012	K	J-EMPC	0.013	K	J-EMPC	0.014	K	J-EMPC
25		0.047	K	J-EMPC	0.044			0.044			0.052		
26	26 + 29	0.112	C		0.116	C		0.127	C		0.126	C	
27		0.045			0.05			0.05			0.051		
28	20 + 28		C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18	
31		0.532			0.555			0.609			0.632		
32		0.121			0.138			0.141			0.14		
33	21 + 33		C21			C21			C21			C21	
34		0.005	U		0.0038	U		0.006		U	0.003	K	U
35		0.079			0.081			0.101			0.121		
36		0.02	K	J-EMPC	0.02			0.032			0.031		
37		0.12			0.121			0.131			0.147		
38		0.0049	U		0.007			0.006	K	J-EMPC	0.003	K	J-EMPC
39		0.006	K		0.0037	U		0.0035	U		0.0029	U	
40	40 + 41 + 71	0.21	C		0.198	C		0.196	C		0.213	C	
41	40 + 41 + 71		C40			C40			C40			C40	
42		0.101			0.097			0.101			0.113		
43		0.0033	U		0.021			0.0024	U		0.027		
44	44 + 47 + 65	0.53	C		0.506	C	U	0.525	C	U	0.707	C	
45	45 + 51	0.096	C	U	0.088	C	U	0.09	C	U	0.11	C	U
46		0.033			0.032			0.031	K	J-EMPC	0.035	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44	
48		0.0027	U		0.085			0.0019	U		0.0013	U	
49	49 + 69	0.289	C		0.275	C		0.274	C		0.309	C	
50	50 + 53	0.083	C K		0.085	C		0.079	C		0.08	C	
51	45 + 51		C45			C45			C45			C45	
52		0.878			0.856			0.846			0.941		
53	50 + 53		C50			C50			C50			C50	
54		0.004		U	0.004		U	0.004	K	U	0.002		U
55		0.0096	U		0.01			0.0077	U		0.006	K	J-EMPC
56		0.121	K	J-EMPC	0.12			0.134			0.147		
57		0.009	U		0.0061	U		0.0073	U		0.0055	U	
58		0.0091	U		0.0061	U		0.0073	U		0.0056	U	
59	59 + 62 + 75	0.045	C		0.046	C K	J-EMPC	0.043	C		0.047	C	
60		0.076			0.074			0.073			0.086		
61	61 + 70 + 74 + 76	0.669	C		0.664	C		0.678	C		0.744	C	
62	59 + 62 + 75		C59			C59			C59			C59	
63		0.019	K		0.009			0.011	K	J-EMPC	0.017		
64		0.201			0.198			0.205			0.225		
65	44 + 47 + 65		C44			C44			C44			C44	
66		0.276			0.283			0.281			0.277		
67		0.01			0.0055	U		0.012	K	J-EMPC	0.012		
68		0.014	K	U	0.0065	U		0.0079	U		0.021		U
69	49 + 69		C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40	
72		0.0089	U		0.006	U		0.0072	U		0.0054	U	
73		0.015	K		0.003			0.01	K	J-EMPC	0.016		
74	61 + 70 + 74 + 76		C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61	
77		0.033		U	0.033		U	0.029		U	0.077	K	J-EMPC
78		0.0096	U		0.0064	U		0.0077	U		0.0059	U	
79		0.0085	U		0.0057	U		0.0069	U		0.009	K	J-EMPC
80		0.0083	U		0.0056	U		0.0067	U		0.0051	U	
81		0.0098	U		0.0064	U		0.0076	U		0.0059	U	
82		0.047			0.049	K	J-EMPC	0.045	K	J-EMPC	0.063		
83	83 + 99	0.257	C		0.243	C		0.244	C		0.31	C	
84		0.147			0.141			0.141			0.168		
85	85 + 116 + 117	0.065	C K	J-EMPC	0.076	C		0.078	C		0.104	C	
86	86 + 87 + 97 + 108 + 119 + 125	0.339	C		0.332	C		0.335	C		0.463	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
88	88 + 91	0.069	C K	J-EMPC	0.065	C K	J-EMPC	0.064	C		0.071	C	
89		0.006	K	J-EMPC	0.005	K	J-EMPC	0.0023	U		0.007	K	J-EMPC
90	90 + 101 + 113	0.54	C		0.505	C		0.532	C		0.633	C	
91	88 + 91		C88			C88			C88			C88	
92		0.104			0.1			0.109			0.117		
93	93 + 95 + 98 + 100 + 102	0.548	C		0.51	C		0.514	C		0.627	C	
94		0.004			0.0025	U		0.0024	U		0.003	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
96		0.004			0.002	K	J-EMPC	0.003			0.005	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
103		0.0029	U		0.003	K	J-EMPC	0.003			0.0024	U	
104		0.002	K	U	0.0012	U		0.0011	U		0.001	U	
105		0.119			0.114			0.119			0.163		
106		0.0049	U		0.0038	U		0.0053	U		0.007		
107	107 + 124	0.01	C K	J-EMPC	0.017	C K	J-EMPC	0.017	C K	J-EMPC	0.021	C K	J-EMPC
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
109		0.034			0.027	K	J-EMPC	0.041			0.041	K	J-EMPC
110	110 + 115	0.575	C		0.551	C		0.57	C		0.721	C	
111		0.0025	U		0.0017	U		0.0017	U		0.0021	U	
112		0.0025	U		0.0017	U		0.0017	U		0.0021	U	
113	90 + 101 + 113		C90			C90			C90			C90	
114		0.012		U	0.008	K	U	0.01	K	U	0.009	K	U
115	110 + 115		C110			C110			C110			C110	

Table 5a. Summary of Qualifiers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08021252XAD L10998-1 (Column)	Lab Qualifier	URS Review Qualifier	08021354XAD L10998-3 (Column)	Lab Qualifier	URS Review Qualifier	08022156XAD L10998-5 (Column)	Lab Qualifier	URS Review Qualifier	08022453XAD L10998-2 (Column)	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85	
118		0.36			0.325			0.361			0.499		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
120		0.0023	U		0.0016	U		0.0016	U		0.002	U	
121		0.0024	U		0.0017	U		0.0017	U		0.0021	U	
122		0.0053	U		0.0041	U		0.0057	U		0.0034	U	
123		0.007		U	0.0037	U		0.01	K	J-EMPC	0.009	K	J-EMPC
124	107 + 124		C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
126		0.0054	U		0.0042	U		0.0057	U		0.006	K	U
127		0.0047	U		0.0036	U		0.005	U		0.003	U	
128	128 + 166	0.04	C		0.036	C		0.033	C		0.053	C	
129	129 + 138 + 160 + 163	0.288	C		0.246	C		0.255	C		0.379	C	
130		0.019			0.018			0.018	K	J-EMPC	0.024		
131		0.004	U		0.003	U		0.004	K	J-EMPC	0.006	K	J-EMPC
132		0.094			0.081			0.088	K	J-EMPC	0.115		
133		0.0038	U		0.006		U	0.004	K	U	0.007	K	U
134	134 + 143	0.019	C K	J-EMPC	0.017	C		0.018	C K	J-EMPC	0.021	C	
135	135 + 151 + 154	0.124	C		0.105	C		0.116	C		0.116	C	
136		0.038			0.031			0.033			0.039		
137		0.012	K	J-EMPC	0.009			0.013	K	J-EMPC	0.015		
138	129 + 138 + 160 + 163		C129			C129			C129			C129	
139	139 + 140	0.0036	C U		0.003	C K	J-EMPC	0.004	C K	J-EMPC	0.008	C	
140	139 + 140		C139			C139			C139			C139	
141		0.044			0.039			0.034	K	J-EMPC	0.05		
142		0.004	U		0.003	U		0.0026	U		0.0014	U	
143	134 + 143		C134			C134			C134			C134	
144		0.016			0.012			0.014	K	J-EMPC	0.014	K	J-EMPC
145		0.0015	U		0.0013	U		0.0012	U		0.0011	U	
146		0.047			0.044			0.044			0.055		
147	147 + 149	0.257	C		0.228	C		0.23	C		0.275	C	
148		0.0018	U		0.0016	U		0.0015	U		0.0013	U	
149	147 + 149		C147			C147			C147			C147	
150		0.0014	U		0.0012	U		0.0011	U		0.001	U	
151	135 + 151 + 154		C135			C135			C135			C135	
152		0.0013	U		0.0012	U		0.0011	U		0.001	U	
153	153 + 168	0.261	C		0.214	C		0.239	C		0.301	C	
154	135 + 151 + 154		C135			C135			C135			C135	
155		0.002	K	U	0.002	K	U	0.001	K	U	0.001	K	U
156	156 + 157	0.026	C	U	0.023	C K	U	0.023	C	U	0.036	C	
157	156 + 157		C156			C156			C156			C156	
158		0.029			0.021	K	J-EMPC	0.022			0.031		
159		0.0027	U		0.002	U		0.0018	U		0.003	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129	
161		0.0027	U		0.0021	U		0.0018	U		0.001	U	
162		0.0029	U		0.0022	U		0.0019	U		0.001	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129	
164		0.018			0.014			0.018			0.025		
165		0.0031	U		0.0023	U		0.0021	U		0.0011	U	
166	128 + 166		C128			C128			C128			C128	
167		0.014			0.01			0.011	K	J-EMPC	0.013		
168	153 + 168		C153			C153			C153			C153	
169		0.0029	U		0.0021	U		0.0018	U		0.0014	U	
170		0.033			0.019		U	0.02		U	0.032		
171	171 + 173	0.011	C		0.006	C K	J-EMPC	0.008	C		0.011	C K	J-EMPC
172		0.009	K	J-EMPC	0.006			0.007	K	J-EMPC	0.006		
173	171 + 173		C171			C171			C171			C171	
174		0.051	K	U	0.03		U	0.033		U	0.046		U
175		0.0016	U		0.002	K	J-EMPC	0.0016	U		0.001	K	J-EMPC
176		0.008	K	J-EMPC	0.005	K	J-EMPC	0.007	K	J-EMPC	0.006	K	J-EMPC
177		0.033			0.023			0.026			0.03		
178		0.016			0.011	K	J-EMPC	0.013	K	J-EMPC	0.015	K	J-EMPC
179		0.023	K	J-EMPC	0.015			0.016			0.02		
180	180 + 193	0.115	C	U	0.061	C	U	0.067	C	U	0.107	C	U
181		0.0016	U		0.0014	U		0.0016	U		0.0012	U	
182		0.002	K	U	0.0013	U		0.0016	U		0.002	K	U
183	183 + 185	0.04	C K	J-EMPC	0.023	C K	U	0.025	C	U	0.039	C	U
184		0.0011	U		0.001	U		0.0012	U		0.0009	U	
185	183 + 185		C183			C183			C183			C183	
186		0.0012	U		0.0011	U		0.0013	U		0.0009	U	
187		0.112		U	0.07		U	0.078		U	0.09		U
188		0.001	U		0.0009	U		0.0011	U		0.0008	U	
189		0.004		U	0.0025	U		0.0018	U		0.0022	U	
190		0.008			0.006	K	J-EMPC	0.004	K	J-EMPC	0.009		
191		0.002	K	J-EMPC	0.001	U		0.0013	U		0.0009	U	
192		0.0014	U		0.0012	U		0.0014	U		0.001	U	
193	180 + 193		C180			C180			C180			C180	
194		0.032		U	0.01	K	U	0.014		U	0.029	K	U
195		0.008			0.005	K	J-EMPC	0.008	K	J-EMPC	0.01	K	J-EMPC
196		0.031			0.013	K	U	0.013		U	0.027		
197	197 + 200	0.016	C K	J-EMPC	0.006	C		0.007	C K	J-EMPC	0.013	C K	J-EMPC
198	198 + 199	0.101	C	U	0.041	C K	U	0.054	C	U	0.102	C	U
199	198 + 199		C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197	
201		0.012	K	J-EMPC	0.006	K	J-EMPC	0.005			0.013		
202		0.024	K	J-EMPC	0.01		U	0.012		U	0.023		
203		0.075			0.03	K	J-EMPC	0.035			0.081		
204		0.001	U		0.0009	U		0.0012	U		0.001	U	
205		0.003	K	U	0.002	U		0.0016	U		0.003	K	U
206		0.034			0.018	K	J-EMPC	0.019	K	J-EMPC	0.036		
207		0.014	K	J-EMPC	0.0048	U		0.008			0.016	K	J-EMPC
208		0.034			0.011	K	U	0.012	K	U	0.028		U
209		0.017	K	U	0.012	K	U	0.009		U	0.012	K	U

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all th
coeluting congeners, to eliminate possible errors during congener summation.

Table 5b. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS1	08022555XAD L10998-4 (Column)	Lab Qualifier	URS Review Qualifier	08022757XAD L10998-6 (Column)	Lab Qualifier	URS Review Qualifier	08022959XAD L10998-8 (Column)	Lab Qualifier	URS Review Qualifier	08030460XAD L10998-9 (Column)	Lab Qualifier	URS Review Qualifier
1		0.197			0.164			0.209			0.213		
2		0.256			0.291			0.256			0.292		
3		0.133			0.132			0.147			0.17		
4		0.43			0.364			0.634			0.554		
5		0.02			0.023			0.0051	U		0.0046	U	
6		0.108			0.114			0.144			0.129		
7		0.034		U	0.029		U	0.032	K	U	0.027	K	U
8		0.487			0.497			0.512			0.5		
9		0.037			0.038			0.041	K	J-EMPC	0.039		
10		0.016			0.018			0.026			0.017		
11		139			140			133			130		
12	12 + 13	0.0054	C U		0.0081	C U		0.0052	C U		0.0046	C U	
13	12 + 13		C12			C12			C12			C12	
14		0.011			0.0077	U		0.0049	U		0.0044	U	
15		0.586	K	J-EMPC	0.261			0.839			0.543	K	J-EMPC
16		0.295			0.288			0.348			0.322		
17		0.261			0.244			0.303			0.28		
18	18 + 30	0.647	C		0.6	C		0.763	C		0.729	C	
19		0.097			0.093			0.139			0.115		
20	20 + 28	0.745	C		0.655	C		0.749	C		0.736	C	
21	21 + 33	0.284	C		0.306	C		0.284	C		0.289	C K	J-EMPC
22		0.29			0.283			0.271			0.288		
23		0.004	U		0.0057	U		0.017		U	0.0032	U	
24		0.012			0.011			0.014	K	J-EMPC	0.013		
25		0.047	K	J-EMPC	0.05			0.051			0.05		
26	26 + 29	0.125	C		0.123	C		0.136	C		0.131	C	
27		0.051			0.047			0.062			0.056		
28	20 + 28		C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18	
31		0.61			0.559			0.622			0.612		
32		0.142			0.145	K	J-EMPC	0.16			0.149		
33	21 + 33		C21			C21			C21			C21	
34		0.006	K	U	0.0057	U		0.026		U	0.005	K	U
35		0.122			0.11			0.118			0.125		
36		0.029			0.025			0.027	K	J-EMPC	0.027		
37		0.124			0.127			0.147			0.145		
38		0.0039	U		0.0056	U		0.003	K	J-EMPC	0.01		
39		0.006	K	J-EMPC	0.0056	U		0.006	K	J-EMPC	0.01		
40	40 + 41 + 71	0.215	C		0.185	C		0.221	C		0.224	C	
41	40 + 41 + 71		C40			C40			C40			C40	
42		0.113			0.102			0.129	K	J-EMPC	0.127		
43		0.022	K	J-EMPC	0.017	K	J-EMPC	0.02			0.023		
44	44 + 47 + 65	0.617	C		0.543	C		0.644	C		0.654	C	
45	45 + 51	0.093	C		0.085	C		0.103	C		0.091	C	
46		0.033			0.03			0.034	K	J-EMPC	0.033		
47	44 + 47 + 65		C44			C44			C44			C44	
48		0.0024	U		0.08	K	J-EMPC	0.0017	U		0.0014	U	
49	49 + 69	0.304	C		0.243	C		0.318	C		0.281	C	
50	50 + 53	0.091	C		0.071	C		0.091	C		0.09	C	
51	45 + 51		C45			C45			C45			C45	
52		0.935			0.754			0.973			0.898		
53	50 + 53		C50			C50			C50			C50	
54		0.002		U	0.004		U	0.018		U	0.002	K	U
55		0.01			0.0072	U		0.01	K	J-EMPC	0.0061	U	
56		0.149			0.126			0.153			0.162		
57		0.0057	U		0.0068	U		0.0064	U		0.0059	U	
58		0.0057	U		0.0069	U		0.0067	U		0.0062	U	
59	59 + 62 + 75	0.045	C		0.042	C K	J-EMPC	0.051	C		0.053	C	
60		0.076			0.068	K	J-EMPC	0.088			0.087		
61	61 + 70 + 74 + 76	0.687	C		0.624	C		0.739	C		0.746	C	
62	59 + 62 + 75		C59			C59			C59			C59	
63		0.011	K	J-EMPC	0.01			0.016	K	J-EMPC	0.015		
64		0.21			0.184			0.0013	U		0.209		
65	44 + 47 + 65		C44			C44			C44			C44	
66		0.302			0.26			0.299			0.324		
67		0.01			0.012	K	J-EMPC	0.015	K	J-EMPC	0.012	K	J-EMPC
68		0.011	K	U	0.014	K	U	0.0068	U		0.014	K	U
69	49 + 69		C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40	
72		0.0056	U		0.0067	U		0.0063	U		0.0058	U	
73		0.013	K	J-EMPC	0.003			0.0013	U		0.013		
74	61 + 70 + 74 + 76		C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61	
77		0.048	K	J-EMPC	0.047			0.043		U	0.041		U
78		0.0061	U		0.0072	U		0.0071	U		0.0066	U	
79		0.009			0.007	K	J-EMPC	0.009	K	J-EMPC	0.01	K	J-EMPC
80		0.0052	U		0.0063	U		0.0057	U		0.0053	U	
81		0.006	U		0.0073	U		0.007	K	U	0.0062	U	
82		0.05			0.042			0.05			0.055		
83	83 + 99	0.281	C		0.229	C		0.296	C		0.302	C	
84		0.161			0.137			0.153			0.142		
85	85 + 116 + 117	0.092	C		0.075	C		0.088	C		0.089	C	
86	86 + 87 + 97 + 108 + 119 + 125	0.387	C		0.333	C		0.387	C		0.411	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
88	88 + 91	0.071	C		0.05	C K	J-EMPC	0.067	C		0.067	C	
89		0.005			0.0034	U		0.005			0.005		
90	90 + 101 + 113	0.589	C		0.485	C		0.607	C		0.606	C	
91	88 + 91		C88			C88			C88			C88	
92		0.111			0.092			0.115			0.112		
93	93 + 95 + 98 + 100 + 102	0.584	C		0.497	C		0.632	C		0.613	C	
94		0.002			0.0035	U		0.0034	U		0.003	K	J-EMPC
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
96		0.004			0.003	K	J-EMPC	0.004	K	J-EMPC	0.004	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
103		0.005	K	J-EMPC	0.003			0.0028	U		0.002	K	J-EMPC
104		0.001	U		0.0018	U		0.017		U	0.001	K	U
105		0.147			0.125			0.149			0.144		
106		0.005			0.0067	U		0.005			0.0039	U	
107	107 + 124	0.02	C		0.016	C K	J-EMPC	0.022	C		0.023	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
109		0.039			0.032	K	J-EMPC	0.033	K	J-EMPC	0.036	K	J-EMPC
110	110 + 115	0.66	C		0.549	C		0.692	C		0.705	C	
111		0.0013	U		0.0025	U		0.0025	U		0.0016	U	
112		0.0013	U		0.0025	U		0.0025	U		0.0016	U	
113	90 + 101 + 113		C90			C90			C90			C90	
114		0.015	K	U	0.011	K	U	0.017	K	U	0.01	K	U
115	110 + 115		C110			C110			C110			C110	

Table 5b. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS1	08022555XAD L10998-4 (Column)	Lab Qualifier	URS Review Qualifier	08022757XAD L10998-6 (Column)	Lab Qualifier	URS Review Qualifier	08022959XAD L10998-8 (Column)	Lab Qualifier	URS Review Qualifier	08030460XAD L10998-9 (Column)	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85	
118		0.448			0.378			0.489			0.553		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
120		0.0012	U		0.0023	U		0.0023	U		0.002	K	J-EMPC
121		0.0013	U		0.0025	U		0.0025	U		0.0016	U	
122		0.006	K	J-EMPC	0.0072	U		0.004	U		0.005	K	J-EMPC
123		0.006	K	U	0.007	K	U	0.009		U	0.014		U
124	107 + 124		C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
126		0.006	K	U	0.0068	U		0.0039	U		0.0041	U	
127		0.0023	U		0.0063	U		0.0039	U		0.0041	U	
128	128 + 166	0.043	C		0.038	C K	J-EMPC	0.044	C		0.045	C	
129	129 + 138 + 160 + 163	0.319	C		0.29	C		0.351	C		0.381	C	
130		0.022			0.017	K	J-EMPC	0.02			0.02		
131		0.004	K	J-EMPC	0.0044	U		0.004	K	J-EMPC	0.003	K	J-EMPC
132		0.102			0.078			0.091			0.091		
133		0.006		U	0.004	K	U	0.006		U	0.004	K	U
134	134 + 143	0.016	C K	J-EMPC	0.019	C		0.018	C K	J-EMPC	0.016	C	
135	135 + 151 + 154	0.127	C		0.101	C		0.111	C		0.127	C	
136		0.04	K	J-EMPC	0.0021	U		0.032			0.035		
137		0.014			0.013			0.016			0.01		
138	129 + 138 + 160 + 163		C129			C129			C129			C129	
139	139 + 140	0.003	C U		0.004	C U		0.006	C K	J-EMPC	0.005	C K	J-EMPC
140	139 + 140		C139			C139			C139			C139	
141		0.041			0.033			0.037			0.037		
142		0.0033	U		0.0044	U		0.0013	U		0.0023	U	
143	134 + 143		C134			C134			C134			C134	
144		0.013	K	J-EMPC	0.012	K	J-EMPC	0.01	K	J-EMPC	0.015		
145		0.0012	U		0.0022	U		0.0011	U		0.0006	U	
146		0.053			0.049			0.059			0.063		
147	147 + 149	0.282	C		0.225	C		0.288	C		0.298	C	
148		0.0015	U		0.0027	U		0.0014	U		0.0008	U	
149	147 + 149		C147			C147			C147			C147	
150		0.0011	U		0.0021	U		0.0011	U		0.002	K	J-EMPC
151	135 + 151 + 154		C135			C135			C135			C135	
152		0.0011	U		0.002	U		0.001	U		0.001	K	J-EMPC
153	153 + 168	0.304	C		0.28	C		0.327	C		0.356	C	
154	135 + 151 + 154		C135			C135			C135			C135	
155		0.002	K	U	0.0018	U		0.012		U	0.001	K	U
156	156 + 157	0.028	C	U	0.026	C	U	0.032	C	U	0.03	C	U
157	156 + 157		C156			C156			C156			C156	
158		0.029			0.022			0.027			0.025		
159		0.0022	U		0.003	U		0.002			0.0017	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129	
161		0.0023	U		0.003	U		0.0009	U		0.0016	U	
162		0.0024	U		0.0032	U		0.002	K	J-EMPC	0.0018	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129	
164		0.021			0.014			0.022			0.02		
165		0.0026	U		0.0034	U		0.0011	U		0.0019	U	
166	128 + 166		C128			C128			C128			C128	
167		0.014		U	0.013	K	U	0.015		U	0.016		U
168	153 + 168		C153			C153			C153			C153	
169		0.0023	U		0.003	U		0.001	U		0.0016	U	
170		0.026		U	0.027		U	0.022		U	0.019		U
171	171 + 173	0.012	C		0.008	C		0.01	C		0.009	C	
172		0.007	K	J-EMPC	0.007	K	J-EMPC	0.005	K	J-EMPC	0.006	K	J-EMPC
173	171 + 173		C171			C171			C171			C171	
174		0.05	K	J-EMPC	0.043			0.034			0.031		
175		0.002	K	J-EMPC	0.0023	U		0.0011	U		0.001	K	J-EMPC
176		0.006	K	J-EMPC	0.006	K	J-EMPC	0.006	K	J-EMPC	0.0005	U	
177		0.031			0.025			0.024			0.021		
178		0.015			0.011	K	J-EMPC	0.012			0.011		
179		0.021			0.018			0.022	K	J-EMPC	0.018		
180	180 + 193	0.125	C		0.109	C		0.087	C		0.07	C K	J-EMPC
181		0.0012	U		0.0023	U		0.0011	U		0.0008	U	
182		0.0012	U		0.0023	U		0.003	K	U	0.001	K	U
183	183 + 185	0.044	C		0.026	C		0.03	C		0.026	C	
184		0.0009	U		0.0017	U		0.001			0.001	K	J-EMPC
185	183 + 185		C183			C183			C183			C183	
186		0.001	U		0.0018	U		0.0009	U		0.0006	U	
187		0.113			0.101			0.105			0.09		
188		0.0008	U		0.0016	U		0.006		U	0.001	K	U
189		0.0022	U		0.0036	U		0.002	K	U	0.002	K	U
190		0.01			0.007			0.007	K	J-EMPC	0.008		
191		0.001			0.0018	U		0.0009	U		0.001	K	J-EMPC
192		0.001	U		0.002	U		0.001	U		0.0006	U	
193	180 + 193		C180			C180			C180			C180	
194		0.034			0.037			0.019	K	J-EMPC	0.01		
195		0.015	K	J-EMPC	0.013	K	J-EMPC	0.005			0.004	K	J-EMPC
196		0.045			0.033	K	J-EMPC	0.016			0.009	K	J-EMPC
197	197 + 200	0.021	C		0.013	C		0.006	C		0.004	C	
198	198 + 199	0.135	C		0.111	C		0.054	C		0.029	C	
199	198 + 199		C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197	
201		0.016	K	J-EMPC	0.012			0.005			0.004		
202		0.029			0.02	K	J-EMPC	0.016	K	U	0.008		U
203		0.099			0.083			0.037			0.021		
204		0.0008	U		0.0016	U		0.0009	U		0.0006	U	
205		0.003		U	0.0025	U		0.002	K	U	0.001	K	U
206		0.049			0.053	K	J-EMPC	0.027	K	J-EMPC	0.01		
207		0.02	K	J-EMPC	0.015			0.005	U		0.0037	U	
208		0.041			0.041			0.015		U	0.007	K	U
209		0.015	K	U	0.016	K	U	0.012	K	U	0.01		U

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 5c. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08030661XAD L10998-10 (Column)	Lab Qualifier	URS Review Qualifier	08030758XAD L10998-7 (Column)	Lab Qualifier	URS Review Qualifier
1		0.18			0.185		
2		0.237			0.236		
3		0.155			0.135		
4		0.391			0.392		
5		0.009	K	J-EMPC	0.013		
6		0.103			0.106		
7		0.033		U	0.037		U
8		0.462			0.501		
9		0.038			0.037		
10		0.016			0.017		
11		107			91.6		
12	12 + 13	0.0055	C U		0.385	C	
13	12 + 13		C12			C12	
14		0.0052	U		0.01		
15		0.737			0.761		
16		0.302			0.289		
17		0.243			0.25		
18	18 + 30	0.657	C		0.646	C	
19		0.09			0.091		
20	20 + 28	0.728	C		1.02	C	
21	21 + 33	0.286	C		0.0022	C U	
22		0.282			0.267		
23		0.002	K	U	0.0025	U	
24		0.013			0.012		
25		0.043	K	J-EMPC	0.049		
26	26 + 29	0.121	C		0.124	C	
27		0.052			0.054		
28	20 + 28		C20			C20	
29	26 + 29		C26			C26	
30	18 + 30		C18			C18	
31		0.588			0.612		
32		0.136			0.149		
33	21 + 33		C21			C21	
34		0.006	K	U	0.003	K	U
35		0.103			0.091		
36		0.022			0.021		
37		0.146			0.146		
38		0.004			0.013	K	J-EMPC
39		0.005	K	J-EMPC	0.005		
40	40 + 41 + 71	0.229	C		0.219	C	
41	40 + 41 + 71		C40			C40	
42		0.125			0.123		
43		0.02			0.021		
44	44 + 47 + 65	0.736	C		0.801	C	
45	45 + 51	0.105	C		0.11	C	
46		0.031			0.033		
47	44 + 47 + 65		C44			C44	
48		0.0015	U		0.002	U	
49	49 + 69	0.294	C		0.3	C	
50	50 + 53	0.094	C		0.092	C	
51	45 + 51		C45			C45	
52		0.0014	U		0.99		
53	50 + 53		C50			C50	
54		0.001		U	0.0014	U	
55		0.008			0.008		
56		0.165			0.14		
57		0.0062	U		0.0068	U	
58		0.0065	U		0.0069	U	
59	59 + 62 + 75	0.048	C		0.052	C	
60		0.089			0.075		
61	61 + 70 + 74 + 76	0.783	C		0.791	C	
62	59 + 62 + 75		C59			C59	
63		0.018			0.016		
64		0.213			0.217		
65	44 + 47 + 65		C44			C44	
66		0.318			0.313		
67		0.014			0.013	K	J-EMPC
68		0.0066	U		0.017		U
69	49 + 69		C49			C49	
70	61 + 70 + 74 + 76		C61			C61	
71	40 + 41 + 71		C40			C40	
72		0.0061	U		0.0068	U	
73		0.012			0.0015	U	
74	61 + 70 + 74 + 76		C61			C61	
75	59 + 62 + 75		C59			C59	
76	61 + 70 + 74 + 76		C61			C61	
77		0.08			0.092		
78		0.0068	U		0.0067	U	
79		0.011			0.021		
80		0.0055	U		0.0061	U	
81		0.0066	U		0.007	U	
82		0.057			0.061		
83	83 + 99	0.324	C		0.342	C	
84		0.165			0.175		
85	85 + 116 + 117	0.104	C		0.101	C	
86	86 + 87 + 97 + 108 + 119 + 125	0.468	C		0.482	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
88	88 + 91	0.076	C		0.08	C	
89		0.005	K	J-EMPC	0.004	K	J-EMPC
90	90 + 101 + 113	0.649	C		0.675	C	
91	88 + 91		C88			C88	
92		0.125			0.125		
93	93 + 95 + 98 + 100 + 102	0.637	C		0.691	C	
94		0.003			0.0027	U	
95	93 + 95 + 98 + 100 + 102		C93			C93	
96		0.004	K	J-EMPC	0.004	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93	
99	83 + 99		C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93	
101	90 + 101 + 113		C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93	
103		0.005	K	J-EMPC	0.004		
104		0.0009	U		0.0009	U	
105		0.16			0.178		
106		0.0061	U		0.003	U	
107	107 + 124	0.024	C K	J-EMPC	0.019	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
109		0.034			0.033		
110	110 + 115	0.781	C		0.74	C	
111		0.0018	U		0.0018	U	
112		0.0018	U		0.0018	U	
113	90 + 101 + 113		C90			C90	
114		0.009		U	0.011		U
115	110 + 115		C110			C110	

Table 5c. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS^1	08030661XAD L10998-10 (Column)	Lab Qualifier	URS Review Qualifier	08030758XAD L10998-7 (Column)	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85	
117	85 + 116 + 117		C85			C85	
118		0.552			0.593		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
120		0.002	K	J-EMPC	0.002		
121		0.0018	U		0.0019	U	
122		0.0066	U		0.004	K	J-EMPC
123		0.011		U	0.014	K	U
124	107 + 124		C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
126		0.007	K	U	0.006		U
127		0.0064	U		0.0029	U	
128	128 + 166	0.049	C		0.044	C	
129	129 + 138 + 160 + 163	0.388	C		0.375	C	
130		0.021			0.02		
131		0.005			0.0034	U	
132		0.106			0.111		
133		0.007	K	U	0.005	K	U
134	134 + 143	0.019	C		0.021	C K	J-EMPC
135	135 + 151 + 154	0.128	C		0.133	C	
136		0.036			0.043		
137		0.017			0.012		
138	129 + 138 + 160 + 163		C129			C129	
139	139 + 140	0.007	C K	J-EMPC	0.0031	C U	
140	139 + 140		C139			C139	
141		0.042	K	J-EMPC	0.044		
142		0.0019	U		0.0034	U	
143	134 + 143		C134			C134	
144		0.015			0.015		
145		0.0009	U		0.0013	U	
146		0.063			0.061		
147	147 + 149	0.307	C		0.322	C	
148		0.0011	U		0.0016	U	
149	147 + 149		C147			C147	
150		0.0008	U		0.0012	U	
151	135 + 151 + 154		C135			C135	
152		0.0008	U		0.001	K	J-EMPC
153	153 + 168	0.402	C		0.406	C	
154	135 + 151 + 154		C135			C135	
155		0.002		U	0.001		U
156	156 + 157	0.034	C	U	0.036	C	U
157	156 + 157		C156			C156	
158		0.031			0.031		
159		0.002			0.002	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129	
161		0.0013	U		0.0024	U	
162		0.0014	U		0.0023	U	
163	129 + 138 + 160 + 163		C129			C129	
164		0.021			0.022		
165		0.0015	U		0.0027	U	
166	128 + 166		C128			C128	
167		0.018	K	U	0.018		U
168	153 + 168		C153			C153	
169		0.0014	U		0.0024	U	
170		0.02	K	U	0.025	K	U
171	171 + 173	0.005	C K	J-EMPC	0.009	C	
172		0.005			0.006		
173	171 + 173		C171			C171	
174		0.033			0.036		
175		0.002			0.002	K	J-EMPC
176		0.004	K	J-EMPC	0.005		
177		0.024			0.023		
178		0.009			0.012	K	J-EMPC
179		0.018			0.019		
180	180 + 193	0.078	C		0.105	C	
181		0.001	U		0.0015	U	
182		0.001	K	U	0.0015	U	
183	183 + 185	0.031	C		0.032	C	
184		0.0007	U		0.0012	U	
185	183 + 185		C183			C183	
186		0.0008	U		0.0012	U	
187		0.098			0.09		
188		0.0007	U		0.0011	U	
189		0.0014	U		0.0021	U	
190		0.01			0.008		
191		0.002	K	J-EMPC	0.0012	U	
192		0.0009	U		0.0013	U	
193	180 + 193		C180			C180	
194		0.016	K	J-EMPC	0.029		
195		0.005	K	J-EMPC	0.009		
196		0.011			0.03		
197	197 + 200	0.007	C		0.009	C	
198	198 + 199	0.046	C		0.086	C	
199	198 + 199		C198			C198	
200	197 + 200		C197			C197	
201		0.006	K	J-EMPC	0.008		
202		0.01	K	U	0.015	K	U
203		0.032			0.076		
204		0.0008	U		0.0013	U	
205		0.002	K	U	0.002	K	U
206		0.014	K	J-EMPC	0.04		
207		0.005	K	J-EMPC	0.013		
208		0.011		U	0.027		
209		0.009		U	0.016	K	U

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 5d. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry

February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08021252XAD L11001-1 (Filter)	Lab Qualifier	URS Review Qualifier	08021354XAD L11001-3 (Filter)	Lab Qualifier	URS Review Qualifier	08022156XAD L11001-5 (Filter)	Lab Qualifier	URS Review Qualifier	08022453XAD L11001-2 (Filter)	Lab Qualifier	URS Review Qualifier
1		0.13			0.051		U	0.026		U	0.021		U
2		0.265			0.125			0.069			0.042		U
3		0.201			0.14			0.057		U	0.041	K	U
4		0.02		U	0.082		U	0.033		U	0.063		U
5		0.007	U		0.0069	U		0.0053	U		0.004	U	
6		0.009		U	0.011	K	U	0.017		U	0.0037	U	
7		0.011		U	0.0064	U		0.015		U	0.009		U
8		0.043		U	0.051		U	0.09		U	0.0034	U	
9		0.007		U	0.0061	U		0.006		U	0.005	K	U
10		0.0058	U		0.011	K	J-EMPC	0.0045	U		0.006		
11		4.12			7.16			9.18			10.8		
12	12 + 13	0.054	C		0.0069	C U		0.0053	C U		0.004	C U	
13	12 + 13		C12			C12			C12			C12	
14		0.0067	U		0.0064	U		0.005	U		0.0038	U	
15		0.054		U	0.073		U	0.141			0.07		U
16		0.034		U	0.034	K	U	0.074			0.039		U
17		0.032		U	0.11			0.073			0.104		
18	18 + 30	0.071	C	U	0.079	C	U	0.146	C	U	0.104	C	U
19		0.01	K	U	0.306			0.018	K	U	0.208		
20	20 + 28	0.165	C	U	0.216	C		0.452	C		0.259	C	
21	21 + 33	0.053	C	U	0.081	C	U	0.198	C		0.096	C	U
22		0.051		U	0.068			0.158			0.077	K	J-EMPC
23		0.0017	U		0.018		U	0.0022	U		0.004		U
24		0.0014	U		0.0014	U		0.003	K	J-EMPC	0.0008	U	
25		0.01	K	U	0.028			0.029			0.028		
26	26 + 29	0.023	C	U	0.041	C		0.064	C		0.046	C	
27		0.007		U	0.074			0.014			0.062		
28	20 + 28		C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18	
31		0.121		U	0.148			0.356			0.178		
32		0.015		U	0.078			0.032		U	0.066		
33	21 + 33		C21			C21			C21			C21	
34		0.0016	U		0.016	K	U	0.0022	U		0.006	K	U
35		0.018			0.028			0.038			0.035		
36		0.006	K	J-EMPC	0.003	K	J-EMPC	0.009			0.009		
37		0.057	K	U	0.078	K	J-EMPC	0.12			0.082		
38		0.0017	U		0.02	K	J-EMPC	0.006	K	J-EMPC	0.004	K	J-EMPC
39		0.0017	U		0.0028	U		0.003	K	J-EMPC	0.002		
40	40 + 41 + 71	0.081	C		0.223	C		0.153	C		0.204	C	
41	40 + 41 + 71		C40			C40			C40			C40	
42		0.037			0.083			0.084			0.082		
43		0.004	K	J-EMPC	0.03			0.014	K	J-EMPC	0.025		
44	44 + 47 + 65	0.202	C	U	1.95	C		0.46	C		1.61	C	
45	45 + 51	0.031	C	U	0.483	C		0.048	C	U	0.381	C	
46		0.006	K	U	0.022	K	J-EMPC	0.014	K	J-EMPC	0.023	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44	
48		0.03			0.047			0.057			0.051		
49	49 + 69	0.104	C		0.574	C		0.214	C		0.484	C	
50	50 + 53	0.021	C		0.344	C		0.031	C		0.262	C	
51	45 + 51		C45			C45			C45			C45	
52		0.254			0.629			0.556			0.629		
53	50 + 53		C50			C50			C50			C50	
54		0.002		U	0.175			0.001	K	U	0.121		
55		0.005	K	J-EMPC	0.009	K	J-EMPC	0.0081	U		0.0051	U	
56		0.101			0.125			0.181			0.135		
57		0.0045	U		0.01			0.0078	U		0.005		
58		0.0047	U		0.0048	U		0.0079	U		0.0052	U	
59	59 + 62 + 75	0.016	C		0.086	C		0.027	C		0.076	C	
60		0.056	K	J-EMPC	0.065			0.104			0.073		
61	61 + 70 + 74 + 76	0.429	C		0.558	C		1	C		0.574	C	
62	59 + 62 + 75		C59			C59			C59			C59	
63		0.009			0.015	K	J-EMPC	0.014			0.012		
64		0.083			0.106			0.17			0.118		
65	44 + 47 + 65		C44			C44			C44			C44	
66		0.23			0.319			0.43			0.314		
67		0.007	K	J-EMPC	0.009	K	J-EMPC	0.009			0.006		
68		0.007	K	U	0.025		U	0.015		U	0.022		U
69	49 + 69		C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40	
72		0.0044	U		0.012			0.0079	U		0.008	K	J-EMPC
73		0.0015	U		0.038			0.0009	U		0.027		
74	61 + 70 + 74 + 76		C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61	
77		0.031		U	0.046			0.051			0.056		
78		0.005	U		0.0051	U		0.0084	U		0.0055	U	
79		0.008	K	J-EMPC	0.013			0.01	K	J-EMPC	0.013		
80		0.004	U		0.0045	U		0.0074	U		0.0044	U	
81		0.0045	U		0.006		U	0.0084	U		0.0052	U	
82		0.06			0.073			0.107			0.082		
83	83 + 99	0.295	C		0.973	C		0.494	C		0.922	C	
84		0.091			0.202			0.165			0.19		
85	85 + 116 + 117	0.101	C		0.173	C		0.18	C		0.178	C	
86	86 + 87 + 97 + 108 + 119 + 125	0.358	C		0.685	C		0.609	C		0.717	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
88	88 + 91	0.057	C		0.249	C		0.089	C		0.202	C	
89		0.005	K	J-EMPC	0.009	K	J-EMPC	0.006	K	J-EMPC	0.007	K	J-EMPC
90	90 + 101 + 113	0.542	C		1.78	C		0.856	C		1.54	C	
91	88 + 91		C88			C88			C88			C88	
92		0.108			0.421			0.142			0.337		
93	93 + 95 + 98 + 100 + 102	0.323	C		1.43	C		0.515	C		1.25	C	
94		0.0025	U		0.079			0.002	K	J-EMPC	0.054		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
96		0.003			0.028			0.003			0.026		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
103		0.003			0.082			0.004	K	J-EMPC	0.062		
104		0.001	K	U	0.035	K	J-EMPC	0.002		U	0.022		U
105		0.221			0.332			0.421			0.339		
106		0.0039	U		0.0097	U		0.005	U		0.0049	U	
107	107 + 124	0.023	C		0.035	C		0.049	C		0.037	C K	J-EMPC
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
109		0.046			0.078			0.075			0.075		
110	110 + 115	0.644	C		1.04	C		1.09	C		1.08	C	
111		0.0018	U		0.0012	U		0.002	K	J-EMPC	0.003		
112		0.0018	U		0.072			0.0014	U		0.0017	U	
113	90 + 101 + 113		C90			C90			C90			C90	
114		0.017	K	U	0.025		U	0.02		U	0.02		U
115	110 + 115		C110			C110			C110			C110	

Table 5d. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08021252XAD L11001-1 (Filter)	Lab Qualifier	URS Review Qualifier	08021354XAD L11001-3 (Filter)	Lab Qualifier	URS Review Qualifier	08022156XAD L11001-5 (Filter)	Lab Qualifier	URS Review Qualifier	08022453XAD L11001-2 (Filter)	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85	
118		0.518			0.947			1.07			1.07		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
120		0.0017	U		0.009	K	J-EMPC	0.004	K	J-EMPC	0.007		
121		0.0018	U		0.009			0.0014	U		0.007		
122		0.008	K	J-EMPC	0.0106	U		0.007	K		0.01	K	J-EMPC
123		0.013	K	U	0.018	K	U	0.023	K	U	0.017	K	U
124	107 + 124		C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
126		0.004	K	U	0.0112	U		0.0059	U		0.0057	U	
127		0.0041	U		0.0097	U		0.005	U		0.0051	U	
128	128 + 166	0.13	C		0.389	C		0.154	C		0.344	C	
129	129 + 138 + 160 + 163	0.864	C		4.43	C		1	C		4.18	C	
130		0.052			0.159			0.06			0.15		
131		0.008			0.024	K	J-EMPC	0.012			0.024		
132		0.209			0.799			0.255			0.74		
133		0.015	K	J-EMPC	0.076			0.015	K	J-EMPC	0.061		
134	134 + 143	0.038	C		0.175	C		0.041	C K	J-EMPC	0.134	C	
135	135 + 151 + 154	0.209	C		1.6	C		0.25	C		1.19	C	
136		0.063	K	J-EMPC	0.393			0.074			0.32		
137		0.04			0.07	K	J-EMPC	0.041			0.08		
138	129 + 138 + 160 + 163		C129			C129			C129			C129	
139	139 + 140	0.012	C		0.031	C		0.019	C		0.027	C K	J-EMPC
140	139 + 140		C139			C139			C139			C139	
141		0.129			1			0.123			0.8		
142		0.0023	U		0.012	U		0.0033	U		0.009	U	
143	134 + 143		C134			C134			C134			C134	
144		0.027			0.188			0.035			0.143		
145		0.0008	U		0.002	K	J-EMPC	0.0008	U		0.001	K	J-EMPC
146		0.115			0.686			0.142			0.563		
147	147 + 149	0.54	C		2.94	C		0.65	C		2.75	C	
148		0.002			0.016			0.002	K	J-EMPC	0.012		
149	147 + 149		C147			C147			C147			C147	
150		0.001	K	J-EMPC	0.016			0.001	K	J-EMPC	0.011		
151	135 + 151 + 154		C135			C135			C135			C135	
152		0.001	K	J-EMPC	0.017			0.0008	U		0.011		
153	153 + 168	0.686	C		4.99	C		0.881	C		4.13	C	
154	135 + 151 + 154		C135			C135			C135			C135	
155		0.002	K	U	0.011		U	0.004	K	U	0.006		U
156	156 + 157	0.085	C		0.359	C		0.101	C		0.319	C	
157	156 + 157		C156			C156			C156			C156	
158		0.07			0.351			0.084			0.284		
159		0.008	K	J-EMPC	0.056			0.008			0.036	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129	
161		0.0016	U		0.0085	U		0.0023	U		0.0062	U	
162		0.0017	U		0.0088	U		0.004	K	J-EMPC	0.0068	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129	
164		0.056			0.209			0.06			0.169		
165		0.0019	U		0.0096	U		0.0026	U		0.0072	U	
166	128 + 166		C128			C128			C128			C128	
167		0.033			0.148			0.044			0.139		
168	153 + 168		C153			C153			C153			C153	
169		0.0017	U		0.0088	U		0.0024	U		0.0066	U	
170		0.161			2.08			0.142			1.51		
171	171 + 173	0.056	C K	J-EMPC	0.539	C		0.051	C		0.398	C	
172		0.028			0.343			0.032			0.247		
173	171 + 173		C171			C171			C171			C171	
174		0.168			1.18			0.141			0.878		
175		0.008	K	J-EMPC	0.069			0.009			0.047		
176		0.019			0.178			0.021			0.131		
177		0.121	K	J-EMPC	1.19			0.124			0.835		
178		0.043			0.337			0.043			0.245		
179		0.068			0.499			0.072			0.391		
180	180 + 193	0.359	C		4.82	C		0.341	C		3.51	C	
181		0.001	U		0.012			0.002	K	J-EMPC	0.006		
182		0.002	K	U	0.012		U	0.003	K	U	0.008	K	U
183	183 + 185	0.129	C		1.27	C		0.117	C		0.907	C	
184		0.002	K	J-EMPC	0.002	K	J-EMPC	0.004	K	J-EMPC	0.003	K	J-EMPC
185	183 + 185		C183			C183			C183			C183	
186		0.0008	U		0.0009	U		0.0008	U		0.0009	U	
187		0.265			2.47			0.284			1.7		
188		0.002	K	U	0.008	K	U	0.0008	U		0.004		U
189		0.007	K	U	0.09	K	J-EMPC	0.008	K	U	0.064		
190		0.038			0.409			0.039			0.287		
191		0.01	K	J-EMPC	0.076			0.007			0.055		
192		0.0009	U		0.001	U		0.0008	U		0.001	U	
193	180 + 193		C180			C180			C180			C180	
194		0.075			0.88			0.067			0.656		
195		0.028			0.302			0.027			0.241		
196		0.038			0.374			0.04	K	J-EMPC	0.257		
197	197 + 200	0.014	C K	J-EMPC	0.09	C		0.017	C K	J-EMPC	0.064	C	
198	198 + 199	0.099	C K	J-EMPC	0.711	C		0.096	C		0.489	C	
199	198 + 199		C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197	
201		0.012	K	J-EMPC	0.078			0.01	K	J-EMPC	0.049		
202		0.028	K	J-EMPC	0.109			0.027			0.077		
203		0.063			0.466			0.066			0.331		
204		0.0008	U		0.001			0.0008	U		0.0008	U	
205		0.003		U	0.048			0.006	K	U	0.033		
206		0.054			0.15			0.061			0.118		
207		0.008			0.021	K	J-EMPC	0.012			0.016		
208		0.021		U	0.035			0.024			0.028		
209		0.067			0.073			0.105			0.071		

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit

[1] When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 5e. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08022555XAD L11001-4 (Filter)	Lab Qualifier	URS Review Qualifier	08022757XAD L11001-6 (Filter)	Lab Qualifier	URS Review Qualifier	08022959XAD L11001-8 (Filter)	Lab Qualifier	URS Review Qualifier	08030460XAD L11001-9 (Filter)	Lab Qualifier	URS Review Qualifier
1		0.019		U	0.01		U	0.015		U	0.019		U
2		0.055			0.033		U	0.042	K	U	0.056		
3		0.033		U	0.016	K	U	0.032	K	U	0.036		U
4		0.03		U	0.024	K	U	0.026		U	0.038		U
5		0.0065	U		0.0071	U		0.008	U		0.0047	U	
6		0.011		U	0.009	K	U	0.011		U	0.019		U
7		0.013		U	0.008		U	0.011		U	0.014		U
8		0.055		U	0.045		U	0.046		U	0.004	U	
9		0.007	K	U	0.0063	U		0.0071	U		0.007		U
10		0.0054	U		0.006	U		0.0067	U		0.004	U	
11		9.26			13.3			9.81			11.3		
12	12 + 13	0.0065	C U		0.0071	C U		0.008	C U		0.0047	C U	
13	12 + 13		C12			C12			C12			C12	
14		0.0061	U		0.0067	U		0.0075	U		0.0044	U	
15		0.065		U	0.044		U	0.059		U	0.081		U
16		0.032		U	0.031		U	0.042		U	0.052		U
17		0.035		U	0.039		U	0.048		U	0.052		U
18	18 + 30	0.081	C	U	0.072	C K	U	0.093	C	U	0.116	C	U
19		0.014		U	0.013		U	0.015		U	0.017	K	U
20	20 + 28	0.202	C		0.198	C		0.195	C		0.237	C	
21	21 + 33	0.073	C	U	0.082	C	U	0.063	C	U	0.094	C	U
22		0.069	K	J-EMPC	0.07			0.072	K	J-EMPC	0.089		
23		0.0018	U		0.002	U		0.0043	U		0.006		U
24		0.001	K	J-EMPC	0.0018	U		0.003	K	J-EMPC	0.003		
25		0.013		U	0.013		U	0.013		U	0.015		
26	26 + 29	0.029	C K	U	0.027	C K	U	0.028	C	U	0.035	C K	U
27		0.007		U	0.007	K	U	0.009	K	U	0.01	K	U
28	20 + 28		C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18	
31		0.156			0.151			0.144		U	0.179		
32		0.018	K	U	0.016		U	0.023		U	0.029		U
33	21 + 33		C21			C21			C21			C21	
34		0.0018	U		0.003	K	U	0.0043	U		0.005	K	U
35		0.029	K	J-EMPC	0.043			0.03			0.039		
36		0.009	K	J-EMPC	0.01			0.005	K	J-EMPC	0.007	K	J-EMPC
37		0.061		U	0.065			0.067			0.08		
38		0.0019	U		0.002	K	J-EMPC	0.0045	U		0.003	K	J-EMPC
39		0.002			0.002	K	J-EMPC	0.0044	U		0.002	K	J-EMPC
40	40 + 41 + 71	0.091	C		0.097	C		0.089	C		0.101	C	
41	40 + 41 + 71		C40			C40			C40			C40	
42		0.057			0.055			0.067			0.075		
43		0.008	K	J-EMPC	0.007	K	J-EMPC	0.007	K	J-EMPC	0.013		
44	44 + 47 + 65	0.268	C	U	0.27	C	U	0.302	C		0.368	C	
45	45 + 51	0.033	C K	U	0.033	C	U	0.038	C	U	0.045	C	U
46		0.009	K	J-EMPC	0.009			0.01	K	J-EMPC	0.01	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44	
48		0.037			0.04			0.039			0.046		
49	49 + 69	0.14	C		0.126	C		0.134	C		0.146	C	
50	50 + 53	0.021	C		0.02	C	U	0.027	C		0.03	C	
51	45 + 51		C45			C45			C45			C45	
52		0.359			0.333			0.335			0.393		
53	50 + 53		C50			C50			C50			C50	
54		0.001	K	U	0.003	K	U	0.001	K	U	0.005		U
55		0.0073	U		0.0056	U		0.0046	U		0.0046	U	
56		0.116			0.114			0.104			0.118		
57		0.007	U		0.0054	U		0.0044	U		0.0044	U	
58		0.0071	U		0.0055	U		0.0045	U		0.0045	U	
59	59 + 62 + 75	0.021	C		0.021	C		0.021	C		0.023	C	
60		0.071			0.062			0.064	K	J-EMPC	0.067		
61	61 + 70 + 74 + 76	0.563	C		0.515	C		0.495	C		0.571	C	
62	59 + 62 + 75		C59			C59			C59			C59	
63		0.011	K	J-EMPC	0.01			0.01	K	J-EMPC	0.011	K	J-EMPC
64		0.11			0.097			0.097			0.114		
65	44 + 47 + 65		C44			C44			C44			C44	
66		0.282			0.251			0.261			0.279		
67		0.008			0.006			0.008	K	J-EMPC	0.008	K	J-EMPC
68		0.0069	U		0.0053	U		0.0043	U		0.011		U
69	49 + 69		C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40	
72		0.0071	U		0.0055	U		0.0045	U		0.0045	U	
73		0.001	U		0.001	U		0.0014	U		0.0008	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61	
77		0.039		U	0.032		U	0.039		U	0.057		
78		0.0076	U		0.0058	U		0.0048	U		0.0048	U	
79		0.0065	U		0.007	K	J-EMPC	0.01	K	J-EMPC	0.015		
80		0.0066	U		0.0051	U		0.0042	U		0.0042	U	
81		0.0073	U		0.0055	U		0.0047	U		0.0047	U	
82		0.079	K	J-EMPC	0.057			0.058			0.068		
83	83 + 99	0.422	C		0.351	C		0.388	C		0.448	C	
84		0.12			0.112			0.109			0.124		
85	85 + 116 + 117	0.14	C		0.112	C		0.12	C		0.136	C K	J-EMPC
86	86 + 87 + 97 + 108 + 119 + 125	0.476	C		0.409	C		0.442	C		0.512	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
88	88 + 91	0.075	C		0.057	C		0.07	C		0.074	C	
89		0.0019	U		0.006	K	J-EMPC	0.004	K	J-EMPC	0.006	K	J-EMPC
90	90 + 101 + 113	0.73	C		0.609	C		0.684	C		0.779	C	
91	88 + 91		C88			C88			C88			C88	
92		0.126			0.114	K	J-EMPC	0.123			0.128		
93	93 + 95 + 98 + 100 + 102	0.453	C		0.405	C		0.46	C		0.512	C	
94		0.0019	U		0.0027	U		0.0032	U		0.0019	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
96		0.003			0.002	K	J-EMPC	0.003			0.003		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
103		0.005	K	J-EMPC	0.003			0.004			0.003	K	J-EMPC
104		0.001	K	U	0.003	K	U	0.002	K	U	0.004		U
105		0.339			0.262			0.297			0.327		
106		0.004	U		0.0049	U		0.0057	U		0.0051	U	
107	107 + 124	0.038	C K	J-EMPC	0.03	C		0.036	C K	J-EMPC	0.037	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
109		0.064			0.054			0.058			0.065		
110	110 + 115	0.836	C		0.721	C		0.765	C		0.869	C	
111		0.0014	U		0.002	U		0.0024	U		0.0014	U	
112		0.002	K	J-EMPC	0.0019	U		0.0023	U		0.0014	U	
113	90 + 101 + 113		C90			C90			C90			C90	
114		0.021		U	0.014		U	0.017		U	0.02		U
115	110 + 115		C110			C110			C110			C110	

Table 5e. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08022555XAD L11001-4 (Filter)	Lab Qualifier	URS Review Qualifier	08022757XAD L11001-6 (Filter)	Lab Qualifier	URS Review Qualifier	08022959XAD L11001-8 (Filter)	Lab Qualifier	URS Review Qualifier	08030460XAD L11001-9 (Filter)	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85	
118		0.825			0.743			0.884			1.08		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
120		0.005	K	J-EMPC	0.004	K	J-EMPC	0.004			0.004		
121		0.0014	U		0.0019	U		0.0023	U		0.0014	U	
122		0.0044	U		0.006	K	J-EMPC	0.0062	U		0.009		
123		0.015	K	U	0.017	K	U	0.02	K	U	0.026	K	U
124	107 + 124		C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
126		0.0046	U		0.0055	U		0.0063	U		0.008	K	U
127		0.004	U		0.0049	U		0.0057	U		0.0051	U	
128	128 + 166	0.167	C		0.121	C		0.137	C		0.146	C	
129	129 + 138 + 160 + 163	1.07	C		0.809	C		1.04	C		1.28	C	
130		0.067			0.043	K	J-EMPC	0.053			0.057		
131		0.008	K	J-EMPC	0.007	K	J-EMPC	0.01	K	J-EMPC	0.012	K	J-EMPC
132		0.238			0.176			0.213			0.226		
133		0.015			0.012	K	J-EMPC	0.014			0.013		
134	134 + 143	0.04	C		0.026	C		0.033	C		0.032	C	
135	135 + 151 + 154	0.276	C		0.194	C		0.247	C		0.278	C	
136		0.075			0.053			0.063			0.071		
137		0.043	K	J-EMPC	0.033			0.035	K	J-EMPC	0.047		
138	129 + 138 + 160 + 163		C129			C129			C129			C129	
139	139 + 140	0.016	C		0.013	C K	J-EMPC	0.014	C K	J-EMPC	0.016	C	
140	139 + 140		C139			C139			C139			C139	
141		0.126			0.093			0.089			0.116		
142		0.0055	U		0.0023	U		0.0027	U		0.0042	U	
143	134 + 143		C134			C134			C134			C134	
144		0.03			0.023			0.027			0.027		
145		0.0008	U		0.0008	U		0.0011	U		0.0008	U	
146		0.159			0.125			0.156			0.183		
147	147 + 149	0.672	C		0.506	C		0.644	C		0.778	C	
148		0.003	K	J-EMPC	0.002	K	J-EMPC	0.0013	U		0.0008	U	
149	147 + 149		C147			C147			C147			C147	
150		0.001	K	J-EMPC	0.002	K	J-EMPC	0.002	K	J-EMPC	0.0008	U	
151	135 + 151 + 154		C135			C135			C135			C135	
152		0.0008	U		0.001	K	J-EMPC	0.001	U		0.0008	U	
153	153 + 168	1.04	C		0.834	C		1.19	C		1.52	C	
154	135 + 151 + 154		C135			C135			C135			C135	
155		0.002	K	U	0.002		U	0.003	K	U	0.004		U
156	156 + 157	0.11	C		0.085	C		0.099	C		0.115	C	
157	156 + 157		C156			C156			C156			C156	
158		0.082			0.062			0.073			0.083		
159		0.007			0.005	K	J-EMPC	0.008			0.005		
160	129 + 138 + 160 + 163		C129			C129			C129			C129	
161		0.0039	U		0.0016	U		0.0019	U		0.003	U	
162		0.004	U		0.004			0.003	K	J-EMPC	0.0031	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129	
164		0.057			0.041	K	J-EMPC	0.044			0.053		
165		0.0043	U		0.0018	U		0.0022	U		0.0033	U	
166	128 + 166		C128			C128			C128			C128	
167		0.049			0.041			0.056			0.07		
168	153 + 168		C153			C153			C153			C153	
169		0.004	U		0.0017	U		0.002	U		0.0032	U	
170		0.152			0.099			0.132			0.123		
171	171 + 173	0.049	C		0.037	C		0.05	C		0.054	C	
172		0.031			0.02			0.025			0.027		
173	171 + 173		C171			C171			C171			C171	
174		0.152			0.111			0.128			0.131		
175		0.009	K	J-EMPC	0.007	K	J-EMPC	0.009	K	J-EMPC	0.008	K	J-EMPC
176		0.022			0.015			0.02			0.021		
177		0.13			0.079			0.104			0.112		
178		0.045			0.036			0.044	K	J-EMPC	0.042		
179		0.074			0.057			0.068			0.077		
180	180 + 193	0.365	C		0.265	C		0.369	C		0.392	C	
181		0.003	K	J-EMPC	0.002	K	J-EMPC	0.002	K	J-EMPC	0.002	K	J-EMPC
182		0.003		U	0.002	K	U	0.001		U	0.003		U
183	183 + 185	0.129	C		0.09	C		0.131	C		0.142	C	
184		0.002			0.002			0.001			0.002	K	J-EMPC
185	183 + 185		C183			C183			C183			C183	
186		0.0008	U		0.001	U		0.001	U		0.0008	U	
187		0.295			0.224			0.319			0.349		
188		0.0008	U		0.0008	U		0.001		U	0.003		U
189		0.006	K	U	0.005		U	0.006	K	U	0.004	K	U
190		0.038			0.035			0.045			0.048		
191		0.008			0.005			0.001	U		0.007		
192		0.0008	U		0.0011	U		0.0011	U		0.0008	U	
193	180 + 193		C180			C180			C180			C180	
194		0.063			0.043			0.054			0.052		
195		0.026			0.019	K	J-EMPC	0.029			0.024		
196		0.035			0.027			0.036			0.036		
197	197 + 200	0.016	C		0.01	C K	J-EMPC	0.014	C K	J-EMPC	0.013	C K	J-EMPC
198	198 + 199	0.096	C		0.079	C K	J-EMPC	0.093	C		0.087	C	
199	198 + 199		C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197	
201		0.013			0.01			0.012			0.01	K	J-EMPC
202		0.029			0.024	K	J-EMPC	0.024	K	J-EMPC	0.028	K	J-EMPC
203		0.071			0.052			0.084			0.078		
204		0.0008	U		0.0008	U		0.0008	U		0.0008	U	
205		0.005	K	U	0.002	K	U	0.004		U	0.005	K	U
206		0.049			0.04			0.047			0.056		
207		0.01	K	J-EMPC	0.006	K	J-EMPC	0.007			0.006		
208		0.02		U	0.016		U	0.022	K	U	0.021		U
209		0.056			0.106			0.062			0.064		

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once fc all the coeluting congeners, to eliminate possible errors during congener summation.

Table 5f. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08030661XAD L11001-10 (Filter)	Lab Qualifier	URS Review Qualifier	08030758XAD L11001-7 (Filter)	Lab Qualifier	URS Review Qualifier
1		0.015		U	0.016		U
2		0.047		U	0.034		U
3		0.034		U	0.028		U
4		0.026		U	0.024		U
5		0.0056	U		0.005	U	
6		0.012		U	0.012	K	U
7		0.0052	U		0.005	K	U
8		0.064		U	0.056		U
9		0.005	U		0.0045	U	
10		0.0047	U		0.0042	U	
11		8.97			7.85		
12	12 + 13	0.0056	C U		0.005	C U	
13	12 + 13		C12			C12	
14		0.0052	U		0.0047	U	
15		0.072		U	0.056		U
16		0.04		U	0.038		U
17		0.042		U	0.039		U
18	18 + 30	0.09	C	U	0.088	C	U
19		0.015		U	0.014		U
20	20 + 28	0.293	C		0.205	C	
21	21 + 33	0.129	C		0.08	C	U
22		0.115			0.076		
23		0.0019	U		0.0029	U	
24		0.002	K	J-EMPC	0.002		
25		0.018			0.012	K	U
26	26 + 29	0.042	C		0.028	C	U
27		0.01		U	0.007	K	U
28	20 + 28		C20			C20	
29	26 + 29		C26			C26	
30	18 + 30		C18			C18	
31		0.22			0.156		
32		0.025		U	0.026		U
33	21 + 33		C21			C21	
34		0.002	K	U	0.0029	U	
35		0.041			0.03	K	J-EMPC
36		0.006	K	J-EMPC	0.007		
37		0.105			0.071		
38		0.004			0.0031	U	
39		0.002	K	J-EMPC	0.003	U	
40	40 + 41 + 71	0.121	C		0.098	C	
41	40 + 41 + 71		C40			C40	
42		0.075			0.065		
43		0.009	K	J-EMPC	0.008		
44	44 + 47 + 65	0.432	C		0.341	C	
45	45 + 51	0.044	C	U	0.038	C	U
46		0.009	K	J-EMPC	0.01	K	J-EMPC
47	44 + 47 + 65		C44			C44	
48		0.045			0.04		
49	49 + 69	0.164	C		0.135	C	
50	50 + 53	0.028	C		0.026	C	
51	45 + 51		C45			C45	
52		0.45			0.37		
53	50 + 53		C50			C50	
54		0.003		U	0.002	K	U
55		0.0058	U		0.004	U	
56		0.163			0.131		
57		0.0056	U		0.0039	U	
58		0.0056	U		0.0039	U	
59	59 + 62 + 75	0.027	C		0.022	C K	J-EMPC
60		0.088			0.069		
61	61 + 70 + 74 + 76	0.816	C		0.583	C	
62	59 + 62 + 75		C59			C59	
63		0.012			0.011		
64		0.136			0.102		
65	44 + 47 + 65		C44			C44	
66		0.363			0.276		
67		0.008	K	J-EMPC	0.008		
68		0.012	K	U	0.009	K	U
69	49 + 69		C49			C49	
70	61 + 70 + 74 + 76		C61			C61	
71	40 + 41 + 71		C40			C40	
72		0.0057	U		0.0039	U	
73		0.0008	U		0.0008	U	
74	61 + 70 + 74 + 76		C61			C61	
75	59 + 62 + 75		C59			C59	
76	61 + 70 + 74 + 76		C61			C61	
77		0.071			0.047		
78		0.006	U		0.0042	U	
79		0.015	K	J-EMPC	0.012		
80		0.0053	U		0.0037	U	
81		0.0057	U		0.0043	U	
82		0.084			0.074		
83	83 + 99	0.479	C		0.397	C	
84		0.144			0.115		
85	85 + 116 + 117	0.164	C		0.13	C	
86	86 + 87 + 97 + 108 + 119 + 125	0.616	C		0.483	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
88	88 + 91	0.078	C		0.074	C	
89		0.006			0.004	K	J-EMPC
90	90 + 101 + 113	0.857	C		0.72	C	
91	88 + 91		C88			C88	
92		0.14			0.127		
93	93 + 95 + 98 + 100 + 102	0.537	C		0.472	C	
94		0.004	K	J-EMPC	0.002	K	J-EMPC
95	93 + 95 + 98 + 100 + 102		C93			C93	
96		0.003	K	J-EMPC	0.002	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93	
99	83 + 99		C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93	
101	90 + 101 + 113		C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93	
103		0.004			0.004		
104		0.001	K	U	0.002		U
105		0.403			0.282		
106		0.0041	U		0.0037	U	
107	107 + 124	0.044	C		0.032	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
109		0.075			0.062		
110	110 + 115	1.08	C		0.793	C	
111		0.0011	U		0.0012	U	
112		0.0011	U		0.0012	U	
113	90 + 101 + 113		C90			C90	
114		0.022		U	0.02	K	U
115	110 + 115		C110			C110	
116	85 + 116 + 117		C85			C85	

Table 5f. Summary of Qualifers for Infiltrex Samples (Congeners)

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

IUPAC #	COELUTING CONGENERS[1]	08030661XAD L11001-10 (Filter)	Lab Qualifier	URS Review Qualifier	08030758XAD L11001-7 (Filter)	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85	
118		1.22			0.932		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
120		0.002			0.005		
121		0.0011	U		0.0012	U	
122		0.008			0.007		
123		0.026	K	U	0.019	K	U
124	107 + 124		C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
126		0.008	K	U	0.007		U
127		0.0041	U		0.0037	U	
128	128 + 166	0.156	C		0.127	C	
129	129 + 138 + 160 + 163	1.11	C		1.04	C	
130		0.058			0.049		
131		0.01	K	J-EMPC	0.007		
132		0.247			0.2		
133		0.017			0.011	K	J-EMPC
134	134 + 143	0.035	C		0.025	C K	J-EMPC
135	135 + 151 + 154	0.285	C		0.237	C	
136		0.07			0.061		
137		0.048			0.037		
138	129 + 138 + 160 + 163		C129			C129	
139	139 + 140	0.016	C		0.012	C	
140	139 + 140		C139			C139	
141		0.122			0.1		
142		0.0034	U		0.0043	U	
143	134 + 143		C134			C134	
144		0.033			0.025		
145		0.0008	U		0.0009	U	
146		0.167			0.161		
147	147 + 149	0.725	C		0.634	C	
148		0.002			0.001	K	J-EMPC
149	147 + 149		C147			C147	
150		0.001	K	J-EMPC	0.001	K	J-EMPC
151	135 + 151 + 154		C135			C135	
152		0.0008	U		0.0008	U	
153	153 + 168	1.26	C		1.18	C	
154	135 + 151 + 154		C135			C135	
155		0.003	K	U	0.003	K	U
156	156 + 157	0.104	C		0.094	C	
157	156 + 157		C156			C156	
158		0.084			0.074		
159		0.007	K	J-EMPC	0.005	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129	
161		0.0024	U		0.0031	U	
162		0.003	K	J-EMPC	0.0032	U	
163	129 + 138 + 160 + 163		C129			C129	
164		0.055			0.048	K	J-EMPC
165		0.0027	U		0.0034	U	
166	128 + 166		C128			C128	
167		0.06			0.057		
168	153 + 168		C153			C153	
169		0.0024	U		0.0034	U	
170		0.14			0.106		
171	171 + 173	0.054	C		0.04	C K	J-EMPC
172		0.031			0.024		
173	171 + 173		C171			C171	
174		0.145			0.108		
175		0.008			0.009		
176		0.02			0.017	K	J-EMPC
177		0.11			0.09		
178		0.037			0.033	K	J-EMPC
179		0.07			0.068		
180	180 + 193	0.389	C		0.321	C	
181		0.002	K	J-EMPC	0.002		
182		0.0008	U		0.0008	U	
183	183 + 185	0.122	C		0.119	C	
184		0.002	K	J-EMPC	0.002	K	J-EMPC
185	183 + 185		C183			C183	
186		0.0008	U		0.0008	U	
187		0.323			0.276		
188		0.001		U	0.002	K	U
189		0.005	K	U	0.004	K	U
190		0.05	K	J-EMPC	0.043	K	J-EMPC
191		0.006			0.005	K	J-EMPC
192		0.0008	U		0.0008	U	
193	180 + 193		C180			C180	
194		0.069			0.048		
195		0.033			0.018		
196		0.041			0.031		
197	197 + 200	0.013	C		0.01	C	
198	198 + 199	0.096	C		0.075	C	
199	198 + 199		C198			C198	
200	197 + 200		C197			C197	
201		0.013	K	J-EMPC	0.008		
202		0.029			0.021		
203		0.073			0.064		
204		0.0008	U		0.001	K	J-EMPC
205		0.006		U	0.004	K	U
206		0.048			0.039		
207		0.007	K	J-EMPC	0.007	K	J-EMPC
208		0.02		U	0.02		U
209		0.062			0.048		

Notes:

All results are in units of pg/L (picograms/Liter)

C = concentration represents coeluting congeners
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = A peak was detected that did not meet all criteria for identification as the target analyte; the reported value is the estimated maximum possible concentration of analyte present.
Non-detect values reported at the analytical reporting limit
PCBs = Polychlorinated Biphenyls
RL = method reporting limit
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 6. Infiltrex Sampling Recovery Standards

Quality Control Summary Report for Analytical Chemistry
February/March 2008 Sampling Event

Station Number	URS ID	Date Collected	Axys ID (Column)	Anthracene-d10	PCB 31L	PCB 95L	PCB 153L
				% recovery			
52	08021252XAD	12-Feb-08	L10998-1	106	100	101	91.1
53	08022453XAD	24-Feb-08	L10998-2	105	94.1	93.8	96.4
54	08021354XAD	13-Feb-08	L10998-3	105	106	95.2	95.7
55	08022555XAD	25-Feb-08	L10998-4	105	96.3	94.3	95.8
56	08022156XAD	21-Feb-08	L10998-5	103	101	90.0	93.7
57	08022757XAD	27-Feb-08	L10998-6	105	92.6	93.7	94.1
58	08030758XAD	7-Mar-08	L10998-7	101	97.5	99.8	99.7
59	08022959XAD	29-Feb-08	L10998-8	104	89.1	96.3	88.4
60	08030460XAD	4-Mar-08	L10998-9	101	92.7	91.7	91
61	08030661XAD	6-Mar-08	L10998-10	104	90.4	94.4	96.1
Field Blank	080306FBXAD	6-Mar-08	L10998-11	111	95.6	102	93.9

Notes:

Axys spiked carbon-13 labeled PCBs and deuterated anthracene onto the Infiltrex columns prior to shipment to URS. High recoveries of these standards indicate little to no loss of adsorbded analytes during the sampling event.

BRADFORD ISLAND REMEDIAL INVESTIGATION PROJECT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

REFERENCE AREA SMALLMOUTH BASS COLLECTED FALL 2008

JULY 2008

Prepared by:
URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the sample results shows the quality of the data is acceptable for supporting project objectives. The contracted laboratories provided all requested analyses, and delivered data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect, ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this deliverable. The end user should be aware of the potential low bias of the mercury results due to hold time (as discussed in Section 4.1). Additionally, the 27 standards used to quantify PCB congeners were added post extraction and were not exposed to the potential losses encountered during extraction, all fish tissue sample results have the potential to be biased slightly low (see Section 4.5 and 4.8).

2.0 Project Description

URS retrieved seven archived smallmouth bass fish samples from the United States Army Corp of Engineers (USACE) storage facility near Bonneville Dam on February 11, 2008. The fish were collected from October to November 2007 in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. Fish were captured under the supervision of the USACE and archived frozen by USACE for future analysis as described below.

3.0 Sampling and Analytical Procedures

Samples were analyzed according to the Quality Assurance Project Plan (QAPP) *River Operable Unit Remedial Investigation* (URS 2007). Table 1 summarizes the sample IDs, capture dates, fish length and weight, and requested analyses for each sample. Whole-body fish samples were homogenized using an industrial blender, then stored frozen by Columbia Analytical Services (CAS), located in Kelso Washington. An aliquot of the homogenized tissue was sent to Axys Analytical Services Ltd located in Sidney, British Columbia (Axys) to perform the PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*. The Axys analytical data report includes a listing of Axys Method 1668A modifications.

The following table lists the parameters analyzed for one or more of the samples. Table 1 summarizes the specific requested analyses for each medium by URS and laboratory identification numbers. (Note: SVOCs and PAHs were analyzed separately for tissue matrices and are discussed separately in this report).

Method	Analytical Parameter
EPA 1668A	Polychlorinated Biphenyls (PCBs) - Congeners

Method	Analytical Parameter
EPA 8270C-SIM	Semivolatile Organic Compounds (SVOCs)
EPA 8270C-SIM	Polynuclear Aromatic Hydrocarbons (PAHs)
EPA 6000/7000 series	Metals
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry	Percent Solids

4.0 Data Validation

Analyses were performed in general accordance with the above reference methods and variations from method requirements were well-documented. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed on 15% or greater of the data: primary and secondary column verification (method 8270C and 6000/7000 series), instrument calibration and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP) (USACE 2007). Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (September 2005)* and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB data (USEPA 1995)* as appropriate for method performed. In the case of disagreement between the documents listed as guidance or the analytical method, method criteria were utilized for data review. The SVOC and Metals results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006) and the above listed methods and EPA's *NFGs for Organic Data Review, and the NFGs for Inorganic Data Review* (USEPA 2004), in that order of precedence. Project-specific QC criteria are listed in the above mentioned QAPP.

