Supplemental PCB Self-Implementing Notice to EPA
PCC Large Parts Campus
Portland, Oregon

July 25, 2016

Prepared for

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

LANDAU ASSOCIATES

333 SW 5th Avenue, Suite 700
Portland, OR 97204
(503) 542-1080

Supplemental PCB Self-Implementing Notice to EPA PCC Large Parts Campus Portland, Oregon

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by: Della Fawcett, RG
Senior Project Geologist

Document reviewed by: Jay Bower, PE
Principal

Date: July 20, 2016
Project No.: 883002.040.044
File path: \\Portland2\Data\Projects\883\002\FileRm\R\040\Upland PCBs\Supplemental PCB Self-Implementing Notice to EPA\RBDM Post Removal\Final\Supplemental Self Implementing-RBDA FINAL July 2016.docx
Project Coordinator: JLN

TABLE OF CONTENTS

Page

1.0 NOTICE AND CERTIFICATION....1-1
2.0 PREVIOUS SUBMISSIONS TO EPA....2-1
3.0 BACKGROUND AND NATURE OF CONTAMINATION....3-1
3.1 Stormwater System Sampling....3-1
3.2 City of Portland Stormwater System Inspection....3-1
3.3 Additional Stormwater System Sampling....3-2
3.4 Potential PCB Source Area Investigations....3-2
3.5 Ancillary Activity....3-3
4.0 SELF-IMPLEMENTING FRAMEWORK CLEANUP LEVELS....4-1
5.0 CHARACTERIZATION SAMPLING PROCEDURES....5-1
5.1 Catch Basin Solids and Stormwater Sampling....5-1
5.2 Surface Debris and Wipe Sampling....5-1
5.3 Soil Sampling....5-2
6.0 LOCATION AND EXTENT OF CONTAMINATION....6-1
6.1 Location of Source Areas....6-1
6.2 Summary of October 2014 Characterization Results....6-1
6.3 Follow-up to October 2014 Characterization....6-1
6.4 Summary of August 2015 Characterization Results....6-2
6.4.1 Area A....6-2
6.4.2 Area B....6-2
6.4.2.1 Area B West....6-3
6.4.2.2 Area B East....6-3
6.4.3 Area C....6-3
6.4.4 Area D....6-4
7.0 PREVIOUS CLEANUP ACTIVITIES....7-1
7.1 Area A....7-1
7.2 Area B West....7-1
7.3 Area C....7-2
8.0 CLEANUP PLAN....8-1
8.1 Area A....8-1
8.1.1 Contamination Control....8-1
8.1.2 Decontamination....8-2
8.2 Area B West....8-2
8.2.1 Contamination Control....8-4
8.2.2 Decontamination....8-4
8.3 Area B East....8-5

8.4 Area C 8-5
8.5 Area D 8-5
8.6 Schedule 8-5
8.7 Disposal Technology 8-6
8.8 Cleanup Verification Sampling and Next Steps 8-6
9.0 REFERENCES 9-1

FIGURES

Figure	Title
1	PCB Source Area Investigation Sampling Locations
2	Area A PCB Analytical Results
3	Area B West PCB Analytical Results
4	Area B East PCB Analytical Results
5	Area C PCB Analytical Results
6	Area D PCB Analytical Results
7	Area B West Cap Plan
8	Area B West Cap Plan – Plan View

TABLES

Table	Title
1	2014 Surface Debris and Wipe Sample PCB Analytical Results
2	August 2015 Upland Soil PCB Analytical Results

APPENDICES

Appendix	Title
A	Interim Soil Removal Measure – Area B West
B	Proposed Concrete Cloth Specifications
C	Health and Safety Plan

LIST OF ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
CESF	chitosan enhanced sand filtration
CFR	Code of Federal Regulations
City	City of Portland
cm	centimeters
EPA	U.S. Environmental Protection Agency
ft	feet/foot
LAI	Landau Associates, Inc.
LPC	PCC Large Parts Campus
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
NPDES	National Pollutant Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
PCB	polychlorinated biphenyl
Permit	NPDES General Stormwater Discharge 1200-Z Permit
PCC	PCC Structurals, Inc.
ppm	parts per million
RI	Remedial Investigation
TSCA	Toxics Substances Control Act
TSS	total suspended solids
VCP	Voluntary Cleanup Program

This page intentionally left blank.

1.0 NOTICE AND CERTIFICATION

This document serves as notice to the U.S. Environmental Protection Agency (EPA) Region 10 of PCC Structurals, Inc.'s (PCC) intent to conduct cleanup in accordance with the Toxics Substances Control Act (TSCA) under the requirements of the self-implementing procedure for the cleanup and disposal of polychlorinated biphenyl (PCB) remediation waste (40 Code of Federal Regulations [CFR] § 761.61 [a]). This notice and certification of proposed self-implementing cleanup was prepared by Landau Associates, Inc. (LAI) on behalf of PCC.

The cleanup activities described in this document will be conducted at the PCC Large Parts Campus (LPC), located at 4600 Southeast Harney Drive, in Portland, Oregon. These activities are supplemental to activities performed under a prior notice and certification, discussed in Section 2.0.

In addition to the self-implementing cleanup described herein, PCC plans to address one area (i.e., Area B West) under the risk-based disposal approval framework in accordance with 40 CFR 761.61 (c), as described in Section 8.2. Cleanup under the self-implementing procedures using removal and disposal of contaminated soil is not practicable in this area due to safety concerns associated with excavating around high-voltage electrical lines and equipment, and the potential to undermine the foundations of the transformer platform. PCC proposes to cap the soil in place using alternative specifications (relative to the cap specifications under the self-implementing rules), which requires approval under the risk-based framework. PCC is seeking formal approval from EPA to implement this risk-based approach in advance of the planned remedy for this area.

2.0 PREVIOUS SUBMISSIONS TO EPA

On July 1, 2015, PCC submitted a Notice and Certification of Self-Implementing Cleanup letter to EPA (LAI 2015a). The letter and its attached work plan proposed self-implementing cleanup under a high-occupancy classification as defined in 40 CFR 761.3. EPA conditionally approved the proposed self-implementing cleanup for Area A and requested additional characterization in Areas B, C, and D (EPA 2015a).

Additional characterization sampling and assessment that occurred following the July 2015 notice, the results of which are described herein, indicated that cleanup to levels prescribed for high-occupancy was not practicable; additionally, the cleanup areas at the site meet the definition of low-occupancy based on actual use, as described in Section 4.0. This supplemental plan serves as PCC's request for EPA's concurrence on a low-occupancy classification for these areas.

A preliminary draft of this supplemental plan was submitted to EPA on February 19, 2016. EPA provided comments on March 10, 2016 (EPA 2016a) and June 23, 2016 (EPA 2016b); those comments have been addressed in this supplemental plan.

