Appendix D

Framework for Portland Harbor Storm Water Screening Evaluations

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Appendix D Framework for Portland Harbor Storm Water Screening Evaluations

D.1 Introduction

A detailed understanding of storm water discharge quality and quantity to Portland Harbor is needed to evaluate potential adverse impacts to the Willamette River. This information will be utilized to identify, prioritize, and implement storm water source control measures to prevent contamination of river sediments and recontamination of river sediments following the Portland Harbor clean up.

Over 250 private and public storm water outfalls have been identified within the Portland Harbor initial study area (ISA). Given the commercial/industrial nature of upland development within this area, storm water is a potentially significant mechanism for transporting contaminants from upland sites to the Willamette River. The storm water pathway evaluation and screening process described in this document has been designed as a first step towards characterizing storm water impacts on Willamette River sediment and water quality from upland sites being investigated under Oregon Department of Environmental Quality (DEQ) cleanup authority[1].

D.1.1 Purpose

The purpose of this document is to provide DEQ Cleanup Program project managers with a framework for overseeing the development of site-specific work plans for evaluating the storm water pathway at Portland Harbor upland sites (including both permitted and unpermitted facilities) and public outfalls. This framework includes information regarding adequate characterization for screening current storm water discharges from cleanup sites (*e.g.*, sampling procedures, sampling frequencies, storm event criteria) and is intended as a companion document to the Interim Final "*Joint Source Control Strategy*" (JSCS) for Portland Harbor prepared by DEQ and Region X of the U.S. Environmental Protection Agency (EPA) (DEQ/EPA, 2005). The JSCS provides a detailed discussion of the storm water screening process including screening level values (SLVs), source control prioritization, and weight-of-evidence evaluations to determine if source control is needed under the JSCS. This document is intended as guidance for employees of DEQ and is presented as framework or method that others may use for that purpose, if appropriate. Its use, however, is not required.

Storm water discharges are highly variable both in terms of flow and pollutant concentrations. Based on the intermittent discharge periods and unknown pollutant and sediment loads associated with storm water, a conservative approach is used in the JSCS for screening. This approach is used to identify potentially significant hazardous substance sources (*i.e.*, dissolved or sediment loads) to the river.

[1] Oregon Revised Statute (ORS) 465.200 et seq. and Oregon Administrative Rules (OAR) 340-122-0010 to 0140.

Piped storm water or sheetflow discharges have the potential to suspend and transport soil (including catch basin or conveyance line sediment) into the river, especially during storm events. Particulates settling out of storm water discharges may represent a source of contaminant loading to river sediment, therefore cumulative sampling approaches may be required (*e.g.*, sediment traps). This document relies on the use of catch basin sediment to initially screen potential particulate input to the river, alternative methods (*e.g.*, sediment traps, sampling of sediments accumulated in conveyance lines; high-volume filtering of storm water discharges) may be proposed. DEQ may require some sites, based on the results of storm water screening and other site -specific information, to characterize storm water sediments in a more quantitative way to assess contaminant loading to the river. DEQ may develop additional information (*e.g.*, guidance, fact sheets) for DEQ project managers regarding potential sampling methods, loading calculations, or evaluating sediment recontamination from upland sources.

Upland sites with potentially complete storm water pathways will be selected for storm water screening evaluation, based on DEQ's site discovery process (see Appendix B of the JSCS) or site-specific information (*e.g.*, Willamette River sediment data, National Pollutant Discharge Elimination System (NPDES) monitoring results, intra-agency referrals, conveyance line data or facility sampling, spill history, inspections, etc.).

Evaluating storm water discharges is considered a high priority in the JSCS and should be addressed in early 2006 and 2007 to allow completion of upland source control decisions and to provide needed data to the in-water remedial investigation (RI).

D.1.2 Background

Available Willamette River data indicate that sediments are contaminated with metals (*e.g.*, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), semivolatile organic compounds (SVOCs), phthalates, chlorinated pesticides (*e.g.*, DDT, DDE and DDD), chlorinated herbicides, polychlorinated dibenzo-p-dioxins and furans (PCDD/PCDF), total petroleum hydrocarbons (TPH), and polychlorinated biphenyls (PCBs) (See Appendix B of the JSCS). Detailed information on sediment data is available in the Lower Willamette Group's (LWG) *Portland Harbor RI/FS Programmatic Work Plan* (LWG, 2004a) and the City of Portland's *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project* (CH2M Hill, 2004).

Of the 250 outfalls identified in the Portland Harbor ISA, approximately 100 upland facilities are subject to/covered by NPDES storm water permits Industrial storm water permits are required for specific industry classifications as established by EPA. These include individual permits, 1200-Z general permits, and 1300-J permits for the discharge of storm water from facilities storing, transferring, formulating and/or packaging bulk petroleum products. The City of Portland administers NPDES 1200-Z and 1300-J storm water permits within the City limits under a Memorandum of Agreement (MOA) with DEQ (See Appendix A of the JSCS). A number of shoreline and upland sites do not have storm water discharge permits because there is no exposure of activities or the activities described for their operations do not match the specific federal Standard Industrial Classification (SIC) codes that require a permit. Storm water monitoring required by these NPDES permits does not include the broad suite of contaminants typically detected in Willamette River sediment.

The City of Portland and co-permittees Port of Portland and Multnomah County implement storm water management programs under a permit issued by DEQ under the federal Clean Water Act (CWA). The permit is formally called the Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. DEQ issued the first-term permit to the City in 1995 and issued the final second-term permit in July 2005. In August 1991, the City of Portland signed an agreement with DEQ (amended in 1994) that established a schedule to eliminate combined sewer overflows (CSOs) to the Willamette River by 94 percent by the end of 2011.

D.1.3 DEQ's Regulatory Authority

DEQ regulates storm water discharges under its Water Quality program (See Appendix A of the JSCS). DEQ's Water Quality rules[2] state:

> *Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.* OAR 340-041-0033

In addition, Oregon's Narrative Water Quality Criteria (OAR Chapter 340, Division 41) prohibit the creation of: 1) tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish; 2) objectionable discoloration, scum, oily sheen or floating solids or coating of aquatic life with oil film; 3) aesthetic conditions offensive to the human senses; and 4) formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry.

DEQ's Environmental Cleanup rules provide a conditional exemption to permitted releases of hazardous substances into the environment, except as provided below:

> *These rules do not apply to permitted or authorized releases of hazardous substances, unless the Director determines that application of these rules might be necessary in order to protect public health, safety or welfare, or the environment. These rules may be applied to the deposition, accumulation, or migration resulting from otherwise permitted or authorized releases.* OAR 340-122-0030[3].

[2] Oregon Administrative Rules (OAR) Chapter 340, Division 041, Section 0033
[3] Oregon Administrative Rules (OAR) Chapter 340, Division 122, Section 0030

Available data suggest contaminants are accumulating in Portland Harbor sediments and aquatic tissue that may adversely affect public health, safety or welfare, or the environment. Therefore, DEQ is requiring upland facilities (including public outfalls) being investigated under DEQ's cleanup rules to fully characterize and evaluate potential hazardous substance discharges to the Willamette River via groundwater, storm water, or soil erosion. This data may be required by DEQ under preliminary assessments with sampling (XPAs) or RIs.

It is DEQ's intent that data collected under Cleanup Program authorities will meet NPDES monitoring requirements and be acceptable to the Water Quality Program, as discussed in Subsection 3.2. DEQ's Water Quality Program will be proposing changes to 1200-Z permits, in 2006. These changes can be tracked on DEQ's website: http://www.deq.state.or.us/wq/wqpermit/stormwaterhome.htm.

D.1.4 Objectives

The goal of this document is to provide DEQ Cleanup Program project managers with a framework for overseeing the development of storm water work plans for evaluating storm water discharges from upland facilities in Portland Harbor. The specific objectives of this framework are to:

1) Provide acceptable sampling procedures and sampling frequencies, consistent with the JSCS, for characterizing storm water discharges (*i.e.*, liquid and particulate transport) to the Willamette River through individual or shared storm water conveyance systems; and

2) Provide consistency in storm water collection and evaluation between individual Portland Harbor facilities through implementation of this framework.

Data obtained from work plans and fieldwork implemented in accordance with this framework will be screened against Portland Harbor screening level values (SLVs) as defined in the JSCS. In addition, the data will be used to:

1) Determine the types, concentrations, and variability of hazardous substances (including Persistent, Bioaccumulative and Toxic pollutants (PBTs) such as PCBs and phthalates) in storm water discharges (both liquid and solid) from upland facilities to the Willamette River;

2) Determine if storm water discharges potentially impair the identified beneficial uses of the Willamette River;

3) Identify upland facilities that may require further investigation of potential impacts associated with storm water discharges or may require source control; and

4) Assess the effectiveness of Best Management Practices (BMPs) and determine if addition additional source control measures might be needed.

This framework addresses current, ongoing releases only. It does not purport to make conclusions regarding historical discharges to the receiving water body that may have occurred via the storm water system.

The following sections present the types of information that should be included in an upland work plan for evaluating the storm water pathway at a cleanup site within the Portland Harbor study area. This document is presents an acceptable framework for storm water screening; other methods may be used for that purpose, if appropriate, and approved by DEQ.

D.2 Site Information

The initial step in developing a storm water characterization work plan is collecting and documenting basic site information. That information will provide the framework for selecting catch basin sediment and storm water monitoring parameters for the screening evaluation.

D.2.1 Potential Contaminant Sources

Potential current and historic contaminant sources should already have been identified during the preliminary assessment (PA) or remedial investigation (RI)[4]. Taking the following steps will help to identify potential storm water contaminant sources:

- Evaluate the site from a storm water perspective – identify areas of industrial storm water run-on and runoff;
- Review current and historic site operations (*e.g.,* manufacturing or other industrial processes, transportation-related activities, equipment or vehicle maintenance or washing, outdoor storage, on-site waste disposal, dust or particulate generating activities);
- Review the site regulatory history *(e.g.,* pre-treatment requirements, permits, spills, inspections, enforcement actions);
- Evaluate current and historic[5] uses of the property;
- Review the site materials inventory (*e.g.,* fuels, solvents, detergents, plastic pellets, metallic products, hazardous substances, transformers, fertilizers, pesticides, ash, slag, sludge, etc.). The State Fire Marshal's Community Right-to-Know hazardous substance database can be used, along with facility inventory records.
- Review the results of any environmental investigations performed at the site;
- Review federal, state and local spill databases;
- Review the results of catch basin solids waste disposal characterizations;

[4] DEQ's PA and RI process is described in the Appendix B of the JSCS.
[5] The history of Portland Harbor sites is typically reviewed back to the very early 1900's.

- Review DEQ program files (*e.g.,* air, water, storm water, underground storage tank, cleanup, underground injection control point); and
- Review of City of Portland program files (*e.g.,* storm water, plumbing records, etc.).

Information regarding potential current and historic contaminant sources (*e.g*., potential source, contaminant(s) associated with potential source, estimated volume, storage method, period used) should be tabulated and the location of each potential source should be shown on an appropriate site plan.

D.2.2 Facility Storm Water System

Maps and figures should be developed to illustrate and evaluate current and historic site features and facility storm water drainage. The following DEQ and City of Portland resources may have specific drainage information: PAs, RIs, facility as-built drawings, plumbing records, NPDES Storm Water Permit and monitoring reports, Storm Water Pollution Control Plans, and City Storm Water Inspection Records, etc.

The site storm water map prepared for this evaluation should include:

General Site Data:
- Property line and adjacent streets;
- Buildings/structures (onsite and adjacent properties);
- Surface water bodies;
- Paved/unpaved areas; and
- Locations of current and historic industrial activities (*e.g.,* fueling stations, loading and unloading areas, vehicle or equipment maintenance areas, waste disposal areas, storage areas, non-storm water discharges).

Facility Drainage Data:
- Catch basins;
- Storm water conveyance lines (including pipe diameter, connections, invert elevations);
- Discharge points ("outfalls" or connection to shared conveyance line);
- Drainage areas and impervious nature of each outfall and catch basin;
- Direction of storm water flow; and
- Structural control measures (any constructed features to control storm water flow such as berms, retention/detention ponds, vegetative swales, sediment traps, ditches, oil-water separators, etc.).

The description of the site storm water drainage system should be verified through facility inspection records and/or dye testing, if necessary. In addition, available storm water system construction data and site hydrogeologic data should be assessed to determine if the storm water system (both the piping and backfill materials) might intercept and preferentially transport contaminated groundwater. If it is determined that the storm water may provide a preferential pathway for groundwater contaminant migration, DEQ may require additional work under upland agreements to assess the groundwater pathway.

D.2.3 Current Site Storm Water Controls

Preventative measures (largely nonstructural practices) or control measures (structural practices) implemented at the facility (including public outfalls) to reduce storm water contamination should be presented the work plan. That information is needed to understand current site conditions and will likely be used in making source control decisions. Information sources regarding potential site storm water controls may include facility records, DEQ Water Quality files, and City of Portland industrial files, and may include the following:

- Storm Water Pollution Control Plans;
- Storm Water Best Management Practices;
- Spill Prevention and Response Procedures; and
- Preventative Maintenance Programs.

Preventative measures are typically management techniques that reduce the exposure of storm water to potential contaminants. Examples of preventative measures a facility may implement include:

- Employee education and training programs: proper material handling, storage, and disposal practices; alternative materials; toxic use reduction; spill prevention and response, etc.;
- Debris Removal: catch basin cleaning and parking lot sweeping etc.;
- Exposure Reduction: limiting exposure of materials that are potential contaminant sources to rainfall or runoff; reducing and covering inventory installing secondary containment for hazardous liquids, etc.; and
- Runoff Diversion: channeling runoff away from contaminant sources.

Control measures are used to reduce the level of contaminants in storm water and may include filtering, settling, or biological uptake. These are usually engineered systems (*e.g.*, oil/water separators; constructed wetlands; swales). Design documents should be available for review.

The efficiency and effectiveness of preventative or control measures is dependent on system design, implementation, and operation and maintenance. Therefore, it is important that design documents, available system monitoring data, and system operations and maintenance records be obtained and reviewed to assess the potential effectiveness of these measures. Regular maintenance and cleanout of storm drain inlets (*e.g.*, catch basins) has been shown to reduce contaminant loading. Therefore, facility record keeping may be an indicator of the effectiveness of preventative or control measures.

D.3 Sample Analyses Parameter Selection

D.3.1 General Considerations

The site information collected and reviewed as described in Section 2 provides the framework for selecting parameters for monitoring catch basin sediment and storm water quality and locations for characterizing the storm water pathways. The resulting upland site storm water data will be screened against the Portland Harbor SLV defined in the JSCS. Appendix B of the JSCS describes DEQ's process for identifying and screening potential current and historical releases of hazardous substances.

Available site information, including NPDES storm water permit limits or benchmarks, should be incorporated in the selection of screening parameters. This coordination should allow the screening evaluation conducted under the cleanup program to fulfill the monitoring requirements of the industrial NPDES permit. A site's specific catch basin sediment and storm water monitoring parameters may include or be based upon:

- Site-specific contaminants of interest (COI);
- Portland Harbor Willamette River data (*e.g.*, surface water or sediment) supporting a specific suite of COIs;
- Facility NPDES permit parameters; and
- Other applicable regulatory requirements (*e.g.* whether the facility discharges to an impaired (303(d) listed) water body, Total Maximum Daily Loads (TMDLs)).

Additional information regarding the general categories of potential storm water parameters is presented below for DEQ Cleanup program project managers.

D.3.1.1 Site-Specific and Portland Harbor COIs

Evaluating the contribution of storm water to the measured sediment contamination in Portland Harbor or the impacts to water quality in the Willamette River requires storm water discharge data for both site-specific and Portland Harbor COIs. Site-specific COIs are developed from the general site information described in Section 2 and DEQ's Preliminary Assessment (PA) and Remedial Investigation (RI) process.

The ongoing RI[6] of Willamette River sediment and water quality is generating data characterizing the nature and extent of contaminants within the Portland Harbor initial study area. The available RI data (*e.g.*, Round 1 fish tissue data, Round 2 sediment data) supports a more comprehensive suite of parameters during the storm water screening process than site-specific information alone. PBT compounds such as PCBs, dioxins, and mercury, as well as metals, pesticides and herbicides, and polycyclic aromatic

[6] The Portland Harbor RI is being performed by the Lower Willamette Group (LWG) under EPA oversight.

hydrocarbons (PAHs) have been detected in sediment and fish tissue and identified as potential contaminants of concern for Portland Harbor. Attachment A presents a fact sheet that identifies potential sources of PCBs in the environment. Information similar to that in the fact sheet should be considered when developing COI and sampling parameters.

D.3.1.2 NPDES Permit Parameters

The NPDES 1200-Z industrial storm water general permits include benchmarks for total copper, total lead, total zinc, pH, total suspended solids (TSS), and total oil & grease. Facility-specific discharge limitations vary for individual NPDES permits.

D.3.1.3 Other Regulatory Programs

In addition to the site-specific concerns, broader regulatory objectives may warrant inclusion of other parameters to assess potential pollutant contributions to the Willamette River. For example, the Willamette River was listed as "impaired" under Clean Water Act § 303 (d) in 1996, requiring the DEQ to develop a water quality improvement plan. The Lower Willamette River[7], river miles 0 to 24.8, is currently listed for:

- Temperature;
- Fecal coliform;
- Aldrin;
- Dieldrin;
- DDT;
- DDT metabolites;
- Polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs);
- Pentachlorophenol;
- Mercury; and
- Manganese.

Currently, TMDLs have been proposed for mercury, bacteria and temperature in the Willamette Basin. Screening for mercury could support mercury reduction goals under the TMDL.