A summary of qualifiers assigned to results in this investigation is included in Tables 2. Samples are listed by their URS sample identification assigned in the field as well as the laboratory identification. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit (for SVOCs and metals) or above the noise-based sample-specific detection limit for PCB congeners.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J-EMPC – The analyte was not positively identified; the associated numerical value is the **E**stimated **M**aximum **P**otential **C**oncentration of the analyte in the sample - used only for PCB congener results.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Fish Tissue (non-congeners)

The chain-of-custody (COC) forms indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below. Data were not qualified based on cooler temperatures.

All samples were analyzed within the technical and contracted holding time with the following exceptions:

- All samples were analyzed from 88 to 113 days past the 28 day holding time for inorganic mercury in solid matrixes. The mercury data were not rejected based on hold time due to the fact that it is believed that a large percentage of the mercury in these samples is in the form of methyl mercury due to the higher tropic level of the sample.

The short hold time for inorganic mercury is due to the loss of analyte from evaporation; however, methyl mercury is more resistant to loss via evaporation. Methyl mercury was not specifically analyzed in these samples nor are there specific hold times for methyl mercury listed in QSM DoD. All mercury results are qualified as estimated and flagged ‘J’. The end user should be aware of the potential low bias of the mercury results due to hold time.

Fish Tissue (congeners)

The chain-of-custody (COC) forms from CAS to Axys indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. The Axys receipt date of March 5, 2007, printed on the COC form appears to be in error, as it is before the sample collection date of October and November 2007. The CAS relinquish date on the COC form is listed as March 4, 2008, the Axys Sample Receiving Record included as page 12 in data package DPWG25561 lists March 5, 2008 as the sample receipt date, and the sample shipping information included as page 11 in data package DPWG25561 lists March 4, 2008 as the sample shipment date. For these reasons, it is concluded the March 5, 2007 Axys receipt date printed on the COC form should be March 5, 2008.

Sample temperature during transport from CAS to Axys was not indicated on the COC form or on the Axys Sample Receiving Record. However, the sample shipping information included as page 11 in data package DPWG25561 lists dry ice in the description field of the Federal Express paperwork. The samples were stored at -20°C by Axys prior to extraction and analysis. The condition of the samples upon receipt by Axys was appropriate, custody seals were intact, and all samples listed on the COC form were present. Data were not qualified based COC and sample shipment procedures.

All samples were analyzed within the technical and contracted holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for target and surrogate compounds as required by the analytical methods. Initial calibrations (ICAL) and continuing calibrations (CCAL) were performed at the proper frequency and at the appropriate concentrations required by the methods.

Fish Tissue (non-congeners)

Instrument calibrations were acceptable for non-congener sample analyses performed with the following exceptions:

- The ICAL for di-n-butyl phthalate, di-n-octyl phthalate and terphenyl-d4 exceeded the DoD QSM RSD limit of ≤15% with 16.4%, 15.9%, 15.5%, respectively. The alternative criteria presented in both the DoD QSM (p.139) and EPA guidance were met. Additionally, CCALs for these analytes were within the control limits. No qualification was given to the data based on ICAL values.

Fish Tissue (congeners)

ICALs and continuing calibration verifications (CCVs) were reviewed for PCB congener analyses. The laboratory performed initial multipoint calibrations for all target and standard compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations required by EPA Method 1668A. Calibration compounds analyzed associated with the fish tissue samples met the acceptance criteria as listed in the method.

4.3 Review of Blanks

Method blanks were used to check for laboratory contamination and instrument bias. The laboratories analyzed at least one method blank for each analysis and for each batch, per QAPP requirements. Qualification of samples due to method or field blank contamination followed guidelines set forth in the EPA NFGs.

Fish Tissue (non-congeners)

For non-congener organic analyses, sample results less than five times (5x) and inorganic sample results (or common laboratory organic contaminates such as phthalates) less than ten times (x10) the method blank or field blank concentration and between the method detection limit (MDL) and the method reporting limits (MRL) were flagged as non-detect 'U' at the MRL. When sample results were less than 5x the blank concentration but above the MRL, the reported result was qualified as non-detect 'U'. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, the above guidelines were applied using wet weight results and any flags applied were also applied to the dry weight results. Field blanks were not collected as part of this sampling event. All analytical tests indicate non-detects for all method blanks with the following exceptions:

- Lead and nickel were detected above the MDL and below the MRLs in the method blank associated with sample delivery group K0801240, additionally, cobalt was detected in the calibration blanks bracketing the samples. Sample results were above 10x the blank concentrations with the exception of cobalt in samples K0801240-001 through K0801240-007 and lead in samples K0801240-001 through K0801240-007 and nickel in samples K0801240-004, K0801240-005 and K0801240-006. These samples were qualified and flagged 'U' as described above and reported in Table 2.
- Di-n-butyl phthalate was detected in the SVOC method blank associated with delivery group K0801240 at a concentration above the MRL. The following samples had results below 10x the method blank concentration and were detected above the MRL and were flagged 'U' at the reported sample concentration, K0801240-001, -003 through -007.

Fish Tissue (congeners)

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged 'U' or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as EMPCs were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using corn oil to approximate the lipid content of the samples.

The method blank associated with fish tissue samples had only low levels of few PCBs. No sample results were qualified based on method blank concentrations.

4.4 Surrogate Recovery Review (non-congener analyses only)

Each sample analyzed for organic compounds other than PCBs was spiked with surrogates (system monitoring compounds). Surrogate recoveries are a measure of accuracy for the overall extraction and analysis of each individual sample. Surrogate recoveries were acceptable for all analyses with the following exceptions:

- PAH surrogate recoveries for fluorene-d10 and fluoranthene-d10 were below the lower DoD QSM control limit of 60% for samples K0801240-001 and -004. The associated MS/MSD and LCS/LCSD were within control limits for fluorene and fluoranthene suggesting analytical batch was in control. All PAHs in samples K0801240-001 and K0801240-004 were estimated and flagged 'J/UJ' to indicate potential low bias.

4.5 Labeled Internal Standard Recovery Review (congener analysis only)

Samples analyzed for PCB congeners were spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to typically evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narrative. Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency.

Because Axys anticipated high level congener concentrations in these tissue samples based on previous fish tissue samples collected [Bonneville Dam Forebay, 2006/2007], the three standards typically used as cleanup standards (28L, 111L, and 178L) were introduced prior to extraction and used as "extraction standards." The internal standards (27 labeled congeners used to quantitate target congeners) were introduced after extraction and prior to cleanup and should therefore be considered "cleanup standards" for these samples. This approach was taken as a result of the anticipated high congener levels and resulting volumetric amount of standard necessary to be introduced prior to extraction, and the relative cost of the three labeled congener standard solution to that of the 27 labeled congener standard solution. Section 4.8 presents additional details on the target congener quantification effects of this approach by Axys. The internal standards were within the 25-150% control limits set by EPA Method 1668A, and cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

Isotopic dilution calculations are designed to compensate for recovery or loss. Therefore, PCB congeners quantified against chemically identical ^{13}C-labeled standards were not considered for qualification based upon internal standard recoveries. However, congeners with concentrations calculated based upon internal standards that are not chemically identical have the accuracy of the results potentially affected by low extraction and/or cleanup efficiency since the efficiency for the standard may not match the target compound exactly. These congeners were considered for qualification if recoveries were outside specified limits. Internal standard recoveries were within Method 1668A specified control limits for the samples reported in this data package, and data qualification was not necessary.

As described later in Section 4.8, Axys analyzed each sample extract twice due to the levels observed in the first analyses. The standards used to monitor the efficiency of the extraction were reported from the original analyses and the remainder of the data was reported from the repeat analyses.

4.6 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control samples (LCS) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. Per method requirements, at least one LCS and one MS/MSD were analyzed for each analysis and for each batch.

Fish Tissue (non-congeners)

LCS/LCSD and MS/MSD recoveries were acceptable for all non-congener analytical tests with the following exceptions:

- MS recoveries for sample K0801240-006 were over the DoD QSM control limit of 120% for arsenic and zinc with 121% and 131%, respectively. The MSD performed on the same sample had arsenic and zinc recoveries of 122% and 135%, respectively. The LCS and SRM recoveries for arsenic and zinc were in control indicating batch was in control. Arsenic and zinc were flag ‘J’ in sample K0801240 due to potential high bias due to sample matrix.
- SVOC MS/MSD recoveries for sample K0801240-006 were outside control limits for di-n-butyl phthalate and bis(2-ethylhexyl) phthalate. Accurate quantification of these analytes was prevented due to unknown matrix interferences in the chromatograms even

after additional gel-permeation chromatography (GPC) cleanup was performed. Recovery in the associated LCS/LCSD was acceptable suggesting analytical batch was in control; data were not flagged based on MS/MSD recoveries of these analytes. Recoveries for di-n-octyl phthalate within the same MS/MSD pair were above the upper control limit of 130% with recoveries of 206% and 220%, respectively. Sample results in the associated sample delivery group were all non-detect for di-n-octyl phthalate. Results were not qualified based on the potential bias high for di-n-octyl phthalate. Additionally, recoveries for 4-methylphenol in the same MSD were below the lower control limit of 40% with 18%. The 4-methylphenol recovery in the associated MS was 40%. The resulting RPD for the MS/MSD pair for 4-methylphenol was above the control limit. Therefore, results for 4-methylphenol in the parent sample (K0801240-006) were flagged ‘UJ’ due to potentially low bias.

- The MSD recovery for sample K0801240-001 was below the DoD QSM control limit of 45% for pyrene with 43%, additionally, the RPD for the MS/MSD pair was above the 30% control limit with 54%. The associated MS, LCS and calibration standards indicate analytical batch was in control. The sample result for pyrene was estimated and flagged ‘UJ’ for sample K0801240-001 due to MSD and RPD results.

Fish Tissue (congeners)

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, Ongoing Precision and Recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using corn oil to approximate the lipid content of the samples. OPR recoveries were acceptable for congener analyses.

4.7 Duplicate Review (non-congener analyses only)

Field duplicates were not collected as part of this sampling event. Laboratory precision was evaluated through duplicate analyses (i.e. LCS/LCSD and MS/MSD). No samples were qualified exclusively on duplicate precision exceedances.

4.8 Compound Quantification

Fish Tissue (congeners)

An accurately weighed, approximately 2 gram subsample of the tissue was spiked with extraction standards (28L, 111L, and 178L, Section 4.5) then extracted and the resulting extract was split by weight into two uneven portions; 95% of the extract was reserved as backup. The remaining five percent of the extract was spiked with quantification standards, cleaned up, and used for initial analyses on April 24, 2008. This approach was taken by Axys due to high level congener concentrations expected in these samples based on previous fish tissue samples collected (as stated above). Due to the low levels of target analytes observed in these initial analyses, repeat analyses were conducted using the reserved portion of the extract on May 15, 2008. Repeat analyses are indicated by the “RX” suffix added to the laboratory sample ID.

A combination of the two analyses was reported by Axys. As described in Section 4.5 above, labeled standards 28L, 111L, and 178L were used to monitor extraction efficiency. Following routine sample preparation and cleanup procedures, Axys staff inadvertently introduced more cleanup standard solution (28L, 111L, and 178L) to the 95% portion of the extract prior to its cleanup (forgetting that the cleanup and internal standards were reversed for these samples as discussed in Section 4.5). For this reason, the standards used to monitor the efficiency of the extraction were reported from the initial analyses (five percent extract aliquot) and the remainder of the data were reported from the repeat analyses (95% extract aliquot).

Because the labeled quantification standards were introduced to the extract (post extraction and pre cleanup as described in Section 4.5), these standards were not exposed to the potential loss one might expect during the extraction process. Rather the “extraction standards” 28L, 111L, and 178L were used as a measure of aggregate loss encountered during extract and cleanup. Because the quantification standards used to quantify congener results were not exposed to the potential losses encountered during extraction, all fish tissue sample results have the potential to be biased slightly low. The presence and magnitude of this bias are indicated by the recoveries of the 28L, 111L, and 178L standards. As all labeled standards were recovered within method limits, no data qualification was considered necessary.

Congener results were reported by Axys as picograms per gram (pg/g) on a wet weight basis. The removal of an aliquot for the lipid determination has been accounted for in the quantification procedures such that the final results are in terms of the whole subsample extracted.

Homologue totals were obtained by summing the concentration of all detected congeners at each level of chlorination. Toxic Equivalents (TEQs) were calculated using World Health Organization 2005 Toxicity Equivalence Factors. Chromatographic peaks that met all other qualitative identification criteria but did not meet the method ion abundance ratio criteria were not included in the homologue totals or TEQ calculations.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range and over time. If detector response varies between the retention time of the standard and that of the target compound, concentrations can be biased high or low based on the variations in detector sensitivity. During congener analysis, PFK (perfluororkerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of co-eluting interferences or decreased sensitivity. No PCB congener results were qualified due to lock mass variations.

4.9 Target Compound Identification

Fish Tissue (non-congeners)

- Two metal standard reference materials (SRM) were analyzed. One (N.R.C.C Dolt-3) exceeded the upper CAS control limit for lead (i.e. 0.460 mg/kg versus control limit of 0.437 mg/kg) in sample delivery group K0801240. The LCS, MS/MSD, calibration standard and second SRM were all within the recovery control limits set by either the DoD QSM or CAS. Lead sample results were not flagged due to the SRM recovery.

Fish Tissue (congeners)

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but were more than 15% different from the theoretical ion abundance criterion set by EPA Method 1668A are flagged in the laboratory report with a ‘K’ flag. Those results flagged ‘K’ with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged ‘J-EMPC’ during this review. If the analyte result was previously qualified ‘U’ by method blank detection, the result retained the ‘U’ qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). These EMPC flags are not tabulated in this report but appear within the data tables in the main body of this deliverable. In addition, these flags are entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

Additionally, the flag ‘C’ was used in Table 3 to indicate co-eluting PCB isomers for this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification.

5.0 Completeness

The laboratory reported all requested analyses, and the deliverable data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. A summary of qualifiers can be found in Tables 2. A completeness summary follows; congener completeness was calculated using 209 congener results.

The electronic and pdf versions of the deliverables were cross-checked for accuracy at frequency of 20% for the congener data and 20% for non-congener data. No discrepancies were found between the deliverables.

- *Technical Completeness* = (number of useable results/total reported results) x100
  All samples results are considered useable.
  Congener = *(1,463 compliant / 1,463 total results) = 100*%
  Non-congener = *(259 compliant / 259 total results)*= 100%

- *Contract Completeness* = (number of contract compliant results/total reported results) x100
  Congener = *(1,463 compliant / 1,463 total results)* = 100%

Non-congener = *(259 compliant / 259 total results)*= 100%

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  Congener = *(1,317 compliant / 1,463 total results) = 90*%
  Non-congener = *(230 compliant / 259 total results)* = 88%
  Some congener data were qualified as estimated 'J-EMPC'.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100
  All proposed field samples were successfully collected.
  Congener = *(1,463 compliant / 1,463 total results)* = 100%
  Non-congener = *(259 compliant / 259 total results)*= 100%

6.0 References

URS 2007. Quality Assurance Project Plan, *Water Quality Monitoring for the In-Water Removal Action,* Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. July 2007.

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

USEPA 1995. U.S. Environmental Protection Agency (USEPA) Region 10 SOP for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

USEPA 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

USEPA 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 2005. USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

TABLES

Table 1. Reference Area Smallmouth Bass Collected Fall 2007

Quality Control Summary Report for Analytical Chemistry
Reference Area Smallmouth Bass Collected October/November 2007

						Analytes				
URS ID	**Length (mm)**	**Weight (grams)**	**Collection Date**	**CAS ID**	**Axys ID (congeners)**	**PCB (congeners) (Axys Analtyical)**	**SVOCs**	**Metals**	**%Lipids**	**%Solids**
071027R01SB	380	820	10/27/07	K0801240-001	L10965-1	X	X	X	X	X
071027R02SB	360	802	10/27/07	K0801240-002	L10965-2	X	X	X	X	X
071027R03SB	325	548	10/27/07	K0801240-003	L10965-3	X	X	X	X	X
071027R04SB	370	906	10/27/07	K0801240-004	L10965-4	X	X	X	X	X
071027R05SB	350	646	10/27/07	K0801240-005	L10965-5	X	X	X	X	X
071027R06SB	330	501	10/27/07	K0801240-006	L10965-6	X	X	X	X	X
071115R07SB	425	964	11/15/07	K0801240-007	L10965-7	X	X	X	X	X

Notes:

CAS – Columbia Analytical Services
ID – Identification
mm – millimeter
PCB – Polychlorinated biphenyl
SVOCs – Semivolatile Organic Compounds

Table 2. Smallmouth Bass Non-congener Qualifer Summary

Quality Control Summary Report for Analytical Chemistry

Reference Area Smallmouth Bass Collected October/November 2007

CAS ID	URS ID	Analyte	Qualifer	Rational
K0801240-001	071027R01SB	mercury	J	hold time
K0801240-002	071027R02SB			
K0801240-003	071027R03SB			
K0801240-004	071027R04SB			
K0801240-005	071027R05SB			
K0801240-006	071027R06SB			
K0801240-007	071115R07SB			
K0801240-001	071027R01SB	lead	13U	MB detections
K0801240-002	071027R02SB		14U	
K0801240-003	071027R03SB		14U	
K0801240-004	071027R04SB		15U	
K0801240-005	071027R05SB		14U	
K0801240-006	071027R06SB		13U	
K0801240-007	071115R07SB		14U	
K0801240-004	071027R04SB	nickel	298U	
K0801240-005	071027R05SB		306U	
K0801240-006	071027R06SB		277U	
K0801240-001	071027R01SB	di-n-butyl phthlate	220U	
K0801240-003	071027R03SB		150U	
K0801240-004	071027R04SB		280U	
K0801240-005	071027R05SB		150U	
K0801240-006	071027R06SB		230U	
K0801240-007	071115R07SB		87U	
K0801240-001	071027R01SB	cobalt	25.5U	calibration blank detections
K0801240-002	071027R02SB		30.9U	
K0801240-003	071027R03SB		27.8U	
K0801240-004	071027R04SB		24.8U	
K0801240-005	071027R05SB		25.5U	
K0801240-006	071027R06SB		26.7U	
K0801240-007	071115R07SB		36.1U	
K0801240-001	071027R01SB	acenapthene fluorene phenanthrene anthracene fluoranthene pyrene benzo(a)anthracene chrysene benzo(b)fluoranthene benzo(k)fluoranthene benzo(a)pyrene indeno(1,2,3-cd)pyrene dibenzo(a,h)anthracene benzo(g,h,i)perylene	J/UJ	PAH surrogate recovery (*fluorene-d10 and fluoranthene-d10*)
K0801240-004	071027R04SB			
K0801240-006	071027R06SB	arsenic zinc	J	MS/MSD recoveries
K0801240-006	071027R06SB	4-methylphenol	UJ	MSD recovery and RPD
K0801240-001	071027R01SB	pyrene	UJ	MSD recovery and RPD

Notes:

Not included are J flags indicating detections above the MDL and below the MRL.

Concentrations are reported in weight wet (μg/kg).

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

CONGENER RESULTS FOR FOREBAY AND REFRENCE AREA CLAMS AND CRAYFISH COLLECTED FROM FEBRUARY THROUGH MARCH 2008

JANUARY 2009

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the clam and crayfish Polychlorinated Biphenyl (PCB) results show the quality of the data is acceptable to support project objectives. The contracted laboratory provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged ‘J’ or ‘J-EMPC’. Some data were qualified as not detected and flagged ‘U’. Refer to Section 4.0 of this report for a listing of qualifier definitions. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report.

2.0 Project Description

A total of 67 tissue samples (35 clam samples and 32 crayfish samples) were submitted to Axys Analytical Services Ltd. of Sidney, British Columbia, Canada (Axys) for PCB congener analysis. These samples were collected from both the forebay and reference area during the February/March 2008 sampling event in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. Table 1 summarizes the URS sample and analytical laboratory identification numbers, collection dates and requested analyses. These samples were previously analyzed for PCB Aroclors, polynuclear aromatic hydrocarbons (PAHs), semivolatile organic compounds (SVOCs) and selected metals by Columbia Analytical Services (CAS) of Kelso, Washington. The analytical results for these analyses were presented in the *River Operable Unit Remedial Investigation Data Summary Report*, July 29, 2008 (URS 2008). This quality control summary report and attached tables only address PCB congener analytical results for the 67 clam and tissue samples. The other CAS-reported analytical results for these tissue samples and the PCB congener results reported for sediment samples are addressed in separate quality control summary reports.

3.0 Sampling and Analytical Procedures

Samples were analyzed according to the Bradford Island Bonneville Lock and Dam Project, *River Operable Unit Remedial Investigation Quality Assurance Project Plan* (QAPP) (URS 2007). The clam and tissue samples were submitted to CAS of Kelso, Washington in discrete batches throughout the February/March 2008 sampling event. The specifics of the sample receipts are detailed in the quality summary report attached with the original data report (URS 2008). In summary, all tissue samples arrived intact at CAS and were archived frozen prior to and following whole-body homogenization using an industrial blender. Authorization to release the remainder of the homogenized tissue samples to Axys to perform PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry* was given on June 25, 2008 by URS. The Axys analytical data reports include a listing of the Axys Method 1668A modifications. The PCB congener results for the clam and crayfish samples are reported in six Axys sample delivery groups, as outlined in Table 1.

Note: Clam samples from stations 9 and 67 and crayfish samples from stations 2 and 3 had insufficient sample volume (<3 grams) for congener analysis. Crayfish samples from stations 38 and 42 were analyzed as a composite to overcome inadequate individual sample volume. Refer to Section 4.10 for additional details regarding sample volume and sample specific reporting limits.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced method. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, reporting limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. As appropriate for the analytical method, the following items were reviewed for 20% or greater of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* (DOD 2006) does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (USEPA 2005a)* and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data* (USEPA 1995) as appropriate for method performed. In the case of disagreement between the documents listed as guidance or the analytical method, method criteria were utilized for data review. Project-specific QC criteria are listed in the above mentioned QAPP.

A summary of qualifiers assigned during this review is provided Tables 2 and 3. Samples are listed by their URS sample identification number assigned in the field as well as the laboratory identification number. All qualifiers are included in the database and are included in the data tables included in the main body of this report. Congeners are reported using sample-specific detection limits. Qualifiers that may be assigned to the results of this investigation as part of this QA/QC review include the following:

- U - The analyte was analyzed for but was not detected above the reported sample reporting limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample. This qualifier is used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample reporting limit. However, the reported reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

As stated above in Section 3.0, all tissue samples arrived intact at CAS and were archived frozen prior to and following whole-body homogenization using an industrial blender. As reported previously, the COC forms indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. All coolers were submitted to CAS at temperatures within the EPA-recommended temperature of 6 degrees Celsius (°C) or below. Representativeness was maintained during the sampling effort by completing all samples using similar sampling procedures and in accordance with approved QAPP.

The chain-of-custody (COC) forms from CAS to Axys indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All samples listed on the COC forms were present. The condition and temperature of the samples upon receipt by Axys was appropriate with the following exceptions:

- The coolers containing clam samples L11379-1 through L11379-37 and crayfish samples L11380-13 through L11380-19, L11380-22 through L11380-30, L11380-33 through L11380-35 and L11512-6 were recorded upon receipt by Axys at 12°C. (*Note*: sample L11512-6 was originally logged in under sample name L11380-21). All samples were frozen prior to shipment and packaged on dry ice per Method 1668A. Samples were shipped from CAS to Axys on June 30, 2008. Due to complications at customs the samples were received on July 3, 2008 by Axys, two days beyond the anticipated date of arrival. The samples were immediately frozen upon receipt by Axys. PCBs are known for long term stability (USEPA 2005b). The sample results were not qualified based on the slight elevation in temperature during the last day of shipment.

- Sample L11433-1 was shipped frozen separately. The cooler temperature upon receipt on July 16, 2008 was recorded at 9°C. The cooler was in transit for two days. Due to reasons previously stated above, sample results were not qualified based on cooler temperature upon receipt by Axys.
- If individual clams or crayfish were collected from the same sample station over the course of two or more sampling days the earliest acquisition date was used in both the sample identification number and reported on the chain of custody. In most instances, CAS was asked to composite and homogenize the sample specimens from multiple acquisition dates and relabel the sample containers prior to shipping the samples Axys. However, there were a few sample containers with inaccurate sample dates (i.e. not the oldest sample date); these are documented in the login notes taken by Axys. All sample acquisition dates were resolved and properly reported within the data deliverables by Axys.

All samples were analyzed within the technical and contracted holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and standard compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. Calibration compounds met the acceptance criteria as listed in the method with the following exception:

- The 12-hour CCV bracketing clam samples L11379-21WI, L11379-24WI, L11379-25WI, L11379-26WI and L11379-27WI within data deliverable DPWG26457 was inadvertently omitted. The initial CCV bracketing the above-listed samples was analyzed on August 26, 2008 at 9:44 am and the subsequent successful CCV was analyzed on August 27, 2008 at 8:44 am (23hrs later), both met acceptance criteria (only the initial CCV is listed in the report). The 'WI' suffix for the five above-listed samples indicates the extracts were diluted and instrumentally reanalyzed. The only congener reported from the diluted extracts was PCB 11, all other congeners were reported from the original (undiluted extract). Results for PCB 11 in these clam samples were not qualified due to the omission of the 12-hour CCV.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs and EPA Region 10 SOP.

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged 'U' or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as EMPCs were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using corn oil to approximate the lipid content of the samples.

Method blanks associated with the clam and crayfish samples had only low levels of a few PCBs. Samples qualified non-detect and flagged 'U' as a result of method blank detected PCB congeners are indentified in the URS Review Qualifier field of Tables 2 and 3.

4.4 Labeled Internal Standard Recovery Review

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to typically evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narratives. All recoveries were acceptable with the following exception:

- The percent recoveries of ^{13}C-labeled PCB 1 and ^{13}C-labeled PCB 4 in clam sample L11379-3 were below the Axys control limits of 15% and 30% with 12.7% and 20.0%, respectively. Recovery of ^{13}C-labeled PCB 4 in clam sample L11379-6 was also below the control of 30% with 23.6%. Both PCB 1 and PCB 4 have chemically identical isotopic labeled standards. Given that isotopic dilution calculations produce recovery corrected quantitation results, only the non-chemically identical PCB congeners, quantitated using these labeled standards were estimated based on these internal standard recoveries. Associated analytical results for PCB 2, and PCB 5 through 14 for clam sample L11379-3 and results PCB 5 through 14 for clam sample L11379-6 were qualified 'J/UJ'.

Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A with the following exception:

- The cleanup standards were inadvertently omitted from clam sample L11379-27 during sample preparation, the sample was not reanalyzed. All the labeled extraction standards were recovered within the acceptance criteria; therefore, no further action was taken.

4.5 Ongoing Precision and Recovery

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, Ongoing Precision and Recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using corn oil to approximate the lipid content of the samples. OPR recoveries were acceptable for congener analyses.

4.6 Duplicate Review

Field duplicates were not collected due to the statistical nature of the sampling event (as discussed in detail in the QAPP). Laboratory precision however, was monitored through laboratory duplicate analysis. Axys performed duplicate analysis on clam samples L11379-12, L11379-14, L11379-32 and crayfish samples L11380-15 and L11380-25. There is no guidance on laboratory duplicate precision for individual PCB congeners in the NFGs, the EPA Region 10 SOP, or Method 1668A. Axys uses the general rule that: if any one congener has an RPD greater than 40%, the data is flagged (at a minimum) and corrective action may be taken (i.e. reextraction or reanalysis). For analytical results greater than 5x the sample specific detection limit and not reported as EMPCs, the relative percent difference for individual congeners were on average less than 20%, indicating good analytical precision. Detailed evaluations of duplicate results can be found within the associated Axys analytical reports.

- The one exception was PCB 55 reported from the duplicate analysis of clam sample L11379-14 with a reported RPD of 57.4%. All other PCB congeners for this duplicate pair and the associated QC samples were in control, no further action was taken. Analytical results for PCB 55 in clam sample L11379-14 were estimated and flagged ‘J’ due to duplicate precision.

4.7 Compound Quantification

Multiple crayfish samples and clam samples were diluted and reanalyzed to bring area responses of some target congeners to within the linear calibration range of the instrument. Only the affected target compounds are reported from the reanalysis. Relevant concentrations from both the undiluted and diluted analytical results are reported within the data deliverable. The diluted reanalysis results are identified with a ‘W’ or ‘Wi’ within the Axys data deliverables. If a congener result is reported from the diluted analysis, Axys flagged the result with a ‘D’, these are shown in the Lab Qualifier columns of Tables 2 and 3.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass stability and its effect on analyte quantification was acceptable with the following exceptions:

- Crayfish sample L11380-7 had deflections in lock mass, interfering with several analytical analytes. The sample was re-injected and the lock mass stability was method compliant in the second analysis; the affected target analytes were reported from the re-injection. The re-injection results were reported with an 'i' suffix within the Axys data deliverables. No qualification was necessary.
- For clam sample L11379-15, a disturbance in the lock mass ion was observed at the retention time associated with PCB 54. Results for PCB 54 were flagged 'G' by Axys to indicate lock mass interference during the retention time window for PCB 54. The sample was not reanalyzed. PCB 54 for clam sample L11379-15 was qualified J-EMPC (J-EMPC is defined in Section 4.8 below), further qualification was not necessary.

4.8 Target Compound Identification

The flag 'C' assigned by Axys and listed in Tables 2 and 3 is used to indicate co-eluting PCB isomers. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification.

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but were more than 15% different from the theoretical ion abundance criterion set by EPA Method 1668A are flagged in the laboratory report with a 'K' flag. Those results flagged 'K' with ion abundance ratios outside the identified quantitation criteria were considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). These EMPC flags are tabulated in Tables 2 and 3 of this report and appear within the data tables in the main body of this deliverable. In addition, these flags are entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives. Additionally, it is important to note EMPC results were not included in the Axys-reported homologue totals or Toxicity Equivalent Quotient (TEQ) calculations.

All analytes flagged 'K' by Axys were due to the above-mentioned ion abundance ratio exceedance with the following exception:

- PCB 81 results for clam samples L11379-1 through L11379-13 and PCB 122 results for clam sample L11379-12 were flagged 'K' by Axys to indicate that the elution of peaks for PCB 81 and PCB 122 were on the tail of an adjacent peak with no distinct peak separation. While the ion abundance ratios met acceptance criteria, the peak integration and therefore quantification may be biased due to coeluting congeners. PCB 81 and PCB 122 in the above-listed samples were estimated and flagged 'J-EMPC'.

Relative retention times (RRTs) are used for qualitative determination of congener identification. All RRTs were within the guidelines presented in Table 2 of Method 1668A with the following exceptions:

- Clam samples L11379-2, L11379-3, L11379-5, L11379-6, L11379-7 and L11379-8 (within data package DPWG26475) all had a RRT for PCB 39 of 0.948 which was outside the acceptance window of 0.943-0.947.
- Clam samples L11379-32, L11379-34 and L11379-36 (within data package DPWG26479) all had a RRT for PCB 39 of 0.948 which was outside the acceptance window of 0.943-0.947.
- Clam sample L11379-12 (within data package DPWG26475) had a RRT for PCB 15 of 0.998 which was outside the acceptance window of 1.163-1.169.

Congener identification in the above-listed samples was determined based on comparisons between sample and calibration chromatograms. Analytical results for PCB 39 in the above-listed clam samples and PCB 15 in clam sample L11379-12 were qualified estimated and flagged 'J' due to RRT exceedance.

4.9 Comparability

The results from this sampling event are comparable to other sampling events because of the use of standard techniques to collect representative samples, consistent application of analytical method protocols, and reporting analytical results with appropriate units and reporting limits.

4.10 Reporting Limits

All non-detect congener results are reported at sample specific reporting limits. All clam and crayfish samples were analyzed using approximately 10 grams as recommended by Method 1668A, with the below-listed exceptions. Based on historical experience, Axys suggested 3 grams as the absolute minimum sample volume for standard Method 1668A analysis. Therefore, if the sample mass was below 10 grams, but above 3 grams, URS authorized Axys to analyze the sample.

- Crayfish samples L11380-32, L11380-33 and L11433-1 were analyzed using 3.19 grams, 7.67 grams and 7.03 grams, respectively. Axys used all available sample tissue, but there was not enough tissue to meet the above-mentioned 10 gram recommended criteria. The data user should be aware that the sample-specific detection limits reported for these samples, are on average slightly higher than those reported for the other tissue samples. As a result the total congener concentration, summed using non-detected congeners as zero, may have a slight low bias for these samples, the precise bias can not be determined. The overall data usability is considered sufficient to meet project objectives.

Axys performed dilution on both crayfish and clam samples due to calibration exceedances for some PCB congeners. The dilutions appear to have little to no impact on the reporting limits. Only those PCB congener results exceeding the calibration range in the initial analysis were selected for reporting from the diluted analysis.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. As part of this review, some data were qualified as estimated 'J' or 'J-EMPC' and some as non-detect 'U'. A summary of qualifiers can be found in Tables 2 and 3. A completeness summary follows; analysis completeness was calculated using 159 congener results, 209 total congeners minus the 50 co-eluting congeners which were reported with the lowest numbered congener in the co-eluting set.

The electronic and portable delivery format (.pdf) data package versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to Axys and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  All samples results are considered useable

  = (10,653 compliant / 10,653 total results) = 100%

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = (9,866 compliant / 10,653 total results) = 93%

  Data were qualified as estimated and flagged 'J' or 'J-EMPC' and some qualified non-detect and flagged 'U'.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = (10,653 compliant / 10,653 total results) = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/total reported results) x100

  = *(68 compliant / 72 total results) = 94%*

  Two clam and two crayfish samples submitted for analysis did not have adequate sample mass for congener analysis. Additionally crayfish mass collected from two different sample stations were combined to create enough sample mass for congener analysis; congener results were reported for one composite crayfish sample representing these two stations.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon, September 2007.

URS 2008. *River Operable Unit Remedial Investigation Data Summary Report*, Bradford Island Remedial Investigation, July 29, 2008.

USEPA 1995. *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data.*

USEPA 2005a. *National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review.* September 2005.

USEPA 2005b. *Environmental Protection Agency (EPA) Sample Holding Time Reevaluation*, EPA/600/R-05/124, October 2005.

Table 1. Sample ID and Analysis Summary
Bradford Island Remedial Investigation - Tissue Samples

						Anaytes					
Station Number	URS ID	Collection Date	CAS ID (non-congeners)	Axys ID (congeners)	Sample Delievery Group	PCB (Aroclors) (CAS)	PCB (congeners) (Axys Analytical)	PAHs	SVOCs	Metals	%Solids
Clams											
4	08022604TC	02/19/08	K0801325-010	L11379-1	DPWG26475	--	X	--	--	--	--
7	08021507TC	02/15/08	K0801325-004	L11379-2		--	X	--	--	--	--
8	08021508TC	02/15/08	K0801325-005	L11379-3		--	X	--	--	--	--
9	08021409TC	02/14/08	K0801325-006	Insufficient Volume (no sample)		--		--	--	--	--
10	08021410TC	02/14/08	K0801325-008	L11379-5		--	X	--	--	--	--
11	08021411TC	02/14/08	K0801325-007	L11379-6		--	X	--	--	--	--
15	08022115TC	02/21/08	K0801325-012	L11379-7		--	X	--	--	--	--
16	08022116TC	02/21/08	K0801325-013	L11379-8		--	X	--	--	--	--
17	08022117TC	02/11/08	K0801325-014	L11379-9		--	X	--	--	--	--
18	08021118TC	02/11/08	K0801325-003	L11379-10		--	X	--	--	--	--
21	08021221TC	02/12/08	K0801325-002	L11379-11		--	X	--	--	--	--
6	08031806TC	03/18/08	K0802503-001	L11379-13		--	X	--	--	--	--
5	08031905TC	03/19/08	K0802503-006	L11379-12		--	X	--	--	--	--
13	08031713TC	03/17/08	K0802503-002	L11379-14	DPWG26457	--	X	--	--	--	--
14	08031814TC	03/14/08	K0802503-003	L11379-15		--	X	--	--	--	--
65	08022965TC	02/29/08	K0802503-008	L11379-16		--	X	--	--	--	--
67	08030367TC	03/03/08	K0802503-007	Insufficient Volume (no sample)		--		--	--	--	--
88	08031788TC	03/17/08	K0802503-004	L11379-18		--	X	--	--	--	--
89	08031789TC	03/17/08	K0802503-005	L11379-19		--	X	--	--	--	--
22	08030522TC	03/05/08	K0801772-012	L11379-20		--	X	--	--	--	--
24	08030524TC	03/05/08	K0801772-011	L11379-21		--	X	--	--	--	--
28	08030428TC	03/04/08	K0801772-014	L11379-24		--	X	--	--	--	--
29	08022229TC	02/22/08	K0801772-020	L11379-25		--	X	--	--	--	--
34	08022534TC	02/25/08	K0801772-021	L11379-26		--	X	--	--	--	--
35	08022535TC	02/25/08	K0801772-001	L11379-27		--	X	--	--	--	--
36	08022536TC	02/25/08	K0801772-002	L11379-28	DPWG26479	--	X	--	--	--	--
37	08022637TC	02/26/08	K0801772-003	L11379-29		--	X	--	--	--	--
38	08022738TC	02/27/08	K0801772-004	L11379-30		--	X	--	--	--	--
39	08022739TC	02/27/08	K0801772-005	L11379-31		--	X	--	--	--	--
40	08022740TC	02/27/08	K0801772-006	L11379-32		--	X	--	--	--	--
41	08022741TC	02/27/08	K0801772-007	L11379-33		--	X	--	--	--	--
42	08022742TC	02/27/08	K0801772-010	L11379-34		--	X	--	--	--	--
85	08030685TC	03/06/08	K0801772-015	L11379-35		--	X	--	--	--	--
86	08030686TC	03/06/08	K0801772-016	L11379-36		--	X	--	--	--	--
87	08030687TC	03/06/08	K0801772-017	L11379-37		--	X	--	--	--	--
26	08030426TC	03/04/08	K0801772-018	L11379-22	DPWG26795	--	X	--	--	--	--
27	08030427TC	03/04/08	K0801772-019	L11379-23		--	X	--	--	--	--
Crayfish											
1	08021901CF	02/19/08	K0801458-005	L11380-1	DPWG26607	--	X	--	--	--	--
2	08021902CF	02/19/08		Insufficient Volume (no sample)		--				--	--
3	08022003CF	02/20/08				--				--	--
4	08021904CF	02/19/08	K0801458-008	L11380-4		--	X	--	--	--	--
5	08021505CF	02/15/08	K0801458-009	L11380-5		--	X	--	--	--	--
6	08021406CF	02/14/08	K0801458-001	L11380-6		--	X	--	--	--	--
7	08021407CF	02/14/08	K0801458-003	L11380-7		--	X	--	--	--	--
8	08021408CF	02/14/08	K0801458-002	L11380-8		--	X	--	--	--	--
13	08021413CF	02/14/08	K0801458-004	L11380-9		--	X	--	--	--	--
14	08022014CF	02/20/08	K0801458-010	L11380-10		--	X	--	--	--	--
15	08021915CF	02/19/08	K0801458-011	L11380-11		--	X	--	--	--	--
16	08022216CF	02/22/08	K0801458-019	L11433-1		--	X	--	--	--	--
17	08021917CF	02/19/08	K0801458-012	L11380-13		--	X	--	--	--	--
18	08021918CF	02/19/08	K0801458-013	L11380-14		--	X	--	--	--	--
19	08021919CF	02/19/08	K0801458-014	L11380-15		--	X	--	--	--	--
20	08021920CF	02/19/08	K0801458-015	L11380-16		--	X	--	--	--	--
21	08021921CF	02/19/08	K0801458-016	L11380-17		--	X	--	--	--	--
22	08022622CF	02/26/08	K0802375-024	L11380-18		--	X	--	--	--	--
33	08022233CF	02/22/08	K0802375-025	L11380-19	DPWG26606	--	X	--	--	--	--
38	08021838CF	02/18/08	K0802375-003	Composite (38+42)		--	X	--	--	--	--
42	08022842CF	02/28/08	K0802375-004	L11512-6		--	X	--	--	--	--
72	08030372CF	03/03/08	K0802375-005	L11380-22		--	X	--	--	--	--
73	08030373CF	03/03/08	K0802375-006	L11380-23		--	X	--	--	--	--
74	08030374CF	03/03/08	K0802375-007	L11380-24		--	X	--	--	--	--
75	08030375CF	03/03/08	K0802375-008	L11380-25		--	X	--	--	--	--
76	08030376CF	03/03/08	K0802375-009	L11380-26		--	X	--	--	--	--
78	08030378CF	03/03/08	K0802375-010	L11380-27		--	X	--	--	--	--
79	08030379CF	03/03/08	K0802375-011	L11380-28		--	X	--	--	--	--
82	08030382CF	03/03/08	K0802375-012	L11380-29		--	X	--	--	--	--
90	08031290CF	03/12/08	K0802375-013	L11380-30		--	X	--	--	--	--
91	08031291CF	03/12/08	K0802375-014	L11380-31		--	X	--	--	--	--
92	08031292CF	03/12/08	K0802375-015	L11380-32		--	X	--	--	--	--
94	08031294CF	03/12/08	K0802375-016	L11380-33		--	X	--	--	--	--
98	08031298CF	03/12/08	K0802375-017	L11380-34		--	X	--	--	--	--
100	080312100CF	03/12/08	K0802375-018	L11380-35		--	X	--	--	--	--
105	080314105CF	03/14/08	K0802375-019	Insufficient Volume (no sample)		--		--		--	--

Notes:

CAS - Columbia Analytical Services
Axys - Axys Analytical Services, Ltd.
ID - Identification
PCB - Polychlorinated Biphenyl
PAHs - Polyaromatic Hydrocarbons
SVOCs - Semivolatile Organic Compounds
-- previously reported, not included in this quality control summary report.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-1 through L11379-6

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	08022604TC L11379-1	Lab Qualifier	URS Review Qualifier	08021507TC L11379-2	Lab Qualifier	URS Review Qualifier	08021508TC L11379-3	Lab Qualifier	URS Review Qualifier	08021410TC L11379-5	Lab Qualifier	URS Review Qualifier	08021411TC L11379-6	Lab Qualifier	URS Review Qualifier
1		2.74			1.68			2.18			1.41			1.66		
2		3.68			3.01			4.21		J	2.54			3.06		
3		0.763			0.592			0.795			0.435			0.654		
4		100			59.5			39.8			32.8			36.8		
5		1.08			0.834			0.805		J	0.629			0.828		J
6		13.9			8.19			7.02		J	6.5			7.86		J
7		0.503			0.472			0.358		J	0.29	U		0.347		J
8		26.5			19.4			18.5		J	14.3			17.6		J
9		0.799			0.789			0.487		J	0.405			0.539		J
10		0.872			0.669			0.39		J	0.371			0.428	K	J-EMPC
11		8810	D		6810	D		8370	D	J	5260			6580	D	J
12	12 + 13	0.124	C U		0.212	C U		0.268	C U	UJ	0.308	C U		0.186	C U	UJ
13	12 + 13		C12			C12			C12			C12			C12	
14		0.167			0.202	U		0.255	U	UJ	0.293	U		0.178	U	UJ
15		25.7			18.5			22.9			27.4			26.3		
16		127			63.8			62.4			52.7			58		
17		208			85.9			64.1			47.4			50.7		
18	18 + 30	346	C		144	C		131	C		110	C		121	C	
19		24.8			14.3			8			6.35			7.4		
20	20 + 28	142	C		80.2	C		86.1	C		62.1	C		77.6	C	
21	21 + 33	70.4	C		38.2	C		42.3	C		30.3	C		38.6	C	
22		159			84.1			90.5			70.1			84		
23		0.115	U		0.0991	U		0.12	U		0.0879	U		0.083		
24		0.0417	U		0.758			0.0469	U		0.734	K	J-EMPC	0.0473	U	
25		33.9			9.37			7.96			5.64			6.52		
26	26 + 29	34	C		15.9	C		15.6	C		11.1	C		14.4	C	
27		107			36.2			22.6			15.8			14.4		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		83.6			47.1			51.4			35.6			48.1		
32		23.3			7.95			5			3.75			4.66		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.351			0.183	K	J-EMPC	0.187			0.18			0.191		
35		14			12.6			12.7			8.72			11.9		
36		3.86			3.07			3.54			2.45			3.13		
37		58.1			35.1			35.9			27.7			35.3		
38		2.77			1.04			1.15			0.815			0.832	K	J-EMPC
39		7.79			2.26		J	2.44		J	1.79		J	1.98		J
40	40 + 41 + 71	494	C		104	C		83.8	C		63.7	C		68.1	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		982			255			195			133			121		
43		14.3			5.57			6.01			4.04			4.35		
44	44 + 47 + 65	8950	C D		1710	C		1050	C		633	C		456	C	
45	45 + 51	65.2	C		19.9	C		17.5	C		13.4	C		14.7	C	
46		7.57			3.13			2.86			2.15			2.69		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		209			63.1			63.1			45.3			51.1		
49	49 + 69	771	C		140	C		121	C		85.9	C		92.9	C	
50	50 + 53	455	C		90.4	C		58.8	C		37.8	C		31.7	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		3660			501			392			284			279		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.452	K	J-EMPC	0.219			0.124			0.075			0.073		
55		0.968	U		0.34	U		0.339	U		0.241	U		0.421	U	
56		697			147			115			89			91		
57		1.2			0.579			0.566			0.45			0.624		
58		0.91	U		0.328	U		0.328	U		0.233	U		0.406	U	
59	59 + 62 + 75	74.6	C		28.8	C		30.1	C		22.8	C		25.5	C	
60		178			60			58.1			42.5			51.8		
61	61 + 70 + 74 + 76	3230	C D		542	C		446	C		317	C		344	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		42.6			11.6			10.7			7.84			9.51		
64		368			90.3			82.3			59.8			68.3		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		1680			387			337			244			280		
67		20.9			8.22			8.43			6.66			8.23		
68		5.15			2.48			2.36			1.78			2.36		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		5.58			2.37			2.33			1.76			2.05		
73		0.0417	U		0.0468	U		0.0469	U		0.0488	U		0.0473	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		69			35.9			34.8			26.9			33.6		
78		0.92	U		0.343	U		0.343	U		0.244	U		0.425	U	
79		613			125			78.5			43.8			23.9		
80		0.83	U		0.298	U		0.298	U		0.212	U		0.369	U	
81		3.3	K	J-EMPC	1.56	K	J-EMPC	1.42	K	J-EMPC	0.693	K	J-EMPC	1.42	K	J-EMPC
82		357			43.2			31.9			24.6			19.3		
83	83 + 99	9730	C D		1520	C		1210	C		726	C		621	C	
84		834			110			81.8			57.3			52.3		
85	85 + 116 + 117	1880	C		291	C		242	C		157	C		145	C	
86	86 + 87 + 97 + 108 + 119 + 125	17400	C D		2880	C		1860	C		1070	C		615	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	1010	C		129	C		105	C		69.7	C		61.1	C	
89		31.7			3.9			2.99			2.17			1.99		
90	90 + 101 + 113	15900	C D		2200	C		1790	C		1100	C		992	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		1290			187			162			112			115		
93	93 + 95 + 98 + 100 + 102	15200	C D		2410	C		1620	C		899	C		593	C	
94		10.5			1.53			1.28			0.906			0.943		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		8.86			1.27			0.979			0.732			0.662		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		16.2			3.03			2.92			2.1			2.26		
104		0.366			0.101	K	J-EMPC	0.091	K	J-EMPC	0.0598	U		0.094	K	J-EMPC
105		6200	D		924			741			455			407		
106		1.06	U		0.453	U		0.405	U		0.301	U		0.167	U	
107	107 + 124	521	C		77.4	C		62.7	C		37.4	C		32.8	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		653			120			102			66.5			69.8		
110	110 + 115	12400	C D		1720	C		1360	C		928	C		852	C	
111		0.359	U		0.295	U		0.321			0.26	K	J-EMPC	0.524	K	J-EMPC
112		0.359	U		0.275	U		0.261	U		0.225	U		0.206	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		445			65.5			52.5			28.1			23.8		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-1 through L11379-6
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	08022604TC L11379-1	Lab Qualifier	URS Review Qualifier	08021507TC L11379-2	Lab Qualifier	URS Review Qualifier	08021508TC L11379-3	Lab Qualifier	URS Review Qualifier	08021410TC L11379-5	Lab Qualifier	URS Review Qualifier	08021411TC L11379-6	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		64700	D		12100	D		7970	D		4090	D		2260		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		15.5			6.92			7.21			5.52			7.17		
121		0.506			0.297	U		0.339			0.266			0.309		
122		60.9			13.4			12.7			6.55			4.83		
123		1150			229			152			83.7			46.2		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		11			4.57			4.17			3.37			4.13		
127		23.4			5.19			2.92			1.68			0.178	U	
128	128 + 166	1220	C		231	C		200	C		130	C		128	C	
129	129 + 138 + 160 + 163	30900	C D		5610	C		4250	C		2590	C		2080	C	
130		488			112			96.1			65.3			68.5		
131		87.8			14.5			11.8			7.5			7		
132		1420			265			223			157			152		
133		80			23.5			21.9			14.9			17.9		
134	134 + 143	253	C		50.1	C		43.3	C		28.9	C		29	C	
135	135 + 151 + 154	1440	C		343	C		323	C		223	C		258	C	
136		406			67.2			59.2			41.6			41.4		
137		956			164			113			65.6			37.9		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	183	C		31.9	C		27.6	C		16.5	C		15.5	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		299			61.6			58.8			43.3			35.9		
142		0.834	U		0.433	U		0.443	U		0.546	U		0.596	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		204			36.1			33			21.7			23.4		
145		2.16			0.288			0.29			0.232			0.108		
146		2310			584			501			327			331		
147	147 + 149	10000	C D		1910	C		1640	C		1070	C		1070	C	
148		5.32			1.86			1.94			1.42			1.71		
149	147 + 149		C147			C147			C147			C147			C147	
150		5.1			1.31			1.38			0.918			1.09		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		4.02			0.611			0.541			0.349			0.332		
153	153 + 168	61300	C D		14400	C D		10100	C D		5270	C		3560	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		1.06			0.802			0.869	K	J-EMPC	0.664			0.894		
156	156 + 157	3610	C		584	C		405	C		228	C		136	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		1480			264			215			126			115		
159		5.83			2.11			1.77			1.47			1.85		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.554	U		0.304	U		0.311	U		0.383	U		0.418	U	
162		25.6			5.18			4.23			2.51			2.71		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		255			46			42.1			30.7			32		
165		1.63			0.636			0.575			0.439	U		0.587		
166	128 + 166		C128			C128			C128			C128			C128	
167		3800	D		944			566			302			146		
168	153 + 168		C153			C153			C153			C153			C153	
169		16.5	U		5.6	U		4.73	U		3.37	U		3.27	U	
170		188			49.4			44.6			32.9			38.9		
171	171 + 173	283	C		88.2	C		79.6	C		55.6	C		62.4	C	
172		18.4			6.23			5.91			4.7			5.65		
173	171 + 173		C171			C171			C171			C171			C171	
174		129			41.6			39.7			31.6			36.1		
175		28.9			9.62			9.47			6.5			7.84		
176		86.4			31			29.8			21.7			25.6		
177		485			196			188			136			164		
178		179			88.2			88			62.9			80.6		
179		245			116			115			84.2			105		
180	180 + 193	2720	C		874	C		692	C		491	C		476	C	
181		30.8			5.6			4.57			2.73			2.16		
182		3.27			1.4			1.51			1.19			1.21		
183	183 + 185	865	C		265	C		243	C		171	C		194	C	
184		2			1.29			1.43			1			1.31		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0417	U		0.0468	U		0.0469	U		0.0488	U		0.0473	U	
187		1490			679			671			479			602		
188		1.86			1.27			1.22			0.917			1.11		
189		10.1			2.22			2.12			1.52			1.71		
190		435			130			114			78.7			79.8		
191		32.2			8.64			7.73			5.5			5.77		
192		0.0417	U		0.0468	U		0.0495	U		0.0488	U		0.0473	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		19.5			8.22			8.38			6.54			8.52		
195		54			24.7			24.5			18			22.2		
196		34.2			13.9			14			10.5			12.7		
197	197 + 200	17	C		7.61	C		7.75	C		5.7	C		6.96	C	
198	198 + 199	61.1	C		29.1	C		28.6	C		22.6	C		28	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		40.6			19.7			19.2			14.2			17.8		
202		101			60.9			61.2			45.2			57.8		
203		324			144			136			98.7			111		
204		0.082			0.074	K	J-EMPC	0.081			0.093			0.073	K	J-EMPC
205		9.52			4.16			4.14			2.98			3.65		
206		30.2			15.7			15.9			11.8			14.7		
207		5.44			3.05			3.05			2.26			2.84		
208		11.7			7.24			7.2			5.51			7		
209		13.5			10.8			11.2			8.26			10.8		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-7 through L11379-11
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	08022115TC L11379-7	Lab Qualifier	URS Review Qualifier	08022116TC L11379-8	Lab Qualifier	URS Review Qualifier	08022117TC L11379-9	Lab Qualifier	URS Review Qualifier	08021118TC L11379-10	Lab Qualifier	URS Review Qualifier	08021221TC L11379-11	Lab Qualifier	URS Review Qualifier
1		1.65			1.32			1.78			1.91			1.8		
2		3.31			3.05			3.56			3.45			3.64		
3		0.642	K	J-EMPC	0.654			0.677			0.634			0.576	K	J-EMPC
4		36.6			36.2			33.1			37.1			38.9		
5		0.8			0.728			0.74			0.719			0.61		
6		7.64			7.43			7.39			8.01			8.3		
7		0.379			0.297			0.321			0.355			0.296		
8		19.7			16.3			17.5			19.8			17		
9		0.51	K	J-EMPC	0.456	K	J-EMPC	0.504			0.576			0.444		
10		0.493			0.426			0.408			0.443			0.392		
11		6630	D		6220	D		6080	D		6840	D		6470	D	
12	12 + 13	0.27	C U		0.225	C U		0.132	C U		0.108	C U		0.15	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.258	U		0.214	U		0.128	U		0.127			0.146	U	
15		20.1			23.3			16.4			17.3			20.4		
16		60.9			62			63.7			66			68.7		
17		52.3			51.9			53.1			55.3			54		
18	18 + 30	123	C		127	C		127	C		132	C		133	C	
19		7.74			6.67			6.71			7.63			6.96		
20	20 + 28	79.4	C		74.7	C		75.5	C		77.8	C		69.8	C	
21	21 + 33	38.3	C		35.2	C		37.6	C		41.8	C		34.2	C	
22		80.3			77.8			82.4			86.6			76.3		
23		0.077			0.086			0.0996	U		0.082			0.075		
24		0.0481	U		0.0484	U		0.723	K	J-EMPC	0.0466	U		0.0457	U	
25		6.53			6.13			6.55			6.53			5.8		
26	26 + 29	14.1	C		13.4	C		13.4	C		14.4	C		13	C	
27		14.5			15.5			14.3			14.5			15.8		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		47.6			42.7			45.1			48.4			39.3		
32		4.81			4.43			5.03			5.87			4.41		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.227			0.183			0.215			0.225			0.213		
35		11.9			9.93			9.6			10.4			9.54		
36		3.15			2.84			2.76			2.98			2.75		
37		35.2			30.6			31.8			36.1			32.4		
38		0.868			0.797			0.845			0.887			0.791		
39		1.91		J	1.85		J	2.06			2.26			1.95		
40	40 + 41 + 71	64.4	C		64.3	C		66.5	C		77.6	C		63.2	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		124			128			132			141			122		
43		3.83			4.33			4.24			4.68			4.15		
44	44 + 47 + 65	458	C		484	C		484	C		504	C		452	C	
45	45 + 51	15.6	C		14.2	C		16.7	C		18	C		14.8	C	
46		2.6			2.45			2.77			3.03			2.51		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		48			49.9			54			58			49.7		
49	49 + 69	88.1	C		83.7	C		95	C		101	C		83.7	C	
50	50 + 53	32.9	C		34.1	C		37.4	C		38.3	C		34.2	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		262			261			277			296			261		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.135			0.0484	U		0.066			0.071			0.058	K	J-EMPC
55		0.395	U		0.488	U		0.424	U		0.496	U		0.449	U	
56		86.5			80			89.6			101			79.6		
57		0.496			0.535			0.563			0.6			0.497		
58		0.381	U		0.472	U		0.399	U		0.466	U		0.422	U	
59	59 + 62 + 75	24.7	C		26.3	C		26.6	C		28.1	C		26.3	C	
60		51.2			45.3			49			56.2			46.6		
61	61 + 70 + 74 + 76	319	C		307	C		330	C		358	C		300	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		8.78			8.57			9.25			10			8.44		
64		67.9			61.6			69.2			76.2			61.9		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		258			249			269			300			253		
67		7.55			6.99			8.06			8.39			7.32		
68		2.15			1.94			2.22			2.18			1.76		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		1.99			1.87			2.13			2.07			1.81		
73		0.0481	U		0.0484	U		0.0469	U		0.0466	U		0.0457	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		33.3			30.1			30.7			33.9			32		
78		0.398	U		0.493	U		0.403	U		0.471	U		0.427	U	
79		24.5			22.8			22.8			23.6			22.1		
80		0.346	U		0.429	U		0.363	U		0.425	U		0.385	U	
81		1.31	K	J-EMPC	1.54	K	J-EMPC	1.55	K	J-EMPC	1.42	K	J-EMPC	1.38	K	J-EMPC
82		19.1			15.6			18.7			19			16		
83	83 + 99	579	C		567	C		583	C		592	C		554	C	
84		51.2			45.9			52.6			54.2			48.8		
85	85 + 116 + 117	142	C		129	C		136	C		143	C		134	C	
86	86 + 87 + 97 + 108 + 119 + 125	614	C		583	C		599	C		600	C		573	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	59.4	C		55.3	C		64.2	C		63.6	C		57.9	C	
89		2.04			1.8			1.98			2.21			1.9		
90	90 + 101 + 113	923	C		899	C		968	C		967	C		927	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		109			104			114			117			109		
93	93 + 95 + 98 + 100 + 102	603	C		605	C		676	C		648	C		591	C	
94		0.923			0.766			0.894			0.95			0.735		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.667			0.591			0.743			0.724			0.647		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		2.1			2.13			2.47			2.49			2.04		
104		0.084	K	J-EMPC	0.074	K	J-EMPC	0.074			0.081			0.072	K	J-EMPC
105		397			361			365			377			371		
106		0.293	U		0.28	U		0.314	U		0.212	U		0.287	U	
107	107 + 124	32.4	C		29.4	C		29.9	C		30.1	C		30.8	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		69.1			64.5			60.9			62.5			61.4		
110	110 + 115	812	C		738	C		786	C		796	C		784	C	
111		0.495	K	J-EMPC	0.383	K	J-EMPC	0.545			0.412	K	J-EMPC	0.418		
112		0.185	U		0.124	U		0.184	U		0.205	U		0.22	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		23.1			20.9			20.2			22.8			21.6		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		2300			2170			2080			2130			2050		

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-7 through L11379-11
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	08022115TC L11379-7	Lab Qualifier	URS Review Qualifier	08022116TC L11379-8	Lab Qualifier	URS Review Qualifier	08022117TC L11379-9	Lab Qualifier	URS Review Qualifier	08021118TC L11379-10	Lab Qualifier	URS Review Qualifier	08021221TC L11379-11	Lab Qualifier	URS Review Qualifier
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		6.72			6.52			6.4			6.56			6.4		
121		0.319			0.321			0.363			0.321			0.311		
122		5.1			3.84			3.95			3.8			3.87		
123		47.1			42			38.4			41.3			39.2		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		3.86			4.02			3.39			3.63			4		
127		1.04			1.13			0.319	U		1.03			1.15		
128	128 + 166	135	C		114	C		114	C		122	C		118	C	
129	129 + 138 + 160 + 163	2070	C		1970	C		1800	C		1890	C		1890	C	
130		69.4			61.2			57.6			58.6			57.4		
131		6.9			6.11			5.92			5.9			5.96		
132		147			131			129			132			127		
133		17.7			16.3			14.8			15.3			14.7		
134	134 + 143	29.2	C		26.4	C		26.4	C		26.9	C		24.8	C	
135	135 + 151 + 154	256	C		241	C		246	C		259	C		243	C	
136		41.3			39.3			44.2			44.5			39.3		
137		37.5			37.3			28.8			33.8			30.6		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	15.3	C		14.5	C		13.6	C		14.5	C		13.4	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		39.5			33.2			33			37.5			33.7		
142		0.759	U		0.745	U		0.588	U		0.589	U		0.754	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		22.3			21.6			21			23.5			20.9		
145		0.143	K	J-EMPC	0.097	K	J-EMPC	0.117			0.116			0.107		
146		324			311			270			290			286		
147	147 + 149	1040	C		993	C		941	C		1000	C		962	C	
148		1.54			1.58			1.64			1.74			1.66		
149	147 + 149		C147			C147			C147			C147			C147	
150		1.01			1.05			1.14			1.21			1.06		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.314			0.325	K	J-EMPC	0.357			0.371			0.322		
153	153 + 168	3830	C		3740	C		2980	C		3160	C		2950	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.856			0.72			0.822	K	J-EMPC	0.826			0.732		
156	156 + 157	133	C		128	C		120	C		124	C		121	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		115			103			98.8			104			103		
159		1.78			1.56			1.49			1.62			1.71		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.533	U		0.523	U		0.39	U		0.392	U		0.501	U	
162		2.92			2.06			2.23			2.24			2.2		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		33.2			27.4			29.3			31.3			29.8		
165		0.61	U		0.599	U		0.521			0.58			0.58	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		157			149			134			131			125		
168	153 + 168		C153			C153			C153			C153			C153	
169		3.56	U		3.53	U		3.4	U		3.66	U		3.62	U	
170		39.3			32.3			32.2			34.7			34.3		
171	171 + 173	66.8	C		56.3	C		55.5	C		55.1	C		57.2	C	
172		5.45			4.6			4.53			5.02			4.75		
173	171 + 173		C171			C171			C171			C171			C171	
174		37.9			31.1			30.8			32.9			32.1		
175		8.34			7.2			6.9			7.01			7.22		
176		25.8			23.3			21.2			21.1			22.2		
177		170			148			146			141			151		
178		82.3			72.4			70.3			70			72.9		
179		105			95.7			88.2			86.2			88.3		
180	180 + 193	509	C		489	C		420	C		424	C		433	C	
181		2.34			2.13			1.95			2.04			2.07		
182		1.14			0.0484	U		1.18			1.23			1.12		
183	183 + 185	201	C		183	C		170	C		175	C		184	C	
184		1.38			1.2			1.1			1.05			1.09		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0481	U		0.0484	U		0.0469	U		0.0466	U		0.0463	U	
187		617			549			502			520			556		
188		1.2			1.08			1.02			1.06			1		
189		1.56			1.56			1.67			1.6			1.66		
190		84.1			76.5			68.5			71.6			77.5		
191		6.07			5.28			5.26			5.28			5.14		
192		0.0481	U		0.0484	U		0.0469	U		0.0466	U		0.0539	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		7.72			6.83			7.11			7.23			7.74		
195		22.6			19.9			19.5			18.5			19.3		
196		12.4			11.4			11.9			11.8			11.6		
197	197 + 200	7.31	C		6.44	C		6.39	C		6.3	C		6.09	C	
198	198 + 199	27.3	C		24	C		25.2	C		25.1	C		23.9	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		18.6			16.4			16.3			15.8			15.6		
202		58.2			52.1			49.2			47.4			49.4		
203		116			111			106			107			104		
204		0.053			0.066	K	J-EMPC	0.066	K	J-EMPC	0.067	K	J-EMPC	0.061	K	J-EMPC
205		3.69			3.36			3.35			3.26			3.22		
206		14.8			13.1			13.1			12.5			12.7		
207		2.77			2.58			2.71			2.51			2.64		
208		7.09			6.1			6.13			5.82			5.95		
209		10.9			9.41			9.45			8.11			8.91		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.

D = The reported value is from a diluted analysis.

G = Axys qualifier indicating a lockmass deflection affected the result.

J = The reported value is an estimate.

J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

K = Axys qualifier indicating the analyte did not meet relative response factor criteria.

Non-detect values reported at the RL.