3.0 BACKGROUND AND NATURE OF CONTAMINATION

Historically, PCC used hydraulic oils that contained PCBs in their vacuum furnace hydraulic pump components. Additionally, many of the electrical transformers and capacitors used in the electrical system at the LPC contained dielectric fluid that contained PCBs (Hahn and Associates 1993).

PCC is currently conducting a remedial investigation (RI) under a Voluntary Cleanup Program (VCP) Agreement with ODEQ. As described in the VCP Agreement, the initial focus of the RI was chlorinated solvents. PCBs became a component of the RI in late 2012 and early 2013, when PCBs were detected in stormwater samples collected as part of PCC's 1200-Z National Pollutant Discharge Elimination System (NPDES) permit compliance sampling requirements.

The following provides information on previous investigations in roughly chronological order.

3.1 Stormwater System Sampling

To investigate potential sources of PCBs in stormwater, ODEQ directed PCC to collect stormwater and catch basin solids samples from stormwater system catch basins (Bower 2013); the sampling was performed in January and June 2014.

Catch basin solids samples were collected from 12 locations during both sampling events. Stormwater samples were collected from eight locations during the January 2014 sampling event.

The highest concentrations of PCBs in the catch basin solids in samples collected from those two sampling events were from the following locations (see Figure 1):

- CB-X, CB-Y, and CB-Z (based on the results of one sample composited across these three locations), located north of the Steel Building,
- CB-10 and CB-11, located near the northeast corner of the Steel Building, and
- CB-4, located near the northwest corner of the Titanium Building.

3.2 City of Portland Stormwater System Inspection

In July 2014, the City of Portland (City) completed field activities that included sampling of solids that had accumulated in the storm line at an access point (i.e., manhole) within the stormwater system that runs beneath the LPC. On August 5, 2014, ODEQ issued a letter regarding *Results of Recent City of Portland Storm Investigation* (ODEQ 2014a) documenting that PCBs were identified in accumulated solids in one of the LPC's stormwater system manholes and required that PCC further investigate the source of the PCBs. ODEQ established scoping criteria of 200 micrograms per kilogram (µg/kg) total PCBs for catch basin solids and 0.1 micrograms per liter (µg/L) total PCBs for stormwater, to be used to identify areas where PCB source investigation activities should be performed (LAI 2014a, ODEQ 2014b) .

3.3 Additional Stormwater System Sampling

As an additional follow-up to the August 2014 letter, ODEQ directed PCC to collect two rounds of catch basin solids and stormwater samples from within the LPC's stormwater network; sampling was conducted as outlined in a technical memorandum approved by ODEQ (LAI 2014b); the samples were collected in November/December 2014 and January 2015.

Catch basin solids samples were collected from 13 locations during both events and stormwater samples were collected from 14 locations during both events. The results of these two sampling events were summarized in subsequent technical memoranda submitted to ODEQ (LAI 2015b, LAI 2015c).

3.4 Potential PCB Source Area Investigations

Based on the results of the stormwater system sampling, PCC conducted an upland PCB investigation to identify potential PCB source areas. The highest concentrations of PCBs in stormwater and catch basins solids that were detected during the January and June 2014 sampling events were near or downslope from transformers and areas that may have formerly been used to store PCB-containing oil.

Six areas were initially identified for surface debris (e.g., soil, fine particulates, organic debris) and wipe sampling[1] in the work plan submitted to ODEQ (LAI 2014a). Prior to collecting the planned samples, LAI met with representatives from ODEQ and PCC at the site to discuss proposed sampling locations. During the site walk on October 8, 2014, two additional areas were added for sampling by ODEQ to provide relevant data that would exclude these areas from further consideration as potential PCB sources. The eight areas were designated Areas A through H. The specific media and locations to be sampled within each of the eight areas were determined during the site walk based on the locations of transformers and oil storage areas, and the presence of soil, loose debris, and/or staining that could contribute to PCBs previously detected in catch basin solids. A total of 49 surface debris samples and 3 wipe samples were collected in October 2014. The results of the upland sampling investigation were summarized in the December 2014 technical memorandum (LAI 2014c) submitted to ODEQ.

Results of the October 2014 upland PCB investigation and the two rounds of additional stormwater and catch basin solids sampling (November 2014 through January 2015) were used to identify areas where PCB concentrations were indicative of potential nearby sources. Of the eight potential PCB source areas evaluated in the October 2014 upland PCB investigation, four areas were identified as requiring additional work (i.e., Areas A through D), as discussed in Section 6.2.

[1] The purpose of wipe samples in this program was to sample and analyze oily material on solid surfaces for the presence of PCBs.

3.5 Ancillary Activity

In 2016, PCC began design of a stormwater treatment system that would allow for effective compliance with the requirements of its National Pollutant Discharge Elimination System (NPDES) General Stormwater Discharge 1200-Z Permit (Permit) (LAI 2016). The stormwater treatment system was also designed to support PCC's efforts to remove legacy pollutants from its stormwater discharges, such as PCBs. The operation of the end-of-pipe stormwater treatment system provides an engineering control to prevent potential PCB migration to surface water or other exposure pathways (i.e., in addition to measures implemented in source areas).

The stormwater treatment system was installed in June 2016, and brought online on June 30, 2016. The treatment system is composed of a chitosan enhanced sand filtration (CESF) system, which is a coagulation and filtration system; CESF systems are currently the best available technology for removing total suspended solids (TSS) and pollutants associated with those solids including, but not limited to, PCBs. The system is enhanced with granulated activated carbon as a filter media for removal of residual pollutants. CESF has been specifically approved by EPA as the preferred treatment technology at another industrial facility for removal of TSS, PCBs, and other pollutants in facility stormwater (LAI 2016).

4.0 SELF-IMPLEMENTING FRAMEWORK CLEANUP LEVELS

As discussed later in this document, PCB source areas will be cleaned up to appropriate cleanup levels based upon the TSCA definition of the PCB remediation waste present in each source area at the LPC. The contaminated media at the four potential source areas fall under TSCA's definition of *bulk PCB remediation waste*, which is defined as non-liquid PCB waste including soil, sediments, dredged materials, muds, PCB sewages sludge, and industrial sludge (40 CFR 761.61[a][4][i]).

Per TSCA regulations, cleanup levels for *bulk PCB remediation waste* are further categorized specific to *high-occupancy* and *low-occupancy* areas (40 CFR 761.3). A high-occupancy area is any area where PCB remediation waste has been disposed of onsite and where occupancy for any individual not wearing dermal and respiratory protection is 840 hours or more (an average of 16.8 hours or more per week) for non-porous surfaces and 335 hours or more (an average of 6.7 hours or more per week) during a calendar year. Examples cited in EPA guidance (EPA 2005) could include a residence, school, day care center, sleeping quarters, a single- or multiple-occupancy 40-hours-per-week work station, a school classroom, a cafeteria in an industrial facility, a control room, or a work station at an assembly line.