D.3.2 Catch Basin Sediment Sampling and Analyses Parameters

Catch basin sediment screening is intended to precede the storm water screening, so that analytical results from the catch basin screening can be used to help develop and refine the site-specific storm water analytical suite. Fine-grained sediments may be useful in screening for some hydrophobic compounds such as PCBs and SVOCs. The analytical suite for catch basins should be based on the information gathered during the site information review as well as overarching programmatic concerns. At this stage, it is

[7] The EPA approved DEQ's 2002 303(d) list on March 24, 2003.

recommended that upland sites conduct a broader suite of analyses for each relevant site-specific pollutant category (*e.g.*, priority pollutant metals, SVOCs) rather than to narrow the list to individual constituents.

At a minimum, the following information, when available, should be considered when developing site-specific COIs for catch basin sediment sampling (See Appendix B of the JSCS for additional information):

- Contaminants associated with current and historical operations;
- Materials stored on site and their potential for release;
- Hazardous and solid wastes generated on-site and their potential for release;
- Knowledge of historical contaminant releases (spills, leaks, dumping, etc.);
- Nature and extent of contamination;
- Facility drainage system and proximity of catch basins to potential contaminants;
- Results from waste disposal characterization of catch basin cleaning solids;
- Compliance history with regulatory permits (wastewater pretreatment, storm water permits, air, etc.);
- Storm water permit monitoring results and requirements;
- 303(d) listings;
- Applicable TMDLs; and
- Available Portland Harbor sediment, surface water, or tissue data.

Laboratory reporting limits should achieve the JSCS SLVs to meet the established data quality objectives (DQOs) and to facilitate data evaluation in the context of both the site itself and within Portland Harbor.

D.3.3 Site-Specific Storm Water Sampling and Analyses Parameters

Parameters for the initial round(s) of storm water sampling and analyses should be developed on a site-specific basis, based on consideration of available information, including the following:

- Site-specific COIs;
- Site-specific catch basin sediment data (or other available storm water sediment data);
- COI fate and transport (*i.e.*, would the COI be more likely transported in storm water in a dissolved or solid phase);
- NPDES permit parameters and other potential regulatory requirements; and
- Portland Harbor sediment, surface water, or tissue data in the vicinity of the site's outfalls or shared conveyances.

Site-specific COIs should be determined based on a review of available site data and the potential for contaminants to be transported via storm water. One of the objectives of storm water sampling is to determine whether or not storm water discharges are or may be contributing PBTs to the Willamette River. Historical analytical data may not exist for some COIs identified during the site information review process, therefore, analyses for these compounds may help to remove these COIs from future consideration. Analyzing both catch basin solids and storm water discharges from the same sampling location may help to better understand the storm water pathway and the relationship between catch basin solids and storm water discharge. However, direct sampling of storm water sediments (in-line sediment trapping or high-volume filtered samples) will provide more pertinent data for evaluating whole water samples and evaluating mass loading.

Catch basin sediment data (or other storm water sediment data) should be utilized as a tool in the developing of the parameter list for site storm water evaluations. Storm water sample analyses should consider parameters detected in catch basin sediment above JSCS SLVs. The absence of a certain pollutant in catch basin sediments may not warrant its exclusion from storm water monitoring, but it may support a weight of evidence determination to eliminate it from further consideration when viewed in the context of current and historic facility operations.

Field parameters, such as pH, conductivity, and temperature, can be useful to the data interpretation process. Including these field tests in the analytical suite may allow correlation of screening level exceedances to specific operations or runoff characteristics if multiple measurements are made during the course of a storm event.

Following collection and screening of representative site data, including soil, groundwater, storm water, and catch basin sediments, the list of parameters for storm water analyses may be reduced for additional rounds of sampling, if determined appropriate by DEQ. Upland site owners, operators and/or their representatives may recommend changes to the future monitoring or sampling events. Such changes would need to be approved by DEQ's Cleanup program project manager.

Laboratory reporting limits should achieve the JSCS SLVs to meet the established data quality objectives and to facilitate data evaluation in the context of both the site itself and Portland Harbor generally. If storm water samples are intended to satisfy NPDES permit monitoring requirements, the DEQ Cleanup Program project manager should verify before sample collection that the suggested methods will be acceptable to the DEQ's Water Quality program.

D.4 Catch Basin Sediment Sampling Design

DEQ's fact sheet on basic catch basin design and effectiveness is presented in Attachment B for informational purposes. The City of Portland, Bureau of Environmental Services has developed Standard Operating Procedures (CH2M Hill/COP, 2005) for the sampling of catch basin solids (see Attachment C). Refer to this document for components of an acceptable catch basin sediment sampling plan; other methods or approaches may be acceptable, if approved by DEQ.

D.4.1 Catch Basin Sediment Sampling Locations

Evaluate the facility drainage diagram, Storm Water Pollution Control Plan (SWPCP), and site storm water inspection records to locate all potential points of entry for site sediment into the storm water collection system. Some facilities have multiple catch basins, clean outs, and sediment traps while others may have few or none. Refer to the facility storm water map (see Subsection 2.2) to identify locations that may contain potential COIs based on current or historic operations. Ideally, representative-sampling locations[8] will be available for all site drainage areas with potential COIs.

Certain structures may be more difficult to sample than others due to structure, access, or operations. Field verification of all potential sampling locations is recommended, so any necessary access issues may be resolved prior to mobilizing the sampling crew.

D.4.2 Catch Basin Sediment Sampling Frequency

Catch basin sediments represent a time-integrated snapshot of potential sediment discharge to the river. If the first round of catch basin sediment sampling indicates JSCS SLV exceedances, additional sampling events may be performed to assess sediment quality variability, source identification, or to assess BMP or corrective action effectiveness. Initial catch basin sediment sampling results (*e.g.*, quarterly, semi-annual) may also provide baseline concentrations for evaluating BMP effectiveness and mass-load reductions. In addition, results from catch basin sediment sampling may be used to help refine the analytical suite for site storm water discharge sampling and future catch basin sediment sampling. Use of in-line sediment trap sampling, in conjunction with or instead of catch basin sampling may provide data to trace contaminant sources, evaluate mass loading, and assess potential impacts to the river.

D.4.3 Catch Basin Sediment Sampling Methods

The methodology for catch basin sediment sampling will depend on the structure of the catch basins, the expected presence or absence of standing water, and the characteristics of the sediment itself (*e.g.*, density, moisture content, grain size). Refer to Attachment C for information on sample method selection.

The catch basin sediment sampling work plan should address equipment selection, preparation and decontamination, collection and handling procedures, and sample documentation. Implementation of these protocols will be critical to the collection of representative samples that meet the established objectives.

[8] NPDES 1200-Z permittees have selected "representative" catch basins for storm water sampling, based on the areas where industrial activities take place and industrial materials are stored and handled. These selected catch basins are identified in the facility's storm water plan approved by DEQ's Water Quality Program.

D.4.4 Field Documentation

Comprehensive field documentation should be made to aid in the interpretation of analytical results. At a minimum, field documentation should include a description of the catch basin (*e.g.*, dimensions, construction, inlets), depth to water, height of standing water, sediment thickness, sediment characteristics, debris, etc. Sample collection information, such as how the sample was collected and any problems that occurred during collection, visual sample observations, and any other unusual circumstances that may affect the analytical results should all be noted. Any field measurements, such as pH, temperature, or observations such as odor or sheen should also be recorded on the field data sheets.

Standard sample collection methods and chain-of-custody procedures require basic information such as date and time, sample collector, and number of sample bottles filled and parameters to be analyzed. Consult with the analytical laboratory for chain-of-custody forms.

D.4.5 Data Quality Assurance and Control

The catch basin sediment-sampling plan should include or reference a site-specific data quality assurance plan that is developed in accordance with DEQ and EPA guidance documents.

D.5 Storm Water Sampling Design

Successful storm water monitoring presents a variety of challenges. Rainfall can be intermittent and sampling locations may be inadequate or difficult to identify or access. Planning efforts that address the variability of storm water runoff, as well as the technical considerations of sample collection, are critical to the acquisition of representative data. In 1992, EPA published its *NPDES Storm Water Sampling Guidance Document* (EPA, 1992), which provides comprehensive information on storm water sampling. The Washington State Department of Ecology (WDOE) subsequently published a more user-friendly guidance document for industrial facilities subject to NPDES monitoring requirements entitled *How To Do Stormwater Sampling* (WDOE, 2005, see Attachment D). The WDOE document describes the necessary steps and procedures to collect storm water samples from industrial facilities. Both the EPA and WDOE guidance documents may be helpful in designing and conducting storm water sampling.

A thorough storm water quality characterization will entail “first flush” grab sampling as well as flow monitoring and composite sampling throughout the duration of the storm event to establish pollutant loading. For purposes of Portland Harbor screening, “first flush” is defined as being within the first 30 minutes of storm water discharge. For the purposes of Portland Harbor storm water screening evaluations, grab samples will be utilized to ascertain whether or not storm water poses or may pose a threat to Willamette River sediment or water quality. A more detailed characterization may be required if source control measures do not adequately address pollutant discharges identified with the grab sample screening.

D.5.1 Sampling Locations

Storm water sampling locations that represent all points of potential contaminant discharge should be selected. Refer to the drainage areas identified in the SWPCP, if available, and the information developed for the site storm water map (See Subection 2.2) to aid in the selection process for catch basin sediment sampling sites. Facilities operating under NPDES permits will have established points of compliance[9]. These locations represent storm water discharge from areas regulated by the NPDES permits – additional sampling locations may be needed to evaluate discharges from other areas of known or suspected contamination.

Sampling locations may be at outfalls, manholes, catch basins, drainage ditches, detention ponds, and areas with sheet flow. Each type presents unique challenges to sample collection, but selecting sampling locations that represent the storm water discharge from all areas of concern at the site is a critical piece of the storm water screening evaluation. Ideally, sampling locations should not include storm water flows from other facilities or offsite areas.

D.5.2 Storm Water Sampling Frequency

It is recommended that at least four separate storm events per year be sampled for screening purposes. Because storm water quality varies considerably with rainfall intensity and duration, two of the four sampling events should be representative of "first flush" conditions (*i.e.*, within the first 30 minutes of storm water discharge). For the remaining two events, samples should be collected within the first three hours of storm water discharge, to the extent practicable.

D.5.3 Storm Event Criteria and Selection

Adhering to target storm event criteria will help to ensure that storm water runoff will be adequate for sample collection, will be representative of storm water runoff, and will be consistent with other sites undergoing storm water screening evaluations. If storm water samples are intended to satisfy NPDES permit monitoring requirements, more restrictive event criteria and specific requirements for samples taken during storm events that fall short of expected volume or duration may apply.

[9] NPDES 1200-Z permittees have selected "representative" outfalls for storm water sampling, based on the areas where industrial activities take place and industrial materials are stored and handled. These selected outfalls are identified in a facilities storm water plan approved by DEQ's Water Quality Program

Storm event criteria for the screening evaluation are as follows:

- Antecedent dry period of at least 24 hours (as defined by <0.1" over the previous 24 hours);
- Minimum predicted rainfall volume of >0.2" per event; and
- Expected duration of storm event of at least 3 hours.

The City of Portland owns and operates a series of rain gauges around the City. Several of these rain gauges are located within the Portland Harbor ISA. These can be utilized to evaluate the antecedent dry period criteria, as well as post-storm event rainfall distribution and totals. Rain gauges located in or near the Portland Harbor ISA are listed below:

River Bank	***Gauge No.***	***Gauge Name***	***Gauge Address***
West	*121*	*Yeon*	*3395 NW Yeon St.*
East	*122*	*Swan Island*	*2600 N. Going St.*
East	*160*	*WPCL*	*6543 N. Burlington Ave.*
East	*167*	*Terminal 4 NE*	*11040 N. Lombard St.*
East	*193*	*Astor Elementary School*	*5601 N. Yale St.*

The United States Geological Service provides online access to the City rain gauges at *http://or.water.usgs.gov/non-usgs/bes/raingage_info/clickmap.html*. Rain gauge data is updated hourly.

Weather forecast information can be obtained from the National Weather Service web site at *http://www.wrh.noaa.gov/pqr/* or by contacting the National Weather Service by phone. Web site information includes rainfall observations and forecasts, both of which are essential to storm event targeting. Refer to the WDOE guide in Attachment D for additional tips on storm event selection.

D.5.4 Storm Water Sampling Methods

There are two types of storm water samples: grab samples and composite samples. Grab samples are typically collected during a short period of time and characterize the nature of storm water discharge at that particular point in the storm event. Some laboratory analyses, such as oil and grease, require grab samples directly into sample bottles to ensure that the sample is not compromised during material transfer.

Storm water composite samples are comprised of a number of discrete individual samples of specific volumes taken at specific intervals. Intervals can be time-weighted or flow-weighted, and samples can be collected and composited manually or with automatic sampling equipment. Composite samples typically characterize storm water quality during a longer period of runoff. Flow-weighted composite samples are utilized to assess contaminant-loading and to evaluate the variable nature of storm water discharges.

Grab samples, collected by upland facilities during both the initial runoff ("first flush grab samples") and at a point within the first three hours of runoff ("periodic grab samples"), will provide the screening level data on which decisions for further storm water characterization or source control measures can be made. For the purposes of Portland Harbor storm water screening evaluations, composite sampling is not required initially. If site-specific storm water data indicates the need for a composite sampling, then composite samples may be required.

Proper sample collection methods and techniques are needed to collect representative samples. Sampling protocols should address bottle handling, equipment preparation, collection methods, and sample storage. Basic principles are detailed below. Refer to the WDOE guidance document (see Attachment D) or EPA's 1992 guidance document for more detailed information on sample types and collection methods.

Because COIs are often present at low concentrations in storm water, alternative sampling or analytical methods, may be needed to obtain meaningful detection limits (see the discussion on practical quantification limits in the JSCS).

D.5.4.1 First Flush Grab Samples

Grab sample collection, for two of the four storm events recommended to be sampled each year, should be timed to be within the first 30 minutes of storm water runoff, to extent practicable. This period, termed "first flush," often represents a worst-case scenario of storm water quality for pollutants likely to be mobilized by storm water runoff. Sampling first flush runoff requires significant advance preparation to ensure that equipment and personnel are available at sampling locations at the proper time. Initial rainfall intensity can vary widely, resulting in delayed or immediate first flush conditions.

Other factors also influence the timing of first flush discharge. Each sample point represents a specific drainage area, and each drainage area may have different runoff characteristics depending on the type of surface area (pervious or impervious), slope, and size. In storm water monitoring, runoff coefficients are utilized to calculate the amount of rainfall expected to be discharged from an area rather than absorbed by underlying soil. A runoff coefficient of 1.0 would indicate that 100% of the rainfall volume within the drainage area will be discharged. A review of the storm water drainage areas identified on the facility storm water map will help to predict how first flush discharge could be expected to occur.

D.5.4.2 Periodic Grab Samples

Sample collection for the remaining two storm events recommended to be sampled each year should take place within the first three hours of storm water runoff. This will allow for a higher degree of flexibility and potential for opportunistic sampling. When selecting the timing of sampling, consideration should be given to seasonal or operational variations (*e.g.*, heavy production, truck use, product storage) at the facility to assure representative samples are collected. Mobilization could occur once the storm event is already underway. Separate storm events must be sampled for each of the four samples needed for the screening evaluation.

While the screening evaluation only requires one set of grab samples per storm event, collecting periodic grab samples at various times throughout the storm may provide useful information on pollutant discharge correlation with rainfall intensity, volume, or duration.

D.5.5 Field Documentation

Comprehensive field documentation should be made to aid in the interpretation of analytical results. At a minimum, field documentation should include a description of the weather – what time rainfall began and when runoff was first observed at the sampling location. Sample collection information, such as how the sample was collected and any problems that occurred during collection, visual sample observations, and any other unusual circumstances that may affect the analytical results should all be noted. Any field measurements, such as pH, temperature, or conductivity, should also be recorded on the field data sheets.

Standard sample collection methods and chain-of-custody procedures require basic information such as date and time, sample collector, and number of sample bottles filled and parameters to be analyzed. Consult with the analytical laboratory for chain-of-custody forms.

D.5.6 Data Quality Assurance and Control

The storm water sampling plan should include or reference a site-specific data quality assurance plan that is developed in accordance with DEQ and EPA guidance documents.

D.6 Screening Evaluation

The JSCS describes the source control decision process to help DEQ project managers determine if source control measures are required at Portland Harbor sites and, if so, the priority for source control implementation and type of source controls to be implemented. This decision is ultimately based on whether the contaminant discharge has a current or reasonably likely future adverse effect on water or sediment quality.

Storm water discharge and catch basin sediment data (or other storm water sediment data) should be screened against the SLVs presented in the JSCS to assess potential impacts to the Willamette River. As a first step, exceedances of storm water or catch basin SLVs may require implementation of readily implementable BMPs or additional investigation and evaluation. BMPs should be applied with the goal of preventing contaminants from entering the storm water system and of ensuring proper maintenance of that system to improve its effectiveness.

The source control screening process is an iterative process requiring the upland PRP or DEQ project team to update the site conceptual site model (CSM) at the completion of each major phase of the investigation. The primary purposes of source control screening include:

- Determining if site characterization is sufficient to support informed source control decisions;
- Determining if storm water sediment data is needed; and
- Prioritizing sites for further remedial action (or source control activities (*e.g.*, investigation, evaluation, cleanup).