PCBs = Polychlorinated Biphenyls

RL = analyte-specific reporting limit

U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-12 through L11379-13
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	0803190STC L11379-12	Lab Qualifier	URS Review Qualifier	0803180GTC L11379-13	Lab Qualifier	URS Review Qualifier
1		2.83			4.56		
2		2.78			3.68		
3		0.763			0.914		
4		93.7			227		
5		0.956			1.11		
6		9.6			12.9		
7		0.493			1.06		
8		24			37		
9		0.801			1.64		
10		1.02			2.45		
11		7750			9620	D	
12	12 + 13	0.229	C U		0.173	C U	
13	12 + 13		C12			C12	
14		0.218	U		0.168	U	
15		23		J	25.7		
16		77.3			97		
17		105			159		
18	18 + 30	193	C		235	C	
19		13.8			40.9		
20	20 + 28	97.1	C		115	C	
21	21 + 33	46.7	C		56.9	C	
22		107			117		
23		0.219	U		0.175	U	
24		0.571			0.0487	U	
25		12.6			15.4		
26	26 + 29	18.7	C		23.8	C	
27		42.1			68.1		
28	20 + 28		C20			C20	
29	26 + 29		C26			C26	
30	18 + 30		C18			C18	
31		61.3			76.2		
32		8.09			17.8		
33	21 + 33		C21			C21	
34		0.259			0.348		
35		14.3			16.5		
36		3.68			4.31		
37		43			53.7		
38		1.49			1.53		
39		3.32			3.85		
40	40 + 41 + 71	114	C		182	C	
41	40 + 41 + 71		C40			C40	
42		262			341		
43		4.49			10.9		
44	44 + 47 + 65	1760	C		2430	C	
45	45 + 51	22.2	C		34.2	C	
46		3.71			6.15		
47	44 + 47 + 65		C44			C44	
48		72.2			101		
49	49 + 69	171	C		310	C	
50	50 + 53	104	C		158	C	
51	45 + 51		C45			C45	
52		665			1320		
53	50 + 53		C50			C50	
54		0.175	K	J-EMPC	0.544		
55		1.08	U		0.575	U	
56		180			243		
57		0.948	U		0.813		
58		1.06	U		0.541	U	
59	59 + 62 + 75	35	C		43.4	C	
60		76.2			104		
61	61 + 70 + 74 + 76	729	C		1210	C	
62	59 + 62 + 75		C59			C59	
63		15.1			21.5		
64		110			186		
65	44 + 47 + 65		C44			C44	
66		516			714		
67		11.6			15		
68		2.5			3.66		
69	49 + 69		C49			C49	
70	61 + 70 + 74 + 76		C61			C61	
71	40 + 41 + 71		C40			C40	
72		2.61			3.33		
73		0.0495	U		0.0487	U	
74	61 + 70 + 74 + 76		C61			C61	
75	59 + 62 + 75		C59			C59	
76	61 + 70 + 74 + 76		C61			C61	
77		41			52.3		
78		1.02	U		0.547	U	
79		152			160		
80		0.903	U		0.493	U	
81		2.7	K	J-EMPC	1.97	K	J-EMPC
82		57.4			120		
83	83 + 99	1540	C		2710	C	
84		123			301		
85	85 + 116 + 117	330	C		591	C	
86	86 + 87 + 97 + 108 + 119 + 125	2790	C		4080	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
88	88 + 91	146	C		303	C	
89		4.63			9.91		
90	90 + 101 + 113	2310	C		4200	C	
91	88 + 91		C88			C88	
92		207			423		
93	93 + 95 + 98 + 100 + 102	2390	C		3930	C	
94		1.68			4.22		
95	93 + 95 + 98 + 100 + 102		C93			C93	
96		1.57			3.71		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93	
99	83 + 99		C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93	
101	90 + 101 + 113		C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93	
103		3.57			6.7		
104		0.167	K	J-EMPC	0.132	K	J-EMPC
105		1020			1730		
106		0.391	U		0.715	U	
107	107 + 124	88.9	C		136	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
109		148			224		
110	110 + 115	1920	C		3490	C	
111		0.657	U		0.68	U	
112		0.636	U		0.68	U	
113	90 + 101 + 113		C90			C90	
114		77.4			126		
115	110 + 115		C110			C110	
116	85 + 116 + 117		C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-12 through L11379-13

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26475

IUPAC #	COELUTING CONGENERS[1]	08031905TC L11379-12	Lab Qualifier	URS Review Qualifier	08031806TC L11379-13	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85	
118		10300	D		15900	D	
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
120		8.05			9.61		
121		0.649	U		0.699	U	
122		19.9	K	J-EMPC	22.3		
123		239			293		
124	107 + 124		C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
126		5.27			5.74		
127		5.67			7.75		
128	128 + 166	244	C		416	C	
129	129 + 138 + 160 + 163	5880	C		7400	C	
130		125			176		
131		13.3			27.3		
132		272			497		
133		24.9			35.1		
134	134 + 143	51	C		96	C	
135	135 + 151 + 154	362	C		579	C	
136		71.9			143		
137		163			237		
138	129 + 138 + 160 + 163		C129			C129	
139	139 + 140	29.6	C		54.8	C	
140	139 + 140		C139			C139	
141		104			100		
142		2.04	U		0.91	U	
143	134 + 143		C134			C134	
144		39.9			69.2		
145		0.34			0.686		
146		591			776		
147	147 + 149	1920	C		2760	C	
148		2.12			2.99		
149	147 + 149		C147			C147	
150		1.45			2.49		
151	135 + 151 + 154		C135			C135	
152		0.702			1.45		
153	153 + 168	13300	C D		18100	C D	
154	135 + 151 + 154		C135			C135	
155		1.09			1.18		
156	156 + 157	614	C		828	C	
157	156 + 157		C156			C156	
158		259			397		
159		2.58			2.88		
160	129 + 138 + 160 + 163		C129			C129	
161		1.43	U		0.604	U	
162		4.31			8.18		
163	129 + 138 + 160 + 163		C129			C129	
164		60.4			88.6		
165		1.62	U		0.7	U	
166	128 + 166		C128			C128	
167		956			1180		
168	153 + 168		C153			C153	
169		1.73	U		6.6	U	
170		58.5			78.4		
171	171 + 173	91.8	C		119	C	
172		7.22			8.92		
173	171 + 173		C171			C171	
174		46.6			61.2		
175		10.6			13.7		
176		31.3			41.3		
177		217			266		
178		90.9			118		
179		116			149		
180	180 + 193	929	C		1050	C	
181		5.76			8.24		
182		1.55			2.18		
183	183 + 185	288	C		343	C	
184		1.44			1.67		
185	183 + 185		C183			C183	
186		0.0929	U		0.0487	U	
187		736			879		
188		1.18			1.64		
189		2.77			4.03		
190		142			162		
191		10.7			12.7		
192		0.11	U		0.0563	U	
193	180 + 193		C180			C180	
194		10			11.8		
195		25.3			30.9		
196		15.2			18.9		
197	197 + 200	8.14	C		9.58	C	
198	198 + 199	31.4	C		38.5	C	
199	198 + 199		C198			C198	
200	197 + 200		C197			C197	
201		19.9			25		
202		59.7			73.6		
203		144			171		
204		0.097			0.132	K	J-EMPC
205		4.26			5.31		
206		16.7			19.7		
207		3.29			3.9		
208		7.88			9		
209		11			12.7		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-14 through L11379-19
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26457

IUPAC #	COELUTING CONGENERS[1]	0803171 3TC L11379-14	Lab Qualifier	URS Review Qualifier	0803181 4TC L11379-15	Lab Qualifier	URS Review Qualifier	0802296 5TC L11379-16	Lab Qualifier	URS Review Qualifier	0803178 8TC L11379-18	Lab Qualifier	URS Review Qualifier	0803178 9TC L11379-19	Lab Qualifier	URS Review Qualifier
1		1.66			1.87			1.87			1.69			1.85		
2		3.32			3.72			3.48			3.25			3.31		
3		0.716		U	0.777		U	0.846		U	0.755		U	0.723		U
4		42.9			44.6			46.3			39.3			34.7		
5		0.94			1.16			1.14			1.08			0.946		
6		11.4			10.9			11.4			9.06			8.02		
7		0.443			0.46			0.474			0.446			0.567		
8		24.8			25			25.6			23.4			22.3		
9		0.647			0.752			0.714			0.668			0.648	K	J-EMPC
10		0.596			0.729			0.664			0.674			0.647		
11		7780	D		7370	D		8450	D		8120	D		7760		
12	12 + 13	51.1	C		59.3	C		71.7	C		59.9	C K	J-EMPC	59.1	C	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.174			0.24	K	J-EMPC	0.201			0.182			0.194	K	J-EMPC
15		16.2			15.3			18.7			14.2			13.5		
16		89.6			86.3			96.8			81.9			71.1		
17		80.6			76.3			81.1			69.7			62.4		
18	18 + 30	195	C		188	C		195	C		164	C		146	C	
19		7.78			8.22			8.42			8.38			8.24		
20	20 + 28	102	C		104	C		99.8	C		89.2	C		86.6	C	
21	21 + 33	47.3	C		48.6	C		49.1	C		44.1	C		43.4	C	
22		109			109			105			97.9			87.7		
23		0.121	K	J-EMPC	0.127	K	J-EMPC	0.104	K	J-EMPC	0.096	K	J-EMPC	0.118	K	J-EMPC
24		1.5			0.956			1.25			1.14			1.05		
25		9.05			8.79			9.06			8.33			7.62		
26	26 + 29	18.3	C		18.2	C		19.2	C		17.1	C		16.7	C	
27		21.1			20.6			20.9			18			16.4		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		58.6			60.7			61.3			55.4			57.4		
32		7.07			7.58			6.82			5.9			6		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.294			0.295			0.273			0.286	K	J-EMPC	0.258	K	J-EMPC
35		12.4			13.3			13.6			14.4			13.7		
36		3.6			3.83			4.07			3.8			3.55		
37		39			41.7			45.1			42.5			39.9		
38		1.12			1.3			1.13			1.25	K	J-EMPC	1.09	K	J-EMPC
39		2.44			2.66			2.59			2.52			2.34		
40	40 + 41 + 71	81.1	C		80.6	C		87.8	C		79.8	C		77.5	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		184			179			163			154			149		
43		3.92			3.72			4.21			3.47			3.65		
44	44 + 47 + 65	665	C		647	C		610	C		592	C		558	C	
45	45 + 51	21.4	C		20.6	C		22.4	C		20.2	C		19.8	C	
46		3.53			3.43			3.78			3.55			3.72		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		69.5			67			72.5			63.1			60		
49	49 + 69	117	C		115	C		132	C		122	C		122	C	
50	50 + 53	51.4	C		47.9	C		49.2	C		45.1	C		42.1	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		347			339			376			356			342		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.086			0.06	K G	J-EMPC	0.136			0.126	K	J-EMPC	0.118	K	J-EMPC
55		2.38		J	4.37			4.43			4.02	K	J-EMPC	5.2		
56		106			115			106			108			100		
57		0.839			0.912	K	J-EMPC	1.01			0.737			0.853		
58		0.929			1.02			1.22			1.3			1.23		
59	59 + 62 + 75	32.1	C		31.5	C		33.7	C		30	C		26.9	C	
60		57.9			60.6			65.3			63.1			61.4		
61	61 + 70 + 74 + 76	425	C		446	C		459	C		444	C		432	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		11.9			12.4			12.9			12.1			12		
64		83.3			83.6			92.3			88			87.4		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		347			361			362			347			328		
67		11.4			11.6			11.6			10.6			10		
68		2.77			2.78			3.26			2.87			2.58		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		2.47			2.62			3			2.69			2.39		
73		0.0481	U		0.0488	U		0.0492	U		0.0471	U		0.0495	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		37.5			38.8			42			39.8			35.9		
78		0.404	U		0.428	U		0.309	U		0.319	U		0.325	U	
79		25			29.5			26.1			29.1			27.3		
80		0.356	U		0.377	U		0.278	U		0.287	U		0.293	U	
81		1.94			2.08	K	J-EMPC	2.46			2.01			2.38		
82		17.9			20.1			20.5			20.9			20.6		
83	83 + 99	709	C		729	C		771	C		764	C		701	C	
84		60.5			61.6			66.6			68.2			65.3		
85	85 + 116 + 117	163	C		173	C		186	C		189	C		172	C	
86	86 + 87 + 97 + 108 + 119 + 125	777	C		803	C		744	C		792	C		753	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	76.1	C		75.6	C		83.9	C		81.2	C		76.1	C	
89		2.36			2.25			2.51			2.47			2.55		
90	90 + 101 + 113	1160	C		1190	C		1250	C		1240	C		1130	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		132			135			146			140			134		
93	93 + 95 + 98 + 100 + 102	835	C		811	C		768	C		796	C		753	C	
94		1.1			1.09			1.2			1.22			1.14		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.923			0.857			0.944			0.949			0.998		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		2.91			2.92			3.29			3.08			2.89		
104		0.123	K	J-EMPC	0.104	K	J-EMPC	0.149			0.09	K	J-EMPC	0.088	K	J-EMPC
105		437			464			478			476			444		
106		2.73	U		2.96	U		2.41	U		3.02	U		2.56	U	
107	107 + 124	37.1	C		41.6	C		41.3	C		41.6	C		39.2	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		79.8			82.3			89.3			84.9			77.4		
110	110 + 115	956	C		1010	C		1050	C		1050	C		955	C	
111		0.4	K	J-EMPC	0.445	K	J-EMPC	0.624	K	J-EMPC	0.645			0.59		
112		0.0793	U		0.0904	U		0.058	U		0.173	U		0.148	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		26			27.4			29.1			28.7			27.3		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-14 through L11379-19
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26457

IUPAC #	COELUTING CONGENERS[1]	08031713TC L11379-14	Lab Qualifier	URS Review Qualifier	08031814TC L11379-15	Lab Qualifier	URS Review Qualifier	08022965TC L11379-16	Lab Qualifier	URS Review Qualifier	08031788TC L11379-18	Lab Qualifier	URS Review Qualifier	08031789TC L11379-19	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		2730			2870			2540			2760			2670		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		8.1			8.63			8.59			8.27			7.57		
121		0.352			0.459			0.498			0.401			0.392	K	J-EMPC
122		4.18			4.47	K	J-EMPC	3.65			4.77			4.8	K	J-EMPC
123		51.2			59.5			43.8			52			54.4		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		5.06			5.31			5.3			5.1			4.72		
127		2.78	U		3	U		2.56	U		3.22	U		2.72	U	
128	128 + 166	145	C		157	C		170	C		164	C		151	C	
129	129 + 138 + 160 + 163	2550	C		2740	C		2610	C		2650	C		2430	C	
130		78.6			84			85.7			80.9			73.9		
131		7.82			8.42			8.56			8.61			7.99		
132		170			181			182			191			173		
133		19.9			21.2			23.6			21.6			19.8		
134	134 + 143	32	C		36.3	C		36.3	C		35.3	C		32.4	C	
135	135 + 151 + 154	318	C		333	C		353	C		347	C		322	C	
136		53.8			55.7			58.9			60.3			55.4		
137		43.6	K	J-EMPC	44.5			42.5			47.8			41.9		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	18.5	C		19.8	C		19.8	C		20	C		18.1	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		37.3			38.5			34.9			40.6			37.4		
142		0.45	U		0.594	U		0.401	U		0.378	U		0.28	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		29.5			30.3			32.2			32.1			29.6		
145		0.171	K	J-EMPC	0.174			0.218	K	J-EMPC	0.17	K	J-EMPC	0.207	K	J-EMPC
146		402			434			412			401			377		
147	147 + 149	1270	C		1330	C		1340	C		1340	C		1220	C	
148		2.13			2.2	K	J-EMPC	2.42			2.19			2		
149	147 + 149		C147			C147			C147			C147			C147	
150		1.44			1.48			1.63			1.51			1.38		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.459			0.405			0.471	K	J-EMPC	0.477			0.474		
153	153 + 168	5180	C		5530	C		4140	C		4590	C		4620	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.952			1.14			1.18	K	J-EMPC	1.03			0.919		
156	156 + 157	157	C		171	C		156	C		168	C		158	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		125			134			141			139			128		
159		1.91			1.98			2.52			2.47			2.4	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.305	U		0.403	U		0.284	U		0.267	U		0.198	U	
162		2.43			3			3.31			2.89			2.66	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		36.8			41.3			42.7			42.1			41.3		
165		0.675	K	J-EMPC	0.596			0.75			0.594			0.601		
166	128 + 166		C128			C128			C128			C128			C128	
167		209			213			154			185			201		
168	153 + 168		C153			C153			C153			C153			C153	
169		1.35	U		1.09	U		0.94	U		0.901	U		1.1	U	
170		38.8			43.3			44.5			45.4			40.8		
171	171 + 173	66.7	C		72.5	C		73.6	C		71.2	C		63.9	C	
172		5.74			6			6.35			6.37			6.01		
173	171 + 173		C171			C171			C171			C171			C171	
174		39.1			40.7			44			46.2			42.2		
175		8.71			9.35			9.56			9.44			8.02		
176		27.8			29.4			30.9			30.1			26.3		
177		177			189			203			189			166		
178		87.2			93			97.5			89.8			78.9		
179		114			119			128			122			108		
180	180 + 193	657	C		696	C		508	C		558	C		540	C	
181		2.45			2.64			2.42			2.57			2.4		
182		1.01			1.03			0.916			0.989			0.901		
183	183 + 185	225	C		242	C		227	C		229	C		209	C	
184		1.47			1.52			1.69			1.44			1.44		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0481	U		0.0713	U		0.0492	U		0.0498	U		0.0495	U	
187		656			709			700			672			615		
188		1.25			1.36			1.39			1.36			1.21		
189		1.66			2.03			2.21			2.18			1.81		
190		95.5			102			90.3			94.1			85.6		
191		6.11			6.48			6.27			6.56			5.92		
192		0.0481	U		0.0807	U		0.0492	U		0.056	U		0.0495	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		8.78			9.54			10.7			10.3			9.1		
195		24.7			26.7			27.8			26.5			23.7		
196		14.4			14.9			15.8			16			13.9		
197	197 + 200	7.73	C		8.23	C		9.13	C		8.9	C		7.85	C	
198	198 + 199	31.6	C		32.4	C		35.1	C		33.5	C		29.3	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		19.6			21.6			21.9			21.4			18.8		
202		62.8			66.4			69.5			60.8			54.4		
203		155			159			123			131			129		
204		0.053	K	J-EMPC	0.082	K	J-EMPC	0.132	K	J-EMPC	0.079			0.089		
205		3.97			4.34			4.66			4.3			3.78		
206		16.7			17.2			18.3			16.1			14.6		
207		3.24			3.46			3.56			3.38			2.94		
208		7.78			8.28			8.63			7.69			6.97		
209		12			12.6			12.8			10.4			10.3		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-20 through L11379-27
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26457

IUPAC #	COELUTING CONGENERS[1]	08030522TC L11379-20	Lab Qualifier	URS Review Qualifier	08030524TC L11379-21	Lab Qualifier	URS Review Qualifier	08030428TC L11379-24	Lab Qualifier	URS Review Qualifier	08022229TC L11379-25	Lab Qualifier	URS Review Qualifier	08022534TC L11379-26	Lab Qualifier	URS Review Qualifier	08022535TC L11379-27	Lab Qualifier	URS Review Qualifier
1		1.73			1.41			1.57			3.03			2.71			2.98		
2		5.27			3.57			3.59			7.28			5.79			5.12		
3		0.699		U	0.686		U	0.687		U	0.92			0.853	K	U	1.02		
4		37.7			35.8			40.3			126			142			95.4		
5		1.09			0.917			1.01			1.78			1.82			1.66		
6		9.53			9.05			9.62			35.3			39.9			25.8		
7		0.447			0.544			0.38			0.81			0.905			0.896		
8		20.3			19.1			19.3			46.9			49.6			43.7		
9		0.583			0.552			0.488			1.44			1.5			1.53		
10		0.62			0.528			0.544			1.56			1.62			1.5		
11		8040	D		6830	D		7030	D		6960	D		6720	D		8190	D	
12	12 + 13	40.7	C		46.1	C K	J-EMPC	33.1	C		31.7	C		32.8	C		55.4	C	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.193	K	J-EMPC	0.129			0.152	K	J-EMPC	0.17			0.126	K	J-EMPC	0.221		
15		12.8			15			14.8			19.8			21.8			19.7		
16		84.7			90			99.2			187			208			147		
17		64.4			68			74.1			165			197			142		
18	18 + 30	164	C		174	C		192	C		406	C		457	C		315	C	
19		7.95			6.96			7.71			18.2			19.2			15.6		
20	20 + 28	83.8	C		81.9	C		86	C		154	C		163	C		147	C	
21	21 + 33	41.8	C		40.1	C		40.8	C		95.9	C		103	C		79.3	C	
22		93.1			91.3			101			170			191			149		
23		0.127	K	J-EMPC	0.101			0.099	K	J-EMPC	0.127	K	J-EMPC	0.136			0.201	K	J-EMPC
24		1.01			1.11			0.986			2.21			1.84			1.56		
25		7.56			7.13			7.5			15.3			17			13.8		
26	26 + 29	16.7	C		15.3	C		16.3	C		35	C		37.5	C		31.9	C	
27		17.4			18.4			20.7			38.4			43.6			32.1		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		49.2			46.8			46.9			95.4			100			103		
32		5.55			5.06			5.41			19.6			22.3			15.1		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.307			0.252			0.228			0.419			0.436			0.499	K	J-EMPC
35		13.2			11.1			11.9			12.4			11.6			16		
36		3.58			3.17			3.25			3.27			3.08			4.22		
37		38.5			35.2			36.8			56.3			58.2			54.6		
38		1.32			1.12			1.2			1.44			1.53			1.41		
39		2.47			2.26			2.42			3.86			4.37			3.39		
40	40 + 41 + 71	76.3	C		74.7	C		79.1	C		138	C		150	C		132	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		148			156			179			235			261			233		
43		3.19			3.61			3.48			6.01			6.02			5.77		
44	44 + 47 + 65	556	C		591	C		680	C		784	C		818	C		791	C	
45	45 + 51	18.3	C		20.2	C		20.9	C		37.4	C		41.4	C		35.4	C	
46		3.18			3.14			3.23			5.74			6.16			6.1		
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		59.6			63.7			66.9			111			126			105		
49	49 + 69	104	C		109	C		108	C		159	C		170	C		172	C	
50	50 + 53	41.7	C		47.7	C		52.6	C		75	C		81.9	C		70.4	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		319			327			337			431			442			462		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.109	K	J-EMPC	0.089	K	J-EMPC	0.108			0.138			0.171			0.176	K	J-EMPC
55		3.08			4.4			3.34			4.1			5.26			2.65		
56		108			93.8			106			106			108			121		
57		0.964			0.82	K	J-EMPC	0.643			1.24			1.08			1.4		
58		0.98			1.19	K	J-EMPC	1.35			1.14			1.12	K	J-EMPC	1.89		
59	59 + 62 + 75	28.8	C		30.9	C		33	C		46.2	C		49.7	C		45	C	
60		56.9			52.2			54.2			58.9			60.2			70.5		
61	61 + 70 + 74 + 76	395	C		366	C		381	C		445	C		454	C		521	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		10.7			10.5			10.8			13.3			13.7			15.3		
64		77.7			77			78			112			117			122		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		319			301			319			336			348			397		
67		10			9.85			10.5			13.2			14			14.4		
68		2.67			2.52			2.76			2.88			2.97			3.67		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		2.65			2.52			2.49			2.93			3.1			3.47		
73		0.0477	U		0.0476	U		0.0499	U		0.0492	U		0.0491	U		0.0491	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		37.8			33.8			37.3			36.4			36.1			42.8		
78		0.308	U		0.363	U		0.356	U		0.305	U		0.318	U		0.274	U	
79		26.8			21.7			26.9			22.2			24.2			26.3		
80		0.277	U		0.327	U		0.32	U		0.274	U		0.286	U		0.247	U	
81		1.89			2.04			2.11			2.07			2.23	K	J-EMPC	2.6		
82		19			16.5			16.4			18.2			18.5			22		
83	83 + 99	683	C		663	C		716	C		668	C		690	C		806	C	
84		60.7			56.8			59.3			63.2			64.5			78.3		
85	85 + 116 + 117	169	C		161	C		165	C		159	C		166	C		198	C	
86	86 + 87 + 97 + 108 + 119 + 125	694	C		652	C		760	C		644	C		662	C		768	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	69.8	C		70.7	C		73.4	C		75.4	C		78.3	C		91.4	C	
89		2.14			2.06			2.17			2.47			2.64			3		
90	90 + 101 + 113	1110	C		1070	C		1160	C		1090	C		1130	C		1320	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		129			122			128			133			136			163		
93	93 + 95 + 98 + 100 + 102	710	C		742	C		854	C		742	C		754	C		862	C	
94		1.09			1.09			1.06			1.25			1.42			1.5		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.772			0.786			0.843			1.04			1.05			1.27		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		2.79			2.94			2.77			3.11			3.37			3.85		
104		0.127			0.095			0.099			0.089			0.104			0.125	K	J-EMPC
105		438			399			434			406			424			484		
106		1.95	U		2.29	U		2.28	U		1.85	U		1.65	U		1.41	U	
107	107 + 124	41	C		36.1	C		39.6	C		36.6	C		37.5	C		44.2	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		80			72.6			75.6			76.1			79.4			89		
110	110 + 115	978	C		892	C		954	C		936	C		954	C		1120	C	
111		0.609			0.601	K	J-EMPC	0.52			0.549			0.674	K	J-EMPC	0.664		
112		0.174	U		0.132	U		0.0861	U		0.0997	U		0.151	U		0.093	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		26.7			22.8			25.8			23.6			24.6			29.9		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		2420			2220			2660			2140			2200			2470		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		8.63			7.84			8.51			7.58			7.98			9.18		
121		0.353			0.358			0.333			0.444	K	J-EMPC	0.49			0.513		
122		5.96			4.09			4.21	K	J-EMPC	4.18	K	J-EMPC	4.37			6.06		
123		48.4			42.3			54			40.3			38.4			46.1		

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-20 through L11379-27
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26457

IUPAC #	COELUTING CONGENERS[1]	08030522TC L11379-20	Lab Qualifier	URS Review Qualifier	08030524TC L11379-21	Lab Qualifier	URS Review Qualifier	08030428TC L11379-24	Lab Qualifier	URS Review Qualifier	08022229TC L11379-25	Lab Qualifier	URS Review Qualifier	08022534TC L11379-26	Lab Qualifier	URS Review Qualifier	08022535TC L11379-27	Lab Qualifier	URS Review Qualifier
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		5.01			4.44			5.04			4.05			4.03			5.35		
127		2.08			2.44	U		2.42	U		1.96	U		1.94	K	J-EMPC	1.9		
128	128 + 166	158	C		144	C		140	C		144	C		147	C		178	C	
129	129 + 138 + 160 + 163	2410	C		2270	C		2550	C		2150	C		2210	C		2590	C	
130		75.4			72.7			71			71.4			73.6			92.3		
131		7.87			7.4			7.07			7.81			7.94			9.53		
132		175			161			162			160			169			207		
133		20.5			20.2			18.8			20			19.8			25.4		
134	134 + 143	34.2	C		32.4	C		30.5	C		32.9	C		35.1	C		40	C	
135	135 + 151 + 154	320	C		314	C		305	C		316	C		328	C		405	C	
136		52.5			53.9			51.7			54.1			56.9			70.3		
137		38.3			36.7			40.3			33.9			35.2			44.1		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	17.8	C		17.5	C		17.2	C		17.2	C		17.8	C		21.9	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		32.3			31			33.7			28.9			31.2			37.2		
142		0.437	U		0.417	U		0.533	U		0.313	U		0.326	U		0.452	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		28.8			27.9			27			27.6			29			36.4		
145		0.143			0.175	K	J-EMPC	0.165	K	J-EMPC	0.155	K	J-EMPC	0.205	K	J-EMPC	0.231	K	J-EMPC
146		367			343			386			335			348			421		
147	147 + 149	1230	C		1210	C		1280	C		1140	C		1200	C		1460	C	
148		2.09			2.07			2.04			2.11			2.18			2.7		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		1.31			1.47			1.44			1.48			1.56			1.89		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.449			0.416			0.406			0.441			0.472			0.6		
153	153 + 168	4070	C		3660	C		4570	C		3450	C		3500	C		3970	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		1.01			0.948			0.861			0.956			1.02			1.25		
156	156 + 157	138	C		126	C		152	C		125	C		129	C		148	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		129			120			129			117			124			149		
159		2.36			1.95			2.16	K	J-EMPC	1.95			2.26			2.45		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.309	U		0.295	U		0.377	U		0.221	U		0.231	U		0.32	U	
162		3.1			2.99			2.64	K	J-EMPC	3			2.87			3.69		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		41.3			35.5			38.1			36			38.3			45.7		
165		0.647			0.639	K	J-EMPC	0.476			0.589			0.257	U		0.791	K	J-EMPC
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		149			127			170			130			127			139		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.809	U		0.933	U		0.872	U		0.9	U		0.939	U		0.901	U	
170		42.6			36.4			38.8			36.5			39.9			45.6		
171	171 + 173	70.1	C		65.8	C		67	C		65.2	C		68.4	C		78.9	C	
172		6.14			5.3			5.47			5.27			5.93			6.78		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		42.4			36.9			40			37.6			41.2			47.7		
175		8.78			8.31			8.63			8.38			8.54			10.4		
176		27.5			27.4			27.2			27.8			28.4			34		
177		184			171			174			172			174			205		
178		87.8			83.9			83.9			85.5			86.9			101		
179		115			112			111			112			116			140		
180	180 + 193	512	C		440	C		584	C		422	C		431	C		474	C	
181		2.45			2.16			2.39			2.2			2.32			2.49		
182		0.938	K	J-EMPC	0.889	K	J-EMPC	0.991	K	J-EMPC	0.803			0.998			0.986		
183	183 + 185	214	C		195	C		220	C		191	C		198	C		231	C	
184		1.43			1.45			1.32			1.55			1.45			1.83		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0477	U		0.0476	U		0.0499	U		0.058	U		0.0491	U		0.0598	U	
187		656			605			661			615			631			733		
188		1.35			1.23			1.27			1.33			1.31			1.5		
189		1.83			1.75			1.85			1.68			1.98			2.23		
190		90.1			79.1			98.6			78			78.5			89.2		
191		6.18			5.39			6.2			5.33			5.86			6.52		
192		0.0477	U		0.0476	U		0.0499	U		0.0653	U		0.0491	U		0.0673	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		8.77			7.58			8.56			7.56			8.38			9.99		
195		26.3			23.9			26.2			24			25.1			29.8		
196		14.8			12.9			15			13.3			14.5			16.3		
197	197 + 200	8.37	C		7.77	C		8.04	C		8.07	C		8.11	C		10	C	
198	198 + 199	32.3	C		29.9	C		32	C		30.6	C		33.5	C		38	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		19.9			19.4			20.2			20.1			20.6			24.8		
202		62.4			58.7			61.8			61.6			62			71		
203		130			113			146			114			115			131		
204		0.094			0.081			0.082			0.1			0.094			0.102		
205		4.12			3.75			4.03			3.97			4			4.76	K	J-EMPC
206		17			15.7			16.6			17.5			19.3			20.6		
207		3.55			3.26			3.44			3.42			4			4.26		
208		8.18			7.31			8			8.87			9.49			10.1		
209		11.2			10.2			11.4			12.4			13.1			14.1		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

[1] = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-28 through L11379-32
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26479

IUPAC #	COELUTING CONGENERS[1]	0802536TC L11379-28	Lab Qualifier	URS Review Qualifier	0802637TC L11379-29	Lab Qualifier	URS Review Qualifier	0802738TC L11379-30	Lab Qualifier	URS Review Qualifier	0802739TC L11379-31	Lab Qualifier	URS Review Qualifier	0802740TC L11379-32	Lab Qualifier	URS Review Qualifier
1		3.16			2.89			2.59			2.42			2.64		
2		4.7			4.12			3.88			4.08			4.58		
3		0.929			0.891			0.863			0.777			0.853		
4		95			93.8			80.3			77			79.2		
5		1.02			1.53			1.3			1.18			1.43		
6		23			22.7			19.1			17.9			16.9		
7		0.774			0.701			0.721			0.686			0.618		
8		43.2			40			35			34.2			32.1		
9		1.53			1.44			1.34			1.22			1.14		
10		1.52			1.33			1.19			1.13			1.12		
11		8770	D		7370	D		7100	D		8990	D		8260	D	
12	12 + 13	83.8	C		53	C K	J-EMPC	70.1	C		113	C		90.6	C	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.226			0.187			0.157			0.187			0.251	U	
15		23.8			20.3			30.4	K	J-EMPC	35.6	K	J-EMPC	35.1	K	J-EMPC
16		133			127			111			111			107		
17		133			122			106			104			103		
18	18 + 30	310	C		300	C		252	C		252	C		242	C	
19		15.6			15.2			13.4			13			12.9		
20	20 + 28	161	C		163	C		138	C		133	C		128	C	
21	21 + 33	80.7	C		79.8	C		68.9	C		66.5	C		65.7	C	
22		165			162			138			141			135		
23		0.148			0.123	K	J-EMPC	0.184			0.134	U		0.12	K	J-EMPC
24		2.35			1.69			1.95			1.55			1.56		
25		14.5			14.2			11.9			11.7			12.1		
26	26 + 29	31.1	C		30.9	C		26.8	C		25.3	C		25.2	C	
27		31			30.6			26.4			25.5			25.9		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		103			95.8			83			83.2			83.9		
32		16.3			16.5			13.4			11.1			11.3		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.418			0.395			0.365			0.328	K	J-EMPC	0.366		
35		13.5			12.1			11.1			13.7			14.3		
36		3.86			3.29			3.08			3.79			3.71		
37		53			49.8			43.9			48			53.7		
38		1.15	K	J-EMPC	1.06			0.913			1.08			1.1		
39		2.43			2.13			2			2.31			2.95		J
40	40 + 41 + 71	121	C		98.3	C		98.1	C		103	C		102	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		207			203			168			185			183		
43		7.01			5.94			6.44			6.63			7.4		
44	44 + 47 + 65	699	C		689	C		599	C		665	C		681	C	
45	45 + 51	31.2	C		31.2	C		26.9	C		27	C		28.7	C	
46		5.76			5.4			4.93			4.81			4.83		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		98.1			90.6			77.5			83.4			84.2		
49	49 + 69	159	C		143	C		126	C		138	C		141	C	
50	50 + 53	62.6	C		63.1	C		53.7	C		57.4	C		60	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		416			385			353			394			420		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.158			0.149			0.172			0.144			0.133		
55		6.3			3.85			7.14			7.25			7.12		
56		117			107			102			114			112		
57		1.03			0.936			0.977	K	J-EMPC	0.93	K	J-EMPC	0.874		
58		1.12	K	J-EMPC	0.924			0.987			1.01	K	J-EMPC	1.35		
59	59 + 62 + 75	41.8	C		39.8	C		36	C		39.2	C		40	C	
60		75.3			64.2			60.8			66.6			63.8		
61	61 + 70 + 74 + 76	518	C		437	C		434	C		493	C		455	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		14			12			11.4			12.1			12.7		
64		114			102			91.1			101			101		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		420			360			345			387			366		
67		13			11.2			10.5			11.4			11.5		
68		3.14			2.73			2.46			2.97			2.91		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		3.11			2.73			2.41			2.86			3.11		
73		0.0491	U		0.0484	U		0.0475	U		0.0499	U		0.0497	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		44.3			38.4			37.1			43.2			46.3		
78		0.516	U		0.348	U		0.453	U		0.593	U		0.509	U	
79		19.7			17.8			17.6			22.8			23		
80		0.484	U		0.326	U		0.425	U		0.556	U		0.476	U	
81		2.51			1.67	K	J-EMPC	1.99	K	J-EMPC	2.13	K	J-EMPC	2.75		
82		24.5			20.6			21.5			25.1			21.7		
83	83 + 99	833	C		720	C		717	C		849	C		738	C	
84		79.1			69.4			64.2			78.4			70.9		
85	85 + 116 + 117	202	C		173	C		166	C		203	C		175	C	
86	86 + 87 + 97 + 108 + 119 + 125	773	C		692	C		668	C		792	C		702	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	94.7	C		82.7	C		75.7	C		91.9	C		83.8	C	
89		2.86			2.47			2.51			2.97			2.47		
90	90 + 101 + 113	1350	C		1170	C		1140	C		1350	C		1220	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		160			143			133			163			146		
93	93 + 95 + 98 + 100 + 102	821	C		761	C		701	C		855	C		811	C	
94		1.33			1.22			1.15	K	J-EMPC	1.43			1.34		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		1.22			1.08			1.06			1.16			1.1	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		3.76			3.24			2.95			3.5			3.46		
104		0.111			0.118	K	J-EMPC	0.108	K	J-EMPC	0.091	K	J-EMPC	0.126		
105		484			419			416			484			535		
106		2.6	U		1.74	U		2.55	U		3.1	U		2.93	U	
107	107 + 124	49.1	C		37.6	C		38.7	C		44.5	C		41.6	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		97.9			82.4			80.1			96.6			83.5		
110	110 + 115	1120	C		982	C		972	C		1140	C		999	C	
111		0.778			0.688	K	J-EMPC	0.635	K	J-EMPC	0.669			0.59	K	J-EMPC
112		0.233	U		0.275	U		0.283	U		0.232	U		0.292	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		27.2			24			23.3			28.7			30.8		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-28 through L11379-32
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26479

IUPAC #	COELUTING CONGENERS[1]	0802253 6TC L11379-28	Lab Qualifier	URS Review Qualifier	0802263 7TC L11379-29	Lab Qualifier	URS Review Qualifier	0802273 8TC L11379-30	Lab Qualifier	URS Review Qualifier	0802273 9TC L11379-31	Lab Qualifier	URS Review Qualifier	0802274 0TC L11379-32	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		2420			2180			2140			2520			2770		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		9.24			8.11			7.9			9.36			8.34		
121		0.5	K	J-EMPC	0.416			0.372			0.435	K	J-EMPC	0.446		
122		6.07			5.46			5.39			6.58			4.83		
123		43.9			41.8			36.8			46.9			53.2		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		5.19			4.64			4.74			5.33			5.64		
127		2.71	U		1.8	U		2.65	U		3.22	U		3	U	
128	128 + 166	159	C		166	C		144	C		168	C		165	C	
129	129 + 138 + 160 + 163	2240	C		2170	C		2050	C		2370	C		2440	C	
130		87.2			77.9			75.8			88.1			85.2		
131		9.27			7.82			7.84			9.01			9.07		
132		188			177			171			202			192		
133		24.1			20.9			18.8			22.3			22.9		
134	134 + 143	38.8	C		35.7	C		35.8	C		41.9	C		38.9	C	
135	135 + 151 + 154	367	C		332	C		321	C		376	C		362	C	
136		63.5			58.6			55.2			64.4			60		
137		37.3			35.6			34.4			46.8			41.8		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	21.9	C		18.8	C		18.1	C		20.1	C		20.3	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		32.6			30.4			32.8			40.7			40.9		
142		1.57	U		0.46	U		0.935	U		1.18	U		0.673	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		33			30.1			29.4			34.6			32.8		
145		0.158			0.165			0.171	K	J-EMPC	0.241	K	J-EMPC	0.185		
146		374			342			319			389			397		
147	147 + 149	1290	C		1190	C		1190	C		1360	C		1360	C	
148		2.53			2.1			1.98			2.54			2.35		
149	147 + 149		C147			C147			C147			C147			C147	
150		1.72			1.46			1.42			1.73			1.6		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.495			0.475			0.41			0.522			0.447		
153	153 + 168	3420	C		3340	C		3030	C		3800	C		3670	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		1.28			1.06			1.06			1.37			1.27		
156	156 + 157	154	C		138	C		135	C		166	C		158	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		139			125			124			147			142		
159		1.98			1.41	K	J-EMPC	1.54			2.03	K	J-EMPC	1.98		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		1.06	U		0.312	U		0.634	U		0.801	U		0.469	U	
162		3.68			3.38			2.99			3.8			3.76		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		43.1			38			36.9			41.5			41.1		
165		1.26	U		0.825			0.752	U		0.949	U		0.7	K	J-EMPC
166	128 + 166		C128			C128			C128			C128			C128	
167		139			146			123			154			146		
168	153 + 168		C153			C153			C153			C153			C153	
169		1.32	U		0.698	U		0.987	U		1.01	U		1.25	U	
170		52.1			43.2			43.9			54.3			46.5		
171	171 + 173	84.3	C		71.2	C		70.7	C		83.9	C		76	C	
172		7.29			6.24			6.01			6.98			6.32		
173	171 + 173		C171			C171			C171			C171			C171	
174		46.2			40.1			38.1			46.9			42.6		
175		10.4			8.84			8.54			10.3			9.73		
176		33.6			28.8			28			33			31.7		
177		220			188			181			216			198		
178		110			90.5			87.9			107			97.4		
179		136			116			113			134			129		
180	180 + 193	494	C		489	C		414	C		547	C		476	C	
181		2.53			2.23			2.38			2.84			2.31		
182		1.24			1.11			0.0475	U		1.55			1.61		
183	183 + 185	228	C		202	C		197	C		243	C		220	C	
184		1.87			1.54			1.59			2.05			1.93		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0491	U		0.0484	U		0.0475	U		0.0499	U		0.068	U	
187		734			625			625			758			704		
188		1.52			1.3			1.25			1.39			1.57		
189		2.4			2.09			1.95			2.34			2.41		
190		93.8			84.8			80.3			102			88.7		
191		6.81			6.2			6.01			7.62			6.69		
192		0.0491	U		0.0484	U		0.0475	U		0.0499	U		0.0766	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		10.2			9.1			8.85			10.9			10.3		
195		29.6			26.4			24.4			29.6			28.8		
196		17.4			14.9			14.6			16.6			15.8		
197	197 + 200	9.91	C		8.47	C		7.81	C		9.62	C		8.9	C	
198	198 + 199	37.7	C		32.9	C		29.4	C		36.7	C		33.8	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		23.7			20.3			19.1			23			22.1		
202		77.3			65.6			60.3			73.2			69.3		
203		122			120			101			130			122		
204		0.129			0.092	K	J-EMPC	0.082	K	J-EMPC	0.15	K	J-EMPC	0.123		
205		5.01			4.33			4.04			4.93			4.93		
206		21.2			18.8			17.1			20.3			19.4		
207		4			3.58			3.37			4.18			3.76		
208		10.3			9.2			8.06			9.69			8.93		
209		17			15			12.8			16.1			13.3		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

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G = Axys qualifier indicating a lockmass deflection affected the result.
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Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

[1] When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-33 through L11379-37
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26479

IUPAC #	COELUTING CONGENERS[1]	08022741 TC L11379-33	Lab Qualifier	URS Review Qualifier	08022742 TC L11379-34	Lab Qualifier	URS Review Qualifier	08030685 TC L11379-35	Lab Qualifier	URS Review Qualifier	08030686 TC L11379-36	Lab Qualifier	URS Review Qualifier	08030687 TC L11379-37	Lab Qualifier	URS Review Qualifier
1		2.41			1.95			1.68			1.66			1.84		
2		4.36			3.4			3.81			3.71			3.68		
3		0.785			0.61	K	J-EMPC	0.811			0.697			0.686	K	J-EMPC
4		70.6			54.1			37.1			38.4			38.9		
5		1.33			1.18			0.997			0.876			0.929		
6		15.4			11.1			8.17			8.41			8.15		
7		0.674	K	J-EMPC	0.5	K	J-EMPC	0.362			0.351	K	J-EMPC	0.363		
8		29			23.1			21.6			18.9			19.4		
9		0.988			0.752	K	J-EMPC	0.543			0.47			0.524		
10		0.982			0.736	K	J-EMPC	0.517			0.452			0.524		
11		8070	D		7380	D		7720	D		6790	D		7180	D	
12	12 + 13	62.5	C K	J-EMPC	118	C		109	C		93.8	C		62.3	C K	J-EMPC
13	12 + 13		C12			C12			C12			C12			C12	
14		0.235	U		0.203	U		0.241	U		0.263	U		0.245	U	
15		21.8			20.1	K	J-EMPC	30.8	K	J-EMPC	32.8	K	J-EMPC	17.8		
16		105			85.4			75.7			74.4			72		
17		98.9			75.9			67.8			65.8			59.3		
18	18 + 30	236	C		186	C		159	C		156	C		151	C	
19		11.7			9.16			7.22			7.21			7.72		
20	20 + 28	122	C		101	C		94.5	C		81.9	C		80.3	C	
21	21 + 33	60.1	C		49.4	C		46.5	C		41.4	C		42.1	C	
22		131			109			104			98.5			93.2		
23		0.116			0.116	U		0.0965	U		0.0738	U		0.114	K	J-EMPC
24		1.44			1.4			1.08			1.22			1.08		
25		11.2			9.22			8.62			7.68			7.61		
26	26 + 29	23.6	C		18.7	C		16.8	C		15.3	C		15.6	C	
27		24.9			20.2			18.2			17.2			16.4		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		78.4			64.1			59			50.6			49.2		
32		9.77			7.08			6.09			5.53			5.44		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.34			0.235	K	J-EMPC	0.256			0.225			0.271		
35		14.8			13.3			13.1			11.3			11.6		
36		3.81			3.47			3.6			2.86			2.91		
37		52.1			45.1			43.2			39.1			37.7		
38		0.946			0.923			1.02			0.888			0.951		
39		2.85			2.34		J	2.43			2.18		J	1.99		
40	40 + 41 + 71	98.7	C		81.9	C		78.2	C		74.3	C		71.8	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		178			151			165			148			137		
43		7.19			6.16			5.06			4.8			5.18		
44	44 + 47 + 65	678	C		598	C		619	C		567	C		538	C	
45	45 + 51	27.8	C		22.6	C		21.1	C		20.5	C		20	C	
46		4.82			3.86			3.48			3.45			3.27		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		81.7			67.9			67.4			64.8			58.4		
49	49 + 69	139	C		119	C		121	C		113	C		104	C	
50	50 + 53	59	C		50.4	C		46.3	C		46.7	C		44.9	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		419			368			346			332			329		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.144			0.108	K	J-EMPC	0.069			0.066	K	J-EMPC	0.088	K	J-EMPC
55		6.01			8.15			5.8			7.86			7.59		
56		112			98.9			97.8			97.1			92.6		
57		1.01			0.723			0.802			0.776	K	J-EMPC	0.662		
58		1.63			1.37	K	J-EMPC	1.3	K	J-EMPC	1.14			1.07		
59	59 + 62 + 75	38.9	C		33.5	C		32.2	C		31.2	C		29.8	C	
60		64.9			58.9			58.7			54			50.6		
61	61 + 70 + 74 + 76	458	C		411	C		406	C		373	C		346	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		13			11.4			11.5			10.5			9.72		
64		99.7			85.8			85.3			79.1			74.5		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		368			332			332			313			287		
67		11.3			9.74			9.98			9.56			8.51		
68		2.91			2.6			2.79			2.62			2.52		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		3.04			2.68			2.75			2.43			2.44		
73		0.0495	U		0.0481	U		0.0487	U		0.0452	U		0.0476	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		46.8			41.4			40.8			38.4			35.7		
78		0.453	U		0.522	U		0.433	U		0.482	U		0.435	U	
79		22			20.3			20.9			19.5			18.7		
80		0.423	U		0.488	U		0.405	U		0.451	U		0.407	U	
81		2.21			2.03			1.88	K	J-EMPC	1.8			1.51	K	J-EMPC
82		20.9			18.8			18.8			16.8			17.1		
83	83 + 99	750	C		674	C		686	C		629	C		590	C	
84		73.1			64.4			62.4			56			52.7		
85	85 + 116 + 117	174	C		158	C		164	C		145	C		136	C	
86	86 + 87 + 97 + 108 + 119 + 125	707	C		645	C		684	C		596	C		578	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	85.7	C		75.1	C		77.8	C		71	C		65.9	C	
89		2.53			2.25			2.36			2.06			2.01		
90	90 + 101 + 113	1260	C		1130	C		1140	C		1030	C		965	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		152			136			129			116			113		
93	93 + 95 + 98 + 100 + 102	829	C		746	C		769	C		687	C		682	C	
94		1.3	K	J-EMPC	1.15			1.1			1.03			1.08	K	J-EMPC
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		1			0.923			0.913			0.785			0.76		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		3.35			3.27			3.13			2.96			2.68		
104		0.128	K	J-EMPC	0.0652	U		0.0564	U		0.078			0.05	K	J-EMPC
105		556			488			478			440			414		
106		3.39	U		3.3	U		4.08	U		3.05	U		2.77	U	
107	107 + 124	41.6	C		36.4	C		35.8	C		32.9	C		30.8	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		88			79.4			76.9			70.2			66.6		
110	110 + 115	999	C		910	C		877	C		809	C		779	C	
111		0.464			0.639	K	J-EMPC	0.582	K	J-EMPC	0.385			0.413		
112		0.308	U		0.286	U		0.271	U		0.244	U		0.262	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		33			28.1			27.1			24.9			24.7		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-33 through L11379-37
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26479

IUPAC #	COELUTING CONGENERS[1]	08022741 TC L11379-33	Lab Qualifier	URS Review Qualifier	08022742 TC L11379-34	Lab Qualifier	URS Review Qualifier	08030685 TC L11379-35	Lab Qualifier	URS Review Qualifier	08030686 TC L11379-36	Lab Qualifier	URS Review Qualifier	08030687 TC L11379-37	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		2820			2530			2640			2290			2270		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		8.56			8.04			7.81			6.36			6.68		
121		0.362			0.415	K	J-EMPC	0.416			0.305	K	J-EMPC	0.289		
122		6.65			6.11	K	J-EMPC	4.58	U		5.52	K	J-EMPC	6.59		
123		50.6			43.8			50			41.2			40.9		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		5.36			5.12			5.88	U		4.46			4.51		
127		3.47	U		3.38	U		4.17	U		3.12	U		2.84	U	
128	128 + 166	171	C		154	C		150	C		140	C		127	C	
129	129 + 138 + 160 + 163	2470	C		2260	C		2270	C		2060	C		1990	C	
130		87.7			78.3			77.8			71.3			64.1		
131		9.29			8.15			7.96			7.22			6.33		
132		193			171			165			156			146		
133		23.6			20.8			20.9			17.3			16.9		
134	134 + 143	39.1	C		34.5	C		34.1	C		31.1	C		28.6	C	
135	135 + 151 + 154	355	C		324	C		316	C		282	C		268	C	
136		59.7			53.7			53.6			50			44.4		
137		40.2			37.3			32.6			32.6			32.6		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	20.4	C		17.8	C		18.6	C		17.1	C		15.3	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		44.8			40.7			39.1			38.3			39.6		
142		1.09	U		1.14	U		1.05	U		1.1	U		0.806	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		33.6			29.4			30			26.5			23.5		
145		0.209	K	J-EMPC	0.2			0.21	K	J-EMPC	0.22	K	J-EMPC	0.173		
146		395			361			353			302			314		
147	147 + 149	1350	C		1240	C		1230	C		1140	C		1080	C	
148		2.32			2.1			2.04			1.61			1.64		
149	147 + 149		C147			C147			C147			C147			C147	
150		1.57			1.5			1.45			1.38			1.23		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.421			0.426			0.448			0.383			0.375		
153	153 + 168	3630	C		3380	C		4070	C		3060	C		3190	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		1.35			1.18	K	J-EMPC	1.09			0.946	K	J-EMPC	0.846		
156	156 + 157	161	C		145	C		137	C		123	C		125	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		144			129			126			117			108		
159		2.16			1.72			1.61	K	J-EMPC	1.53	K	J-EMPC	1.51		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.761	U		0.793	U		0.733	U		0.767	U		0.561	U	
162		3.56			3.07			2.68			2.74			2.41	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		43.5			39.1			37			34			32.9		
165		0.868	U		0.905	U		0.836	U		0.875	U		0.64	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		146			137			165			123			131		
168	153 + 168		C153			C153			C153			C153			C153	
169		1.03	U		1.01	U		1.73	U		1.17	U		1.57	U	
170		47.9			43.4			37			37.3			35.6		
171	171 + 173	78.5	C		70.4	C		68	C		64.4	C		56	C	
172		6.59			6.01			5.19			5.14			4.85		
173	171 + 173		C171			C171			C171			C171			C171	
174		43.3			40.1			34.6			34.5			32.5		
175		10.1			8.98			8.11			7.15			6.96		
176		32			29.5			27.3			25.5			23.4		
177		206			188			180			169			153		
178		99.9			90.4			87			78.2			73.3		
179		131			119			116			108			97.9		
180	180 + 193	476	C		458	C		474	C		390	C		384	C	
181		2.46			2.22	K	J-EMPC	2.07			1.97			2.17		
182		1.57	K	J-EMPC	1.25			1.28	K	J-EMPC	1.2	K	J-EMPC	1.21	K	J-EMPC
183	183 + 185	223	C		209	C		189	C		171	C		168	C	
184		1.74			1.53			1.41			1.12			1.13		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0649	U		0.0481	U		0.0533	U		0.0452	U		0.055	U	
187		705			660			614			555			541		
188		1.48			1.41			1.48			1.16			1.24		
189		2.37			2.17			2.01			1.71			1.72		
190		89.6			84.7			79.4			72.8			72.4		
191		7.04			6.73			5.99			5.43			5.45		
192		0.073	U		0.0481	U		0.06	U		0.0467	U		0.0618	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		10.6			10.4			7.99			7.57			8.29		
195		30.2			27.1			24.5			25			21.6		
196		16.3			14.7			12.2			12			11.7		
197	197 + 200	9.36	C		8.25	C		7.71	C		6.94	C		6.61	C	
198	198 + 199	35.9	C		32	C		29	C		29.2	C		27.6	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		23.2			20.2			19.6			16.8			16.7		
202		72.1			64.9			67.4			58.8			58.2		
203		122			115			117			97.3			99.5		
204		0.096	K	J-EMPC	0.068			0.084			0.082	K	J-EMPC	0.109	K	J-EMPC
205		5.16			4.65			4.26			4.02			3.78		
206		20.1			17.7			16.5			15.9			15.7		
207		3.99			3.45			3.14			2.96			3.02		
208		9.49			8.61			7.81			7.63			7.36		
209		14.3			12.5			11.9			10.6			10.6		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-22 and L11379-23

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26795

IUPAC #	COELUTING CONGENERS[1]	08030427TC L11379-22	Lab Qualifier	URS Review Qualifier	08030426TC L11379-23	Lab Qualifier	URS Review Qualifier
1		1.59			1.41		
2		4.31			3.24		
3		0.675		U	0.584		U
4		33.3			31.8		
5		0.399	U		0.236	U	
6		10.9			9.35		
7		0.376	U		0.222	U	
8		24.6			22		
9		0.359	U		0.212	U	
10		0.331	U		0.195	U	
11		8520			7970	D	
12	12 + 13	0.401	C U		0.237	C U	
13	12 + 13		C12			C12	
14		0.369	U		0.218	U	
15		11			8.81		
16		88.4			88		
17		78.3			73.8		
18	18 + 30	193	C		184	C	
19		8.54			8.48		
20	20 + 28	101	C		99.2	C	
21	21 + 33	45.8	C		46.5	C	
22		103			105		
23		0.183	U		0.157	U	
24		0.946			1.08		
25		8.61			8.64		
26	26 + 29	18.2	C		18.4	C	
27		21.9			20.4		
28	20 + 28		C20			C20	
29	26 + 29		C26			C26	
30	18 + 30		C18			C18	
31		60.4			60.3		
32		6.1			6.19		
33	21 + 33		C21			C21	
34		0.349			0.246	K	J-EMPC
35		13.9			13.2		
36		3.96			3.97		
37		31.5			30.6		
38		1.24			1.2		
39		2.92			2.79	K	J-EMPC
40	40 + 41 + 71	82.5	C		84.9	C	
41	40 + 41 + 71		C40			C40	
42		180			168		
43		0.122	U		0.0799	U	
44	44 + 47 + 65	648	C		630	C	
45	45 + 51	20.3	C		23.3	C	
46		3.47			3.82		
47	44 + 47 + 65		C44			C44	
48		65.1			71.6		
49	49 + 69	112	C		124	C	
50	50 + 53	48.7	C		52.6	C	
51	45 + 51		C45			C45	
52		339			381		
53	50 + 53		C50			C50	
54		0.0789	U		0.0485	U	
55		0.353	U		0.192	U	
56		111			95.5		
57		1.01			0.862		
58		0.364	U		0.198	U	
59	59 + 62 + 75	32.7	C		35.2	C	
60		65.4			56.5		
61	61 + 70 + 74 + 76	426	C		382	C	
62	59 + 62 + 75		C59			C59	
63		11.6			10.9		
64		0.0694	U		84.7		
65	44 + 47 + 65		C44			C44	
66		342			306		
67		10.8			9.84		
68		3.11			2.86		
69	49 + 69		C49			C49	
70	61 + 70 + 74 + 76		C61			C61	
71	40 + 41 + 71		C40			C40	
72		2.86			2.68		
73		2.69			2.78		
74	61 + 70 + 74 + 76		C61			C61	
75	59 + 62 + 75		C59			C59	
76	61 + 70 + 74 + 76		C61			C61	
77		34.3			33.2		
78		0.36	U		0.196	U	
79		32.3			26.3		
80		0.309	U		0.169	U	
81		0.961	K	J-EMPC	1.43	K	J-EMPC
82		18.5			18.9		
83	83 + 99	728	C		760	C	
84		60.4			63.9		
85	85 + 116 + 117	166	C		170	C	
86	86 + 87 + 97 + 108 + 119 + 125	779	C		785	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
88	88 + 91	74.2	C		75.9	C	
89		2.2			2.29		
90	90 + 101 + 113	1200	C		1240	C	
91	88 + 91		C88			C88	
92		132			127		
93	93 + 95 + 98 + 100 + 102	787	C		822	C	
94		1.11	K	J-EMPC	1.21	K	J-EMPC
95	93 + 95 + 98 + 100 + 102		C93			C93	
96		0.735			1.05		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93	
99	83 + 99		C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93	
101	90 + 101 + 113		C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93	
103		2.94			2.95		
104		0.122	U		0.116	U	
105		370			350		
106		1.97	U		1.56	U	
107	107 + 124	42.7	C		36.9	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
109		84.2			73.5		
110	110 + 115	981	C		986	C	
111		0.233	U		0.218	U	
112		0.225	U		0.211	U	
113	90 + 101 + 113		C90			C90	
114		24.2			21.3		
115	110 + 115		C110			C110	
116	85 + 116 + 117		C85			C85	

Table 2
PCB Congener Qualifer Summary - Clams
Lab Sample ID's L11379-22 and L11379-23
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26795

IUPAC #	COELUTING CONGENERS[1]	08030427TC L11379-22	Lab Qualifier	URS Review Qualifier	08030426TC L11379-23	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85	
118		2130			1910		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
120		8.78			8.71		
121		0.392	K	J-EMPC	0.217	U	
122		6.44			4.53		
123		42.1			39		
124	107 + 124		C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86	
126		4.51			4.07		
127		1.86	U		1.48	U	
128	128 + 166	184	C		174	C	
129	129 + 138 + 160 + 163	2700	C		2650	C	
130		79.6			72.8		
131		8.12			0.674	U	
132		172			169		
133		22.2			21.4		
134	134 + 143	31.1	C		33.1	C	
135	135 + 151 + 154	325	C		352	C	
136		0.0686	U		0.0753	U	
137		45.5			40.8		
138	129 + 138 + 160 + 163		C129			C129	
139	139 + 140	19.3	C		19.4	C	
140	139 + 140		C139			C139	
141		39.2			35.3		
142		0.668	U		0.686	U	
143	134 + 143		C134			C134	
144		29.6			30.7		
145		0.0724	U		0.181	K	J-EMPC
146		432			412		
147	147 + 149	1400	C		1370	C	
148		2.26			2.32	K	J-EMPC
149	147 + 149		C147			C147	
150		1.55			1.74		
151	135 + 151 + 154		C135			C135	
152		0.445	K	J-EMPC	0.0748	U	
153	153 + 168	5010	C		4530	C	
154	135 + 151 + 154		C135			C135	
155		1.01			1.05		
156	156 + 157	149	C		137	C	
157	156 + 157		C156			C156	
158		140			136		
159		1.94			1.92		
160	129 + 138 + 160 + 163		C129			C129	
161		0.412	U		0.423	U	
162		3.18			2.8		
163	129 + 138 + 160 + 163		C129			C129	
164		39.2			38.1		
165		0.48	U		0.493	U	
166	128 + 166		C128			C128	
167		167			151		
168	153 + 168		C153			C153	
169		1.7	U		1.53	U	
170		41			37.8		
171	171 + 173	70.8	C		66.3	C	
172		6.08			5.7		
173	171 + 173		C171			C171	
174		38.5			37		
175		9.04			8.29		
176		28.8			28.3		
177		179			165		
178		86.8			83.4		
179		0.0805	U		113		
180	180 + 193	529	C		465	C	
181		2.58			2.47		
182		0.102	U		0.933		
183	183 + 185	216	C		202	C	
184		1.54			1.58		
185	183 + 185		C183			C183	
186		0.0816	U		0.0602	U	
187		691			650		
188		1.54			1.32		
189		1.51	K	J-EMPC	1.44		
190		90.9			80.3		
191		6.14			5.82		
192		0.0834	U		0.0615	U	
193	180 + 193		C180			C180	
194		9.49			9.21		
195		26.3			25.3		
196		14.8			13.9		
197	197 + 200	7.8	C		8.48	C	
198	198 + 199	29.3	C		29.2	C	
199	198 + 199		C198			C198	
200	197 + 200		C197			C197	
201		19.8			19.7		
202		72.1			65.4		
203		131			126		
204		0.0638	U		0.087	K	J-EMPC
205		4.21			3.85		
206		17.2			15.5		
207		3.47			3.37		
208		7.67			7.34		
209		11.5			10		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifier Summary - Crayfish
Lab Sample ID's L11380-1 through L11380-7
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26607

IUPAC #	COELUTING CONGENERS[1]	08021901CF L11380-1	Lab Qualifier	URS Review Qualifier	08021904CF L11380-4	Lab Qualifier	URS Review Qualifier	08021505CF L11380-5	Lab Qualifier	URS Review Qualifier	08021406CF L11380-6	Lab Qualifier	URS Review Qualifier	08021407CF L11380-7	Lab Qualifier	URS Review Qualifier
1		0.135			0.196			0.26			0.243			0.255	K	J-EMPC
2		0.078			0.109			0.146			0.236			0.0531	U	
3		0.175	K	J-EMPC	0.23			0.192			0.215	K	J-EMPC	0.22	K	J-EMPC
4		0.474		U	0.535		U	2.29			0.919			0.706		U
5		0.0959	U		0.163	U		0.101	U		0.0854	U		0.137	U	
6		0.235			0.248			0.217			0.235			0.239		
7		0.091			0.144	U		0.096	K	J-EMPC	0.0757	U		0.121	U	
8		1.05		U	0.991		U	0.895		U	0.661		U	0.9		U
9		0.101			0.164	K	J-EMPC	0.184	K	J-EMPC	0.087	K	J-EMPC	0.121	U	
10		0.0826	U		0.14	U		0.114	K	J-EMPC	0.0736	U		0.118	U	
11		50.1			30.2			36.9			75.9			16.4		
12	12 + 13	0.092	C U		0.156	C U		0.0967	C U		0.0819	C U		0.131	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.0888	U		0.151	U		0.0934	U		0.0791	U		0.127	U	
15		1.98	K	J-EMPC	1.35			3.55	K	J-EMPC	2.5	K	J-EMPC	2.44	K	J-EMPC
16		0.53			0.369	K	J-EMPC	0.411	K	J-EMPC	0.655			0.373	K	J-EMPC
17		0.51			0.537			1.11			0.806			0.504		
18	18 + 30	1.71	C	U	1.04	C	U	2.12	C	U	2.31	C	U	1.27	C	U
19		0.131	K	U	0.189	K	U	0.847			0.235		U	0.179		U
20	20 + 28	2.63	C	U	2.58	C	U	3.24	C		3	C		2.13	C	U
21	21 + 33	0.746	C	U	0.687	C	U	0.804	C	U	0.774	C	U	0.507	C K	U
22		0.544			0.568			0.489			0.695			0.501	K	J-EMPC
23		0.0636	U		0.0652	U		0.0634	U		0.0497	U		0.0696	U	
24		0.0489	U		0.0592	U		0.05	U		0.0497	U		0.0785	U	
25		0.086	K	J-EMPC	0.177	K	J-EMPC	0.256			0.169	K	J-EMPC	0.115	K	J-EMPC
26	26 + 29	0.443	C K	U	0.474	C	U	1.22	C		0.58	C		0.336	C	U
27		0.107	K	J-EMPC	0.233			0.348			0.332			0.106	K	J-EMPC
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		1.29		U	1.28		U	1.63		U	1.19		U	1.06		U
32		0.289			0.266			0.453			0.246			0.327		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.0649	U		0.0665	U		0.0647	U		0.0497	U		0.071	U	
35		0.271	K	J-EMPC	0.143			0.28			0.351			0.069	U	
36		0.07	K	J-EMPC	0.0569	U		0.0554	U		0.092			0.0607	U	
37		3.31			2.55			4.15			4.29			8.02		
38		0.059	U		0.0606	U		0.0589	U		0.0497	U		0.0646	U	
39		0.062	U		0.0636	U		0.151			0.0497	U		0.0678	U	
40	40 + 41 + 71	0.487	C K	J-EMPC	0.987	C		1.34	C		1.57	C		0.751	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		0.608			1.44			0.791			2.24			0.591		
43		0.0514	U		0.0696	U		0.182	K	J-EMPC	0.143	K	J-EMPC	0.109	K	J-EMPC
44	44 + 47 + 65	4.56	C		12.4	C		7.96	C		24	C		6.23	C	
45	45 + 51	0.141	C		0.258	C		0.431	C		0.311	C		0.25	C	
46		0.0489	U		0.075			0.149			0.071			0.0755	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		0.291		U	0.372		U	0.431		U	0.672			0.395		U
49	49 + 69	0.743	C		2.91	C		3.89	C		2.79	C		1.62	C	
50	50 + 53	0.275	C K	J-EMPC	0.573	C		1.02	C		1.14	C		0.346	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		2.76			10			16.9			17.8			4.46		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.0489	U		0.0641	U		0.052			0.0497	U		0.0586	U	
55		0.157	U		0.259	U		0.135	U		0.112	U		0.33	U	
56		0.544	K	U	1.6			1.47			2.13			1.23		
57		0.143	U		0.235	U		0.141	K	J-EMPC	0.101	U		0.3	U	
58		0.167	U		0.275	U		0.143	U		0.119	U		0.351	U	
59	59 + 62 + 75	0.158	C K	U	0.119	C K	U	0.192	C	U	0.396	C K	J-EMPC	0.163	C	U
60		0.84	K	J-EMPC	1.78			1.59			1.89			1	K	J-EMPC
61	61 + 70 + 74 + 76	13.9	C		44.6	C		213	C		140	C		109	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		1.7			10.6			23.5			33.8			14.6		
64		0.494		U	1.51			2.1			1.18			0.819		U
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		13.2			35.7			57.7			96.7			142		
67		0.174			0.237	U		0.292	K	J-EMPC	0.459			0.303	U	
68		0.353			1.02	K	J-EMPC	1.8			0.911			0.539		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.13	U		0.214	U		0.25			0.18			0.273	U	
73		0.0489	U		0.0496	U		0.05	U		0.0497	U		0.05	K	J-EMPC
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		3.76			6.54			14.8			20.7			10.5		
78		0.166	U		0.273	U		0.142	U		0.118	U		0.348	U	
79		0.516	K	J-EMPC	2.67			0.87			2.47			0.711		
80		0.142	U		0.234	U		0.122	U		0.101	U		0.299	U	
81		0.239	K	J-EMPC	0.446			0.823	K	J-EMPC	1.32			0.361	U	
82		0.396	K	J-EMPC	2.73			1.96			1.45			0.831	K	J-EMPC
83	83 + 99	18.6	C		92.8	C		69	C		87.2	C		276	C	
84		0.47	K	U	4.02			4.02			2.46			0.894		
85	85 + 116 + 117	6.37	C		123	C		92.4	C		347	C		94.4	C	
86	86 + 87 + 97 + 108 + 119 + 125	7.22	C		42.5	C		10	C		39.8	C		14.6	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	0.513	C		3.48	C		2.5	C		2.15	C		1.08	C	
89		0.0615	U		0.0834	U		0.119			0.1	U		0.155	U	
90	90 + 101 + 113	11.6	C		57.7	C		60.8	C		169	C		70.6	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		1.83			6.84			5.38			6.39			2.43		
93	93 + 95 + 98 + 100 + 102	6.85	C		34.1	C		18.1	C		40.1	C		11.6	C	
94		0.0611	U		0.0828	U		0.0893	U		0.0997	U		0.154	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.0489	U		0.0496	U		0.104	K	J-EMPC	0.0497	U		0.0565	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		0.05	U		0.189			0.166			0.11			0.171		
104		0.0489	U		0.0496	U		0.05	U		0.0497	U		0.0796	U	
105		14.6			93.1			56.6			86.3	K	J-EMPC	134		
106		0.481	U		2.58	U		2.31	U		4.51	U		5.36	U	
107	107 + 124	0.887	C		3.94	C		2.61	C		4.95	C U		5.89	C U	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		16.1			301			401			1040			227		
110	110 + 115	4.32	C		31.8	C		19.4	C		24.7	C		9.47	C	
111		0.229	K	J-EMPC	0.605			0.661			0.842	K	J-EMPC	0.194		
112		0.0489	U		0.0645	U		0.0695	U		0.0777	U		0.12	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		6.61			351			355			804			121		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 3
PCB Congener Qualifier Summary - Crayfish
Lab Sample ID's L11380-1 through L11380-7
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26607

IUPAC #	COELUTING CONGENERS[1]	08021901CF L11380-1	Lab Qualifier	URS Review Qualifier	08021904CF L11380-4	Lab Qualifier	URS Review Qualifier	08021505CF L11380-5	Lab Qualifier	URS Review Qualifier	08021406CF L11380-6	Lab Qualifier	URS Review Qualifier	08021407CF L11380-7	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		206			3520			6340	D		14000	D		4400		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		1.1			2.95			2.51			3.74			1.17		
121		0.0489	U		0.0639	U		0.0689	U		0.077	U		0.119	U	
122		0.595	U		3.19	U		2.85	U		5.57	U		6.62	U	
123		4.75			247			206			460			69		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		0.8			3.51	U		3.6			7.83			2.6	U	
127		0.56	U		34.8			29.5			78.5			15.2		
128	128 + 166	3.34	C		132	C		59.7	C		112	C		28.7	C	
129	129 + 138 + 160 + 163	136	C		1490	C		1250	C		3840	C		983	C	
130		6.23			13.1			15.7			31			89.7		
131		0.16	U		0.521			0.226	U		0.281	U		0.632	U	
132		1.64	K	J-EMPC	8.32			4.01			3.69			3.12		
133		3.9			11.3			32.3			39.5			26.8		
134	134 + 143	0.164	C U		2.94	C		0.988	C		0.288	C U		0.648	C U	
135	135 + 151 + 154	7.02	C		13.2	C		11.8	C		8.25	C		34.1	C	
136		0.679			3.94			3.02			1.79			27.8		
137		11.9			698			662			1770			291		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	0.444	C K	J-EMPC	1.84	C		1.4	C		0.26	C U		13.9	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		0.154	U		0.204	U		0.218	U		0.271	U		0.609	U	
142		0.166	U		0.22	U		0.235	U		0.292	U		0.657	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		0.433			1.45			0.977			0.957			0.853	K	J-EMPC
145		0.0489	U		0.0496	U		0.0514	U		0.0497	U		0.0641	U	
146		52.3			483			601			1790			323		
147	147 + 149	11.8	C		52.2	C		27.4	C		92.6	C		57.3	C	
148		0.091			0.084			0.113			0.085	K	J-EMPC	0.737		
149	147 + 149		C147			C147			C147			C147			C147	
150		0.0489	U		0.082	K	J-EMPC	0.05	U		0.0497	U		0.317		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.0489	U		0.0496	U		0.05	U		0.0497	U		0.0532	U	
153	153 + 168	242	C		2060	C		2870	C		7730	C		2320	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.082			0.0496	U		0.112			0.191	K	J-EMPC	0.19	K	J-EMPC
156	156 + 157	38.2	C		2280	C		1620	C		3910	C		655	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		2.61			10.5			5.41			7.03			9.62		
159		0.198	K	J-EMPC	0.36	K	J-EMPC	0.177	U		0.22	U		1.01	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.117	U		0.155	U		0.165	U		0.205	U		0.462	U	
162		1.46			38.2			31.8			74.6			13.1		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		0.124	U		0.164	U		0.175	U		0.217	U		0.489	U	
165		0.133	U		0.524			0.866	K	J-EMPC	0.234	U		0.528	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		23			1180			629			1530			222		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.597	U		2.95	U		1.8	U		1.2	U		2.22	U	
170		21.6			137			160			326			239		
171	171 + 173	2.99	C		5.3	C		4.06	C		3.04	C		18.8	C	
172		2.97			5.77			10.3			11.5			24.4		
173	171 + 173		C171			C171			C171			C171			C171	
174		2.39			8.43			6.02			3.65			16.2		
175		0.921			1.56			2.38			3.3			5.92		
176		0.531			1.08			0.443	K	J-EMPC	0.351			1.39		
177		22.1			34.2			25.9			36.4			58.5		
178		7.12			9.28			13.6			10.2			21.1		
179		1.62			2.86			2.26			1.89			2.8		
180	180 + 193	143	C		1710	C		0.0552	C U		2450	C		495	C	
181		0.776	K	J-EMPC	28.1			14.7			30.6			8.48		
182		0.0596	U		0.0594	U		0.0632	U		0.0593	U		1.47		
183	183 + 185	16.8	C		28.4	C		40.5	C		42.5	C		81.3	C	
184		0.094			0.0496	U		0.05	U		0.0497	U		0.147	K	J-EMPC
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0489	U		0.0496	U		0.05	U		0.0497	U		0.0574	U	
187		165			792			424			896			238		
188		0.349	K	J-EMPC	1.27			0.657			0.755			0.422		
189		2.69			68.3			41.4			82.1			16		
190		14.1			130			49.4			40.3			51.9		
191		1.75			13.3			13.6			33.6			11.6		
192		0.056	U		0.0558	U		0.0593	U		0.0557	U		0.0697	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		11			39.5			36.3			37.8			47.1		
195		7.44			19.1			14.7			12.6			15.9		
196		9.34			35.9			19.8			22.1			27.4		
197	197 + 200	1.05	C		2.37	C		1.36	C		0.678	C		3.82	C	
198	198 + 199	19	C		57.7	C		38.6	C		38.9	C		62.9	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		3.7			8.46			5.73			4.9			8.53		
202		2.79			3.73			3.95			3.21			11		
203		16.1			43.4			18.8			13			44.2		
204		0.0489	U		0.0615	U		0.0572	U		0.0702	U		0.0597	U	
205		0.689	K	J-EMPC	1.5			1.37			0.796			2.02		
206		4.4			6.06			7.23			4.38			25.4		
207		1.88			4.24			2.49			1.54			4.31		
208		2.57			4.14			3.5			2.98			7.18		
209		5.07			4.84			5.75			4.94			4.45		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L11380-8 through L11380-11 and L11433-1

Bradford Island - Remedial Investigation
Sample Delivery Group WG26097

IUPAC #	COELUTING CONGENERS[1]	08021408CF L11380-8	Lab Qualifier	URS Review Qualifier	08021413CF L11380-9	Lab Qualifier	URS Review Qualifier	08022014CF L11380-10	Lab Qualifier	URS Review Qualifier	08021915CF L11380-11	Lab Qualifier	URS Review Qualifier	08022216CF L11433-1	Lab Qualifier	URS Review Qualifier
1		0.144	K	J-EMPC	0.138			0.134			0.153			0.224		
2		0.121	K	J-EMPC	0.097	K	J-EMPC	0.123	K	J-EMPC	0.139			0.175		
3		0.167			0.193	K	J-EMPC	0.209	K	J-EMPC	0.203	K	J-EMPC	0.191	K	J-EMPC
4		0.462		U	0.224	K	U	0.275		U	0.52		U	0.884	U	
5		0.139	U		0.156	U		0.114	U		0.129	U		0.745	U	
6		0.156			0.138	U		0.147			0.192			0.653	U	
7		0.123	U		0.142	U		0.104	U		0.118	U		0.655	U	
8		0.505		U	0.339		U	0.579		U	0.782		U	0.585	U	
9		0.123	U		0.14	U		0.102	U		0.116	U		0.654	U	
10		0.12	U		0.144	U		0.105	U		0.12	U		0.648	U	
11		31			12			16.7			32.3			56.4		
12	12 + 13	0.134	C U		0.156	C U		0.114	C U		0.13	C U		0.714	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.129	U		0.147	U		0.108	U		0.122	U		0.677	U	
15		1.35	K	J-EMPC	0.931			0.832			3.11			1.03	U	
16		0.328	K	J-EMPC	0.172			0.321			0.365			0.378	K	J-EMPC
17		0.314	K	J-EMPC	0.143	K	J-EMPC	0.34	K	J-EMPC	0.341			0.389		
18	18 + 30	1.06	C	U	0.46	C	U	0.668	C K	U	1.16	C	U	1.3	C	U
19		0.121		U	0.0964	U		0.0679	U		0.097	K	U	0.157	K	U
20	20 + 28	1.44	C	U	1.27	C	U	1.87	C	U	2.61	C	U	2.21	C	U
21	21 + 33	0.386	C	U	0.395	C K	U	0.507	C K	U	0.743	C K	U	0.48	C K	U
22		0.369	K	J-EMPC	0.32			0.399	K	J-EMPC	0.564			0.362		
23		0.0669	U		0.0692	U		0.0515	U		0.0709	U		0.0981	U	
24		0.0498	U		0.0682	U		0.0509	U		0.0683	U		0.0802	U	
25		0.075	K	J-EMPC	0.0618	U		0.063			0.122			0.101	K	J-EMPC
26	26 + 29	0.283	C	U	0.239	C K	U	0.247	C	U	0.479	C	U	0.488	C K	U
27		0.056			0.0659	U		0.052	K	J-EMPC	0.103			0.0748	U	
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		0.701		U	0.607		U	0.932		U	1.14		U	1.05		U
32		0.145			0.125	K	J-EMPC	0.199			0.239			0.185		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.0682	U		0.0709	U		0.0527	U		0.0726	U		0.0998	U	
35		0.124	K	J-EMPC	0.087	K	J-EMPC	0.068	K	J-EMPC	0.12	K	J-EMPC	0.157		
36		0.0584	U		0.0672	U		0.05	U		0.0689	U		0.095	K	J-EMPC
37		1.79			1.52			1.01			5.58			3.88		
38		0.0621	U		0.0692	U		0.0515	U		0.0709	U		0.0956	U	
39		0.0652	U		0.149			0.0567	U		0.0781	U		0.106	U	
40	40 + 41 + 71	0.461	C		0.343	C		0.435	C		0.627	C		0.502	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		0.577	K	J-EMPC	0.154	K	U	0.174		U	0.464			0.409	K	U
43		0.0716	U		0.0837	U		0.0849	U		0.088	U		0.118	U	
44	44 + 47 + 65	4.23	C		1.13	C		1.28	C		2.98	C		3.12	C	
45	45 + 51	0.159	C K	J-EMPC	0.129	C K	J-EMPC	0.09	C		0.144	C		0.261	C K	J-EMPC
46		0.0673	U		0.0852	U		0.0864	U		0.0896	U		0.11	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		0.22	K	U	0.145	K	U	0.184		U	0.189		U	0.275	K	U
49	49 + 69	0.776	C		0.603	C		0.659	C		0.716	C		0.892	C K	J-EMPC
50	50 + 53	0.219	C		0.137	C		0.107	C K	J-EMPC	0.195	C		0.194	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		2.56			1.56			1.72			2.28			2.58		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.0498	U		0.0644	U		0.0578	U		0.0616	U		0.0711	U	
55		0.194	U		0.191	U		0.109	U		0.234	U		0.268	U	
56		0.383	K	U	0.287		U	0.329		U	0.414	K	U	0.612		U
57		0.176	U		0.172	U		0.0979	U		0.211	U		0.254	U	
58		0.206	U		0.187	U		0.106	U		0.229	U		0.285	U	
59	59 + 62 + 75	0.096	C K	U	0.096	C K	U	0.0573	C U		0.151	C K	U	0.13	C K	U
60		0.474		U	0.222	K	U	0.282	K	U	0.462	K	U	0.691		
61	61 + 70 + 74 + 76	16.1	C		6.77	C		4.72	C		7.95	C		14	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		5.17			1.75			1.24			1.88			2.48		
64		0.473		U	0.339		U	0.458		U	0.563		U	0.578		U
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		18			7.05			3.86			8.47			19		
67		0.178	U		0.161	U		0.0917	U		0.197	U		0.25	U	
68		0.741			0.87	K	J-EMPC	0.424			0.52			0.741		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.16	U		0.165	U		0.0936	U		0.201	U		0.234	U	
73		0.0498	U		0.059	U		0.0598	U		0.062	U		0.0715	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		4.33			2.11			1.74			4.38			5.14		
78		0.204	U		0.195	U		0.111	U		0.238	U		0.286	U	
79		0.529			0.15	U		0.0854	U		0.227	K	J-EMPC	0.24	K	J-EMPC
80		0.175	U		0.167	U		0.0951	U		0.205	U		0.228	U	
81		0.228	U		0.215	U		0.125	U		0.273	U		0.289	U	
82		0.203	K	J-EMPC	0.206	K	J-EMPC	0.198			0.237	K	J-EMPC	0.259	K	J-EMPC
83	83 + 99	37.8	C		7.35	C		3.17	C		7.66	C		18.9	C	
84		0.519		U	0.402		U	0.453		U	0.597	K	J-EMPC	0.533	K	U
85	85 + 116 + 117	28.7	C		4.58	C		3.1	C		4.28	C		6.45	C	
86	86 + 87 + 97 + 108 + 119 + 125	9.11	C		1.73	C		1.62	C	U	3.39	C		4.91	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	0.504	C		0.256	C K	U	0.29	C	U	0.375	C		0.276	C K	U
89		0.131	U		0.0941	U		0.0759	U		0.095	U		0.108	U	
90	90 + 101 + 113	17.2	C		5.43	C		4.32	C		6.03	C		9.84	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		1.76			0.626	K	J-EMPC	0.515	K	J-EMPC	0.781	K	J-EMPC	1.98		
93	93 + 95 + 98 + 100 + 102	7.46	C		1.88	C	U	1.82	C	U	3.68	C		7.5	C	
94		0.13	U		0.0971	U		0.0783	U		0.098	U		0.111	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.0498	U		0.0491	U		0.0726	U		0.05	U		0.0711	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		0.106	U		0.0806	U		0.0651	U		0.0814	U		0.0926	U	
104		0.0498	U		0.0541	U		0.0771	U		0.0501	U		0.0711	U	
105		34.7			4.89	K	J-EMPC	3.67	K	J-EMPC	7.46			13.2		
106		0.856	U		0.193	U		0.168	U		0.285	U		0.778	U	
107	107 + 124	2.35	C K	J-EMPC	0.441	C		0.176	C U		0.694	C K	J-EMPC	1.15	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		57.5			10.7			10.9			9.05			16.2		
110	110 + 115	4.96	C		2.42	C		2.52	C		3.48	C		3.06	C	
111		0.238			0.303			0.283			0.159	K	J-EMPC	0.326		
112		0.101	U		0.0655	U		0.0529	U		0.0662	U		0.0826	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		48.4			3.7			5.69			4.07			6.61		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		847			95.5			112			122			248		

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L11380-8 through L11380-11 and L11433-1