A low-occupancy area is any area where PCB remediation waste has been disposed of onsite and where occupancy for any individual not wearing dermal and respiratory protection is less than 840 hours (an average of 16.8 hours per week) for non-porous surfaces and less than 335 hours (an average of 6.7 hours per week) during a calendar year. Examples cited in EPA guidance (EPA 2005) could include an electrical substation or a location in an industrial facility where a worker spends small amounts of time per week (such as an unoccupied area outside a building, an electrical equipment vault, or in the non-office space in a warehouse where occupancy is transitory).

The July 1, 2015 Notice and Certification of Self-Implementing Cleanup letter (LAI 2015a) indicated that the LPC cleanup areas would be designated as high-occupancy and that the associated lowest cleanup criteria would be achieved (for high-occupancy scenarios). Following the August 2015 sampling, it became apparent that cleanup to high-occupancy area levels was not practicable and further assessment was conducted to better classify the source areas. This assessment concluded that the potential upland PCB source areas investigated (i.e., Areas A through D) are located in low-occupancy areas within the LPC as defined by 40 CFR 761.3. These areas are located in portions of the LPC that do not have foot traffic or regular operations that require long-term occupancy by employees, and are unoccupied areas outside of the facility buildings. Several of the areas (specifically Areas A, portions of B, and D) are on slopes behind retaining walls and covered in thick vine and brush growth, which limits accessibility. Furthermore, the western portion of Area B is located beneath the transformer platform. Therefore, potential cleanup of Areas A through D will be addressed based on the requirements outlined for low-occupancy.

Cleanup requirements for management of PCB remediation waste under the self-implementing framework, based on the low-occupancy classification, are summarized below.

Low-Occupancy Area Cleanup Requirements

Cleanup Requirement	Low Occupancy
No Action	≤1 ppm (≤1,000 µg/kg)
Institutional Control (i.e., deed restriction)	>1 ppm to ≤25 ppm (>1,000 µg/kg to ≤25,000 µg/kg)
Fence and Signs	>25 ppm to ≤50 ppm (>25,000 µg/kg to ≤50,000 µg/kg)[a]
Cap (minimum 6 inches concrete or asphalt)	>25 ppm to ≤100 ppm (>25,000 µg/kg to ≤100,000 µg/kg)[a]
Removal	>100 ppm (>100,000 µg/kg)

[a] Institutional controls (i.e.., deed restrictions) also required with cleanup requirements.
µg/kg – micrograms per kilogram
ppm – parts per million

Cleanup requirements can range from no action, to institutional controls (e.g., deed restrictions, etc.), to isolation from the area (e.g., fencing), containment (e.g., capping), to physical removal depending on the concentration of PCBs in the remediation waste present in the area requiring cleanup. When a cleanup activity for low-occupancy areas includes a cap or fencing and signage, the owner of a site must also implement institutional controls (e.g., deed restriction as outlined under 40 CFR 761.61 [a][8]) in perpetuity so that potential future owners receive appropriate disclosure concerning the continued presence of bulk PCB remediation waste on the site. A deed restriction is also required for residual concentrations between 1 parts per million (ppm) and 25 ppm to ensure that the low occupancy use continues to apply.

5.0 CHARACTERIZATION SAMPLING PROCEDURES

The following section summarizes the methods and procedures for sample collection and handling for investigation activities completed to date.

5.1 Catch Basin Solids and Stormwater Sampling

Catch basin solids samples were collected using a clean, stainless-steel spoon to scoop the materials out of the catch basin filter sock and into the sampling container. Where composite samples were required, a stainless-steel spoon was used to scoop material into a stainless-steel bowl and the materials were consolidated, homogenized, and then placed into the sampling container. Each sample was placed in a laboratory-provided jar, labeled, and placed in a cooler under standard chain-of-custody documentation for shipment to the laboratory.

Stormwater samples were collected directly into the sample containers during a qualifying rain event (as defined in ODEQ stormwater sampling guidance) from sheet flow running into the sampling locations. Each sample was collected in a laboratory-provided bottle, labeled, and placed in a cooler under standard chain-of-custody documentation for shipment to the laboratory.

5.2 Surface Debris and Wipe Sampling

Surface debris samples were collected from paved areas using a new clean broom and/or a clean stainless-steel spoon. Surface soil samples were collected from unpaved areas, from one or more locations within the identified sampling location, using a clean stainless-steel spoon. Both the surface debris and surface soil samples were homogenized in a clean stainless-steel bowl using a clean stainless-steel spoon, placed into a glass sample jar, labeled, and placed in a cooler under standard chain-of-custody documentation for shipment to the laboratory. New disposable sampling equipment (brooms, etc.) was used for each sample collection.

Wipe samples were collected by isolating a 10 centimeters (cm) by 10 cm sampling area using a pre-made template. The sampler, wearing a clean pair of disposable nitrile gloves, removed the laboratory-prepared wipe (i.e., sterile gauze pad soaked with hexane) from its packaging container and firmly wiped the marked surface area within the template to collect a sample. The sample was collected by wiping first in one direction and then again, 90 degrees offset from the original wiping direction, to optimize sample collection coverage. After the sample was collected, the gauze was placed in a glass sample jar, labeled, and placed in a cooler under standard chain-of-custody documentation for shipment to the laboratory.

5.3 Soil Sampling

Soil samples were collected using a clean stainless-steel spoon or hand auger. The samples were homogenized in a clean stainless-steel bowl using a clean stainless-steel spoon, placed into an 8-ounce glass sample jar, labeled, and stored on ice. Disposable sampling equipment (e.g., gloves, etc.) was discarded after each use. Other sampling equipment (such as stainless-steel spoons) was decontaminated between each sample location. Soil samples were submitted to Apex Laboratories of Tigard, Oregon under standard chain-of-custody procedures. Samples were analyzed for PCB Aroclors by EPA Method 8082. At locations where composite samples were collected at multiple depths, the samples were not vertically composited; each composite sample was representative of a specific sampling depth (e.g., surface, or 6 to 8 inches).

Sample grids and composite sample procedures are discussed in Section 6.4.

6.0 LOCATION AND EXTENT OF CONTAMINATION

The location and extent of contamination within the identified PCB source areas, based on work performed in October 2014 and August 2015, is discussed in the sections below.