If readily implementable BMPs are not effective in reducing storm water or storm water sediment concentrations to below applicable SLVs, a qualitative or quantitative weight-of-evidence evaluation should be performed by the responsible party to determine if more aggressive storm water investigation and/or source control, such as source removal, storm system improvements (*e.g.*, line cleaning, catch basin replacement), or storm water treatment are needed. The weight-of-evidence evaluation will be reviewed and approved by DEQ, EPA, and its partners in accordance with the JSCS.

Data collected for evaluating the storm water pathway may also be used by DEQ to determine if a Storm Water Pollution Control Plan is needed at the facility.

D.7 Reporting

D.7.1 Catch Basin Sediment Sampling Event Summary

Following the collection of catch basin sediment data, a summary report should be developed that compiles the field documentation, analytical results, and background information. Background information should include documentation of precipitation totals preceding and during sample collection, as well as any field notes generated during the sampling event. This report, in addition to the considerations listed in Section 3.3, will be the basis for review to identify storm water sampling parameters, and should be submitted as soon as possible after the receipt of analytical results.

D.7.1.1 Analytical Results

Copies of original laboratory reports and chain-of-custody documentation should be submitted as part of the summary reports of catch basin sampling events. Laboratory results should be tabulated. The tables should clearly identify the sampling location(s), unit of measurement, compounds detected, laboratory detection limits, and SLVs. Detected compounds should be in bold text and compounds exceeding SLVs should be shaded for easy reference.

D.7.1.2 Catch Basin Sediment Screening Evaluation

A summary of the catch basin sediment screening results (see Section 6) should be presented. The report should include a discussion of compounds detected, compounds detected above SLVs, magnitude of SLV exceedance, and a list of any PBTs detected. While the absence of a certain contaminant may not alone warrant its exclusion from storm water monitoring, in the context of current and historic facility operations, it may provide information relevant to a weight of evidence determination to eliminate a contaminant from further consideration.

D.7.2 Storm Water Sampling Event Summaries

Following the storm water sampling event, rainfall and weather information should be documented along with the field data sheets. This information can be included in the quarterly progress report required under DEQ's Portland Harbor Voluntary Agreements or in brief summary reports developed for each of the storm water sampling events. The RI report should include the results of all storm water monitoring events, if the schedule allows.

D.7.2.1 Rain Gauge Data – Sample Event Criteria Evaluation

It is not uncommon for rainfall volume or distribution to fall short of expectations. Rainfall may have been intermittent when first flush grab samples were collected at different times for a given site. Hourly rain gauge data as well as rain gauge totals should be included in the summary report, as well as documentation of the antecedent dry period (minimum of 24 hours). The data should be evaluated to determine whether or not the target storm criteria (Subsection 5.3) were met. If runoff coefficients were generated for the drainage basins, the rainfall data can also be utilized to estimate the volume of storm water discharge during the course of the event.

If samples were collected from a storm event that did not meet the target storm criteria but are being submitted to comply with NPDES permit monitoring requirements, specific approval is required from DEQ to justify the protocol modification.

D.7.2.2 Analytical Results

Copies of original laboratory reports and chain-of-custody documentation should be submitted as part of the sampling event summary reports. Laboratory results should be tabulated. In addition, an electronic copy of the data should be provided to DEQ. The tables should clearly identify the sampling location(s), unit of measurement, compounds detected, laboratory detection limits, and SLVs. Compounds detected should be in bold text and compounds exceeding SLVs should be shaded for easy reference.

D.7.2.3 Storm Water Screening Evaluation

A summary of the storm water screening results (see Section 6) should be presented in the report. The report should include a discussion of compounds detected, compounds detected above SLVs and/or NPDES industrial benchmarks, magnitude of the exceedance, and a list of any PBTs detected.

Analytical data should be evaluated in the context of the hydrologic conditions that preceded the storm event as well as in those that existed at the time of sample collection. Each storm event will present unique conditions. In some cases, difficulties with sample collection may lead to samples that are not representative of storm water discharge from a given basin or facility. In these and other cases, results may warrant a more comprehensive characterization of storm water discharges before the identification of source control measures.

D.8 References

D.8.1 Cited References

CH2M Hill, 2004. *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project*. Prepared for City of Portland Bureau of Environmental Services. March 19, 2004.

CH2M Hill/COP, 2005. *Standard Operating Procedures Draft 3.0. Guidance for Sampling of Catch Basin Solids.* Prepared by CH2M Hill for the City of Portland (City provided revisions). June, 2005. City of Portland, Bureau of Environmental Services.

DEQ/EPA, 2005. *Portland Harbor Joint Source Control Strategy*. Oregon Department of Environmental Quality Northwest Region Cleanup Program and United States Environmental Protection Agency – Region X. pending (Anticipated September 2005).

EPA, 1992. *NPDES Storm Water Sampling Guidance Document*. United States Environmental Protection Agency. Office of Water. EPA 833-8-92-001. July 1992.

LWG, 2004a. *Portland Harbor RI/FS - Programmatic Work Plan(Volumes 1 through 3).* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., Kennedy/Jenks Consultants, Anchor Environmental L.L.C., and Groundwater Solutions, Inc. Prepared for The Lower Willamette Group (LWG). Dated April 23, 2004.

WDOE, 2005. *How To Do Stormwater Sampling – A guide for industrial facilities*. Washington Department of Ecology. Publication #02-10-071. December 2002 (revised January 2005).

D.8.2 Additional References

COP, 2000a. *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area, (Eastshore).* July 2000. City of Portland, Bureau of Environmental Services.

COP, 2000b. *Preliminary Evaluation of City Outfalls, Portland Harbor Study Area, (Westshore*). November 2000. City of Portland, Bureau of Environmental Services.

DEQ, 1998. *DEQ Storm Water Management Guidelines.* Oregon Department of Environmental Quality Water Quality Program. February 1998.

DEQ, 2004. *Water Quality Criteria Summary.* Table 20. Oregon Administrative Rules, Chapter 340, Division 041 - Department of Environmental Quality

DEQ, 2005. *Water Quality Criteria Summary Tables 33A, 33B, and 33C.* AWQC based on the acute and chronic freshwater aquatic life criteria in Table 33A and C, which is an update of OAR 34-41 Table 20. The Environmental Quality Commission adopted Table 33A on May 20, 2004 to become effective February 15, 2005. However, EPA has not yet (as of June 2005) approved the criteria for federal Clean Water Act purposes. Table 20 should be used for federal Clean Water Act purposes (except for Section 303(d) listing which should only use Table 20 until these criteria receive EPA approval).

EPA, 1997. *Ambient Water Quality Criteria Document for Tributyltin*, U.S. Environmental Protection Agency, 62 FR 42554, August 7, 1997.
-Freshwater Chronic Criteria.

EPA, 1998 *National Recommended Water Quality Criteria*. Federal Register 63 (Dec. 10): 68353-64.

EPA, 1999. *National Recommended Water Quality Criteria — Correction*. EPA 822-Z-99-001. Office of Water.

EPA, 2000. *Guidance Manual for Conditional Exclusion from Storm Water Permitting Based on "No Exposure" of Industrial Activities to Storm Water*. United States Environmental Protection Agency. Office of Water. EPA 833-B-00-001. June 2000.

EPA, 2003. *National Primary Drinking Water Standards*. EPA 816-F-02-013. Office of Water. June 2003. Available on EPA's website at: http://www.epa.gov/safewater/mcl.html#mcls

EPA, 2004. *Region 9 Preliminary Remediation Goals*, prepared by Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Team, San Francisco, California. Revision Date: 12/28/04

EPA, 2000. *Guidance Manual for Conditional Exclusion from Storm Water Permitting Based on "No Exposure" of Industrial Activities to Storm Water*. United States Environmental Protection Agency. Office of Water. EPA 833-B-00-001. June 2000.

LWG, 2004c. *Portland Harbor RI/FS – Round 2 – Field Sampling Plan – Sediment Sampling and Benthic Toxicity Testing.* Prepared by Integral Consulting, Inc., Windward Environmental, L.L.C., and Anchor Environmental L.L.C. Prepared for The Lower Willamette Group (LWG). Dated March 22, 2004.

NOAA, 2003. *HCD Stormwater Online Guidance – ESA Guidance for Analyzing Stormwater Effects*. NOAA Fisheries Service. Northwest Region. March 2003.

Attachment A

Catch Basin Fact Sheets

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Fact Sheet

Portland Harbor

Catch Basins

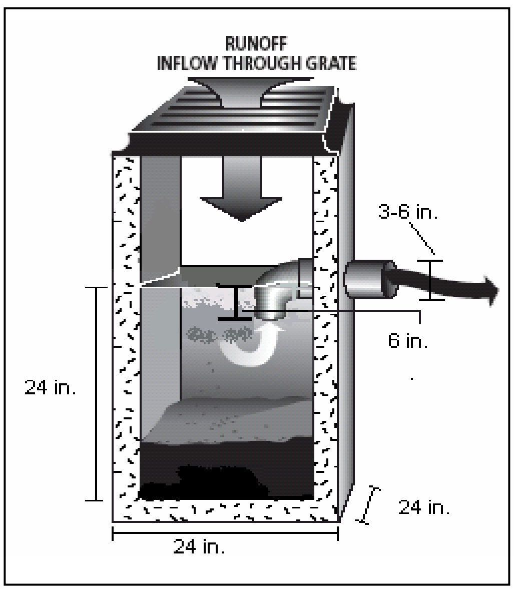
The purpose of this fact sheet is to provide basic information on catch basin design, effectiveness, and sediment sampling.

A catch basin is an inlet to a storm drain system that typically includes a grate where stormwater enters, and a sump to capture sediment, debris, and associated pollutants.

Catch basins are designed specifically for capturing and conveying stormwater. It is important to note, that although catch basins often have sumps for the collection of sediment, the actual design specifications and placement of catch basins are not based on expected sediment load.

Design

Trapped catch basins, commonly referred to as "Lynch-style" catch basins, are constructed of concrete, cast iron, or steel. According to the 1997 City of Portland *Uniform Plumbing Code* §1108.0 - .5, catch basins must adhere to the design specifications in the drawing below:



Standard "Lynch-style" catch basin

Typically, on private commercial/industrial sites, there is no standard for the placement of catch basins. Stormwater drain systems are often installed based on the best professional judgment and experience of the design engineer.

The estimated peak stormwater flow rate dictates the number of catch basins needed on a site. The percent impervious surface, slope, average rainfall, and rainfall intensity are all factors in calculating the peak flow rate.

Catch basins are designed to hold water below the ¼ bend outlet pipe, or "elbow pipe." The pipe is also referred to as a 90 degree invert. The standing water allows some larger sediments to settle out. Any oil or grease washed into the basin will float to the top of the water level, above the elbow pipe. The catch basin is only effective for oil and grease separation if the water level is maintained above the elbow pipe intake.

Effectiveness

There are several factors that contribute to the capture efficiency of catch basins. These include catch basin placement, catch basin design (e.g., sump size); maintenance frequency (e.g., sediment removal), flow rate, pollutant loading, and particle size.

The sump in a catch basin captures settleable solids under low flow conditions. According to information obtained from EPA, catch basins are typically best at removing particles greater than 0.04 inches (approx. 1mm in diameter). They are not designed to remove total suspended solids (TSS) or soluble pollutants.

There is limited data on the effectiveness of "Lynch style" standard catch basins to capture TSS. Several studies indicate TSS may be reduced by about 20% in some catch basins.

Resuspension and discharge of sediments previously collected in a catch basin is a potential problem during large storm events or "first flush" scenarios.

Catch basin efficiency can be improved by frequent maintenance, implementation of best management practices (BMPs) or with the use of catch basin inserts, as discussed below.

Maintenance: Maintaining catch basins is critical to their effectiveness. Catch basins should be cleaned when the amount of sediment is greater than 1/3 the distance between the bottom of the basin and the water line. It is recommended that catch basins draining industrial areas be cleaned once per month or more frequently if sediment accumulates above

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Department of Environmental Quality

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Cleanup and Lower Willamette Section
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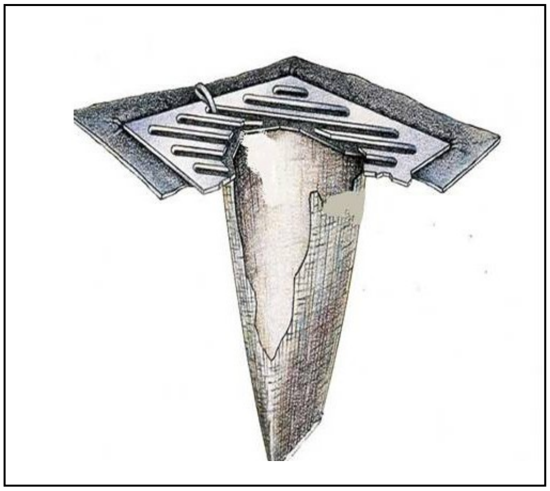
Contact: Rod Struck
www.deq.state.or.us

Last Updated: 05/31/05
By: Jordan Palmeri
DEQ 05-NWR-006

the 1/3 threshold. A study of 60 catch basins draining industrial land in Alameda County, California showed that monthly cleaning of industrially used catch basins increased the total pounds of collected sediment from 30 lbs. when cleaned annually to 180 lbs. when cleaned monthly. For more information on catch basin maintenance, see the City of Portland's fact sheet titled, "Maintaining Catch Basins" at: http://www.portlandonline.com/shared/cfm/image.cfm?id=71693

Best Management Practices: Implementation of BMPs, such as frequent sweeping, covered material storage areas, etc. will help reduce potential sediment and pollutant loading. BMPs recommended by DEQ are available on our website at: www.deq.state.or.us/nwr/Industrial%20BMPs.pdf

Catch Basin Inserts: Sediment and pollutant loading can be reduced using catch basin inserts. Many different styles of catch basin inserts are available. Some provide oil absorbent strips while others just provide sediment capture (e.g., filtering). Generally, the capacity of inserts is much less than that of the actual basin, which means more frequent maintenance. The advantage to using inserts is that a greater amount of sediment (settleable solids and TSS) is expected to be captured. In addition, the maintenance is much simpler since most inserts can be removed and disposed of by hand. It is recommended that inserts without overflow slots be used to provide for maximum efficiency. The method of sediment disposal depends on whether the captured sediment is contaminated. See DEQ's fact sheet "How to Determine if Your Waste is Hazardous" http://www.deq.state.or.us/wmc/hw/factsheets/HowDetermineHazWaste.pdf for more information.



Catch Basin Insert

Stormwater Management Manual

All projects within the City of Portland, including industrial sites, developing or redeveloping over 500 square feet of impervious surface, or existing properties proposing new stormwater discharges off site are subject to the requirements of the Bureau of Environmental Services (BES) Stormwater Management Manual (SWMM). The SWMM requires 70 percent removal of TSS for 90 percent of the average annual runoff.

A site may achieve 70 percent removal of TSS by many different means. Please refer to the 2004 BES SWMM for more details. http://www.portlandonline.com/bes/index.cfm?c=35122

Catch basin sediment sampling

Catch basin sediment sampling is typically required at Portland Harbor upland sites to help characterize and evaluate the stormwater pathway and to determine if source control measures are required to prevent contaminants from impacting the river and its sediments. Catch basin sampling is required to provide a time-integrated sample of contaminants that may be or may have been transported to the river. Catch basin sample analyses should be based on a comprehensive review of potential contaminant sources, available in-water sediment data, and other available data. Sampling should be conducted in accordance with a DEQ approved work plan and BES sampling guidelines.

Considerations when assessing catch basins:

- The presence and size of the sump;
- The outlet location and type;
- The pollutant loading potential of the area drained;
- The use of catch basin inserts and frequency of replacement;
- The schedule of catch basin maintenance;
- Other BMPs the facility has implemented; and
- Available stormwater monitoring data and catch basin sediment data.

Alternative formats

Alternative formats (Braille, large type) of this document can be made available. Contact DEQ's Office of Communications & Outreach, Portland, at (503) 229-5317, or toll-free in Oregon at 1-800-452-4011.

Fact Sheet: Information for Property Owners

State of Oregon
Department of Environmental Quality

Portland Harbor and Lower Willamette Sections Voluntary Cleanup Program Northwest Region

2020 SW 4th Avenue
Portland, OR 97202
Phone: (503) 229-6361
(800) 452-4011
Fax: (503) 229-6899
Contact: Jordan Palmeri
www.deq.state.or.us

Portland Harbor

Cleaning Private Stormwater Conveyance Lines

Introduction

Property owners of upland sites in DEQ's Cleanup Program within the Portland Harbor Superfund Site are required to investigate stormwater as a potential migration pathway for contaminants to the Willamette River. As property owners of these sites evaluate the stormwater pathway, they may choose to clean their stormwater system conveyance lines of any solids or debris that may have accumulated in them from onsite erosion, operational processes, or spills.

The purpose of this fact sheet is to provide the following information:

- why a private stormwater system is considered part of an upland "facility";
- the importance of characterizing the solids in or being cleaned from the stormwater lines; and
- the necessity to notify the City of Portland of stormwater system cleaning activities if certain conditions apply.

For facilities under a cleanup agreement with DEQ, DEQ considers the private stormwater system to be a part of the upland "facility" and subject to DEQ oversight and cleanup rules. Oregon Revised Statute (ORS) 465.200 defines a facility as "… *any…pipe or pipeline including any pipe into a sewer or publicly owned treatment works…ditch…or any site where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located and where a release has occurred or where there is a threat of a release….*" Therefore, DEQ requires that any sampling or cleaning of the stormwater system be performed under an approved DEQ Cleanup Program work plan.