Bradford Island - Remedial Investigation
Sample Delivery Group WG26097

IUPAC #	COELUTING CONGENERS[1]	08021408CF L11380-8	Lab Qualifier	URS Review Qualifier	08021413CF L11380-9	Lab Qualifier	URS Review Qualifier	08022014CF L11380-10	Lab Qualifier	URS Review Qualifier	08021915CF L11380-11	Lab Qualifier	URS Review Qualifier	08022216CF L11433-1	Lab Qualifier	URS Review Qualifier
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		1.2			0.985			1.2			0.778			1.41		
121		0.1	U		0.0702	U		0.0567	U		0.0708	U		0.0799	U	
122		1.06	U		0.214	U		0.186	U		0.316	U		0.899	U	
123		30.2			2.42			5.81			3.37			6.82		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		1.3	U		0.306			0.238			0.468			1.1	U	
127		3.46			0.438			0.494	K	J-EMPC	0.34	U		0.852	U	
128	128 + 166	11.4	C		1.63	C K	J-EMPC	1.61	C		1.91	C		2.59	C	
129	129 + 138 + 160 + 163	260	C		60.4	C		54.7	C		69.1	C		122	C	
130		11.2			3.21			0.988	K	J-EMPC	3.58			7.22		
131		0.164	U		0.147	U		0.226	U		0.207	U		0.185	U	
132		1.25			0.857			0.819			0.999			0.945	K	J-EMPC
133		5.97			2.55			1.6			1.64			3.42		
134	134 + 143	0.907	C		0.143	C U		0.22	C U		0.45	C K	J-EMPC	0.185	C U	
135	135 + 151 + 154	5.84	C		0.0574	C U		1.54	C		3.26	C		7.56	C	
136		1.05			0.433			0.329			0.548			1.05		
137		83.3			6.57			9.31			5.97			10.9		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	0.878	C		0.236	C		0.203	C U		0.187	C		0.435	C K	J-EMPC
140	139 + 140		C139			C139			C139			C139			C139	
141		0.158	U		0.133	U		0.205	U		1.64			0.183	U	
142		0.171	U		0.149	U		0.23	U		0.211	U		0.185	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		0.461			0.186	K	J-EMPC	0.174	K	J-EMPC	0.244			0.516		
145		0.055	U		0.0491	U		0.0499	U		0.0654	U		0.0711	U	
146		101			30.9			26.1			27			55		
147	147 + 149	14.5	C		4.72	C		3.96	C		6.55	C		9.04	C	
148		0.0724	U		0.059	U		0.0587	U		0.0828	U		0.113		
149	147 + 149		C147			C147			C147			C147			C147	
150		0.0508	U		0.0491	U		0.0499	U		0.0626	U		0.0711	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.0498	U		0.0491	U		0.0499	U		0.0592	U		0.0711	U	
153	153 + 168	570	C		122	C		201	C		151	C		322	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.077			0.15	K	J-EMPC	0.0499	U		0.0722	U		0.082		
156	156 + 157	211	C		13.8	C		26.3	C		16.9	C		28	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		3.49			0.898			0.612			1.44			2.55	K	J-EMPC
159		0.189	K	J-EMPC	0.157			0.172	U		0.158	U		0.221		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.12	U		0.102	U		0.157	U		0.144	U		0.133	U	
162		4.77			0.973			1.28			0.82	K	J-EMPC	1.18		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		0.127	U		0.108	U		0.166	U		0.153	U		0.137	U	
165		0.172	K	J-EMPC	0.201	K	J-EMPC	0.174	U		0.159	U		0.153	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		97.1			8.53			22.8			12.1			21.5		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.487	U		0.249	U		0.257	U		0.35	U		0.539	U	
170		29.3			9.04			12.5			11.3			14.4		
171	171 + 173	1.86	C		0.958	C K	J-EMPC	0.571	C		1.05	C		2.27	C	
172		3.38			1.75			0.953			1.85			2.17		
173	171 + 173		C171			C171			C171			C171			C171	
174		2.45	K	J-EMPC	1.34			1.09	K	J-EMPC	2.33			2.37		
175		1.01			0.571			0.341	K	J-EMPC	0.595			0.925		
176		0.299			0.134	K	J-EMPC	0.156	K	J-EMPC	0.292	K	J-EMPC	0.474		
177		17.4			8.44			4.28			10.6			19.1		
178		6.02			3.88			1.81			3.77			7.59		
179		1.62			0.599			0.549			1.06			2.48		
180	180 + 193	194	C		0.061	C U		111	C		73.9	C		0.0766	C U	
181		2.06			0.34			0.507			0.363			0.631		
182		0.0879	U		0.0648	U		0.0788	U		0.167	K	J-EMPC	0.584		
183	183 + 185	13.6	C		6.59	C		3.75	C		8.26	C		14.8	C	
184		0.0613	U		0.091			0.0574	U		0.05	U		0.0711	U	
185	183 + 185		C183			C183			C183			C183			C183	
186		0.068	U		0.0519	U		0.0631	U		0.05	U		0.0711	U	
187		160			78.2			101			81.1			138		
188		0.317			0.38			0.408			0.267	K	J-EMPC	0.354		
189		5.48			1.17			1.62	K	J-EMPC	1.26			1.55	K	J-EMPC
190		13.8			4.84			2.85			7.76			11.9		
191		3.01			0.982			1.45			1.1			1.59		
192		0.0826	U		0.0651	U		0.0791	U		0.061	U		0.0798	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		9.33			6.3			7.03			6.69			6.53		
195		4.55			2.18			3.96			3.12			3.95		
196		6.12			4.04			6.38			4.03			4.69		
197	197 + 200	0.475	C		0.407	C		0.298	C		0.5	C		0.533	C K	J-EMPC
198	198 + 199	14.1	C		11.1	C		9.4	C		12.1	C		12.9	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		2.42			1.79			2.67			1.85			2.77		
202		2.74			1.87			0.89	K	J-EMPC	2.29			4.22		
203		9.43			5.37			2.53			10.2			13.1		
204		0.072	U		0.0509	U		0.0561	U		0.0543	U		0.0711	U	
205		0.545	K	J-EMPC	0.305			0.216			0.421			0.633		
206		3.63			2.23			1.62			3.5			3.32		
207		1.03			0.852			1.38			0.853	K	J-EMPC	0.931		
208		1.91			1.42			1.01			1.84			1.84		
209		3.19			2.17	K	J-EMPC	2.83			2.76			3.47		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L11380-13 through L11380-18
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26607

IUPAC #	COELUTING CONGENERS[1]	0802917CF L11380-13	Lab Qualifier	URS Review Qualifier	0802918CF L11380-14	Lab Qualifier	URS Review Qualifier	0802919CF L11380-15	Lab Qualifier	URS Review Qualifier	0802920CF L11380-16	Lab Qualifier	URS Review Qualifier	0802921CF L11380-17	Lab Qualifier	URS Review Qualifier	0802622CF L11380-18	Lab Qualifier	URS Review Qualifier
1		0.151			0.128	K	J-EMPC	0.161	K	J-EMPC	0.182	K	J-EMPC	0.142			0.13		
2		0.108	K	J-EMPC	0.139	K	J-EMPC	0.106	K	J-EMPC	0.167	K	J-EMPC	0.123			0.138		
3		0.239	K	J-EMPC	0.227	K	J-EMPC	0.222	K	J-EMPC	0.261			0.13			0.186		
4		0.483	K	U	0.308		U	0.467	K	U	0.514		U	0.79	U		0.889	U	
5		0.163	U		0.161	U		0.168	U		0.13	U		0.655	U		0.735	U	
6		0.145	U		0.143	U		0.149	K	J-EMPC	0.251			0.573	U		0.644	U	
7		0.149	U		0.147	U		0.153	U		0.118	U		0.576	U		0.647	U	
8		0.53	K	U	0.466		U	0.477		U	0.889		U	0.514	U		0.577	U	
9		0.146	U		0.144	U		0.15	U		0.116	U		0.574	U		0.645	U	
10		0.151	U		0.149	U		0.155	U		0.12	U		0.569	U		0.639	U	
11		37.9			41.9			49.4			48.2			49.7			15.1		
12	12 + 13	0.164	C U		0.162	C U		0.168	C U		0.13	C U		0.627	C U		0.705	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.155	U		0.152	U		0.159	U		0.123	U		0.595	U		0.668	U	
15		1.02	K	J-EMPC	1.15			1.73	K	J-EMPC	1.57	K	J-EMPC	4.5	K	J-EMPC	0.998	U	
16		0.409	K	J-EMPC	0.278			0.397	K	J-EMPC	0.519			0.408			0.225	K	J-EMPC
17		0.488			0.306	K	J-EMPC	0.274			0.524	K	J-EMPC	0.359	K	J-EMPC	0.188		
18	18 + 30	1.03	C	U	0.828	C K	U	1.55	C	U	1.52	C	U	1.64	C	U	0.447	C	U
19		0.104		U	0.147	K	U	0.0967	U		0.119		U	0.145		U	0.087	K	U
20	20 + 28	1.91	C	U	2.07	C	U	2.3	C	U	3.1	C		2.53	C	U	0.883	C	U
21	21 + 33	0.481	C	U	0.544	C	U	0.386	C	U	0.722	C K	U	0.482	C K	U	0.31	C K	U
22		0.786			0.492	K	J-EMPC	0.386	K	J-EMPC	0.587			0.522			0.26		
23		0.0862	U		0.0598	U		0.0855	U		0.0751	U		0.0952	U		0.075	U	
24		0.0615	U		0.0606	U		0.083	U		0.0614	U		0.0797	U		0.0633	U	
25		0.085			0.0535	U		0.121	K	J-EMPC	0.105			0.0834	U		0.0657	U	
26	26 + 29	0.31	C	U	0.358	C	U	0.378	C	U	0.414	C	U	0.951	C		0.149	C K	U
27		0.085	K	J-EMPC	0.0586	U		0.109			0.072			0.131	K	J-EMPC	0.059	U	
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		1.03		U	0.88		U	0.782		U	1.58		U	1.1		U	0.495	K	U
32		0.148			0.161			0.101	K	J-EMPC	0.27			0.168			0.118	K	J-EMPC
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0883	U		0.0613	U		0.0876	U		0.077	U		0.0968	U		0.0763	U	
35		0.0961	U		0.149			0.254			0.147	K	J-EMPC	0.157	K	J-EMPC	0.079	U	
36		0.0838	U		0.0582	U		0.0831	U		0.0731	U		0.089	U		0.0701	U	
37		1.51			2.84			2.37			2.81			6.25			1.02		
38		0.0862	U		0.0598	U		0.0855	U		0.0752	U		0.0928	U		0.0731	U	
39		0.095	U		0.0659	U		0.0941	U		0.0828	U		0.103	U		0.0809	U	
40	40 + 41 + 71	0.666	C		0.534	C		0.46	C K	J-EMPC	0.553	C		0.513	C		0.277	C K	J-EMPC
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		0.916			0.369		U	0.459	K	J-EMPC	0.564	K	J-EMPC	0.673	K	J-EMPC	0.187		U
43		0.0942	U		0.0936	U		0.105	U		0.0913	U		0.126	U		0.0919	U	
44	44 + 47 + 65	3.28	C		2.17	C		3.98	C		3.41	C		4.45	C		1.05	C	
45	45 + 51	0.194	C		0.184	C		0.171	C		0.213	C		0.187	C K	J-EMPC	0.138	C	
46		0.0959	U		0.0953	U		0.107	U		0.093	U		0.118	U		0.0857	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.454	K	U	0.204	K	U	0.185		U	0.343		U	0.342		U	0.089	K	U
49	49 + 69	1.36	C		0.738	C K	J-EMPC	0.499	C		0.911	C K	J-EMPC	0.991	C		0.368	C	
50	50 + 53	0.212	C		0.124	C		0.224	C K	J-EMPC	0.239	C		0.258	C K	J-EMPC	0.08	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		2.72			2.14			2.03			2.63			2.93			0.872		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0655	U		0.0733	U		0.0692	U		0.0558	U		0.0742	U		0.0567	U	
55		0.14	U		0.13	U		0.192	U		0.125	U		0.191	U		0.133	U	
56		0.822		U	0.427		U	0.362	K	U	0.502		U	0.744	K	U	0.269		U
57		0.126	U		0.117	U		0.173	U		0.112	U		0.182	U		0.126	U	
58		0.137	U		0.127	U		0.188	U		0.122	U		0.203	U		0.141	U	
59	59 + 62 + 75	0.124	C	U	0.085	C	U	0.156	C K	U	0.113	C K	U	0.128	C K	U	0.0568	C U	
60		0.726			0.619			0.857			1.08			1.01			0.207	K	U
61	61 + 70 + 74 + 76	8.04	C		8.64	C		9.75	C		11.3	C		14.5	C		2.66	C	U
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.615			1.91			1.1			1.59			1.69			0.612		
64		0.892		U	0.488		U	0.321		U	0.536		U	0.599		U	0.247	K	U
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		6.72			10.8			10.3			10.5			17.6			2.43		
67		0.118	U		0.11	U		0.162	U		0.13	K	J-EMPC	0.307	K	J-EMPC	0.124	U	
68		0.225			0.629	K	J-EMPC	0.304	K	J-EMPC	0.342	K	J-EMPC	0.352			0.235	K	J-EMPC
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.121	U		0.112	U		0.165	U		0.108	U		0.167	U		0.116	U	
73		0.0664	U		0.0659	U		0.0737	U		0.0644	U		0.0763	U		0.0555	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		1.57			4.12			2.67			3.38			3.66			1.3		
78		0.143	U		0.133	U		0.196	U		0.127	U		0.204	U		0.142	U	
79		0.189	K	J-EMPC	0.206	K	J-EMPC	0.343			0.338			0.368			0.115	U	
80		0.123	U		0.114	U		0.168	U		0.109	U		0.163	U		0.113	U	
81		0.164	U		0.313	K	J-EMPC	0.218	U		0.211			0.25			0.135	U	
82		0.372	K	J-EMPC	0.224			0.139	K	J-EMPC	0.204	K	J-EMPC	0.257	K	J-EMPC	0.088	K	J-EMPC
83	83 + 99	8.36	C		9.81	C		13.8	C		13.4	C		17.4	C		2.57	C	
84		0.657			0.419	K	U	0.311		U	0.371		U	0.489		U	0.219		U
85	85 + 116 + 117	2.8	C		5.87	C		3.21	C		3.9	C K	J-EMPC	3.71	C		1.31	C	
86	86 + 87 + 97 + 108 + 119 + 125	5.21	C		2.83	C		5.66	C		4.85	C		6.75	C		1.12	C	U
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	0.788	C		0.343	C		0.324	C	U	0.426	C K	J-EMPC	0.576	C		0.141	C K	U
89		0.129	U		0.0851	U		0.117	U		0.0794	U		0.104	U		0.073	U	
90	90 + 101 + 113	9.08	C		7.35	C		6.68	C		7.56	C		9.91	C		2.15	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		1.32			0.9			1.27			1.09			1.88			0.267	K	J-EMPC
93	93 + 95 + 98 + 100 + 102	4.28	C		3.13	C		5.14	C		4.75	C		6.91	C		1.07	C	U
94		0.133	U		0.0878	U		0.121	U		0.0819	U		0.107	U		0.075	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.052	U		0.0491	U		0.0557	U		0.0637	U		0.058	U		0.0494	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.111	U		0.073	U		0.1	U		0.0681	U		0.0886	U		0.0624	U	
104		0.0559	U		0.0532	U		0.0626	U		0.0611	U		0.0633	U		0.0494	U	
105		6.36			7.37			11.1			11			12.7			1.97		
106		0.278	U		0.339	U		0.462	U		0.5	U		0.435	U		0.153	U	
107	107 + 124	0.363	C		0.577	C		0.53	C K	J-EMPC	0.609	C K	J-EMPC	0.711	C		0.16	C U	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		5.55			16.3			8			10.8			8.96			3.9		
110	110 + 115	7.22	C		3.33	C		3.35	C		3.46	C		5.81	C		1.36	C	U
111		0.131			0.311			0.131	K	J-EMPC	0.171	K	J-EMPC	0.117			0.081	K	J-EMPC
112		0.09	U		0.0593	U		0.0816	U		0.0553	U		0.079	U		0.0556	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		2.14			6.1			2.61	K	J-EMPC	3.61			3.89			2.62		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		82.4			173			111			152			156			52.6		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.561			1.32			0.668			0.903			0.754			0.418	K	J-EMPC
121		0.0964	U		0.0635	U		0.0874	U		0.0592	U		0.0764	U		0.0538	U	
122		0.308	U		0.376	U		0.513	U		0.554	U		0.503	U		0.177	U	
123		2.11			5.06			3.11	K	J-EMPC	3.62			4			1.93		

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L11380-13 through L11380-18

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26607

IUPAC #	COELUTING CONGENERS[1]	08021917CF L11380-13	Lab Qualifier	URS Review Qualifier	08021918CF L11380-14	Lab Qualifier	URS Review Qualifier	08021919CF L11380-15	Lab Qualifier	URS Review Qualifier	08021920CF L11380-16	Lab Qualifier	URS Review Qualifier	08021921CF L11380-17	Lab Qualifier	URS Review Qualifier	08022622CF L11380-18	Lab Qualifier	URS Review Qualifier
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.397	U		0.469			0.65	U		0.748	U		0.547	U		0.207	U	
127		0.331	U		0.54	K	J-EMPC	0.551	U		0.596	U		0.476	U		0.265		
128	128 + 166	2.3	C K	J-EMPC	2.21	C		1.84	C		1.6	C		2.97	C		0.887	C K	J-EMPC
129	129 + 138 + 160 + 163	44.8	C		99.8	C		73.8	C		81	C		79.1	C		23.2	C	
130		1.47			4.35			3.33			3.48			4.29			0.614		
131		0.188	U		0.141	U		0.265	U		0.246	U		0.249	U		0.171	U	
132		1.72			0.871			1.35			1.36			1.98			0.407		U
133		1.11			2.83			1.84			2			1.95			0.574	K	J-EMPC
134	134 + 143	0.457	C K	J-EMPC	0.431	C		0.487	C K	J-EMPC	0.24	C U		0.249	C U		0.171	C U	
135	135 + 151 + 154	3.32	C		3.24	C		5.73	C		4.19	C		6.96	C		0.856	C	U
136		0.678			0.561	K	J-EMPC	0.641			0.472	K	J-EMPC	0.867			0.246		U
137		4.34			10.1			4.72			6.25			6			4.35		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.297	C K	J-EMPC	0.31	C K	J-EMPC	0.262	C K	J-EMPC	0.221	C U		0.419	C		0.156	C U	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		0.171	U		0.128	U		0.241	U		0.224	U		0.247	U		0.17	U	
142		0.192	U		0.143	U		0.27	U		0.251	U		0.25	U		0.171	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		0.314	K	J-EMPC	0.235			0.341			0.404			0.453			0.08		
145		0.0711	U		0.0502	U		0.0621	U		0.0498	U		0.0572	U		0.0494	U	
146		13.9			46.9			24.8			32.5			27.9			9.49		
147	147 + 149	9.22	C		6.66	C		9.47	C		8.93	C		11	C		1.72	C	
148		0.09	U		0.0635	U		0.0786	U		0.061	U		0.0712	U		0.0494	U	
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.068	U		0.0491	U		0.0594	U		0.0498	U		0.0541	U		0.0494	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0644	U		0.0491	U		0.0563	U		0.0498	U		0.0513	U		0.0494	U	
153	153 + 168	76	C		220	C		158	C		192	C		181	C		77.4	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0662	U		0.0518	U		0.111	K	J-EMPC	0.066			0.113	K	J-EMPC	0.0494	U	
156	156 + 157	13.6	C		25.7	C		13.9	C		19.2	C		19.1	C		14.3	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		1.41	K	J-EMPC	1.4			2.07			1.37	K	J-EMPC	2.35			0.216		
159		0.144	U		0.123	K	J-EMPC	0.202	U		0.188	U		0.191	U		0.132	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.131	U		0.0975	U		0.184	U		0.171	U		0.179	U		0.123	U	
162		0.454	K	J-EMPC	1.42			0.616			0.82	K	J-EMPC	0.741	K	J-EMPC	0.389	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		0.139	U		0.104	U		0.195	U		0.182	U		0.721	K	J-EMPC	0.127	U	
165		0.145	U		0.178			0.204	U		0.189	U		0.206	U		0.142	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		11.8			17.7			12			14.1			14.4			9.8		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.167	U		0.254	U		0.24	U		0.298	U		0.265	U		0.18	U	
170		4.86			13.8			6.75			8.53			9.35			6.33		
171	171 + 173	1.18	C K	J-EMPC	1.25	C		1.5	C K	J-EMPC	1.25	C K	J-EMPC	2.69	C		0.341	C	
172		0.456			1.45			0.835	K	J-EMPC	0.829			1.18			0.314	K	J-EMPC
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		0.855	K	J-EMPC	1.36			1.18			1.01			2.02			0.395		
175		0.203	K	J-EMPC	0.617			0.475	K	J-EMPC	0.42	K	J-EMPC	0.647	K	J-EMPC	0.141	K	J-EMPC
176		0.345			0.164			0.376	K	J-EMPC	0.335	K	J-EMPC	0.648			0.087	K	J-EMPC
177		3.6			11.6			9.27			11.5			12.5			2.34		
178		1.92			4.27			4.25			3.43			5.11			0.892		
179		1.17			0.911	K	J-EMPC	1.53			0.765			2.41			0.253		
180	180 + 193	47.3	C		104	C		54.2	C		66.8	C		73.8	C		63	C	
181		0.241			0.613	K	J-EMPC	0.272	K	J-EMPC	0.43			0.445	K	J-EMPC	0.323	K	J-EMPC
182		0.0719	U		0.0521	U		0.294	K	J-EMPC	0.0717	U		0.0912	U		0.0601	U	
183	183 + 185	4.09	C		8.75	C		7.93	C		8.16	C		11.9	C		2.89	C	
184		0.0524	U		0.0491	U		0.083	K	J-EMPC	0.057			0.103			0.0494	U	
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0576	U		0.0491	U		0.0632	U		0.0575	U		0.0744	U		0.0494	U	
187		50.9			136			67.1			87.6			77.7			27.8		
188		0.219	K	J-EMPC	0.474			0.197	K	J-EMPC	0.237			0.383	K	J-EMPC	0.153		
189		0.926			1.58			0.923			1.09	K	J-EMPC	1.23			1.24		
190		2.82			7.41			5.92			6.14			7.38			2.39		
191		0.565	K	J-EMPC	1.49			0.684			0.867			0.814			0.688	K	J-EMPC
192		0.0722	U		0.0523	U		0.0792	U		0.072	U		0.0902	U		0.0595	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		2.14			8.18			3.41			4.08			4.48			2.79		
195		1.67			4.16			2.43			3.11			3.38			2.34	K	J-EMPC
196		2.51			5.9			2.6			3.24			4.02			3.2		
197	197 + 200	0.504	C		0.44	C		0.364	C		0.396	C		0.979	C		0.215	C K	J-EMPC
198	198 + 199	4.2	C		13.4	C		6.57	C		7.03	C		7.98	C		2.93	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		1.45			3			1.7			2.09			2.35			0.705	K	J-EMPC
202		1.09			2.54			2.16			1.65			2.88			0.575	K	J-EMPC
203		2.84			6.41			6.31			5.08			8.24			1.79		
204		0.0564	U		0.0491	U		0.067	U		0.0572	U		0.051	U		0.0494	U	
205		0.123			0.363			0.26			0.242			0.428			0.162		
206		1.26			2.22			1.75			1.56			2.51			0.714		
207		0.763			1.27			0.609			0.816			1.17			0.808		
208		0.541			1.64			0.977	K	J-EMPC	1.1			1.47			0.442		
209		1.77			2.61			2.16			2.41			3.43			2.95		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifer Summary- Crayfish
Lab Sample ID's L11512-6 and L113380-19 through L11380-24

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26606

IUPAC #	COELUTING CONGENERS[1]	08021838/42CF L11512-6	Lab Qualifier	URS Review Qualifier	08022233CF L11380-19	Lab Qualifier	URS Review Qualifier	08030372CF L11380-22	Lab Qualifier	URS Review Qualifier	08030373CF L11380-23	Lab Qualifier	URS Review Qualifier	08030374CF L11380-24	Lab Qualifier	URS Review Qualifier
1		0.176		U	0.156		U	0.152	K	U	0.191		U	0.14		U
2		0.186			0.186	K	J-EMPC	0.665			0.474			0.09		
3		0.156			0.188	K	J-EMPC	0.109	K	J-EMPC	0.213			0.175		
4		0.695	U		0.445			0.367	U		0.434			0.313		
5		0.532	U		0.184	U		0.257	U		0.229	U		0.165	U	
6		0.466	U		0.164	U		0.228	U		0.204	U		0.147	U	
7		0.468	U		0.168	U		0.234	U		0.209	U		0.15	U	
8		0.627			0.682			0.588			0.559			0.334		
9		0.467	U		0.162	U		0.227	U		0.202	U		0.146	U	
10		0.463	U		0.163	U		0.227	U		0.202	U		0.146	U	
11		64.3			35.8			57			40			30.9		
12	12 + 13	0.51	C U		0.181	C U		0.253	C U		0.226	C U		0.163	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.484	U		0.17	U		0.237	U		0.212	U		0.153	U	
15		2.12			1.87			1.35			1.24			0.891		
16		0.488			0.497			0.284			0.264			0.298		
17		0.578			0.614	K	J-EMPC	0.317			0.281	K	J-EMPC	0.22		
18	18 + 30	1.4	C	U	1.28	C	U	0.756	C	U	0.804	C	U	0.733	C	U
19		0.142			0.111			0.126			0.14	K	J-EMPC	0.0717	U	
20	20 + 28	4.7	C		3.94	C		1.8	C	U	1.95	C	U	2.54	C	
21	21 + 33	0.625	C	U	0.78	C	U	0.464	C	U	0.364	C	U	0.379	C	U
22		0.638			0.691			0.342			0.344			0.297		
23		0.0709	U		0.0497	U		0.0683	U		0.0717	U		0.049	U	
24		0.0527	U		0.0497	U		0.0534	U		0.0587	U		0.049	U	
25		0.072			0.177			0.077			0.0603	U		0.075	K	J-EMPC
26	26 + 29	0.544	C		0.46	C		0.267	C		0.27	C		0.208	C	
27		0.09			0.088			0.0496	U		0.0546	U		0.065		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		1.54		U	1.6		U	0.904		U	0.779		U	0.705		U
32		0.24		U	0.264		U	0.178		U	0.229	K	U	0.129	K	U
33	21 + 33		C21			C21			C21			C21			C21	
34		0.0721	U		0.0497	U		0.0659	U		0.08	K	J-EMPC	0.049	U	
35		0.408	K	J-EMPC	0.112	K	J-EMPC	0.348			0.384			0.0502	U	
36		0.177			0.0497	U		0.116	K	J-EMPC	0.143			0.049	U	
37		4.39			3.32			2.4			3.36			2.38		
38		0.0691	U		0.0497	U		0.0667	U		0.0699	U		0.049	U	
39		0.0765	U		0.0497	U		0.0689	U		0.0723	U		0.049	U	
40	40 + 41 + 71	0.652	C K	U	0.594	C K	U	0.5	C	U	0.412	C	U	0.433	C	U
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		0.46			0.51			0.24	K	J-EMPC	0.255	K	J-EMPC	0.433	K	J-EMPC
43		0.09			0.0742	U		0.0705	U		0.0838	U		0.062	U	
44	44 + 47 + 65	2.87	C		2.3	C	U	1.82	C	U	1.63	C K	U	2.45	C	
45	45 + 51	0.276	C K	J-EMPC	0.223	C		0.21	C		0.211	C K	J-EMPC	0.141	C	
46		0.0827	U		0.0748	U		0.071	U		0.0844	U		0.0625	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		0.362			0.365	K	J-EMPC	0.25	K	J-EMPC	0.179	K	J-EMPC	0.239		
49	49 + 69	1.1	C	U	1.05	C	U	0.722	C	U	0.504	C K	U	0.722	C	U
50	50 + 53	0.235	C		0.266	C K	J-EMPC	0.124	C K	J-EMPC	0.195	C K	J-EMPC	0.173	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45	
52		2.94			2.36		U	1.84		U	1.36		U	1.87		U
53	50 + 53		C50			C50			C50			C50			C50	
54		0.05	U		0.0497	U		0.0497	U		0.082			0.049	U	
55		0.158	U		0.138	U		0.16	U		0.132	U		0.107	U	
56		0.542			0.429	K	J-EMPC	0.423			0.365			0.416		
57		0.148	U		0.127	U		0.147	U		0.122	U		0.0987	U	
58		0.152	U		0.128	U		0.149	U		0.123	U		0.0998	U	
59	59 + 62 + 75	0.162	C K	J-EMPC	0.177	C		0.102	C K	J-EMPC	0.076	C K	J-EMPC	0.112	C K	J-EMPC
60		1.01			0.957			0.392			0.583			1.56		
61	61 + 70 + 74 + 76	11.6	C		9.41	C		7.41	C		8.95	C		10.3	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		1.2			1.06			1.19			1.23			1.22		
64		0.653			0.718			0.48			0.379			0.483		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		11.9			7.92			5.78			8.94			13.6		
67		0.152	K	J-EMPC	0.109	U		0.126	U		0.104	U		0.1	K	J-EMPC
68		0.384			0.446			0.444			0.414			0.405		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.145	U		0.121	U		0.14	U		0.116	U		0.0939	U	
73		0.0536	U		0.0526	U		0.0499	U		0.0593	U		0.049	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		2.88			2.39			2.62			3.29			2.99		
78		0.154	U		0.138	U		0.16	U		0.132	U		0.107	U	
79		0.141			0.155			0.139	K	J-EMPC	0.208			0.208		
80		0.133	U		0.123	U		0.143	U		0.118	U		0.096	U	
81		0.175	U		0.176			0.169	U		0.161	K	J-EMPC	0.167		
82		0.18			0.144			0.247	K	J-EMPC	0.166			0.0707	U	
83	83 + 99	12.7	C		9.17	C		5.76	C		9.09	C		16.3	C	
84		0.424			0.489			0.421			0.272			0.365		
85	85 + 116 + 117	3.47	C		2.87	C		3.64	C		3.53	C		3.68	C	
86	86 + 87 + 97 + 108 + 119 + 125	3.23	C		2.99	C		2.03	C		2.21	C		3.49	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	0.353	C		0.477	C K	J-EMPC	0.319	C		0.325	C		0.403	C	
89		0.0798	U		0.0798	U		0.0601	U		0.106	U		0.0655	U	
90	90 + 101 + 113	6.46	C		5.33	C		4.97	C		4.86	C		6.91	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		1.22			0.852			0.781			0.546			0.926		
93	93 + 95 + 98 + 100 + 102	3.46	C		2.43	C		2.31	C		2.3	C		3.17	C	
94		0.0819	U		0.0814	U		0.0614	U		0.108	U		0.0668	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.05	U		0.0497	U		0.0496	U		0.0512	U		0.049	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		0.0682	U		0.066	U		0.0497	U		0.0877	U		0.0542	U	
104		0.0507	U		0.0497	U		0.0496	U		0.0549	U		0.049	U	
105		8.98			7.62			3.57			6.03			12.7		
106		0.281	U		0.197	U		0.186	U		0.258	U		0.266	U	
107	107 + 124	0.526	C K	J-EMPC	0.33	C K	J-EMPC	0.327	C		0.402	C		0.405	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		7.79			6.8			8.91			8.22			7.05		
110	110 + 115	3.13	C		3.44	C		2.71	C		2.03	C		3.33	C	
111		0.099	K	J-EMPC	0.172			0.205	K	J-EMPC	0.123			0.137	K	J-EMPC
112		0.059	U		0.0565	U		0.0496	U		0.0752	U		0.049	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		2.92			3.2			3.69			3.51			3.9		
115	110 + 115		C110			C110			C110			C110			C110	

Table 3
PCB Congener Qualifer Summary- Crayfish
Lab Sample ID's L11512-6 and L113380-19 through L11380-24
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26606

IUPAC #	COELUTING CONGENERS[1]	08021838/42CF L11512-6	Lab Qualifier	URS Review Qualifier	08022233CF L11380-19	Lab Qualifier	URS Review Qualifier	08030372CF L11380-22	Lab Qualifier	URS Review Qualifier	08030373CF L11380-23	Lab Qualifier	URS Review Qualifier	08030374CF L11380-24	Lab Qualifier	URS Review Qualifier
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		107			95.3			95.8			111			138		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		0.585			0.669			0.737			0.704			0.865		
121		0.0588	U		0.0583	U		0.0496	U		0.0775	U		0.049	U	
122		0.324	U		0.221	U		0.209	U		0.29	U		0.299	U	
123		2.45			2.71			2.47			3.07			3.76		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		0.377			0.273	U		0.45			0.455			0.376	U	
127		0.307	U		0.221	U		0.209	U		0.29	U		0.299	U	
128	128 + 166	1.58	C		1.84	C		1.46	C		1.46	C		2.7	C	
129	129 + 138 + 160 + 163	58	C		51	C		59.5	C		62.7	C		61.4	C	
130		3.3			1.8			2.94			3.43			2.66		
131		0.13	U		0.0961	U		0.124	U		0.137	U		0.0754	U	
132		1.08			1.18			0.919			0.957			1.08		
133		1.69			1.33			1.99			1.85			1.21		
134	134 + 143	0.488	C		0.277	C K	J-EMPC	0.229	C		0.438	C		0.312	C	
135	135 + 151 + 154	4.01	C		2.61	C		2.8	C		3.23	C		2.78	C	
136		0.454			0.403	K	J-EMPC	0.435			0.401			0.425		
137		4.02			5.15			5.78			5.84			5.1		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	0.361	C		0.262	C K	J-EMPC	0.158	C		0.258	C		0.339	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		0.13	U		1.33			1			0.132	U		0.0731	U	
142		0.131	U		0.1	U		0.13	U		0.142	U		0.0786	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		0.374			0.259			0.141	K	J-EMPC	0.201	K	J-EMPC	0.261	K	J-EMPC
145		0.05	U		0.0497	U		0.0496	U		0.0598	U		0.049	U	
146		22.7			23.5			27.9			25.2			21.6		
147	147 + 149	5.57	C		5.76	C		4.56	C		4.97	C		6.85	C	
148		0.05	U		0.0594	U		0.0496	U		0.0764	U		0.0511	U	
149	147 + 149		C147			C147			C147			C147			C147	
150		0.05	U		0.0497	U		0.0496	U		0.0574	U		0.049	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.05	U		0.0497	U		0.0496	U		0.0547	U		0.049	U	
153	153 + 168	113	C		115	C		115	C		142	C		174	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.05	U		0.0497	U		0.055	K	J-EMPC	0.063	K	J-EMPC	0.057	K	J-EMPC
156	156 + 157	12.7	C		14.7	C		17.3	C		16.9	C		18.8	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		1.52			1.16			0.855			0.957			1.88		
159		0.1	U		0.077			0.0966	U		0.106	U		0.0586	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.0936	U		0.0693	U		0.0898	U		0.0985	U		0.0544	U	
162		0.47			0.572			0.847			0.642	K	J-EMPC	0.522	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		0.514			0.308			0.24			0.0989	U		0.357		
165		0.108	U		0.085			0.102	U		0.118	K	J-EMPC	0.067	K	J-EMPC
166	128 + 166		C128			C128			C128			C128			C128	
167		8.88			9.44			10.6			10.6			13.6		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.126	U		0.158	U		0.0992	U		0.154	U		0.103	U	
170		7.25			7.41			12.6			13.2			7.82		
171	171 + 173	1.59	C		1.06	C		0.879	C		1.33	C		1.32	C	
172		1.06			0.75			1.3	K	J-EMPC	1.17			0.535		
173	171 + 173		C171			C171			C171			C171			C171	
174		1.53			0.943			1.26			1.04			0.802		
175		0.372			0.254	K	J-EMPC	0.391			0.493			0.316		
176		0.265			0.227			0.172	K	J-EMPC	0.233			0.324		
177		10			5.32			8.23			10.9			7.16		
178		4.64			2.18			3.61			4.15			2.71		
179		0.916			0.681			0.504	K	J-EMPC	0.474			0.75		
180	180 + 193	47.6	C		52.3	C		59.1	C		61.3	C		55.5	C	
181		0.247			0.325			0.393	K	J-EMPC	0.343			0.324		
182		0.0571	U		0.242			0.0496	U		0.0718	U		0.049	U	
183	183 + 185	7.37	C		5.09	C		6.19	C		7.93	C		7.07	C	
184		0.05	U		0.0497	U		0.0496	U		0.0541	U		0.049	U	
185	183 + 185		C183			C183			C183			C183			C183	
186		0.05	U		0.0497	U		0.0496	U		0.0585	U		0.049	U	
187		69.8			65.6			75.8			69.5			55.2		
188		0.197			0.159			0.147			0.275			0.214		
189		0.767			0.956			1.33			1.19			1.04		
190		4.95			3.57			5.05			5.69			5		
191		0.651			0.74			0.75			0.639			0.727		
192		0.0565	U		0.0509	U		0.0496	U		0.0726	U		0.049	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		3.38			3.76			6.01			5.36			3.88		
195		2.28			2.33			3.41			3.75			3.38		
196		2.42			2.87			3.28			3.72			3.42		
197	197 + 200	0.421	C K	J-EMPC	0.36	C		0.395	C		0.359	C		0.521	C	
198	198 + 199	7.41	C		6.53	C		8.55	C		8.71	C		5.1	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		1.56			1.23			1.45			1.74			1.5		
202		2.45			0.948			1.31			1.88			1.84		
203		5.5			2.7			4.17			5.11			5.08		
204		0.05	U		0.0497	U		0.0496	U		0.0494	U		0.049	U	
205		0.322			0.238			0.335			0.3			0.287		
206		2.25			1.62			2.11			2.18			1.63		
207		0.606			0.787			0.787			0.789	K	J-EMPC	0.772	K	J-EMPC
208		1.34			0.999			1.24			1.18			0.799		
209		2.07			2.6			2.48			2.46			2.43		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifer Summary- Crayfish
Lab Sample ID's L113380-25 through L11380-29
Bradford Island - Remedial Investigation
Sample Delivery Group WG26606

IUPAC #	COELUTING CONGENERS[1]	08030375CF L11380-25	Lab Qualifier	URS Review Qualifier	08030376CF L11380-26	Lab Qualifier	URS Review Qualifier	08030378CF L11380-27	Lab Qualifier	URS Review Qualifier	08030379CF L11380-28	Lab Qualifier	URS Review Qualifier	08030382CF L11380-29	Lab Qualifier	URS Review Qualifier
1		0.1		U	0.152		U	0.228		U	0.238		U	0.127		U
2		0.457	K	J-EMPC	0.268			0.235	K	J-EMPC	0.324			0.13		
3		0.122	K	J-EMPC	0.114			0.204			0.185			0.166	K	J-EMPC
4		0.648	U		0.32			0.627			0.544			0.337		
5		0.531	U		0.249	U		0.197	U		0.26	U		0.215	U	
6		0.465	U		0.221	U		0.324			0.273			0.191	U	
7		0.467	U		0.227	U		0.179	U		0.237	U		0.195	U	
8		0.417	U		0.639			1.05			0.937			0.433		
9		0.466	U		0.22	U		0.174	U		0.229	U		0.189	U	
10		0.462	U		0.22	U		0.174	U		0.23	U		0.19	U	
11		50.5			40.5			42.9			71.1			60		
12	12 + 13	0.509	C U		0.245	C U		0.194	C U		0.256	C U		0.212	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.483	U		0.23	U		0.182	U		0.24	U		0.199	U	
15		0.721	U		0.782			0.898			1.41			1.35		
16		0.523			0.249			0.365			0.349			0.414		
17		0.407			0.376			0.516			0.524			0.367		
18	18 + 30	1.29	C	U	0.836	C	U	1.3	C	U	1.49	C	U	1.29	C	U
19		0.0991	U		0.078	K	J-EMPC	0.15			0.138	K	J-EMPC	0.098		
20	20 + 28	2.43	C		1.32	C	U	1.93	C	U	2.59	C		4.47	C	
21	21 + 33	0.405	C	U	0.38	C K	U	0.622	C	U	0.671	C	U	0.554	C K	U
22		0.604			0.285			0.467			0.369			0.413	K	J-EMPC
23		0.0882	U		0.057	U		0.0536	U		0.0721	U		0.0675	U	
24		0.0782	U		0.055	U		0.0498	U		0.0529	U		0.0497	U	
25		0.0772	U		0.075			0.106	K	J-EMPC	0.101			0.0568	U	
26	26 + 29	0.274	C K	J-EMPC	0.228	C		0.311	C		0.5	C		0.355	C	
27		0.087	K	J-EMPC	0.0511	U		0.066			0.076	K	J-EMPC	0.094	K	J-EMPC
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		0.874		U	0.725		U	1.3		U	1.18		U	1.29		U
32		0.137		U	0.205		U	0.324		U	0.203		U	0.16		U
33	21 + 33		C21			C21			C21			C21			C21	
34		0.0897	U		0.055	U		0.0516	U		0.0695	U		0.0651	U	
35		0.251			0.281	K	J-EMPC	0.431			0.854			0.152	K	J-EMPC
36		0.0913	U		0.074	K	J-EMPC	0.0539	U		0.491			0.0679	U	
37		2.68			1.33			1.96			3.13			4.2		
38		0.0859	U		0.0557	U		0.0523	U		0.0704	U		0.0658	U	
39		0.0951	U		0.0575	U		0.054	U		0.0728	U		0.0681	U	
40	40 + 41 + 71	0.505	C	U	0.441	C	U	0.552	C K	U	0.536	C	U	0.657	C	U
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		0.794			0.267			0.348	K	J-EMPC	0.342			0.762		
43		0.139	U		0.077	U		0.064	U		0.0859	U		0.0871	U	
44	44 + 47 + 65	3.92	C		1.43	C	U	1.68	C	U	2.42	C		4.31	C	
45	45 + 51	0.243	C		0.181	C		0.287	C		0.227	C K	J-EMPC	0.262	C K	J-EMPC
46		0.13	U		0.0776	U		0.071			0.0866	U		0.0877	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		0.339			0.189	K	J-EMPC	0.271			0.267			0.394	K	J-EMPC
49	49 + 69	1.06	C	U	0.535	C K	U	0.658	C	U	0.872	C	U	1.14	C	U
50	50 + 53	0.281	C K	J-EMPC	0.132	C K	J-EMPC	0.146	C K	J-EMPC	0.198	C		0.271	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		2.23	K	U	1.39		U	1.79		U	2.31		U	3.57		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.0745	U		0.0497	U		0.0498	U		0.0529	U		0.0497	U	
55		0.168	U		0.115	U		0.0898	U		0.141	U		0.16	U	
56		0.543	K	J-EMPC	0.266			0.405			0.428			0.501		
57		0.158	U		0.106	U		0.0828	U		0.13	U		0.147	U	
58		0.162	U		0.107	U		0.0837	U		0.132	U		0.149	U	
59	59 + 62 + 75	0.189	C		0.104	C		0.096	C		0.135	C		0.183	C	
60		1.18	K	J-EMPC	0.324			0.468	K	J-EMPC	0.764			2.63		
61	61 + 70 + 74 + 76	12.3	C		4.04	C		5.99	C		9.99	C		26.6	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		1.19			0.811			0.752			1.49			2.13		
64		0.678	K	J-EMPC	0.358			0.467			0.596			0.671		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		12.9			3.81			5.43			9.4			27.9		
67		0.142	U		0.0909	U		0.071	U		0.151			0.203		
68		0.352			0.215			0.232			0.524			0.745		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.154	U		0.101	U		0.0787	U		0.124	U		0.191		
73		0.0841	U		0.0545	U		0.0498	U		0.0609	U		0.0617	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		2.57			1.87			2.09			3.49			4.66		
78		0.164	U		0.115	U		0.0897	U		0.141	U		0.159	U	
79		0.246	K	J-EMPC	0.0941	U		0.114	K	J-EMPC	0.264			0.434		
80		0.142	U		0.103	U		0.0805	U		0.126	U		0.143	U	
81		0.194	U		0.127	U		0.104	U		0.162	U		0.25	K	J-EMPC
82		1.31	U		0.0854	U		0.187			0.153	K	J-EMPC	0.212		
83	83 + 99	16.2	C		4.44	C		5.29	C		10.6	C		41.2	C	
84		1.3	U		0.373			0.365			0.47			0.6		
85	85 + 116 + 117	3.51	C		2.47	C		2.44	C		4.25	C		7.65	C	
86	86 + 87 + 97 + 108 + 119 + 125	6.42	C		1.63	C		1.61	C		3.53	C		10.2	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	1.16	C U		0.26	C		0.263	C		0.404	C		0.657	C	
89		1.22	U		0.0791	U		0.0653	U		0.0734	U		0.0927	U	
90	90 + 101 + 113	9	C		3.68	C		3.55	C		7.01	C		17.1	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		1.19	U		0.546			0.515			1.39			2.4		
93	93 + 95 + 98 + 100 + 102	5.36	C		1.86	C	U	1.88	C	U	3.47	C		6.93	C	
94		1.25	U		0.0807	U		0.0666	U		0.0749	U		0.0947	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.344	U		0.0497	U		0.0498	U		0.0496	U		0.0497	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		1.04	U		0.0654	U		0.054	U		0.0607	U		0.0767	U	
104		0.339	U		0.0497	U		0.0498	U		0.0496	U		0.0497	U	
105		10.6			3.01			3.34			7.99			24.8		
106		1.42	U		0.171	U		0.188	U		0.281	U		0.514	U	
107	107 + 124	1.49	C U		0.265	C K	J-EMPC	0.217	C K	J-EMPC	0.665	C		1.67	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		9.24			5.65			5.37			9.59			16.7		
110	110 + 115	5.47	C		2.11	C		2.04	C		3.44	C		4.76	C	
111		0.916	U		0.066	K	J-EMPC	0.093	K	J-EMPC	0.189	K	J-EMPC	0.266	K	J-EMPC
112		0.904	U		0.0561	U		0.0498	U		0.052	U		0.0657	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		3.64			2.52			2.36			3.56			8.15		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 3
PCB Congener Qualifer Summary- Crayfish
Lab Sample ID's L113380-25 through L11380-29
Bradford Island - Remedial Investigation
Sample Delivery Group WG26606

IUPAC #	COELUTING CONGENERS[1]	08030375CF L11380-25	Lab Qualifier	URS Review Qualifier	08030376CF L11380-26	Lab Qualifier	URS Review Qualifier	08030378CF L11380-27	Lab Qualifier	URS Review Qualifier	08030379CF L11380-28	Lab Qualifier	URS Review Qualifier	08030382CF L11380-29	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		157			63.6			69.7			122			323		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		0.866	U		0.517	K	J-EMPC	0.438	K	J-EMPC	0.769	K	J-EMPC	1.41		
121		0.901	U		0.0578	U		0.0498	U		0.0536	U		0.0677	U	
122		1.64	U		0.217			0.212	U		0.316	U		0.578	U	
123		3.72			1.96			2.05			3.26			7.36		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		1.96	U		0.231	U		0.267	U		0.53			0.792	U	
127		1.56	U		0.192	U		0.212	U		0.315	U		0.587	K	J-EMPC
128	128 + 166	2.94	C		1.19	C		0.835	C		2.66	C		3.35	C	
129	129 + 138 + 160 + 163	78.4	C		37.8	C		38.9	C		74.5	C		167	C	
130		3			1.58			2.07			4.19			8.8		
131		0.2	U		0.0938	U		0.1	U		0.117	U		0.168	U	
132		1.88			0.655			0.763			0.965	K	J-EMPC	2.19		
133		1.92			0.878			1.14			2.11			3.55		
134	134 + 143	0.674	C		0.183	C K	J-EMPC	0.18	C		0.443	C		0.58	C	
135	135 + 151 + 154	5.26	C		1.67	C		2.13	C		4.33	C		8.38	C	
136		0.679			0.34			0.435	K	J-EMPC	0.597			0.701		
137		7			3.8			4.02			6.47			14.5		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	0.354	C		0.105	C		0.214	C		0.277	C K	J-EMPC	0.653	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		0.199	U		0.0909	U		0.0973	U		0.113	U		0.163	U	
142		0.201	U		0.0977	U		0.105	U		0.122	U		0.175	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		0.343			0.131	K	J-EMPC	0.137			0.284	K	J-EMPC	0.994		
145		0.0591	U		0.0497	U		0.0498	U		0.0496	U		0.0497	U	
146		29.4			16.5			17.2			31.9			66		
147	147 + 149	10.1	C		3.54	C		3.72	C		6.69	C		15.9	C	
148		0.0736	U		0.0521	U		0.0498	U		0.0579	U		0.055	U	
149	147 + 149		C147			C147			C147			C147			C147	
150		0.0559	U		0.0497	U		0.0498	U		0.0496	U		0.0497	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.0531	U		0.0497	U		0.0498	U		0.0496	U		0.0497	U	
153	153 + 168	199	C		83.2	C		90.6	C		155	C		472	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.0524	U		0.0497	U		0.0498	U		0.056	K	J-EMPC	0.084	K	J-EMPC
156	156 + 157	22.2	C		12.3	C		13	C		18.8	C		39.1	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		2.25			0.41			0.537			1.58			3.55		
159		0.154	U		0.0729	U		0.087			0.133	K	J-EMPC	0.172	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.144	U		0.0677	U		0.0725	U		0.0844	U		0.122	U	
162		0.679			0.54	K	J-EMPC	0.478			0.851	K	J-EMPC	1.48		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		0.345	K	J-EMPC	0.264	K	J-EMPC	0.0728	U		0.525			1.17	K	J-EMPC
165		0.175			0.0771	U		0.0825	U		0.141	K	J-EMPC	0.138	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		16.7			8.46			8.16			11.2			30.1		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.171	U		0.105	U		0.0911	U		0.114	U		0.2	U	
170		7.37			6.92			6.83			14.5			22		
171	171 + 173	2	C		0.56	C K	J-EMPC	1.02	C		1.5	C		2.96	C	
172		0.414			0.551			0.632			1.42			2.5		
173	171 + 173		C171			C171			C171			C171			C171	
174		0.888			0.87			0.777			1.69			2.36		
175		0.476			0.206			0.26			0.497			0.99		
176		0.526			0.108	K	J-EMPC	0.158			0.309			0.577		
177		9.14			4.52			6.63			11.1			19.9		
178		5.19			1.45			2.81			4.35			8.53		
179		1.48			0.478	K	J-EMPC	0.387			1.05			0.97		
180	180 + 193	74.1	C		39.2	C		41.9	C		70.1	C		145	C	
181		0.381	K	J-EMPC	0.267			0.303			0.457			0.789	K	J-EMPC
182		0.0807	U		0.067	U		0.0498	U		0.0563	U		0.0725	U	
183	183 + 185	9	C		3.55	C		4.61	C		8.46	C		22.7	C	
184		0.0591	U		0.0505	U		0.0498	U		0.0496	U		0.0546	U	
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0658	U		0.0546	U		0.0498	U		0.0496	U		0.0591	U	
187		87.9			47.6			47.4			85.3			167		
188		0.238			0.163			0.132			0.189			0.268		
189		1.25			0.851			0.907			1.31			2.2		
190		5.95			3.09			3.11			7.28			12.9		
191		0.997			0.304			0.452			0.996			2.02		
192		0.0798	U		0.0678	U		0.0498	U		0.0569	U		0.0734	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		3.73			3.47			2.9			6.15			9.42		
195		2.76			1.97			2.28			3.87			5.8		
196		3.07			2.06			2.31			4.18			6.28		
197	197 + 200	0.565	C		0.14	C		0.296	C		0.479	C		0.713	C	
198	198 + 199	6.56	C		3.64	C		4.93	C		9.03	C		14.9	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		1.83			0.856			1.26			1.84			2.85		
202		2.76			0.635			1.27			1.98			2.91		
203		4.41			2.46			2.7			8.67			11.8		
204		0.057	U		0.0511	U		0.0498	U		0.0496	U		0.0514	U	
205		0.286			0.156			0.207	K	J-EMPC	0.378			0.71		
206		1.31			1.06			1.14			2.76			3.22		
207		0.76			0.414			0.599			0.766			1.27		
208		0.735			0.506			0.669			1.23			1.4		
209		1.82			1.68			2			2.5			2.95		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L113380-30 through L11380-35
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26606

IUPAC #	COELUTING CONGENERS[1]	08031290CF L11380-30	Lab Qualifier	URS Review Qualifier	08031291CF L11380-31	Lab Qualifier	URS Review Qualifier	08031292CF L11380-32	Lab Qualifier	URS Review Qualifier	08031294CF L11380-33	Lab Qualifier	URS Review Qualifier	08031298CF L11380-34	Lab Qualifier	URS Review Qualifier	08031210OCF L11380-35	Lab Qualifier	URS Review Qualifier
1		0.097		U	0.132		U	0.341		U	0.162		U	0.145		U	0.135		U
2		0.079			0.13			0.327	K	J-EMPC	1.14			0.171			0.492		
3		0.106			0.176	K	J-EMPC	0.936			0.238			0.166			0.191		
4		0.262	U		0.297			0.61	U		0.41			0.28			0.369		
5		0.251	U		0.113	U		0.415	U		0.165	U		0.119	U		0.123	U	
6		0.223	U		0.104	U		0.383	U		0.164	K	J-EMPC	0.11	U		0.152	K	J-EMPC
7		0.228	U		0.106	U		0.39	U		0.188			0.112	U		0.122		
8		0.38			0.418			0.892	K	J-EMPC	0.718			0.414			0.586		
9		0.221	U		0.101	U		0.369	U		0.147	U		0.106	U		0.109	U	
10		0.222	U		0.1	U		0.369	U		0.147	U		0.105	U		0.109	U	
11		25.9			51			37.3			61.9			28.1			58		
12	12 + 13	0.247	C U		0.119	C U		0.436	C U		0.174	C U		0.125	C U		0.129	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.232	U		0.11	U		0.403	U		0.16	U		0.115	U		0.119	U	
15		0.527			1.21			1	K	J-EMPC	1			0.932			1.24		
16		0.263			0.32			0.326	U		0.323			0.214			0.407		
17		0.357			0.332			0.463	K	J-EMPC	0.424			0.202			0.452		
18	18 + 30	0.767	C	U	1.34	C	U	0.854	C K	U	1.02	C	U	0.611	C K	U	1.31	C	U
19		0.076			0.0696	U		0.269	U		0.101			0.117	K	J-EMPC	0.117	K	J-EMPC
20	20 + 28	2.65	C		2.75	C		1.68	C	U	1.79	C	U	1.15	C	U	2.6	C	
21	21 + 33	0.433	C	U	0.336	C	U	0.582	C	U	0.552	C	U	0.311	C	U	0.439	C	U
22		0.384			0.328			0.43			0.431			0.286			0.433		
23		0.057	U		0.0644	U		0.215	U		0.0928	U		0.0604	U		0.0513	U	
24		0.05	U		0.0517	U		0.201	U		0.067	U		0.0577	U		0.0496	U	
25		0.071			0.066			0.187	U		0.119			0.065			0.1		
26	26 + 29	0.195	C		0.252	C		0.263	C		0.303	C K	J-EMPC	0.193	C		0.375	C	
27		0.0498	U		0.069			0.189	U		0.0652	U		0.0542	U		0.066		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		0.833		U	0.866		U	1.03	K	U	1.06		U	0.553		U	0.911		U
32		0.177		U	0.12	K	U	0.255	K	U	0.251	K	U	0.099		U	0.221		U
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0549	U		0.0633	U		0.212	U		0.0912	U		0.0594	U		0.0505	U	
35		0.0647	U		0.186			0.249	U		0.65			0.171			0.389		
36		0.0573	U		0.0635	U		0.212	U		0.231			0.0596	U		0.112	K	J-EMPC
37		1.96			4.04			1.6			2.06			2.18			3.58		
38		0.0556	U		0.0633	U		0.212	U		0.0912	U		0.0594	U		0.0504	U	
39		0.0575	U		0.0653	U		0.218	U		0.0941	U		0.0613	U		0.052	U	
40	40 + 41 + 71	0.59	C	U	0.411	C	U	0.672	C	U	0.419	C	U	0.269	C K	U	0.522	C K	U
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		0.608			0.841			0.286	U		0.31	K	J-EMPC	0.248			0.67		
43		0.0837	U		0.0782	U		0.303	U		0.102	U		0.0911	U		0.0799	U	
44	44 + 47 + 65	2.24	C	U	4.11	C		1.59	C	U	1.72	C	U	1.32	C	U	2.84	C	
45	45 + 51	0.234	C K	J-EMPC	0.157	C K	J-EMPC	0.263	C U		0.21	C K	J-EMPC	0.0792	C U		0.225	C	
46		0.0843	U		0.0789	U		0.305	U		0.103	U		0.0919	U		0.0806	U	
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.301			0.272	K	J-EMPC	0.303			0.214			0.15			0.27		
49	49 + 69	0.852	C	U	0.738	C	U	0.866	C	U	0.659	C	U	0.475	C	U	0.759	C	U
50	50 + 53	0.171	C		0.227	C		0.255	C U		0.185	C		0.0768	C U		0.205	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		1.87		U	2.06		U	2.15	K	U	1.45		U	1.18		U	2.07		U
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0498	U		0.0492	U		0.188	U		0.0742	U		0.076			0.0496	U	
55		0.166	U		0.167	U		0.36	U		0.145	U		0.0796	U		0.146	U	
56		0.36			0.436			0.349	U		0.3	K	J-EMPC	0.294			0.347		
57		0.153	U		0.153	U		0.328	U		0.132	U		0.0725	U		0.133	U	
58		0.155	U		0.15	U		0.323	U		0.13	U		0.0712	U		0.131	U	
59	59 + 62 + 75	0.169	C K	J-EMPC	0.166	C		0.205	C U		0.069	C		0.0618	C U		0.134	C K	J-EMPC
60		1.47			1.55			0.425	K	J-EMPC	0.383	K	J-EMPC	0.404			0.977		
61	61 + 70 + 74 + 76	10.6	C		17.6	C		4.9	C		5.52	C		5.15	C		13.2	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.626			1.34			0.762	K	J-EMPC	0.887	K	J-EMPC	1.02			1.42		
64		0.566	K	J-EMPC	0.429			0.5	K	J-EMPC	0.42			0.355			0.462	K	J-EMPC
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		14.4			16.5			3.39			5.75			5.65			14		
67		0.131	U		0.201	K	J-EMPC	0.288	U		0.116	U		0.0636	U		0.117	U	
68		0.327	K	J-EMPC	0.403			0.313	U		0.316			0.252	K	J-EMPC	0.423	K	J-EMPC
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.145	U		0.143	U		0.309	U		0.124	U		0.0681	U		0.125	U	
73		0.0592	U		0.055	U		0.213	U		0.0714	U		0.0641	U		0.0562	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		1.87			3.8			1.9			2.74			2.28			4.02		
78		0.166	U		0.164	U		0.353	U		0.142	U		0.078	U		0.143	U	
79		0.176	K	J-EMPC	0.387			0.296	U		0.119	U		0.118	K	J-EMPC	0.379		
80		0.149	U		0.143	U		0.307	U		0.124	U		0.0678	U		0.124	U	
81		0.204	U		0.188	U		0.401	U		0.151	U		0.146	K	J-EMPC	0.193	K	J-EMPC
82		0.0887	U		0.17	K	J-EMPC	0.362	U		0.135	K	J-EMPC	0.137			0.15		
83	83 + 99	24.3	C		20.3	C		3.59	C		5.65	C		5.64	C		16.4	C	
84		0.432			0.396			0.545	K	J-EMPC	0.375			0.208			0.491		
85	85 + 116 + 117	2.14	C		4.15	C		2.28	C		2.21	C		2.34	C		3.93	C	
86	86 + 87 + 97 + 108 + 119 + 125	3.29	C		6.91	C		1.7	C		1.52	C		1.69	C		4.78	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	0.527	C		0.699	C K	J-EMPC	0.383	C K	J-EMPC	0.287	C		0.243	C		0.439	C	
89		0.0822	U		0.0955	U		0.333	U		0.0861	U		0.0579	U		0.0594	U	
90	90 + 101 + 113	5.3	C		9.27	C		3.57	C		3.67	C		3.28	C		6.61	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		0.693	K	J-EMPC	1.25			0.475			0.548			0.504			0.951		
93	93 + 95 + 98 + 100 + 102	2.75	C		5.56	C		2.78	C		1.78	C	U	1.71	C K	U	3.65	C	
94		0.0839	U		0.0971	U		0.339	U		0.0875	U		0.0588	U		0.0604	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.0498	U		0.0492	U		0.172	U		0.0652	U		0.0496	U		0.0496	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.068	U		0.0797	U		0.278	U		0.0718	U		0.0495	U		0.0496	U	
104		0.0498	U		0.0492	U		0.184	U		0.0744	U		0.068	K	J-EMPC	0.0496	U	
105		15.5			14.3			2.25			4			4.33			11.8		
106		0.237	U		0.0985	U		0.24	U		0.152	U		0.0804	U		0.0962	U	
107	107 + 124	0.264	C		0.945	C		0.254	C U		0.208	C K	J-EMPC	0.271	C		0.674	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		5.82			10			5.65			6.22			5.98			10		
110	110 + 115	3.4	C		3.36	C		1.88	C K	J-EMPC	1.9	C		1.93	C		2.86	C	
111		0.0607	U		0.221			0.248	U		0.095	K	J-EMPC	0.132	K	J-EMPC	0.178	K	J-EMPC
112		0.0582	U		0.0687	U		0.24	U		0.0652	U		0.0495	U		0.0496	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		4.71			4.17			2.86			3.02			3.47			4.58		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		264			163			69.7			112			101			149		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		1.1			0.97			0.5	K	J-EMPC	0.584			0.685			0.891	K	J-EMPC
121		0.06	U		0.0706	U		0.246	U		0.0652	U		0.0495	U		0.0496	U	
122		0.267	U		0.109	U		0.264	U		0.167	U		0.0885	U		0.106	U	
123		6.45			3.72			2.26			2.91			3			4.17		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	

Table 3
PCB Congener Qualifer Summary - Crayfish
Lab Sample ID's L113380-30 through L11380-35
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26606

IUPAC #	COELUTING CONGENERS[1]	08031290CF L11380-30	Lab Qualifier	URS Review Qualifier	08031291CF L11380-31	Lab Qualifier	URS Review Qualifier	08031292CF L11380-32	Lab Qualifier	URS Review Qualifier	08031294CF L11380-33	Lab Qualifier	URS Review Qualifier	08031298CF L11380-34	Lab Qualifier	URS Review Qualifier	08031210OCF L11380-35	Lab Qualifier	URS Review Qualifier
126		0.329	U		0.402			0.275	U		0.243	K	J-EMPC	0.261	K	J-EMPC	0.481		
127		0.267	U		0.107	U		0.261	U		0.165	U		0.0875	U		0.105	U	
128	128 + 166	2.56	C		2.85	C		1.18	C		1.33	C		1.3	C		2.55	C	
129	129 + 138 + 160 + 163	67.9	C		91.9	C		37.3	C		40.1	C		44.3	C		82.1	C	
130		2.09	K	J-EMPC	4.86			1.09			1.45			1.74			3.5		
131		0.0908	U		0.159	K	J-EMPC	0.368	U		0.174	U		0.0844	U		0.136	K	J-EMPC
132		1.16			2.32			0.558			0.534			0.584			1.07		
133		0.786			2.12			1.01			1.17			0.994			2.3		
134	134 + 143	0.355	C K	J-EMPC	0.358	C		0.354	C U		0.176	C K	J-EMPC	0.229	C K	J-EMPC	0.271	C K	J-EMPC
135	135 + 151 + 154	2.25	C		5.58	C		1.47	C		1.69	C		1.73	C		4.5	C	
136		0.476			0.545			0.394			0.391			0.38			0.659		
137		8.45			5.64			4.2			3.77			4.24			5.77		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.296	C K	J-EMPC	0.347	C		0.314	C U		0.148	C U		0.111	C K	J-EMPC	0.321	C K	J-EMPC
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		0.088	U		0.923	K	J-EMPC	0.344	U		0.597			0.322	K	J-EMPC	0.711		
142		0.0946	U		0.158	U		0.368	U		0.173	U		0.0843	U		0.124	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		0.205	K	J-EMPC	0.487			0.256	U		0.097			0.1	K	J-EMPC	0.366	K	J-EMPC
145		0.0498	U		0.0595	U		0.204	U		0.0652	U		0.0495	U		0.0496	U	
146		19			31			15.6			17.7			17.4			31.8		
147	147 + 149	5.17	C		12	C		2.98	C		3.12	C		3.29	C		8.45	C	
148		0.0514	U		0.0753	U		0.259	U		0.0779	U		0.0495	U		0.0496	U	
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.0498	U		0.055	U		0.189	U		0.0652	U		0.0495	U		0.0496	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0498	U		0.0527	U		0.181	U		0.0652	U		0.0495	U		0.0496	U	
153	153 + 168	323	C		204	C		78.8	C		140	C		129	C		171	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0498	U		0.098			0.21	U		0.0684	U		0.16			0.066		
156	156 + 157	29.6	C		20.4	C		15.1	C		16.7	C		20.1	C		24.4	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		2.29			2.14			0.249	U		0.652			0.625			1.69		
159		0.073	K	J-EMPC	0.117	U		0.272	U		0.128	U		0.0624	U		0.0914	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.0655	U		0.104	U		0.242	U		0.114	U		0.0554	U		0.0812	U	
162		0.464			0.895			0.678	K	J-EMPC	0.57	K	J-EMPC	0.757			0.882		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		0.0658	U		0.377	K	J-EMPC	0.266	U		0.126	U		0.0611	U		0.356	K	J-EMPC
165		0.0746	U		0.135	K	J-EMPC	0.289	U		0.136	U		0.0663	U		0.0971	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		27.3			13.4			9.47			12.3			16.6			18		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.223	U		0.237	U		0.301	U		0.307	U		0.0971	U		0.325	U	
170		7.97			10.7			7.26			8.06			7.72			9.43		
171	171 + 173	2.87	C		2.6	C		0.667	C K	J-EMPC	0.817	C		0.768	C K	J-EMPC	1.89	C	
172		0.262	K	J-EMPC	0.808			0.75	K	J-EMPC	0.531			0.472			0.921	K	J-EMPC
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		0.846	K	J-EMPC	0.949			0.723	K	J-EMPC	0.623			0.759			1.17		
175		0.214	K	J-EMPC	0.578	K	J-EMPC	0.281	U		0.317			0.219			0.435	K	J-EMPC
176		0.298	K	J-EMPC	0.665			0.21	U		0.174	K	J-EMPC	0.15			0.463	K	J-EMPC
177		4.96			18.2			5.45			7.3			5.6			10.3		
178		2.81			5.7			2.29	K	J-EMPC	2.64			2.36			4.95		
179		0.608			1.41			0.305	K	J-EMPC	0.463			0.556			0.882		
180	180 + 193	98.6	C		71.1	C		58.7	C		57.2	C		65.5	C		79.3	C	
181		0.409			0.389	K	J-EMPC	0.336			0.344			0.278	K	J-EMPC	0.507		
182		0.0589	U		0.086	U		0.274	U		0.0857	U		0.0549	U		0.123		
183	183 + 185	15	C		12.4	C		4.21	C		6.21	C		4.69	C		9.06	C	
184		0.0498	U		0.0621	U		0.198	U		0.0652	U		0.0495	U		0.0496	U	
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0498	U		0.0726	U		0.231	U		0.0723	U		0.0495	U		0.0562	U	
187		53.4			83.7			58.6			53.6			60			79.9		
188		0.234			0.204	K	J-EMPC	0.222	U		0.209			0.202	K	J-EMPC	0.297		
189		1.29			1.14	K	J-EMPC	1.31			0.936			1.32			1.65		
190		4.71			7.11			4.3			6.46			4.93			10.7		
191		1.61			0.641	K	J-EMPC	0.46			0.566	K	J-EMPC	0.483			0.857		
192		0.0596	U		0.085	U		0.271	U		0.0847	U		0.0542	U		0.0658	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		2.89			3.96			3.85			2.91			3.44			4.53		
195		3.45			3.94			2.32	K	J-EMPC	3.12			2.36			3.87		
196		3.85			3.26			2.55			2.37			2.27			3.43		
197	197 + 200	0.827	C		0.638	C		0.244	C U		0.284	C		0.214	C		0.448	C	
198	198 + 199	3.19	C		7.24	C		6.09	C		4.47	C		4.59	C		8.19	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		1.15			2.16			1.27			1.51			1.28			2.01		
202		1.42	K	J-EMPC	2.62			0.961	K	J-EMPC	1.21			1.18			2.22		
203		4.45			5.92			3.04			4.86			4.32			9.69		
204		0.0499	U		0.0661	U		0.238	U		0.0786	U		0.0495	U		0.0648	U	
205		0.139	K	J-EMPC	0.38			0.288	U		0.319	K	J-EMPC	0.242	K	J-EMPC	0.45		
206		1.07			1.83			1.28			1.63			1.35			2.54		
207		0.849			0.892			0.757	K	J-EMPC	0.666			0.499			0.813		
208		0.449	K	J-EMPC	1.06			0.701	U		0.739	K	J-EMPC	0.641			1.19		
209		1.72			2.23			2.02			2.37			1.71	K	J-EMPC	2.67		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL.
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the analyte-specific reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coelutin
congeners, to eliminate possible errors during congener summation.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

CONGENER RESULTS FOR FOREBAY AND REFRENCE AREA SEDIMENT COLLECTED FROM FEBRUARY THROUGH MARCH 2008

JANUARY 2009

Prepared by:

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the sediment Polychlorinated Biphenyl (PCB) results show the quality of the data is acceptable to support project objectives. The contracted laboratory provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged 'J' or 'J-EMPC'. Some data were qualified as not detected and flagged 'U'. Refer to Section 4.0 of this report for a listing of qualifier definitions. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report.

2.0 Project Description

A total of 37 sediment samples were submitted to Axys Analytical Services Ltd. of Sidney, British Columbia, Canada (Axys) for PCB congener analysis. These samples were collected from both the forebay and reference areas during the February/March 2008 sampling event in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. Table 1 summarizes the identification numbers from URS and the analytical laboratory, the collection dates and the requested analyses for each sample. These samples were previously analyzed for PCB Aroclors, polynuclear aromatic hydrocarbons (PAHs), semivolatile organic compounds (SVOCs) and selected metals by Columbia Analytical Services (CAS) of Kelso, Washington. The analytical results for these analyses were presented in the *River Operable Unit Remedial Investigation Data Summary Report*, July 29, 2008 (URS 2008). This quality control summary report and attached tables only addresses the PCB congener analytical results for the 37 sediment samples. The other CAS-reported analytical results for these tissue samples and the PCB congener results reported for clam and tissue samples are addressed in a separate quality control summary reports.

3.0 Sampling and Analytical Procedures

Samples were analyzed according to the *Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan* (QAPP) (URS 2007). The sediment samples were submitted to Columbia Analytical Services (CAS) of Kelso, Washington in discrete batches throughout the February/March 2008 sampling event. The specifics of the sample receipts are detailed in the quality control summary report attached with the original data report (URS 2008). In summary, all sediment samples arrived intact at CAS and were archived frozen prior to and following homogenization using an industrial blender. Authorization to release the remainder of the homogenized sediment samples to Axys to perform PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry* was given to CAS on June 25, 2008 by URS. The Axys analytical data reports include a listing of the Axys Method 1668A modifications. The PCB congener results for the sediment samples are reported in four Axys sample delivery groups; these are outlined in Table 1.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced method. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain of custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, initial and continuing calibrations, reporting limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. As appropriate for the analytical method, the following items were reviewed for 20% or greater of the data: primary and secondary column verification, instrument calibration and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* (DOD 2006) does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (*USEPA 2005a) and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data* (USEPA 1995) as appropriate for the method performed. In the case of disagreement between the documents listed as guidance and the analytical method, method criteria were utilized for data review. Project-specific QC criteria are listed in the above mentioned QAPP.

A summary of qualifiers assigned to results during this review is provided in Table 2. Samples are listed by their URS sample identification number assigned in the field as well as the laboratory identification number. All qualifiers are included in the database, the data tables, and the main body of this report. Congeners are reported using sample-specific detection limits. Qualifiers that may be assigned to analytical results because of this investigation as part of this QA/QC review include the following:

- U - The analyte was analyzed for but was not detected above the reported sample reporting limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample - used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample reporting limit. However, the reported reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

As stated above in Section 3.0, all sediment samples arrived intact at CAS and were archived frozen prior to and following homogenization using an industrial blender. As reported previously, the COC forms indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended temperature of 6 degrees Celsius (°C) or below. Representativeness was maintained during the sampling effort by completing all sampling using similar sampling procedures and in accordance with an approved QAPP.

The COC forms from CAS to Axys indicate that samples were maintained under chain of custody and forms were signed upon release and receipt. All samples listed on the COC forms were present. The collection date was omitted from the jars for samples L11366-13 and L11366-19; they were logged in according to the date listed on the COC. All sediment samples were received by Axys at 12-13°C. Samples were frozen prior to shipment and packaged on dry ice per Method 1668A. Samples were shipped on June 30th, 2008. Due to complications at customs the samples were received on July 3rd, 2008 by Axys, two days beyond the expected date of arrival. The samples were immediately frozen upon receipt by Axys. PCBs are known for long term stability (USEPA 2005b). Therefore, the sample results were not qualified based on the elevation in temperature during shipment.

All samples were analyzed within the technical and contracted holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and standard compounds as required by the Method 1668A. Initial calibration (ICAL), and continuing calibration (CCV) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. All calibration compounds met the acceptance criteria listed in the method with the following exceptions:

- Samples L11366-13, L11366-31, and L11366-32 were re-injected due to a continuing calibration standard being out of control. The re-injection results were used for all analytes in these samples. They were reported with an ‘i’ suffix. No data qualification was necessary.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs and EPA Region 10 SOP.

PCB congener results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as estimated maximum possible concentrations (EMPCs) were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using clean sand to imitate the sediment matrix.

Method blanks associated with the sediment samples had low levels of some PCBs. The results of a few congeners were qualified non-detect based on these method blank concentrations. Samples qualified non-detect and flagged ‘U’ as a result of method blank detected PCB congeners are indentified in the URS Review Qualifier field of Table 3.

4.4 Labeled Internal Standard Recovery Review

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narratives. All recoveries were acceptable with the following exception:

- The percent recoveries of ^{13}C-labeled PCB 4 for samples L11366-9, L11366-13 and L11366-35 were below the Axys control limits of 30% with 18.8%, 21.2%, and 23.3%, respectively. Given that isotopic dilution calculations produce recovery corrected quantitation results, only the non-chemically identical PCB congeners, quantitated using these labeled standards were qualified as estimated based on these internal standard recoveries. Associated analytical results of PCB 5 through 14 for samples L11366-9, L11366-13, and L11366-35 were qualified as estimated and flagged 'J/UJ' due to the low recovery of ^{13}C-labeled PCB 4.

Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

4.5 Ongoing Precision and Recovery

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, ongoing precision and recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using clean sand to imitate the solid matrix of the samples. OPR recoveries were acceptable for congener analyses with the following exception:

- The recovery of ^{13}C-labeled PCB 4 in the OPR associated with sample delivery group (SDG) DPWG26268 was 28.3%. This is below the minimum control limit of 30%. This labeled standard was only used to calculate the concentration of non-labeled congeners in the OPR. All non labeled congeners were within method required recovery limits. No data qualification was deemed necessary.

4.6 Duplicate Review

Field duplicates were not collected due to the statistical nature of the sampling event (as discussed in detail in the QAPP). Laboratory precision was monitored through laboratory duplicate analysis. Axys performed duplicate analysis on sediment sample L11366-20. There is no guidance on laboratory duplicate precision for individual PCB congeners, in either the NFGs, the EPA Region 10 SOP, or Method 1668A. Axys uses the general rule that: if any one congener has an RPD greater than 40% the data is flagged (at a minimum) and corrective action may be taken (i.e. reextraction or reanalysis). For analytical results greater than 5x the sample specific detection limit and not reported as EMPCs, the RPDs for individual congeners were less than 40%, indicating acceptable analytical precision. The detailed laboratory duplicate evaluation can be found within the Axys analytical reports.

4.7 Compound Quantification

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass stability and its effect on analyte quantification was acceptable with the following exceptions:

- Samples L11366-6, L11366-8, L11366-9, L11366-14, and L11366-15 had deflections in lock mass which interfered with several analytes. The sample was re-injected and the lock mass was within control in the second analysis. The affected target analytes were reported from the re-injection. The reanalysis results are identified with a ‘W’ suffix.
- Sample L11366-15 had a lock mass deflection that affected the recovery standard ^{13}C-labeled PCB 194, which is used to quantify hepta- through deca- (PCB 170-209) chlorinated ^{13}C-labeled PCBs. Upon dilution the lock mass was within control limits. However, the laboratory reported PCB 208 and 209 from the initial, non-diluted, analysis due to their low concentrations. The alternative recovery standard ^{13}C-labeled PCB 138 was used to quantify the hepta- through deca- chlorinated ^{13}C-labeled PCBs in the non-diluted analysis. No data qualification was deemed necessary.
- Sample L11366-15 had a lock mass deflection that affected ^{13}C-labeled PCB 188. Isotopic dilution calculations produce recovery corrected quantitation results, therefore only the non-chemically identical PCB congeners using this labeled standard for quantitation were estimated based on the internal standard recovery. Associated analytical results for PCB 170 through 193, excluding 188 and 189 which are calculated by isotope dilution, were qualified as estimated and flagged ‘J/UJ’ (See Table 2).
- Many samples in SDGs DPWG26478, DPWG26229, and DPWG26565 had lock mass deflections which interfered with the analysis of several PCBs. Results affected by lock mass deflection were qualified as estimated and flagged ‘J/UJ’. See the Table 2 for the affected samples and analytes.