6.1 Location of Source Areas

As discussed in Section 3.0, at least some of the transformers, capacitors, and vacuum pumps at the LPC historically contained PCBs, and oil stored in LPC oil storage locations may also have contained PCBs. It is expected that former use and storage of PCB-containing oil is the primary source of current PCB contamination and that potential source areas are at or near these storage and use areas. This expectation is consistent with the PCB concentrations identified during the previous catch basin solids and stormwater sampling events. The locations of the identified potential upland PCB source areas, Areas A though D, are shown on Figure 1.

6.2 Summary of October 2014 Characterization Results

Surface debris and soil samples with concentrations of total PCBs above the scoping criterion of 200 µg/kg were detected at 21 locations within Areas A through D (Table 1) during the October 2014 upland PCB investigation. Nine of the 21 locations were in Area A, two locations in Area B, nine locations in Area C, and one location in Area D[2]. Analytical results for Areas A through D are shown on Figures 2 through 6.

The total PCB concentrations in the samples collected from Areas E through H were below the scoping criterion of 200 µg/kg, ranging from 6.8 µg/kg to 71 µg/kg (Table 1), and below EPA's unrestricted self-implementing cleanup level of ≤1,000 µg/kg (Section 4.0). Therefore, based on these results, no further action is required within Areas E through H under TSCA regulations (EPA 2005).

6.3 Follow-up to October 2014 Characterization

Following their review of the scope for the proposed additional investigation for Areas A through D, ODEQ, in consultation with EPA, indicated that the cleanup would need to be performed in accordance with TSCA under the requirements of the self-implementing procedures for the cleanup and disposal of PCB remediation waste (40 CFR § 761.61 [a]). In April 2015, PCC, ODEQ, and EPA began discussions regarding the methods in which the removal and disposal of the surface debris and soil associated with Areas A and C would be conducted (Areas B and D required additional characterization sampling prior to discussing cleanup options).

In July 2015, PCC submitted the Notice and Certification of Self-Implementing Cleanup letter (LAI 2015a) to EPA and ODEQ, which outlined the planned interim cleanup activities for Areas A and C, as well as the steps for additional characterization of the four potential source areas (i.e., Areas A, B,

[2] Note that Area A drains to the sanitary sewer system and not the stormwater system.

C, and D). EPA conditionally approved the cleanup plan for Area A and requested the supplemental of a revised plan upon completion of the additional characterization already scheduled for Areas B, C, and D (EPA 2015a). Work completed in Area A under this previously-submitted Self-Implementing Cleanup Plan (LAI 2015a), including sampling procedures and results, is summarized below.

6.4 Summary of August 2015 Characterization Results

Field activities were conducted on August 19 and 20, 2015. Activities associated with Area A were completed in accordance with the Self-Implementing Plan (LAI 2015a). Additional characterization sampling in Areas B, C, and D was completed in the same manner as Area A. Sampling areas are shown on Figure 1; specific sample locations and results are shown by area on Figures 2 through 4, and 6. Sample analytical results are provided in Table 2. Data with "J" qualifiers indicate that the result is an estimate and the associated numerical value is the approximate concentration of the analyte in the sample. Specifically, the results were estimated due to the presence of multiple PCB Aroclors and/or matrix interference.

6.4.1 Area A

Figure 2 shows two adjacent areas in green (sample locations AA-C1 and AA-C2) where composite samples were collected from 0 to 2 inches below ground surface (bgs). The composite samples collected were located on the upslope side (north) of the wooden walkway in Area A. Each composite sampling area was approximately 5 feet (ft) by 5 ft and was subdivided in to nine grid sections for compositing.

Total PCBs were detected in the two composite samples collected above the walkway at concentrations of 1,002 µg/kg (sample AA-C1) and 17,300 µg/kg (sample AA-C2) Sample results are provided in Table 2. These results do not exceed the EPA cleanup level of 100,000 µg/kg for removal in low-occupancy areas, nor do they exceed the EPA cleanup level of 25,000 µg/kg, which would require fencing and signage in low-occupancy areas. Based on the detected results and the cleanup requirements outlined for low-occupancy areas, institutional controls (i.e., deed restrictions) will be required for this area.

An additional confirmation sample collected in Area A below the walkway identified total PCBs at a concentration of 54,000 µg/kg (sample AA-CC), which is above the EPA cleanup level of 50,000 µg/kg, thereby requiring capping, fencing and signage, plus institutional controls under the low-occupancy cleanup scenario (Section 4.0). Therefore, additional cleanup in this portion of Area A will be performed, as discussed in Section 8.1.

6.4.2 Area B

Area B was divided into two sub-areas (Area B West and Area B East). Area B West is located beneath a transformer platform and Area B East is an open hillside; a stairway physically separates the two areas. Area B was sampled in accordance with the ODEQ work plan that was submitted as an attachment to the Notice and Certification of Self-Implementing Cleanup letter (LAI 2015d). The selected grid sample system deviated from the standard grid sample system specified in 40 CFR 761, due to the relatively small size of the areas being sampled. The grid sample system used in the field was verbally approved by Dave Bartus of the EPA during a telephone conversation with Della Fawcett, RG, of LAI, on August 17, 2015, to be sufficient for the proposed characterization activities.

Figure 3 shows four adjacent sample areas in green in the Area B West location, which are located in an area of limited access under the Steel Building transformer platform. Two composite samples were collected from each of these four areas; each area was subdivided into nine grid sections for composite sample collection. Soil from each grid section was collected from the surface and from 6 to 8 inches bgs. Each composite sampling area was approximately 12.5 ft by 13.5 ft.

Figure 4 shows three adjacent sample areas in green in the Area B East location. Two composite samples were collected from each of the three areas; each area was subdivided into nine grid sections for composite sample collection. Soil from each grid section was collected from the surface and from 6 to 8 inches bgs. Each sampling area was approximately 8.4 ft by 11.6 ft.

6.4.2.1 Area B West

Total PCBs were detected in each of the eight composite samples collected from the four sample areas in Area B West, ranging from 91.5 µg/kg to 117,000 µg/kg. The total PCB results in two composite samples from one sample area exceed the maximum EPA cleanup level of 100,000 µg/kg requiring removal under low-occupancy criteria. Analytical results are provided in Table 2 and presented on Figure 3.

6.4.2.2 Area B East

Total PCBs were detected in the six composite samples collected from three sample areas in the eastern portion of Area B, ranging from 360 µg/kg to 8,610 µg/kg. Analytical results are provided in Table 2 and presented on Figure 4. These results do not exceed the EPA cleanup level of 100,000 µg/kg, which would require removal in low-occupancy areas, or the minimum cleanup level of 25,000 µg/kg, which would require a combination of fencing and signage plus institutional controls. Therefore, active cleanup of this area will not be required under TSCA regulations; however, a deed restriction will be filed for this area, as discussed in Section 4.0.