Characterization of inline solids

Characterizing solids that have accumulated in stormwater lines may be necessary to define the nature and extent of hazardous substances at an upland facility. Property owners should make an effort to delineate stormwater drainage basins at their facility, and to strategically use this information to develop the line cleaning work plan. Inline data may be used to help focus on drainage basins with potential contaminant sources and to assess potential source control measures. Based on this characterization, Best Management Practices (BMPs) may be implemented to prevent future movement of contaminants through the stormwater system or potential recontamination of Willamette River sediments. When feasible, sampling the undisturbed solids (i.e., sediment) before cleaning contributes to the investigation and source control evaluation of the upland facility. This data helps characterize the extent and migration of contaminants via the stormwater pathway.

Inline solids removed from the collection system may require dewatering and additional testing to ensure appropriate disposal in accordance with applicable DEQ Solid and Hazardous Waste regulations.

Wastewater generated from line cleaning activities may not be discharged to the private or municipal stormwater conveyance system. Wastewater disposal options include offsite disposal by a permitted private waste management company capable of appropriate treatment and disposal, or discharge to the City of Portland's sanitary sewer system through a batch discharge process (see below for details). The line cleaning work plan should include disposal plans for both inline solids and wastewater generated by the cleaning process.

Notify the City of Portland

Notify the City of Portland, Bureau of Environmental Services (BES) before you begin stormwater line cleanouts if any of the following three conditions apply to your facility:

- *Lines are connected to a municipal stormwater conveyance system.*

BES has requested notification of proposed cleaning operations in order to ensure worker safety for City and contract personnel and to verify that prohibited discharges of solids or wastewater are not made to the municipal conveyance system. A permit will be required if cleaning or sampling activities necessitate access to the City system. All stormwater line cleaning activities that connect to the City's conveyance system, and affiliated proposed access to City stormwater lines should be coordinated with the

Last Updated: 11/14/05
By: Jordan Palmeri
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BES Portland Harbor Program, at (503) 823-2296.

- *Facility operations are covered by an active NPDES stormwater permit.*

For facilities with active NPDES stormwater permits, notification will also allow for technical assistance and oversight from BES Permit Managers. BES administers stormwater NPDES permits for facilities within the City of Portland through a Memorandum of Understanding with DEQ. Contact the BES Industrial Stormwater Program at (503) 823-5320.

- *Line cleaning wastewater will be discharged to the sanitary sewer.*

Wastewater collected from these cleaning operations may not be discharged to the stormwater conveyance system even if the facility has an NPDES permit. It may be discharged to the City sanitary sewer system through a batch discharge process if it meets the wastewater discharge limitations established in City Code Chapter 17.34 "Industrial Wastewater Discharges" and is approved by the BES Industrial Source Control Division. Prohibited discharges include discharges of chemicals in toxic concentrations, of visible floating solids, and discharges that may cause a hazard to the City's system, personnel, or receiving waters. Coordinate batch discharge requests with the BES Industrial Projects Section at (503) 823-5320. Information and forms can also be found at the following link: http://www.portlandonline.com/index.cfm?c=37681#batch. Facilities with BES Industrial Wastewater Discharge Permits should consult directly with their BES Permit Managers.

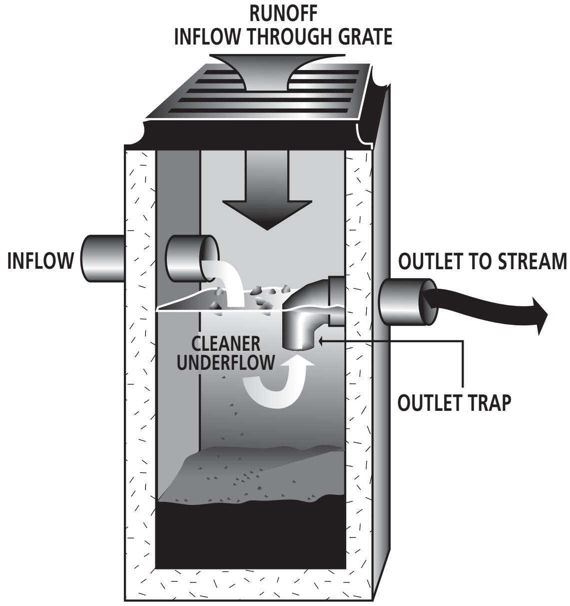
Further Information

For more information on evaluating the stormwater pathway at upland facilities within Portland Harbor, please refer to the "Framework for Portland Harbor Storm Water Screening Evaluations", which is located in Appendix E of the Portland Harbor Joint Source Control Strategy at the following website: http://www.deq.state.or.us/nwr/PortlandHarbor/JSCS.htm. Information on catch basin sampling can also be found in this appendix. Additionally, a fact sheet on catch basin design, effectiveness, and sampling can be found at the following website: http://www.deq.state.or.us/nwr/PortlandHarbor/phfactsheets.htm.

Alternative formats

Alternative formats (large type) of this document can be made available. Contact DEQ's Office of Communications & Outreach, Portland, at (503) 229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696.

17 Maintaining Catch Basins



A catch basin is an inlet to a storm drain system that typically includes a grate where stormwater enters the catch basin, and a basin to capture sediment, debris, and associated pollutants. The purpose of the basin is to help prevent the downstream pipes from becoming clogged and to reduce the amount of sediment and debris being discharged into our rivers and streams. Many catch basins are installed with a downturned elbow or tee to trap floatable material. Storm drain inlets that do not contain basins or outlet traps are not effective in reducing pollutants in stormwater.

Catch basins must be cleaned periodically to maintain their ability to trap sediment and provide drainage for stormwater. The removal of sediment, decaying debris, and associated pollutants from catch basins has aesthetic and water quality benefits. The benefits include reducing foul odors, solids, and other pollutants that reach receiving waters.

Grates:

- Remove leaves and trash so the grate doesn't clog.
- Stencil the message "Dump No Waste, Drains to Stream" next to your grates. Call the City's Industrial Stormwater Program at 503-823-5320 to borrow the materials you need.

Catch Basin:

- The more frequently a catch basin is cleaned, the more pollutants it removes. The U.S. Environmental Protection Agency (EPA) recommends cleaning if the depth of solids reaches one-third the depth from the basin bottom to the invert of the lowest pipe into or out of the basin.
- Clean the catch basin. You can hire a contractor or you can do it yourself by lifting the grate and using a bucket (to remove water) and a shovel.
- Dispose of the water in a sanitary sewer through a shop drain or sink. Otherwise, use a toilet or other appropriate drain. Let the removed solids dry out, then properly dispose of them. When deciding how to dispose of the sediment, you need to consider the types of activities and pollutants on site. Catch basins in areas used for chemical or hazardous waste storage, material handling or equipment maintenance may collect the chemicals used in these activities from spills or via stormwater runoff. Solids removed from catch basins at commercial or industrial sites are usually not considered hazardous waste.

  However, as the "generator" of this waste, you are responsible for making that decision and deciding how to properly manage the solids. If you need assistance deciding whether the solids should be managed as a hazardous waste, contact the Oregon Department of Environmental Quality at 503-229-5263. Make sure the removed solids don't wash back into your catch basin, and don't dispose of it on your or someone else's property.

continued on back

Be sure to follow safety precautions:

- The grate may be heavy.
- Don't leave an open catch basin unattended.
- Never enter a catch basin or other drainage structure unless you are properly trained.
- Ensure proper traffic safety is in place.

Tips:

- Sweep your lot regularly to reduce the need for catch basin cleaning.
- Consider installing and maintaining catch basin inserts or an oil-absorbent pillow.
- Repair or replace damaged outlet traps.
- Install an outlet trap if there isn't one already. They're inexpensive and make it easier and cheaper to remove any floatable pollutants that spill into your catch basin.
- Make sure your chemical and waste storage practices aren't exposed to rainfall and stormwater runoff.
- Don't wash vehicles or equipment to the storm sewer system.

For additional Best Management Practices to minimize pollution from other site activities call 503-823-5320.

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

Dan Saltzman, Commissioner   Dean Marriott, Director

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Attachment B

Potential PCB Source Fact Sheet

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Fact Sheet: Sources of Polychlorinated Biphenyls

Purpose

This fact sheet is intended to help Oregon Department of Environmental Quality (DEQ) project managers and City of Portland stormwater inspectors understand the types of industries, processes, and products that might be potential sources of polychlorinated biphenyls (PCBs). There are a variety of potential PCB sources in addition to more commonly recognized sources such as electrical transformer and capacitor oils and fluorescent light ballasts.

Background

PCBs are mixtures of synthetic organic chemicals that were commonly used for various applications from approximately 1929 until 1979 when the U.S. banned PCB manufacturing, processing, distribution, and use (EIP Associates, 1997). The U.S. was responsible for approximately half of the world's production of PCBs and imported approximately 50% of the remainder produced by other countries (minus exports) (EIP Associates, 1997; UNEP Chemicals, 1999). PCBs were produced and marketed in the U.S. under the trade names of Aroclor (produced by Monsanto Chemical Company) and Pyranol (produced by General Electric) (Nagpal, 1992). Because of health concerns, in 1971 Monsanto voluntarily restricted manufacturing of PCBs to use only in closed systems. Monsanto discontinued manufacture of PCBs in 1977, though PCBs continued to be imported into the U.S. until 1979 when the U.S. ban took effect (EIP Associates, 1997; ATSDR, 2000).

There are no natural sources of PCBs. Although their current commercial use is restricted in the U.S., they continue to be a common environmental contaminant because they are extremely stable.

Regulatory Framework

PCBs were regulated under a series of EPA actions culminating with a ban in 1979 on manufacturing, processing, distribution, and use of PCBs under the Toxic Substances Control Act (TSCA). Items such as transformers and hydraulic fluids were identified as high-risk sources and were targeted for accelerated phase-out. EPA anticipated that other lower-risk sources would eventually be removed from circulation as various products reached the end of their useful lives.

Certain current uses of PCBs are authorized under 40 CFR Part 761 and are summarized in Table 1:

TABLE 1 Current Authorized Uses of PCBs	
Use	Comments
Transformers	Authorized use at any concentration though restrictions and regulatory requirements increase with higher PCB concentration thresholds.
Railroad Transformers	Transformers used in locomotives and self-propelled railcars. Authorized use at < 1,000 ppm; < 50 ppm if transformer coil is removed at any time.
Heat transfer systems, hydraulic systems, mining equipment	Authorized use at < 50 ppm
Natural gas pipelines	Authorized at < 50 ppm, or at > 50 ppm with additional requirements. PCBs may be present in natural gas compressors, scrubbers, filters, and in condensate.
Research & Development	Authorized primarily for purposes relating to environmental analysis, management, and disposal of PCBs. R&D for PCB products is prohibited.
Scientific Instruments	Examples include oscillatory flow birefringence & viscoelasticity instruments for the study of the physical properties of polymers, microscopy mounting fluids, microscopy immersion oil, and optical liquids.
Carbonless copy paper	Use of existing carbonless copy paper is permitted; manufacturing of new carbonless copy paper is not authorized.
Electromagnets, switches, voltage regulators, circuit breakers, reclosers, cable	No restrictions on existing use; restrictions on PCB concentrations if serviced and oil is removed or replaced.
Porous surfaces	EPA considers building materials, such as concrete, porous with respect to PCB leaks and spills. Porous building materials may be left in place following spills provided various conditions are met. Older industrial machinery often was designed to slowly leak (PCB-containing) hydraulic oil as a lubricant.
Source: EPA (2002)	

Under 40 CFR Part 761, recycled PCBs are defined as “those PCBs which appear in the processing of paper products or asphalt roofing materials from PCB-contaminated raw materials”. Recycled PCBs are subject to the following restrictions:

- No detectable concentrations of PCBs are permitted in asphalt roofing materials that leave the manufacturing site; and
- Manufactured and imported paper products must have an annual average of less than 25 ppm PCBs with a maximum of 50 ppm.

Some manufacturing processes may inadvertently generate PCBs. These typically include chemical processes that involve hydrocarbons, chlorine, and heat. Typical processes include production of chlorinated solvents, paints, printing inks, agricultural chemicals, plastics, and detergent bars. These processes may be defined as “excluded manufacturing processes” under 40 CFR Part 761 if the following conditions are met:

- Manufactured or imported products must contain < 25 ppm PCBs;
- Manufactured or imported detergent bars must contain < 5 ppm PCBs;
- PCB concentrations must be less than 10 ppm at the point which PCBs are released to ambient air;
- "…PCBs added to water discharged from a manufacturing site must be less than 100 micrograms per resolvable gas chromatographic peak per liter of water discharged"; and
- Disposal of process wastes with PCB concentrations > 50 ppm must be conducted in accordance with 40 CFR Part 761 Subpart D.

Sources of PCBs

In the U.S., the most commonly used Aroclors were: 1221, 1232, 1242, 1248, 1254, and 1260 (DEQ, 1997). These and other Aroclors were used in a variety of materials to enhance insulative properties, improve physical and chemical resistance, and act as plasticizers, coolants, and lubricants. Additional information about specific Aroclors is included in Table A-1 (see Attachment 1).

Approximate usage of PCBs in the US is summarized as follows (EIP Associates, 1997):

> Closed system and heat transfer fluids (transformers, capacitors, fluorescent light ballasts, etc.): 60%
>
> Plasticizers: 25%
>
> Hydraulic fluids and lubricants: 10%
>
> Miscellaneous uses: 5%

As shown in Table 2, PCBs were commonly used in a number of electrical, heat transfer, and hydraulic applications as well as a range of other applications.

TABLE 2

PCB Uses

Primary Applications	
Dielectric fluids and transformers	Used as insulating material, coolant, and for fire-resistant properties. Potential sources would be facilities which used, stored, and serviced electrical equipment and which used significant amounts of electricity. These facilities could include, but are not limited to: Electrical transmission and distribution facilities; electrical equipment maintenance facilities and salvage yards; rail yards; and manufacturing facilities (sawmills, pulp and paper mills, chemical manufacturing, shipyards, primary and secondary metals smelting and refining, etc.)
Capacitors	Present in industrial facilities, industrial machinery both fixed and mobile, and consumer products. Includes larger power-factor correction capacitors associated with transformers, manufacturing facilities, and commercial buildings (usually near high power-usage equipment such as computer rooms and heating and cooling units); and smaller electric motor-start capacitors used in industrial

	equipment and appliances such as hair dryers, air conditioners, refrigerators, power tools, and submersible well pumps. Also includes capacitors used in appliances and electronics such as televisions and microwave ovens.
Fluorescent light ballasts	PCB-containing capacitors were used in fluorescent light ballasts. PCB-containing asphaltic resin (potting material) was also utilized as insulating material for some ballasts.
Electromagnets	Oil-cooled electromagnets are constructed with coils immersed in transformer oil to prevent over-heating and shorting. Used in cranes for picking up metal and for metal separation in recycling operations (metal scrap yards, tire shredding, concrete crushing, slag operations, etc.).
Miscellaneous electrical equipment	Switches, voltage regulators, circuit breakers, reclosers, rectifiers, and some oil-cooled electric motors.
Heat transfer systems	Where oil is circulated through a non-contact system as a heat transfer medium for heating, cooling, and maintaining uniform temperature throughout a system or manufacturing process. Wide variety of applications in manufacturing industries including high-tech, asphalt, pulp and paper, metal products such as steel tubing and die casting, adhesives, chemicals, food processing, paint & coatings, textiles, etc.
Hydraulic fluids	Any application of hydraulic oil such as industrial equipment and machinery, commercial equipment, automotive brake fluid, etc.
Plasticizers	Used in polyvinyl chloride plastic, neoprene, chlorinated rubbers, laminating adhesives, sealants and caulking, joint compounds (concrete), etc.
Lubricants	Cutting oils, compressors, electrical equipment, oil-impregnated gaskets and filters; also currently present in low concentrations in recycled oil. Also used in vacuum pumps at high tech and electronics manufacturing facilities, research labs, and wastewater treatment plants.
Other applications of PCBs	
Dust control (dedusting agents)	Present in dust control formulations, and used oil historically used for dust suppression.
Pesticides	As an extender to extend the life of pesticides.
Fire retardants	Coatings on ceiling tiles, and textiles including ironing boards and yarn.
Paints, coatings	As plasticizers in paint, corrosion resistant paints for various applications including military/navy ships, corrosion resistant epoxy resins on metal surfaces, film casting solutions for electrical coatings, varnish, lacquers, and waterproofing coatings for various applications.
Carbonless copy paper	Used as an ink pigment carrier (microencapsulation of dye); when the top sheet was pressed down, ink and PCB oil were transferred to the copy.
Printing inks	Ink for newsprint and as a dye carrier; also used as a solvent for deinking newsprint for recycling.
Investment casting waxes	Used as wax extenders.
Wood treatment	May be present as an impurity in pentachlorophenol (Warrington, 1996).
Sources: ATSDR (2000), DEQ (1997), EIP Associates (1997), UNEP Chemicals (1999)	

Due to the long service life of many PCB-containing items and the use of PCBs in some durable, relatively inert products, PCB-containing materials will continue to be disposed of and processed in waste and recycling operations. Waste products and recycling operations that may process significant quantities of PCB-containing materials are described in Table 3:

TABLE 3

PCB Sources In Waste Materials And Recycling Operations

Material or Operation	Comments
Scrap metal recycling	Transformer shell salvaging; heat transfer and hydraulic equipment; and fluff (shredder waste from cars and appliances including upholstery, padding and insulation). Also present in non-ferrous metal salvaging as parts from PCB-containing electrical equipment, and oil & grease insulated electrical cable.
Auto salvage yards, auto crushing	Hydraulic fluid, brake fluid, recycled oil, capacitors, and oil-filled electrical equipment such as some ignition coils.
Repair activities	Shipyards (electrical equipment, hydraulic oil, paint, etc.), locomotive repair, heavy equipment repair facilities, auto repair, repair of manufacturing equipment, etc.
Used oil	May be present in used oil from various sources including auto salvage yards, automotive and heavy equipment repair shops, hydraulic equipment repair, industrial machinery repair, etc. Because some PCBs have been mixed with used oil, some recycled oils currently in circulation may contain PCBs at concentrations generally < 50 ppm. PCBs may also be present where used oil has been used for dust suppression/road oiling, weed control, and energy recovery.
Recycled paper	Paper may contain PCBs where carbonless copy paper has been used in recycling. However, PCB concentrations have decreased over time as the volume of unrecycled carbonless copy paper is reduced. Recycled paper containing PCBs has historically been used for food packaging (CWC, 1997). PCB concentrations in food packaging are restricted to 10 ppm unless an impermeable barrier is present between the packaging and food product (FDA, 2003).
Effluent	PCBs may be in wastewaters from manufacturing facilities and equipment such as chemical and pesticide facilities, pulp and paper mills, cooling waters from vacuum pumps and electric power generation facilities where leaks have occurred, and condensate from vacuum pumps and natural gas pipelines. Significant cleanup activities have been performed at natural gas pipeline compressor stations from discharges of condensate to ground and storm drainage systems (DOJ, 2002).
Asphalt roofing materials, tar paper, and roofing felt	Anticipated at generally very low concentrations where used oil containing PCBs has been used in asphalt mix.
Building demolition	Electrical equipment, joint caulking, oil & grease insulated cable, surface coatings as flame retardant and waterproofing.
Dredge spoils	From areas where contaminated sediments are present.
Landfills	Municipal and industrial solid waste; virtually all potential sources could be present, including waste materials and soils from remediation sites.
Wastewater treatment plant sludge	Derived from atmospheric deposition and stormwater, water supply systems, leaks and spills, leaching from coatings and plastics containing PCBs, PCBs in food and human waste.