4.8 Target Compound Identification

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria, but deviated from the theoretical ion abundance criterion set by EPA Method 1668A by more than 15%, are flagged in the laboratory report with a ‘K’ flag. Those results flagged ‘K’ with ion abundance ratios outside the identified quantitation criteria were considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and was not qualified further because the ion abundance ratio was outside control limits (there is no ion abundance ratio criterion for non-detects). These "J-EMPC" flags are not tabulated in this report but appear within Table 2 and are entered into the database.

Ion abundance ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives. Additionally, it is important to note EMPC results were not included in the Axys-reported homologue totals or Toxicity Equivalent Quotient (TEQ) calculations.

Additionally, the flag 'C' was assigned by the laboratory and listed in Table 2 to indicate co-eluting PCB isomers in this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification.

4.9 Comparability

The results from this sampling event are comparable to other sampling events because of the use of standard techniques to collect representative samples, consistent application of analytical method protocols, and reporting analytical results with appropriate units and reporting limits.

4.10 Reporting Limits

All non-detect congener results are reported at sample specific detection limits. All sediment samples were analyzed using approximately 10 grams dry weight as recommended by Method 1668A. Axys performed a dilution on some samples due to matrix interferences. The dilutions appear to have had little impact on the reporting limits.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. As part of this review, some data were qualified as estimated 'J' or 'J-EMPC' and some as non-detect 'U'. A summary of qualifiers can be found in Table 2 and Table 3. A completeness summary follows; analysis completeness was calculated using 159 congener results, 209 total congeners minus the 50 co-eluting congeners which were reported with the lowest numbered congener in the co-eluting set.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to Axys and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  = (5,883 compliant / 5,883 total results) = 100%

  All samples results are considered useable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  = (5137 compliant / 5,883 total results) = 87%

  Data were qualified as estimated and flagged 'J' or 'J-EMPC' or qualified non-detect and flagged 'U'.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  = (5,883 compliant / 5,883 total results) = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/number of samples required) x100

  = (37 compliant / 37 required) =100%

  Sediment samples were collected from the reference region (18) and the forebay region (19). Sediment was collected in conjunction with collocated clam tissue samples. All samples collected and submitted to the laboratory for analysis had a complete set of results. All samples had sufficient sample volume to analyze the full analyte list as detailed in the QAPP.

6.0 References

DOD 2006. D*epartment of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories*. Final Version 3. January 2006. Retrieved from [http://www.navylabs.navy.mil/Archive/DoDV3.pdf] on 3/3/06

URS 2007. *Quality Assurance Project Plan, River Operable Unit Remedial Investigation,* Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

URS 2008. *River Operable Unit Remedial Investigation Data Summary Report*, Bradford Island, July 29, 2008.

USEPA 1995. *EPA Region 10 SOP for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data*, Revision 1.0. December 1995.

USEPA 2005a. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review*. September 2005.

USEPA 2005b. *Environmental Protection Agency (EPA) Sample Holding Time Reevaluation*, EPA/600/R-05/124, October 2005.

Table 1. Sample ID and Analysis Summary

Bradford Island Remedial Investigation - Sediment Samples

						Anaytes					
Station Number	URS ID	Collection Date	CAS ID (non-congeners)	Axys ID (congeners)	Axys Sample Delivery Group	PCB (Aroclors) (CAS)	PCB (Congeners) (Axys Analytical)	PAHs	SVOCs	Metals	%Solids
4	08022604SD	02/26/08	K0801328-022	L11366-1	DPWG26229	--	X	--	--	--	--
7	08021507SD	02/15/08	K0801328-007	L11366-2		--	X	--	--	--	--
8	08021508SD	02/15/08	K0801328-009	L11366-3		--	X	--	--	--	--
9	08021409SD	02/14/08	K0801328-004	L11366-4		--	X	--	--	--	--
10	08021410SD	02/14/08	K0801328-005	L11366-5		--	X	--	--	--	--
11	08021411SD	02/14/08	K0801328-006	L11366-6		--	X	--	--	--	--
15	08022115SD	02/21/08	K0801328-012	L11366-7		--	X	--	--	--	--
16	08022116SD	02/21/08	K0801328-013	L11366-8		--	X	--	--	--	--
17	08022117SD	02/21/08	K0801328-011	L11366-9		--	X	--	--	--	--
18	08021118SD	02/11/08	K0801328-003	L11366-10		--	X	--	--	--	--
21	08021221SD	02/12/08	K0801328-002	L11366-11		--	X	--	--	--	--
5	08031905SD	03/19/08	K0802371-005	L11366-12		--	X	--	--	--	--
13	08031713SD	03/17/08	K0802371-001	L11366-14		--	X	--	--	--	--
14	08031814SD	03/14/08	K0802371-004	L11366-15		--	X	--	--	--	--
65	08022965SD	03/29/08	K0802371-009	L11366-16		--	X	--	--	--	--
67	08030367SD	03/03/08	K0802371-010	L11366-17		--	X	--	--	--	--
88	08031788SD	03/17/08	K0802371-003	L11366-18	DPWG26478	--	X	--	--	--	--
89	08031789SD	03/17/08	K0802371-002	L11366-19		--	X	--	--	--	--
22	08030522SD	03/05/08	K0801769-010	L11366-20		--	X	--	--	--	--
24	08030524SD	03/05/08	K0801769-011	L11366-21		--	X	--	--	--	--
26	08030426SD	03/04/08	K0801769-005	L11366-22		--	X	--	--	--	--
27	08030427SD	03/04/08	K0801769-006	L11366-23		--	X	--	--	--	--
28	08030428SD	03/04/08	K0801769-007	L11366-24		--	X	--	--	--	--
29	08022229SD	02/22/08	K0801769-021	L11366-25		--	X	--	--	--	--
34	08022534SD	02/25/08	K0801769-024	L11366-26		--	X	--	--	--	--
35	08022535SD	02/25/08	K0801769-023	L11366-27		--	X	--	--	--	--
36	08022536SD	02/25/08	K0801769-022	L11366-28		--	X	--	--	--	--
38	08022738SD	02/27/08	K0801769-026	L11366-30		--	X	--	--	--	--
37	08022637SD	02/26/08	K0801769-025	L11366-29	DPWG26565	--	X	--	--	--	--
6	08031806SD	03/18/08	K0802371-006	L11366-13	DPWG26268	--	X	--	--	--	--
39	08022739SD	02/27/08	K0801769-027	L11366-31		--	X	--	--	--	--
40	08022740SD	02/27/08	K0801769-028	L11366-32		--	X	--	--	--	--
41	08022741SD	02/27/08	K0801769-029	L11366-33		--	X	--	--	--	--
42	08022742SD	02/27/08	K0801769-030	L11366-34		--	X	--	--	--	--
85	08030685SD	03/06/08	K0801769-017	L11366-35		--	X	--	--	--	--
86	08030686SD	03/06/08	K0801769-009	L11366-36		--	X	--	--	--	--
87	08030687SD	03/06/08	K0801769-018	L11366-37		--	X	--	--	--	--

Notes:

CAS - Columbia Analytical Services
Axys - Axys Analytical Services, Ltd.
ID - Identification
PCB - Polychlorinated Biphenyl
PAH - Polycyclic Aromatic Hydrocarbon
SVOCs - Semivolatile Organic Compounds
-- previously reported, not included in this quality control summary report.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-1 through L11366-5

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08022604SD L11366-1	Lab Qualifier	URS Review Qualifier	08021507SD L11366-2	Lab Qualifier	URS Review Qualifier	08021508SD L11366-3	Lab Qualifier	URS Review Qualifier	08021409SD L11366-4	Lab Qualifier	URS Review Qualifier	08021410SD L11366-5	Lab Qualifier	URS Review Qualifier
1		1.16			0.181			0.168			0.296	K	J-EMPC	0.324	K	J-EMPC
2		2.78			1.28			1.69			6.62			4.86		
3		0.5	K	J-EMPC	0.206			0.252	K	J-EMPC	0.467			0.416	K	J-EMPC
4		7.11			1.46			0.628			0.985			0.566		
5		0.0659	U		0.0521	U		0.0719	U		0.0625	U		0.0504	U	
6		0.897			0.254			0.219	K	J-EMPC	0.352			0.292		
7		0.597			0.163	K	J-EMPC	0.124			0.222	K	J-EMPC	0.172		
8		4.61			1.14			0.958			1.67			1.52		
9		0.758			0.149	K	J-EMPC	0.083	K	J-EMPC	0.161			0.119		
10		0.323			0.067	K	J-EMPC	0.0653	U		0.0569	U		0.0477	U	
11		79.5			42.6			52.6			68.8			84.4		
12	12 + 13	1.52	C		0.503	C K	J-EMPC	0.551	C		0.974	C		0.803	C K	J-EMPC
13	12 + 13		C12			C12			C12			C12			C12	
14		0.0612	U		0.0484	U		0.0668	U		0.0581	U		0.0477	U	
15		6.4			1.67			2.01			2.76			3.26		
16		1.71			0.667			0.457			0.942			0.813		
17		12.1			2.28			1.14			2.44			2.67		
18	18 + 30	12	C		2.74	C		1.55	C		3.07	C		2.33	C	
19		4.73			0.986			0.362			0.878	K	J-EMPC	0.394		
20	20 + 28	52.9	C		5.68	C		5.61	C		10.1	C		13.2	C	
21	21 + 33	12.8	C		2.15	C		1.59	C		3.91	C		2.78	C	
22		7.7			1.29			1.45			2.42			2.37		
23		0.0491	U		0.0473	U		0.0505	U		0.0495	U		0.0477	U	
24		0.135	K	J-EMPC	0.0473	U		0.0478	U		0.059	K	J-EMPC	0.0477	U	
25		20.9			0.608			0.449	K	J-EMPC	0.825			0.937		
26	26 + 29	32.7	C		0.97	C		0.717	C		1.39	C		1.39	C	
27		4.33			0.726			0.374			0.747			0.524		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		36.7			4.32			3.62			6.58			5.89		
32		13.5			1.06			0.448			1			0.918		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.463			0.0473	U		0.0485	U		0.079	K	J-EMPC	0.065	K	J-EMPC
35		0.488			0.173	K	J-EMPC	0.305			0.346			0.44		
36		0.132			0.0473	U		0.128	K	J-EMPC	0.106			0.143		
37		8.11			1.63			2.05			3			3.2		
38		0.106	K	J-EMPC	0.0473	U		0.055	K	J-EMPC	0.129	K	J-EMPC	0.096	K	J-EMPC
39		0.451	K	J-EMPC	0.058	K	J-EMPC	0.0478	U		0.078	K	J-EMPC	0.056	K	J-EMPC
40	40 + 41 + 71	97.6	C		7.84	C		3.21	C		7.96	C		4.57	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		39.8			4.32			1.92			4.65			2.83		
43		4.96	K	J-EMPC	0.653			0.296			0.591	K	J-EMPC	0.459		
44	44 + 47 + 65	403	C		37	C		15.7	C		34.8	C		19	C	
45	45 + 51	21.6	C		1.45	C		0.655	C		0.927	C		0.631	C	
46		7.95			0.607			0.222			0.607			0.343		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		14.7			1.79			1.01			2.24			1.46		
49	49 + 69	299	C		23	C		10.2	C		24.2	C		12.1	C	
50	50 + 53	49.8	C		3.87	C		1.49	C		3.5	C		2.18	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		964			87			34.1			70.8			32.2		
53	50 + 53		C50			C50			C50			C50			C50	
54		1.28			0.109	K	J-EMPC	0.0478	U		0.136			0.054	K	J-EMPC
55		4.34			0.597			0.203			0.676	K	J-EMPC	0.307		
56		117			9.68			5.45			10.4			6.92		
57		1.19			0.0895	U		0.0814	U		0.144	U		0.146	U	
58		1.47			0.127	K	J-EMPC	0.13	K	J-EMPC	0.178	K	J-EMPC	0.146	U	
59	59 + 62 + 75	9.53	C		0.9	C		0.549	C		1.43	C		1.02	C	
60		49.7			3.95			2.89			4.71			3.4		
61	61 + 70 + 74 + 76	1250	C		85.8	C		45.7	C		85.7	C		45.6	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		12.7			0.963			0.711	K	J-EMPC	1.46			0.822		
64		137			13.6			6.7			13.2			6.89		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		356			27.3			16.8			33.3			20.5		
67		4.03			0.185			0.164	K	J-EMPC	0.292	K	J-EMPC	0.265		
68		2.56			0.131	K	J-EMPC	0.083	K	J-EMPC	0.451	K	J-EMPC	0.245	K	J-EMPC
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		3.55			0.236			0.148	K	J-EMPC	0.582			0.277		
73		0.0491	U		0.0473	U		0.0478	U		0.0495	U		0.0477	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		7.09			1.1			1.21			1.99			1.98		
78		0.406	U		0.0865	U		0.0786	U		0.139	U		0.141	U	
79		21.7			1.16			0.648			1.44	K	J-EMPC	0.66		
80		0.373	U		0.0795	U		0.0723	U		0.128	U		0.13	U	
81		3.4	K	J-EMPC	0.192	K	J-EMPC	0.103	K	J-EMPC	0.14	U		0.147	K	J-EMPC
82		232			14			7.06			14.7			6.5		
83	83 + 99	1360	C		73.4	C		42.6	C		86	C		40.9	C	
84		493			36.4			15.1			34			15		
85	85 + 116 + 117	426	C		25.2	C		15.2	C		27.6	C		14	C	
86	86 + 87 + 97 + 108 + 119 + 125	1580	C		93.4	C		48.4	C		94.5	C		43.7	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	292	C		20	C		9.18	C		19.3	C		9.36	C	
89		13			0.851			0.414			0.905			0.389		
90	90 + 101 + 113	2180	C		125	C		66.3	C		136	C		63	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		368			22.1			11.4			24.4			12.2		
93	93 + 95 + 98 + 100 + 102	1550	C		121	C		51.8	C		105	C		48	C	
94		6.65			0.476			0.202	K	J-EMPC	0.483	K	J-EMPC	0.226		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		6.32			0.653			0.239			0.588			0.268		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		8.63			0.599			0.325			0.88			0.428		
104		0.127	K	J-EMPC	0.0473	U		0.0478	U		0.0495	U		0.0477	U	
105		1080			47.5			33.5			57.2			31.1		
106		2.43	U		0.178	U		0.138	U		0.127	U		0.117	U	
107	107 + 124	95.4	C		4	C		2.83	C		5.1	C		2.53	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		149			7.04			5.17			10			4.91		
110	110 + 115	2690	C		171	C		90.1	C		171	C		84.3	C	
111		0.216	U		0.0479	U		0.0478	U		0.0675	U		0.0477	U	
112		0.21	U		0.0473	U		0.0478	U		0.0656	U		0.0477	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		60.3			2.8			1.85			3.27			1.71	K	J-EMPC
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-1 through L11366-5
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08022604SD L11366-1	Lab Qualifier	URS Review Qualifier	08021507SD L11366-2	Lab Qualifier	URS Review Qualifier	08021508SD L11366-3	Lab Qualifier	URS Review Qualifier	08021409SD L11366-4	Lab Qualifier	URS Review Qualifier	08021410SD L11366-5	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		2650			131			92.6			145			79.4		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		0.78	K	J-EMPC	0.106	K	J-EMPC	0.113	K	J-EMPC	0.317			0.229		
121		0.219	U		0.0486	U		0.0478	U		0.0684	U		0.0477	U	
122		27.2			1.25			0.806	K	J-EMPC	1.61			0.725		
123		36.3			1.9	K	J-EMPC	1.44			2.04			1.19		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		2.69	U		0.203	U		0.177	K	J-EMPC	0.219	K	J-EMPC	0.252	K	J-EMPC
127		2.51	U		0.184	U		0.143	U		0.131	U		0.121	U	
128	128 + 166	445	C		14.7	C		13	C		26.5	C		14.6	C	
129	129 + 138 + 160 + 163	2340	C		85.9	C		74.2	C		138	C		82.5	C	
130		142			5.14			4.29			9.23			5.29		
131		32.4			1.11			0.742			1.68			0.881		
132		725			25.2			18			41.8			21.2		
133		19.8			0.866			0.791			1.68			1.07		
134	134 + 143	105	C		3.84	C		2.73	C		6.51	C		3.33	C	
135	135 + 151 + 154	376	C		18.3	C		13.9	C		31.4	C		19.9	C	
136		152			7.76			4.71			11.5			6.15		
137		178			5.16			4.31			7.92			3.75		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	48.2	C		1.68	C		1.26	C		2.77	C		1.42	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		273			7.76			6.16			15			7.6		
142		1.16	U		0.12	U		0.114	U		0.162	U		0.133	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		54.6			2.38			1.89			3.9			2.1		
145		0.838			0.0473	U		0.0478	U		0.074	K	J-EMPC	0.0477	U	
146		269			12.4			10.9			20			12.5		
147	147 + 149	1190	C		49	C		37	C		81.3	C		46.6	C	
148		0.844			0.066	K	J-EMPC	0.0478	U		0.184	K	J-EMPC	0.139		
149	147 + 149		C147			C147			C147			C147			C147	
150		1.54			0.069	K	J-EMPC	0.076	K	J-EMPC	0.181			0.106		
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		1.8			0.078			0.049	K	J-EMPC	0.104	K	J-EMPC	0.06		
153	153 + 168	1580	C		72.6	C		62	C		101	C		68	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.0491	U		0.0473	U		0.0478	U		0.0495	U		0.0477	U	
156	156 + 157	380	C		12	C		10.4	C		19.5	C		10.6	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		245			7.81			6.61			13			6.91		
159		6.36			0.232	K	J-EMPC	0.266			0.609			0.443		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.822	U		0.0849	U		0.0804	U		0.115	U		0.094	U	
162		8.11			0.182	K	J-EMPC	0.211			0.41	K	J-EMPC	0.233		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		118			4.42			3.36			7.97			4.4		
165		0.934	U		0.0964	U		0.0913	U		0.13	U		0.107	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		113			4.52			4.3			6.33			3.91		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.879	U		0.0923	U		0.0881	U		0.126	U		0.123	U	
170		190			5.53			6.14			14.4			10.6		
171	171 + 173	59.2	C		1.88	C		2.28	C		5.17	C		4.06	C	
172		30.1			0.852			1.03			2.77			2.17		
173	171 + 173		C171			C171			C171			C171			C171	
174		127			4.02			4.53			12.2			9.72		
175		5.87			0.255			0.284			0.608			0.448		
176		18.1			0.625			0.761			1.82			1.39		
177		81.6			3.74			4.69			9.64			8.49		
178		22.1			1.24			1.68			3.52			3.4		
179		38.9			2.04			2.65			5.88			5.29		
180	180 + 193	316	C		11.2	C		12.7	C		29.1	C		23.7	C	
181		4.54			0.153			0.108	K	J-EMPC	0.281	K	J-EMPC	0.18	K	J-EMPC
182		1.41			0.075			0.049	K	J-EMPC	0.172	K	J-EMPC	0.108	K	J-EMPC
183	183 + 185	102	C		3.96	C		4.58	C		10.2	C		8.38	C	
184		0.168	K	J-EMPC	0.0473	U		0.0478	U		0.06			0.067	K	J-EMPC
185	183 + 185		C183			C183			C183			C183			C183	
186		0.104	K	J-EMPC	0.0473	U		0.0478	U		0.0495	U		0.0477	U	
187		153			8.76			11.1			24.3			22		
188		0.149			0.0473	U		0.0478	U		0.071	K	J-EMPC	0.073		
189		9.01			0.331	K	J-EMPC	0.347	K	J-EMPC	0.787			0.617		
190		34.6			1.45			1.66			3.47			2.87		
191		7.46			0.22			0.242			0.569			0.45		
192		0.0491	U		0.0473	U		0.0478	U		0.0495	U		0.0477	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		40.4			2.08			2.94			6.83			6.09		
195		17.3			1.21			1.71			3.36			3.03		
196		21.7			1.11			1.48			3.79			3.17		
197	197 + 200	9.25	C G	J	0.61	C		0.726	C		1.23	C G	J	1.09	C G	J
198	198 + 199	42.6	C		2.8	C		4.05	C		9.73	C		8.92	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		5.47			0.371	K	J-EMPC	0.596			1.31			1.08		
202		10.2			1.02			1.57			3.19			2.96		
203		31.2			2.26			3.4			6.95			6.36		
204		0.0491	U		0.0473	U		0.0478	U		0.0495	U		0.0477	U	
205		2.56			0.158	K	J-EMPC	0.235	K	J-EMPC	0.437	K	J-EMPC	0.406		
206		15.5			1.88			2.85			6.96			6.35		
207		2.22			0.254	K	J-EMPC	0.405	K	J-EMPC	0.948			0.888		
208		3.84			0.707			0.988	K	J-EMPC	2.56			2.35		
209		7.48			1.85			2.94			7.14			7.75		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.

[1] = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-6 through L11366-10
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08021411SD L11366-6	Lab Qualifier	URS Review Qualifier	08022115SD L11366-7	Lab Qualifier	URS Review Qualifier	08022116SD L11366-8	Lab Qualifier	URS Review Qualifier	08022117SD L11366-9	Lab Qualifier	URS Review Qualifier	08021118SD L11366-10	Lab Qualifier	URS Review Qualifier
1		0.257			0.671			0.298	K	J-EMPC	0.337	K	J-EMPC	0.183		
2		4.76			6.34			6.03			4.21			1.54		
3		0.351			0.515			0.387	K	J-EMPC	0.371	K	J-EMPC	0.245	K	J-EMPC
4		2.24			0.965			0.892			0.457			0.466		
5		0.0438	U		0.07	K	J-EMPC	0.0493	U		0.0669	U	UJ	0.048	U	
6		0.736			0.431			0.472			0.294	K	J-EMPC	0.215		
7		0.131	K	J-EMPC	0.133	K	J-EMPC	0.155	K	J-EMPC	0.092		J	0.122		
8		3.83			1.95			2.65			1.27		J	0.978		
9		0.197			0.107	K	J-EMPC	0.147			0.08	K	J-EMPC	0.06		
10		0.067			0.0618	U		0.0478	U		0.0585	U	UJ	0.0478	U	
11		86.8			118			92.2			65.2		J	71.5		
12	12 + 13	1.15	C		1.04	C K	J-EMPC	1.1	C		0.776	C	J	0.74	C	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.066			0.072			0.064	K	J-EMPC	0.0605	U	UJ	0.0478	U	
15		4.26			2.83			4.36			2.33			1.75		
16		5.69			1.99			2.09			0.817	K	J-EMPC	0.759		
17		5.25			2.18			2.47			0.97			0.759		
18	18 + 30	11.2	C		4.79	C		4.66	C		2.04	C		1.96	C	
19		1.56			0.399			0.559	K	J-EMPC	0.255	K	J-EMPC	0.201	K	J-EMPC
20	20 + 28	20.7	C		10.7	C		13.2	C		8.21	C		5.31	C	
21	21 + 33	10.1	C		3.53	C		5.27	C		2.87	C		1.49	C	
22		7.51			3.83			3.99			2.7			1.89		
23		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
24		0.176			0.066	K	J-EMPC	0.088	K	J-EMPC	0.0475	U		0.0478	U	
25		1.36			0.6			0.861			0.435			0.25		
26	26 + 29	3.07	C		1.28	C		1.73	C		0.922	C		0.498	C	
27		0.864			0.429			0.377			0.14			0.182		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		15.5			7.18			8.59			5.58			3.5		
32		3.13			0.82			1.15			0.661			0.321		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.081			0.0618	U		0.063			0.0475	U		0.0478	U	
35		0.617			0.516			0.532			0.344			0.298		
36		0.154			0.163			0.117			0.106	K	J-EMPC	0.091	K	J-EMPC
37		6.47			4			5.01			2.94			2.21		
38		0.131			0.175			0.115	K	J-EMPC	0.092			0.057	K	J-EMPC
39		0.104			0.092	K	J-EMPC	0.056	K	J-EMPC	0.0475	U		0.0478	U	
40	40 + 41 + 71	7.5	C		4.98	C		3.83	C		2.55	C		2.3	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		4.07			3.66			2.43			1.55			1.75		
43		0.559			0.356			0.23	K	J-EMPC	0.191			0.143		
44	44 + 47 + 65	17.1	C		14.8	C		9.75	C		6.35	C		7.14	C	
45	45 + 51	2.37	C		1.48	C		1.15	C		0.783	C		0.602	C	
46		0.817			0.458			0.399			0.235			0.178	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		3			2.11			1.63			1.05			1.05		
49	49 + 69	9.54	C		7.72	C		5.59	C		3.86	C		3.62	C	
50	50 + 53	1.89	C		1.46	C		1.05	C		0.666	C		0.62	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		24.7			17			11.8			8.12			8.54		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.042	K	J-EMPC	0.0618	U		0.0478	U		0.0486	U		0.0478	U	
55		0.134	U		0.189	K	J-EMPC	0.171			0.208			0.18		
56		7.6			6.32			5.47			4.29			3.56		
57		0.134	U		0.128	U		0.0742	U		0.0854	U		0.112	U	
58		0.134	U		0.135	U		0.0781	U		0.0898	U		0.118	U	
59	59 + 62 + 75	1.47	C		1.13	C		0.879	C		0.577	C		0.567	C	
60		4.48			3.63			2.95			2.7			2.45		
61	61 + 70 + 74 + 76	33	C		26.9	C		22.2	C		18.5	C		15.4	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		0.708			0.726			0.534			0.477			0.379		
64		7.1			5.91			4.42			3.35			3.3		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		17.1			15.7			13			10.6			9.17		
67		0.483			0.368			0.341			0.225	K	J-EMPC	0.155		
68		0.13	U		0.158	K	J-EMPC	0.14	K	J-EMPC	0.0827	U		0.109	U	
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.175	K	J-EMPC	0.215	K	J-EMPC	0.174	K	J-EMPC	0.103	K	J-EMPC	0.109	U	
73		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		2.31			2.4			2.17			1.51			1.32		
78		0.13	U		0.127	U		0.0734	U		0.0845	U		0.111	U	
79		0.389	K	J-EMPC	0.482			0.379			0.227	K	J-EMPC	0.205	K	J-EMPC
80		0.119	U		0.117	U		0.068	U		0.0783	U		0.103	U	
81		0.129	U		0.138	U		0.0754	U		0.0802	U		0.115	U	
82		4.67			2.94			2.97			1.84			1.65		
83	83 + 99	26	C		24.4	C		17.9	C		12.3	C		11.7	C	
84		10.4			5.94			4.88			3.12			2.73		
85	85 + 116 + 117	9.4	C		7.79	C		6.93	C		4.9	C		4.22	C	
86	86 + 87 + 97 + 108 + 119 + 125	31.9	C		23.5	C		18.2	C		12.1	C		11.8	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	5.51	C		4.21	C		3.24	C		2.23	C		2.06	C	
89		0.301			0.251	K	J-EMPC	0.182	K	J-EMPC	0.109	K	J-EMPC	0.136		
90	90 + 101 + 113	47.1	C		36.9	C		27.6	C		18.7	C		17.3	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		9.4			7.26			5.52			4.57			3.31		
93	93 + 95 + 98 + 100 + 102	35.6	C		26	C		18.1	C		12.4	C		11.6	C	
94		0.141			0.111			0.059	K	J-EMPC	0.06	K	J-EMPC	0.0478	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.178			0.14			0.085	K	J-EMPC	0.06	K	J-EMPC	0.051	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		0.275			0.295	K	J-EMPC	0.183			0.128			0.113	K	J-EMPC
104		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
105		21.1			18.8			16.8			12			11.3		
106		0.086	U		0.116	U		0.0726	U		0.0494	U		0.0712	U	
107	107 + 124	2.05	C		1.41	C		1.34	C		0.947	C		0.82	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		3.9			3.64			3.16			2.27			1.96		
110	110 + 115	59.2	C		43.6	C		39.3	C		26.8	C		22.8	C	
111		0.0378	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
112		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		1.17			0.965	K	J-EMPC	0.813			0.665			0.621		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		52.8			51.6			40.8			27.4			29		

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-6 through L11366-10

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08021411SD L11366-6	Lab Qualifier	URS Review Qualifier	08022115SD L11366-7	Lab Qualifier	URS Review Qualifier	08022116SD L11366-8	Lab Qualifier	URS Review Qualifier	08022117SD L11366-9	Lab Qualifier	URS Review Qualifier	08021118SD L11366-10	Lab Qualifier	URS Review Qualifier
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		0.206			0.249			0.227			0.13			0.11		
121		0.0384	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
122		0.557			0.344	K	J-EMPC	0.417			0.291			0.27		
123		0.859			0.796			0.833			0.459			0.582		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		0.212	K	J-EMPC	0.296	K	J-EMPC	0.238			0.173			0.123	K	J-EMPC
127		0.0888	U		0.118	U		0.0736	U		0.0501	U		0.0722	U	
128	128 + 166	12.6	C		9.53	C		9.51	C		6.89	C		5.57	C	
129	129 + 138 + 160 + 163	74.2	C		62.5	C		55.9	C		39.5	C		35.5	C	
130		4.88			3.78			3.62			2.56			2.16		
131		0.775			0.434			0.483	K	J-EMPC	0.277			0.237		
132		18.9			12			12.2			8.41			6.06		
133		1.06			0.956	K	J-EMPC	0.836			0.607			0.559		
134	134 + 143	2.98	C		1.95	C		1.91	C		1.25	C		1.03	C	
135	135 + 151 + 154	20	C		18.9	C		15.3	C		9.93	C		8.92	C	
136		5.68			4.58			3.86			2.19			1.92		
137		3.11			1.65			1.74			1.22			1.24		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	1.23	C		0.855	C		0.785	C K	J-EMPC	0.55	C		0.442	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		7.88			4.92			5.21			3.59			2.71		
142		0.106	U		0.0772	U		0.0951	U		0.0728	U		0.0537	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		2.2			1.65			1.51	K	J-EMPC	1.11			0.829		
145		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
146		11.9			12			10.3			7.86			7.06		
147	147 + 149	44.6	C		37.8	C		32.7	C		23.7	C		18.7	C	
148		0.104			0.114	K	J-EMPC	0.117	K	J-EMPC	0.077	K	J-EMPC	0.151		
149	147 + 149		C147			C147			C147			C147			C147	
150		0.106			0.1	K	J-EMPC	0.073	K	J-EMPC	0.0475	U		0.0478	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.063			0.0618	U		0.0478	U		0.0475	U		0.0478	U	
153	153 + 168	64.4	C		66.7	C		51	C		35.1	C		38.3	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.049	K	J-EMPC	0.069			0.0478	U		0.0475	U		0.0478	U	
156	156 + 157	8.74	C		6.53	C		6.61	C		4.48	C		3.81	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		6.31			4.55			4.49			3.09			2.58		
159		0.485			0.452			0.42			0.34			0.202		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.0746	U		0.0618	U		0.0683	U		0.0523	U		0.0478	U	
162		0.226			0.158	K	J-EMPC	0.0727	U		0.13	K	J-EMPC	0.101		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		4.03			2.92			2.94			2.08			1.59		
165		0.0848	U		0.0642	U		0.0791	U		0.0605	U		0.0478	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		3.49			3.37			2.87			1.84			1.9		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.111	U		0.161	K	J-EMPC	0.132	U		0.109	U		0.0841	U	
170		10.4			9.65			10.4			8.28			4.95		
171	171 + 173	4.13	C		4.05	C		4.12	C		2.74	C		2.05	C	
172		2.27	D		2.13			2.04	K D	J-EMPC	1.34	D		1.02		
173	171 + 173		C171			C171			C171			C171			C171	
174		9.65			9.67			9.52			6.72			4.68		
175		0.518			0.542			0.524			0.292			0.267		
176		1.56			1.6			1.47			1.09			0.801		
177		8.98			9.85			9.45			6.5			4.72		
178		3.56			4.36			3.57			2.61			2.28		
179		5.73			6.75			6.18			4.18			3.4		
180	180 + 193	24.3	C		27.7	C		26.1	C		20.9	C		14	C	
181		0.165			0.134			0.152	K	J-EMPC	0.058	K	J-EMPC	0.075		
182		0.108			0.185			0.0478	U		0.105	K	J-EMPC	0.09		
183	183 + 185	9.08	C		9.97	C		8.75	C		6.13	C		4.78	C	
184		0.067	K	J-EMPC	0.066			0.068			0.059	K	J-EMPC	0.0478	U	
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
187		23.4			28.3			23.3			17.4			13.9		
188		0.059			0.099			0.057	K	J-EMPC	0.0475	U		0.0478	U	
189		0.589	D		0.534	K	J-EMPC	0.452	D		0.428	K D	J-EMPC	0.217	K	J-EMPC
190		2.98	K D	J-EMPC	3.53			2.68	D		1.91	D		1.73		
191		0.483	D		0.523	K	J-EMPC	0.412	K D	J-EMPC	0.354	D		0.229		
192		0.146	U D		0.0618	U		0.0949	U D		0.106	U D		0.0478	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		5.38			4.82			4.86			4.77			2.4		
195		2.99	D		2.05			3.38	D		2.56	D		1.1		
196		3.05			2.75			2.82			2.4			1.55		
197	197 + 200	1.74	C D		1.15	C G	J	1.35	C D		1.31	C K D	J-EMPC	0.722	C G	J
198	198 + 199	8.23	C		7.79	C		7.77	C		6.68	C		4.97	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		1.16			1.22			1.15			0.789			0.676		
202		3.06			3.29			2.92			2.17			1.83		
203		6.09			6.28			5.77			4.62			3.85		
204		0.0368	U		0.0618	U		0.0478	U		0.0475	U		0.0478	U	
205		0.404	K	J-EMPC	0.372			0.4			0.331			0.169		
206		5.52			5.36			6.06			4.52			3.91		
207		0.81			0.7			0.763			0.569	K	J-EMPC	0.487		
208		2.11			2.09			2.27			1.72			1.55		
209		7.16			5.44			7.3			4.83			3.2		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.
1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-11, L11366-12, and L11366-14 through L11366-17
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08021221SD L11366-11	Lab Qualifier	URS Review Qualifier	08031905SD L11366-12	Lab Qualifier	URS Review Qualifier	08031713SD L11366-14	Lab Qualifier	URS Review Qualifier	08031814SD L11366-15	Lab Qualifier	URS Review Qualifier	08022965SD L11366-16	Lab Qualifier	URS Review Qualifier	08030367SD L11366-17	Lab Qualifier	URS Review Qualifier
1		0.212			0.179			0.24			0.11			0.147			0.104		
2		3.61			0.113	K	U	3			0.832			2.07			0.17		U
3		0.294	K	J-EMPC	0.153	K	J-EMPC	0.343	K	J-EMPC	0.123	K	J-EMPC	0.206			0.066	K	J-EMPC
4		0.386			0.777			0.82			0.197	K	J-EMPC	0.291			0.113		
5		0.0488	U		0.0479	U		0.0486	U		0.0509	U		0.0487	U		0.0479	U	
6		0.23			0.182			0.359	G	J	0.079			0.148			0.06	K	J-EMPC
7		0.134			0.153			0.487			0.177	K	J-EMPC	0.074			0.083	K	J-EMPC
8		1.01			0.394		U	1.49	D		0.343		U	0.69		U	0.246		U
9		0.057			0.075	K	J-EMPC	0.093	K	J-EMPC	0.0484	U		0.0487	U		0.0479	U	
10		0.0488	U		0.058			0.0486	U		0.0484	U		0.0487	U		0.0479	U	
11		71.1			11.9			110			20.9			48.5			10.5		
12	12 + 13	0.936	C		0.185	C K	J-EMPC	0.857	C K	J-EMPC	0.456	C		0.684	C		0.156	C K	J-EMPC
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
15		2.7			0.676			2.75			0.771			1.74			0.346		
16		0.521			0.163	K	J-EMPC	1.19			0.185			0.472			0.125	K	J-EMPC
17		0.646			0.804			1.2			0.168			0.478			0.127	K	J-EMPC
18	18 + 30	1.42	C		1.23	C		3.53	C D		0.402	C		1.1	C		0.273	C	
19		0.161	K	J-EMPC	0.524			0.23			0.063	K	J-EMPC	0.104	K	J-EMPC	0.053	K	J-EMPC
20	20 + 28	5.49	C		1.3	C		7.12	C		1.57	C		4.17	C		0.908	C	
21	21 + 33	1.53	C		0.315	C	U	2.41	C		0.434	C	U	1.13	C		0.333	C	U
22		1.58			0.319			2.53			0.447			1.21			0.392		
23		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
24		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
25		0.25	K	J-EMPC	0.628			0.401			0.082			0.203			0.0479	U	
26	26 + 29	0.529	C		0.781	C		0.945	C		0.153	C		0.437	C		0.12	C	
27		0.114			0.282			0.28			0.052	K	J-EMPC	0.089			0.0479	U	
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		3.35			0.971			5			0.927			2.46			0.593	K	U
32		0.221			0.755			0.387			0.086	K	J-EMPC	0.188			0.09		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
35		0.347	K	J-EMPC	0.0479	U		0.418			0.091	K	J-EMPC	0.221			0.054	K	J-EMPC
36		0.115	K	J-EMPC	0.0479	U		0.097			0.0484	U		0.064	K	J-EMPC	0.0479	U	
37		2.6			0.396		U	3.96			0.745			1.88			0.439		
38		0.058			0.0479	U		0.097			0.0484	U		0.0487	U		0.0479	U	
39		0.0488	U		0.0479	U		0.063			0.0484	U		0.0487	U		0.0479	U	
40	40 + 41 + 71	1.52	C		1.38	C		3.03	C		0.482	C		1.26	C		0.55	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		1.11			0.724			2.68			0.282			0.83			0.277	K	J-EMPC
43		0.119			0.105			0.214			0.0548	U		0.058	K	J-EMPC	0.0582	U	
44	44 + 47 + 65	5.02	C		6.4	C		10.4	C		1.32	C		4.16	C		1.03	C	
45	45 + 51	0.443	C		0.553	C		0.73	C		0.088	C K	J-EMPC	0.317	C		0.104	C	
46		0.142	K	J-EMPC	0.208	K	J-EMPC	0.199			0.0538	U		0.14			0.063	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.68			0.241			1.39			0.18	K	J-EMPC	0.556			0.163		
49	49 + 69	3.08	C		4.07	C		4.45	C		0.733	C		2.28	C		0.515	C	
50	50 + 53	0.408	C		1.38	C		0.848	C		0.118	C		0.31	C		0.102	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		7.33			13.1			10.9			1.73			6.22			1.07		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0488	U		0.09	K	J-EMPC	0.0486	U		0.0484	U		0.0487	U		0.0533	U	
55		0.172	K	J-EMPC	0.0802	U		0.197			0.0717	U		0.126	K	J-EMPC	0.0756	U	
56		2.64			1.28			3.87			0.762			1.96			0.714		
57		0.0915	U		0.0768	U		0.09	U		0.0695	U		0.105	U		0.0734	U	
58		0.0963	U		0.0808	U		0.091	U		0.0704	U		0.106	U		0.0742	U	
59	59 + 62 + 75	0.45	C		0.122	C		0.828	C		0.088	C K	J-EMPC	0.346	C K	J-EMPC	0.051	C	
60		1.92			0.701			2.43			0.588			1.38			0.436		
61	61 + 70 + 74 + 76	13.3	C		11.8	C		17.6	C		3.69	C		10.5	C		2.07	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.347	K	J-EMPC	0.127	K	J-EMPC	0.447			0.069	K	J-EMPC	0.269			0.0712	U	
64		2.45			1.99			3.89			0.656			2			0.478		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		8.2			4.2			11.6			2.48			6.88			1.41		
67		0.164			0.0675	U		0.242			0.0622	U		0.139			0.0656	U	
68		0.0886	U		0.0744	U		0.119	K	J-EMPC	0.0674	U		0.101	U		0.0711	U	
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.0887	U		0.0744	U		0.156			0.0672	U		0.101	U		0.0709	U	
73		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		1.47			0.209			1.63			0.417			1.04			0.289		
78		0.0905	U		0.076	U		0.0867	U		0.067	U		0.101	U		0.0707	U	
79		0.248			0.186	K	J-EMPC	0.343			0.0568	U		0.172			0.0599	U	
80		0.0839	U		0.0704	U		0.079	U		0.0611	U		0.0919	U		0.0644	U	
81		0.0934	U		0.0773	U		0.091	U		0.0694	U		0.102	U		0.0693	U	
82		1.62			1.98			1.61			0.36			1.2			0.27	K	J-EMPC
83	83 + 99	11.6	C		11.1	C		15	C		2.78	C		8.81	C		1.01	C	
84		2.59			3.89			3.22			0.728			2.41			0.368	K	J-EMPC
85	85 + 116 + 117	4.38	C		3.98	C		4.69	C		0.993	C		3.07	C		0.413	C	
86	86 + 87 + 97 + 108 + 119 + 125	11.8	C		13	C		15	C		2.77	C		9	C		1.17	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	1.9	C		2.39	C		2.28	C		0.462	C		1.47	C		0.218	C	
89		0.075	K	J-EMPC	0.107			0.114	K	J-EMPC	0.0484	U		0.081	K	J-EMPC	0.0479	U	
90	90 + 101 + 113	18.4	C		16.6	C		24	C		4.27	C		14.4	C		1.59	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		3.49			2.72			4.06			0.802			2.62			0.293		
93	93 + 95 + 98 + 100 + 102	10.5	C		14	C		15.6	C		2.68	C		9.42	C		1.11	C K	J-EMPC
94		0.0488	U		0.067			0.064			0.0484	U		0.0487	U		0.0479	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.054			0.066	K	J-EMPC	0.063	K	J-EMPC	0.0484	U		0.0487	U		0.0479	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.121	K	J-EMPC	0.077	K	J-EMPC	0.129	K	J-EMPC	0.0484	U		0.101			0.0479	U	
104		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
105		12.5			9.54			12.4			2.87			8.49			1.3		
106		0.0791	U		0.0637	U		0.0828	U		0.0606	U		0.0577	U		0.0479	U	
107	107 + 124	0.966	C		0.718	C		1.07	C		0.239	C		0.684	C		0.089	C K	J-EMPC
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		2.52			1.37			2.41			0.58			1.61			0.174		
110	110 + 115	24.8	C		23.9	C		27.4	C		5.56	C		18.8	C		2.32	C	
111		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
112		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		0.666			0.631			0.661			0.136	K	J-EMPC	0.429			0.058	K	J-EMPC
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-11, L11366-12, and L11366-14 through L11366-17
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26229

IUPAC #	COELUTING CONGENERS[1]	08021221SD L11366-11	Lab Qualifier	URS Review Qualifier	08031905SD L11366-12	Lab Qualifier	URS Review Qualifier	08031713SD L11366-14	Lab Qualifier	URS Review Qualifier	08031814SD L11366-15	Lab Qualifier	URS Review Qualifier	08022965SD L11366-16	Lab Qualifier	URS Review Qualifier	08030367SD L11366-17	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		29.9			29.4			38.4			6.9			20.9			2.71		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.154			0.0479	U		0.165			0.0484	U		0.083	K	J-EMPC	0.0479	U	
121		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
122		0.289			0.227	K	J-EMPC	0.249			0.076	K	J-EMPC	0.177			0.0479	U	
123		0.569			0.61	K	J-EMPC	0.661			0.107	K	J-EMPC	0.327	K	J-EMPC	0.064	K	J-EMPC
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.189			0.0725	U		0.199	K	J-EMPC	0.0662	U		0.135	K	J-EMPC	0.0479	U	
127		0.0802	U		0.0646	U		0.0818	U		0.0599	U		0.057	U		0.0479	U	
128	128 + 166	7.54	C		3.22	C		6.15	C		1.61	C		4.96	C		0.621	C	
129	129 + 138 + 160 + 163	43.3	C		20.9	C		41.1	C		9.69	C		27	C		3.67	C	
130		2.9			1.1			2.17			0.62	K	J-EMPC	1.57			0.189		
131		0.389	K	J-EMPC	0.214	K	J-EMPC	0.281			0.073			0.197	K	J-EMPC	0.0479	U	
132		10.1			4.47			7.21			2			5.46			0.702		
133		0.743			0.177			0.517			0.125			0.406			0.0479	U	
134	134 + 143	1.51	C		0.732	C		1	C		0.342	C		0.913	C		0.087	C	
135	135 + 151 + 154	11.8	C		3.02	C		9.28	C		2.92	C		6.77	C		0.811	C	
136		2.83			1.15			2.32			0.531			1.52			0.198	K	J-EMPC
137		1.49			1.23			1.09			0.257			0.809			0.097	K	J-EMPC
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.648	C		0.277	C K	J-EMPC	0.461	C		0.125	C K	J-EMPC	0.337	C K	J-EMPC	0.052	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		4.09			1.64			2.96			0.92			2.45			0.386		
142		0.0868	U		0.0479	U		0.0649	U		0.0484	U		0.0626	U		0.0479	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		1.25	K	J-EMPC	0.424			0.931			0.343			0.718			0.084		
145		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
146		7.12			2.43			7.03			2	K D	J-EMPC	4.7			0.531		
147	147 + 149	25.3	C		9.13	C		23.7	C		6.2	C		15	C		1.83	C	
148		0.101	K	J-EMPC	0.0479	U		0.057			0.0484	U		0.0487	U		0.0479	U	
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.058			0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
153	153 + 168	38.8	C		20.4	C		45.5	C		9.18	C		23.4	C		2.94	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0488	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
156	156 + 157	4.7	C		3.5	C		4.73	C		1.13	C		3.08	C		0.399	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		3.41			1.76			3.04			0.766			2.22			0.293		
159		0.307			0.055			0.26			0.065	K	J-EMPC	0.207	K	J-EMPC	0.0479	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.0623	U		0.0479	U		0.0486	U		0.0484	U		0.0487	U		0.0479	U	
162		0.123	K	J-EMPC	0.053	K	J-EMPC	0.123	K	J-EMPC	0.0484	U		0.107	K	J-EMPC	0.0479	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		2.27			0.931	K	J-EMPC	1.79			0.522			1.3			0.186	K	J-EMPC
165		0.0722	U		0.0479	U		0.0513	U		0.0484	U		0.0495	U		0.0479	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		1.9			1.52			2.46			0.461			1.37			0.173	K	J-EMPC
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.103	U		0.0479	U		0.104	U		0.0484	U		0.0931	U		0.0479	U	
170		6.51			1.8			8.9	D		2.71	D		5.17			0.967		
171	171 + 173	2.61	C		0.577	C		3.08	C D		0.969	C D		2.41	C		0.363	C K	J-EMPC
172		1.25			0.212			1.91	D		0.561	K D	J-EMPC	1.01			0.18		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		6.26			1.01			7.1	D		2.29	K D	J-EMPC	5.86			0.917	K	J-EMPC
175		0.343			0.0479	U		0.305	U D		0.18	U D		0.264			0.0479	U	
176		1.11			0.14	K	J-EMPC	1.15	D		0.386	K D	J-EMPC	0.737			0.125	K	J-EMPC
177		6.26			0.807			6.09	K D	J-EMPC	1.82	D		5.35			0.723		
178		2.52			0.328	K	J-EMPC	3.02	D		0.771	K D	J-EMPC	1.87			0.284		
179		4.92			0.491			4.5	D		1.36	D		2.87			0.406		
180	180 + 193	16.7	C		3.5	C		21.3	C D		5.52	C D		12.5	C		2.21	C	
181		0.107	K	J-EMPC	0.0479	U		0.336	U D		0.199	U D		0.0487	U		0.0479	U	
182		0.0488	U		0.0479	U		0.311	U D		0.183	U D		0.059	K	J-EMPC	0.0479	U	
183	183 + 185	5.39	C		1.04	C		6.82	C D		2.03	C D		4.74	C		0.701	C	
184		0.054			0.0479	U		0.246	U D		0.145	U D		0.0487	U		0.0479	U	
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0488	U		0.0479	U		0.264	U D		0.156	U D		0.0487	U		0.0479	U	
187		15.4			2.31			17.6	D		4.8	D		13.4			1.77		
188		0.052	K	J-EMPC	0.0479	U		0.229	U D		0.0493	U G	UJ	0.0487	U		0.0479	U	
189		0.332			0.127	K	J-EMPC	0.62	K D	J-EMPC	0.814	U		0.242			0.0479	U	
190		2.06			0.447			2.52	D		0.602	K D	J-EMPC	1.59			0.247	K	J-EMPC
191		0.316			0.06	K	J-EMPC	0.332	K D	J-EMPC	0.318	K D	J-EMPC	0.225			0.0479	U	
192		0.0488	U		0.0479	U		0.291	U D		0.172	U D		0.0487	U		0.0479	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		3.67			0.429			6.45	D		1.63	D		2.64			0.51		
195		1.57			0.226			2.59	D		1.04	D		1.21			0.233	K	J-EMPC
196		2.16			0.215			3.02	D		0.691	K D	J-EMPC	1.32			0.224		
197	197 + 200	0.886	C G	J	0.084	C		1.26	C D		0.239	C U D		0.632	C G	J	0.109	C K	J-EMPC
198	198 + 199	6.22	C		0.582	C		8.61	C D		1.64	C D		3.91	C		0.744	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		0.893			0.081			1.01	K D	J-EMPC	0.333	K D	J-EMPC	0.678			0.111	K	J-EMPC
202		2.12			0.171			2.14	D		0.582			1.42			0.199		
203		4.4			0.542			6.12	D		1.05	D		2.77			0.534		
204		0.0488	U		0.0479	U		0.181	U D		0.239	U D		0.0487	U		0.0479	U	
205		0.281			0.048			0.477	K D	J-EMPC	0.305	U D		0.181			0.0479	U	
206		4.78			0.415			5.28	D		1.14			2.94			0.449		
207		0.621	K	J-EMPC	0.112	U		0.751	U D		0.896	U D		0.508			0.145	U	
208		1.85			0.113	U		1.86	K D	J-EMPC	0.451	K	J-EMPC	1.08			0.143	U	
209		8.55			0.663		U	5.33	D		1.34			3.51			0.366	K	U

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.
1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-18 through L11366-23

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26478

IUPAC #	COELUTING CONGENERS[1]	08031788SD L11366-18	Lab Qualifier	URS Review Qualifier	08031789SD L11366-19	Lab Qualifier	URS Review Qualifier	08030522SD L11366-20	Lab Qualifier	URS Review Qualifier	08030524SD L11366-21	Lab Qualifier	URS Review Qualifier	08030426SD L11366-22	Lab Qualifier	URS Review Qualifier	08030427SD L11366-23	Lab Qualifier	URS Review Qualifier
1		0.144			0.1	K	J-EMPC	0.144			0.395			0.129			0.233		
2		0.432			0.636			4.82			3.23			0.937			3.04		
3		0.184	K	J-EMPC	0.238	K	J-EMPC	0.362			0.244			0.162			0.319		
4		0.283			0.269	K	J-EMPC	0.293			0.352			0.301			1.19		
5		0.0571	U		0.0834	U		0.0769	U		0.154	U		0.0682	U		0.107	U	
6		0.125			0.095	K	J-EMPC	0.12	K	J-EMPC	0.204	K	J-EMPC	0.129			0.346		
7		0.086	K	U	0.078	K	U	0.088	K	U	0.139	U		0.0618	U		0.0966	U	
8		0.46			0.404			0.672			0.693			0.464			0.876		
9		0.0525	U		0.0766	U		0.074	K	J-EMPC	0.137	U		0.0606	U		0.0948	U	
10		0.0514	U		0.075	U		0.0692	U		0.138	U		0.0614	U		0.0959	U	
11		35.1			19.9			57			68			57.6			205		
12	12 + 13	0.0565	C U		0.0825	C U		0.0761	C U		0.15	C U		0.53	C		0.104	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.0546	U		0.0796	U		0.0735	U		0.143	U		0.0633	U		0.0989	U	
15		0.876			0.66			1.52			1.59			1.12			2.59		
16		0.402			0.332			0.553			0.616			0.543			2.43		
17		0.389			0.287			0.568			0.604			0.455			1.6		
18	18 + 30	0.87	C		0.619	C		1.31	C		1.39	C		1.1	C		4.7	C	
19		0.136	K	J-EMPC	0.177			0.126			0.159	K	J-EMPC	0.129	K	J-EMPC	0.26	K	J-EMPC
20	20 + 28	1.86	C		1.31	C		4.43	C		4.15	C		2.7	C		5.93	C	
21	21 + 33	0.687	C		0.453	C	U	1.25	C		1.24	C		0.855	C		1.86	C	
22		0.678			0.482			1.37			1.38			0.913			2.94		
23		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
24		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.055		
25		0.107			0.087	K	J-EMPC	0.198			0.204			0.135			0.298		
26	26 + 29	0.229	C		0.162	C		0.461	C		0.437	C		0.341	C		0.74	C	
27		0.097			0.1	K	J-EMPC	0.111			0.113	K	J-EMPC	0.126			0.58		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		1.16			0.841			2.82			2.65			1.77			3.47		
32		0.178			0.128			0.244			0.222			0.19			0.285		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
35		0.118			0.06	K	J-EMPC	0.23			0.279			0.238			0.438		
36		0.0423	U		0.0454	U		0.085			0.063	K	J-EMPC	0.069			0.12		
37		0.811			0.634			1.67			1.57			1.1			2.22		
38		0.0423	U		0.0454	U		0.065	K	J-EMPC	0.071	K	J-EMPC	0.05	K	J-EMPC	0.12		
39		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.079		
40	40 + 41 + 71	0.867	C		0.588	C	U	1.65	C		1.58	C		1.14	C		2.7	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		0.605			0.519			1.06			1.15			0.88			3.84		
43		0.051			0.0454	U		0.153			0.118	K	J-EMPC	0.076	K	J-EMPC	0.204		
44	44 + 47 + 65	2.73	C		2.04	C	U	4.57	C		5.29	C		3.94	C		18	C	
45	45 + 51	0.261	C		0.185	C		0.47	C		0.415	C		0.355	C		0.771	C	
46		0.084			0.092	K	J-EMPC	0.15			0.144	K	J-EMPC	0.095			0.166		
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.37			0.231			0.65			0.687			0.484			1.48		
49	49 + 69	1.24	C		0.825	C		2.71	C		2.52	C		1.72	C		3.41	C	
50	50 + 53	0.291	C		0.244	C	U	0.41	C		0.443	C		0.369	C		1.36	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		3.5			2.37			6.24			6.44			4.64			12.6		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
55		0.082	K	J-EMPC	0.062	K	J-EMPC	0.3			0.099			0.115			0.207		
56		1.14			0.963			2.37			2.38			1.73			3.74		
57		0.0663	U		0.0492	U		0.0554	U		0.0736	U		0.0362	U		0.0722	U	
58		0.0659	U		0.0489	U		0.0551	U		0.0737	U		0.0362	U		0.0723	U	
59	59 + 62 + 75	0.209	C	U	0.148	C	U	0.397	C	U	0.394	C	U	0.302	C	U	1.01	C	
60		0.709			0.626	K	J-EMPC	1.67			1.58			1.03			1.95		
61	61 + 70 + 74 + 76	4.84	C		3.55	C		11.5	C		10.8	C		7.36	C		14.2	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.105	K	J-EMPC	0.092			0.304			0.255			0.171			0.375		
64		0.987			0.745			2.21			2.12			1.45			2.85		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		3.11			2.51			7.28			6.99			4.81			10		
67		0.057	K	J-EMPC	0.058			0.137			0.125			0.097			0.196		
68		0.0612	U		0.0454	U		0.08			0.076	K	J-EMPC	0.045	K	J-EMPC	0.082		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.063	U		0.0467	U		0.091	K	J-EMPC	0.0735	U		0.045			0.099	K	J-EMPC
73		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		0.409			0.341			0.989			0.983			0.699			1.39		
78		0.0671	U		0.0498	U		0.0561	U		0.0768	U		0.0362	U		0.0754	U	
79		0.105	K	J-EMPC	0.081	K	J-EMPC	0.191			0.212			0.183			0.612		
80		0.0599	U		0.0454	U		0.05	U		0.0689	U		0.0362	U		0.0676	U	
81		0.0662	U		0.0486	U		0.063	K	J-EMPC	0.0786	U		0.049	K	J-EMPC	0.1	K	J-EMPC
82		0.572			0.386			1.14			1.01			1.15			1.53		
83	83 + 99	4.73	C		3.33	C		9.91	C		9.78	C		8.11	C		19.2	C	
84		1.09			0.811			2.55			2.43			2.12			3.94		
85	85 + 116 + 117	1.39	C		1.12	C		3.42	C		3.01	C		2.72	C		5.27	C K	J-EMPC
86	86 + 87 + 97 + 108 + 119 + 125	4.48	C		3.57	C	U	9.22	C		9.26	C		8.05	C		21.8	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	0.753	C		0.518	C		1.59	C		1.53	C		1.35	C		2.51	C	
89		0.05			0.0454	U		0.102	K	J-EMPC	0.08	K	J-EMPC	0.082			0.099	K	J-EMPC
90	90 + 101 + 113	7.17	C		5.08	C		15.2	C		16.2	C		12	C		31.3	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		1.24			0.891			2.92			2.78			2.18			5.23		
93	93 + 95 + 98 + 100 + 102	5.1	C		3.65	C		9.5	C		9.52	C		8.34	C		27.1	C	
94		0.0423	U		0.0454	U		0.0453	U		0.049	K	J-EMPC	0.049			0.094		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.0423	U		0.0454	U		0.048	K	J-EMPC	0.054	K	J-EMPC	0.046	K	J-EMPC	0.069	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.0423	U		0.0454	U		0.094			0.101			0.078	K	J-EMPC	0.128	K	J-EMPC
104		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
105		4.02			3.06			8.92			8.01			7.17			13.2		
106		0.0514	U		0.0571	U		0.0852	U		0.0713	U		0.0725	U		0.11	U	
107	107 + 124	0.281	C		0.204	C		0.602	C		0.734	C		0.603	C		1.07	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		0.594			0.459			1.41			1.35			1.12			2.09		
110	110 + 115	8.56	C		6.03	C		18.7	C		17.1	C		15.1	C		33.9	C	
111		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
112		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		0.267			0.174			0.41			0.485			0.378			0.798		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-18 through L11366-23
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26478

IUPAC #	COELUTING CONGENERS[1]	08031788SD L11366-18	Lab Qualifier	URS Review Qualifier	08031789SD L11366-19	Lab Qualifier	URS Review Qualifier	08030522SD L11366-20	Lab Qualifier	URS Review Qualifier	08030524SD L11366-21	Lab Qualifier	URS Review Qualifier	08030426SD L11366-22	Lab Qualifier	URS Review Qualifier	08030427SD L11366-23	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		12.7			10			22.2			22.4			20.9			64.2		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.055	K	J-EMPC	0.0454	U		0.131			0.108	K	J-EMPC	0.083	K	J-EMPC	0.228		
121		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
122		0.102	K	J-EMPC	0.098	K	J-EMPC	0.176			0.196	K	J-EMPC	0.191			0.373		
123		0.201		U	0.158	K	U	0.38		U	0.429		U	0.442		U	1.22		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.0635	U		0.0693	U		0.175	K	J-EMPC	0.147	K	J-EMPC	0.117			0.234		
127		0.0524	U		0.0582	U		0.0869	U		0.0745	U		0.0758	U		0.115	U	
128	128 + 166	1.75	C		1.22	C		4.22	C		4.07	C		3.46	C		5.93	C	
129	129 + 138 + 160 + 163	13.8	C		11	C		29.3	C		31.6	C		25.6	C		65.7	C	
130		0.645			0.46			1.7			1.71			1.35			2.39		
131		0.0617	U		0.1			0.163	K	J-EMPC	0.157	K	J-EMPC	0.184			0.303		
132		2.33			1.79			5.63			5.8			5.91			8.28		
133		0.153	K	J-EMPC	0.116	K	J-EMPC	0.463			0.365			0.283			0.493		
134	134 + 143	0.33	C		0.216	C		0.807	C		0.758	C		0.707	C		1.18	C	
135	135 + 151 + 154	2.94	C		2.3	C		6.76	C		7.47	C		5.6	C		11.2	C	
136		0.741			0.581			1.62			1.96			1.47			2.59		
137		0.499			0.359			0.929			0.852			0.788			1.41		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.147	C K	U	0.114	C K	U	0.381	C		0.324	C		0.327	C		0.545	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		1.07			0.912			2.24			2.71			2.28			3.28		
142		0.0616	U		0.0564	U		0.087	U		0.0614	U		0.066	U		0.0819	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		0.283			0.244			0.646			0.726			0.613			1.03		
145		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
146		2.17			1.61			3.92	G	J	3.89	G	J	3.31	G	J	8.46	G	J
147	147 + 149	7.88	C		5.81	C		16.6	C		18.3	C		15.4	C		34.9	C	
148		0.0423	U		0.0454	U		0.059	K	J-EMPC	0.065	K	J-EMPC	0.0362	U		0.072		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.05	K	J-EMPC
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
153	153 + 168	15.1	C		12.9	C		26.9	C		31.8	C		27.1	C		100	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
156	156 + 157	1.35	C		0.935	C	U	2.54	C		2.58	C		2.42	C		5.17	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		0.925			0.777			2.11			2.23			1.91			3.67		
159		0.107			0.124			0.154			0.339			0.248			0.286		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.0423	U		0.0454	U		0.0598	U		0.0467	U		0.0474	U		0.0588	U	
162		0.0452	U		0.0454	U		0.078			0.084	K	J-EMPC	0.089			0.125	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		0.577			0.399			1.3			1.45			1.26			2.06		
165		0.0494	U		0.0454	U		0.0699	U		0.0505	U		0.0543	U		0.0674	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		0.71		U	0.64		U	1.18			1.3			1.25			3.84		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.0485	U		0.0454	U		0.0685	U		0.102	U		0.0571	U		0.0971	U	
170		1.91			2.18			3.76			4.89			3.87			5.51		
171	171 + 173	0.715	C		0.765	C		1.55	C		1.9	C		1.47	C K	J-EMPC	2.39	C	
172		0.351			0.379			0.785			1.01			0.752			1.04		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		1.82			2.12			3.7			5.63			4.18			5.36		
175		0.1			0.105	K	J-EMPC	0.205	K	J-EMPC	0.27			0.183	K	J-EMPC	0.333		
176		0.228			0.256	K	J-EMPC	0.581			0.78			0.564			0.966		
177		1.68			1.61			3.89			4.43			3.24			5.22		
178		0.657			0.542			1.63			1.92			1.28			2.16		
179		1.05			0.987			2.54			3.41			2.44			3.65		
180	180 + 193	5.16	C		6.03	C		10.1	C		14.1	C		11	C		22.1	C	
181		0.0423	U		0.0454	U		0.047	K	J-EMPC	0.054			0.073	K	J-EMPC	0.112		
182		0.0423	U		0.0454	U		0.065	K	U	0.087	K	U	0.058	K	U	0.096	K	U
183	183 + 185	1.89	C		1.81	C		3.57	C		4.84	C		3.81	C		7.36	C	
184		0.0423	U		0.0454	U		0.0453	U		0.049	K	J-EMPC	0.0362	U		0.055		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
187		4.61			4.24			10.5			13			9.68			19.8		
188		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.054		U
189		0.1			0.098			0.225			0.26			0.264	K	J-EMPC	0.351		
190		0.641			0.751			1.31			1.6			1.27			3.12		
191		0.066			0.106			0.193			0.211			0.185			0.312		
192		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		1.12			1.94			2.87			3.34			2.42			3.24		
195		0.499			0.853			1.25			1.41			0.988			1.5		
196		0.56			0.909			1.38			1.77			1.34			1.9		
197	197 + 200	0.211	C G	U	0.301	C K	U	0.375	C G	J	0.415	C G	J	0.335	C G	J	0.447	C G	J
198	198 + 199	1.49	C		1.89	C		4.52	C		5.38	C		4.09	C		5.79	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		0.204		U	0.223	K	U	0.636			0.686			0.527			0.765		
202		0.437			0.362			1.53			1.71			1.13			1.92		
203		1.25			1.55			3.29			3.84			3			6.21		
204		0.0423	U		0.0454	U		0.0453	U		0.0467	U		0.0362	U		0.045	U	
205		0.081			0.116			0.231			0.245			0.149			0.192		
206		0.968			0.994			2.9			3.38			2.35			4.29		
207		0.158			0.107	U		0.514			0.432			0.353			0.547		
208		0.386			0.3			1.17			1.31			0.967			1.61		
209		1.14			0.669		U	3.71			3.61			2.46			4.55		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.