6.4.3 Area C

Area C was not sampled in August 2015. Figure 5 provides the analytical results for samples collected in October 2014 from Area C; the results are also included in Table 1. Sample results from the October 2014 event included a maximum detection of PCBs at a concentration of 140,000 µg/kg (PCB Aroclor 1260) from one discrete sample collected from surface debris in the area (see Table 1). The remediation waste associated with the 140,000 µg/kg detection was addressed as described in Section 7.3.

The additional 11 samples collected from Area C were all less than 25,000 µg/kg. Based on the results of these additional samples collected in Area C, the discrete sample result described above is considered anomalous, and a PCB source within the vicinity of this area was not identified. The remaining detections of PCB Aroclors in Area C were well below TSCA cleanup criteria for low-occupancy areas.

6.4.4 Area D

Figure 6 shows three areas in green where composite samples were collected in Area D. Each sample area was subdivided into nine grid sections for composite sample collection. Soil from each subsection was collected from the surface and from 6 to 8 inches bgs (a total of six composite samples were collected). Each composite area was approximately 9.2 ft by 9.3 ft.

Total PCBs were identified in the six composited samples ranging from 54.4 µg/kg to 121.9 µg/kg (total PCB results based on the summation of detections of individual PCB Aroclors 1254 and 1260). These detected total PCB results do not exceed the EPA cleanup levels for removal in low-occupancy areas nor do they exceed the cleanup levels which would require fencing and signage plus institutional controls, or institutional control alone. Based on the results of the collected composited samples, no additional cleanup work will be completed in this area.

7.0 PREVIOUS CLEANUP ACTIVITIES

Following the October 2014 sampling, Areas A and C were identified as locations that required cleanup. Cleanup was proposed for these two areas based on the accumulation of PCB-containing soil and surface debris and bank soil (behind the retaining wall). Additionally, Area B West was identified as a third area requiring cleanup, based on the August 2015 characterization work.

7.1 Area A

Soil located above the retaining wall (downslope of the wooden walkway) was removed in August 2015 to a sufficient depth to prevent sloughing and potential erosional transport into the storm system (i.e., soil was removed to a level below the top of the retaining wall). A large concrete block was encountered in this area and left in place. The paved areas below the retaining wall were swept clean of loose debris and then dry-ice blasted to clean the area, as approved by EPA on August 17, 2015 (EPA 2015b).

After the soil removal above the retaining wall was completed, a confirmation sample was collected, which comprised one composite sample collected from a sampling area subdivided into eight grid sections. Total PCBs were detected in the confirmation sample at a concentration of 54,000 µg/kg. The sample methodology of the composited confirmation sample was approved by EPA (EPA 2015a).

7.2 Area B West

On April 23, 2016, soil was removed from the westernmost grid of Area B West as part of an interim soil removal measure. The soil removal was completed during a scheduled shutdown of the Steel Building transformers. Details regarding this interim measure are described in the Area B West Interim Soil Removal Measure Technical Memorandum, provided in Appendix A.

As indicated in Section 4.0, TSCA regulations require that total PCB concentrations of bulk PCB remediation waste that is left-in-place within low-occupancy areas must be below 100,000 µg/kg to qualify for capping under the self-implementing procedures as outlined in the PCB Self-Implementing Interim Cleanup Plan, Area B West (LAI 2016b) submitted on April 19, 2016. PCC excavated portions of Area B West in April 2016 during a scheduled transformer shutdown. EPA acknowledged receipt of the plan and stated they would consider it a temporary measure and that the PCB regulations do no prohibit any person from conducting these actions prior to receipt of written approval.

Cleanup verification samples collected from the newly-exposed soil surface demonstrated the <100,000 µg/kg cleanup level was met and that capping under the low-occupancy criteria can proceed in the area. However, due to the location of Area B West underneath the transformers for the LPC, access to the area for capping purposes is impaired.

Traditional capping with concrete or asphalt to the required 6-inch thickness would be difficult, and would not necessarily be the best alternative for capping. Therefore, this area will be addressed under 40 CFR 761.61 (c), Risk-Based Disposal Approval, as described in Section 8.2.

7.3 Area C

As described in Section 6.4.3, PCB remediation waste in this area consisted of surface debris that had collected on paved surfaces. Equipment and stored materials in Area C were moved and the surface was swept to remove re-accumulated debris on November 25, 2014. Depressions in the asphalt adjacent to the Steel Building were cleaned (i.e., debris removed to the extent practicable) and filled with new asphalt. The new asphalt was sloped away from the building to prevent re-accumulation of debris in this area and to promote stormwater drainage away from the building. With removal of the surface debris, no material remained for collection of confirmation samples.

Area C was further cleaned using dry-ice blasting on April 18th through 20th, 2016. Debris generated during the dry-ice blasting was drummed and shipped to an authorized Subtitle C landfill.

8.0 CLEANUP PLAN

The following sections provide the detailed cleanup plan for the source areas still requiring some additional level of cleanup, based on characterization activities and completed interim measures described above, as applicable. Proposed cleanup activities are based on low-occupancy cleanup level criteria, as discussed in Section 4.0.

8.1 Area A

The post-removal cleanup verification sample collected from Area A above the retaining wall (as discussed in Section 6.4.1) had a total PCB concentration of 54,000 µg/kg, indicating that additional removal will be necessary in Area A. Therefore, additional soil will be removed to approximately 1 ft bgs, assuming the depth will not compromise the wooden walkway or staircase bordering the removal area. The concrete block that was not removed during the initial cleanup activities (Section 6.4.1) will be removed to facilitate cleanup of this area.

Following removal of soils from Area A to 1 ft bgs, verification sampling will be conducted to demonstrate that the remaining soils are below the low-occupancy cleanup standard of 25,000 µg/kg (requiring institutional control only). In the event that verification sampling indicates that total PCB concentrations remain above 25,000 µg/kg, additional removal will be conducted (with verification sampling), or institutional controls (i.e., a deed restriction) and fencing and signage will be installed in the area, depending on stability of the hillside and structures.

8.1.1 Contamination Control

Soil removal and disposal will be performed by qualified construction contractors selected by PCC that are familiar with such work and have had the health and safety training required to perform cleanup under TSCA. The contractor will work with PCC prior to beginning work to define and implement procedures that will minimize the potential for deposition of PCB-contaminated debris (and address any inadvertent occurrence) on nearby paved surfaces.