Sources: EIP Associates (1997), EPA (2002), UNEP Chemicals (1999)

Releases of PCBs

Prior to the regulation of PCBs under the Toxic Substances Control Act (TSCA) in 1976, PCBs were released (both accidentally and intentionally) into the atmosphere, water, and land through sewers, smokestacks, stormwater runoff, spills, and direct application to the environment (for example, to reduce dust emissions and to extend the life of some agricultural pesticide formulations) (Flynn, 1997). Large volumes of PCBs have been introduced to the environment through the burning of PCB-containing products, vaporization from PCB-containing coatings and materials, releases into sewers and streams, improper disposal of PCB-containing equipment in non-secure landfill sites and municipal disposal facilities, and by other routes (such as ocean dumping) (ATSDR, 2001).

Based on the current regulation of PCBs, the current primary "new" sources of PCB contamination are limited to outdated or illegal landfills and scrap yards and leaks or explosions of electrical equipment and other equipment (such as locomotive transformers) that may still contain PCBs (ATSDR, 2001). Other sources are facilities or sites that were previously contaminated with PCBs (for example, contaminated sediments). From contaminated sites, PCBs are emitted and re-deposited to the environment via volatilization from water and soil, wet and dry depositions, and revolatilization (HSDB, 2003). These processes are discussed in further detail in Attachment 2.

Attachment 1 – Common Uses of Aroclors

Common uses of specific Aroclors are shown in Table A-1.

TABLE A-1

Common Uses of Aroclors

Aroclor Type	Use and Comments
A-1016	Capacitors
A-1221	Capacitors Gas Transmission Turbines Rubber Polyvinyl acetate - Improved quick-track and fiber-tear properties Polystyrene – Plasticizer Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1232	Hydraulic fluid Rubber Adhesives Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1242	Transformers Heat transfer Hydraulic fluid Gas transmission turbines Rubbers Carbonless copy paper Wax extenders Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1248	Hydraulic fluids Vacuum pumps Rubbers Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1254	Transformers Capacitors

TABLE A-1

Common Uses of Aroclors

Aroclor Type	Use and Comments
	Hydraulic fluids
	Vacuum pumps
	Synthetic resins
	Wax extenders
	Dedusting agents
	Inks
	Cutting oils
	Pesticide extenders
	Sealants and caulking compounds
	Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance
	Styrene-butadiene co-polymers - Better chemical resistance
	Ethylene vinyl acetate – Pressure-sensitive adhesives
	Chlorinated rubber - Enhanced resistance, flame retardence, electrical insulation properties
A-1260	Transformers
	Hydraulic fluids
	Dedusting agents
	Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance
	Polyester resins - Stronger fiberglass; reinforced resins and economical fire retardants
	Varnish - Improved water and alkali resistance
A-1262	Synthetic resins
	Crepe rubber - Plasticizers in paints
	Nitrocellulose lacquers - Co-plasticizers
	Wax - Improved moisture and flame resistance
A-1268	Rubbers
	Synthetic resins
	Neoprene - Fire retardant; injection moldings
	Wax extenders

Sources: Nagpal (1992); ATSDR (2000).

Attachment 2 – Fate and Transport of PCBs

The basic chemical structure of PCBs includes two benzene rings (known as the biphenyl) and between 1 and 10 chlorine atoms substituted on each of the benzene molecules. Figure 1 shows the basic structure of PCBs, where the numbers 2-6 and 2'-6' represent possible substitution locations for chlorine. There are a total of 209 individual PCB compounds (known as congeners) (Flynn, 1997). Typically, PCBs occur as mixtures of congeners (that is, Aroclors) (Bernhard and Petron , 2001). Aroclors are identified by number (such as 1254), with the last two digits representing the percent content of chlorine; higher Aroclor numbers reflect higher chlorine content (ATSDR, 2001).

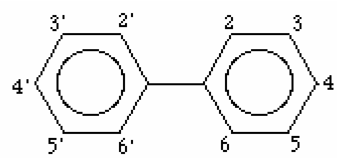

Figure 1. Basic PCB Structure

As discussed in the main text of this fact sheet, PCBs were emitted in large quantities before PCB manufacturing was banned in the U.S. Between 1930 and 1970, approximately 30,000 tons were released to air, 60,000 tons to fresh and coastal waters, and 300,000 tons to dumps and landfills (HSDB, 2003). Because of their extreme chemical and thermal stability, once they are introduced to the environment they remain there for years or even decades (ATSDR, 2000).

PCBs are nonpolar and therefore are only slightly soluble. This characteristic inhibits the transport of PCBs from soil to water (groundwater or surface water) and makes them bind strongly to soils. PCBs can be transported to surface water via entrainment of contaminated soil particles in surface water runoff. In water, a small portion of PCBs will dissolve, but the majority will bind to organic particles and bottom sediments (Nagpal, 1992). Although PCBs have a strong affinity for sediment, small amounts of PCBs are released from sediments to water over time (ATSDR, 2000). Once in the water, PCBs are also taken up by small organisms and fish. PCBs accumulate in the fatty tissue of these organisms.

PCBs have a relatively low vapor pressure. Despite their low volatility, PCBs do volatilize from both soil and water. This is a result of their widespread presence and extreme stability (DEQ, 1997). Once re-emitted, PCBs can be transported long distances in air, and then redeposited by settling or scavenging by precipitation. This cycling process continues indefinitely and is referred to as the grasshopper effect (EPA, 2001). It is estimated that there are currently 1,000 tons of PCBs cycling through the atmosphere over the U.S. (HSDB, 2003). Studies performed at Lake Michigan show that 80 percent of the PCBs entering the lake come from the air (Delta Institute, 2000). Additional evidence of the atmospheric deposition of PCBs is the presence of PCBs in sparsely populated areas of Canada and in Arctic polar bears (both far from point sources of PCB contamination) (Fiedler, 1997).

References

ATSDR. 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). November 2000. Agency for Toxic Substances and Disease Registry Web page: http://www.atsdr.cdc.gov/toxprofiles/tp17.html. Web page visited: July 2003.

ATSDR. 2001. Polychlorinated Biphenyls. February 2001. Agency for Toxic Substances and Disease Registry Web page: http://www.atsdr.cdc.gov/tfacts17.html. Web page visited: February 2003.

Bernhard, Teresa and Petron, Steve. 2001. Analysis of PCB Congeners vs. Aroclors in Ecological Risk Assessment. April 2001.

CWC. 1997. Mill-Based Residual Fiber For Use in Molded Pulp Technology. 1997. Report No. PA-97-2. Clean Washington Center web page: http://www.cwc.org/paper/pa_htm/PA97-2rpt.htm. Web page visited: July 2003

Delta Institute. 2000. PCBs. Delta Institute Web page: http://www.delta-institute.org/publications/PCBFS.pdf. Web page visited: March 2003.

DEQ. 1997. PCB Generic Remedies. December 1997. Eco-USA. 2002. PCBs. Eco-USA Web page: http://www.eco-usa.net/toxics/pcbs.shtml. Web page visited: February 2003.

DOJ. 2002. United States Settles With Natural Gas Pipeline Company. February 1, 2002. United States Department of Justice web page: http://www.usdoj.gov/opa/pr/2002/February/02_enrd_053.htm. Web page visited: July 2003.

EIP Associates. 1997. Polychlorinated Biphenyls (PCBs) Source Identification. Prepared by: EIP Associates, October 28, 1997. Prepared for: Palo Alto Regional Water Quality Control Plant. City of Palo Alto web page: http://www.city.palo-alto.ca.us/cleanbay/publications.html. Web page visited: July 2003.

EPA. 2001. Frequently Asked Questions About Atmospheric Deposition. September 2001.

EPA. 2002. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions. July 1, 2002. 40 CFR Part 761. EPA Office of Pollution Prevention & Toxics web page: http://www.epa.gov/opptintr/pcb/200240CFR761.pdf. Web page visited: July 2003.

FDA. 2003. Unavoidable Contaminants in Food for Human Consumption and Food-Packaging Material, SubPart B, Tolerances for Polychlorinated Biphenyls (PCBs). April 1, 2003. 21 CFR 109.30. National Archives and Records Administration, Code of Federal Regulations web page: http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi. Web page visited: July 2003.

Fiedler, Dr. Heidelore. 1997. Polychlorinated Biphenyls: Uses and Releases. July 1-4, 1997. Proceedings of the Subregional Awareness Raising Workshop on Persistent Organic Pollutants (POPs), St. Peterburg, Russian Federation. United Nations Environmental Program (UNEP) Chemicals web page: http://www.chem.unep.ch/pops/. Web page visited: July 2003.

Flynn, Leonard. 1997. Public Health Concerns about Environmental Polychlorinated Biphenyls (PCBs). American Council on Science and Health Web page: http://www.acsh.org/publications/reports/pcupdate2.html. Web page visited: February 2003.

HSDB. 2003. Polychlorinated Biphenyls. Compiled by the National Library of Medicine. Hazardous Substance Data Bank Web page: http://csi.micromedex.com/Data/HS/HS3945H.htm. Web page visited: February 2003.

Nagpal, N.K., Ph. D. 1992. Water Quality Criteria for Polychlorinated Biphenyls. January 1992. Ministry of Environment, Lands, and Parks, Province of British Columbia web page: http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/pcbs/index.html. Web page visited: July 2003.

UNEP Chemicals, 1999. Guidelines for the Identification of PCBs and Materials Containing PCBs, First Issue, August 1999. United Nations Environmental Program (UNEP) Chemicals web page: http://www.chem.unep.ch/pops/. Web page visited: July 2003.

Warrington, P.D., Ph. D. 1996. Water Quality Guidelines for Chlorophenols. November 1996. Ministry of Environment, Lands, and Parks, Province of British Columbia web page: http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/chlorophenols/index.htm. Web page visited: July 2003.

Attachment C

Catch Basin Solid Sampling Standard Operating Procedures

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Standard Operating Procedures

Guidance for Sampling of Catch Basin Solids

Prepared for

City of Portland

July 2003

Prepared by

CH2MHILL

VERSION 1.0
PDX/031550010.DOC

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Contents

Standard Operating Procedures—Guidance for Sampling of Catch Basin Solids

1.0 Purpose

This document describes Standard Operating Procedures (SOPs) for the collection of environmental solids samples from stormwater catch basins. It provides procedures to be used for assessing potential pathways of contamination from upland sources via stormwater conveyances to receiving waters and sediments. Sampling for environmental investigations requires different methods than those that may be used for determining waste profiles for catch basin solids disposal.

The procedures described here are intended to provide representative samples of catch basin contents. These procedures may be modified for other purposes, such as assessing characteristics of older or newer solids, or because of space or access limitations. All deviations from these SOPs should be noted in field logs and reports.

1.1 Background

Catch basins are typically designed to prevent debris, gravels, and soils from fouling storm drain lines, and generally remove larger particles (greater than approximately 1 millimeter in diameter). Unlike specially designed stormwater treatment vaults, catch basins are not intended to remove fine particles or soluble pollutants, and they may only marginally reduce concentrations of contaminants or suspended solids. Catch basin retention efficiencies for suspended solids may be highly variable as functions of basin design, stormwater flow rates, accumulated solids in the sump (a function of cleaning frequency), and solids particle characteristics. Finer particle fractions may be suspended in moving water and carried beyond the catch basin. Because these finer particles are often correlated with organic and inorganic contaminants, special care needs to be taken while collecting catch basin solids samples to ensure that the finer particle fraction is sampled.

2.0 Scope and Applicability

The methodologies discussed in these SOPs are intended to provide procedures for collecting representative environmental samples of solids in stormwater catch basins. These SOPs describe specific steps that can be used to ensure representative and comparable data.

Residual material in catch basins is inherently variable. Factors that can affect variability include the characteristics of catch basin structures, the sources of particles, water flow rates and stormwater quality, and the depth and pattern of accumulated solids. In addition, the characteristics of catch basin solids can vary from slurry-like to dry solids. Although variability may be unavoidable, standard methods of collecting and handling samples can improve data quality.

3.0 Equipment and Materials

The following equipment should be available for collecting solids samples from catch basins:

- Sampler (generally one type will be selected per catch basin)
  - Stainless steel scoop, trowel, or spoon
  - Bucket (hand) auger
  - Hand corer
  - Petite Ponar® dredge/Van Veen® dredge (0.025 square meter [m^2])
- Sampling Equipment List
  - Site Sampling and Analysis Plan and/or site files detailing sampling locations, sample collection, and site information
  - Large stainless steel bowl
  - Stainless steel mixing spoon
  - Latex gloves
  - Metal or wooden rod
  - Field data sheets or other documentation
  - Laboratory-supplied sample containers
  - Cooler and ice/chilled blue ice
  - Tape measure
  - Ziploc® bags
  - Field notebook
  - Permanent marking pens
  - Sample labels
  - Chain-of-custody seals
  - Personal Protective Equipment (PPE)

4.0 Procedures

4.1 Documentation

Regardless of the equipment to be used, the following general procedures apply:

- Confirm any active catch basin best management practices such as sweeping and cleaning, frequency of activity, etc., if known.
- Document design flow rates (base flow, storm flow) for catch basins, if known.
- Record weather conditions at the time of sampling and last known rainfall event(s).
- Record the location of the catch basin. Include potential solids or contaminant sources such as construction activities, erosion, equipment storage or use, waste or material storage, vehicles, exhaust vents, onsite processes, etc. Site features, distances, flow directions, and gradients should be noted or sketched on a site map.

- Record dimensions of catch basin. Diagram inlet/outlet pipes in the catch basin. The source of inlet flows and destination of outlet flows should be noted, if known.
- Note the presence of water, visible flows, signs of flooding, clogging, debris in or around the catch basin, blocked inlets/outlets, staining, etc.
- Note any apparent evidence of contamination in the catch basin, such as odor, sheen, discoloration, etc., of water or solids.
- Measure the depth of solids in the catch basin and the total depth of the catch basin or sump. Use a decontaminated metal rod or disposable wooden dowel to probe the total depth of the catch basin.
- When recovering samples, record visual observations of:
  - Color
  - Texture, estimates of particle size fractions (as soil classification)
  - Amount and type of debris (Note: any large debris observed in the sample, including sticks, leaves, beverage containers, miscellaneous pieces of plastic and metal, stones and gravel, etc., should be removed, but paint chips and small organic matter should be left in the sample)
- Prepare a diagram of sampling locations within the catch basin, noting any special features such as sumps, inlets and outlets, etc.
- Decontaminate all sampling equipment using documented procedures before and after any sampling activities. Record the decontamination procedures in the field notes.
- Record any deviations from the specified sampling procedures or any obstacles encountered.
- Complete a chain-of-custody form for all samples.

4.2 Selection of Sampling Method

Sampling equipment should be matched with the presence and depth of water, solids water content, and catch basin depth. Figure 1 presents a flow chart for determining the appropriate sampling device. Detailed descriptions of each sampling method are presented in Section 4.3.

4.2.1 Decontamination of Equipment

Non-disposable equipment that contacts solids samples should be thoroughly cleaned and decontaminated before each set of samples is collected. Decontamination should be done in accordance with City of Portland SOP 7.01a[1] or comparable standard. Decontamination solutions should be selected on the basis of the type of analysis being conducted on samples.

[1] Bureau of Environmental Services, Environmental Investigations Division, SOP No. 7.01a Draft or subsequent revisions, Decontamination of Sampling Equipment.

4.3 Sample Collection

This guidance for sampling catch basins is intended to assess individual catch basins as potential sources of past, present, or future conduits of contamination to Willamette River sediments. Sample collection should therefore incorporate material representative of the total depth and area unless specific alternative sampling objectives are otherwise noted and approved. In some cases, sample collection from discrete depths may be desired based on knowledge of catch basin maintenance and time since last cleaning, activities conducted within the drainage area, spills or releases, and related information.