1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-24 through L11366-28 and L11366-30
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26478

IUPAC #	COELUTING CONGENERS[1]	08030428SD L11366-24	Lab Qualifier	URS Review Qualifier	08022229SD L11366-25	Lab Qualifier	URS Review Qualifier	08022534SD L11366-26	Lab Qualifier	URS Review Qualifier	08022535SD L11366-27	Lab Qualifier	URS Review Qualifier	08022536SD L11366-28	Lab Qualifier	URS Review Qualifier	08022738SD L11366-30	Lab Qualifier	URS Review Qualifier
1		0.145			0.198			0.375			0.156			0.176	K	J-EMPC	0.178	K	J-EMPC
2		2.16			7.02			7.86			2.01			2.11			1.69		
3		0.242			0.58			0.88			0.253			0.222			0.241		
4		0.278	K	J-EMPC	0.928			1.22			0.4	K	J-EMPC	0.488			1.02		
5		0.135	U		0.13	U		0.085	K	J-EMPC	0.0916	U		0.105	U		0.0987	U	
6		0.18	K	J-EMPC	1.1			0.878			0.218			0.243			0.332		
7		0.123	U		0.258		U	0.215		U	0.098	K	U	0.104		U	0.103	K	U
8		0.716			4.71			3.33			0.88			0.988			0.904		
9		0.12	U		0.364			0.219			0.0814	U		0.0938	U		0.0885	U	
10		0.122	U		0.117	U		0.0761	U		0.0824	U		0.0973	U		0.0919	U	
11		66.4			70.5			83			65			69.4			135		
12	12 + 13	0.132	C U		1.43	C		1.4	C		0.0893	C U G	UJ	0.102	C U		0.0966	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.125	U		0.121	U		0.11	K	J-EMPC	0.085	U		0.098	U		0.0925	U	
15		1.83			5.29			5.42			1.99			2.26			1.98		
16		0.507			2.08			2.19			0.621			0.884			1.64		
17		0.531	K	J-EMPC	2.57			2.64			0.797			0.958			1.29		
18	18 + 30	1.17	C		5.01	C		5.11	C		1.57	C		2.17	C		3.6	C	
19		0.107	K	J-EMPC	0.352			0.464			0.141			0.197	K	J-EMPC	0.189		
20	20 + 28	4.86	C		16.1	C		15.5	C		5.51	C		6.11	C		5.01	C	
21	21 + 33	1.37	C		6.77	C		5.58	C G	J	1.47	C		1.89	C		1.56	C	
22		1.48			5.44			4.93			1.65			2			2.16		
23		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
24		0.0443	U		0.087	K	J-EMPC	0.081			0.0466	U		0.049	U		0.044	U	
25		0.214			0.93			0.883			0.259			0.29			0.269		
26	26 + 29	0.471	C		2.02	C		1.83	C		0.546	C		0.659	C		0.657	C	
27		0.094			0.364			0.466			0.129	G	J	0.195			0.397		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		3.01			11.5			10.9	G	J	3.32	G	J	3.87			3.09		
32		0.264			1.07			0.859			0.258			0.316			0.238		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0443	U		0.058	K	J-EMPC	0.062	K	J-EMPC	0.0466	U		0.049	U		0.044	U	
35		0.326			0.387			0.543			0.319			0.261			0.349		
36		0.133	K	J-EMPC	0.097	K	J-EMPC	0.136			0.101	K	J-EMPC	0.103			0.112	K	J-EMPC
37		1.93			4.09			4.73			2.1			2.15			1.97		
38		0.059			0.053	K	J-EMPC	0.12			0.053			0.049	K	J-EMPC	0.044		
39		0.061			0.068	K	J-EMPC	0.136			0.0466	U		0.049	U		0.058	K	J-EMPC
40	40 + 41 + 71	1.55	C		3.73	C		6.64	C		2.03	C		1.76	C		1.98	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		0.939			2.22			4.01			1.14			1.3			2.02		
43		0.148	K	J-EMPC	0.306			0.543			0.132	K	J-EMPC	0.157	K	J-EMPC	0.183	K	J-EMPC
44	44 + 47 + 65	4.46	C		8.76	C		21.4	C		5.03	C		5.26	C		8.45	C	
45	45 + 51	0.475	C		1.13	C		1.8	C		0.527	C		0.523	C		0.47	C	
46		0.183			0.362			0.646			0.167			0.14			0.16		
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.643			1.76			3.03			0.702			0.834			1.03		
49	49 + 69	2.76	C		5.26	C		11.9	C		3.35	C		2.88	C		2.85	C	
50	50 + 53	0.391	C		0.815	C		1.83	C		0.485	C		0.471	C		0.726	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		6.31			10.4			37.5			7.05			6.82			8.74		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
55		0.225			0.293			0.428			0.151			0.233			0.194		
56		2.46			3.18			6.34			2.04			2.41			2.35		
57		0.0774	U		0.0577	U		0.114	U		0.0693	U		0.0858	U		0.0731	U	
58		0.0775	U		0.0578	U		0.114	U		0.0694	U		0.0896	U		0.0763	U	
59	59 + 62 + 75	0.39	C	U	0.822	C		1.23	C		0.396	C	U	0.522	C		0.591	C	
60		1.7			1.95			3.47			1.38			1.63			1.53		
61	61 + 70 + 74 + 76	10.7	C		15	C		40.3	C		10.5	C		11.4	C		11.1	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.283			0.393			0.777			0.261			0.269			0.248		
64		2.33			4.16			8.72			2.25			2.43			2.26		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		6.87			9.65			18			6.49			7.22			7.06		
67		0.133			0.263			0.368			0.159			0.174			0.155		
68		0.0752	U		0.11	K	J-EMPC	0.122			0.0673	U		0.0809	U		0.0689	U	
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.085	K	J-EMPC	0.128	K	J-EMPC	0.206			0.08			0.0802	U		0.089		
73		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		1.11			1.4			2.01			1.04			0.965			1.13		
78		0.0808	U		0.0602	U		0.119	U		0.0723	U		0.0871	U		0.0743	U	
79		0.206			0.255			0.605			0.154			0.162	K	J-EMPC	0.295		
80		0.0725	U		0.0541	U		0.107	U		0.0649	U		0.0804	U		0.0685	U	
81		0.0832	U		0.073	K	J-EMPC	0.143			0.075	U		0.0896	U		0.0767	U	
82		1.23			1.43			5.71			0.953			1.01			1.14		
83	83 + 99	9.86	C		11.9	C		33	C		8.5	C		8.11	C		13	C	
84		2.48			2.89			13.2			2.43			2.07			2.51		
85	85 + 116 + 117	3.55	C		3.77	C		10.6	C		2.72	C		2.58	C		3.83	C	
86	86 + 87 + 97 + 108 + 119 + 125	9.4	C		11.2	C		39.1	C		8.07	C		7.7	C		13.3	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	1.48	C		1.97	C		6.79	C		1.56	C		1.36	C		1.8	C	
89		0.063	K	J-EMPC	0.1	K	J-EMPC	0.462			0.079	K	J-EMPC	0.069			0.084	K	J-EMPC
90	90 + 101 + 113	14.8	C		18.4	C		58.9	C		13.1	C		13.1	C		20.7	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		2.94			3.28			10.3			2.41			2.46			3.87		
93	93 + 95 + 98 + 100 + 102	9.08	C		10.9	C		43.8	C		8.42	C		8.08	C		13.4	C	
94		0.0614	U		0.065			0.209	K	J-EMPC	0.052	K	J-EMPC	0.067	K	J-EMPC	0.044	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.053	K	J-EMPC	0.074			0.235			0.055	K	J-EMPC	0.049	U		0.044	K	J-EMPC
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.092			0.138			0.339			0.086			0.106	K	J-EMPC	0.104	K	J-EMPC
104		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
105		9.06			10.9			27.5			8.18			8.03			9.85		
106		0.106	U		0.136	U		0.156	U		0.0664	U		0.111	U		0.111	U	
107	107 + 124	0.716	C		0.794	C		2.36	C		0.623	C		0.477	C		0.792	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		1.48			1.79			4.61			1.38			1.27			1.52		
110	110 + 115	19.4	C		22.1	C		68.2	C		16.1	C		15.6	C		25	C	
111		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
112		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		0.479			0.602			1.63			0.382			0.372			0.422		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-24 through L11366-28 and L11366-30
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26478

IUPAC #	COELUTING CONGENERS[1]	08030428SD L11366-24	Lab Qualifier	URS Review Qualifier	08022229SD L11366-25	Lab Qualifier	URS Review Qualifier	08022534SD L11366-26	Lab Qualifier	URS Review Qualifier	08022535SD L11366-27	Lab Qualifier	URS Review Qualifier	08022536SD L11366-28	Lab Qualifier	URS Review Qualifier	08022738SD L11366-30	Lab Qualifier	URS Review Qualifier
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		22.1			28.3			70.5			19.9			20.7			35.6		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.077	K	J-EMPC	0.118	K	J-EMPC	0.177			0.099	K	J-EMPC	0.074			0.144		
121		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
122		0.22			0.27			0.718			0.189	K	J-EMPC	0.16	K	J-EMPC	0.168	K	J-EMPC
123		0.408		U	0.446		U	0.98			0.309		U	0.401		U	0.656		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.185	K	J-EMPC	0.205			0.337			0.126			0.139	U		0.184		
127		0.111	U		0.142	U		0.17			0.0694	U		0.115	U		0.114	U	
128	128 + 166	4.61	C		5.17	C		12.7	C		4.08	C		3.88	C		4.37	C	
129	129 + 138 + 160 + 163	32.5	C		36.7	C		81.3	C		25.9	C		26.9	C		38.8	C	
130		2.05			2.12			4.97			1.63			1.66			1.94		
131		0.223			0.244			0.868			0.188			0.185			0.247		
132		6.59			7.24			22.6			5.81			5.23			6.08		
133		0.438			0.508			0.956			0.459			0.34			0.411		
134	134 + 143	0.948	C		1.1	C		3.31	C		0.809	C		0.712	C		0.886	C	
135	135 + 151 + 154	7.66	C		8.3	C		17.9	C		6.04	C		6.18	C		7.89	C	
136		1.83			2.11			6.15			1.73			1.49			1.84		
137		0.88			0.955			3.11			0.768			0.71			0.838		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.443	C		0.454	C		1.21	C		0.381	C		0.32	C		0.413	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		2.68			2.75			8.66			2.14			1.94			2.04		
142		0.0521	U		0.0742	U		0.123	U		0.0648	U		0.0515	U		0.044	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		0.65			0.821			2.37			0.589			0.552			0.771		
145		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
146		4.23	G	J	4.6	G	J	9.76	G	J	3.44			3.7	G	J	6.01	G	J
147	147 + 149	18.5	C		21.3	C		48.8	C		15.5	C		14.3	C		22	C	
148		0.051	K	J-EMPC	0.086	K	J-EMPC	0.1			0.0466	U		0.071	K	J-EMPC	0.076	K	J-EMPC
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.048			0.0425	U		0.097			0.049	K	J-EMPC	0.049	U		0.047		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
153	153 + 168	27.9	C		32.8	C		63.5	C		22.9	C		25.6	C		47	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
156	156 + 157	2.82	C		3.19	C		8.5	C		2.42	C		2.4	C		3.12	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		2.35			2.47			6.86			1.99			1.91			2.56		
159		0.288			0.303			0.614			0.184	K	J-EMPC	0.211			0.203		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.0443	U		0.0533	U		0.0885	U		0.0466	U		0.049	U		0.044	U	
162		0.139			0.121	K	J-EMPC	0.214			0.072			0.095	K	J-EMPC	0.116		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		1.67			1.63			4.32			1.21			1.22			1.32		
165		0.0443	U		0.061	U		0.101	U		0.0533	U		0.049	U		0.044	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		1.18			1.46			3.2			1.1		U	1.01		U	1.86		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.11	U		0.0811	U		0.179	U		0.0711	U		0.0891	U		0.0951	U	
170		5.64			5.72			10.9			4.58			3.68			3.83		
171	171 + 173	2.03	C		2.16	C		4.41	C		1.84	C		1.59	C		1.92	C	
172		1.12			1.13			1.86			0.864			0.733			0.73		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		5.39			5.45			10.6			4.36			3.72			3.62		
175		0.224			0.284			0.519			0.233			0.204	K	J-EMPC	0.212	K	J-EMPC
176		0.727			0.842			1.54			0.646			0.605			0.718		
177		4.88			5.3			8.81			3.94			3.66			4.73		
178		2.04			2.1			3.48			1.66			1.33			1.93		
179		3.22			3.49			5.98			2.82			2.46			3.12		
180	180 + 193	14	C		14	C		24.5	C		11	C		9.2	C		11.3	C	
181		0.114	K	J-EMPC	0.082			0.191	K	J-EMPC	0.057	K	J-EMPC	0.061	K	J-EMPC	0.091	K	J-EMPC
182		0.054		U	0.058	K	U	0.143		U	0.054	K	U	0.053	K	U	0.071	K	U
183	183 + 185	4.56	C		4.98	C		9.01	C		3.87	C		3.4	C		4.7	C	
184		0.0443	U		0.084	K	J-EMPC	0.065			0.0466	U		0.049	U		0.051	K	J-EMPC
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
187		12.8			13.6			22			9.79			9.27			13.2		
188		0.0443	U		0.0425	U		0.066	K	U	0.0466	U		0.049	U		0.044	U	
189		0.416			0.357	K	J-EMPC	0.573			0.248	K	J-EMPC	0.237			0.188		
190		1.74			1.9			3.01			1.48			1.21			1.69		
191		0.224			0.224			0.457			0.223	K	J-EMPC	0.155	K	J-EMPC	0.18		
192		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		3.6			3.2			5.11			3.05			2.32			2.33		
195		1.57			1.45			2.3			1.33			1.17			1.24		
196		1.85			1.74			2.87			1.47			1.19			1.28		
197	197 + 200	0.491	C G	J	0.447	C G	J	0.572	C G	J	0.474	C K G	J-EMPC	0.35	C G	J	0.426	C G	J
198	198 + 199	6.38	C		5.26	C		8.78	C		5.19	C		3.27	C		3.25	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		0.662			0.642			1.2			0.639			0.428			0.568		
202		1.86			1.6			2.59			1.6			1.07			1.39		
203		4.26			3.96			6.34			3.71			2.61			3.19		
204		0.0443	U		0.0425	U		0.0455	U		0.0466	U		0.049	U		0.044	U	
205		0.222			0.242			0.347			0.197			0.172	K	J-EMPC	0.194	K	J-EMPC
206		6.18			4.59			7.21			4.28			2.85			2.71		
207		0.652			0.601			0.938			0.517			0.445			0.416		
208		2.41			1.85			2.5			1.59			1.13			1.04		
209		6.38			6.12			7.86			4.05			3.47			3.33		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.
1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-13 and L11366-31 through L11366-33
Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26268

IUPAC #	COELUTING CONGENERS[1]	08031806SD L11366-13	Lab Qualifier	URS Review Qualifier	08022739SD L11366-31	Lab Qualifier	URS Review Qualifier	08022740SD L11366-32	Lab Qualifier	URS Review Qualifier	08022741SD L11366-33	Lab Qualifier	URS Review Qualifier
1		0.368		U	0.144		U	0.233		U	0.276		U
2		0.711	K	J-EMPC	1.13			1.63			1.73		
3		0.467			0.261	K	J-EMPC	0.372	K	J-EMPC	0.238		
4		1.39	K	J-EMPC	0.274	K	J-EMPC	0.629			0.506	K	J-EMPC
5		0.212	U	UJ	0.12	U		0.107	U		0.125	U	
6		0.258	K	J-EMPC	0.154			0.231	K	J-EMPC	0.224		
7		0.202	K	UJ	0.112	U		0.124	K	J-EMPC	0.114	U	
8		1.15	K	J-EMPC	0.543			0.771			1.05		
9		0.189	U	UJ	0.107	U		0.0948	U		0.11	U	
10		0.191	U	UJ	0.109	U		0.0961	U		0.113	U	
11		32.1		J	51.1			100			56.1		
12	12 + 13	0.223	C U	UJ	0.127	C U		0.112	C U		0.118	C U	
13	12 + 13		C12			C12			C12			C12	
14		0.204	U	UJ	0.116	U		0.103	U		0.114	U	
15		1.02			1.55			1.91			1.74		
16		0.408			0.284		U	0.815			0.498		
17		1.25			0.343			0.75			0.466	K	J-EMPC
18	18 + 30	1.52	C		0.727	C	U	1.97	C		1.16	C	
19		0.723			0.072			0.18			0.139		
20	20 + 28	2.94	C		2.9	C		4.11	C		3.23	C	
21	21 + 33	1.23	C		0.811	C		1.18	C		0.955	C	
22		0.698			0.889			1.64			1.16		
23		0.0626	U		0.0474	U		0.0475	U		0.0535	U	
24		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
25		0.405			0.171	K	J-EMPC	0.247			0.16		
26	26 + 29	0.678	C		0.319	C K	J-EMPC	0.466	C		0.385	C	
27		0.395			0.067			0.203	K	J-EMPC	0.124	K	J-EMPC
28	20 + 28		C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18	
31		2.49			1.81			2.42			1.9		
32		0.635			0.131			0.207			0.199		
33	21 + 33		C21			C21			C21			C21	
34		0.0626	U		0.0474	U		0.062	K	J-EMPC	0.0513	U	
35		0.15			0.283			0.352	K	J-EMPC	0.216		
36		0.0626	U		0.125	K	J-EMPC	0.095	K	J-EMPC	0.073	K	J-EMPC
37		0.808			1.35			1.54			1.45		
38		0.0626	U		0.0474	U		0.0475	U		0.0502	U	
39		0.0626	U		0.0474	U		0.0475	U		0.0493	U	
40	40 + 41 + 71	2.88	C		0.791	C		1.32	C		0.867	C	
41	40 + 41 + 71		C40			C40			C40			C40	
42		1.44			0.523			1.44			0.737	K	J-EMPC
43		0.284			0.066	K	J-EMPC	0.086			0.063	K	J-EMPC
44	44 + 47 + 65	13.7	C		2.44	C		5.89	C		3.11	C	
45	45 + 51	0.538	C		0.205	C		0.36	C		0.241	C	
46		0.251			0.072			0.1	K	J-EMPC	0.095		
47	44 + 47 + 65		C44			C44			C44			C44	
48		0.712			0.337			0.728			0.442		
49	49 + 69	8.72	C		1.41	C		2.2	C		1.49	C	
50	50 + 53	1.61	C		0.227	C		0.475	C		0.283	C	
51	45 + 51		C45			C45			C45			C45	
52		32.9			3.71			6.06			3.99		
53	50 + 53		C50			C50			C50			C50	
54		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
55		0.121	U		0.0606	U		0.0558	U		0.0992	U	
56		3.93			1.51			2.3			1.47		
57		0.115	U		0.0577	U		0.0532	U		0.0928	U	
58		0.118	U		0.059	U		0.0544	U		0.0968	U	
59	59 + 62 + 75	0.404	C K	J-EMPC	0.155	C K	J-EMPC	0.426	C K	J-EMPC	0.211	C	
60		2.07			1.1			1.51			1.08		
61	61 + 70 + 74 + 76	37.3	C		7.25	C		9.82	C		6.76	C	
62	59 + 62 + 75		C59			C59			C59			C59	
63		0.489	K	J-EMPC	0.194			0.266	K	J-EMPC	0.164	K	J-EMPC
64		5.19			1.26			1.86			1.3		
65	44 + 47 + 65		C44			C44			C44			C44	
66		13			4.56			6.89			4.44		
67		0.107	K	J-EMPC	0.093			0.158			0.0849	U	
68		0.107	U		0.0536	U		0.08	K	J-EMPC	0.0921	U	
69	49 + 69		C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40	
72		0.109	U		0.0547	U		0.079			0.0906	U	
73		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61	
77		0.596			0.637			0.883			0.709		
78		0.123	U		0.0614	U		0.0565	U		0.0939	U	
79		0.539			0.164			0.29	K	J-EMPC	0.097	K	J-EMPC
80		0.11	U		0.0553	U		0.0509	U		0.087	U	
81		0.106	U		0.0556	U		0.058			0.0927	U	
82		5.79			0.66			0.821			0.584		
83	83 + 99	31	C		5.72	C		9.46	C		5.37	C	
84		11.8			1.31			1.77			1.12		
85	85 + 116 + 117	11.7	C		1.98	C		2.89	C		1.68	C	
86	86 + 87 + 97 + 108 + 119 + 125	35.7	C		5.28	C		9.13	C		5.07	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
88	88 + 91	6.54	C		0.878	C		1.36	C		0.782	C	
89		0.334			0.0474	U		0.0475	U		0.0485	U	
90	90 + 101 + 113	47.4	C		8.77	C		16	C		8.58	C	
91	88 + 91		C88			C88			C88			C88	
92		7.97			1.68			2.51			1.55		
93	93 + 95 + 98 + 100 + 102	37.5	C		5.11	C		9.32	C		5.25	C	
94		0.148			0.0474	U		0.0475	U		0.0485	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
96		0.191	K	J-EMPC	0.0474	U		0.0475	U		0.0485	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93	
103		0.227	K	J-EMPC	0.062	K	J-EMPC	0.078			0.051	K	J-EMPC
104		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
105		24.6			5.34			7.46			4.89		
106		0.282	U		0.0492	U		0.0942	U		0.0487	U	
107	107 + 124	2.04	C		0.448	C		0.641	C		0.424	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
109		3.74			0.984			1.3			0.908		
110	110 + 115	67.9	C		11.1	C		17.3	C		10.5	C	
111		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
112		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
113	90 + 101 + 113		C90			C90			C90			C90	
114		1.6			0.337	K	J-EMPC	0.345			0.284		
115	110 + 115		C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85	
118		68.7			13.1			24.4			13.9		

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-13 and L11366-31 through L11366-33

Bradford Island - Remedial Investigation
Sample Delivery Group DPWG26268

IUPAC #	COELUTING CONGENERS[1]	08031806SD L11366-13	Lab Qualifier	URS Review Qualifier	0802739SD L11366-31	Lab Qualifier	URS Review Qualifier	0802740SD L11366-32	Lab Qualifier	URS Review Qualifier	0802741SD L11366-33	Lab Qualifier	URS Review Qualifier
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
120		0.0626	U		0.063	K	J-EMPC	0.12	K	J-EMPC	0.087		
121		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
122		0.619			0.153	K	J-EMPC	0.158			0.103		
123		1.11	K	J-EMPC	0.235	K	J-EMPC	0.406			0.272		
124	107 + 124		C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86	
126		0.318	U		0.115	K	J-EMPC	0.147	K	J-EMPC	0.093	K	J-EMPC
127		0.299	U		0.0522	U		0.1	U		0.0508	U	
128	128 + 166	8.59	C		2.89	C		3.29	C		2.72	C	
129	129 + 138 + 160 + 163	52.8	C		19.4	C		29.7	C		18	C	
130		2.98			1.14			1.46			1.06		
131		0.602			0.131	K	J-EMPC	0.162			0.078		
132		13			3.73			4.4			3.06		
133		0.415			0.309			0.334	K	J-EMPC	0.226	K	J-EMPC
134	134 + 143	1.91	C		0.499	C		0.724	C		0.392	C	
135	135 + 151 + 154	7.66	C		4.23	C		5.98	C		4.03	C	
136		3.12			1.05			1.38			0.919		
137		3.5			0.541			0.754			0.454		
138	129 + 138 + 160 + 163		C129			C129			C129			C129	
139	139 + 140	0.911	C		0.267	C		0.303	C K	J-EMPC	0.216	C	
140	139 + 140		C139			C139			C139			C139	
141		4.71			1.56	K	J-EMPC	1.56			1.26	K	J-EMPC
142		0.0814	U		0.0474	U		0.0823	U		0.0558	U	
143	134 + 143		C134			C134			C134			C134	
144		1.11			0.441			0.563			0.399		
145		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
146		6.07			3.13			4.84			3.15		
147	147 + 149	23.8	C		10.7	C		16.7	C		10.1	C	
148		0.0626	U		0.0474	U		0.049	K	J-EMPC	0.0485	U	
149	147 + 149		C147			C147			C147			C147	
150		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
151	135 + 151 + 154		C135			C135			C135			C135	
152		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
153	153 + 168	41.7	C		16.5	C		33.5	C		18.9	C	
154	135 + 151 + 154		C135			C135			C135			C135	
155		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
156	156 + 157	7.65	C		1.8	C		2.46	C		1.65	C	
157	156 + 157		C156			C156			C156			C156	
158		4.38			1.54			1.95			1.26		
159		0.158	K	J-EMPC	0.197			0.152			0.101		
160	129 + 138 + 160 + 163		C129			C129			C129			C129	
161		0.0626	U		0.0474	U		0.0559	U		0.0485	U	
162		0.187			0.058	K	J-EMPC	0.0626	U		0.054	K	J-EMPC
163	129 + 138 + 160 + 163		C129			C129			C129			C129	
164		2.51			0.891			1.09			0.796		
165		0.0637	U		0.0474	U		0.0645	U		0.0485	U	
166	128 + 166		C128			C128			C128			C128	
167		2.55			0.761			1.4			0.87		
168	153 + 168		C153			C153			C153			C153	
169		0.0626	U		0.2	U		0.1	U		0.1	U	
170		4.3			2.79			3.13			2.55		
171	171 + 173	1.16	C		1.21	C		1.42	C		1.06	C	
172		0.526			0.565			0.55			0.446		
173	171 + 173		C171			C171			C171			C171	
174		2.79			2.6			2.94			2.38		
175		0.132			0.168			0.187			0.119		
176		0.351	K	J-EMPC	0.409			0.526			0.458		
177		2.15			2.78			3.38			2.46		
178		0.713			1.09			1.37			0.918		
179		1.18			1.82			2.17			1.59		
180	180 + 193	8.17	C		7.12	C		9.27	C		6.75	C	
181		0.125	K	J-EMPC	0.0474	U		0.062	K	J-EMPC	0.0485	U	
182		0.0626	U		0.048	K	J-EMPC	0.054			0.0485	U	
183	183 + 185	2.54	C		2.58	C		3.61	C		2.48	C	
184		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
185	183 + 185		C183			C183			C183			C183	
186		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
187		5.28			6.87			9.6			6.93		
188		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
189		0.241	K	J-EMPC	0.159	K	J-EMPC	0.181			0.132		
190		0.98			0.97			1.29			0.969		
191		0.17			0.14			0.192			0.137	K	J-EMPC
192		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
193	180 + 193		C180			C180			C180			C180	
194		1.85			1.9			1.82			1.4		
195		0.672			0.904			1.06			0.708		
196		0.812			0.958	K	J-EMPC	0.968			0.788		
197	197 + 200	0.316	C		0.332	C		0.357	C		0.316	C K	J-EMPC
198	198 + 199	2.31	C		2.42	C		2.78	C		2.07	C	
199	198 + 199		C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197	
201		0.263	K	J-EMPC	0.347			0.444			0.286	K	J-EMPC
202		0.653			0.885			1.05			0.686		
203		1.76			1.96			2.7			1.83		
204		0.0626	U		0.0474	U		0.0475	U		0.0485	U	
205		0.127	K	J-EMPC	0.137	K	J-EMPC	0.152			0.119	K	J-EMPC
206		1.87			1.89			2.28			1.7		
207		0.267			0.276			0.376			0.244		
208		0.6			0.751			0.849			0.645		
209		1.83			2.49			3.78			2.4		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

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D = The reported value is from a diluted analysis.
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Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
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1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentratio
is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-34 through L11366-37 and L11366-29

Bradford Island - Remedial Investigation
Sample Delivery Groups DPWG26268 and DPWG26565

IUPAC #	COELUTING CONGENERS[1]	0802742SD L11366-34	Lab Qualifier	URS Review Qualifier	0803068SD L11366-35	Lab Qualifier	URS Review Qualifier	0803068SD L11366-36	Lab Qualifier	URS Review Qualifier	0803068SD L11366-37	Lab Qualifier	URS Review Qualifier	0802263SD L11366-29	Lab Qualifier	URS Review Qualifier
1		0.165		U	0.27		U	0.192		U	0.189		U	0.186	U	
2		0.614			3.93			2.99			2.29			1.83		
3		0.193	K	J-EMPC	0.361			0.252			0.246			0.469	K	J-EMPC
4		0.302	K	J-EMPC	0.655			0.336			0.318			0.414		
5		0.113	U		0.107	U	UJ	0.0815	U		0.0791	U		0.115	U	
6		0.123	K	J-EMPC	0.306		J	0.195			0.164	K	J-EMPC	0.285	K	J-EMPC
7		0.103	U		0.0973	U	UJ	0.123			0.134	K	J-EMPC	0.138		
8		0.436			1.14		J	0.747			0.686			1.22		
9		0.0986	U		0.112	K	J-EMPC	0.0714	U		0.0694	U		0.102	U	
10		0.102	U		0.0962	U	UJ	0.0736	U		0.0715	U		0.106	U	
11		32.1			131		J	46.6			49.1			68.3		
12	12 + 13	0.106	C U		0.1	C U	UJ	0.449	C		0.535	C K	J-EMPC	0.29	C	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.102	U		0.0965	U	UJ	0.0738	U		0.0716	U		0.104	U	
15		0.924			1.86			1.41			1.56			2.54		
16		0.356		U	1.04			0.458	K	J-EMPC	0.711			0.69		
17		0.351			0.975			0.505	K	J-EMPC	0.648			0.814		
18	18 + 30	0.655	C	U	2.52	C		1.11	C		1.49	C		1.76	C	
19		0.105	K	J-EMPC	0.225			0.15			0.184	K	J-EMPC	0.196	U	
20	20 + 28	1.97	C		5.85	C		3.52	C		4.13	C		6.4	C	
21	21 + 33	0.644	C		2.05	C		1.07	C		1.28	C		2.07	C	
22		0.67			2.15			1.04			1.32			1.93		
23		0.0487	U		0.0619	U		0.0471	U		0.0534	U		0.123	U	
24		0.0487	U		0.048	K	J-EMPC	0.0471	U		0.0457	U		0.118	U	
25		0.111			0.32			0.181	K	J-EMPC	0.215	K	J-EMPC	0.313	K	J-EMPC
26	26 + 29	0.244	C K	J-EMPC	0.718	C		0.417	C		0.498	C		0.744	C	
27		0.089			0.247			0.107			0.141			0.159	K	J-EMPC
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		1.17			3.85			2.23			2.76			4.24		
32		0.142	K	J-EMPC	0.364			0.214			0.346			0.321		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.0487	U		0.0594	U		0.0471	U		0.0512	U		0.116	U	
35		0.0487	U		0.453	K	J-EMPC	0.253	K	J-EMPC	0.285			0.387	K	J-EMPC
36		0.0487	U		0.151			0.062	K	J-EMPC	0.085	K	J-EMPC	0.109	U	
37		0.938			2.21			1.35			1.64			2.41		
38		0.0487	U		0.135			0.068			0.074			0.112	U	
39		0.0487	U		0.0571	U		0.0471	U		0.0492	U		0.111	U	
40	40 + 41 + 71	0.656	C		2.03	C		1.08	C		1.53	C		1.96	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		0.416	K	J-EMPC	1.83			0.822			1.11			1.28		
43		0.0487	U		0.136	K	J-EMPC	0.072	K	J-EMPC	0.12			0.131	K	J-EMPC
44	44 + 47 + 65	2.07	C		8.1	C		3.54	C		4.43	C		4.9	C	
45	45 + 51	0.2	C		0.575	C K	J-EMPC	0.344	C K	J-EMPC	0.443	C		0.588	C	
46		0.068	K	J-EMPC	0.223			0.117	K	J-EMPC	0.189			0.171		
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		0.28			0.972			0.516			0.634			0.928		
49	49 + 69	0.987	C		3.56	C		2.01	C		2.62	C		3.09	C	
50	50 + 53	0.22	C K	J-EMPC	0.687	C		0.316	C		0.353	C		0.506	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45	
52		2.73			9.07			4.6			5.84			6.4		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0532	U	
55		0.0774	U		0.0805	U		0.0714	U		0.107	U		0.0648	U	
56		1.1			3.14			1.74	K	J-EMPC	2.2			2.31		
57		0.0724	U		0.0753	U		0.0667	U		0.1	U		0.061	U	
58		0.0755	U		0.0785	U		0.0696	U		0.105	U		0.0609	U	
59	59 + 62 + 75	0.178	C		0.616	C		0.289	C		0.393	C		0.471	C K	J-EMPC
60		0.734			2.08			1.15			1.41	K	J-EMPC	1.53		
61	61 + 70 + 74 + 76	4.36	C		14	C		8.19	C		10.2	C		11	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		0.103	K	J-EMPC	0.335			0.181	K	J-EMPC	0.242			0.257		
64		0.805			3.06			1.58			2.14			2.59		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		2.96			8.39			4.77			5.64			6.39		
67		0.071	K	J-EMPC	0.221	K	J-EMPC	0.105	K	J-EMPC	0.14	K	J-EMPC	0.16		
68		0.0718	U		0.095	K	J-EMPC	0.0662	U		0.0996	U		0.069		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		0.0706	U		0.124			0.0652	U		0.105			0.083		
73		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0498	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		0.434			1.27			0.734			0.89			1.02		
78		0.0732	U		0.0762	U		0.0675	U		0.102	U		0.0613	U	
79		0.072	K	J-EMPC	0.296	K	J-EMPC	0.156			0.167			0.383	K	J-EMPC
80		0.0678	U		0.0705	U		0.0625	U		0.0941	U		0.0557	U	
81		0.07	U		0.0748	U		0.068	U		0.0988	U		0.0639	U	
82		0.31			1.57			0.852			1.17			0.964		
83	83 + 99	3.47	C		13.2	C		7.01	C		8.82	C		7.44	C	
84		0.625			3.03			1.77			2.27			1.87		
85	85 + 116 + 117	1.09	C		4.67	C		2.41	C		3.08	C		2.6	C	
86	86 + 87 + 97 + 108 + 119 + 125	3.3	C		14.2	C		7.33	C		8.96	C		6.85	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	0.525	C		2.08	C		1.23	C		1.51	C		1.3	C	
89		0.0538	U		0.097	K	J-EMPC	0.055	K	J-EMPC	0.058	K	J-EMPC	0.086	K	J-EMPC
90	90 + 101 + 113	5.39	C		20.4	C		11	C		13.4	C		11.8	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		0.903			4.16			2.2			2.59			2.51		
93	93 + 95 + 98 + 100 + 102	3.19	C		14.5	C		6.82	C		8.18	C		7.22	C	
94		0.0561	U		0.0656	U		0.0471	U		0.0457	U		0.0832	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.0487	U		0.052	K	J-EMPC	0.0471	U		0.0457	U		0.071	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		0.0487	U		0.118			0.094	K	J-EMPC	0.106			0.101		
104		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.071	U	
105		2.96			10.3			5.82			6.91			6.53		
106		0.0522	U		0.109	U		0.0604	U		0.0551	U		0.0988	U	
107	107 + 124	0.24	C		0.955	C		0.492	C		0.637	C		0.594	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		0.565			1.86			1.02			1.32			1.17		
110	110 + 115	6.34	C		25.2	C		13.6	C		16.8	C		14.3	C	
111		0.0487	U		0.046	U		0.0471	U		0.0457	U		0.0565	U	
112		0.0487	U		0.0467	U		0.0471	U		0.0457	U		0.0598	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		0.154			0.542			0.328			0.336			0.352	K	J-EMPC
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	
118		8.31			29.8			14.1			16.8			15.7		

Table 2
PCB Congener Qualifier Summary
Lab Sample ID's L11366-34 through L11366-37 and L11366-29
Bradford Island - Remedial Investigation
Sample Delivery Groups DPWG26268 and DPWG26565

IUPAC #	COELUTING CONGENERS[1]	0802742SD L11366-34	Lab Qualifier	URS Review Qualifier	08030685SD L11366-35	Lab Qualifier	URS Review Qualifier	08030686SD L11366-36	Lab Qualifier	URS Review Qualifier	08030687SD L11366-37	Lab Qualifier	URS Review Qualifier	08022637SD L11366-29	Lab Qualifier	URS Review Qualifier
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		0.0487	U		0.146			0.075	K	J-EMPC	0.106	K	J-EMPC	0.087		
121		0.0487	U		0.0469	U		0.0471	U		0.0457	U		0.058	U	
122		0.063	K	J-EMPC	0.198			0.127			0.163	K	J-EMPC	0.113	K	J-EMPC
123		0.172	K	J-EMPC	0.679			0.309			0.342			0.374		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		0.0583	U		0.184	K	J-EMPC	0.084			0.123			0.175		
127		0.0544	U		0.114	U		0.063	U		0.0574	U		0.0954	U	
128	128 + 166	1.49	C		6.2	C		3.91	C		4.82	C		3.49	C	
129	129 + 138 + 160 + 163	10.7	C		42.3	C		22.6	C		29.8	C		23.6	C	
130		0.62			2.38			1.46			1.88			1.42		
131		0.091	K	J-EMPC	0.279			0.185			0.234			0.159	K	J-EMPC
132		1.74			7.65			4.89			6.15			5.15		
133		0.157			0.525	K	J-EMPC	0.362			0.426	K	J-EMPC	0.388		
134	134 + 143	0.278	C		1.1	C		0.664	C K	J-EMPC	0.732	C K	J-EMPC	0.718	C K	J-EMPC
135	135 + 151 + 154	2.28	C		9.54	C		5.8	C		6.8	C		6.69	C	
136		0.475			2.06			1.49			1.65			1.52		
137		0.313			1.37			0.643			0.892			0.683		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	0.136	C		0.516	C		0.274	C K	J-EMPC	0.373	C		0.304	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		0.701			3			1.89			2.58			1.72		
142		0.0744	U		0.107	U		0.0499	U		0.0757	U		0.0682	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		0.251	K	J-EMPC	0.889			0.499			0.685			0.577		
145		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0646	U	
146		2.02			6.32			3.86			4.34			3.9		
147	147 + 149	6.06	C		23.9	C		13.7	C		16.5	C		14.1	C	
148		0.0487	U		0.056	K	J-EMPC	0.05	K	J-EMPC	0.052	K	J-EMPC	0.0815	U	
149	147 + 149		C147			C147			C147			C147			C147	
150		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0619	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0571	U	
153	153 + 168	12.2	C		47.7	C		20.9	C		25.3	C		20.1	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0507	U	
156	156 + 157	0.93	C		3.74	C		2.04	C		2.66	C		2.25	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		0.747	K	J-EMPC	2.93			1.72			2.25			1.69		
159		0.0528	U		0.259			0.183			0.228			0.25	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.0501	U		0.0719	U		0.0471	U		0.051	U		0.0449	U	
162		0.0545	U		0.138			0.064	K	J-EMPC	0.112	K	J-EMPC	0.102		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		0.419			1.87			1.24			1.54			1.25		
165		0.0586	U		0.0841	U		0.0471	U		0.0596	U		0.0519	U	
166	128 + 166		C128			C128			C128			C128			C128	
167		0.482	K	J-EMPC	1.97			0.915			1.2			0.918		
168	153 + 168		C153			C153			C153			C153			C153	
169		0.0542	U		0.2	U		0.1	U		0.1	U		0.086	K	J-EMPC
170		1.38			5.22			3.53			5.16			3.58		
171	171 + 173	0.598	C		2.02	C		1.53	C		2.08	C		1.6	C	
172		0.269			1.15			0.816	K	J-EMPC	1.19			0.837		
173	171 + 173		C171			C171			C171			C171			C171	
174		1.31			5.52			3.58			5.3			3.89		
175		0.079	K	J-EMPC	0.283			0.219			0.23	K	J-EMPC	0.17	K	J-EMPC
176		0.248	K	J-EMPC	0.818			0.566			0.732			0.65		
177		1.53			5.1			3.67			4.55			3.94		
178		0.567			2.22			1.52			1.86			1.42		
179		0.931			3.45			2.41			3.01			2.34		
180	180 + 193	3.99	C		15.2	C		9.26	C		13.1	C		9.03	C	
181		0.0487	U		0.082	K	J-EMPC	0.0471	U		0.095			0.0674	U	
182		0.0487	U		0.084	K	J-EMPC	0.0471	U		0.099	K	J-EMPC	0.0634	U	
183	183 + 185	1.5	C		5.44	C		3.37	C		4.71	C		3.36	C	
184		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0471	U	
185	183 + 185		C183			C183			C183			C183			C183	
186		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0509	U	
187		4			15.5			9.63			12.6			9		
188		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0449	U	
189		0.072			0.25			0.158			0.243			0.197		
190		0.545			2.02			1.25			1.6			1.23		
191		0.054	K	J-EMPC	0.285			0.164	K	J-EMPC	0.217			0.158		
192		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0578	U	
193	180 + 193		C180			C180			C180			C180			C180	
194		0.778	K	J-EMPC	3.15			2.46			3.66			2.44		
195		0.49	K	J-EMPC	1.45			1.05			1.57			1.2		
196		0.452			1.8			1.29			1.97			1.23		
197	197 + 200	0.209	C K	J-EMPC	0.658	C		0.464	C		0.741	C		0.442	C	
198	198 + 199	1.12	C K	J-EMPC	5.88	C		3.92	C		6.21	C		3.66	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		0.209	K	J-EMPC	0.731			0.515			0.757			0.559		
202		0.466			1.97			1.36			2			1.1		
203		1.08			4.6			2.78			4.18			2.5		
204		0.0487	U		0.0437	U		0.0471	U		0.0457	U		0.0629	U	
205		0.078	K	J-EMPC	0.233			0.171	K	J-EMPC	0.256			0.156		
206		1.01	K	J-EMPC	4.38			2.98			5.79			3.21		
207		0.141			0.607			0.481			0.799			0.339		
208		0.332	K	J-EMPC	1.83			1.13			2.16			1.16		
209		1.52			4.83			3.58			6.67			3.42		

Notes:

All results are in units of pg/g (picograms per gram), dry weight.

C = Concentration represents coeluting congeners.
D = The reported value is from a diluted analysis.
G = Axys qualifier indicating that a lockmass deflection affected the result.
J = The reported value is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
K = Axys qualifier indicating that the analyte did not meet relative response factor criteria.
Non-detect values reported at the RL
PCBs = Polychlorinated Biphenyls
RL = analyte-specific reporting limit
U = The analyte was not detected above the reported sample quantification limit.
1 = When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

SCULPIN COLLECTED FEBRUARY THROUGH OCTOBER 2008

JUNE 2009

Prepared by:
URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the analytical results for the 35 sculpin samples shows the quality of the data to be acceptable to support project objectives. The contracted laboratories provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged ‘J’ or ‘J-EMPC’. Some data were qualified as not detected and flagged ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report. Refer to Section 4.0 of this report for a listing of qualifier definitions. The end user should be aware of the potential low bias of the mercury and Aroclor results due to hold time exceedances (as discussed in Section 4.1). Additionally, the identification of individual Aroclors may be subjective due to pattern degradation within the sample matrix (Section 4.8).

2.0 Project Description

Sculpin were collected from both the forebay and reference area during 2008 in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. The following five sampling events were conducted by URS and United States Army Corp of Engineers (USACE):

- Forebay and Reference Area (URS event) – February 2 through March 20, 2008
- Reference Area (USACE event) – July 21 through July 25, 2008
- Forebay (USACE event) – September 15 through September 19, 2008
- Reference Area (USACE event) – October 6 through October 10, 2008
- Forebay (USACE event) – October 20 through October 24, 2008

Table 1 summarizes the identification numbers assigned to the individual sculpin, the laboratory identification numbers assigned to the sample composites, collection date and requested analyses for sculpin composites. Those samples collected during the URS sampling event were submitted to Columbia Analytical Services (CAS) of Kelso, Washington on March 18, 2008 and were archived frozen (-20 degrees Celsius, °C). Samples collected by USACE were archived frozen at the USACE Juvenile Fish Monitoring Facility near Bonneville Dam. Details of the chain of custody (COC) are included in the USACE memorandum attached to this report. (Note: Not all sculpin submitted to CAS were selected for analysis, those not selected were archived for potential future analysis).

URS retrieved the USACE archived sculpin on February 5, 2009, relabeled and packaged them for delivery to CAS (via courier) on February 6, 2009. CAS combined the previously archived URS sculpin and composited/homogenized these with the USACE sculpin per the URS compositing scheme (Table 1). All sculpin were logged in under the new sample composite identification numbers (as detailed in Table 1).

3.0 Sampling and Analytical Procedures

Composite samples were analyzed according to the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP)

(URS 2007). Whole-body sculpin were homogenized using an industrial blender by CAS. An aliquot of the homogenized tissue was sent to Axys Analytical Services Ltd. of Sidney, British Columbia, Canada (Axys) to perform the PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*. The Axys analytical data report includes a listing of the Axys Method 1668A modifications.

The following table lists the parameters analyzed for one or more of the samples. Table 1 summarizes the specific requested analyses for each sample by URS and laboratory identification numbers.

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 1668A	PCBs as congeners
EPA 6000/7000 series	Metals
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Freeze Dry	Percent Solids

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, COC, laboratory case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed for 15% or greater of the data: primary and secondary column verification, initial and continuing instrument calibrations and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA 2005) and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data* (USEPA 1995) as appropriate for method performed. In the case of disagreement between the guidance documents and the analytical method, method criteria were utilized for data review. The metals results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above listed methods, and EPA's *NFGs for Inorganic Data Review* (USEPA 2004), in that order of precedence. Project-specific QC criteria are listed in the above-mentioned QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2 and Table 3. Samples are listed by their URS sample identification assigned in the field as well as the laboratory identification. CAS was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS, these 'J' qualifiers are not included in Table 2. These 'J' qualifiers are included in the database and are included in the data tables included in the main body of this report. Congeners are reported using sample-specific detection limits. Qualifiers that may have been assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample - used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Non-congener Results

As noted above, the sculpin were archived frozen by both CAS and the USACE prior to analysis. CAS and the USACE stored all tissues samples frozen at -20°C until homogenization and analysis. The COC forms for the URS to CAS delivery indicate that samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. (*Note*: Data package K0901018, provided from CAS, has an addendum reporting the COC form from the sculpin submitted for the first sampling event.)

All coolers were submitted at temperatures within the EPA-recommended temperature of 6°C or below. The COC documentation for the USACE to URS delivery is included in a USACE memorandum included as an Attachment to the sampling report. Data were not qualified based on sample receipt or COC forms.

All samples were analyzed within technical and contracted holding times with the following exceptions:

- The 28-day EPA recommended hold time (and QAPP identified hold time) for mercury was exceeded for all samples. All samples were analyzed for mercury by CAS on February 25, 2009. Therefore, for those samples collected in February/March 2008, hold time exceedance was 10 months, for samples collected in July 2008 hold time exceedance was approximately 7 months and for samples collected in September/October 2008 hold time exceedance was approximately 5 months. All mercury sample results have been qualified as estimated and flagged 'J' due to hold time exceedance (Table 2). The data were not rejected due to holding time exceedance because mercury was reported as detected in all 35 samples; however, the end user should be aware of the potential low bias of the mercury results due to sample degradation.
- Samples K09010108-012 (F-12) and K09010108-012 (F-13) were analyzed for PCB Aroclors approximately 10 days past the EPA recommend one-year hold time for PCBs. Analytical results for PCB Aroclors were qualified as estimated and flagged 'UJ' due to holding time exceedances (Table 2). It should be noted that these results may be biased low due to sample degradation.

Congener Results

The COC form for CAS to Axys delivery (samples shipped on February 24, 2009 and received on February 25, 2009) indicates that samples were maintained under chain of custody and forms were signed upon release and receipt. The condition and temperature of the samples upon receipt by Axys was appropriate and all samples listed on the COC form were present. Data were not qualified based COC and sample shipment procedures.

All samples were analyzed within technical and contracted holding times with the following exceptions:

- PCB congener samples L12360-1 (F-12), L12360-13 (F-13), L12360-24 (R-7) were analyzed 6 to 15 days past the 1 year hold time. Analytical results for PCB congeners were qualified as estimated and flagged 'J/UJ' due to holding time exceedances (Table 2). It should be noted that these results may be biased low due to sample degradation.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Non-congener Results

Instrument calibrations were acceptable for the sample analyses performed.

Congener Results

The congener analyses were performed in three analysis batches (WG28046, WG28057 and WG28419) due to some samples requiring dilution. ICALs and continuing calibration verifications (CCVs) were reviewed for PCB congener analyses. The laboratory performed initial multipoint calibrations for target and standard compounds as required by the Method 1668A. ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. Calibration compounds met the acceptance criteria as listed in the method with the following exception:

- The 25.3% recovery of ^{13}C-labeled PCB 155 (PCB 155L) in the OPR for analysis batch WG28419 was below the method acceptance criteria of 30%. The 154% recovery of PCB 178L (cleanup standard) in the OPR for the same analysis batch was above the method acceptance criteria of 130%. All native (or unlabeled) congeners were within control limits for the OPR, including PCB 155 and PCB 178. Additionally the labeled and non-labeled standards had acceptable recoveries in the method blank (corn oil) and project samples, with the one exception stated below in section 4.5. Sample analytical results were not qualified as estimated based on the low recovery of PCB 155L and high recovery of PCB 187L within the OPR.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Initial calibration and continuing calibration blanks are also analyzed when appropriate per analytical method (i.e 6000/7000 series metal analyses) to check for laboratory contamination and instrument bias. Field blanks were not collected as part of this analytical program. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs.

Non-congener Results

Non-congener organic sample results less than five times (5x) and inorganic sample results (or common laboratory organic contaminates such as phthalates) less than ten times (10x) the blank concentration and between the method detection limit (MDL) and the MRL were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x for inorganics and phthalates) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, the above-noted guidelines were applied using the wet weight results, and any qualifiers assigned were also assigned to the dry weight results.

All analytical tests indicate non-detects for all method blanks with the following exceptions:

- Lead was detected in the method blanks and in the continuing calibration blanks bracketing samples in CAS delivery group K0901018. All blank concentrations were above the MDL but below the MRL. All detected lead results were greater than 10x the associated blank concentrations with the exception of K0901018-006 and K0901018-029, which were qualified as non-detect and flagged ‘U’ per the criteria listed above.

Congener Results

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as EMPCs were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using corn oil to approximate the lipid content of the samples.

The method blank associated with sculpin tissue samples had only low levels of few PCB congeners. PCB 209 for sample F-3 was the only PCB congener result qualified based on method blank concentrations (Table 3).

4.4 Surrogate Recovery Review

Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Each sample analyzed for PCB Aroclors was spiked with the surrogate decachlorobiphenyl (a system monitoring compound). Surrogate recoveries were acceptable for all analyses.

4.5 Labeled Internal Standard Recovery Review (congener analysis only)

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency, which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narrative. All recoveries were acceptable with the following exception:

- The percent recovery of ^{13}C-labeled PCB 4 in sample L12360-15 (F-15) was 23.1%, which was below the method acceptance criteria of 25%. PCB 4 has a chemically identical isotopic labeled standard. Given that isotopic dilution calculations produce recovery corrected quantitation results, only the non-chemically identical PCB congeners, quantitated using this labeled standard was estimated based on the low ^{13}C-labeled PCB 4 internal standard recovery. As such, analytical results for PCB 5 through 14 for sample L12360-15 were qualified ‘J/UJ’ to reflect the potential low bias.

Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A, with the following exception:

- The percent recovery of ^{13}C-labeled PCB 28 (the cleanup standard) within the laboratory duplicate performed on sample L12360-17 (F-17) was below the method acceptance criteria. Analytical results were not qualified since this was a laboratory quality control sample and therefore the analytical results of this sample are not reported with the primary samples.

4.6 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the ability of the laboratory to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD were performed for each non-congener analysis and for each batch per method requirements.

Non-congener Results

LCS/LCSD and MS/MSD recoveries were acceptable for all non-congener analytical tests with the following exception:

- MS/MSD analyses were performed on four samples (K0901018-016, K0901018-017, K0901018-018 and K0901018-035). The recovery of mercury was below the DoD QSM criteria of 80% for the MS (69.4%) in sample K0901018-016 and the MSD (61.4%) in sample K0901018-018. Additionally, the RPD (20.2%) calculated on the mercury MS/MSD pair for sample K0901018-018 exceeded the DoD QSM precision control limit of 20%. The LCS samples were in control indicating the analytical batch was in control. Analytical results for mercury in sample K0901018-016 were not qualified because two of the three control criteria (MS, MSD and/or RPD) were within the DoD QSM control limits. However, the mercury result for sample K0901018-018 was qualified as estimated due to the bias low MS recovery and RPD precision.

Congener Results

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, Ongoing Precision and Recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using corn oil to approximate the lipid content of the samples. OPR recoveries were acceptable for congener analyses with the exception previously stated in Section 4.2 above.

4.7 Duplicate Review

Non-congener Results

Field duplicates were not collected during this sampling event. To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. All duplicate analyses were within relative percent difference criteria with the one exception described in Section 4.6 above. No samples were qualified exclusively on duplicate precision exceedances.

Congener Results

Axys performed a laboratory duplicate analyses on samples L12360-14 (F-17) and L12360-27 (R-10). For these analytical results greater than 5x the sample specific detection limit and not reported as Estimated Maximum Potential Concentrations (EMPCs), the relative percent difference for individual congeners on average was less than 10%, indicating good analytical precision. The detailed evaluation can be found within the Axys analytical report. Analytical results were not qualified based on laboratory duplicate precision.

4.8 Compound Quantification

Non-congener Results

All second column confirmations performed by CAS using Method 8082 were acceptable.

CAS reported that samples associated with sample delivery groups K0901018 "*appear to have been subjected to environmental stresses…causing pattern degradation and changing peak ratios. When pattern degradation occurs, correct identification and quantitative analysis of the individual Aroclors can be subjective*." "*Care was taken to report Aroclor with the best pattern match. Aroclor 1254 was reported for the data set.*" Aroclor analytical results were not estimated for sample delivery group K0901018, but the data user should consider this when examining Aroclor results from these deliverables.

Congener Results

Samples L12360-2, L12360-6, L12360-16, L12360-20, L12360-30, L12360-32, L12360-33, L12360-34 and L12360-35 were diluted and reanalyzed to bring area responses of some target congeners within the linear calibration range of the instrument. Only the affected target congeners are reported from the reanalysis; consequently, only one result was reported by Axys for each sample congener. Relevant concentrations from both the undiluted and diluted analytical results are reported within the data deliverable and project database. The reanalysis results are identified with a sample ID suffix of 'W' within the report.

Samples L12360-4 and L12360-5 were diluted, and refortified with labeled standards prior to reanalysis. Only the affected target compounds are reported from the reanalysis; consequently, only one result was reported by Axys for each sample congener. Relevant concentrations from both the undiluted and diluted analytical results are reported within the data deliverable. The reanalysis results are identified with a sample ID suffix of 'NK' within the report. Sample data for the NK dilution have been recovery corrected using the original labeled standard recoveries, to account for losses during extraction.

Sample L12360-3 was originally analyzed in extraction batch WG28046 and due to observed levels above the calibration range was reextracted using a smaller sample size (3 grams) and reported in extraction batch WG28419. All sample data are reported from reextracted analysis, results are identified with a sample ID suffix of 'R' within the report.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass stability and sensitivity were acceptable for the sculpin sample analyses.

4.9 Target Compound Identification

Non-congener Results

- Two standard reference materials (SRM) were analyzed for metals (N.R.C.C Dorm-3 and N.R.C.C. Tort-2). Both SRMs were extracted twice and all recoveries were within CAS control limits with the exception of lead in N.R.C.C. Dorm-3 which had a recovery of 63%, below the laboratory control limit of 70%. All other QC parameters including MS/MSD, method blank and calibration standards were in control for lead. Therefore, data were not qualified based on the single SRM recovery.

Congener Results

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but differ by more than 15% from the theoretical ion abundance criterion set by EPA Method 1668A were flagged in the laboratory report with a 'K' flag. Those results flagged 'K' with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). These "EMPC" flagged data are listed in Table 3, appear within the data tables in the main body of this deliverable, and have been entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

Additionally, the laboratory-assigned flag 'C' was used in Table 3 to indicate co-eluting PCB isomers for this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification as part of this data review.

4.10 Reporting Limits

Non-congener Results

Sample concentrations for non-congener analyses that were detected below the MRL but above the MDL, were qualified as estimated flagged with a ‘J’ by the laboratory (CAS). All laboratory J-flagged results are considered estimates. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report.

Several Aroclor results have elevated MDL and MRLs due to matrix interferences. These results were not qualified during this review, but should be considered as part of data use by the end users.

Congener Results

All non-detect congener results are reported at sample specific reporting limits. All sculpin samples were analyzed using approximately 10 grams as recommended by Method 1668A, with the below-listed exceptions. Exceptions were typically caused by insufficient sample volume or large sample concentrations requiring smaller extraction size. Based on historical experience, Axys suggested 3 grams as the absolute minimum sample volume for standard Method 1668A analysis. Therefore, if the sample mass provided was below 10 grams, but above 3 grams, or a smaller extraction size was warranted due to sample concentration, URS authorized Axys to analyze the sample using a sample size less than 10 grams.

- Samples L12360-6, L12360-10, L12360-12, L12360-13, L12360-15, L12360-23, L12360-24 and L12360-31 were analyzed using 4 grams.
- Sample L12360-27 was analyzed using 5 grams.
- Samples L12360-3 was initially analyzed using 10 grams, and was re-extracted using 3 grams (as previously stated in Section 4.8 above).

The data user should be aware that the sample-specific detection limits reported for these samples, may be slightly higher than those reported for the other tissue samples. As a result the total congener concentration, summed using non-detect congeners as zero, may have a slightly low bias for these samples; the precise bias can not be determined. The overall data usability is considered sufficient to meet project objectives.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. A summary of qualifiers can be found in Tables 2 and 3. A completeness summary follows; analysis completeness was calculated using 159 congener results, 209 total congeners minus the 50 co-eluting congeners which were reported with the lowest numbered congener in the co-eluting set.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  All samples results are considered useable.

  Non-congener = (490 compliant / 490 total results) = 100%
  Congener = (5,565 compliant / 5,565 total results) = 100%

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  Non-congener = (435 unqualified results/ 490 total results) = 89%

  Data were qualified as estimated 'J' due to hold time exceedances. Non-congener data qualified 'J' due to detections between the MRL and the MRL were not included in this calculation.

  Congener = (5,084 unqualified results/ 5,565 total results) = 91%

  Congener data were qualified as estimated and flagged 'J' or 'J-EMPC'.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  Non-congener = *(437 contract compliant results / 490 total results) = 89*%

  Congener = *(5,565 contract compliant results / 5,565 total results) = 100*%

  All samples analyzed met laboratory contract requirements with the exception of the samples analyzed outside of the 28 day hold time for mercury and the 1 year hold time for PCB Aroclors. Due to the nature of the sampling event, samples were not received by CAS or authorized for analysis until after the hold time expired.

- *Field Sampling Completeness* =(number samples collected/number samples planned) x100

  Non-congener = *(35 samples collected / 35 planned samples) =100*%

  Congener = *(35 samples collected / 35 planned samples) =100*%

  All sculpin composite samples submitted to CAS and Axys for analysis had a complete set of results. All samples had sufficient sample volume to analyze the full analyte list as detailed in the QAPP. A set number of sculpin composite samples was not specified in the QAPP; however there are sufficient number of samples from both the forebay and reference area to met minimum statistical requirements detailed in the QAPP.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [*http://www.navylabs.navy.mil/Archive/DoDV3.pdf*] on 3/3/06

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

USEPA 1995. EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 2005. Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

USEPA 2008. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. June 2008.

Table 1
Sample Identification and Analysis Summary
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

					Analytes			
URS Composite ID	CAS Composite ID (non-congener)	Axys Composite ID (congener)	USACE and URS Individual ID	Collection Date	PCB Aroclors (EPA 8082)	PCB Congeners (EPA 1668A)	Metals (EPA 6000/7000 series)	%Lipids / %Solids
FOREBAY (39 individual sculpin, 17 composite samples)								
F-1	K0901018-001	L12360-1	88B10917S4	9/17/2008	X	X	X	X
			881021S1	10/21/2008				
			88B10918S1	9/18/2008				
F-2	K0901018-002	L12360-2	89B10919S1	9/19/2008	X	X	X	X
			89B10917S3	9/17/2008				
			89B10917S2	9/17/2008				
F-3	K0901018-003	L12360-3	05B10917S10	9/17/2008	X	X	X	X
			8B21022S3	10/22/2008				
F-4	K0901018-004	L12360-4	05B20919S1	9/19/2008	X	X	X	X
			5B21021S1	10/21/2008				
			05B10917S11	9/17/2008				
			05B20918S1	9/18/2008				
F-5	K0901018-005	L12360-5	6B21022S1	10/22/2008	X	X	X	X
			6B21022S2	10/22/2008				
F-6	K0901018-006	L12360-6	10B10919S2	9/19/2008	X	X	X	X
F-7	K0901018-007	L12360-7	13B11021S3	10/21/2008	X	X	X	X
			13B11021S5	10/21/2008				
			13B11021S4	10/21/2008				
F-8	K0901018-008	L12360-8	14B10917S6	9/17/2008	X	X	X	X
			14B10917S7	9/17/2008				
			14B11021S2	10/21/2008				
			14B10917S5	9/17/2008				
F-9	K0901018-009	L12360-9	11B10919S3	9/19/2008	X	X	X	X
			15B11021S7	10/21/2008				
			15B11021S6	10/21/2008				
F-10	K0901018-010	L12360-10	16B11021S8	10/21/2008	X	X	X	X
			16B11021S9	10/21/2008				
F-11	K0901018-011	L12360-11	B10916S115	9/16/2008	X	X	X	X
			15B10917S8	9/17/2008				
F-12	K0901018-012	L12360-12	08022217SC	2/22/2008	X	X	X	X
F-13	K0901018-013	L12360-13	08022218SC	2/22/2008	X	X	X	X
F-14	K0901018-014	L12360-14	65B11022S1	10/22/2008	X	X	X	X
			65B11022S2	10/22/2008				
			65B11022S3	10/22/2008				
F-15	K0901018-015	L12360-15	67B21021S1	10/21/2008	X	X	X	X
F-16	K0901018-016	L12360-16	18B11021S10	10/21/2008	X	X	X	X
			18B11021S11	10/21/2008				
F-17	K0901018-017	L12360-17	21B21021S1	10/21/2008	X	X	X	X
			21B21021S2	10/21/2008				
REFERENCE (60 individual sculpin, 18 composite samples)								
R-1	K0901018-018	L12360-18	861008S1	10/8/2008	X	X	X	X
			861010S1	10/10/2008				
			861010S2	10/10/2008				
			861010S3	10/10/2008				
			861010S4	10/10/2008				
			861010S5	10/10/2008				
			861010S6	10/10/2008				
			080723RSC01	7/23/2008				
			871010S7	10/10/2008				
R-2	K0901018-019	L12360-19	080724RSC06	7/24/2008	X	X	X	X
			080724RSC07	7/24/2008				
			080724RSC05	7/24/2008				
R-3	K0901018-020	L12360-20	211008S2	10/8/2008	X	X	X	X
			08031491SC	3/14/2008				
R-4	K0901018-021	L12360-21	401009S11	10/9/2008	X	X	X	X
R-5	K0901018-022	L12360-22	080724RSC08	7/24/2008	X	X	X	X
			080724RSC09	7/24/2008				
R-6	K0901018-023	L12360-23	08022622SC	2/26/2008	X	X	X	X
				2/26/2008				
R-7	K0901018-024	L12360-24	08021935SC	3/10/2008	X	X	X	X
				3/10/2008				
			08031035SC	3/10/2008				
R-8	K0901018-025	L12360-25	341010S19	10/10/2008	X	X	X	X
			341009S15	10/9/2008				
			341009S16	10/9/2008				
R-9	K0901018-026	L12360-26	080724RSC17	7/24/2008	X	X	X	X
			080724RSC18	7/24/2008				
			351009S14	10/9/2008				
			080724RSC16	7/24/2008				
R-10	K0901018-027	L12360-27	080723RSC44	7/23/2008	X	X	X	X
			080724RSC15	7/24/2008				
R-11	K0901018-028	L12360-28	080722RSC02	7/22/2008	X	X	X	X
			371009S13	10/9/2008				
			08030337SC	3/3/2008				
			080722RSC01	7/22/2008				
R-12	K0901018-029	L12360-29	261009S6	10/9/2008	X	X	X	X
			271009S9	10/9/2008				
			281009S10	10/9/2008				
R-13	K0901018-030	L12360-30	261009S5	10/9/2008	X	X	X	X
			261009S7	10/9/2008				
			271009S8	10/9/2008				
			080723RSC27	7/23/2008				
			261009S4	10/9/2008				
R-14	K0901018-031	L12360-31	271010S16	10/10/2008	X	X	X	X
			371010S18	10/10/2008				
R-15	K0901018-032	L12360-32	241009S3	10/9/2008	X	X	X	X
			241010S14	10/10/2008				
			241009S2	10/9/2008				
R-16	K0901018-033	L12360-33	221010S9	10/10/2008	X	X	X	X
			221010S10	10/10/2008				
			241010S11	10/10/2008				
			241010S12	10/10/2008				
			241010S13	10/10/2008				
			241010S15	10/10/2008				
R-17	K0901018-034	L12360-34	221009S1	10/9/2008	X	X	X	X
			221010S8	10/10/2008				
R-18	K0901018-035	L12360-35	401008S4	10/8/2008	X	X	X	X
			080724RSC02	7/25/2008				
			080724RSC10	7/24/2008				
			080724RSC01	7/25/2008				

Notes:
ID = Identification Number
CAS = Columbia Analytical Services
PCB = Polychlorinated Biphenyls
USACE = U.S. Army Corps of Engineers

Table 2
Non-congener Qualifer Summary
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

URS Composite ID	CAS Composite ID (non-congener)	Analyte	Qualifer	Rationale
F-1	K0901018-001	Mercury	J	Hold Time
F-2	K0901018-002			
F-3	K0901018-003			
F-4	K0901018-004			
F-5	K0901018-005			
F-6	K0901018-006			
F-7	K0901018-007			
F-8	K0901018-008			
F-9	K0901018-009			
F-10	K0901018-010			
F-11	K0901018-011			
F-12	K0901018-012			
F-13	K0901018-013			
F-14	K0901018-014			
F-15	K0901018-015			
F-16	K0901018-016			
F-17	K0901018-017			
R-1	K0901018-018			
R-2	K0901018-019			
R-3	K0901018-020			
R-4	K0901018-021			
R-5	K0901018-022			
R-6	K0901018-023			
R-7	K0901018-024			
R-8	K0901018-025			
R-9	K0901018-026			
R-10	K0901018-027			
R-11	K0901018-028			
R-12	K0901018-029			
R-13	K0901018-030			
R-14	K0901018-031			
R-15	K0901018-032			
R-16	K0901018-033			
R-17	K0901018-034			
R-18	K0901018-035			
F-12	K0901018-012	PCB Aroclors	UJ	Hold Time
F-13	K0901018-013			
F-6	K0901018-006	Lead	21.4U	Method Blank Detection
R-12	K0901018-029		21.4U	

Notes:
units: ug/kg
ID = Identification Number
CAS = Columbia Analytical Services
Concentrations are reported as wet weight, qualifiers would apply to dry weight concentrations also.
-- = Not applicable
PCBs = Polychlorinated Biphenyls
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
U = The analyte was analyzed for but was not detected above the reported concentration.

Table 3a
PCB Congener Analytical Results
Lab Sample ID's L12360-1 through L12360-6
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-1 L12360-1	Lab Qualifier	URS Qualifier	F-2 L12360-2	Lab Qualifier	URS Qualifier	F-3 L12360-3	Lab Qualifier	URS Qualifier	F-4 L12360-4	Lab Qualifier	URS Qualifier	F-5 L12360-5	Lab Qualifier	URS Qualifier	F-6 L12360-6	Lab Qualifier	URS Qualifier
1		0.121	K	J-EMPC	0.161			66.3	U		0.205			0.246			0.382		
2		0.482			0.409			72.3	U		0.561			0.444			1.22		
3		0.22	K	J-EMPC	0.444	K	J-EMPC	77	U		0.496	K	J-EMPC	0.247			0.665	K	J-EMPC
4		1.03	K	J-EMPC	1.22	K	J-EMPC	336	U		1.01			1.78			2.94		
5		0.151	U		0.148	U		251	U		0.184	U		0.132	U		0.216	U	
6		0.681			0.684			226	U		1.21	K	J-EMPC	0.961			1.75		
7		0.267	K	J-EMPC	0.154	K	J-EMPC	229	U		0.191	K	J-EMPC	0.233			0.469	K	J-EMPC
8		3.47			3.4			209	U		2.78			4.36			8.63		
9		0.233	K	J-EMPC	0.268			225	U		0.744			0.304			0.652	K	J-EMPC
10		0.139	U		0.136	U		230	U		0.169	U		0.121	U		0.206	U	
11		211			191			233	U		90.5			124			450		
12	12 + 13	0.146	C U		0.143	C U		233	C U		1.07	C K	J-EMPC	0.127	C U		0.221	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.139	U		0.135	U		228	U		0.168	U		0.12	U		0.208	U	
15		1.16	K	J-EMPC	1.19			278	U		0.62			0.854			2.93	K	J-EMPC
16		3.94			3.64			130	U		2.63			5.38			11.5		
17		6.55			5.96			189			14.6			14.8			36.3		
18	18 + 30	15.6	C		15.1	C		882	C K	J-EMPC	65.2	C		25.9	C		60.1	C	
19		0.437			0.499	K	J-EMPC	111	U		0.492			1.01			1.76		
20	20 + 28	68	C		60.6	C		2330	C		283	C		122	C		280	C	
21	21 + 33	9.9	C		7.6	C		380	C		20.7	C		14.1	C		40.1	C	
22		9.74			8.99			86.1	U		14.6			13.3			48.1		
23		0.074	K	J-EMPC	0.0497	U		80.7	U		0.418			0.196	U		0.33	U	
24		0.314	K	J-EMPC	0.248			79.9	U		0.29			0.376			0.655		
25		1.53			1.32			69.3	U		5.51			2.62			10.5		
26	26 + 29	7.77	C		6.49	C		211	C K	J-EMPC	31.4	C		12.4	C		38.8	C	
27		1			1.02			79	U		2.75			2.39			7.03		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		29.8			23			850			243			37.4			170		
32		1.61			1.23			75.3	U		4.21			4.08			13.3		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.234	K	J-EMPC	0.21			79.8	U		0.804			0.397			1.02		
35		0.068	K	J-EMPC	0.141			77.7	U		0.325	U		0.198	U		0.343	U	
36		0.0517	U		0.086			74	U		0.882	K	J-EMPC	0.169	U		0.302	U	
37		2.53			3.54			96.5			28.7			9.62			13.9		
38		0.119	K	J-EMPC	0.108			78.9	U		1.99			0.559			0.972		
39		0.315	K	J-EMPC	0.184			76.6	U		8.92			1.95			3.59		
40	40 + 41 + 71	10.6	C		7.53	C		3320	C		322	C		162	C		227	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		7.19			6.24			3610			505			82.5			115		
43		2.21	K	J-EMPC	1.62			2880			54.4			17.3			23.3		
44	44 + 47 + 65	71.3	C		67.5	C		52400	C		5620	C		1120	C		1300	C	
45	45 + 51	2.1	C		1.52	C		313	C K	J-EMPC	5.89	C		11.8	C		20.4	C	
46		0.359			0.385	K	J-EMPC	94.7	U		0.515			2.14			2.66		
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		8.08			6.12			2690			0.25	U		52.9			93.1		
49	49 + 69	56.3	C		53.1	C		35700	C		8730	C		909	C		1090	C	
50	50 + 53	1.05	C		0.876	C K	J-EMPC	1090	C		18.7	C		18.5	C		15.5	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		142			109			165000			29800			3220			3640		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.062	K	J-EMPC	0.0497	U		59.6	U		0.261			0.214	K	J-EMPC	1.38		
55		0.198	U		0.24	U		258	U		4.22	U		1.64	U		1.7	U	
56		7.85			6.63			5290			1340			18.1			217		
57		0.622			0.608	K	J-EMPC	260	U		7.88			1.68			2.88	K	J-EMPC
58		0.405	K	J-EMPC	0.461			262	U		3.85	U		4.39	K	J-EMPC	4.32	K	J-EMPC
59	59 + 62 + 75	6.14	C		5.8	C		1070	C		97.1	C		25.5	C		44.7	C	
60		41.4			63.5			8840			1950			370			357		
61	61 + 70 + 74 + 76	246	C		360	C		131000	C		41600	C		3970	C		5880	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		14.2			31.5			2480			501			199			82.5		
64		29.7			26.5			9120			1710			417			559		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		201			396			73300			16800			3060			1970		
67		1.28			1.39			225	U		10.4			2.07			8.86		
68		2.62			3.22			236	U		12.1			7.68			10.6		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		3.46			3.83			237	U		19.2			9.09			15.4		
73		0.0505	U		0.0497	U		58.2	U		0.192	U		0.178	U		0.124	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		10.8			19.9			443			111			40			48.7		
78		0.494			0.241	U		251	U		47.1			26.2			6.78	K	J-EMPC
79		1.63			1.9			3020			471			71.4			59.4		
80		0.456			0.486	K	J-EMPC	233	U		9.75	K	J-EMPC	3.83			1.57		
81		0.449	K	J-EMPC	0.807	K	J-EMPC	295	U		9.5	U		5.23	U		3.88	U	
82		2.29	K	J-EMPC	1.23	K	J-EMPC	22200			2230			361			227		
83	83 + 99	708	C		1480	C		315000	C		69000	C		33400	C		8610	C	
84		6.44			4.5			29200			1240			588			420		
85	85 + 116 + 117	198	C		365	C		73900	C		18800	C		8850	C		2650	C	
86	86 + 87 + 97 + 108 + 119 + 125	117	C		129	C		196000	C		33500	C		7090	C		5600	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	9.41	C		6.34	C		23900	C		2730	C		566	C		535	C	
89		0.294			0.229	K	J-EMPC	366	U		6.26			31.7			25.4		
90	90 + 101 + 113	302	C		311	C		303000	C		58700	C		12600	C		10000	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		82.8			85.9			49100			9270			1840			1760		
93	93 + 95 + 98 + 100 + 102	96.2	C		75.1	C		113000	C		12100	C		2720	C		2860	C	
94		0.083			0.0908	U		363	U		1.96			4.01			1.48		
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.507	K	J-EMPC	0.3			234	K	J-EMPC	8.61			19			19.6		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		1.35			0.795	K	J-EMPC	954			120			24.4			26.7		
104		0.0505	U		0.0615	U		52.9	U		0.49	U		0.4	U		0.189	U	
105		383			881			269000			38200			21400			5130		
106		1.28	U		2.55	U		325	U		23.9	U		13.5	U		7.53	U	
107	107 + 124	14.5	C		14.6	C		10400	C		2180	C		182	C		465	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		100			283			40600			7130			3890			955		
110	110 + 115	197	C		197	C		247000	C		45700	C		12200	C		9350	C	
111		1.83			5.01			256	U		6.01			4.76			3.22		
112		0.0505	U		0.0639	U		235	U		0.657	U		0.441	U		0.194	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		44.8			162			19900			3510			2890			356		
115	110 + 115		C110			C110			C110			C110			C110			C110	

Table 3a
PCB Congener Analytical Results
Lab Sample ID's L12360-1 through L12360-6
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-1 L12360-1	Lab Qualifier	URS Qualifier	F-2 L12360-2	Lab Qualifier	URS Qualifier	F-3 L12360-3	Lab Qualifier	URS Qualifier	F-4 L12360-4	Lab Qualifier	URS Qualifier	F-5 L12360-5	Lab Qualifier	URS Qualifier	F-6 L12360-6	Lab Qualifier	URS Qualifier
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		1630			6700			757000			111000			86900			19300		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		9.36			26.6			234	U		33.1			32			19.5		
121		0.677			1.11			259	U		1.55			1.54	K	J-EMPC	1.63		
122		1.44	U		2.87	U		4460			257			15.2	U		56		
123		22.9			61			11800			1660			920			268		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		3.21			7.31			405	K	J-EMPC	54			29.1			11.7		
127		4.51			15			1950			283			14	U		31.9		
128	128 + 166	305	C		597	C		60700	C		20800	C		17100	C		2510	C	
129	129 + 138 + 160 + 163	2040	C		4800	C		463000	C		113000	C		91300	C		15100	C	
130		32.6			44.2			23600			3040			774			577		
131		0.63			0.562	U		2350			332			48			38.7		
132		16			9.49			38400			4080			1010			874		
133		37.7			107			4820			912			827			176		
134	134 + 143	5.45	C		3.43	C		10400	C		1330	C		233	C		200	C	
135	135 + 151 + 154	164	C		204	C		31900	C		6240	C		1740	C		1710	C	
136		16.1			12.6			13700			1280			493			453		
137		130			424			57700			12800			14700			979		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	34.3	C		70.6	C		6590	C		2040	C		1530	C		306	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		63.5			74.5			37700			7460			2330			1220		
142		0.206	U		0.561	U		233	U		6.08	U		3.32	U		2.18	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		7.37			5.71			7050			1100			195			191		
145		0.0505	U		0.0497	U		55.1	K	J-EMPC	0.343	U		2.17			1.88		
146		304			845			59200			10500			7890			1840		
147	147 + 149	57.5	C		49.8	C		69800	C		8440	C		1360	C		1480	C	
148		1.07	K	J-EMPC	1.15			91.1	K	J-EMPC	17.2			5.27			7.33		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.094			0.0497	U		61.9	K	J-EMPC	8.6			1.37			1.72		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.377			0.332			49.8	U		10.4			9.62			8.39		
153	153 + 168	2940	C		13600	C		423000	C		105000	C		106000	C		14500	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		2.34	K	J-EMPC	5.11			46.1	U		4.5			5.38			4.76		
156	156 + 157	306	C		1220	C		118000	C		21900	C		25400	C		2020	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		169			380			40500			12800			11400			1450		
159		1.03			1.11	K	J-EMPC	375			31.3			7.48			7.47		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.136	U		0.371	U		158	U		4.01	U		2.19	U		1.47	U	
162		10.8			36.1			2740			426			475			53.8		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		20.8			20.3			15200			2580			618			456		
165		1.73			4.68			177	U		14.5			14.3			1.64	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		97.9			322			30800			5230			3520			766		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		2.46	U		7.04	U		164	U		23.2	U		28.8	U		5.51	U	
170		285			1120			49200			9460			12900			988		
171	171 + 173	103	C		281	C		6420	C		2160	C		2240	C		379	C	
172		37.6			71.5			5030			851			830			134		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		12.7			8.59			8400			687			134			152		
175		5.64			11.3			839			125			63.5			27.8		
176		1.55			0.819			566			64.3			10.7			20.8		
177		40.6			58			8900			851			309			311		
178		81.8			246			4160			659			599			300		
179		26.8			21.3			2220			318			121			220		
180	180 + 193	975	C		7050	C		84000	C		16500	C		26600	C		2040	C	
181		6.76			26.4			1410			311			412			28.4		
182		2.35			3.95			266	K	J-EMPC	48			47.7			7.86		
183	183 + 185	234	C		788	C		16100	C		3520	C		3550	C		721	C	
184		2.66			6.37			48.8	U		12			12			5.82		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0513	U		0.0497	U		53.4	U		0.475	U		0.246	U		0.137	K	J-EMPC
187		451			952			28700			3350			2620			1750		
188		1.06			2.28			53.1	U		6.22			4.29			3.12		
189		12.8			88.1			2480			400			501			43.7		
190		107			421			7060			1640			1990			294		
191		15.9			84.3			2130			337			438			39.8		
192		0.057	U		0.274	K	J-EMPC	56	U		0.528	U		0.273	U		0.124	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		101			422			9210			950			1480			147		
195		60.8			394			3180			371			534			90.2		
196		59.5			445			3890			462			688			86.5		
197	197 + 200	9.52	C		39.6	C		393	C		44.2	C		63.9	C		17.8	C	
198	198 + 199	72.8	C		172	C		7560	C		564	C		449	C		193	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		11.1			30.4			830	K	J-EMPC	65.7			48.2			29.6		
202		53.2			205			1790			226			309			131		
203		128			409			2960			717			1220			232		
204		0.214	K	J-EMPC	0.765			35.6	U		0.801			1.1			0.363		
205		6.94			27.4			265			50.5			67.1			12.7		
206		54.5			147			1650			321			635			75.8		
207		12			57			405			60.6			92.8			12.3		
208		10.7			26.7			631			54.2			54.7			20		
209		28.5			75			282		U	67			85.5			28.5		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3b
PCB Congener Analytical Results
Lab Sample ID's L12360-7 through L12360-12
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-7 L12360-7	Lab Qualifier	URS Qualifier	F-8 L12360-8	Lab Qualifier	URS Qualifier	F-9 L12360-9	Lab Qualifier	URS Qualifier	F-10 L12360-10	Lab Qualifier	URS Qualifier	F-11 L12360-11	Lab Qualifier	URS Qualifier	F-12 L12360-12	Lab Qualifier	URS Qualifier
1		0.234			0.178			0.16	K	J-EMPC	0.251	K	J-EMPC	0.175			0.929		J
2		0.446			0.473			0.535			0.479	K	J-EMPC	0.384			1.14		J
3		0.251	K	J-EMPC	0.265	K	J-EMPC	0.368	K	J-EMPC	0.594	K	J-EMPC	0.236	K	J-EMPC	0.702	K	J-EMPC
4		1.27			1.1			1.36			1.84			1.01			5.26		J
5		0.0876	U		0.112	U		0.172	U		0.134	K	J-EMPC	0.112	U		0.347	K	J-EMPC
6		0.687			0.657			0.161	U		0.125	U		0.518			2.55		J
7		0.146	K	J-EMPC	0.176			0.165	U		0.289			0.114	K	J-EMPC	0.477		J
8		3.26			3.58			3.05			5.69			2.44			12.2		J
9		0.241			0.244			0.237			0.391			0.178	K	J-EMPC	0.946	K	J-EMPC
10		0.089	K	J-EMPC	0.106	U		0.163	U		0.125	U		0.106	U		0.257	K	J-EMPC
11		128			213			152			132			179			332		J
12	12 + 13	0.0896	C U		0.114	C U		0.176	C U		0.125	C U		0.114	C U		0.132	C U	UJ
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.0845	U		0.108	U		0.166	U		0.125	U		0.108	U		0.125	U	UJ
15		0.784			1.51	K	J-EMPC	0.923	K	J-EMPC	1.19			1.16	K	J-EMPC	1.98	K	J-EMPC
16		4.02			4.16			3.47			5.68			2.7			12.7		J
17		7.31			8.49			5.65			9.32			4.84			21.4		J
18	18 + 30	16.5	C		18.8	C		12.6	C		20.5	C		11.9	C		49.6	C	J
19		0.561			0.461			0.534	K	J-EMPC	0.754			0.423			1.89		J
20	20 + 28	89	C		97.6	C		66.2	C		99.7	C		66.3	C		184	C	J
21	21 + 33	11.8	C		13	C		8.45	C		16.7	C		7.27	C		28.3	C	J
22		11.2			13.1			9.07			14.8			7.21			27.8		J
23		0.126			0.0752	U		0.065	K	J-EMPC	0.125	U		0.0815	U		0.184		J
24		0.319			0.299			0.309			0.419			0.214			0.88	K	J-EMPC
25		1.75			1.9			1.31			2.45			1.13			3.53		J
26	26 + 29	9.6	C		10.5	C		6.89	C		11.5	C		6.6	C		18.2	C	J
27		1.04			1.16			0.877			1.4			0.649			3.56		J
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		36.8			40.5			26.7			50.6			22.3			93.8		J
32		1.6			1.81			1.2			2.83			1.1			4.38		J
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.394			0.394	K	J-EMPC	0.28			0.422			0.273			0.63		J
35		0.088	U		0.105	K	J-EMPC	0.107	K	J-EMPC	0.239			0.0847	U		0.179	U	UJ
36		0.0775	U		0.0689	U		0.051	K	J-EMPC	0.138			0.0746	U		0.157	U	UJ
37		2.29			11.4			2.55			3.23			3.24			3.7		J
38		0.17	K	J-EMPC	0.151			0.125	K	J-EMPC	0.235	K	J-EMPC	0.108	K	J-EMPC	0.407	K	J-EMPC
39		0.464			0.454			0.364			0.653	K	J-EMPC	0.244			1.21		J
40	40 + 41 + 71	17.5	C		16.8	C		10.7	C		24.3	C		7.51	C		43.3	C	J
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		14.3			12.4			9.84			15.5			5.21			42.9		J
43		3.47			3.43			1.97			4.51			2.04	K	J-EMPC	8.19		J
44	44 + 47 + 65	118	C		119	C		69	C		138	C		65.9	C		307	C	J
45	45 + 51	2.74	C		2.59	C		2	C		4.74	C		1.32	C		8.77	C	J
46		0.55			0.413	K	J-EMPC	0.489			0.836			0.3	K	J-EMPC	1.71		J
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		15.1			13.7			0.0623	U		0.125	U		6.24			40.9		J
49	49 + 69	105	C		105	C		62.2	C		128	C		57.5	C		208	C	J
50	50 + 53	1.4	C		1.22	C		1.25	C		2.31	C		0.829	C		6.12	C	J
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		231			234			122			310			123			564		J
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.087	K	J-EMPC	0.075	K	J-EMPC	0.0527	U		0.125	U		0.057			0.125	U	UJ
55		0.236	U		0.396	U		0.262	U		0.361	U		0.341	U		0.745	U	J
56		11.2			11.6			8.27			15.7			5.84			37.9		J
57		1.12			1.48			0.775	K	J-EMPC	1.39			0.728			2.22		J
58		0.96			0.589			0.45			1.47			0.525			2.0	K	J-EMPC
59	59 + 62 + 75	10.5	C		10.1	C		5.95	C		12.8	C		5.67	C		26.4	C	J
60		68.6			77.2			46			70.9			54.5			154		J
61	61 + 70 + 74 + 76	402	C		505	C		259	C		514	C		307	C		940	C	J
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		19.2			31			14.4			16.6			22.1			33.5		J
64		58.4			54.8			37.4			73.9			27.7			0.125	U	UJ
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		330			458			227			318			319			633		J
67		2.17			2.52			1.52			2.71			1.23			4.86		J
68		3.55			4.22			2.92			3.66			3.36			7.33		J
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		5.47			5.89			3.24			5.8			3.92			9.79		J
73		0.05	U		0.0501	U		0.0497	U		0.125	U		0.0498	U		0.125	U	UJ
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		12.8			29.8			11.4			14.3			14.2			29.2		J
78		0.905	K	J-EMPC	0.831			0.621			0.349	U		0.92			1.44		J
79		2.87			2.68			1.76			3.91			1.59			10.9		J
80		0.315	K	J-EMPC	0.441	K	J-EMPC	0.298	K	J-EMPC	0.306	U		0.385			0.717		J
81		0.553	U		1.45			0.382	K	J-EMPC	0.524	U		0.71	K	J-EMPC	0.818	U	UJ
82		4.11	K	J-EMPC	3.48			3.07			6.08			2.22	K	J-EMPC	16.8		J
83	83 + 99	1020	C		1210	C		524	C		1060	C		877	C		1880	C	J
84		11			9.27			7.46			18.2			4.05			56.4		J
85	85 + 116 + 117	280	C		347	C		154	C		316	C		234	C		608	C	J
86	86 + 87 + 97 + 108 + 119 + 125	241	C		227	C		133	C		342	C		110	C		733	C	J
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	J
88	88 + 91	19.8	C		17.2	C		11.4	C		30.9	C		6.16	C		90.2	C	J
89		0.75			0.638			0.47	K	J-EMPC	1.14			0.208	U		1.93	K	J-EMPC
90	90 + 101 + 113	730	C		661	C		375	C		920	C		291	C		2080	C	J
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		166			169			76.4			203			74.4			469		J
93	93 + 95 + 98 + 100 + 102	180	C		180	C		88.8	C		240	C		76.6	C		520	C	J
94		0.232	U		0.214	U		0.262	U		0.224			0.214	U		0.449		J
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.928			0.804			0.448	K	J-EMPC	1.25			0.361	K	J-EMPC	2.09		J
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		3.09			2.5			1.54			3.67			0.943			7.22		J
104		0.103	U		0.103	U		0.113	U		0.137	U		0.106	U		0.141	U	UJ
105		600			752			325			652			527			1210		J
106		1.73	U		1.97	U		1.18	U		1.6	U		1.74	U		3.09	U	UJ
107	107 + 124	25.9	C		33.6	C		16.7	C		43.3	C		17.7	C		63.8	C	J
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		159			187			107			143			171			320		J
110	110 + 115	462	C		430	C		263	C		649	C		172	C		1720	C	J
111		2.87			3.04			1.87			2.16			3.1			4.08		J
112		0.159	U		0.146	U		0.179	U		0.144	U		0.147	U		0.219	U	UJ
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		55.3			73.4			32.7			47.8			68.2			63.8		J
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 3b
PCB Congener Analytical Results
Lab Sample ID's L12360-7 through L12360-12
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-7 L12360-7	Lab Qualifier	URS Qualifier	F-8 L12360-8	Lab Qualifier	URS Qualifier	F-9 L12360-9	Lab Qualifier	URS Qualifier	F-10 L12360-10	Lab Qualifier	URS Qualifier	F-11 L12360-11	Lab Qualifier	URS Qualifier	F-12 L12360-12	Lab Qualifier	URS Qualifier
118		2430			3000			1360			2090			2880			3840		J
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		14.7			16.2			8.97			11			16.8			22.6		J
121		1.17			1.09			0.633			1.08			0.789			2.38		J
122		1.94	U		2.2	U		1.32	U		1.79	U		1.95	U		3.46	U	UJ
123		32.6			37.6			21.4			24.1			39.4			30.3		J
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		4.35			5.97			3.21			4.2			5.5			10.2		J
127		3.82			6			2.78			4.89			5.91			3.17	U	UJ
128	128 + 166	392	C		500	C		207	C		476	C		347	C		834	C	J
129	129 + 138 + 160 + 163	3090	C		3700	C		1550	C		3270	C		2960	C		5390	C	J
130		72.7			65.2			43.8			78.9			37.5			183		J
131		1.67			1.45			1.03			2.26			0.492	U		2.39	U	UJ
132		33.7			31.4			19.6			60.4			8.62			237		J
133		61.3			70.4			34.8			56.5			61.3			117		J
134	134 + 143	14.4	C		11.6	C		7.45	C		20.4	C		3.34	C		59.8	C	J
135	135 + 151 + 154	320	C		307	C		144	C		356	C		138	C		1030	C	J
136		34.9			32.9			16.6			45.3			12.2			129		J
137		138			180			73.3			140			163			59.6		J
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	46.3	C		56.8	C		22.3	C		56.3	C		40.1	C		62.6	C	J
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		115			130			53.5			161			65.4			123		J
142		0.37	U		0.424	U		0.33	U		0.52	U		0.501	U		2.44	U	UJ
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		16.8			14.2			8.62			22.3			5.07			31.2		J
145		0.101	U		0.0808	U		0.0954	U		0.125	U		0.0685	U		0.125	U	UJ
146		525			570			310			420			538			935		J
147	147 + 149	109	C		105	C		65.2	C		158	C		40.9	C		808	C	J
148		2.23			1.86			1.11			2.52			0.727			8.49		J
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.202			0.152	K	J-EMPC	0.09	U		0.273			0.0647	U		1.14		J
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.598			0.0745	U		0.341			0.808			0.305			1.94		J
153	153 + 168	4650	C		5270	C		2190	C		3950	C		6260	C		5280	C	J
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		3.62			4.12			1.77			3.97			3.47			6.51		J
156	156 + 157	340	C		428	C		179	C		337	C		414	C		283	C	J
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		233			293			106			284			205			186		J
159		1.63			1.64			0.922			1.93			0.778	K	J-EMPC	3.66		J
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.25	U		0.286	U		0.223	U		0.351	U		0.338	U		1.65	U	UJ
162		14.7			18.9			8.77			14.1			17.7			18.1		J
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		41.5			43.3			20.9			58.6			18.8			160		J
165		2.7			3.12			1.72			2.31			2.83			3.77	K	J-EMPC
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		116			140			71.6			93.5			165			131		J
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		3.65			3.63	U		2.18	U		3.22	U		4.79	U		4.05	U	UJ
170		328			388			175			373			478			218		J
171	171 + 173	152	C		177	C		77.6	C		188	C		159	C		127	C	J
172		49.9			57.4			27.5			52.7			64.3			42.1		J
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		21			19.4			12			32.3			7.51			70.8		J
175		9.72			9.21			5.65			9.54			8.02			10.6		J
176		3.09			2.74			1.73			5.13			0.614	K	J-EMPC	13.6		J
177		85.4			72.4			57.1			91.3			45.5			414		J
178		159			168			87.7			147			133			386		J
179		67.1			53.3			34.3			82.8			17.5			333		J
180	180 + 193	1290	C		1460	C		693	C		1150	C		2270	C		744	C	J
181		8.39			10			4.24			8.19			9.88			6.22		J
182		3			3.49			1.73	K	J-EMPC	3.59			2.68			3.09		J
183	183 + 185	347	C		384	C		172	C		379	C		398	C		309	C	J
184		4.22			4.81			2.2			5.12			4.13			5.36		J
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.05	U		0.0574	U		0.0507	U		0.125	U		0.0498	U		0.125	U	UJ
187		705			643			468			526			654			2230		J
188		1.83			1.76			1.34			1.47			1.75			5.34		J
189		13.5			15.7			8.13			13.6			20.9			9.62		J
190		172			202			83			170			242			161		J
191		19.9			24.2			10.3			21.1			33.3			11.1		J
192		0.0542	U		0.0647	U		0.0571	U		0.175	K	J-EMPC	0.101	K	J-EMPC	0.125	U	UJ
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		124			130			69.5			118			190			65.9		J
195		84.9			92			44.6			83			123			67.9		J
196		68.4			77.7			40.9			71.8			120			40.7		J
197	197 + 200	14.1	C		15.1	C		7.56	C		16.7	C		18.3	C		10.3	C	J
198	198 + 199	115	C		108	C		73.7	C		91.8	C		110	C		155	C	J
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		19.6			17.6			13			15.5			18.5			20.7		J
202		106			113			57.8			104			93.2			199		J
203		213			227			102			217			288			142		J
204		0.407			0.42			0.214			0.374	K	J-EMPC	0.476			0.229		J
205		11.2			11.6			5.74			10.7			14.3			5.73		J
206		73.4			74.9			40.7			66.6			73.4			34.8		J
207		14.5			15.6			8.48			14.6			18.3			7.46		J
208		17.4			16.3			10.9			13.9			14.4			14.8		J
209		37.1			39.3			20.9			29.6			34.9			15.9		J