The control measures to be implemented include the following:

- **Plastic Sheeting / Liner**. The contractor will place plastic sheeting or other protective barriers over paved surfaces adjacent to the cleanup area to eliminate the need for decontamination of paved areas. Plastic sheeting and barriers will be monitored for rips and tears that may occur due to vehicle or foot traffic and will be replaced immediately if damage is observed. Note that excavation will be by hand, and vehicular traffic will be minimal, if any.
- **Dry-Ice Blasting**. In the event that impacted soil reaches the asphalt, or debris accumulation occurs, dry-ice blasting will be employed to clean up paved surfaces in the vicinity of Area A.
- **Weather Restrictions**. Removal of PCB-containing material will not be conducted during periods of significant rain.

- **Catch Basin Seals or Other Control Devices**. Prior to installation of the cap, the catch basins and French drain in the vicinity of Area A will be blocked off with catch basin seals to eliminate potential for debris to enter the storm drain system.

8.1.2 Decontamination

Non-disposable and non-porous equipment such as construction tools that come into contact with PCB-contaminated soil and debris will be decontaminated after each use. Decontamination of equipment after removal of soil from Area A, will be performed using hand-wiping with appropriate solvent in accordance with decontamination procedures required under 40 CFR 761.79, or by using the double wash/rinse method for decontaminating non-porous surfaces under 40 CFR 761 Subpart S. Disposable equipment or tools will be managed as contaminated TSCA waste and placed in 55-gallon drums to be disposed of at the authorized Subtitle C landfill permitted to accept TSCA waste under 40 CFR 761.75. Only parts of the tools that are reasonably likely to have been in contact with PCB-containing materials will be decontaminated.

8.2 Area B West

Cleanup of Area B West was required under TSCA based on the originally-detected concentrations of up to 117,000 µg/kg of PCB Aroclor 1254. As previously discussed, the proximity to high voltage electrical lines, constrained space, adjacent slope, and existing infrastructure make complete excavation complicated and potentially hazardous. Therefore, cleanup of Area B West will be conducted under the risk-based disposal approval framework in accordance with 40 CFR 761.61(c) following formal approval of the proposed plan from EPA.

The cleanup approach consists of two phases, an interim soil removal measure followed by placement of a proposed concrete cloth cap. The interim soil removal measure was completed in April 2016 and consisted of removing soil to a maximum depth of approximately 18 inches bgs in the western-most grid of Area B West; the completed interim soil removal measure is documented in detail in Appendix A. The western-most grid of Area B West was graded and partially backfilled with pea gravel (see Appendix A) following soil removal in preparation for installation of the cap described below.

The next phase of the proposed cleanup method for Area B West will consist of installation of a concrete cap. Institutional controls (i.e., deed restrictions) will also be established for the area once the capping process is complete. The concrete cap will be placed by a qualified construction contractor selected by PCC who is familiar with the safety restrictions required for working under the LPC transformers.

Due to the inaccessible nature of the area to be capped, concrete cloth was selected as the most feasible solution for cap construction that will effectively protect workers and the environment. It is also expected to provide a better seal around perforations for electrical conduits than a poured concrete slab. The westernmost grid of Area B West is sloped to the southwest and located under the transformer platform. Traditional concrete applications, including shotcrete, would be difficult to uniformly apply due to the slope and accessibility constraints. Additionally, both poured concrete and shotcrete add a significant amount of weight to the slope surface, which may cause settling of the underlying soils.

Concrete cloth, a geosynthetic cementitious composite mat, provides a thin (0.5 inches), durable, waterproof, and fire/chemical resistant concrete layer upon hydration per the manufacturer's specifications (specification information provided in Appendix B). Concrete cloth is lightweight and remains workable for 2 hours after the initial hydration, allowing for manipulation of the product to provide a tight seal to the underlying soils and adjacent infrastructure. The concrete cloth is fully set (i.e., cured) in approximately 240 minutes, allowing for a single day's application.

Per the manufacturer-provided brochure in Appendix B, "concrete cloth can be used to protect slopes as a replacement for shotcrete, riprap, and other hard armor systems." Additional information regarding the strength and durability of the cured concrete cap is provided in Appendix B. Use of concrete cloth has previously been approved by EPA for Superfund site remediation at the Sheldon Mine site near Walker, Arizona.[3]

The concrete cloth meets the requirements outlined at 40 CFR 264.310(a) for a cap by:

- Providing long-term minimization of migration of liquids through the capped area,
- Functioning with minimal maintenance,
- Promoting drainage and minimize erosion or abrasion of the cap material,
- Accommodating settling and subsidence to maintain the cap's integrity, and
- Having a permeability less than or equal to the permeability of the underlying subsoils.

Independent hydrocarbon impermeability testing indicates that the concrete cloth can be classified as impervious with waterproofing properties similar to clay and an equivalent average coefficient of impermeability (k) of $1x10^{-9}$ meters/second (Appendix B), which complies with the technical requirements for cap permeability in 40 CFR 761.75 (b)(1)(ii).

A design schematic showing the location and makeup of the proposed concrete cap is included on Figures 7 and 8. The concrete cap will be constructed by placing one layer (i.e., 0.5 inches) concrete cloth on top of the newly graded area. Concrete cloth will be placed in accordance with manufacturer specifications (a specification sheet for the proposed concrete cloth fabric is included in Appendix B).

Installation of the cap using concrete cloth will also provide for stronger and tighter seals around existing penetrations (e.g., electrical conduits, etc.) within the area to be capped. Based on directions from the manufacturer, the cloth will be wrapped around and molded to the penetrating utilities/conduits to form a boot that promotes drainage away from the penetrations.

[3] https://esemag.com/hazmat-remediation/concrete-cloth-chosen-for-remediation/

The boot will be sealed using an adhesive such as silicon caulking to form a tight seal. Drainage features around the perimeter of the concrete cap will also be installed to support effective drainage; drainage features are detailed on Figure 7. In complying with TSCA regulations, breaches to the cap will be repaired within 72 hours.

Capping activities will be conducted in a manner that minimizes the potential for release of PCBs to the environment. Concrete cloth cap placement will be performed by qualified construction contractors selected by PCC. The contractor will work with PCC prior to beginning capping to initiate procedures that will be used to reduce the potential for deposition of PCB-contaminated debris during cap construction onto nearby paved surfaces that could potentially be discharged to the stormwater conveyance system.