Standing water in the catch basin, if present, may be pumped off to simplify sample collection. If this procedure is conducted, care must be taken to:

- Pump water from the surface only
- Leave a thin layer of water so that fine materials in the solids are not disturbed
- Pump water slowly so that fine materials are not disturbed
- Dispose of pumped water in the sanitary sewer (pumped water may not be released into the storm system)
- Document all steps taken, the depth and volume of water removed, the point of water disposal, water remaining before sampling, and other relevant factors

4.3.1 Sampling Firm Solids in Catch Basins Without Standing Water

Firm solids above the water line are most easily collected using simple soil sampling tools (that is, stainless steel spoon or trowel, or bucket auger). When sampling with a spoon or auger, solids may be moist or wet but should retain their form and structure when handled. (Note: If the sample has a high water content [water drips from solids], another sampling method should be considered to minimize the loss of fine particles in liquid drainage.)

4.3.1.1 Stainless Steel Spoon, Scoop, or Trowel

If necessary, the spoon, scoop, or trowel may be attached to an extension pole in order to reach the bottom of the catch basin, provided a representative sample can be retained on the spoon and recovered intact.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel spoon, scoop, or trowel:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a decontaminated stainless steel spoon, scoop, or trowel, collect an equal amount of material from five locations: each corner (or, if round, each compass point) and the center. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.

5. Place sampled solids into a decontaminated stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume, and mix to homogenize thoroughly using a decontaminated or disposable stainless steel spoon.
6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
10. Complete the chain-of-custody documents.

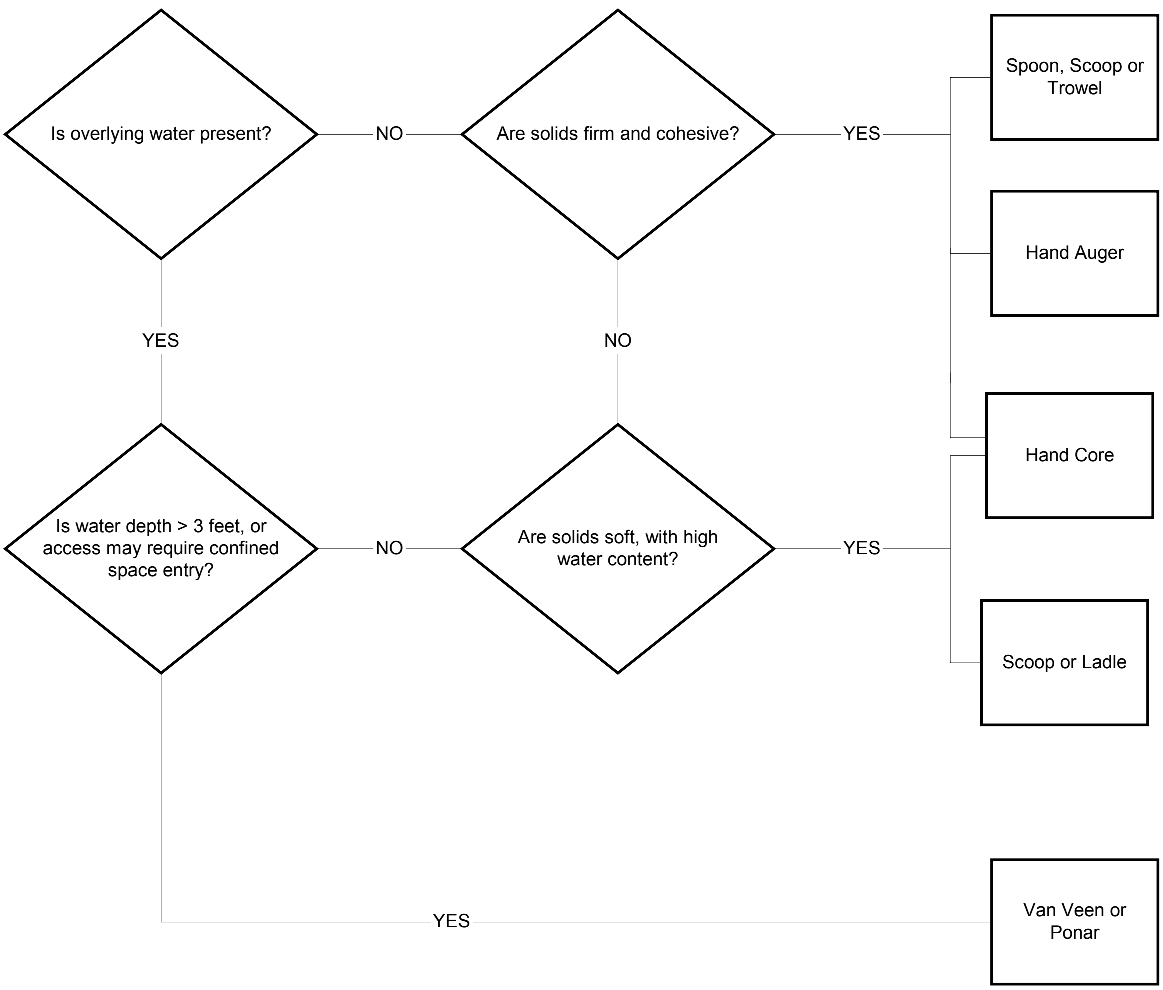
4.3.1.2 Stainless Steel Bucket Auger (Hand Auger)

Bucket augers are applicable to the same situations and materials as the spoon, scoop, and trowel method described above. Most bucket augers have long handles (> 4 feet), and some can be fitted with extension handles that will allow the collection of solids from deeper catch basins.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel bucket auger:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Advance a thoroughly cleaned and decontaminated bucket auger into catch basin solids in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.
5. Empty the auger into a stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume and mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place the sample into each appropriate sample container.

Figure 1. Flow Chart for Selecting the Appropriate Catch Basin Solids Sampler



7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
10. Complete the chain-of-custody documents.

4.3.2 Sampling Solids in Catch Basins with Standing Water

Hand corers or dredge samplers should be used when standing water is present in catch basins to prevent washout of sample material when the sampler is retrieved through the water column. Corers may also be used for dry and moist solids. Some hand corers can be fitted with extension handles that will allow the collection of samples in deeper basins.

4.3.2.1 Hand Corers

The following procedure defines steps to be taken when sampling saturated solids with a stainless steel hand corer:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated corer, advance the sampler into catch basin solids with a smooth, continuous motion, twist corer, and then withdraw it in a single motion.
5. Remove the nosepiece and withdraw the sample into a stainless steel bowl or tray.
6. Repeat steps 4 and 5 in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.
7. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
8. Collect a suitable portion of the mixed solids with the decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
9. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
10. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.

11. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.

12. Complete the chain-of-custody documents.

4.3.2.2 Clamshell-Type Dredge Samplers

Clamshell-type dredge samplers like the Petite Poner® and Van Veen® 0.025-m^2 dredge sampler are capable of sampling moist and wet solids, including those below standing water. However, penetration depths usually will not exceed several inches, so it may not be possible to collect a representative sample if the solids layer is greater than several inches. The sampling action of these devices causes agitation currents that may temporarily resuspend some settled solids. This disturbance can be minimized by lowering the sampler slowly and by allowing slow contact with the solids.

Samples collected with clamshell-type dredge samplers should meet the following acceptability criteria in order to ensure that representative samples have been collected (EPA, 2001):

- Solids do not extrude from the upper surface of the sampler.
- Overlying water is present in the sampler (indicating minimal leakage).
- Overlying water is clear and not excessively turbid.
- Desired depth of penetration has been achieved.
- The solids-water interface is intact and relatively flat, with no sign of channeling or sample washout.
- There is no evidence of sample loss.

The following procedure defines steps to be taken when sampling moist, wet, or submerged solids with a dredge sampler:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated dredge-type sampler and working on a clean, decontaminated surface, arrange the sampler in the open position, setting the trip bar so that the sampler remains open when lifted from the top.
5. Slowly lower the sampler to a point just above the solids surface.
6. Drop the sampler sharply into the solids, then pull sharply on the line, thus releasing the trip bar and closing the dredge.
7. Raise the sampler and place on a clean surface. Slowly decant or siphon any free liquid through the top of the sampler. Take care to ensure that fines are not lost in the process; if necessary, allow the sampler to sit and the fine particles to settle before decanting or siphoning free liquid.

8. Open the dredge and transfer the solids into a large stainless steel bowl or tray of sufficient size to receive three sample loads.
9. Repeat steps 4 through 8 in diagonal corners (or, if round, two opposite compass points) and the center of the catch basin. Material recovered at each point should be representative of the total depth of solids in the sampling device. If necessary, modify sampling points to correspond to catch basin size or dimensions. Record any deviations in the field notes.
10. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
11. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
12. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
13. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
14. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
15. Complete the chain-of-custody documents.

5.0 Sample Acceptability

Only solids that are collected correctly with grab or core sampling devices should be used for subsequent physicochemical testing. Acceptability of grabs can be ascertained by noting that the samplers are closed when retrieved, are relatively full of solids (but not overfilled), and do not appear to have lost surficial fines. Core samples are acceptable if the core was inserted vertically in the solids and an adequate depth was sampled without significant loss out the mouth of the corer.

6.0 Quality Assurance and Quality Control

A rinsate sample may be appropriate or required when non-disposable sampling equipment is used. The equipment rinsate should be collected between sampling locations and after the device has been decontaminated. The rinsate sample should be analyzed for the same parameters analyzed for in solids.

7.0 Resources

1. ASTM. September 1994. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediment for Toxicological Testing. American Society for Testing and Materials (E 1391-94). West Conshohocken, Pennsylvania.

2. EPA. 1987. A Compendium of Superfund Field Operations Methods, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response (EPA/540/P-87/001), Washington, D.C.

3. EPA. 2001. Methods for Collection, Storage, and Manipulation of Sediment for Chemical and Toxicological Analyses: Technical Manual. U.S. Environmental Protection Agency, Office of Water (EPA-823-B-01-002). Washington, D.C. October 2001.

Attachment D

WDOE Storm Water Sampling Guidance

Washington Department of Ecology 2005

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How To Do Stormwater Sampling
A guide for industrial facilities

Washington State
Department of Ecology

December 2002 (rev. 1/05)

Publication #02-10-071

Table of Contents

Introduction

The purpose of this guide is to help those who operate facilities do their own sampling.

The *Industrial Stormwater General Permit* requires that your facility conduct at least quarterly visual monitoring and sampling of stormwater and report the sampling results to Ecology. These requirements are outlined in the permit under *Section S4. MONITORING REQUIREMENTS*. This guide supports the sampling portion of the general permit but does not substitute for it.

The purpose of this guide is to help those who operate facilities do their own sampling by more fully describing the steps and procedures to be followed. This guidance will lead you to be able to sample in a way that will provide you and Ecology with meaningful results.

Sources of pollutants that may enter surface water, sediments, or ground water can be identified by sampling stormwater discharges. The results of sampling will be helpful when developing your Stormwater Pollution Prevention Plan (SWPPP), determining if your existing plan is adequate, and when implementing or assessing Best Management Practices (BMPs).

Some effort is required up front to prepare for sampling in a way that will meet requirements and provide useful data. What follows is a step-by-step procedure of what you need to do to gather and report data that will represent the quality of stormwater leaving your facility. The steps are organized to guide you through the process from start to finish of stormwater sampling.

This guidance is an update to "How to do Stormwater Sampling" which was originally developed by Ecology's Environmental Assessment Program in 2002. The update was made in accordance with the modified The Industrial Stormwater General Permit which became effective in January 2005.

Advance Planning for Stormwater Sampling

Deciding What To Sample

Before beginning your sampling, you'll need to determine the specific pollutants (water quality parameters) you are required to sample and test for. Ecology has listed these parameters on your permit cover sheet. Your parameters are based on:

- ◆ the standard set of parameters for all facilities,
- ◆ your facility's primary Standard Industrial Code (SIC Code),
- ◆ whether your facility discharges to an impaired (303 (d) listed) water body, and
- ◆ any requirements that apply to water cleanup plans (TMDLs).

All facilities must monitor for turbidity, pH, zinc, and oil and grease. Oil and grease are grouped together as a single parameter tested in the lab with a single analysis. Turbidity can be measured directly in the field using a handheld meter, or sampled and analyzed in the lab. pH must be measured in the field using either a calibrated pH meter or pH paper. You can get pH paper from a distributor of scientific/laboratory supplies or through the same laboratory that will be doing your sample analysis. Zinc, oil and grease and other parameters required by the permit (other than turbidity and pH) are measured by sending bottled samples to a laboratory for analysis.

Selecting a Laboratory to Test Your Sample

Having identified the parameters you will need tested, the next step is to select a laboratory to perform the tests. You are required to select a lab accredited by Ecology. Accreditation assures Ecology that the lab is able to do quality testing using the analytical methods specified under Monitoring Requirements in your permit. A list of labs can be found on Ecology's website: www.ecy.wa.gov/programs/eap/labs/lablist.htm.

Contacting the Lab in Advance

You should contact the lab well ahead of time. They will be providing you with the sampling bottles you'll need. For some water quality parameters, such as oil and grease, it is not only desirable but necessary to collect the sample directly into a specially-cleaned container, so you will need to have bottles from the lab on hand before you sample. You can also ask your lab to send pH paper along with your sample bottles.

Discuss with the lab the analytical methods they will use, as specified in the sample parameter tables included in S4. D of the general permit. The lab will provide you helpful information and explanations that go beyond the scope of this guide. If you must meet discharge limits listed in S3, Discharge Limitations, you should carefully review them with the lab.

All facilities must monitor for turbidity, pH, zinc, and oil and grease.

Contact the lab well ahead of time.

Ask questions - your lab can help you.

Issues you may want to cover with the lab include:

The type and size of bottle that will be supplied for each water quality parameter to be sampled and tested.

How full to fill the bottle.

Any safety concerns with materials supplied by the lab.

What you need to know about preserving your samples: Make a note of the parameters for which bottles will have preservative inside. For some tests, a preservative is necessary. The preservative is a substance that stabilizes certain chemicals at the time of sampling so that a valid test can be done later. It is critical that you use the correct bottles because tests requiring preservative will not be valid without the correct preservative. In some cases, the wrong preservative will interfere with a test. It is important not to lose the preservative that comes in the bottles supplied by the lab.

The kind of labels the lab will supply for the bottles and how the labels should be filled out. The labels or tags you use to identify the samples you take must be waterproof, and if you write on them, the writing must be waterproof also.

Typical Sampling Information

Parameter	Bottle Type	Minimum Sample Required	Holding Time	Preservation
Turbidity	500 mL wide-mouthed poly	100 mL	48 hours	Cool to 4º C
Total Zinc	1liter (L) bottle cleaned according to protocol	500 mL	6 months	HNO_3 to pH<2 Cool to 4º C
Oil and Grease	1L glass jar	750 mL (jar ¾ full)	28 days Jar preserved in lab within 24 hours of arrival to lab.	HCl to pH<2 Cool to 4º C

A description of forms or other paperwork to submit to the lab with the samples and how to fill them out.

Whether the lab will supply pH paper as well as sample bottles, tags or labels for the bottles, and blank forms.

How bottles and other supplies from the lab will be delivered to you.

The holding times for each water quality parameter to be sampled and tested. A holding time is the maximum time allowed between taking the sample and doing the lab analysis. If you exceed holding time, the sample analysis is not acceptable.

How and when you will deliver samples to the lab. Plan with the lab how you will get the samples to them in time to begin analysis before the parameter with the shortest holding time reaches that holding time. The fastest way to deliver samples to the lab may be to do so in person, but it may be possible to ship samples (cooled in picnic coolers) and still meet holding times. If you deliver samples in person, you can pick up bottles and supplies for the next quarter at the same time.

The table (left) shows typical sampling information for the three water quality parameters that must be monitored under the Industrial Stormwater General Permit. The information you obtain from your lab may differ somewhat from this:

In many cases, the preservatives listed above come pre-measured in the sampling bottles and there is no need to check pH. Ask your lab about this.

Sampling requirements tend to use scientific words and units of measure. Temperature is measured in degrees Celsius, "C". Thermometers that we typically use in the United States measure temperature in Fahrenheit, "F" and 4º C is about 39° F. But for your purposes, "Cooling to 4º C" means putting the samples on crushed ice or packed with blue ice in an ice chest so they will be kept just above freezing. Metric units are used to measure weight, volume and distance. Liquid volumes do not use "quarts" and "cups" but use measures such as liters, "L" and milliliters "mL". Chemicals use their own scientific notation. Nitric acid for example is HNO_3. Be sure to have the lab explain any words or expressions that you do not understand.

Deciding How You Will Take The Sample

Section S4.A.1 of the Industrial Stormwater General Permit states that a grab, time-proportionate, or flow proportionate sample may be taken. A grab sample is a single sample "grabbed" by filling up a container, either by hand or with the container attached to a pole. It is the simplest type of sample to collect and it is expected that most Permit holders will choose to collect grab samples. The general permit recommends that grab samples be collected within the first hour after stormwater discharge begins.

As we will discuss in the next section, oil and grease samples *must* be collected as grab samples. Some Permit holders may choose to better represent water quality parameters other than oil and grease by collecting time-proportionate or flow-proportionate samples. These samples consist of a number of subsamples taken at intervals rather than a single grab sample. The general permit recommends that time-proportionate and flow-proportionate samples be started within the first 30 minutes after discharge begins, and be taken over a two-hour period.