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3c
PCB Congener Analytical Results
Lab Sample ID's L12360-13 through L12360-17

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-13 L12360-13	Lab Qualifier	URS Qualifier	F-14 L12360-14	Lab Qualifier	URS Qualifier	F-15 L12360-15	Lab Qualifier	URS Qualifier	F-16 L12360-16	Lab Qualifier	URS Qualifier	F-17 L 12360-17	Lab Qualifier	URS Qualifier
1		0.54	K	J-EMPC	0.16			1.94			0.218	K	J-EMPC	0.266	K	J-EMPC
2		0.664		J	0.376			2.04			0.411			0.454		
3		2.45	K	J-EMPC	0.221	K	J-EMPC	20.9	K	J-EMPC	0.461	K	J-EMPC	0.595	K	J-EMPC
4		2.43		J	1.32			0.989	K	J-EMPC	1.27			1.7		
5		0.157	U	UJ	0.096			0.273	U	UJ	0.087	K	J-EMPC	0.233	U	
6		1.21		J	0.748			0.379	K	J-EMPC	0.637			1.34		
7		0.289	K	J-EMPC	0.202	K	J-EMPC	0.651		J	0.187			0.254		
8		4.86		J	3.44			1.92		J	2.84			6.59		
9		0.547		J	0.286	K	J-EMPC	0.975	K	J-EMPC	0.221	K	J-EMPC	0.435		
10		0.15	U	UJ	0.083	K	J-EMPC	0.241	U	UJ	0.076			0.206	U	
11		114		J	127			138	K	J-EMPC	134			133		
12	12 + 13	0.924	C K	J-EMPC	0.0822	C U		0.269	C U	UJ	0.0759	C U		0.23	C U	
13	12 + 13		C12			C12			C12			C12			C12	
14		0.152	U	UJ	0.0769	U		0.252	U	UJ	0.071	U		0.215	U	
15		0.731		J	0.975	K	J-EMPC	1.41			0.779			1.15		
16		4.24		J	3.92			0.937			3.27			6.22		
17		5.96		J	11.2			1.84			5.58			13.7		
18	18 + 30	15.2	C	J	22.5	C		4.69	C		15.3	C		29.9	C	
19		0.735		J	0.456	K	J-EMPC	0.272	K	J-EMPC	0.475			0.621		
20	20 + 28	66.4	C	J	106	C		44.9	C		78.9	C		226	C	
21	21 + 33	6.95	C	J	13.3	C		3.29	C		7.6	C		26.2	C	
22		6.41		J	14.5			3.51			8.85			23.2		
23		0.141	U	UJ	0.106	K	J-EMPC	0.132	U		0.117	K	J-EMPC	0.203	U	
24		0.263	K	J-EMPC	0.352	K	J-EMPC	0.132	U		0.243			0.529	K	J-EMPC
25		0.866		J	2.06			0.576			1.35			3.63		
26	26 + 29	6.67	C	J	11.7	C		3.79	C		8.35	C		18.8	C	
27		1.03		J	1.33			0.291	K	J-EMPC	0.954			1.91		
28	20 + 28		C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18	
31		35.4		J	44.5			15.2			32.2			88.9		
32		1.79		J	1.85			0.452	K	J-EMPC	1.35			7.15		
33	21 + 33		C21			C21			C21			C21			C21	
34		0.153	K	J-EMPC	0.383			0.132	U		0.256			0.467		
35		0.141	U	UJ	0.114	K	J-EMPC	0.132	U		0.0929	U		0.219	U	
36		0.141	U	UJ	0.0776	U		0.132	U		0.08	U		0.188	U	
37		0.874		J	2.34			0.716			2.51			4.1		
38		0.141	U	UJ	0.223			0.132	U		0.134	K	J-EMPC	0.342	K	J-EMPC
39		0.158	K	J-EMPC	0.663	K	J-EMPC	0.132	U		0.35			0.821		
40	40 + 41 + 71	7.86	C	J	17.2	C		2.61	C		8.07	C		35.9	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40	
42		5.17		J	18			1.72			10.9			25.4		
43		1.55		J	0.245			0.88	K	J-EMPC	2.91			6.71		
44	44 + 47 + 65	66.9	C	J	154	C		57.4	C		102	C		279	C	
45	45 + 51	1.8	C	J	2.51	C		1.21	C		2	C		4.69	C	
46		0.493	K	J-EMPC	0.367	K	J-EMPC	0.132	U		0.395	K	J-EMPC	0.619	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44	
48		6.69		J	19.4			2.37			9.48			24.9		
49	49 + 69	58.7	C	J	136	C		29.1	C		82	C		221	C	
50	50 + 53	1.27	C	J	1.03	C		0.223	C		0.972	C		2.17	C	
51	45 + 51		C45			C45			C45			C45			C45	
52		151		J	277			61.8			165			361		
53	50 + 53		C50			C50			C50			C50			C50	
54		0.141	U	UJ	0.081	K	J-EMPC	0.132	U		0.076	K	J-EMPC	0.108	K	J-EMPC
55		0.24	U	UJ	0.819	U		0.336	U		0.349	U		1.18	U	
56		5.32		J	9.89			1.47			6.5			22.3		
57		0.564		J	1.3			0.409			1.1			2.27		
58		0.285		J	0.734	U		0.301	U		0.509			1.06	U	
59	59 + 62 + 75	6.09	C	J	13	C		3.84	C		8.31	C		22.2	C	
60		43.9		J	108			51.1			59.4			249		
61	61 + 70 + 74 + 76	255	C	J	585	C		257	C		477	C		1090	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59	
63		10.4		J	28.2			12.9			29.4			49.5		
64		0.141	U	UJ	68			14.2			42.5			114		
65	44 + 47 + 65		C44			C44			C44			C44			C44	
66		188		J	517			266			383			982		
67		0.612		J	2.45			0.479			1.44	K	J-EMPC	3.52		
68		2.22		J	4.44			2.11			6.21			5		
69	49 + 69		C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40	
72		3.2		J	6.62			2.81			4.89			8.77		
73		0.141	U	UJ	0.0499	U		0.132	U		0.0501	U		0.1	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61	
77		4.31		J	15.3			4.64			18.7			15.4		
78		0.365		J	1.21			0.505	K	J-EMPC	1.32			1.63	K	J-EMPC
79		1.26		J	3.25			0.664			1.91			4.36		
80		0.238	K	J-EMPC	0.682	U		0.28	U		0.46	K	J-EMPC	1.92	K	J-EMPC
81		0.225	U	UJ	0.756	U		0.278	U		0.846	K	J-EMPC	1.11	U	
82		2.64	K	J-EMPC	2.98			0.629	K	J-EMPC	2.73			11.6		
83	83 + 99	502	C	J	1710	C		913	C		878	C		2490	C	
84		6.5		J	8.94			1.27	K	J-EMPC	6.94			21.6		
85	85 + 116 + 117	157	C	J	454	C		158	C		252	C		708	C	
86	86 + 87 + 97 + 108 + 119 + 125	119	C	J	288	C		58.4	C		151	C		447	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
88	88 + 91	7.34	C	J	18.9	C		2.27	C		11.2	C		33.3	C	
89		0.21	K	J-EMPC	0.642			0.209	U		0.382			0.967		
90	90 + 101 + 113	342	C	J	953	C		161	C		485	C		1020	C	
91	88 + 91		C88			C88			C88			C88			C88	
92		99.1		J	228			55			109			251		
93	93 + 95 + 98 + 100 + 102	100	C	J	207	C		46.7	C		114	C		246	C	
94		0.197	U	UJ	0.0839	U		0.214	U		0.138	U		0.286	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
96		0.342	K	J-EMPC	0.836			0.15	U		0.572			1.19		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93	
103		1.43		J	3.07			0.43	K	J-EMPC	2.05			4.13		
104		0.145	U	UJ	0.0743	U		0.211	U		0.0719	U		0.167	U	
105		303		J	997			549			530			1570		
106		0.9	U	UJ	2.63	U		1.58	U		3.47	U		3.9	U	
107	107 + 124	13	C	J	35.7	C		8.36	C		17.6	C		37.5	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
109		72.4		J	221			98.3			393			270		
110	110 + 115	191	C	J	551	C		97.2	C		289	C		756	C	
111		1.2		J	3.71			3.25			3.81			4.41		
112		0.141	U	UJ	0.0586	U		0.15	U		0.0964	U		0.2	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90	
114		21.2		J	81.8			48.8			239			128		
115	110 + 115		C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85	

Table 3c
PCB Congener Analytical Results
Lab Sample ID's L12360-13 through L12360-17

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	F-13 L12360-13	Lab Qualifier	URS Qualifier	F-14 L12360-14	Lab Qualifier	URS Qualifier	F-15 L12360-15	Lab Qualifier	URS Qualifier	F-16 L12360-16	Lab Qualifier	URS Qualifier	F-17 L 12360-17	Lab Qualifier	URS Qualifier
118		870		J	3750			1860			7340			4800		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
120		6.4	K	J-EMPC	22			8.18			19.8			18.5		
121		0.897		J	1.87			0.669	K	J-EMPC	1.15			2.29		
122		1.01	U	UJ	2.99	U		1.8	U		3.94	U		4.42	U	
123		12.8	K	J-EMPC	48.7			19.6			160			56.6		
124	107 + 124		C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86	
126		2.39		J	6.32			2.9			7.26			5.96		
127		1.62		J	5.7			3.59			20.6			10.7		
128	128 + 166	190	C	J	670	C		401	C		335	C		877	C	
129	129 + 138 + 160 + 163	1380	C	J	5510	C		3010	C		3230	C		5830	C	
130		30.9		J	98.3			19.7			65.4			103		
131		0.754	K	J-EMPC	1.69	K	J-EMPC	0.507	U		0.997			3		
132		16.8		J	32.1			2.82			18.5			66.6		
133		27.1		J	100			60.4			73.6			91.2		
134	134 + 143	5.18	C	J	14.3	C		1.24	C		6.6	C		17.2	C	
135	135 + 151 + 154	180	C	J	488	C		114	C		211	C		407	C	
136		0.141	U	UJ	42.9			5.9			20.7			46.2		
137		47.2		J	180			95			602			366		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
139	139 + 140	22.3	C	J	78.3	C		22.9	C		31.3	C		95.7	C	
140	139 + 140		C139			C139			C139			C139			C139	
141		66.6		J	148			47.9			81.5			266		
142		0.555	U	UJ	0.722	U		0.506	U		0.633	U		1.04	U	
143	134 + 143		C134			C134			C134			C134			C134	
144		8.04		J	21.1			2.3			10.4			25.6		
145		0.141	U	UJ	0.061	K	J-EMPC	0.132	U		0.0703	U		0.161	U	
146		216		J	840			547			977			721		
147	147 + 149	53.4	C	J	128	C		17.8	C		82.6	C		196	C	
148		1.32		J	3.54			0.597			1.89			3.14		
149	147 + 149		C147			C147			C147			C147			C147	
150		0.141	U	UJ	0.126	K	J-EMPC	0.132	U		0.0655	U		0.301	K	J-EMPC
151	135 + 151 + 154		C135			C135			C135			C135			C135	
152		0.141	U	UJ	0.852			0.132	U		0.449			0.651	K	J-EMPC
153	153 + 168	1480	C	J	7790	C		4780	C		8030	C		6930	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135	
155		1.98		J	6.24			1.76			3.29			6.24		
156	156 + 157	123	C	J	485	C		381	C		1550	C		759	C	
157	156 + 157		C156			C156			C156			C156			C156	
158		90.3		J	414			183			150			552		
159		0.799		J	1.34			0.556	K	J-EMPC	1.14	K	J-EMPC	2.38	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
161		0.375	U	UJ	0.504	U		0.353	U		0.442	U		0.724	U	
162		6.02		J	20.6			13.4			37.4			28.5		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129	
164		25.1		J	52.9			12.3			27			73.1		
165		1.3		J	4.53			4.52			3.88			3.85	K	J-EMPC
166	128 + 166		C128			C128			C128			C128			C128	
167		43.2		J	179			87.5			671			193		
168	153 + 168		C153			C153			C153			C153			C153	
169		1.45	U	UJ	5.62	U		3.69	U		4.16	U		3.7	U	
170		148		J	411			526			392			641		
171	171 + 173	67.6	C	J	271	C		130	C		112	C		227	C	
172		27.5		J	64			81.2			44.5			102		
173	171 + 173		C171			C171			C171			C171			C171	
174		12.8		J	17.9			3.01			12.9			32.7		
175		5.47		J	15.2			5.04			11.3			14.8		
176		1.61		J	3.85			0.132	U		1.73			4.77		
177		38.4		J	110			19.2			78.6			93.9		
178		79.7		J	292			128			170			200		
179		35.1		J	91.6			10.2			36.5			61		
180	180 + 193	448	C	J	1650	C		1620	C		2710	C		1860	C	
181		3.13		J	11.3			5.02			20.4			13.8		
182		2.19		J	5.01			2.22	K	J-EMPC	3.02			6.29		
183	183 + 185	175	C	J	595	C		319	C		360	C		520	C	
184		1.86		J	7.7			1.58			3.24			5.89		
185	183 + 185		C183			C183			C183			C183			C183	
186		0.141	U	UJ	0.057	U		0.132	U		0.0592	U		0.109	U	
187		306		J	1100			710			1350			720		
188		0.88	K	J-EMPC	2.9			0.692			2.99			2.25		
189		5.86		J	15.8			20.5			41.3			24.8		
190		67		J	246			169			193			191		
191		8.32		J	28.3			20.2			29.8			32.2		
192		0.141	U	UJ	0.225			0.132	U		0.184	K	J-EMPC	0.141	K	J-EMPC
193	180 + 193		C180			C180			C180			C180			C180	
194		62.3		J	116			179			155			204		
195		31.1		J	109			85.5			98.3			98.1		
196		42.7		J	86.9			68.2			121			109		
197	197 + 200	6.51	C	J	20.7	C		12.1	C		12.8	C		16.2	C	
198	198 + 199	87.9	C	J	136	C		166	C		166	C		169	C	
199	198 + 199		C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197	
201		10.3		J	32.6			9.75			33.9			20.8		
202		49.4		J	193			49.4			100			122		
203		112		J	288			208			185			268		
204		0.225		J	0.483			0.276			0.319	K	J-EMPC	0.696		
205		4.88		J	14.8			12			9.79			13.1		
206		46.3		J	82.3			68.2			58.2			102		
207		13.2		J	18.3			12			24.1			18.4		
208		15.6		J	22.4			12			20.3			20.9		
209		22.4		J	41.9			22.8			34.8			31.6		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3d
PCB Congener Analytical Results
Lab Sample ID's L12360-18 through L12360-23

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-1 L12360-18	Lab Qualifier	URS Qualifier	R-2 L12360-19	Lab Qualifier	URS Qualifier	R-3 L12360-20	Lab Qualifier	URS Qualifier	R-4 L12360-21	Lab Qualifier	URS Qualifier	R-5 L12360-22	Lab Qualifier	URS Qualifier	R-6 L12360-23	Lab Qualifier	URS Qualifier
1		0.165			0.19	K	J-EMPC	0.179	K	J-EMPC	0.213			0.323	K	J-EMPC	0.433		
2		0.407	K	J-EMPC	0.44	K	J-EMPC	0.235			0.413	K	J-EMPC	0.611			0.656	K	J-EMPC
3		0.275			0.241	K	J-EMPC	0.218	K	J-EMPC	0.212	K	J-EMPC	0.353			0.458	K	J-EMPC
4		1.24			1.41			1.26			2.03	K	J-EMPC	3.18	K	J-EMPC	1.81		
5		0.275	U		0.25	U		0.192	U		0.198	U		0.242	K	J-EMPC	0.423	U	
6		0.641			0.913			0.573			1.03			1.98			1.05		
7		0.253	U		0.231	U		0.177	U		0.233	K	J-EMPC	0.419	K	J-EMPC	0.402	K	J-EMPC
8		3.15			4.41			2.6			0.172	U		8.86			5.25		
9		0.244	U		0.305	K	J-EMPC	0.201	K	J-EMPC	0.334			0.639			0.45	K	J-EMPC
10		0.257	U		0.234	U		0.179	U		0.184	U		0.198	K	J-EMPC	0.393	U	
11		143			149			119			140			215			112		
12	12 + 13	0.257	C U		0.234	C U		0.179	C U		0.19	C U		0.182	C U		0.405	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.246	U		0.224	U		0.171	U		0.185	U		0.177	U		0.395	U	
15		1.03			1.25			0.587	K	J-EMPC	0.903			2.3			0.976		
16		3.55			5.85			2.64			4.06			12			4.91		
17		6.49			9.45			4.21			7.34			21			6.38		
18	18 + 30	14.3	C		21.8	C		9.94	C		17.9	C		44.9	C		16	C	
19		0.429	K	J-EMPC	0.741			0.392	K	J-EMPC	0.633			1.56			0.916		
20	20 + 28	91.5	C		99.4	C		57	C		112	C		166	C		68.5	C	
21	21 + 33	12.5	C		15.2	C		5.84	C		15.1	C		29.9	C		9.51	C	
22		12.6			15.1			6.81			16.2			31.3			7.54		
23		0.133	U		0.0906	U		0.118	U		0.109			0.239			0.246	U	
24		0.239			0.315			0.183	K	J-EMPC	0.277			0.532	K	J-EMPC	0.337		
25		2.01			2.3			1			2.9			3.96			1.03		
26	26 + 29	9.87	C		12.1	C		6.1	C		12.8	C		19.9	C		6.79	C	
27		0.802			1.62			0.658	K	J-EMPC	1.23			3.23			1.09		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		46.4			39.6			21			57.7			74.1			33.2		
32		1.36			2.85			1.08			1.89			5.54			2.18		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.314			0.394	K	J-EMPC	0.165	K	J-EMPC	0.407			0.722			0.266	K	J-EMPC
35		0.133	U		0.198	K	J-EMPC	0.118	U		0.137	K	J-EMPC	0.288			0.253	U	
36		0.114	U		0.16	K	J-EMPC	0.102	U		0.0852	U		0.138			0.21	U	
37		2.85			4.47			2.27			2.06			7.28			0.674		
38		0.123	U		0.171	K	J-EMPC	0.109	U		0.0926	U		0.276			0.228	U	
39		0.483			0.606	K	J-EMPC	0.108	U		0.0937	U		1.22	K	J-EMPC	0.245	K	J-EMPC
40	40 + 41 + 71	14.8	C		24.4	C		7.61	C		19.5	C		7.73	C		12.7	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		11			19.4			10.9			15.2			40.8			7.92		
43		3.37	K	J-EMPC	5.15			2.22			4.15			7.29			2.78		
44	44 + 47 + 65	112	C		156	C		103	C		126	C		257	C		82.8	C	
45	45 + 51	2.33	C		4.43	C		1.34	C		2.95	C		6.83	C		2.84	C	
46		0.38	K	J-EMPC	0.709			0.124			0.434	K	J-EMPC	1.85			0.792	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		12.1			18.5			8.93			16			35.7			9.05		
49	49 + 69	103	C		121	C		86.1	C		123	C		183	C		67.3	C	
50	50 + 53	0.952	C		2.48	C		0.784	C		1.88	C		6.32	C		2.41	C	
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		216			284			175			256			424			161		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0903	U		0.083	K	J-EMPC	0.0588	U		0.0597	U		0.182			0.141	U	
55		0.334	U		0.481	U		0.475	U		0.311	U		0.362	U		0.75	U	
56		12.4			18.8			5.48	K	J-EMPC	18.6			39.5			7.33		
57		1			1.02			0.803	K	J-EMPC	1.08			1.43			0.811		
58		1.06			0.717	K	J-EMPC	0.502	K	J-EMPC	1.12			1.33	K	J-EMPC	0.725	U	
59	59 + 62 + 75	9.92	C		13.2	C		8.7	C		12.1	C		21.4	C		7.98	C	
60		69			82.1			78.7			67.4			130			52.6		
61	61 + 70 + 74 + 76	415	C		420	C		366	C		463	C		680	C		282	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		15.1			19.5			22.5			17			28			12		
64		55.3			64			41			70.2			116			38.8		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		313			387			409			310			579			215		
67		2.43			2.81			1.73			3.48			4.59			0.972	K	J-EMPC
68		3.3			2.53			2.37			3.89			4.18			2.11		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		5.64			5.95			5.39			6.15			8.38			3.93		
73		0.0823	U		0.0706	U		0.0604	U		0.0582	U		0.0484	U		0.138	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		11.4			12.9			10.7			13.8			21.7			5.19		
78		0.318	U		0.458	U		0.452	U		0.3	U		0.349	U		0.724	U	
79		2.03			3.24			2.19			2.74			6.22			1.42		
80		0.39	K	J-EMPC	0.421	U		0.576			0.374	K	J-EMPC	0.542	K	J-EMPC	0.649	U	
81		0.938	K	J-EMPC	1.4	K	J-EMPC	1.36	K	J-EMPC	0.689	K	J-EMPC	1.98	K	J-EMPC	0.711	U	
82		4.1			6.24			1.61			9.57			15.7			4.3		
83	83 + 99	868	C		1200	C		1730	C		817	C		1930	C		632	C	
84		11.2			16.7			4.57			22.4			40.3			11		
85	85 + 116 + 117	266	C		324	C		445	C		239	C		522	C		192	C	
86	86 + 87 + 97 + 108 + 119 + 125	212	C		263	C		233	C		274	C		496	C		145	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	18	C		23.3	C		9.67	C		29	C		52.6	C		12.1	C	
89		0.483			0.984	K	J-EMPC	0.203			0.674			1.83			0.461	K	J-EMPC
90	90 + 101 + 113	632	C		758	C		775	C		758	C		1270	C		412	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		161			203			213			188			305			127		
93	93 + 95 + 98 + 100 + 102	172	C		204	C		149	C		204	C		347	C		134	C	
94		0.113	U		0.209	U		0.186	U		0.225	K	J-EMPC	0.42			0.221	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.734			1.04			0.497			0.758			1.71			0.569		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		2.53			2.99			2.07			4.04			4.47			1.49	K	J-EMPC
104		0.0591	U		0.0624	U		0.0757	U		0.0619	U		0.136	K	J-EMPC	0.119	U	
105		505			685			972			455			1040			358		
106		1.27	U		2.1	U		2.11	U		1.27	U		2.23	U		0.903	U	
107	107 + 124	29.4	C		25.9	C		23.7	C		32.9	C		41.6	C		13.6	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		123			159			261			104			214			80.7		
110	110 + 115	458	C		498	C		390	C		568	C		1030	C		289	C	
111		1.88			2.7			4.18			1.7	K	J-EMPC	3.81			1.39	K	J-EMPC
112		0.0723	U		0.134	U		0.119	U		0.118	U		0.106	U		0.142	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		32			47.1			82.1			27.2			71.6			25		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 3d
PCB Congener Analytical Results
Lab Sample ID's L12360-18 through L12360-23
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-1 L12360-18	Lab Qualifier	URS Qualifier	R-2 L12360-19	Lab Qualifier	URS Qualifier	R-3 L12360-20	Lab Qualifier	URS Qualifier	R-4 L12360-21	Lab Qualifier	URS Qualifier	R-5 L12360-22	Lab Qualifier	URS Qualifier	R-6 L12360-23	Lab Qualifier	URS Qualifier
118		1540			2180			3870			1270			3490			1050		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		10.2			14.1			24.1			8.82			21.2			7.27		
121		0.984			1.68			0.133	U		0.985			1.95			0.878		
122		2.19	K	J-EMPC	2.24	U		2.25	U		2.92			3.59	K	J-EMPC	0.993	U	
123		20.2			25.8			44.5			21.4			45.3			15.3		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		3.06			3.64			4.62			2.54			5.89			2.72		
127		1.3	U		2.16	U		7.38			2.86			7.33			2.47		
128	128 + 166	361	C		450	C		803	C		319	C		840	C		271	C	
129	129 + 138 + 160 + 163	2440	C		3310	C		6350	C		2110	C		5890	C		1820	C	
130		54.1			56.5			76.2			79.7			124			45.5		
131		1.51			1.33	K	J-EMPC	0.47	U		3.1			3.26	K	J-EMPC	1.08		
132		40			48.5			13.8			72.1			122			25.7		
133		45.1			66.5			123			40.6			97.1			34.4		
134	134 + 143	11.1	C		13.2	C		7.32	C		19.1	C		29.3	C		7.86	C	
135	135 + 151 + 154	310	C		398	C		531	C		354	C		623	C		243	C	
136		32.9			40.7			29.8			43.1			73.6			24		
137		76.5			94.4			179			62.4			172			57.8		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	39.1	C		52.4	C		91.9	C		35.6	C		88.2	C		28.3	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		108			124			138			110			197			78.2		
142		0.274	U		0.543	U		0.458	U		0.209	U		2.05	U		0.379	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		15			17.6			15.7			24			32			10.7		
145		0.0554	U		0.092			0.0663	U		0.0653	U		0.097	K	J-EMPC	0.119	U	
146		352			470			922			353			722			280		
147	147 + 149	131	C		149	C		81.2	C		186	C		330	C		76.6	C	
148		2.23			2.72			3.3			2.86			4.08			2		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.251	K	J-EMPC	0.171	K	J-EMPC	0.0639	U		0.469			0.509			0.119	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.597			0.783	K	J-EMPC	0.735	K	J-EMPC	0.555			1.24			0.472	K	J-EMPC
153	153 + 168	2900	C		4190	C		9000	C		2290	C		7430	C		1950	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		2.55			3.9			7.09			2.47	K	J-EMPC	6.49			2.12		
156	156 + 157	183	C		239	C		464	C		148	C		438	C		140	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		195			268			504			173			482			148		
159		1.7	K	J-EMPC	1.84			0.324	U		2.21			3.48	K	J-EMPC	1.63	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.183	U		0.362	U		0.305	U		0.144	U		1.41	U		0.262	U	
162		9.42			12.1			27.8			7.82			19.7			6.76		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		41			42.3			35.8			49.1			87.1			31.1		
165		1.64			2.65			4.47			1.58	K	J-EMPC	3.99			1.65		
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		70.8			91.2			175			60.6			149			51.9		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		3.36	U		4.03	U		7.77	U		2.14	U		7.56	U		2.9	U	
170		212			245			528			186			560			188		
171	171 + 173	110	C		153	C		361	C		100	C		304	C		91.3	C	
172		39.4			43.8			80.5			34.8			78.8			33.8		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		21.4			21.5			9.27			31.8			50.6			16.3		
175		6.6			8.12			15.1			8.19			13.7			5.72		
176		3.59			3.43			1.58			5.38			8.51			1.97		
177		60.8			62			79.9			84.5			146			47.4		
178		118			164			357			109			257			93.4		
179		57.7			59.1			67.8			72.6			127			44.7		
180	180 + 193	624	C		756	C		1940	C		514	C		1650	C		523	C	
181		4.3			5.84			13.6			3.82			11.5			3.39	K	J-EMPC
182		2.14			3			5.69			2.14	K	J-EMPC	5.39			2.46	K	J-EMPC
183	183 + 185	224	C		321	C		722	C		203	C		550	C		194	C	
184		3.14			4.75			9.57			2.7			7.93			2.38		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0672	U		0.0495	U		0.0683	U		0.0721	U		0.0777	U		0.192	U	
187		450			520			1060			503			917			381		
188		1.19			1.54			2.85			1.32			2.43			1.12		
189		6.91			8.59			0.318	U		5.2			17.2			5.98		
190		97.8			131			322			78.1			260			78.2		
191		10.1			14.6			36.9			8.48			28.6			9.42		
192		0.075			0.068	K	J-EMPC	0.0719	U		0.087	K	J-EMPC	0.193	K	J-EMPC	0.208	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		65.2			75			158			52.9			162			57.7		
195		45.2			59.2			158			37.3			133			38.8		
196		38			49			117			32.4			97.3			34.2		
197	197 + 200	9.08	C		11.5	C		27.7	C		7.31	C		22.5	C		7.29	C	
198	198 + 199	81.8	C		83.8	C		153	C		73.8	C		132	C		67.1	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		13.3			14.7			37.4			12.5			25.7			10.7		
202		67.5			91.1			225			55			151			48.2		
203		114			155			420			82.7			296			90.6		
204		0.244			0.259			0.65			0.133	K	J-EMPC	0.378	K	J-EMPC	0.129	U	
205		5.36			6.54			17.8			4.58			13.4			3.91		
206		34.8			36			88.4			25.8			78.8			27.4		
207		7.22			8.85			22			5.72			17			6.57		
208		10.8			10.2			21.8			9.3			17.5			8.42		
209		17.8			15.1			41.1			13.1			32.3			12.9		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

[1]= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3e
PCB Congener Analytical Results
Lab Sample ID's L12360-24 through L12360-29
Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-7 L12360-24	Lab Qualifier	URS Qualifier	R-8 L12360-25	Lab Qualifier	URS Qualifier	R-9 L12360-26	Lab Qualifier	URS Qualifier	R-10 L12360-27	Lab Qualifier	URS Qualifier	R-11 L12360-28	Lab Qualifier	URS Qualifier	R-12 L12360-29	Lab Qualifier	URS Qualifier
1		1.43		J	0.182			0.166	K	J-EMPC	0.36	K	J-EMPC	0.231	K	J-EMPC	0.185	K	J-EMPC
2		0.719		J	0.411	K	J-EMPC	0.672	K	J-EMPC	0.631	K	J-EMPC	0.45			0.483	K	J-EMPC
3		0.424		J	0.236	K	J-EMPC	0.227	K	J-EMPC	0.428	K	J-EMPC	0.235	K	J-EMPC	0.245	K	J-EMPC
4		16.9		J	2.1			2.49			4.05	K	J-EMPC	2.74			1.5		
5		0.513	U	UJ	0.229	U		0.199	U		0.371	U		0.207	U		0.14	U	
6		7.9		J	1.1			1.7			2.18			1.7			0.818		
7		0.726	K	J-EMPC	0.256	K	J-EMPC	0.283	K	J-EMPC	0.523	K	J-EMPC	0.221			0.18		
8		23.9		J	4.49			5.79			8.77			5.86			4.02		
9		2.21		J	0.366	K	J-EMPC	0.486			0.854			0.485	K	J-EMPC	0.286		
10		0.886		J	0.213	U		0.187	U		0.345	U		0.195	U		0.131	U	
11		178		J	135			145			188			153			204		
12	12 + 13	1.65	C K	J-EMPC	0.219	C U		0.865	C K	J-EMPC	1.14	C		1.14	C K	J-EMPC	0.899	C	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.479	U	UJ	0.214	U		0.185	U		0.346	U		0.192	U		0.13	U	
15		1.92		J	1.03			1.48			2.11			1.32			1.2		
16		17.8		J	4.6			7.35			10.4			7.77			4.1		
17		31.3		J	11.3			14.6			16.6			13.9			8.35		
18	18 + 30	68.6	C	J	21	C		31.9	C		35.4	C		32.1	C		18.1	C	
19		3.18		J	0.566			0.918			1.9			1.17			0.552		
20	20 + 28	251	C	J	138	C		132	C		137	C		135	C		120	C	
21	21 + 33	39.8	C	J	17.3	C		20.2	C		23.1	C		16.2	C		15.6	C	
22		28.8		J	18.4			21.4			25.6			19.5			16.6		
23		0.221	K	J-EMPC	0.137	U		0.096			0.179	U		0.161			0.0764	U	
24		1.06		J	0.245			0.421			0.49	K	J-EMPC	0.476	K	J-EMPC	0.306		
25		4.0		J	2.8			2.82			3.63			2.52			2.79		
26	26 + 29	27.3	C	J	14.5	C		14.6	C		16.3	C		15.1	C		14.2	C	
27		4.32		J	1.25			2.25			2.91			2.21			1.17	K	J-EMPC
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		90.2		J	65.6			60.9			65.1			53.2			56.5		
32		11.6		J	2.65			3.92			5.34			3.61			1.84		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.561		J	0.434			0.514	K	J-EMPC	0.48			0.494			0.527		
35		0.164	U	UJ	0.141	U		0.084	U		0.184	U		0.173	K	J-EMPC	0.148	K	J-EMPC
36		0.136	U	UJ	0.117	U		0.088	K	J-EMPC	0.153	U		0.117	K	J-EMPC	0.0724	U	
37		1.41		J	1.73			3.61			6.08			3.97			2.59		
38		0.149	K	J-EMPC	0.127	U		0.0747	U		0.166	U		0.0917	U		0.129	K	J-EMPC
39		0.911		J	0.651	K	J-EMPC	0.821			0.842			0.763	K	J-EMPC	0.589		
40	40 + 41 + 71	40.5	C	J	20.4	C		27.1	C		39.5	C		23.7	C		18.6	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		24.9		J	14.4			24.8			31.6			22.6			0.081	U	
43		7.1		J	4.02			5.23			5.78			5.05			4.49		
44	44 + 47 + 65	204	C	J	140	C		167	C		195	C		184	C		149	C	
45	45 + 51	7.65	C	J	2.69	C		4.45	C		8.79	C		4.06	C		2.35	C K	J-EMPC
46		1.76		J	0.425	K	J-EMPC	0.753	K	J-EMPC	2.14	K	J-EMPC	0.814			0.447	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		30.3		J	18			23.4			25.8			21			16.4		
49	49 + 69	177	C	J	135	C		132	C		138	C		154	C		141	C	
50	50 + 53	4.5	C	J	0.994	C		2.28	C		7.73	C		3.31	C		1.18	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		347		J	253			285			333			307			315		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.149	K	J-EMPC	0.074	K	J-EMPC	0.0687	U		0.131	K	J-EMPC	0.0833	U		0.078	K	J-EMPC
55		0.709	U	UJ	0.283	U		0.256	U		0.278	U		0.313	U		0.214	U	
56		14		J	13.4			17.7			34			15.1			15.1		
57		1.59		J	1.37			1.22			1.15			1.46			1.43		
58		0.813		J	1.14	K	J-EMPC	0.941			1.04			0.976			1.03	K	J-EMPC
59	59 + 62 + 75	18.1	C	J	13.1	C		14.7	C		16.7	C		16.4	C		13.9	C	
60		92.3		J	84.7			80.6			84			113			100		
61	61 + 70 + 74 + 76	504	C	J	520	C		466	C		493	C		602	C		575	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		23.7		J	20.9			19.2			20			29.3			23.8		
64		0.122	U	UJ	64.5			77.5			89.5			0.0727	U		71		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		409		J	393			380			389			536			477		
67		2.48		J	3.37			3.13			3.69			3.16			3.69		
68		3.06		J	3.57			3.39			3.49			4.12			4.16		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		6.59		J	6.68			5.74			6.17			7.9			8.43		
73		0.122	U	UJ	0.056	U		0.0595	U		0.0994	U		0.0732	U		0.0593	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		9.81		J	13.9			13.2			17.8			13.8			17.7		
78		0.683	U	UJ	0.272	U		0.246	U		0.269	U		0.302	U		0.206	U	
79		2.65		J	2.53	K	J-EMPC	3.07			5.75	K	J-EMPC	3.47			2.58	K	J-EMPC
80		0.613	U	UJ	0.244	U		0.529			0.241	U		0.446	K	J-EMPC	0.423	K	J-EMPC
81		1.41	K	J-EMPC	1.19	K	J-EMPC	1.04	K	J-EMPC	1.39	K	J-EMPC	1.42	K	J-EMPC	0.998	K	J-EMPC
82		5.96		J	3.6			5.26			17.9			4.65			4.09		
83	83 + 99	1010	C	J	1060	C		940	C		1220	C		1720	C		1490	C	
84		11.3		J	7.56			12.8			43.3			12.4			10.8		
85	85 + 116 + 117	285	C	J	280	C		269	C		335	C		456	C		403	C	
86	86 + 87 + 97 + 108 + 119 + 125	269	C	J	235	C		256	C		366	C		322	C		289	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	16.7	C	J	14.9	C		23.7	C		51.1	C		21.8	C		20	C	
89		0.568		J	0.486	K	J-EMPC	0.781	K	J-EMPC	1.92	K	J-EMPC	0.582			0.598	K	J-EMPC
90	90 + 101 + 113	748	C	J	688	C		746	C		925	C		926	C		953	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		197		J	176			181			227			262			254		
93	93 + 95 + 98 + 100 + 102	197	C	J	166	C		198	C		283	C		232	C		240	C	
94		0.351	U	UJ	0.258	U		0.123	U		0.326	U		0.226	U		0.248	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		1.19		J	0.85			0.921			1.6			0.883	K	J-EMPC	0.927		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		3.21		J	3.11			2.84	K	J-EMPC	4.21			3.12			3.45		
104		0.131	U	UJ	0.11	U		0.0526	U		0.137	U		0.0866	U		0.104	U	
105		591		J	593			531			692			937			828		
106		1.48	U	UJ	1.45	U		1.47	U		1.86	U		1.65	U		1.6	U	
107	107 + 124	22.9	C	J	31.2	C		28.3	C		33.3	C		36.5	C		46.5	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		144		J	139			133			138			220			206		
110	110 + 115	460	C	J	425	C		544	C		748	C		585	C		554	C	
111		2.44		J	2.2			1.9			2.61			3.97			2.98		
112		0.225	U	UJ	0.166	U		0.0788	U		0.209	U		0.145	U		0.159	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		39.2		J	37.6			34.7			47.8			68.3			54.4		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 3e
PCB Congener Analytical Results
Lab Sample ID's L12360-24 through L12360-29

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-7 L12360-24	Lab Qualifier	URS Qualifier	R-8 L12360-25	Lab Qualifier	URS Qualifier	R-9 L12360-26	Lab Qualifier	URS Qualifier	R-10 L12360-27	Lab Qualifier	URS Qualifier	R-11 L12360-28	Lab Qualifier	URS Qualifier	R-12 L12360-29	Lab Qualifier	URS Qualifier
118		1710		J	1790			1720			2190			3130			2800		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		11.7		J	11.8			11			13.6			21.6			17.7		
121		1.62		J	0.184	U		1.13			0.232	U		2.16			1.84		
122		1.62	U	UJ	1.59	U		1.7	U		3.66	K	J-EMPC	1.92	U		2.4	K	J-EMPC
123		25.5		J	21.6			23.2			29.8			35.8			33.3		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		3.97		J	3.4			3.35	K	J-EMPC	3.8			5.19			5.93		
127		3.0		J	2.65	K	J-EMPC	3.13			4.57	K	J-EMPC	5.76			4.7		
128	128 + 166	366	C	J	367	C		353	C		465	C		682	C		550	C	
129	129 + 138 + 160 + 163	2740	C	J	2660	C		2550	C		3310	C		4910	C		4120	C	
130		81.1		J	71.4			72.1			93.2			95.1			88		
131		1.94		J	1.41			1.48			4.08			1.37			1.72		
132		32.4		J	26.3			42.4			120			37.8			39.5		
133		53.8		J	50.8			48.8			59.8			96.1			76.3		
134	134 + 143	12.4	C	J	9.89	C		13.3	C		25.8	C		12.3	C		14.5	C	
135	135 + 151 + 154	378	C	J	308	C		359	C		456	C		556	C		484	C	
136		36.2		J	27.3			36.2			58.8			44.2			41.4		
137		64.6		J	73.3			64.1			106			150			132		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	40.8	C	J	40.8	C		38.1	C		53.3	C		80.6	C		66.6	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		107		J	91.2			94.5			135			144			155		
142		0.569	U	UJ	0.27	U		0.472	U		0.486	U		0.415	U		0.399	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		19		J	15.6			17.3			26.1			21.4			21.5		
145		0.153	U	UJ	0.0546	U		0.0551	U		0.184	K	J-EMPC	0.0546	U		0.0788	U	
146		447		J	413			421			531			769			645		
147	147 + 149	101	C	J	95.5	C		156	C		322	C		164	C		139	C	
148		2.91		J	2.63			2.67			3.11			3.92			3.39		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.147	U	UJ	0.145	K	J-EMPC	0.269	K	J-EMPC	0.773			0.268	K	J-EMPC	0.226		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.738		J	0.571			0.691			1.02			0.89			0.904		
153	153 + 168	2930	C	J	2960	C		3130	C		4000	C		6740	C		5350	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		3.24		J	3.39			3.1			4.4			6.36			4.76		
156	156 + 157	187	C	J	192	C		178	C		270	C		374	C		322	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		206		J	219			191			265			415			338		
159		2.01	K	J-EMPC	1.39			1.46			2.68	K	J-EMPC	1.83			1.46	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.393	U	UJ	0.187	U		0.327	U		0.336	U		0.288	U		0.276	U	
162		9.81		J	10.2			8.85			11.6			18.8			15.2		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		57.1		J	36.5			49.7			57.7			58			56.3		
165		1.88	K	J-EMPC	1.98			1.89			2.26			3.87			2.85		
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		77		J	73.9			81.1			101			142			136		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		3.95	U	UJ	2.94	U		3.84	U		4.56	U		5.86	U		3.84	U	
170		188		J	196			181			281			425			340		
171	171 + 173	113	C	J	121	C		112	C		150	C		263	C		190	C	
172		35.2		J	36.5			33.8			49.7			65.1			58.7		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		21.9		J	15.7			22.8			47.4			21.9			21.9		
175		9.25		J	7.83			7.42			9.47			12.8			10.1		
176		3.13		J	2.4			3.5			8.24			3.44			3.43		
177		75.6		J	65.8			80.4			115			93.7			79.6		
178		150		J	136			131			159			247			189		
179		69.2		J	52.6			68.1			93.6			78.8			74.4		
180	180 + 193	576	C	J	584	C		576	C		841	C		1360	C		1020	C	
181		4.84		J	4.27			3.94			5.73			9.47			7.52		
182		2.91		J	2.14			2.23			3.24	K	J-EMPC	4.87			3.17		
183	183 + 185	279	C	J	242	C		233	C		319	C		508	C		379	C	
184		3.31		J	3.47			3.25			4.93			7.63			5.13		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.133	U	UJ	0.0565	U		0.069	U		0.112	U		0.0644	U		0.0647	U	
187		634		J	509			627			661			844			673		
188		1.67		J	1.4	K	J-EMPC	1.31			1.67			2.45			1.95		
189		6.73		J	6.4			5.93			9.63			14.2			11.5		
190		102		J	98.2			98.7			135			227			172		
191		11.8		J	10.3			10.2			14.7			25.6			17.5		
192		0.144	U	UJ	0.096			0.096			0.121	U		0.199			0.104		
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		57.6		J	53.1			55.1			84.5			130			104		
195		40.3		J	41.6			44.3			66.2			124			83.2		
196		42.3		J	32.4			34.7			54.3			90.8			62.5		
197	197 + 200	8.82	C	J	8.12	C		8.57	C		12.2	C		20.6	C		14.6	C	
198	198 + 199	87	C	J	67.5	C		81	C		96.6	C		130	C		112	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		16.3		J	12.2			14.6			17.6			26.8			21.6		
202		72.1		J	70.4			71.3			84			161			120		
203		122		J	98.9			113			151			290			193		
204		0.187		J	0.194	K	J-EMPC	0.245			0.212	K	J-EMPC	0.401	K	J-EMPC	0.315		
205		5.26		J	4.93			5.08			7.2			13			8.62		
206		34.1		J	31			31.1			46.3			66			45.8		
207		7.86		J	6.6			6.47			10.3			16.2			11.1		
208		12.4		J	10.1			10.5			13.5			17.9			14		
209		21.6		J	16.8			16.9			23.6			34.6			24		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

Table 3f
PCB Congener Analytical Results
Lab Sample ID's L12360-30 through L12360-35

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-13 L12360-30	Lab Qualifier	URS Qualifier	R-14 L12360-31	Lab Qualifier	URS Qualifier	R-15 L12360-32	Lab Qualifier	URS Qualifier	R-16 L12360-33	Lab Qualifier	URS Qualifier	R-17 L12360-34	Lab Qualifier	URS Qualifier	R-18 L12360-35	Lab Qualifier	URS Qualifier
1		0.231	K	J-EMPC	0.368	K	J-EMPC	0.175			0.163	K	J-EMPC	0.234	K	J-EMPC	0.228		
2		0.44			0.523			0.295	K	J-EMPC	0.396	K	J-EMPC	0.589			0.447	K	J-EMPC
3		0.333	K	J-EMPC	0.471	K	J-EMPC	0.231	K	J-EMPC	0.241			0.274	K	J-EMPC	0.238		
4		2.36			2.46	K	J-EMPC	1.29			1.88			1.8			1.94		
5		0.22	U		0.605	U		0.29	U		0.251	U		0.245	U		0.407	U	
6		1.75			1.36	K	J-EMPC	0.637			1.1			1.08			1.23	K	J-EMPC
7		0.218	K	J-EMPC	0.572	U		0.268	U		0.233			0.298	K	J-EMPC	0.375	U	
8		6.09			5.51			2.81			4.46			5.31			5.02		
9		0.31			0.56	K	J-EMPC	0.259	U		0.272			0.38			0.406	K	J-EMPC
10		0.207	U		0.562	U		0.273	U		0.236	U		0.23	U		0.383	U	
11		177			183			109			177			264			139		
12	12 + 13	0.868	C K	J-EMPC	0.58	C U		0.694	C		0.239	C U		0.233	C U		0.388	C U	
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.205	U		0.565	U		0.27	U		0.233	U		0.227	U		0.378	U	
15		1.46			1.1	K	J-EMPC	0.932			1.15	K	J-EMPC	1.88	K	J-EMPC	1.41		
16		13.9			7.31			2.89			6.85			5.43			6.97		
17		23.8			12.9			5.33			9.92			12.2			11.4		
18	18 + 30	53.1	C		28.1	C		13.2	C		23.7	C		27.9	C		26.3	C	
19		0.986			1.03	K	J-EMPC	0.573			0.674			0.444			1.05	K	J-EMPC
20	20 + 28	122	C		142	C		67.2	C		76.9	C		155	C		117	C	
21	21 + 33	21.2	C		21.3	C		8.28	C		12.8	C		23.4	C		17.2	C	
22		31.9			23.5			8.69			15.4			21.2			16.8		
23		0.165	U		0.21	U		0.171	U		0.233	U		0.152	K	J-EMPC	0.142	K	J-EMPC
24		0.505	K	J-EMPC	0.398			0.201			0.262	K	J-EMPC	0.357	K	J-EMPC	0.36		
25		3.72			3.39			1.33			2.14			3.37			2.69		
26	26 + 29	15.5	C		16.4	C		7.57	C		9.32	C		17.9	C		13.9	C	
27		4.4			2.01			0.839			1.73			1.7			1.9		
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		57.6			70.6			27.5			38.7			80.1			55.9		
32		3.38			3.64			1.12			1.7	K	J-EMPC	3.3			3.4		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.367			0.201	U		0.225	K	J-EMPC	0.349	K	J-EMPC	0.612			0.527		
35		0.194	K	J-EMPC	0.215	U		0.183	U		0.248	U		0.199	K	J-EMPC	0.142	U	
36		0.157	U		0.179	U		0.162	U		0.221	U		0.146	K	J-EMPC	0.126	U	
37		2.41			2.13			2.5			2.79	K	J-EMPC	3.33			2.64		
38		0.217	K	J-EMPC	0.194	U		0.162	U		1.25	U		0.268	K	J-EMPC	0.126	U	
39		1.32			0.948			0.279	K	J-EMPC	0.496			0.948	K	J-EMPC	0.739		
40	40 + 41 + 71	29.1	C		33.4	C		8.8	C		12.8	C		22.3	C		22.5	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		54.5			31.5			6.15			14.3			11.7			18.2		
43		4.26			5.61			2.25			2.41			5.71			4.45		
44	44 + 47 + 65	218	C		196	C		70.2	C		87.6	C		156	C		142	C	
45	45 + 51	3.76	C		5.36	C		1.39	C K	J-EMPC	2.41	C		2.93	C		4.54	C	
46		0.788			1.09			0.248	K	J-EMPC	0.225			0.394	K	J-EMPC	0.963	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		29.1			26.3			7.8			11.5			18.9			18.6		
49	49 + 69	134	C		148	C		61.2	C		65	C		146	C		117	C	
50	50 + 53	4.64	C		2.89	C		0.79	C		1.7	C		0.234	C K	J-EMPC	3.02	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		312			356			143			157			374			296		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.102	K	J-EMPC	0.152	U		0.0919	U		0.0958	U		0.166	K	J-EMPC	0.132	K	J-EMPC
55		0.381	U		0.618	U		0.358	U		0.328	U		0.409	U		0.401	U	
56		26.5			25.7			7.88			11.5			17.8			23		
57		1.07	K	J-EMPC	1.6	K	J-EMPC	0.745			0.639			1.7			1.23		
58		0.607	K	J-EMPC	1.55	K	J-EMPC	0.517	K	J-EMPC	0.567	K	J-EMPC	1.23	K	J-EMPC	0.762	K	J-EMPC
59	59 + 62 + 75	15.5	C		17.7	C		6.41	C		4.9	C		14.7	C		12.8	C	
60		96.9			91.3			68.7			48.3			123			95.7		
61	61 + 70 + 74 + 76	574	C		575	C		332	C		293	C		660	C		490	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		20.8			21.3			20.9			12.8			24.6			20.4		
64		77.5			94.3			31.3			36.4			80.3			65.3		
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		481			432			342			244			524			381		
67		4.39			4.19			1.52			2.28			4.26			2.86		
68		3.46			5.28			3.06			2.3	K	J-EMPC	5.2			3.34		
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		5.17			7.11			4.59			3.79			8.47			6.59		
73		0.0525	U		0.135	U		0.082	U		0.0832	U		0.0585	U		0.094	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		21.3			19.4			16			14			25.9			13.2		
78		0.367	U		0.596	U		0.344	U		0.316	U		0.394	U		0.386	U	
79		7.86			4.54			2.03	K	J-EMPC	2.89			3.58			5.94		
80		0.474			0.785	K	J-EMPC	0.428	K	J-EMPC	0.287	U		0.662			0.567	K	J-EMPC
81		1.56	K	J-EMPC	1.57	K	J-EMPC	1.49	K	J-EMPC	0.829	K	J-EMPC	2.21	K	J-EMPC	1.22	K	J-EMPC
82		11.8	K	J-EMPC	10.4			2.35			3.81			2.79	K	J-EMPC	10.2	K	J-EMPC
83	83 + 99	1290	C		1040	C		1160	C		664	C		1670	C		1080	C	
84		22.4			27			5.05			8.1			8.84			18.7		
85	85 + 116 + 117	368	C		300	C		290	C		213	C		450	C		308	C	
86	86 + 87 + 97 + 108 + 119 + 125	411	C		403	C		148	C		170	C		279	C		300	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	33.8	C		45.1	C		7.63	C		12.8	C		22.4	C		25	C	
89		1.29	U		1.75	K	J-EMPC	0.306	U		0.497			1.23	K	J-EMPC	1.27	U	
90	90 + 101 + 113	1050	C		1150	C		397	C		445	C		1050	C		823	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		207			253			115			104			281			215		
93	93 + 95 + 98 + 100 + 102	238	C		268	C		90.3	C		124	C		261	C		230	C	
94		1.33	U		0.607	U		0.318	U		0.198	U		0.265	U		1.3	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		1.08			1.5			0.35			0.39	U		1.22			1.16		
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		3.55			5.31			1.1	K	J-EMPC	1.46	K	J-EMPC	3.56			3.61	K	J-EMPC
104		0.155	U		0.15	U		0.144	U		0.171	U		0.111	U		0.262	U	
105		885			614			694			442			908			717		
106		2.45	U		2.16	U		2.76	U		1.67	U		2.37	U		2.21	U	
107	107 + 124	41.7	C		41.1	C		18.9	C		26.1	C		58.2	C		30.9	C	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		178			151			201			125			210			160		
110	110 + 115	768	C		889	C		216	C		363	C		693	C		566	C	
111		2.97			2.36			3.56			1.92			3.11			2.04	K	J-EMPC
112		0.886	U		0.389	U		0.204	U		0.127	U		0.17	U		0.87	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		60.5			40.3			64.4			33.7			57.8			43.9		
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table 3f
PCB Congener Analytical Results
Lab Sample ID's L12360-30 through L12360-35

Bradford Island - Remedial Investigation
Sculpin Collected February through October 2008

IUPAC #	COELUTING CONGENERS[1]	R-13 L12360-30	Lab Qualifier	URS Qualifier	R-14 L12360-31	Lab Qualifier	URS Qualifier	R-15 L12360-32	Lab Qualifier	URS Qualifier	R-16 L12360-33	Lab Qualifier	URS Qualifier	R-17 L12360-34	Lab Qualifier	URS Qualifier	R-18 L12360-35	Lab Qualifier	URS Qualifier
118		2790			1920			3110			1610			2850			1930		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		12.1			12.6			18.3			10			17.9			11.8		
121		1.28			1.28	K	J-EMPC	1.24	K	J-EMPC	0.795			1.8			1.22		
122		2.83	U		2.38	U		3.21	U		1.94	U		2.75	U		10.3	K	J-EMPC
123		47			32	K	J-EMPC	42.3			21.9			40.2			31.3		
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		4.83			5.2			4.93			3.13			5.52			3.91		
127		7.05			2.2	U		7.99	K	J-EMPC	3.94			7.91			4.02	K	J-EMPC
128	128 + 166	614	C		391	C		570	C		344	C		653	C		519	C	
129	129 + 138 + 160 + 163	5200	C		2960	C		4940	C		2800	C		5620	C		4110	C	
130		101			127			48.8			56.5			102			102		
131		3.67	K	J-EMPC	3.25			0.829	K	J-EMPC	1.82	K	J-EMPC	2.13			2.35	K	J-EMPC
132		68.6			101			18			32.1			47.5			66.9		
133		62.4			54.9			78.8			46.1			79.4			70.2		
134	134 + 143	24.7	C		1.62	C U		5.99	C		0.467	C U		17.9	C		19.5	C	
135	135 + 151 + 154	386	C		479	C		219	C		235	C		460	C		438	C	
136		44.5			62.9			15.6			20.2			47.6			44.5		
137		168			76			163			80			146			105		
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	65.5	C		42.9	C		60.8	C		35.4	C		71.5	C		57	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		155			138			90.1			81.9			188			1.55	U	
142		1.45	U		1.61	U		0.524	U		0.465	U		0.557	U		1.75	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		23.7			35.6			7.52			11.6			21.3			21.1		
145		0.112			0.16	U		0.0861	U		0.0872	U		0.0896	U		0.132	U	
146		642			517			627			410			661			617		
147	147 + 149	243	C		315	C		64.2	C		119	C		158	C		225	C	
148		2.59			4.41			1.17			1.65			3.16			3.46		
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.302	K	J-EMPC	0.524	K	J-EMPC	0.126			0.106			0.242			0.258		
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		1.07			1			0.427	K	J-EMPC	0.225	K	J-EMPC	1.16	K	J-EMPC	0.828	K	J-EMPC
153	153 + 168	7400	C		3230	C		6360	C		4080	C		5380	C		4970	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		3.29			3.71			4.95			2.35	K	J-EMPC	5.48			4.1		
156	156 + 157	402	C		203	C		402	C		193	C		350	C		257	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		383			215			356			194			395			314		
159		1.26			3.35			1.54	K	J-EMPC	1.07	K	J-EMPC	2.56			2.4		
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		1	U		1.12	U		0.363	U		0.323	U		0.386	U		1.21	U	
162		14.1			10.1			19.4			9.38			17.2			13.7		
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		55.8			71.6			21.2			34.3			68.2			66		
165		2.15			1.91			3.33	K	J-EMPC	1.75			3.18	K	J-EMPC	2.26		
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		170			96.8			146			91			139			99.2		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		5.05	U		3.66	U		9.29	U		4.88	U		7.12	U		4.67	U	
170		297			205			398			186			342			252		
171	171 + 173	177	C		120	C		221	C		108	C		194	C		150	C	
172		46			41.6			56			31.3	K	J-EMPC	60			48.7		
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		24.7			49.3			15.4			14.2			31.4			30.5		
175		12.6			12.1			9.08			6.65			11.8			11.5		
176		6.51			8.71			1.82	K	J-EMPC	2.9	K	J-EMPC	4.44			4.85	K	J-EMPC
177		127			155			50.7			63.3			94			88.8		
178		193			159			195			115			196			173		
179		99.4			123			31.6			48.6			96.2			79		
180	180 + 193	998	C		630	C		1510	C		670	C		1020	C		756	C	
181		9.42	K	J-EMPC	4.38	K	J-EMPC	10.8	K	J-EMPC	5.26	K	J-EMPC	6.52			7.05		
182		6.3			2.74			5.63			4.19	K	J-EMPC	3.01	K	J-EMPC	7.02	K	J-EMPC
183	183 + 185	362	C		273	C		445	C		239	C		396	C		316	C	
184		3.8			3.62			6.29			3.05	K	J-EMPC	6.34			4.22		
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.384	U		0.154	U		0.417	U		0.352	U		0.402	U		0.332	U	
187		818			889			668			515			700			723		
188		2.45			2.32			2.02			1.51			1.92			2.28		
189		9.74			6.9			15.4			8.2			11	K	J-EMPC	9.2		
190		146			102			229			101			158			120		
191		19.2			11			32.9			14.5			19.3			16.5		
192		0.427	U		0.167	U		0.464	U		0.392	U		0.447	U		0.369	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		71.4			56.8			144			67.3			107			74.8		
195		70.8			43.5			127			56.8			77			59.6		
196		50.3			38			95.7			40.4			60.8			46.6		
197	197 + 200	13.5	C		10.8	C		18.6	C		9.27	C		15.7	C		11.2	C	
198	198 + 199	93.6	C		99.5	C		107	C		70.8	C		109	C		99	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		27.6			20.1			21.6			16.9			20.7			18.8		
202		118			74.1			129			72.3			115			86.6		
203		188			111			274			141			184			137		
204		0.392	K	J-EMPC	0.174			0.367	U		0.364	U		0.368	U		0.482	K	J-EMPC
205		8.12			5			12.3			5.91			8.02			6.69		
206		42.1			30.8			63.1			35.6			49.3			37.6		
207		9.85			6.81			15.9			8.05			9.45			8.4		
208		13.7			12.4			13.5			9.81			13.4			11.9		
209		20.9			15.8			30.6			17.2			24.2			20.4		

Notes:

All results are in units of pg/g (picograms/gram), wet weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quantification limit is an estimate.
K = (CAS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
J-EMPC = (URS qualifer) The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
Non-detect values reported at the analytical reporting limit.

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

GOOSE ISLAND SAMPLES COLLECTED APRIL/MAY 2008

SEPTEMBER 2009

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the analytical results for the two sediment, one clam, one crayfish, and one sculpin sample collected from the Goose Island Slough, shows the quality of the data to be acceptable to support project objectives. The contracted laboratories provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated and flagged ‘J’ or ‘J-EMPC’, and some data were qualified as not detected and flagged ‘U’. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report. Refer to Section 4.0 of this report for a listing of qualifier definitions.

2.0 Project Description

Sediment and tissue were collected from the Goose Island Slough on April 27, 29 and May 1, 2009, in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. Table D-1 summarizes the identification numbers assigned to the samples, the laboratory identification numbers, collection date, and requested analyses.

3.0 Sampling and Analytical Procedures

Samples were collected and analyzed according to the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP) (URS 2007) and QAPP Addendum (URS 2009). Deviations from the proposed sample collection (i.e. number and volume per each pre-determined sample location) are addressed in the Goose Island Slough Data Gap Sampling Report (URS 2009). The sculpin sample (090429110SC) had insufficient sample volume to analyze the full suite of analytes listed in the QAPP Addendum, as indicated in Table D-1. The remaining two tissue samples (clams and crayfish) and the two sediment samples had sufficient sample volume to analyze all the COIs identified in the QAPP Addendum.

All samples were submitted to Columbia Analytical Services (CAS) of Kelso, Washington and logged in under two CAS sample delivery group numbers (K0903809 and K0904119), see Table D-1. (Note: SVOCs and PAHs were analyzed separately for tissue matrices and are therefore discussed separately in this report). Samples were archived frozen by CAS (-20 degrees Celsius, °C) prior to analysis.

Whole-body clam, crayfish, and sediment samples were homogenized using an industrial blender by CAS. An aliquot of the homogenized tissue (clam and crayfish) and sediment sample were sent to Axys Analytical Services Ltd. of Sidney, British Columbia, Canada (Axys) to perform the PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*. Due to limited sample volume, the single sculpin collected was submitted directly to Axys for sample homogenization and PCB congener analysis,.

The Axys analytical data report includes a listing of the Axys Method 1668A modifications. Samples were logged in by Axys under two Axys sample delivery group numbers (DPWG29244 and DPWG29402), see Table D-1.

The following table lists the parameters analyzed for one or more of the samples. Table D-1 summarizes the specific requested analyses for each sample by URS and laboratory identification numbers.

Method	Analytical Parameter
EPA 8082M	Polychlorinated Biphenyls (PCBs) as Aroclors
EPA 1668A	PCBs as congeners
EPA 6000/7000 series	Metals[1]
EPA 8270C-SIM	Semi-Volatile Organic Compounds (SVOCs)
EPA 8270C-SIM	Polynuclear Aromatic Hydrocarbons (PAHs)
NWTPH-Dx (Ecology 1997)	Northwest Total Petroleum Hydrocarbon – Diesel and Residual Range (NWTPH-Dx)
Puget Sound Estuary Program (PSEP 1996)	Percent Lipids
Puget Sound Estuary Program (PSEP 1996)	Total Organic Carbon (TOC)
Gravimetric Freeze Dry	Percent Solids – Sediment Matrix Percent Solids – Tissue Matrices
Puget Sound Estuary Program (PSEP 1996)	Grain Size

[1] = Aluminum, Antimony, Arsenic, Barium, Berylium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, thallium, vanadium, zinc

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, COC, laboratory case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed for 20% or greater of the data: primary and secondary column verification, initial and continuing instrument calibrations and a verification of the reported electronic data with the hard copy deliverable.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA 2005) and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data*

(USEPA 1995) as appropriate for method performed. In the case of disagreement between the guidance documents and the analytical method, method criteria were utilized for data review.

The non-congener organic and metals results were reviewed in accordance with the criteria contained in the DoD QSM (DoD 2006), the above listed methods and EPA's *NFGs for Organic Data Review* (USEPA 2008) or EPA's *NFGs for Inorganic Data Review* (USEPA 2004), in that order of precedence.

A summary of qualifiers assigned to results in this investigation is included in Table D-2 and Table D-3. Samples are listed by their URS sample identification assigned in the field as well as the laboratory identification. CAS was requested to report analytical results above the method detection limit (MDL) but below the method reporting limit (MRL). These results were flagged 'J' by CAS. These 'J' qualifiers are included in the database and in the data tables included in the main body of this report, but are not tabulated in Table D-2. Congeners are reported using sample-specific detection limits. Qualifiers that may have been assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample - used only for PCB congener results.

- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

Non-congener Results

The two sediment samples and the composited bait (dry dog food) sample were received by CAS via courier on May 1, 2009. The tissue samples were received by CAS on May 8, 2009. URS shucked the clam tissue prior to submitting the sample to CAS. As noted above, all samples were archived frozen by CAS prior to analysis. The COC forms for the URS to CAS deliveries indicate that samples were maintained under proper custody and the forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended temperature range of 6°C or below. All samples were analyzed within technical and contracted holding times.

Congener Results

The COC forms for the CAS to Axys delivery of the sediment samples (shipped on May 5, 2009 and received on May 8, 2009) and the tissue samples (shipped on May 26, 2009 and received on May 27, 2009) indicate that samples were maintained under proper custody and the forms were signed upon release and receipt. The condition and temperature of the samples upon receipt by Axys was appropriate and all samples listed on the COC form were present with the following exceptions:

- Sediment samples arrived at Axys at 14 degrees Celsius (°C) above the EPA-recommended temperature of 6 °C or below. The samples were delayed passing through international customs during shipment and therefore spent four days in transit. PCBs are known for long term stability (USEPA 2005b). Therefore, the sample results were not qualified based on the elevation in temperature during shipment.
- The glass sample container for sediment sample 090429111SD was received by Axys broken, the sample was still intact and usable. Samples results were not qualified based on the broken sample container.

All samples were analyzed within technical and contracted holding times.

4.2 Instrument Calibration

The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by the analytical methods. Initial calibrations (ICALs) and continuing calibrations (CCALs) were analyzed at the proper frequency and at the appropriate concentrations required by the methods.

Non-congener Results

Instrument calibrations were acceptable for the sample analyses performed, with the following exception:

- EPA Method 8082 requires a secondary column confirmation. The initial calibration verification criteria for the confirmation column for Aroclors 1016 and 1260, associated with the tissue analytical batch KWG0904914, exceeded the laboratory criterion, but was within the DOD QSM criterion of ± 20% of the expected values. Second source values were -16.8% and -17.2% for Aroclors 1016 and 1260, respectively. Analytical results for Aroclors 1016 and 1260 were reported from the primary column and results were not qualified.

Congener Results

The laboratory performed initial multipoint calibrations for target and standard compounds as required by the Method 1668A. ICALs, continuing calibration verifications (CCVs) and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. Calibration compounds met the acceptance criteria as listed in the method with the following exception:

- The 25.3% recoveries of ^{13}C-labeled PCB 4 (PCB 4L) and ^{13}C-labeled PCB 19 (19L) in the OPR for analysis batch WG28904-102 were below the method acceptance criteria of 30%. All native (or unlabeled) congeners were within control limits for the OPR, including PCB 4 and PCB 19. Additionally the labeled and non-labeled standards had acceptable recoveries in the method blank (canola oil) and project samples, with the one exception stated below in section 4.5. Sample analytical results were not qualified based on the low recovery of PCB 4L and 19L in the OPR.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Initial calibration and continuing calibration blanks are also analyzed when appropriate per analytical method to check for laboratory contamination and instrument bias. Field blanks were not collected as part of this analytical program. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs.

Non-congener Results

Non-congener organic sample results less than five times (5x) and inorganic sample results less than ten times (10x) the blank concentration and between the method detection limit (MDL) and the MRL were qualified as non-detect and flagged with a ‘U’ at the MRL. When sample results were less than 5x (or 10x for inorganics) the blank concentration but above the MRL, the reported result was qualified as non-detect and flagged ‘U’. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Target compounds reported with concentrations greater than 5x (or 10x) the blank concentration were not qualified. For solid matrices reported in both wet and dry weight concentrations, the above-noted guidelines were applied using the wet weight results, and any qualifiers assigned were also assigned to the dry weight results.