8.2.1 Contamination Control

Control measures will be implemented to capture debris generated during the preparation and capping of Area B West, and to prevent potentially contaminated construction debris from entering the stormwater conveyance system. The control measures to be implemented include the following:

- **Plastic Sheeting / Liner**. Plastic sheeting or liners will be laid around the area to be capped prior to the start of work. The sheeting will be used to protect the wooden walkway above the transformers (if remaining in place) and the asphalt below the transformers. The sheeting will provide an extra barrier to ensure impacted soils do not encounter ground surface where employees may be present.
- **Air-Powered Vacuums**. These will be used to remove soil for ease of access for cap anchoring system and for installation of the toe drain. Additionally, any soil that falls onto the liner may be vacuumed with these devices. The vacuums will be used during periods of light rain only.
- **Dry-Ice Blasting**. In the event that impacted soil reaches the asphalt, or debris accumulation occurs, dry-ice blasting will be employed to clean up paved surfaces in the vicinity of Area B.
- **Weather Restrictions**. Removal of PCB-containing material will not be conducted during periods of significant rain.
- **Catch Basin Seals or Other Control Devices**. Prior to installation of the cap, the catch basins and French drain in the vicinity of Area B West will be blocked off with catch basin seals to eliminate potential for debris to enter the storm drain system.

8.2.2 Decontamination

Non-disposable and nonporous equipment such as excavators and other construction tools that come into contact with PCB-contaminated soil and debris will be decontaminated after each use. Decontamination after removal of any soil will be performed using hand-wiping with appropriate solvent in accordance with decontamination procedures required under 40 CFR 761.79, or using the double wash/rinse method for decontaminating non-porous surfaces under 40 CFR 761 Subpart S. Disposable equipment or tools will be discarded as contaminated TSCA waste and placed in 55-gallon drums to be disposed of at the Subtitle C chemical waste landfill permitted to accept TSCA waste under 40 CFR 761.75. Only parts of the equipment that are reasonably likely to have been in contact with PCB-containing materials will be decontaminated. A Health and Safety plan outlining the decontamination procedures is provided in Appendix C.

8.3 Area B East

Based on the maximum total PCB sample result of 8,610 µg/kg and as discussed in Section 4.0, Area B East meets the requirements of self-implementing cleanup standards for low-occupancy areas based on 40 CRF 761.61. No further action will be completed in Area B East; however, a deed restriction will be filed for the area per TSCA cleanup requirements for self-implementing procedures.

8.4 Area C

Area C is composed of paved surfaces and no PCB source has been identified in the vicinity of the discrete sample location. A visual survey of Area C was conducted In July 2016 to determine if additional debris had accumulated since the dry-ice blasting in April 2016; no debris was identified. If additional debris is present at the time the activities outlined in this plan are implemented, cleanup verification sampling (i.e., debris sampling) will be conducted. There is currently no PCB remediation waste present in Area C and no further action beyond the aforementioned contingent sampling is planned.

8.5 Area D

Based on the maximum total PCB sample result of 121.9 µg/kg and as discussed in Section 6.4.4, Area D meets the requirements of self-implementing cleanup standards for low-occupancy areas based on 40 CFR 761.61. Because the maximum concentration also complies with high-occupancy requirements, no further action in Area D is warranted.

8.6 Schedule

The cleanup activities will be conducted under the TSCA self-implementing regulations, with the exception of the cleanup of Area B West, which will follow the risk-based regulation framework. Cleanup of Area A will be initiated following the 30-day waiting period after submittal of this document to EPA; capping of Area B West will occur after receipt of EPA's approval of the cleanup plan proposed in this documentation. Ideally, cleanup in both areas would be initiated at the same time.

The proposed schedule is subject to change, depending on weather-related delays and other site conditions. A proposed project schedule, based on the amount of time following receipt of authorization, is as follows.

Task	Task Description	Estimated Time to Complete
1	Cleanup/Removal/Verification Sampling (Area A and Area C)	5 weeks following receipt of EPA formal authorization
2	Capping (Area B West)	8 weeks following receipt of EPA formal authorization
3	Post Cleanup/Removal Sample Analysis	3 weeks following removal based on standard laboratory turnaround time
4	Reporting	4 weeks following receipt of verification sampling analytical data

8.7 Disposal Technology

Waste associated with the cleaning, decontamination, and/or removal of PCB remediation waste will be categorized as bulk PCB remediation waste. Bulk PCB remediation waste deriving from areas where original PCB concentrations were equal to or greater than 50 mg/kg (i.e., 50,000 µg/kg) will be shipped in Department of Transportation-compliant containers and disposed in a Subtitle C landfill (a chemical waste landfill permitted under 40 CFR § 761.75 to accept TSCA-listed waste). PCB remediation waste known to contain PCBs less than 50 mg/kg will be managed in a Subtitle D landfill in accordance with 40 CFR § 761.61(a)(5)(i)(B)(*2*)(*ii*).

8.8 Cleanup Verification Sampling and Next Steps

Based on the planned cleanup activities described in this supplemental plan, cleanup verification samples will be collected from Area A, downslope of the wooden walkway, and Area C, if sufficient surface debris is present to sample as described in Section 8.4. Cleanup verification samples will conform to 40 CFR § 761.61(a)(6) and will be collected from the footprint of the area of soil removal (Area A) or from debris accumulated on the pavement, if present (Area C). Self-implementing cleanup is complete when verification sampling yields total PCB results less than or equal to the target cleanup level of 25,000 µg/kg (requiring deed restrictions only), based on the TSCA cleanup level for bulk PCBs remediation waste in low-occupancy areas.

In the event that cleanup verification samples yield total PCB concentrations greater than the target cleanup level of 25,000 µg/kg , soil excavation will proceed vertically to the extent practicable (i.e., additional excavation of soil is possible and does not endanger utilities, building foundations, or slope stability) and the cleanup verification sampling procedures will be repeated.

As required by 40 CFR 761.61, upon completion of the cleanup, PCC will complete the following activities within 60 days:

- The following information specific to related cleanup activities will be recorded on the property deed or another document easily accessible in a title search:
  - The land has been used for PCB remediation waste disposal and is restricted to use as a low-occupancy area as defined by 40 CFR 761.3;
  - The existence of a fence or cap and the requirements to maintain the fence or cap; and,
  - The applicable cleanup levels remaining at the site.
- A signed certification will be submitted to the EPA Regional Administrator that the above notations have been recorded.

9.0 REFERENCES

Bower, J. 2013. Follow-up Conversation re Catch Basin Sampling. Jay Bower, PE. December 5. Landau Associates, Inc.

EPA. 2005. Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act (TSCA). Washington, D.C. November. U.S. Environmental Protection Agency.

EPA. 2015a. Notice and Certification of Self-Implementing Cleanup, PCC Structurals, Inc. Large Parts Campus, 4600 SE Harney Drive, Portland, Oregon. Kelly McFadden. July 24. U.S. Environmental Protection Agency.

EPA. 2015b. PCC Cleanup Approval Question. Portland, Oregon. August 17. Dave Bartus. U.S. Environmental Protection Agency.

EPA. 2016a. PCC Cleanup Approval Question. Dave Bartus. Portland, Oregon. March 10. U.S. Environmental Protection Agency.