A time-proportionate sample is one made up of a number of small samples (subsamples) of equal volume collected at regular time intervals combined into a single large sample. A flow-proportionate sample is one made up of a number of subsamples where each subsample is collected in such a way as to represent a given amount of stormwater discharge. Time-proportionate and flow-proportionate samples provide the advantage of including a number of smaller samples (subsamples) in the sample so that the stormwater discharge is better represented than with a grab sample. Time-proportionate and flow proportionate samples can be collected either by hand or with automated equipment. Collecting them by hand is somewhat difficult and collecting them with automated equipment involves additional expenses. Additionally, flow-proportionate sampling requires some knowledge of how to measure fluid flow. A reference for automatic stormwater sampling is the book *Automatic Stormwater Sampling Made Easy* (Thrush and De Leon, 1993) published by the Water Environment Federation. It can be purchased at www.wef.org.

Collecting Oil and Grease Samples

The general permit requires that oil and grease samples be collected by all permit holders. Because of the particular way oil and grease samples must be collected, this requirement may govern your overall approach to sampling.

For some parameters other than oil and grease, it is possible to sample in difficult situations by filling a container and transferring it to the sample bottle to be sent to the lab. Oil and grease samples, however, must be collected from the stormwater source directly. The sample cannot be transferred from another container because oil and grease tends to stick to the inside surfaces of containers. Since you must sample directly into the oil and grease bottle (grab sample), taking grab samples may be the easiest way to collect additional samples for the other parameters. Take samples by collecting stormwater directly from the discharge into the bottles supplied by the lab, filling each bottle one after another.

Oil and grease samples must be collected directly into the bottle you send to the lab.

Because oil and grease samples cannot be transferred between containers, a sample cannot be formed from separate grab samples combined together. If more than one oil and grease sample is desired from a sampling site during a storm event, additional oil and grease grab samples must be collected and analyzed separately.

Because oil and grease samples must be collected directly and not through the tubing of an automatic sampler, those using automatic samplers will still have to grab oil and grease samples by hand.

Determining which Discharges to Sample

The first step in selecting sampling points is to consider the areas draining your facility. The site map in your SWPPP should show the drainage areas. Areas of particular concern are those where raw materials or finished product are exposed to rainfall and/or runoff, and areas where leaking fluids such as petroleum products and hydraulic fluids have the potential to enter stormwater runoff.

The next step is to determine where the runoff from each drainage area is discharged from your facility. If there are separate drainage areas with separate discharge points, stormwater sampled at one discharge sampling point may not represent the facility's stormwater quality overall.

Section S4.A.5 of the Industrial Stormwater General Permit describes the requirements for selecting sampling points:

"Sampling must be conducted to capture stormwater with the greatest exposure to significant sources of pollution. Each distinct point of discharge offsite must be sampled and analyzed separately if activities and site conditions that may pollute the stormwater are likely to result in discharges that will significantly vary in the concentration or type of pollutants. Where pollutant types do not vary, the Permittee may sample only the discharge point with the highest concentration of pollutants. However, the SWPPP must include documentation on how these determinations were made and in the description of each point of discharge, including the relative quantity (volume) of discharge and pollutants likely to be found."

If your facility discharges stormwater collected over areas that are used for similar activities and have similar site conditions, and there is reason to believe pollutant types will be similar in such areas, a single sampling point can be used to represent several discharge points. For example, if a facility has separate discharge points but the industrial activities are similar, you can sample at just one of the discharge points. The site chosen must be the one where there is reason to believe the pollutant concentration is highest (the worst case). For example, select the discharge that drains an area with greater use and/or more equipment activity. Determining where to sample can be approached as a logical deduction, or you may want to take samples at multiple sites and use the results to determine sampling location. Documentation of how sampling sites were chosen is required in the SWPPP, as described above in the general permit.

If your facility has multiple discharge points from areas with different uses or activities, you need to determine if that will result in significant differences in the type of pollutants that may be discharged. For example, if one portion of the site is used to store raw materials and discharges separately from another portion of the site where finished product is stored, it may be necessary to take separate samples. Some initial sampling and analysis may be necessary to make this determination. Ecology expects that most facilities will be able to choose a single sample location for their site.

Making a determination of whether a discharge is likely to have stormwater quality that differs from other discharges and require separate sampling requires a review of the site map in the SWPPP with consideration to sources of pollutants in each drainage area. This should be followed up with an on site assessment of activities, sources and quantities of pollutants in each drainage area. This information will help you document your decision as to whether two or more drainage areas can be represented by a single sample site.

Selecting Sampling Points

◆ Pipes discharging your facility's stormwater offsite.

◆ Ditches carrying your facility's stormwater offsite.

◆ Manhole access to storm sewer's carrying your facility's stormwater, so you can lower a sample bottle attached to a pole into the manhole. In general, manhole access on your property may be simpler and safer than access off property and more readily verifiable as carrying only your facility's stormwater.

These three types of sampling points are not too difficult to access and the flow within them tends to be fast enough, with enough turbulence, to allow you to collect well mixed, representative samples. In some cases, portions of industrial stormwater runoff leave a site as sheet flow. Specific approaches to sampling of pipes, ditches, manholes, grated storm drains, and sheet flow will be covered in the final section of this guide manual.

Make sure your sampling points will provide for sampling only the stormwater that comes from your facility. If the stormwater in a pipe (storm sewer) contains other discharges, move your sampling point upstream to a point where the flow is from your facility only. Also check to see that there is no base flow in the storm sewer during dry periods. Report in your SWPPP the presence of any base flow and measure or estimate its flow rate. If it is not possible to sample only flow from your facility, document the reason for this and provide information concerning the source of the flow you are sampling.

If possible, the stormwater your facility samples should not be a mixture of your facility's stormwater with other water. Some examples of situations where a sample would be of a mixture of water sources, situations in which you should **not** sample:

Examples of mixed water sources situations in which you should not sample:

A ditch that carries additional stormwater from properties upstream. In this case, the stormwater from your facility is mixed with other water and you should find a location or locations where your facility's stormwater alone can be sampled.

A stormwater sewer or pipe (culvert) discharges to a creek or other receiving water, the pipe being partially submerged where it discharges into the receiving water. In this case, this final discharge point will not be able to be used as a sampling point because the stormwater flow is mixed with the receiving water.

A manhole that carries stormwater, not only from your facility but from other stormwater sources as well. If you are grabbing a sample from a manhole but from the point where a storm sewer from your facility ends at a municipal manhole, make sure that the flow in that pipe is entirely from your facility, that the pipe is not submerged or partly submerged and that you are otherwise not prevented from collecting stormwater from your facility only. If you are not sure that a storm sewer carries only flow from your facility, the municipality may

Base flow here refers to any water in the ditch that is not a direct result of stormwater runoff. Ground water seepage into the ditch, for example, would add base flow.

*Manhole access can be a good sample point if it can be accessed safely and the stormwater is solely from your facility. Do **not** climb into the manhole. Use a sample bottle attached to a pole to take the sample.*

Practice sampling before you do the real thing.

Take time to get ready for sampling.

have storm sewer plans to help you determine this. Contact the municipality beforehand to discuss sampling from the manhole and associated safety issues, particularly for manholes in areas with vehicular traffic.

It is important to sample flow from only your facility if possible because otherwise it cannot be determined what the sample actually represents. If you discharge stormwater to a stormwater conveyance system that includes stormwater from other sources, you need to sample before your stormwater commingles with stormwater from other sources. However, if stormwater runs onto your property in an uncontrolled fashion (for example, sheet flow) from adjacent property, into areas of industrial activity on your site so that it becomes a part of the stormwater discharge from your site, this should be included in your sample of stormwater discharge. If you are concerned about this offsite source, you may want to sample that stormwater where it enters your property. If the results show significant pollution, you may want to provide Ecology with a narrative description of the contributing site and sample results to document the relative contribution of the other property or upstream source.

It is a good idea to observe the sampling point(s) you have chosen during actual stormwater runoff conditions to see how readily stormwater can be sampled there. Keep in mind that changing tides and flow conditions in receiving waters, including flood stages may occur during storm events. This may cause a pipe that is discharging your facility's stormwater to become submerged or partly submerged, preventing you from sampling during some conditions.

Obtaining Supplies for Sampling

The supplies you will want to have on hand before sampling include:

◆ Sampling bottles from the lab, including a few extra of each type.

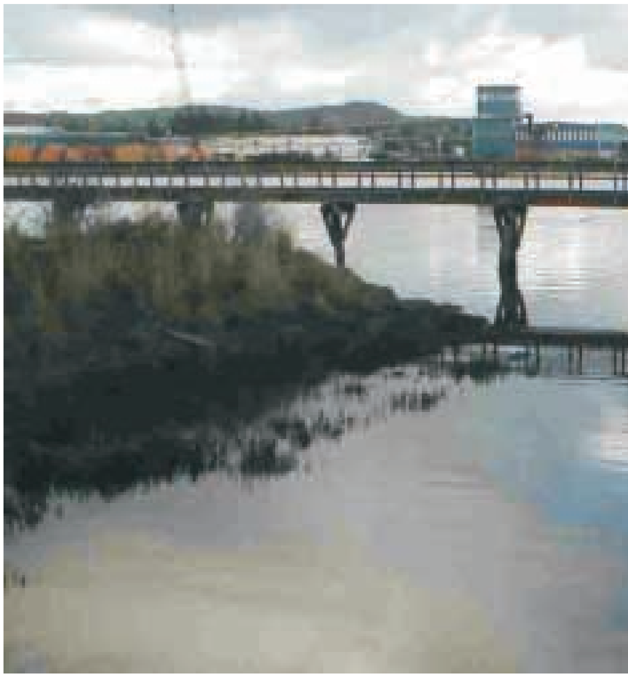
◆ When needed, a pole to hold sample bottles and filament strapping tape.

◆ Powder-free disposable nitrile or latex gloves (sold by medical and laboratory suppliers). Do not use powdered gloves as the powder may contain metals that could contaminate metals samples such as zinc.

◆ Foul-weather gear.

◆ One or more picnic coolers (depending on the number of samples to be stored and transported or shipped).

◆ A bound notebook to serve as a field book for keeping records concerning sampling. Notebooks with waterproof pages are available for these field notes at office supply stores. The information to be included in the notes will be described in the "Keeping Records" section of this guide.



Planning Just Prior to Stormwater Sampling

Now that the bulk of the planning for sampling is complete, there are a few things to keep in mind before deciding to actually begin sampling.

Being Prepared

It is important to assemble everything that will be needed for the sampling event ahead of time because opportunities to sample during storm events often come with little advanced notice. Complete the identification tags and Lab Services Required form. Place the tags, lab form, field notebook, permanent ink pen, meter, and pH paper in the cooler with the sample bottles. Have re-sealable plastic bags or other means on hand to keep the pH paper dry. If you are using a turbidity meter or pH meter, be prepared to protect them from the rain. Have foul-weather gear ready and available. It will be necessary to keep sufficient ice on-site or plan to purchase ice that day.

Choosing the Storm Event

Now you are ready to sample. Successful sampling is first and foremost a matter of being at the right storm event at the right time. What follows is some guidance on how to do that.

The general permit recommends that the storm event to be sampled must meet the following two conditions:

1. Be preceded by at least 24 hours of no greater than trace precipitation.

2. Have an intensity of at least 0.1 inches of rainfall (depth) of rain in a 24-hour period.

If the above criteria can't be met, the permittee must still collect and submit stormwater sampling results in accordance with the general permit. A permittee is required to sample only once in a sample collection period and use its best efforts to achieve the above recommended sample collection criteria. If a sample is taken and the recommended sample collection criteria are not met, the permittee is not required to conduct additional sampling for that sample collection period.

Success in collecting grab samples requires being ready to go as soon as the decision is made to sample during a particular storm event. It is especially important to be at-the-ready because the permit recommends that grab samples be collected during the first hour of stormwater discharge. Note that the permit recommends that the sample be taken within the first hour after discharge from your facility to a point off site, not from when rainfall begins.

You will increase your chances of meeting the second recommended criterion for rainfall intensity at a minimum of effort if you evaluate weather forecasts before deciding whether or not to sample a particular rain event.

Sample during a hard (intense) rain event.

Check weather forecasts.

If your facility is located in an area that is covered by a standing snow pack for days at a time during a year of normal precipitation, you may alternatively sample a snowmelt event during the winter or spring quarter. The recommended sampling conditions for a snowmelt event are as follows:

1. It is preceded by at least 24 hours of no greater than *trace* precipitation.

2. The snowmelt is generated by a rainfall or warm weather melt-producing event on a standing snow pack of at least one inch in depth.

3. The sample is collected during the first hour of discharge from your facility that was produced by the melting snow.

Keeping up with the weather forecast and planning so that sampling can be carried out on short notice are the keys to successful sampling.

Local forecasts, including televised satellite and radar images can give an indication of the expected intensity of coming storms. The National Weather Service is an excellent source of information on upcoming storms. It also includes local current radar and satellite images. Their website: *http://www.wrh.noaa.gov/seattle.* A number of commercial websites, such as *http://www.weather.com/* and *Yahoo* also provide weather information and forecasts.

When evaluating a weather forecast, consider indications of expected intensity, for example "90% chance" rather than "50% chance" and "rain" rather than "showers." Over the telephone, National Weather Service personnel can often provide estimates of anticipated rainfall amounts. In addition to intensity, consider the predicted duration of the storm. It will be very helpful to spend time observing rain events at your site with attention to how rain intensity relates to stormwater discharges from your site, before you begin sampling.

Once the decision has been made to attempt to sample a storm event, the personnel who will be sampling should be notified and they should prepare to sample. If it does rain, they should be at the sampling sites before stormwater begins discharging so they can document the time of discharge and be ready to sample.

Conducting Sampling at Your Facility

After you have selected a storm event and it begins raining, the personnel conducting the sampling should prepare their equipment and go to the sampling site(s). They will be collecting grab samples at the sampling site(s), placing the samples in picnic coolers containing ice, and keeping notes in a field book.

Sampling for the first time may require working out some difficulties, but after performing these duties once, future sampling will not be difficult.

Checklist for Sampling

Because stormwater sampling is not a daily part of the workload of a facility, it is a good idea to keep a checklist of things to have prepared before sampling and to do during sampling. You can make the checklist by jotting down the things you did for the first sampling event to remember for subsequent sampling events. Update this checklist, if necessary, based on the experience you gain with each sampling event.

How to Fill Sample Bottles

This section and an illustrated appendix at the end of this guide describe how to collect a sample properly. Collecting a grab sample can be as simple as holding a bottle under the stormwater falling from a pipe and filling the bottle properly. Still, the person doing the sampling must use care in applying the principles outlined below so that the sample will be representative of the water being sampled.

Simple principles of good grab sample collection:

Wear disposable powder-free gloves when sampling.

Grab samples with the stormwater entering directly into bottles supplied by your lab rather than by transferring the samples from a container that may not be clean. Metal contamination of ordinary containers is common and household detergents often contain phosphorus, a tested parameter for some industries. Again, transferring the sample from another container is not an option for oil and grease samples under any circumstances.

When holding the sample bottle your lab has provided, keep your hands away from the opening in order to prevent contaminating the sample.

Always hold the bottle with its opening facing upstream (into the flow of water) so that the water enters directly into the bottle and does not first flow over the bottle or your hands.

Sample where the water has a moderate flow and, if possible, some turbulence, so that the stormwater discharge will be well-mixed and the sample will be representative. Sampling in still water should be avoided. Include in your field book a note about the sample location and how briskly the water appears to be moving.

Sample from a central portion of the stormwater flow, avoiding touching the bottom of channels or pipes so as not to stir up solid particles.

Have your sampling kit ready to go.

Take notes! Writing down your observations at the time of sampling is importatnt.

Do not rinse or overfill the bottles. The bottles supplied by your lab for some parameters (ammonia and phosphorus) will include small amounts of liquid preservative (generally a few drops). Fill the bottle to about ½ inch of the top (not quite full) to ensure that no preservative is lost.

As soon as the sample is collected, cap the bottle and label it. It is important that the bottles are labeled correctly so that the lab will be able to identify samples by sample site and ensure proper preservation for each parameter. It is a good idea to place sample bottles in re-closable bags. Place the samples in a picnic cooler partially filled with ice. Plan to maintain ice in the picnic cooler until the samples arrive at the lab. Remember to make certain that the samples will be delivered to the lab soon enough for the lab to meet holding times.

Oil and grease sampling raises additional concerns:

Oil and grease floats on water so sampling it requires special attention. Oil and grease samples must be collected directly into the sample bottles supplied by the lab because oil and grease tends to stick to the sides of containers. Do not rinse the sampling bottles beforehand or pour the sample from another container. Do not fill the bottle completely and do not pour out some of the sample if the bottle is overfilled by mistake. If you do overfill a bottle, use a new bottle instead to collect your sample. Because you only get one try at filling an oil and grease bottle, it is a good idea to have plenty of extra bottles on hand.

Oil and grease samples should be collected as the stormwater falls from a pipe or from a running, turbulent stream of flow when possible so the source will be well mixed. When the samples must be collected from a water surface, the person holding the bottle should plunge it below the surface in a sweeping arc and then bring it upwards through the water surface again, so the water surface is broken twice by the mouth of the bottle. Be sure to note in your field book how you collected your samples as this is especially important for the oil and grease sample.

Keeping Records

Section S5. of the general permit specifies requirements for reporting and recordkeeping. In order to comply with the requirement that lab reports include sampling date and sampling location, you will need to supply this information to the lab when submitting samples. You can do this by using the sample location as the field station identification on your labels or sample tags.

You should purchase a notebook for use in the field. Water resistant “rite in the rain” notebooks serve the purpose well. Information is available at www.riteintherain.com.