All analytical tests indicate non-detects for method blanks with the following exceptions:

- Cobalt and nickel were above the MDL and below the MRL and mercury was detected at the MDL in the method blank in CAS delivery group K0903809. Antimony, barium, copper, and thallium were detected in the continuing calibration blanks bracketing the samples in the same sample delivery group. All detected cobalt, nickel, mercury, antimony barium, copper and thallium results were greater than 10x the associated blank concentrations, therefore data were not qualified.

- Antimony and barium were detected above the MDL and below the MRL in the continuing calibration blanks bracketing the samples in the sample delivery group K0904119. All detected antimony and barium results were greater than 10x the associated blank concentrations, therefore data were not qualified.
- Diesel Range Organics (DRO) and Residual Range Organics (RRO) were both detected above the MDL and below the MRL in the method blank associated with delivery group K0903809. All detected DRO and RRO results were greater than 5x the associated method blank concentrations, therefore data were not qualified based on DRO and RRO method blank detections.
- Acenaphthene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, fluorene, fluoranthene and pyrene were detected above the MDL and below the MRL in the method blank associated with the PAHs in sample delivery group K0904119. Acenaphthene, benzo(a)anthracene, fluoranthene, and pyrene results for associated sample K0904119-001 were less than 5x the detected blank concentrations and therefore, qualified as non-detect at the reported concentration (Table D-2).

Congener Results

PCB congener sample results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as EMPCs were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank for sediment was prepared using sand. For the tissues matrices and the dog food canola oil was used to approximate the lipid content of the samples.

PCB congener result qualified based on method blank concentrations are included in Table D-3.

4.4 Surrogate Recovery Review

Surrogate recoveries are a measure of accuracy for the overall analysis of each individual sample. Each sample analyzed for organic compounds (PCB Aroclors and SVOCs) was spiked with surrogate(s) (system monitoring compounds). Surrogate recoveries were acceptable for all analyses, with the following exceptions:

- The SVOC analysis of the bait sample (K0903809-003) required a large dilution (100 fold) to overcome the sample matrix interferences. Due to the large dilution, the surrogate recoveries could not be calculated and therefore the recoveries were reported as 0%. The LCS/LCSD associated with this sample were within control limits, indicating the analytical batch was in control. Analytical results for this sample were not qualified due to the surrogate recoveries.

- The recovery of the surrogate decachlorobiphenyl (56%) associated with PCB Aroclor analysis was below the DoD QSM control limit of 60% for sample K0904119-003. NO PCB Aroclors were detected in this sample. All PCB Aroclors were qualified as estimated and flagged 'UJ' due to the bias low surrogate recovery.

4.5 Labeled Internal Standard Recovery Review (congener analysis only)

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency, which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table D-1 of the Axys narrative. All recoveries were acceptable with the following exception:

- The percent recoveries of ^{13}C-labeled PCB 4 (19.2%) and ^{13}C-labeled PCB 19 (20.9) in sample L12725-1 were below the method acceptance criteria of 25%. PCB 4 and 19 have chemically identical isotopic labeled standards. The isotopic dilution calculations produce recovery corrected quantitation results; therefore, only the non-chemically identical PCB congeners quantitated using these labeled standards were estimated based on the low internal standard recoveries. Analytical results for PCB 5 through 14, 16 through 18, 20 through 36, 38 and 39 for sample L12725-1 were qualified 'J/UJ' to reflect the potential low bias.

Cleanup standards 28L, 111L, and 178L are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

4.6 Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicate Review

Laboratory control/laboratory control duplicate (LCS/LCSD) samples are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and to assess accuracy for the target compounds. Matrix spike/matrix spike duplicate (MS/MSD) samples are analyzed to assess the laboratory's ability to recover the target compounds from the sample matrix. At least one LCS and one MS/MSD were performed for each non-congener analysis and for each batch per method requirements.

Non-congener Results

LCS/LCSD and MS/MSD recoveries were acceptable for all non-congener analytical tests with the following exception:

- The recovery of aluminum was below the DoD QSM criteria of 80% for the MS (-392.7%) and the MSD (-186.5%) performed on sample K0903809-001. The sample result for aluminum was greater than four time (4x) the spike concentration, therefore samples results were not qualified based on MS/MSD recoveries.

- The recovery of mercury was below the DoD QSM criteria of 80% for the MS (67.8%) performed on sample K0903809-003 and the RPD (37.9%) for the MS/MSD pair exceeded the exceeded the DoD QSM precision control limit of 20%. The LCS samples were in control indicating the analytical batch was in control. Mercury results for sample K0903809-003 were qualified as estimated and flagged ‘UJ’ due to bias low MS recovery and RPD precision.
- The recovery of mercury was below the DoD QSM criteria of 80% for the MSD (61.6%) in sample K0904119-003 and the RPD (34.2%) for the MS/MSD pair exceeded the exceeded the DoD QSM precision control limit of 20%. The LCS samples were in control indicating the analytical batch was in control. Mercury results for sample K0904119-003 were qualified as estimated and flagged ‘J’ due to bias low MS recovery and RPD precision.
- Only two Aroclors are required by EPA Method 8082 to monitor LCS recoveries (Aroclors 1016 and 1260). The recovery of Aroclor 1260 in the LCS associated with sample delivery group K0903809 was 59% (below the DoD QSM lower limit of 60%). Aroclor 1016 was with the DoD QSM control limits. Aroclor 1260 in the associated samples (K0903809-001, K0903809-002, and K0903809-003) were qualified as estimated and flagged ‘UJ’ due to bias low LCS recovery.
- Aroclor 1260 recovery in the LCSD (59%) was below the DoD QSM lower limit of 60% for sample delivery group K0904119. The LCS and RPD for the LCS/LCSD pair were in control. Because two of the three parameters were in control, the analytical results were not qualified.
- The MS/MSD recoveries and RPD for Aroclor 1260 associated with sample delivery group K0903809 was outside the DoD QSM control limits. However, the sample chosen for the matrix spike was not a project sample and, therefore, results of the MS/MSD are not applicable for qualification of the project specific sample matrix.

Congener Results

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, Ongoing Precision and Recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using canola oil to approximate the lipid content of the samples. OPR recoveries were acceptable for congener analyses with the exception previously stated in Section 4.2 above.

4.7 Duplicate Review

Field duplicates were not collected during this sampling event.

Non-congener Results

To evaluate laboratory precision, CAS performed duplicate analyses (i.e. LCS/LCSD and MS/MSD) as discussed above. All duplicate analyses were within relative percent difference criteria with the one exception described in Section 4.6 above. No samples were qualified exclusively due to duplicate precision exceedances.

Congener Results

Laboratory duplicates were not performed by Axys on the congener samples.

4.8 Compound Quantification

Non-congener Results

All second column confirmations performed by CAS using Method 8082 were acceptable, with the exception previously mentioned in Section 4.2.

Congener Results

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. The lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass stability and sensitivity were acceptable for the all sample analyses with the following exceptions:

- Sample L12657-1 had lock mass deflections for PCBs 92, 146 and 187 and sample L12657-2 had lock mass deflections for PCBs 92, 146, 187 and 197. These congeners were qualified as estimated and flagged 'J/UJ' due to the lock mass deflection (Table D-3). The overall concentration of the analytes affected by lock mass represents less than 4 percent of the total PCB concentration for each sediment sample.

4.9 Target Compound Identification

Non-congener Results

- CAS applied a 'Z' flag, indicating the chromatographic pattern did not resemble and petroleum product, to the residual range organics (RRO) for samples K0903809-001, K0903809-002 and to both the diesel range organics (DRO) and RRO for sample K0903809-003. Theses results were reported unqualified.

Congener Results

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria, but differ by more than 15% from the theoretical ion abundance criterion set by EPA Method 1668A were flagged in the laboratory report with a 'K' flag. Those results flagged 'K' with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged 'J-EMPC' during this review. If the analyte result was previously qualified 'U' by method blank detection, the result retained the 'U' qualifier and was not qualified further (there is no ion ratio criterion for non-detects). These “J-EMPC” flagged data are listed in Table D-3, appear within the data tables in the main body of this deliverable, and have been entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

Additionally, the laboratory-assigned flag ‘C’ is used in Table D-3 to indicate co-eluting PCB isomers for this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification as part of this data review.

4.10 Reporting Limits

Non-congener Results

Sample concentrations for non-congener analyses that were detected below the MRL but above the MDL, were qualified as estimated flagged with a ‘J’ by the laboratory (CAS). All laboratory J-flagged results are considered estimates. As stated above, these flags are recorded within the database and are reported in the data tables included in the main body of this report.

The SVOC extract for the bait sample (K0903809-003) was highly viscous and colored. Following a semi-quantitative analysis, a 100 fold dilution was performed. Due to the nature of the sample matrix and the dilution the SVOC analytical results have elevated MDL and MRLs. These results were not qualified during this review, but should be considered as part of data use by the end users.

Congener Results

All non-detect congener results are reported at sample specific reporting limits. All samples were analyzed using approximately 10 grams as recommended by Method 1668A, with the below-listed exceptions:

- Inadequate sculpin tissue was received by the laboratory (Axys). Therefore, only 5.91 grams were extracted for the analysis of sample 090429110SC. The end user of the data should be aware that this small sample size may have elevated the reporting limits for some PCB congeners.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. A summary of qualifiers can be found in Tables D-2 and D-3. A completeness summary follows; analysis completeness was calculated using 159 congener results, 209 total congeners minus the 50 co-eluting congeners which were reported with the lowest numbered congener in the co-eluting set.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (number of useable results/total reported results) x100

  Non-congener = (168 compliant / 168 total results) = 100%
  Congener = (954 compliant / 954 total results) = 100%

  All samples results are considered useable.

- *Analytical Completeness* = (number of unqualified results/total reported results) x100

  Non-congener = (154 unqualified results/ 168 total results) = 92%

  Non-congener data qualified 'J' due to detections between the MDL and the MRL were not included in this calculation.

  Congener = (792 unqualified results/ 954 total results) = 83%

  Congener data qualified as estimated and flagged 'J', 'UJ' or 'J-EMPC' were included in this evaluation.

- *Contract Completeness* = (number of contract compliant results/total reported results) x100

  Non-congener = (168 compliant / 168 total results) = 100%

  Congener = (954 compliant / 954 total results) = 100%

  All samples analyzed met laboratory contract requirements.

- *Field Sampling Completeness* =(number samples collected/number samples planned) x100

  Total Samples = *(5 samples collected / 8 planned samples) =63*%

  The target number of samples outlined in the QAP Addendum (URS 2009) was eight; sediment, clam, crayfish and sculpin at two sample stations. Only 5 samples were collected due to insufficient sample volume at one of the sample stations. The bait sample was not included in the field sampling completeness calculations as this sample was not a primary sample, but a QC sample.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [*http://www.navylabs.navy.mil/Archive/DoDV3.pdf*] on 3/3/06

PSEP 1996. Puget Sound Estuary Program *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January 1996 and subsequent chapter revisions.

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

URS 2009. In Water Quality Assurance Project Plan (QAPP) Addendum, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. February 20.

URS 2009. Goose Island Slough Data Gap Sampling Report, Bradford Island Remedial Investigation, Bonneville Lock and Dam Project, Cascade Locks, Oregon. August.

USEPA 1995. EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

USEPA 2004. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. October 2004.

USEPA 2005. Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

USEPA 2005b. U.S. Environmental Protection Agency (USEPA) Sample Holding Time Reevaluation, EPA/600/R-05/124, October 2005.

USEPA 2008. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review. June 2008.

TABLES

Table D-1
Sample Identification and Analysis Summary
Bradford Island - Remedial Investigation
Goose Island Slough Sampling

URS ID	Sample Station	Matrix	Collection Date	CAS ID (non-congener)	Axys ID (congener)	Axys Sample Delivery Group	Analytes									
							PCB Aroclors (EPA 8082)	PCB Congeners (EPA 1668A)	Metals	SVOCs	PAHs	TPH-Dx (NWTPH-Dx)	TOC	Grain Size	%Solids	%Lipids
090427110SD	110	Sediment	4/27/2009	K0903809-001	L12657-1	DPWG29244	X	X	X	X		X	X	X	X	
090429111SD	111	Sediment	4/29/2009	K0903809-002	L12657-2		X	X	X	X		X	X	X	X	
090427110TC	110	Clam	4/27/2009	K0904119-003	L12725-3	DPWG29402	X	X	X	X	X^1				X	X
090429110CF	110	Crayfish	4/29/2009	K0904119-001	L12725-1		X	X	X	X	X^1				X	X
090429110SC	110	Sculpin	4/29/2009	K0904119-002	L12725-2			X								X
090430BaitDF	110/111	Bait (Dog Food)	4/30/2009	K0903809-003	L12658-1	DPWG29244	X	X	X	X		X			X	X

Notes:
ID = Identification Number
CAS = Columbia Analytical Services
PAHs = Polyaromatic Hydrocarbons
PCB = Polychlorinated Biphenyl
NWTPH = Northwest Total Petroluem Hydrocarbons
Dx = Diesel Range Hydrocarbons
SVOCs = Semi-volatile Organic Compound
1 = Selected SVOCs and PAHs were analyzed separately for tissue matrices and are therefore discussed separately in this report. SVOCs and PAHs were analyzed in a single analysis for the sediment matrix.

Table D-2
Non-congener Qualifier Summary
Bradford Island - Remedial Investigation
Goose Island Slough Sampling

URS ID	CAS ID (non-congener)	Analyte	Qualifier	Rationale
090429110CF	K0904119-001	acenaphthene	0.50U	method blank detection
		benz(a)anthracene	0.50U	
		fluoranthene	0.50U	
		pyrene	0.50U	
090427110SD	K0903809-001	Aroclor 1260	UJ	LCS recovery
090429111SD	K0903809-002			
090430BaitDF	K0903809-003			
090429110TC	K0904119-003	All Aroclors	UJ	surrogate recovery
090429110TC	K0904119-003	mercury	J	MS recovery/ RPD precision
090430BaitDF	K0903809-003	mercury	UJ	

Notes:
units: micrograms per kilograms (ug/kg)
CAS = Columbia Analytical Services
Concentrations are reported as wet weight, qualifiers would apply to dry weight concentrations also.
ID = Identification Number
LCS = Laboratory Control Sample
MS = Matrix Spike
PCBs = Polychlorinated Biphenyls

Table D-3
PCB Congener Qualifer Summary
Bradford Island - Remedial Investigation
Goose Island Slough Sampling

IUPAC #	COELUTING CONGENERS[1]	090427110SD L12657-1	Lab Qualifier	URS Review Qualifier	090429111SD L12657-2	Lab Qualifier	URS Review Qualifier	090429110CF L12725-1	Lab Qualifier	URS Review Qualifier	090429110SC L12725-2	Lab Qualifier	URS Review Qualifier	090429110TC L12725-3	Lab Qualifier	URS Review Qualifier	090430BAIT DF L12658-1	Lab Qualifier	URS Review Qualifier
1		0.309	K	J-EMPC	0.339			0.201	U		0.437	K	J-EMPC	1.62			2.19		U
2		22.8			27.2			0.209	U		0.294			3.65			0.493		
3		1.02			1.06			0.258	U		0.388	K	J-EMPC	0.805	K	J-EMPC	1.13		U
4		0.856	K	J-EMPC	0.862			1.29	U		3.87	K	J-EMPC	36.8			2.46		
5		0.289	U		0.232	U		0.703	U	UJ	0.519	U		0.700			0.193	U	
6		0.565			0.564	K	J-EMPC	0.639	U	UJ	2.16			7.82			1.34		
7		0.252	U		0.202	U		0.657	U	UJ	0.485	U		0.480			0.290		
8		2.41			2.79			0.600	U	UJ	7.58			22.6			5.41		
9		0.257	U		0.206	U		0.634	U	UJ	0.540	K	J-EMPC	0.597			0.563	K	J-EMPC
10		0.250	U		0.201	U		0.626	U	UJ	0.462	U		0.501	K	J-EMPC	0.175	U	
11		91.8			101			19.8		UJ	34.1			4,480			6.55		
12	12 + 13	1.51	C		1.42	C K	J-EMPC	0.724	C U	UJ	0.534	C U		0.385	C U		0.350	C K	J-EMPC
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.251	U		0.202	U		0.687	U	UJ	0.507	U		0.366	U		0.184	U	
15		5.52	K	J-EMPC	7.13			0.914	U		1.05	K	J-EMPC	36.9			1.57		
16		1.85			1.77			0.292		UJ	8.56			53.7			1.38	K	J-EMPC
17		1.93			2.00			0.295	K	J-EMPC	17.8			49.7			1.78		
18	18 + 30	4.40	C		4.40	C		0.655	C K	UJ	37.6	C		116	C		3.63	C	
19		0.395			0.385			0.214	U		1.26			9.19			0.472		
20	20 + 28	15.2	C		17.1	C		2.23	C	J	155	C		110	C		4.96	C	
21	21 + 33	4.83	C		5.60	C		0.460	C K	J-EMPC	29.7	C		56.2	C		2.08	C	
22		4.60			5.08			0.566	K	J-EMPC	23.1			102			1.21		
23		0.104	U		0.0716	U		0.115	U	UJ	0.143	K	J-EMPC	0.127	K	J-EMPC	0.150	K	J-EMPC
24		0.0760	K	J-EMPC	0.0474	U		0.104	U	UJ	0.644	K	J-EMPC	1.35			0.0798	U	
25		0.807			0.939			0.117		J	2.42			10.1			0.246		
26	26 + 29	1.70	C		1.88	C		0.348	C		14.2	C		21.0	C		0.812	C	
27		0.382			0.419			0.0930	U	UJ	3.15			13.0			0.242	K	J-EMPC
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		9.39			10.5			1.09		J	38.0			76.2			3.36		
32		0.937			0.929			0.132		J	9.17			9.78			0.947		
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.102	U		0.103	K	J-EMPC	0.116	U	UJ	0.537			0.325			0.0803	U	
35		0.533	K	J-EMPC	0.594			0.136	U	UJ	0.123	U		11.0			0.129	K	J-EMPC
36		0.152			0.183	K	J-EMPC	0.119	U	UJ	0.107	U		2.49			0.0825	U	
37		5.85			7.23			2.59			2.36			47.7			0.525		U
38		0.0946	U		0.0910			0.120	U	UJ	0.108	U		0.867			0.0837	U	
39		0.0939	U		0.117	K	J-EMPC	0.117	U	UJ	0.556			2.04			0.0856	U	
40	40 + 41 + 71	5.92	C		6.31	C		0.647	C K	J-EMPC	35.1	C		102	C		0.760	C	
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		3.75			3.67			0.512			15.6			107			0.0849	U	
43		0.301			0.474			0.103	U		5.01			6.41			0.0912	U	
44	44 + 47 + 65	16.9	C		16.1	C		2.15	C		104	C		399	C		2.37	C	
45	45 + 51	1.67	C		1.83	C		0.138	C K	J-EMPC	4.24	C		22.4	C		0.508	C K	J-EMPC
46		0.637	K	J-EMPC	0.698			0.104	U		0.608	K	J-EMPC	5.07	K	J-EMPC	0.0970	K	J-EMPC
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		2.40			2.42			0.321			15.2			57.7			0.269		
49	49 + 69	9.67	C		10.7	C		0.907	C		92.5	C		120	C		1.09	C K	J-EMPC
50	50 + 53	1.67	C		1.50	C		0.150	C		1.99	C K	J-EMPC	33.3	C		0.257	C K	J-EMPC
51	45 + 51		C45			C45			C45			C45			C45			C45	
52		21.6			22.5			1.89			161			322			3.88		
53	50 + 53		C50			C50			C50			C50			C50			C50	
54		0.0677	U		0.0661	U		0.130	U		0.130	U		0.131			0.0620	U	
55		0.124	U		0.117	U		0.187	K	J-EMPC	6.82			8.48			0.0715	U	
56		6.87			8.25			0.802			17.1			109			0.364	K	J-EMPC
57		0.120	U		0.113	U		0.125	U		0.714			1.01			0.0648	U	
58		0.120	U		0.113	U		0.133	U		0.752	U		1.12			0.0674	U	
59	59 + 62 + 75	1.61	C		1.50	C		0.207	C		10.4	C		29.6	C		0.179	C K	J-EMPC
60		4.46			4.83			0.875			62.1			60.1			0.380		
61	61 + 70 + 74 + 76	34.6	C		39.7	C		6.60	C		249	C		394	C		3.90	C	
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.997			1.18			0.777			12.2			10.5			0.0654	U	
64		7.06			7.58			0.650			51.4			94.4			0.787	K	J-EMPC
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		21.0			24.8			7.41			236			295			1.80		
67		0.469	K	J-EMPC	0.519			0.112	U		1.60			9.20			0.0589	U	
68		0.243	K	J-EMPC	0.361			0.128			0.811			2.75			0.0603	U	
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.327			0.406			0.121	U		3.30			2.59			0.0585	U	
73		0.0731	U		0.0643	U		0.0568	U		0.103	U		0.0585	U		0.0619	U	
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		2.85			3.53			2.26			7.99			33.7			0.121	K	J-EMPC
78		0.117	U		0.111	U		0.137	U		0.772	U		0.714	U		0.0707	U	
79		0.538			0.481			0.146			0.997			15.8			0.0576	U	
80		0.109	U		0.103	U		0.120	U		0.675	U		0.624	U		0.0633	U	
81		0.135			0.150	K	J-EMPC	0.145	U		0.882	K	J-EMPC	2.17	K	J-EMPC	0.0831	U	
82		3.66			4.45			0.168	U		4.24	K	J-EMPC	29.3			0.350	K	J-EMPC
83	83 + 99	30.0	C		33.8	C		7.64	C		398	C		529	C		5.57	C	
84		8.13			9.95			0.560			4.60			64.7			0.546		
85	85 + 116 + 117	9.25	C		10.4	C		2.58	C		132	C		134	C		1.33	C	
86	86 + 87 + 97 + 108 + 119 + 125	28.6	C		32.4	C		3.47	C		103	C		489	C		2.11	C	
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
88	88 + 91	5.27	C		6.11	C		0.404	C		5.64	C		59.6	C		0.329	C	
89		0.309			0.359	K	J-EMPC	0.161	U		0.343	U		2.82			0.111	U	
90	90 + 101 + 113	44.2	C		51.9	C		5.26	C K	J-EMPC	176	C		845	C		2.62	C	
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		8.33	G	J	9.58	G	J	0.850			56.4			110			0.616	K	J-EMPC
93	93 + 95 + 98 + 100 + 102	29.7	C		31.7	C		2.43	C		73.0	C		500	C		2.45	C	
94		0.111	U		0.125	U		0.162	U		0.345	U		1.25	K	J-EMPC	0.110	U	
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.133	K	J-EMPC	0.198	K	J-EMPC	0.0644	U		0.509	K	J-EMPC	0.989			0.0612	U	
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.397			0.469	K	J-EMPC	0.137	U		0.749	K	J-EMPC	2.35			0.0903	U	
104		0.0612	U		0.0557	U		0.106	U		0.119	U		0.0970			0.0723	U	
105		24.9			27.7			6.24			362			352			2.67		
106		0.200	U		0.270	U		0.190	U		0.851	U		0.935	U		0.104	U	
107	107 + 124	1.72	C		2.27	C K	J-EMPC	0.399	C		12.9	C		28.9	C		0.110	C U	
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		4.60			5.25			4.75			53.1			60.4			0.181	K	J-EMPC
110	110 + 115	52.8	C		63.5	C		3.99	C		186	C		786	C		3.11	C	
111		0.0723	U		0.0816	U		0.120	U		1.00			0.344	K	J-EMPC	0.0844	U	
112		0.0716	U		0.0807	U		0.108	U		0.231	U		0.173	U		0.0807	U	
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		1.29			1.37			2.35			22.0			22.8			0.254	K	J-EMPC
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	

Table D-3
PCB Congener Qualifer Summary
Bradford Island - Remedial Investigation
Goose Island Slough Sampling

IUPAC #	COELUTING CONGENERS[1]	090427110SD L12657-1	Lab Qualifier	URS Review Qualifier	090429111SD L12657-2	Lab Qualifier	URS Review Qualifier	090429110CF L12725-1	Lab Qualifier	URS Review Qualifier	090429110SC L12725-2	Lab Qualifier	URS Review Qualifier	090429110TC L12725-3	Lab Qualifier	URS Review Qualifier	090430BAIT DF L12658-1	Lab Qualifier	URS Review Qualifier
118		65.7			69.5			87.0			872			1,590			11.0		
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.319	K	J-EMPC	0.291			0.398			3.45			5.09			0.0815	U	
121		0.0774	U		0.0872	U		0.118	U		0.455			0.287	K	J-EMPC	0.0816	U	
122		0.604			0.576			0.232	U		1.04	U		8.27			0.118	U	
123		0.963			0.970	K	J-EMPC	2.56			16.3			28.0			0.166	K	J-EMPC
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.255	K	J-EMPC	0.419	K	J-EMPC	0.261	K	J-EMPC	3.15			3.07			0.139	U	
127		0.204	U		0.275	U		0.223	U		1.51	K	J-EMPC	1.64			0.115	U	
128	128 + 166	14.2	C		17.3	C		1.48	C K	J-EMPC	194	C		141	C		1.49	C	
129	129 + 138 + 160 + 163	91.4	C		97.5	C		44.5	C		1,130	C		1,640	C		13.3	C	
130		5.75			6.51			1.77			18.2			61.3			0.243		
131		0.721	K	J-EMPC	0.761			0.195	U		0.798	U		7.67			0.116	U	
132		20.9			25.3			1.42			10.7			162			0.989	K	J-EMPC
133		1.28			1.54			0.924			16.8			16.7			0.169		
134	134 + 143	3.04	C		3.76	C		0.689	C K	J-EMPC	2.28	C		31.9	C		0.151	C K	J-EMPC
135	135 + 151 + 154	20.8	C		23.5	C		3.04	C		94.7	C		270	C		1.12	C	
136		6.12			7.28			0.636			9.96			48.9			0.292		
137		2.52	K	J-EMPC	3.22	K	J-EMPC	4.13			33.1			32.7			0.474	K	J-EMPC
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	1.31	C K	J-EMPC	1.33	C		0.178	C U		15.6	C		14.8	C		0.158	C	
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		7.80			10.7			0.177	U		49.7			45.1			0.535		
142		0.168	U		0.307	U		0.198	U		0.812	U		0.913	U		0.119	U	
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		1.98			2.66			0.290	K	J-EMPC	4.25			26.2			0.0893	U	
145		0.0739	U		0.0643	U		0.0866	U		0.113	U		0.256			0.0695	U	
146		9.23	G	J	8.91	G	J	15.0			114			270			1.02		
147	147 + 149	54.9	C		60.2	C		6.32	C		38.4	C		930	C		2.15	C	
148		0.132			0.0796	U		0.111	U		0.473	K	J-EMPC	1.49			0.0882	U	
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.100			0.122	K	J-EMPC	0.0823	U		0.107	U		1.12			0.0656	U	
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0676	U		0.0589	U		0.0787	U		0.254	K	J-EMPC	0.447			0.0615	U	
153	153 + 168	87.6	C		78.8	C		136	C		1,050	C		2,540	C		14.5	C	
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0591	U		0.0523	U		0.118	U		1.20	K	J-EMPC	0.907			0.0668	U	
156	156 + 157	8.50	C		10.4	C		13.3	C		106	C		96.9	C		1.55	C	
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		6.63			7.51			1.04			86.7			103			1.40		
159		0.753			0.871			0.138	U		0.567	U		2.45			0.0929	U	
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.113	U		0.207	U		0.139	U		0.570	U		0.641	U		0.0877	U	
162		0.284	K	J-EMPC	0.250	K	J-EMPC	0.400	K	J-EMPC	4.48			2.92			0.0956	U	
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		5.10			6.01			0.579	K	J-EMPC	23.4			37.4			0.157	K	J-EMPC
165		0.130	U		0.238	U		0.159	U		0.718			0.733	U		0.0952	U	
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		4.02			3.81			11.2			34.8			92.5			0.607		
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.241	U		0.250	U		0.164	U		1.31	U		1.08	U		0.0994	U	
170		13.8			17.1			8.66			113			38.7			3.10		
171	171 + 173	5.36	C		5.94	C		0.960	C		47.8	C		52.7	C		0.729	C K	J-EMPC
172		2.43			3.08			0.676	K	J-EMPC	17.4			6.10			0.371	K	J-EMPC
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		13.9			18.8			1.55			8.12			39.6			0.524	K	J-EMPC
175		0.706			0.698	K	J-EMPC	0.290			2.37			7.22			0.0891	U	
176		1.99			2.20			0.285	K	J-EMPC	0.687			22.0			0.0654	U	
177		11.9			13.8			4.80			19.3			139			0.720		
178		5.05			5.66			2.42			41.6			65.3			0.0898	U	
179		8.08			9.39			1.07			11.5			87.2			0.284	K	J-EMPC
180	180 + 193	32.2	C		37.6	C		57.3	C		264	C		295	C		8.13	C	
181		0.164	K	J-EMPC	0.139	K	J-EMPC	0.267	K	J-EMPC	1.52			1.72			0.0965	U	
182		0.117	U		0.178			0.142	K	J-EMPC	1.28	K	J-EMPC	0.144	U		0.0883	U	
183	183 + 185	11.5	C		13.1	C		5.11	C		89.0	C		153	C		2.36	C	
184		0.0990	K	J-EMPC	0.0741	U		0.0568	U		0.886			1.06			0.0638	U	
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0974	U		0.0791	U		0.0589	U		0.149	U		0.122	U		0.0693	U	
187		31.1	G	J	29.8	G	J	52.2			200			477			1.69	K	J-EMPC
188		0.0892	U		0.0733	U		0.155	K	J-EMPC	0.414	K	J-EMPC	1.09			0.0703	U	
189		0.615			0.869			0.662			3.83			1.57			0.0917	U	
190		4.02			4.11	K	J-EMPC	4.73			44.0			52.6			0.665		
191		0.534	K	J-EMPC	0.630			0.841			5.34			5.48			0.0793	U	
192		0.104	U		0.0844	U		0.0623	U		0.157	U		0.129	U		0.0864	U	
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		9.07			12.0			3.76			35.7			8.03			1.69		
195		4.07			4.76			2.48			23.6			17.8			0.566		
196		4.27			5.18			3.05			19.6			11.4			0.966	K	J-EMPC
197	197 + 200	0.815	C		1.01	C G	J	0.297	C K	J-EMPC	3.63	C		6.84	C		0.216	C K	J-EMPC
198	198 + 199	13.4	C		17.1	C		5.37	C K	J-EMPC	45.2	C		28.2	C		0.911	C	
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		1.64	K	J-EMPC	1.80			1.20			3.32			13.5			0.0830	K	J-EMPC
202		4.07			4.81			1.63			26.9			44.5			0.233	K	J-EMPC
203		9.76			10.9			5.47			60.7			74.5			1.56		
204		0.0942	U		0.0818	U		0.0637	U		0.132			0.0634	U		0.0666	U	
205		0.499			0.631	K	J-EMPC	0.315	K	J-EMPC	3.29			2.87			0.107	U	
206		7.73			11.1			1.53	K	J-EMPC	21.3			10.9			0.915		
207		1.25			1.62			0.425			3.24			2.25			0.260	K	J-EMPC
208		2.71			3.88			0.758			6.62			5.71			0.151		
209		6.79			11.0			1.80			11.0			7.10			0.612		
	Total PCBs^2 (pg/g)	1,195			1,335			578			8,134			21,432			146		
	Total PCBs^2 (ug/kg or ppb)	**1.19**	J		**1.34**	J		**0.578**	J		**8.13**	J		**21.4**	J		**0.146**	J	

Notes:

All results are in units of pg/g (picograms/gram), dry weight, except where noted.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quanitification limit is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
ug/kg = micrograms per kilogram
pg/g = picograms per gram
ppb = parts per billion
1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.
2= Total PCBs are calculated by summing all 209 congeners, excluding results flagged as U, UJ, or J-EMPC.

RIVER OPERABLE UNIT REMEDIAL INVESTIGATION REPORT

QUALITY CONTROL SUMMARY REPORT FOR ANALYTICAL CHEMISTRY

CONGENER RESULTS FOR DOWNSTREAM SEDIMENT COLLECTED MARCH 2008

JUNE 2009

Prepared by:

URS

111 S.W. Columbia, Suite 1500
Portland, Oregon 97201-5850

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TABLES

1.0 Executive Summary

The overall assessment of the analytical results for the six downstream sediment samples shows the quality of the data to be acceptable to support project objectives. The contracted laboratories provided results for all requested analyses and laboratory data reports were complete. Some data were qualified as estimated, and flagged 'J' or 'J-EMPC'. Some data were qualified as not detected, and flagged 'U'. All data qualifiers resulting from this review have been added to both the project database and the data tables within the main body of this report. Refer to Section 4.0 of this report for a listing of qualifier definitions. The end user should be aware of the potential low bias of the PCB congener results due to hold time exceedance (as discussed in Section 4.1). Additionally, the mono- and dichlorbiphenyls (PCBs 1 through PCB 14) could not be validated against method blank concentrations due to inadequate method blank results for these congeners (Section 4.4).

2.0 Project Description

Downstream sediment samples were collected by URS on March 10 and 11, 2008 in support of the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation. Table 1 summarizes the URS identification number, the laboratory identification number, collection date and requested analyses for each of the sediment samples. The samples were previously analyzed for PCB Aroclors, selected semivolatile organic compounds (SVOCs), selected metals, diesel range total petroleum hydrocarbons (TPH-Dx), total organic carbon (TOC), percent solids and grain size. The analytical results and data quality review for the above-listed analytes were presented in the River Operable Unit Remedial Investigation Data Summary Report dated July 28, 2008 (URS 2008a). This quality control summary data report and attached tables only addresses the PCB congener analytical results for the six sediments.

3.0 Sampling and Analytical Procedures

Samples were collected according to the Bradford Island Bonneville Lock and Dam Project, River Operable Unit Remedial Investigation Quality Assurance Project Plan (QAPP) (URS 2007). Deviations from the QAPP (i.e. change in sample locations) are addressed in the Post-Removal Sample Collection Memorandum (URS 2008b). Samples were submitted to Columbia Analytical Services (CAS) of Kelso, Washington and were archived frozen (-20 degrees Celsius, °C). The specifics of the sample receipt are detailed in the quality control summary report attached with the original data report (URS 2008a). In summary, all sediment sample arrived intact at CAS as were archived frozen prior to and following homogenization using an industrial blender. Authorization to release the remainder of the homogenized sediment sample to Axys of Sidney, British Columbia, Canada to perform PCB congener analysis by EPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by High Resolution Gas Chromatography/High Resolution Mass Spectrometry*, was given to CAS on March 25, 2009, by URS. The Axys analytical data report includes a listing of the Axys Method 1668A modifications. Table 1 lists the Axys samples identification numbers.

4.0 Data Validation

Analyses were performed in general accordance with the above-referenced methods. The analytical results for all samples were subjected to a quality assurance/quality control (QA/QC) review. This QA/QC review includes evaluation of representativeness (sample collection/handling), accuracy (spike and/or standard recoveries), analytical precision (duplicate relative percent difference), comparability (use of standard methods) and completeness (percent of usable data). Specifically, the following items were reviewed when appropriate: compliance with the QAPP, chain-of-custody (COC), laboratory case narrative, proper sample preservation and handling procedures, holding times, quantitation limits, field/method/trip blank analyses, matrix/matrix spike duplicate recoveries, laboratory duplicate results, field duplicate results, blank spike recoveries (laboratory control samples), data completeness and format, data qualifiers assigned by the laboratory, and analyte identification. The following items were reviewed for 20% or greater of the data: primary and secondary column verification, initial and continuing instrument calibrations and a verification of the reported electronic data with the hard copy deliverable. In the case of identified inconsistencies in the above-listed items a complete review would be have been performed.

The data review process for this investigation followed the QAPP. Additionally, because the QAPP-referenced *Department of Defense Quality Systems Manual* does not discuss PCB congeners, the data review process utilized guidance from EPA's *Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA 2005) and *EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data* (USEPA 1995) as appropriate for method performed. In the case of disagreement between the guidance documents and the analytical method, method criteria were utilized for data review. Project-specific QC criteria are listed in the above mentioned QAPP.

A summary of qualifiers assigned to results in this investigation is included in Table 2. Samples are listed by their URS sample identification assigned in the field as well as the laboratory identification. Congeners are reported using sample-specific detection limits. Qualifiers that may be assigned to the results of this investigation include the following:

- U - The analyte was analyzed for but was not detected.

- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

- J-EMPC – The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration of the analyte in the sample - used only for PCB congener results.

- UJ - The analyte was not detected. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report. Another value is available that is more reliable or appropriate.

Final sample results and qualifiers are presented in the analytical tables provided in the sampling report.

4.1 Chain-of-Custody, Sample Preservation and Holding Time

As noted above in Section 3.0, all sediment samples arrived intact at CAS and were archived frozen prior to and following homogenization using an industrial blender. As reported previously, the COC forms indicated that the samples were maintained under proper chain-of-custody and forms were signed upon release and receipt. All coolers were submitted at temperatures within the EPA-recommended temperature of 6 degrees Celsius (°C) or below. Representativeness was maintained during the sampling effort by completing all sampling using similar sampling procedures and in accordance with the approved QAPP.

The COC form for the CAS to Axys delivery (samples shipped on March 24, 2009 and were received on March 25, 2009) indicates that samples were maintained under chain-of-custody and the form was signed upon release and receipt. The condition and temperature of the samples upon receipt by Axys was appropriate and all samples listed on the COC form were present. Data were not qualified based COC and sample shipment procedures.

All samples were analyzed on April 15, 2009, 35 to 36 days past the technical and contracted holding time of one year.

- Analytical results for PCB congeners for all six samples were qualified as estimated and flagged ‘J/UJ’ due to holding time exceedances (Table 2). It should be noted that these results may be biased low due to sample degradation.

4.2 Instrument Calibration

The congener analyses were performed within one analysis batch, WG28339. The laboratory performed initial multipoint calibrations for all target and surrogate compounds as required by Method 1668A. The laboratory performed initial multipoint calibrations for all target and standard compounds as required by the ICALs, CCVs and OPR (ongoing precision recovery) standards were analyzed at the proper frequency and at appropriate concentrations as required by EPA Method 1668A. Calibration compounds met the acceptance criteria as listed in the method.

4.3 Review of Blanks

Method blanks are used to check for laboratory contamination and instrument bias. The laboratory analyzed at least one method blank per analysis for each batch, per QAPP requirements. Qualification of samples due to method blank and calibration blank contamination followed guidelines set forth in the EPA NFGs and EPA Region 10 SOP.

PCB congener results that were reported as detected at a concentration less than five times (5x) the associated blank concentration were flagged ‘U’ or non-detect at the reported concentration. Target compounds reported with concentrations greater than 5x the blank concentration were not qualified. Target compounds detected in the method blank but reported as not detected in the associated samples were not qualified. Method blank results reported as estimated maximum possible concentrations (EMPCs) were not considered appropriate for use in qualifying associated sample results. Method 1668A stipulates using a method blank as similar to the matrix as possible. The method blank was prepared using clean sand to imitate the sediment matrix.

Method blanks associated with the sediment samples had low levels of some PCBs. The results of a few congeners were qualified non-detect based on these method blank concentrations. Samples qualified non-detect and flagged ‘U’ as a result of method blank detected PCB congeners are indentified in the URS Review Qualifier field of Table 2.

Recoveries of some of the labeled standards in the method blank were below the acceptance criteria, as a result analytical results for the mono- and di-chlorobiphenyls (PCB 1 through 14) were not available, see Section 4.4 below for details.

4.4 Labeled Internal Standard Recovery Review

Samples analyzed for PCB congeners are spiked with labeled internal (quantification) standards. These standards are used to quantitate target congeners and the calculations of target compound concentrations are designed to compensate for low extraction and/or cleanup efficiencies. In addition, their recovery is measured against injection standards added after extraction and cleanup to evaluate extraction and/or cleanup efficiency which could affect sensitivity and could also affect accuracy for target compounds not quantitated against a chemically identical, isotopically labeled standard. The percent recovery of the labeled standards was compared with the limits set forth in EPA Method 1668A and those set by Axys detailed in Table 1 of the Axys narratives. All recoveries were acceptable with the following exception:

- The percent recoveries of ^{13}C-labeled PCB 1 (14.9%) and ^{13}C-labeled PCB 4 (21.0%) for sample 08031046SD (L12476-1) were below the Axys control limits of 15% and 25%, respectively. Data were not qualified based on ^{13}C-labeled PCB 1 recovery, the recovery was close enough to round to the control limit of 15%. Given that isotopic dilution calculations produce recovery corrected quantitation results, only the non-chemically identical PCB congeners, quantitated using the labeled standard PCB 4 were qualified as estimated based on the internal standard recoveries for PCB 4. Associated analytical results for PCB 5 through 14 were qualified as estimated and flagged ‘J/UJ’ due to the low recovery of ^{13}C-labeled standard PCB 4.

- The percent recoveries of the following labeled standards in the method blank sample (WG28339-101) were below the Axys control limits:

Labeled Standard	% Recovery	Control Limits (%)

^{13}C-labeled PCB 1	Not Quantifiable (NQ)	
^{13}C-labeled PCB 3	NQ	
^{13}C-labeled PCB 4	NQ	
^{13}C-labeled PCB 15	17.3	25-150
^{13}C-labeled PCB 19	12.4	25-150
^{13}C-labeled PCB 54	22.6	25-150

Associated analytical results for mono- and dichlorbiphenyls (PCBs 1 through 14) could not be quantified in the method blank due to the non-quantifiable analytical results for labeled standard PCBs 1 through 4. All other analytes were reported in the method blank sample. The labeled standards in the OPR and the primary samples were acceptable (with the above noted exception). Therefore, the bias low recoveries of the low molecule weight labeled standards appears to be isolated to the method blank sample. When contacted, the laboratory suggested the low recovery is likely attributed to evaporation during the blow-down process.

As a result of not having method blank results for the PCBs 1 through 14, the associated project samples could not be validated against method blank concentrations. Not having the ability to potentially qualify the PCB congeners 1 through 14 non-detect, is deemed to have minimal effect on the overall data usage. All congener results were previously qualified ‘J/UJ’ due to hold time exceedance, further qualification of the data was not necessary.

Cleanup standards 28L, 111L, and 178L typically are added prior to cleanup and quantitated using injection standards added just prior to analysis to evaluate cleanup efficiency. The cleanup standards were within the 30-135% control limits set by EPA Method 1668A.

4.5 Ongoing Precision and Recovery

MS/MSD samples are not required by Method 1668A for PCB congener analysis. For Method 1668A, ongoing precision and recovery (OPR) samples were used in place of LCS to monitor laboratory performance. The OPR was prepared using clean sand to imitate the solid matrix of the samples. OPR recoveries were acceptable for congener analyses.

4.6 Duplicate Review

Field duplicates were not collected due to the statistical nature of the sampling event (as discussed in detail in the QAPP). Project-specific laboratory duplicates were not performed. There is no guidance on laboratory duplicate precision for individual PCB congeners, in either the NFGs, the EPA Region 10 SOP, or Method 1668A.

4.7 Compound Quantification

Sample 08031151SD (L2476-6) was diluted and reanalyzed to bring area responses of some target congeners within the linear calibration range of the instrument. Only the affected target compounds are reported from the reanalysis. Relevant concentrations from both the undiluted and diluted analytical results are reported within the data deliverable and project database. The reanalysis results are identified with a sample ID suffix of ‘W’ within the report.

The internal standard method is used to calculate concentrations of PCB congeners that do not have chemically identical labeled standards. The internal standard method is dependent upon consistent detector response over the calibration range. If the detector response varies, concentrations can be biased high or low based on variations in the detector sensitivity. During congener analysis, PFK (perfluorokerosene) is used as a lock mass reference standard to measure changes in detector sensitivity. Each lock mass must not vary more than 20% throughout its respective retention time window as required by Method 1668A. Variations of more than 20% indicate the presence of a co-eluting interference or decreased sensitivity. Lock mass stability and sensitivity were acceptable for the sediment sample analysis.

4.8 Target Compound Identification

Ion abundance ratios are used to identify PCB congeners. Results that met all other qualitative identification criteria but differ by more than 15% from the theoretical ion abundance criterion set by EPA Method 1668A were flagged in the laboratory report with a ‘K’ flag. Those results flagged ‘K’ with ion abundance ratios outside the identified quantitation criteria are considered estimated maximum possible concentrations (EMPC) and were re-flagged ‘J-EMPC’ during this review. If the analyte result was previously qualified ‘U’ by method blank detection, the result retained the ‘U’ qualifier and it was not qualified further because an ion ratio was out of limits (there is no ion ratio criterion for non-detects). These “EMPC” flagged data are listed in Table 2, appear within the data tables in the main body of this deliverable, and have been entered into the database.

Ion ratios outside the control limits are generally a consequence of co-eluting interferences to either one or both quantitation peaks. In these cases, Axys chose to use the quantitation peak areas as recorded; no adjustments were made to force the peaks to match the theoretical ion abundance ratios before reporting EMPC results. EMPC results should be considered by the data users as part of evaluating the data for end-use objectives.

Additionally, the laboratory-assigned flag ‘C’ was used in Table 2 to indicate co-eluting PCB isomers for this analysis. The concentrations of the co-eluting isomers were reported as a group, eliminating the need for any data qualification as part of this data review.

4.10 Reporting Limits

All non-detect congener results are reported at sample specific reporting limits. All samples were analyzed using approximately 10 grams as recommended by Method 1668A. Axys performed a dilution on sample 080311251SD. The dilution appears to have had little impact on the reporting limits. All reporting limits are considered sufficient to meet project objectives.

5.0 Completeness

The laboratory reported all requested analytes and the deliverable data reports were complete. Some data were qualified as estimated ‘J’ or ‘J-EMPC’ and some as non-detect ‘U’. A summary of qualifiers can be found in Tables 2. A completeness summary follows; analysis completeness was calculated using 159 congener results, 209 total congeners minus the 50 co-eluting congeners which were reported with the lowest numbered congener in the co-eluting set.

The electronic and portable delivery format (.pdf) versions of the deliverables were cross-checked for accuracy at a frequency of 20% or greater. Any minor discrepancies found between the deliverables were reported to CAS and corrected by updating the database to reflect the .pdf deliverable.

- *Technical Completeness* = (useable results/total reported results) x100
  = (954 compliant / 954 total results) = 100%
  All samples results are considered useable.

- *Analytical Completeness* = (unqualified results/total reported results) x100

  = (0 compliant / 954 total results) = 0%

  Congener data were qualified as estimated and flagged ‘J-EMPC’ or qualified non-detect and flagged ‘U’. Additionally, all analytical results were qualified as estimated ‘J/UJ’ due to hold time exceedances.. Samples were analyzed 35 to 36 days past the 1 year hold time for PCB congeners. Samples were authorized for PCB congener analysis by URS per request the USACE (client) after the hold time of 1 year was exceeded. The slight hold time exceedance is not deemed to appreciably effect the data usability.

- *Contract Completeness* = (contract compliant results/total reported results) x100

  = (954 compliant / 954 total results) = 100%

  All samples met laboratory contract requirements.

- *Field Sampling Completeness* =(samples collected/number samples planned) x100

  = (6 samples collected / 6 planned samples) =100%

  All samples submitted to Axys for analysis had a complete set of results. All samples had sufficient sample volume to perform the PCB congener anlaysis as detailed in the QAPP.

6.0 References

DOD 2006. Department of Defense Environmental Data Quality Workgroup. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories. Final Version 3. January 2006. Retrieved from [*http://www.navylabs.navy.mil/Archive/DoDV3.pdf*] on 3/3/06

URS 2007. Quality Assurance Project Plan, *River Operable Unit Remedial Investigation*, Bradford Island, Bonneville Lock and Dam Project, Cascade Locks, Oregon. September 2007.

URS 2008a. River Operable Unit Remedial Investigation Data Summary Report, Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. July 28, 2008.

URS 2008b. Memorandum: Post-Removal Sample Collection, Bradford Island Disposal Site, Bonneville Dam Forebay, Cascade Locks, Oregon. May 12, 2008.

USEPA 1995. EPA Region 10 Standard Operating Procedure (SOP) for the Validation of Method 1668 Toxic, Dioxin-like, PCB Data. December 1995.

USEPA 2008. U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines (NFGs) for Organic Data Review. June 2008.

USEPA 2005. Contract Laboratory Program National Functional Guidelines (EPA NFGs) for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September 2005.

Table 1
Sample Identification and Analysis Summary
Bradford Island - Remedial Investigation
Sediment Samples Collected March 2008

						Anaytes						
Station Number	**URS ID**	**Collection Date**	**CAS ID (non-congeners)**	**Axys ID (congeners)**	**Axys Sample Delivery Group**	**PCB (Aroclors) (CAS)**	**PCB (Congeners) (Axys Analytical)**	**PAHs**	**SVOCs**	**Metals**	**TOC**	**%Solids**
46	08031046SD	03/10/08	K0802371-011	L12476-1	DPWG28676	--	X	--	--	--	--	--
47	08031047SD	03/10/08	K0802371-012	L12476-2		--	X	--	--	--	--	--
48	08031048SD	03/10/08	K0802371-013	L12476-3		--	X	--	--	--	--	--
49	08031049SD	03/10/08	K0802371-014	L12476-4		--	X	--	--	--	--	--
50	08031150SD	03/11/08	K0802371-015	L12476-5		--	X	--	--	--	--	--
51	08031151SD	03/11/08	K0802371-016	L12476-6		--	X	--	--	--	--	--

Notes:

CAS - Columbia Analytical Services
Axys - Axys Analytical Services, Ltd.
ID - Identification
PCB - Polychlorinated Biphenyl
PAHs - Polycyclic Aromatic Hydrocarbons
SVOCs - Semivolatile Organic Compounds
-- previously reported; not included in this quality control summary report.

Table 2
Downstream Sediment PCB Congener Analysis Results
Lab Sample ID's L12476-1 through L11366-6
Bradford Island - Remedial Investigation
Sediment Collected March 2008

IUPAC #	COELUTING CONGENERS[1]	08031046SD L12476-1	Lab Qualifier	URS Review Qualifier	08031047SD L12476-2	Lab Qualifier	URS Review Qualifier	08031048SD L12476-3	Lab Qualifier	URS Review Qualifier	08031049SD L12476-4	Lab Qualifier	URS Review Qualifier	08031150SD L12476-5	Lab Qualifier	URS Review Qualifier	08031151SD L12476-6	Lab Qualifier	URS Review Qualifier
1		0.155	K	J-EMPC	0.187		J	0.226		J	1.130		J	0.276		J	0.118	K	J-EMPC
2		0.263		J	0.406		J	0.439		J	0.411		J	5.390		J	0.335	K	J-EMPC
3		0.186		J	0.186		J	0.155		J	2.670		J	0.319		J	0.148	K	J-EMPC
4		0.531	U	UJ	0.429		J	0.497		J	2.310		J	0.737		J	0.344	U	UJ
5		0.268	U	UJ	0.155	U	UJ	0.205	U	UJ	0.257	U	UJ	0.147	U	UJ	0.201	U	UJ
6		0.247	U	UJ	0.210		J	0.188	U	UJ	0.237	U	UJ	0.436		J	0.185	U	UJ
7		0.255	U	UJ	0.148	U	UJ	0.195	U	UJ	0.245	U	UJ	0.140	U	UJ	0.191	U	UJ
8		0.321		J	0.938		J	0.738		J	1.010		J	2.250		J	0.493		J
9		0.246	U	UJ	0.142	U	UJ	0.187	U	UJ	0.236	U	UJ	0.135	U	UJ	0.184	U	UJ
10		0.254	U	UJ	0.147	U	UJ	0.194	U	UJ	0.244	U	UJ	0.139	U	UJ	0.190	U	UJ
11		18.1		J	27.2		J	27.7		J	25.9		J	52.4		J	32.9		J
12	12 + 13	0.259	C U	UJ	0.150	C U	UJ	0.198	C U	UJ	0.249	C U	UJ	0.478	C	J	0.194	C U	J
13	12 + 13		C12			C12			C12			C12			C12			C12	
14		0.246	U	UJ	0.142	U	UJ	0.188	U	UJ	0.236	U	UJ	0.135	U	UJ	0.184	U	UJ
15		0.286	U	UJ	1.150		J	1.510		J	4.980		J	3.360		J	0.685		J
16		0.201	K	J-EMPC	0.496		J	0.347	K	J-EMPC	0.995		J	1.910		J	0.399		J
17		0.202		UJ	0.605		UJ	0.361		UJ	1.250		J	1.910		J	0.390		UJ
18	18 + 30	0.415	C K	J-EMPC	1.080	C	J	0.981	C	J	2.510	C	J	4.340	C	J	0.832	C	J
19		0.107	U	UJ	0.182	K	J-EMPC	0.212		J	2.660		J	0.443		J	0.121	U	J
20	20 + 28	1.01	C K	UJ	2.43	C	UJ	2.80	C	UJ	9.28	C	J	11.40	C	J	1.80	C	UJ
21	21 + 33	0.360	C	UJ	1.070	C	UJ	0.751	C	UJ	3.810	C	J	3.640	C	J	0.523	C	UJ
22		0.366	K	UJ	0.802		UJ	1.020		UJ	3.070		J	3.570		J	0.604		UJ
23		0.0516	U	UJ	0.0501	U	UJ	0.0492	U	UJ	2.1700		J	0.0751	U	UJ	0.0691	U	UJ
24		0.0563	U	UJ	0.0503	U	UJ	0.0571	U	UJ	0.0912	U	UJ	0.0800		J	0.0801	U	UJ
25		0.0790		J	0.1460		J	0.1350		J	0.5650		J	0.6520		J	0.1080		J
26	26 + 29	0.152	C		0.331	C	J	0.372	C	J	1.300	C	J	1.390	C	J	0.224	C	J
27		0.0527	U	UJ	0.0840		J	0.0870		J	0.1560		J	0.3750		J	0.0750	U	UJ
28	20 + 28		C20			C20			C20			C20			C20			C20	
29	26 + 29		C26			C26			C26			C26			C26			C26	
30	18 + 30		C18			C18			C18			C18			C18			C18	
31		0.679		UJ	1.720		UJ	1.770		UJ	7.670		J	7.660		J	1.250		UJ
32		0.0730		J	0.3290		J	0.2900		J	0.7940		J	0.9640		J	0.1390		J
33	21 + 33		C21			C21			C21			C21			C21			C21	
34		0.0495	U	UJ	0.0501	U	UJ	0.0492	U	UJ	1.9100		J	0.0721	U	UJ	0.0663	U	UJ
35		0.0890		J	0.1130	K	J-EMPC	0.1620		J	0.1670	K	J-EMPC	0.2590	K	J-EMPC	0.1180	K	J-EMPC
36		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.1010	U	UJ	0.0690	K	J-EMPC	0.0628	U	UJ
37		0.504		UJ	1.040		U	1.230		J	4.290		J	3.960		J	0.819		UJ
38		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.1040	U	UJ	0.0705	U	UJ	0.0649	U	UJ
39		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.1020	U	UJ	0.0693	U	UJ	0.0638	U	UJ
40	40 + 41 + 71	0.285	C K	J-EMPC	0.659	C		0.665	C	J	3.770	C	J	4.640	C	J	0.901	C	J
41	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
42		0.200	K	J-EMPC	0.514	K	J-EMPC	0.378		J	1.940		J	2.820		J	0.522	K	J-EMPC
43		0.0683	U	UJ	0.0507	U	UJ	0.0547	U	UJ	0.3160	K	J-EMPC	0.3790		J	0.0890	U	UJ
44	44 + 47 + 65	1.14	C	U	2.20	C	U	1.80	C	UJ	7.04	C	J	12.20	C	J	2.59	C	U
45	45 + 51	0.130	C	J	0.260	C K	J-EMPC	0.272	C	J	1.220	C	J	1.510	C	J	0.282	C	
46		0.0660	U	UJ	0.0800	K	J-EMPC	0.0990		J	0.3860		J	0.5150		J	0.0860	U	UJ
47	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
48		0.132	K	J-EMPC	0.313		J	0.299		J	1.740	K	J-EMPC	1.650		J	0.314	K	J-EMPC
49	49 + 69	0.617	C	U	1.310	C	J	1.150	C	UJ	5.270	C	J	8.710	C	J	1.430	C	J
50	50 + 53	0.143	C K	J-EMPC	0.253	C	J	0.194	C	J	1.100	C K	J-EMPC	1.500	C	J	0.215	C K	J-EMPC
51	45 + 51		C45			C45	J		C45			C45			C45			C45	
52		1.48		UJ	4.19		J	2.84		J	11.10		J	20.30		J	3.57		J
53	50 + 53		C50			C50	J		C50			C50			C50			C50	
54		0.0508	U	UJ	0.0501	U	UJ	0.0492	U	UJ	2.2800		J	0.0473	U	UJ	0.0563	U	UJ
55		0.0774	U	UJ	0.0643	U	UJ	0.0492	U	UJ	0.1920	K	J-EMPC	0.1920	K	J-EMPC	0.0808	U	UJ
56		0.479		UJ	1.020		J	0.944		J	4.570		J	5.850		J	1.140		J
57		0.0723	U	UJ	0.0600	U	UJ	0.0492	U	UJ	0.0635	U	UJ	0.0762	U	UJ	0.0754	U	UJ
58		0.0733	U	UJ	0.0609	U	UJ	0.0492	U	UJ	0.0644	U	UJ	0.0810	K	J-EMPC	0.0765	U	UJ
59	59 + 62 + 75	0.118	C K	J-EMPC	0.187	C	J	0.179	C K	J-EMPC	0.831	C	J	1.060	C	J	0.203	C	J
60		0.359			0.847		J	0.714		J	2.730		J	3.100		J	0.782		J
61	61 + 70 + 74 + 76	2.42	C	UJ	6.30	C	J	4.78	C	J	17.10	C	J	30.30	C	J	5.62	C	J
62	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
63		0.0681	U	UJ	0.1140		J	0.1020		J	0.4920		J	0.7270		J	0.1540		J
64		0.504		UJ	1.220		J	0.956		J	3.990		J	5.840		J	1.120		J
65	44 + 47 + 65		C44			C44			C44			C44			C44			C44	
66		1.40			3.46		J	2.73		J	10.10		J	17.80		J	3.33		J
67		0.0633	U		0.0830		J	0.0600		J	0.2500		J	0.3460	K	J-EMPC	0.0661	U	UJ
68		0.0695	U		0.0577	U	UJ	0.0492	U	UJ	0.0930	K	J-EMPC	0.2110	K	J-EMPC	0.0725	U	UJ
69	49 + 69		C49			C49			C49			C49			C49			C49	
70	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
71	40 + 41 + 71		C40			C40			C40			C40			C40			C40	
72		0.0692	U	UJ	0.0575	U	UJ	0.0492	U	UJ	0.0870		J	0.2990	K	J-EMPC	0.0722	U	UJ
73		0.0493	U	UJ	0.0610	K	J-EMPC	0.0492	U	UJ	0.0699	U	UJ	0.0473	U	UJ	0.0567	U	UJ
74	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
75	59 + 62 + 75		C59			C59			C59			C59			C59			C59	
76	61 + 70 + 74 + 76		C61			C61			C61			C61			C61			C61	
77		0.259	K	J-EMPC	0.531	K	J-EMPC	0.478		J	1.600		J	2.010		J	0.573		J
78		0.0763	U	UJ	0.0633	U	UJ	0.0492	U	UJ	0.0670	U	UJ	0.0805	U	UJ	0.0796	U	UJ
79		0.0602	U	UJ	0.1140	K	J-EMPC	0.0880	K	J-EMPC	0.2180		J	0.5340		J	0.1500		J
80		0.0684	U	UJ	0.0568	U		0.0492	U	UJ	0.0601	U	UJ	0.0722	U	UJ	0.0714	U	UJ
81		0.0831	U	UJ	0.0707	U	UJ	0.0492	U	UJ	0.2600		J	0.1000	U	UJ	0.0981	U	UJ
82		0.157		J	0.610		J	0.464		J	1.240		J	2.340		J	0.552	K	J-EMPC
83	83 + 99	1.65	C		4.91	C	J	3.50	C	J	11.20	C	J	22.00	C	J	4.90	C	J
84		0.376		J	1.170		J	0.826		J	2.410		J	6.290		J	0.926		J
85	85 + 116 + 117	0.712	C K	J-EMPC	2.020	C	J	1.330	C	J	3.400	C	J	5.730	C	J	1.790	C	J
86	86 + 87 + 97 + 108 + 119 + 125	1.57	C	J	4.59	C	J	3.55	C	J	10.10	C	J	19.70	C	J	4.51	C	J
87	86 + 87 + 97 + 108 + 119 + 125		C86			C86	J		C86			C86			C86			C86	
88	88 + 91	0.334	C K	J-EMPC	0.831	C	J	0.568	C	J	1.590	C	J	4.170	C	J	0.775	C	J
89		0.0753	U	UJ	0.0590	K	J-EMPC	0.0691	U	UJ	0.1300	K	J-EMPC	0.2680		J	0.2650	U	UJ
90	90 + 101 + 113	2.61	C	J	7.75	C	J	5.61	C	J	16.60	C	J	30.90	C	J	7.14	C	J
91	88 + 91		C88			C88			C88			C88			C88			C88	
92		0.493		J	1.410		J	1.150	K	J-EMPC	2.900		J	9.030		J	1.200		J
93	93 + 95 + 98 + 100 + 102	1.41	C	UJ	4.85	C	J	3.38	C	J	8.51	C	J	32.30	C	J	4.49	C	J
94		0.0774	U	UJ	0.0529	U	UJ	0.0710	U	UJ	0.1120	U	UJ	0.1420	K	J-EMPC	0.2750	U	UJ
95	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
96		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0760		J	0.1040		J	0.1450	U	UJ
97	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
98	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
99	83 + 99		C83			C83			C83			C83			C83			C83	
100	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
101	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
102	93 + 95 + 98 + 100 + 102		C93			C93			C93			C93			C93			C93	
103		0.0625	U	UJ	0.0700	K	J-EMPC	0.0573	U	UJ	0.0903	U	UJ	0.2220		J	0.2230	U	UJ
104		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.8900		J	0.0473	U	UJ	0.0652	U	UJ
105		1.79		J	6.26		J	4.26		J	9.43		J	19.70		J	3.98		J
106		0.0784	U	UJ	0.0576	U	UJ	0.0587	U	UJ	0.1200	U	UJ	0.0733	U	UJ	0.3280	U	UJ
107	107 + 124	0.159	C K	J-EMPC	0.398	C	J	0.254	C K	J-EMPC	0.438	C	J	1.170	C K	J-EMPC	0.414	C	J
108	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
109		0.272	K	J-EMPC	0.762		J	0.549	K	J-EMPC	1.390		J	2.450		J	0.906		J
110	110 + 115	2.85	C	J	10.60	C	J	7.15	C	J	17.20	C	J	35.90	C		8.71	C	J
111		0.0533	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0771	U	UJ	0.0535	U	UJ	0.1940	U	UJ
112		0.0529	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0765	U	UJ	0.0531	U	UJ	0.1840	U	UJ
113	90 + 101 + 113		C90			C90			C90			C90			C90			C90	
114		0.0976	U	UJ	0.3830		J	0.2390		J	0.6500		J	0.9570		J	0.3150		J
115	110 + 115		C110			C110			C110			C110			C110			C110	
116	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
117	85 + 116 + 117		C85			C85			C85			C85			C85			C85	
118		4.09		J	13.20		J	9.18		J	16.70		J	45.60		J	10.90		J
119	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
120		0.0495	U	UJ	0.0501	U	UJ	0.0590	K	J-EMPC	0.0715	U	UJ	0.2260	K	J-EMPC	0.1830	U	UJ
121		0.0546	U	UJ	0.0501	U	UJ	0.0500	U	UJ	0.0788	U	UJ	0.0547	U	UJ	0.1970	U	UJ
122		0.0913	U	UJ	0.0910	K	J-EMPC	0.0800		J	0.1440	K	J-EMPC	0.3600		J	0.3540	U	UJ
123		0.168	K	J-EMPC	0.271		J	0.130		J	0.497			0.874		J	0.226		J
124	107 + 124		C107			C107			C107			C107			C107			C107	
125	86 + 87 + 97 + 108 + 119 + 125		C86			C86			C86			C86			C86			C86	
126		0.113	U	UJ	0.081	U	UJ	0.079	U	UJ	0.171	U	UJ	0.211		J	0.096	U	UJ
127		0.0869	U	UJ	0.0638	U	UJ	0.0650	U	UJ	0.1330	U	UJ	0.0812	U	UJ	0.3440	U	UJ
128	128 + 166	0.767	C	J	2.550	C	J	1.900	C	J	3.230	C	J	8.950	C	J	2.120	C	J

Table 2
Downstream Sediment PCB Congener Analysis Results
Lab Sample ID's L12476-1 through L11366-6

Bradford Island - Remedial Investigation
Sediment Collected March 2008

IUPAC #	COELUTING CONGENERS[1]	08031046SD L12476-1	Lab Qualifier	URS Review Qualifier	08031047SD L12476-2	Lab Qualifier	URS Review Qualifier	08031048SD L12476-3	Lab Qualifier	URS Review Qualifier	08031049SD L12476-4	Lab Qualifier	URS Review Qualifier	08031150SD L12476-5	Lab Qualifier	URS Review Qualifier	08031151SD L12476-6	Lab Qualifier	URS Review Qualifier
129	129 + 138 + 160 + 163	5.95	C	J	15.80	C	J	12.00	C	J	21.90	C	J	69.10	C	J	16.10	C	J
130		0.312		J	0.928	K	J-EMPC	0.708		J	1.120		J	4.020		J	0.750	K	J-EMPC
131		0.0845	U	UJ	0.1150	U	UJ	0.0800	K	J-EMPC	0.2720	K	J-EMPC	0.4610		J	0.1110	U	UJ
132		0.943			2.600		J	2.420		J	5.880		J	14.500		J	2.060	K	J-EMPC
133		0.0815	U	UJ	0.2120		J	0.1650	K	J-EMPC	0.2980		J	0.8180		J	0.1610	K	J-EMPC
134	134 + 143	0.117	C K	J-EMPC	0.433	C K	J-EMPC	0.289	C	J	0.738	C K	J-EMPC	2.140	C	J	0.310	C K	J-EMPC
135	135 + 151 + 154	1.34	C	J	3.00	C	J	2.63	C	J	6.34	C	J	17.00	C	J	2.48	C	J
136		0.267	K	J-EMPC	0.815		J	0.637		J	1.720		J	4.840		J	0.664		J
137		0.158		J	0.667	K	J-EMPC	0.481		J	1.040	K	J-EMPC	1.960		J	0.454		J
138	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
139	139 + 140	0.0850	C	J	0.2370	C K	J-EMPC	0.1140	C K	J-EMPC	0.3300	C	J	0.7210	C	J	0.1160	C K	J-EMPC
140	139 + 140		C139			C139			C139			C139			C139			C139	
141		0.642		J	1.460		J	1.220		J	2.430		J	7.300		J	1.260		J
142		0.0839	U	UJ	0.1150	U	UJ	0.0793	U	UJ	0.1120	U	UJ	0.1140	U	UJ	0.1100	U	UJ
143	134 + 143		C134			C134			C134			C134			C134			C134	
144		0.114	K	J-EMPC	0.331		J	0.332	K	J-EMPC	0.746		J	1.640		J	0.254		J
145		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	J	0.0482	U	UJ	0.0495	U	UJ	0.0563	U	UJ
146		1.26	K	J-EMPC	2.82		J	2.39		J	5.31		J	13.30		J	3.80		J
147	147 + 149	3.01	C		7.67	C	J	6.04	C	J	13.40	C	J	39.20	C	J	6.15	C	J
148		0.0621	U	UJ	0.0501	U	UJ	0.0529	U	UJ	0.0618	U	UJ	0.0730		J	0.0669	U	UJ
149	147 + 149		C147			C147			C147			C147			C147			C147	
150		0.0493	U	UJ	0.0501	U	J	0.0492	U	UJ	0.0482	U	UJ	0.0482	U	UJ	0.0563	U	UJ
151	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
152		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0482	U	UJ	0.0473	U	UJ	0.0563	U	UJ
153	153 + 168	5.46	C	J	13.20	C	J	9.74	C	J	18.30	C	J	56.80	C	J	12.00	C	J
154	135 + 151 + 154		C135			C135			C135			C135			C135			C135	
155		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.3500		J	0.0473	U	UJ	0.0563	U	UJ
156	156 + 157	0.604	C K	J-EMPC	1.820	C	J	1.390	C K	J-EMPC	2.890	C	J	6.250	C	J	1.740	C	J
157	156 + 157		C156			C156			C156			C156			C156			C156	
158		0.446		J	1.320		J	1.010		J	2.050		J	5.590		J	1.100		J
159		0.0790	K	J-EMPC	0.0817	U	UJ	0.1440		J	0.3190		J	0.9870	K	J-EMPC	0.1180	K	J-EMPC
160	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
161		0.0578	U	UJ	0.0790	U	UJ	0.0547	U	UJ	0.0769	U	UJ	0.0788	U	UJ	0.0760	U	UJ
162		0.0613	U	UJ	0.0838	U	UJ	0.0580	U	UJ	0.0816	U	UJ	0.2260	K	J-EMPC	0.0806	U	UJ
163	129 + 138 + 160 + 163		C129			C129			C129			C129			C129			C129	
164		0.286		J	0.714		J	0.636		J	1.210	K	J-EMPC	3.730		J	0.688		J
165		0.0651	U	UJ	0.0889	U	UJ	0.0615	U	UJ	0.0865	U	UJ	0.0887	U	UJ	0.0855	U	UJ
166	128 + 166		C128			C128			C128			C128			C128			C128	
167		0.320		J	0.697		J	0.554		J	1.030		J	2.610		J	0.765		J
168	153 + 168		C153			C153			C153			C153			C153			C153	
169		0.0697	U	UJ	0.0894	U	UJ	0.0630	U	UJ	0.0900	U	UJ	0.1540	U	UJ	0.0837	U	UJ
170		1.03		J	1.86		J	2.04		J	5.34		J	12.40		J	2.73		J
171	171 + 173	0.410	C K	J-EMPC	0.715	C	J	0.627	C K	J-EMPC	1.670	C	J	4.570	C	J	0.806	C	J
172		0.329	K	J-EMPC	0.524		J	0.481	K	J-EMPC	1.160		J	2.650		J	0.705		J
173	171 + 173		C171			C171			C171			C171			C171			C171	
174		1.12		J	1.82		J	1.69		J	4.75		J	13.10		J	2.21		J
175		0.0600	K	J-EMPC	0.0870	K	J-EMPC	0.1250	K	J-EMPC	0.1750		J	0.6120		J	0.1220	K	J-EMPC
176		0.0930	K	J-EMPC	0.3060	K	J-EMPC	0.2490		J	0.5730		J	1.8000		J	0.2070	K	J-EMPC
177		0.830		J	1.860		J	1.690		J	4.390		J	10.300		J	2.130		J
178		0.449		J	0.667	K	J-EMPC	0.601		J	1.330	K	J-EMPC	4.160		J	0.998		J
179		0.523		J	1.130		J	1.020		J	2.510		J	6.560		J	1.010		J
180	180 + 193	2.87	C	J	4.66	C	J	4.94	C	J	12.60	C	J	31.40	C	J	7.15	C	J
181		0.0521	U	UJ	0.0501	U	UJ	0.0566	U	UJ	0.1220	K	J-EMPC	0.1600	K	J-EMPC	0.0563	U	UJ
182		0.0493	U	UJ	0.0501	U	UJ	0.0522	U	UJ	0.0980	K	J-EMPC	0.1170	K	J-EMPC	0.0920	K	J-EMPC
183	183 + 185	0.947	C	J	1.670	C	J	1.530	C	J	3.860	C	J	10.900	C	J	1.900	C	J
184		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0482	U	UJ	0.0473	U	UJ	0.0563	U	UJ
185	183 + 185		C183			C183			C183			C183			C183			C183	
186		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0515	U	UJ	0.0473	U	J	0.0563	U	UJ
187		2.94		J	4.81		J	4.34			10.90		J	29.70		J	7.70		J
188		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0940		J	0.0473	U	UJ	0.0563	U	UJ
189		0.0733	U	UJ	0.1150	K	J-EMPC	0.0970		J	0.2540		J	0.5960		J	0.1400		J
190		0.301	K	J-EMPC	0.572		J	0.431		J	1.290		J	3.280		J	0.731		J
191		0.0493	U	UJ	0.0690	K	J-EMPC	0.0930		J	0.1730	K	J-EMPC	0.5220		J	0.1040	K	J-EMPC
192		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0603	U	UJ	0.0540	U	UJ	0.0563	U	UJ
193	180 + 193		C180			C180			C180			C180			C180			C180	
194		0.928		J	1.110		J	1.170	K	J-EMPC	3.010		J	7.520		J	2.040		J
195		0.326		J	0.564		J	0.578	K	J-EMPC	1.360		J	3.410		J	1.010		J
196		0.361	K	J-EMPC	0.646	K	J-EMPC	0.558	K	J-EMPC	1.450		J	3.730		J	0.932	K	J-EMPC
197	197 + 200	0.238	C	J	0.339	C	J	0.418	C	J	0.670	C K	J-EMPC	1.460	C	J	0.328	C U	UJ
198	198 + 199	1.49	C	J	2.04	C	J	1.68	C	J	3.57	C K	J-EMPC	9.72	C	J	2.94	C	J
199	198 + 199		C198			C198			C198			C198			C198			C198	
200	197 + 200		C197			C197			C197			C197			C197			C197	
201		0.114	K	J-EMPC	0.321		J	0.216	K	J-EMPC	0.482		J	1.280		J	0.293	K	J-EMPC
202		0.589	K	J-EMPC	0.738		J	0.515		J	1.140		J	3.040		J	1.150		J
203		0.917		J	1.200	K	J-EMPC	1.320		J	2.390		J	6.990		J	2.280		J
204		0.0493	U	UJ	0.0501	U	UJ	0.0492	U	UJ	0.0487	U	UJ	0.0473	U	UJ	0.0563	U	UJ
205		0.0565	U	UJ	0.0950	K	J-EMPC	0.0650	K	J-EMPC	0.1170		J	0.3980		J	0.1150	K	J-EMPC
206		0.784		J	2.920		J	1.050		J	1.590		J	6.160		J	2.160		J
207		0.128	U	UJ	0.413		J	0.118	U	UJ	0.231		J	0.789	K	J-EMPC	0.287	K	J-EMPC
208		0.412		J	1.400		J	0.437		J	0.574		J	2.260		J	0.876		J
209		0.825	K	J-EMPC	2.400		J	1.250		J	1.490		J	7.100		J	3.450		J
	Total PCBs[2] (pg/g)	82.1			210			168			412			915			208		
	Total PCBs[2] (ug/kg or ppb)	**0.0821**	**J**		**0.210**	**J**		**0.168**	**J**		**0.412**	**J**		**0.915**	**J**		**0.208**	**J**	

Notes:

All results are in units of pg/g (picograms/gram), dry weight.

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the reported sample quantification limit.
J = The reported value is an estimate.
UJ = The analyte was not detected. The reported sample quanitification limit is an estimate.
J-EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
PCBs = Polychlorinated Biphenyls
ug/kg = micrograms per kilogram
pg/g = picograms per gram
ppb = parts per billion

1= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners, to eliminate possible errors during congener summation.

2= Total PCBs are calculated by summing all 209 congeners, excluding results flagged as U, UJ, or J-EMPC.