Section S5.C. requires that you record the date, exact place, method, and time of sampling or measurement, and the individual who performed the sampling or measurement (the section also specifies some requirements for lab record keeping). Record these in your field book:

- Time rainfall began
- Sampling location (when there is more than one)
- Date of sampling
- Time of sampling (and time you completed sampling if different)
- How you collected the sample (for example, “from a ditch by hand” or “from a manhole with the bottles on a pole”)
- name of the sampler(s)
- number, types (parameters) of samples collected

◆ field measurement results (such as pH)

◆ unusual circumstances that may affect the sample results.

Entries in the field book should be made with ink. If you make an error in the field book, cross it out rather than whiting out or erasing. Number the pages of the field book consecutively. To ensure that the bound field book is a complete record, do not rip out pages from it.

It is desirable in addition, though not required by the general permit, to record the following information for each storm event sampled:

◆ number of dry days before the day the sample was collected, or a statement that there was at least one day of no greater than trace precipitation before sampling.

◆ inches of rain during a 24-hour period

◆ time of sampling as well as date

◆ date and time the rainfall began

◆ date and time the discharge began at the sampling site

◆ duration of the storm in hours

◆ inches of rainfall during the storm

The information you record for the first two items above (number of preceding days of no greater than trace precipitation and inches of rain during a 24-hour period) will serve to document that you met those recommended criteria for sampling specified in the general permit.

Determining if the Sampled Storm Event Met the Recommended Criteria

Section S4.A. recommends that the storm event be preceded by at least 24-hours of no greater than trace precipitation. During times of clear weather, it may be obvious that this criterion has been met. When it is cloudy, you can verify that there has been no precipitation (including overnight) by installing a simple, inexpensive rain gauge at your site.

The same section of the permit also recommends that the storm have a rainfall intensity of at least 0.1 inches of rain in a 24-hour period. This does not mean that the rainfall must last for a full 24 hours, only that from the time it begins raining to the time you stop sampling, the rainfall be of the recommended intensity or greater. To determine this, you should observe and record the time it began raining as well as the time you stopped sampling. What the storm does after you stop sampling is of no concern. In addition to the times rainfall began and sampling ended, your rain gauge will give you all of the information you need to easily calculate the rainfall intensity.

An example rainfall intensity calculation:

Rainfall begins at 9:35 AM (you empty the rain gauge beforehand)

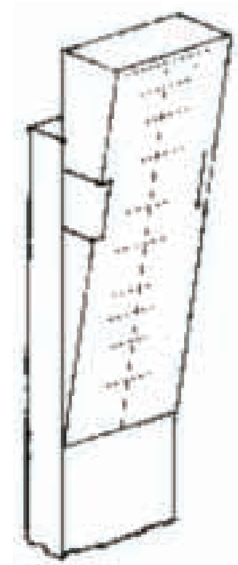
Stormwater discharge at your sampling site begins at 10:05

You complete sampling at 10:30

Your rain gauge shows 0.01 inches of rain when you stop sampling

Rain intensity
= 0.01 inches / 55 minutes
= 0.00018 inches/minute
= 0.00018 inches/minute
x 60 min/hr
x 24 hrs/24 hrs
= 0.26 inches/ 24 hours

The criterion for rain intensity is 0.1 inches / 24 hours. 0.26 is greater than 0.1, so the storm event you sampled meets the recommended criterion.



A simple, inexpensive rain gauge mounted on a post. A rain gauge such as this one provides accurate readings at the low rainfalls often associated with the period from the beginning of rainfall to the end of sampling. The gauge can be removed and the water that has collected in it dumped out between rains.

Get the best sample you can.

If you do not have a rain gauge, you will have to rely on rainfall data from other sources. The National Oceanographic and Atmospheric Administration (NOAA) posts daily rainfall records on their website: *http://www.wrcc.dri.edu/state_climate.html.* (Note that there is an underline between "state" and "climate," but no space, in this web address). The data posted is only for the previous day, so you will have to make sure you don't miss the internet posting. A disadvantage of relying on this data is that it is a measure of nearby rainfall but not that from your site. A further disadvantage is that it gives you only daily (24-hour) rainfall data and, while this may indicate a rainfall of less than 0.1 inches in some cases, you may have had sufficient rainfall intensity at your site to meet the recommended criterion of the general permit, had you measured it with a rain gauge.

When the Sampled Storm Doesn't Meet the Recommended Criteria

There may be times when you start to sample but the rainfall intensity turns out not to meet the recommended criterion of the general permit. Or despite your best efforts, you are unable to collect grab samples during the first hour of a storm event that meets the recommended criterion for preceding dry conditions. When this happens, the general permit states that the permittee must still collect and submit stormwater sampling result, and must include an explanation with the monitoring report identifying what recommended criteria were not met and why.

Special Sampling Considerations

Safety should be the primary consideration in sampling. Samples should never be collected in a way that compromises the safety of the sampler. In cases where a physical hazard such as a trip hazard or when sampling near deep water bodies, samplers should work in pairs. Do not wade in water where the estimated depth in feet times the velocity in feet per second is equal to or greater than 8, as swift currents can lead to drowning accidents. Be aware of the slip hazard common near the banks of water bodies and decide whether a bank is too steep to negotiate safely. Safety comes down to individual judgment. Never put yourself in a position you consider to be unsafe.

Collecting grab samples of stormwater is basically a simple process but an important one since getting good results depends on proper sampling. Samples can be collected easily in some locations, but not all stormwater discharges are as readily sampled as the flow in a ditch or from a pipe falling into a receiving water. Below are some situations you may encounter and suggested approaches for handling them. Because oil and grease samples must be collected directly into the bottle supplied by the lab we will consider only methods for collecting samples directly by hand or with a bottle attached to a pole. When sampling in these or other situations, keep in mind the steps outlined in the section, *How to Fill Sample Bottles*.

Sampling as Stormwater Discharges from a Pipe into a Receiving Water

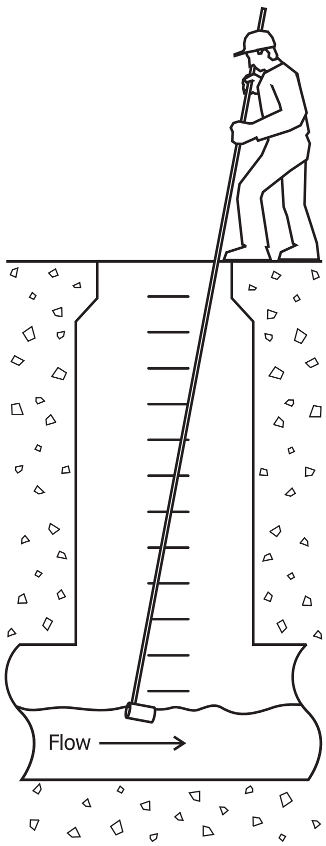
If stormwater is being discharged from your facility through a pipe into a ditch, creek, or other receiving water, it can be readily sampled as it falls from the pipe before it reaches the receiving water if the discharge pipe is safely accessible and not submerged. Hold the bottles with the bottle opening facing upstream (into the flow and be sure not to overfill them. You may need to fasten the collection bottles to a pole to reach the pipe. Attaching a bottle to a pole is described in the section below, *Sampling from a Manhole*.

Sampling from a Manhole

When sampling from the manhole of a municipal storm sewer, remember to contact the municipality beforehand. Discuss sampling being sure to cover safety concerns. Open a manhole with a hook or pick axe, exercising care not to drop the manhole cover on hands or feet. **You should not, under any circumstances, enter the manhole unless trained to safely enter confined spaces**, but you can sample the flow in a manhole from above ground by taping the sampling bottles, one at a time, to a pole and lowering the pole into the manhole.

Each bottle can be fastened to the pole by holding the bottle against it and wrapping tape tightly around the bottom and the top of the bottle as you hold the bottle firmly to the pole. Filament strapping tape works well for this purpose as it is waterproof and strong. If the flow in the storm sewer is shallow, the bottle may have to be positioned horizontally with the bottle's opening somewhat higher than its bottom. When sampling in a manhole, be

Don't take risks - know how to sample safely.



When sampling from a manhole, use a pole to safely sample from above ground. Avoid touching the sides of the manhole or pipes with the bottle to prevent contamination. Place the opening of the bottle upstream so that the flow enters the bottle directly.

careful not to scrape the bottle against the sides of the pipe to avoid picking up extras solids in your sample.

Collecting into bottles with oil and grease samples with a pole is done by plunging the bottle on the pole below the water surface and back upwards. This must be done as a single motion and only once. Because you only get one try at getting a good oil and grease grab sample, it may take some practice and extra bottles to collect the amount of sample you need without overfilling the bottle. Collecting samples other than oil and grease into bottles with preservative can be done by quickly plunging the pole into the flow repeating if necessary until the bottle is most but not all of the way full. If you overfill the bottle, remove it, tape a clean bottle to the pole, and try again. Be sure, when collecting samples with a pole, to follow clean principles by keeping the pole downstream of the bottle while sampling.

Sampling from a Drainage Ditch or Swale

If a drainage ditch carries stormwater flow from your facility offsite, and if it carries no flow other than the flow from your facility, you can sample the water in the ditch simply by placing the bottle where the flow is free, with the bottle opening facing upstream. If you cannot reach a freely flowing portion of the ditch by hand, you may need to attach the bottles, one at a time, to a pole for sampling. Follow the procedure outlined in the section, *How to Fill Sample Bottles*.

If the flow is carried in a small ditch or swale, you can install a barrier device in the channel or deepen a small area so you can gain enough depth of flow to sample directly into the bottles. Make sure to allow for sufficient time after disturbing the bottom so that the solids resulting from muddying the water will not become part of your sample.

Sampling Sheet Flow

It is not always possible to sample stormwater runoff in locations such as ditches or pipes where the flow is concentrated. Sometimes the permittee has no choice but to select sample locations for which sheet flow is sampled before it becomes concentrated. Approaches to sampling sheet flow are described below and illustrated in the figures that follow.

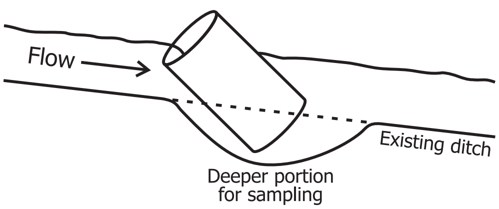
In some cases, a stormwater discharge from a facility is not concentrated at any point and leaves the property in the form of sheet flow as it runs off a work area or driveway or grassy area. In this case the flow may be too shallow for the collection bottle to be filled with sample. It is often possible to find a way to collect the stormwater runoff in these situations.

One way to concentrate sheet flow is to excavate a small basin in an existing ditch or other location where stormwater runoff flows. Another approach is to install a barrier device or trough, gutter, or ditch to intercept and concentrate stormwater flow. As with other sample sites, the flow should be moving and somewhat turbulent so the samples will be well-mixed. Be sure that any excavation you do does not expose the stormwater to be sampled to newly worked soil surfaces that the runoff may erode, increasing the solids in your samples. You may want to consider lining the trough, gutter, or ditch with plastic. Be sure not to introduce materials (such as metals that include zinc) that may contaminate the samples. Sheet flow on paved areas can be concentrated and collected by constructing small bumps, similar to speed bumps.

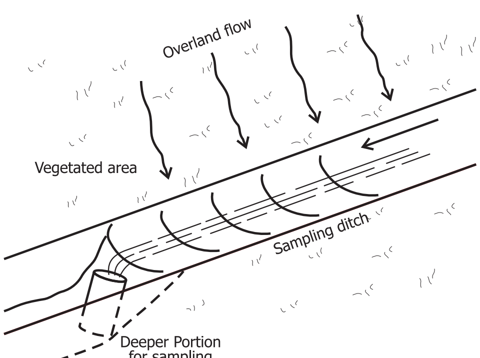
Another way to collect samples from sheet flow is to use a special peristaltic hand pump to pump samples from shallow surface flows. This method is of limited use for collecting the samples required by the general permit as it cannot be used to collect oil and grease samples.

Roger Bannerman of the Wisconsin Department of Natural Resources has developed simple devices to grab samples of sheet flow from paved areas, rooftops, and lawns. Though the devices are intended to be used for simple, automatic sampling, pouring a container of collected sample into other sample bottles, the ways in which they intercept and concentrate flows can be adopted for direct grab sampling.

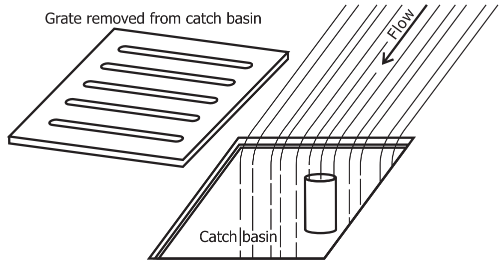
The following figures illustrate the methods of sampling sheet flow discussed above:



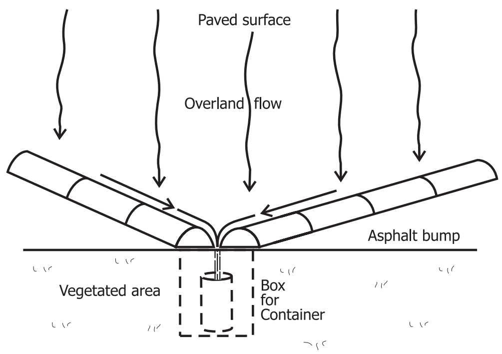
Deepening an existing ditch can allow samples to be collected directly into bottles in some cases. Be careful not to stir up solids from the sides or bottom of the ditch.



Runoff entering a catch basin can sometimes be collected directly into bottles by removing the grate and allowing the runoff to fall into the bottles.



Overland flow from vegetated areas can be sampled by constructing a shallow ditch to intercept the runoff and a deepened area to place bottles to catch the runoff.



Overland flow on paved areas can be sampled by constructing asphalt or concrete bumps to collect and concentrate the flow. A box positioned below ground surface in the paved area or the edge of an unpaved area can provide a place to collect samples directly into bottles.

Sampling from a Stormwater Detention Pond or other BMP

When stormwater from a facility discharges after flowing through a detention pond or other treatment system, sample as the stormwater flows out at the discharge point. Ponds may hold stormwater for a time before discharge begins. Sample within the first hour, preferably 30 minutes from when the pond begins to discharge.

Ecology Wants to Hear from You

If you have suggestions on how Ecology can improve this guidance document, have developed innovative sampling techniques, or just want to comment on stormwater sampling, please contact

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Appendix - Proper and Improper Methods of Sampling

Do not *touch openings of bottles. Keep bottles clean to prevent contamination.*

Do not *allow bottle lids to touch ground. Keep lids clean to prevent contamination.*

Do not *sample in stagnant areas with little flow.* **Do not** *stir up bottom sediments or allow foreign materials to enter the sample bottle. (***Do** *be careful to grab a clean sample in cases where stormwater runoff is shallow.) If the runoff is so shallow that it is not possible to sample without the sample being contaminated in the process, then find an alternative way to sample.*

Do *attach a bottle to a pole for sampling in manholes or when a hand sample would be in stagnant water. A boathook is used in this example and the bottle is attached to it with filament strapping tape.*

If the water is too shallow to sample with the bottle upright on the pole, try taping it on sideways, but tilted up slightly.

Do not *sample with the bottle opening facing downstream, when using a pole or sampling by hand. Water flowing past your container, pole, or hand and into the container can be contaminated by such contact.*

Do *sample with the opening of the bottle facing upstream, into the flow so the water will enter directly into the bottle. This is true when sampling either by hand or with a pole.* **Do** *sample water that is rapidly flowing rather than stagnant.*

Do not *allow water to overfill the bottle, particularly not for sample bottles with preservative. Oil and grease samples should be collected from water falling into the bottle when possible, or otherwise in a single swoop.*

Do *collect samples without overfilling the bottles.*

References

Bannerman, R.T.; Owens, D.W.; Dodds, R.B.; Hornewer, N.J., 1993. *Sources of Pollutants in Wisconsin Stormwater*, Wat. Sci. Tech. Vol. 28. No. 3-5, pp 241-259.

Colorado Department of Public Health and Environment; Water Quality Control Division; Colorado Discharge Permit System, 1996. CDPS Stormwater Sampling Guidance Document.

Dodson, Roy D., 1995. *Storm Water Pollution Control: Municipal, Industrial, and Construction NPDES Compliance*, 1999, 1995. Second Edition. McGraw-Hill.

Ecology, 2005. *The Industrial Stormwater General Permit: A National Pollutant Discharge Elimination System and State Waste Discharge General Permit for Stormwater Discharges Associated with Industrial Activities.* State of Washington Department of Ecology, January 14, 2005.

Ecology, 2000, 1999. *Field Operations and Safety Manual: Environmental Assessment Program*, Washington State Department of Ecology, Environmental Assessment Program, Updated August 2000.

New Jersey Department of Environmental Protection Division of Water Quality, 1998. *General Sampling and Reporting Guidance for PAS and ADI Form*.

Thrush, Cindy and De Leon, Dana B., 1993. *Automatic Stormwater Sampling Made Easy*, Water Environment Federation.

United States Environmental Protection Agency, 1992. NPDES Storm Water Sampling Guidance. EPA 833-B-92-001.

Waschbusch, R.J.; Selbig, W.R.; Bannerman, R.T., 2000. *Sources of Phosphorus in Stormwater and Street Dirt from Two Urban Residential Basins in Madison, Wisconsin, 1994-95.* National Conference on Tools for Urban Water Resource Management and Protection Proceedings, February 7-10, 2000, Chicago, IL.

Wisconsin Department of Natural Resources Bureau of Water Management Municipal Wastewater Section – Storm Water Unit, 1994. *Wisconsin's Guidance for Industrial Storm Water Monitoring.*

Torno, Harry C., 1995. *Stormwater NPDES Related Monitoring Needs*, American Society of Civil Engineers.