EPA. 2016b. Follow-up on PCC Structurals Cleanup Process. Dave Bartus. Portland, Oregon. June 23. U.S. Environmental Protection Agency.

LAI. 2014a. Phase II Remedial Investigation. UIpland PCB Source Investigation. Jay Bower, PE and Colette Gaona. Portland, Oregon. September 15. Landau Associates, Inc.

LAI. 2014b. Phase II Remedial Investigation. Supplemental Stormwater and Catch Basin Sampling. Jay Bower, PE and RG Della Fawcett, RG. Portland, Oregon. October 22 (Revised). Landau Associates, Inc.

LAI. 2014c. Phase II Remedial Investigation. October 2014 Upland Source Investigation. Large Parts Campus. PCC Structurals, Inc.-DEQ NO. LQVC-NWR-08-05. Jay Bower, PE and Della Fawcett, RG. Portland, Oregon. December 17. Landau Associates, Inc.

LAI. 2015a. Letter re: Notice and Certification of Self-Implementing Cleanup, PCC Structurals, Inc. Large Parts Campus, 4600 SE Harney Drive, Portland, Oregon. July 1. Landau Associates, Inc.

LAI. 2015b. Technical Memorandum: Phase II Remedial Investigation, November and December 2014 Catch Basin and Stormwater Sampling, Large Parts Campus, PCC Structurals, Inc. DEQ No. LQVC-NWR-08-05. January 30. Landau Associates, Inc.

LAI. 2015c. Technical Memorandum: Phase II Remedial Investigation, February 2015 Catch Basin and Stormwater Sampling, Large Parts Campus, PCC Structurals, Inc. ODEQ No. LQVC-NWR-08-05. January 28. Landau Associates, Inc.

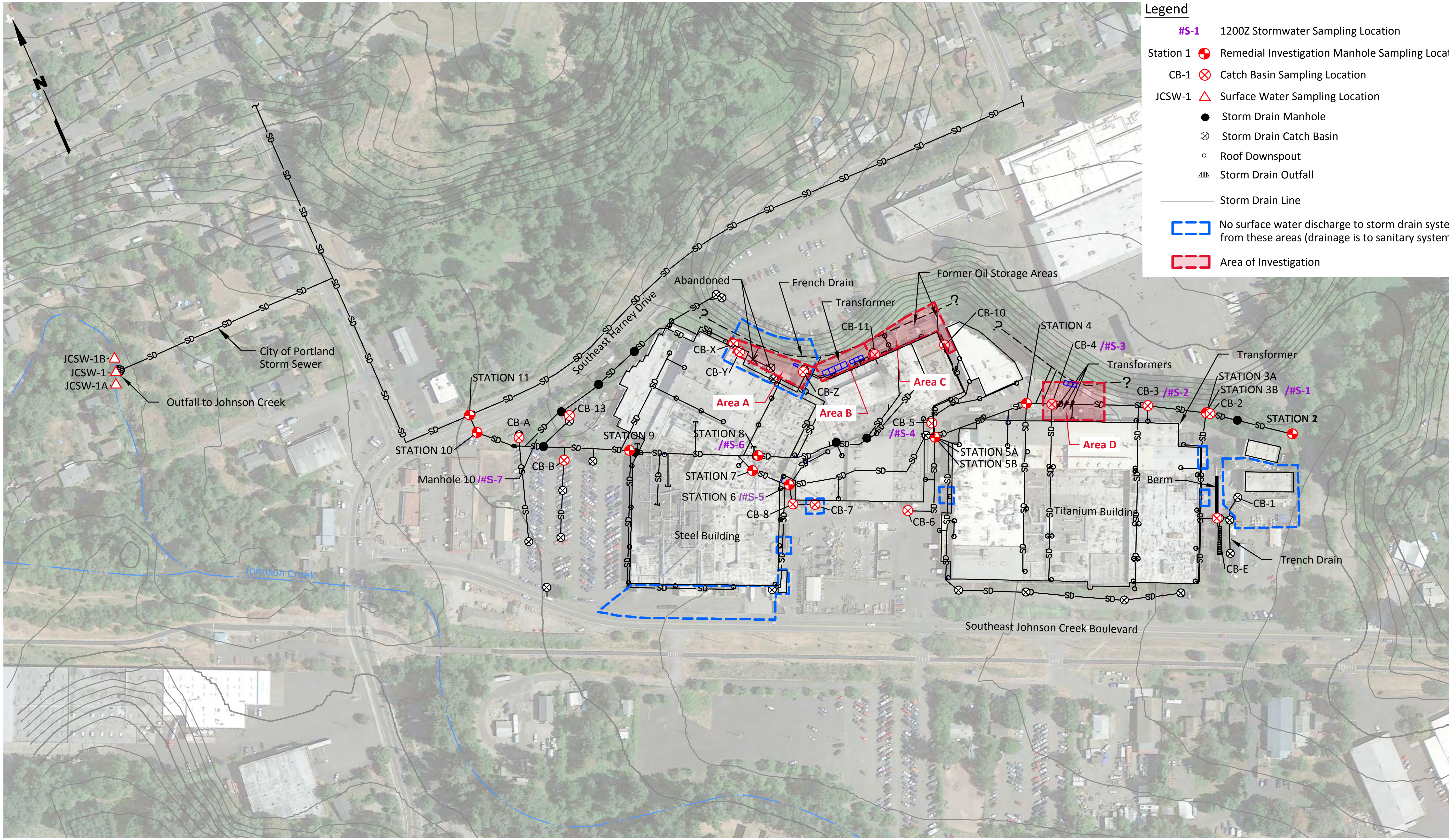
LAI. 2015d. Technical Memorandum: Phase II Remedial Investigation, Proposed Work Plan for Polychlorinated Biphenyl Source Areas and Additional Sampling. January 28. Landau Associates, Inc.

LAI. 2016. Stormwater Treatment System Design Summary. PCC Structurals, Inc Large Parts Campus. 4600 SE Harney Drive, Portland, Oregon. April 29. Joseph Kalmar, PE. Landau Associates, Inc.

LAI. 2016b. Technical Memorandum: PCB Self Implementing Interim Cleanup Plan. Area B West. PCC Large Parts Campus. Portland,Oregon. April 19. Jay Bower, PE and Della Fawcett RG. Landau Associates, Inc.

ODEQ. 2014a. Letter re: Results of Recent City of Portland Storm Investigation, PCC Structurals – Large Parts Campus, ECSI #274. August 5. Oregon Department of Environmental Quality.

ODEQ. 2014b. Email message to Jay Bower, Landau Associates, Inc. from Cindy Ryals re: PCB Source Evaluation Scoping. September 29. Oregon Department of Environmental Quality.



Source: © Google Earth Pro 2012; PCC 1989

Note

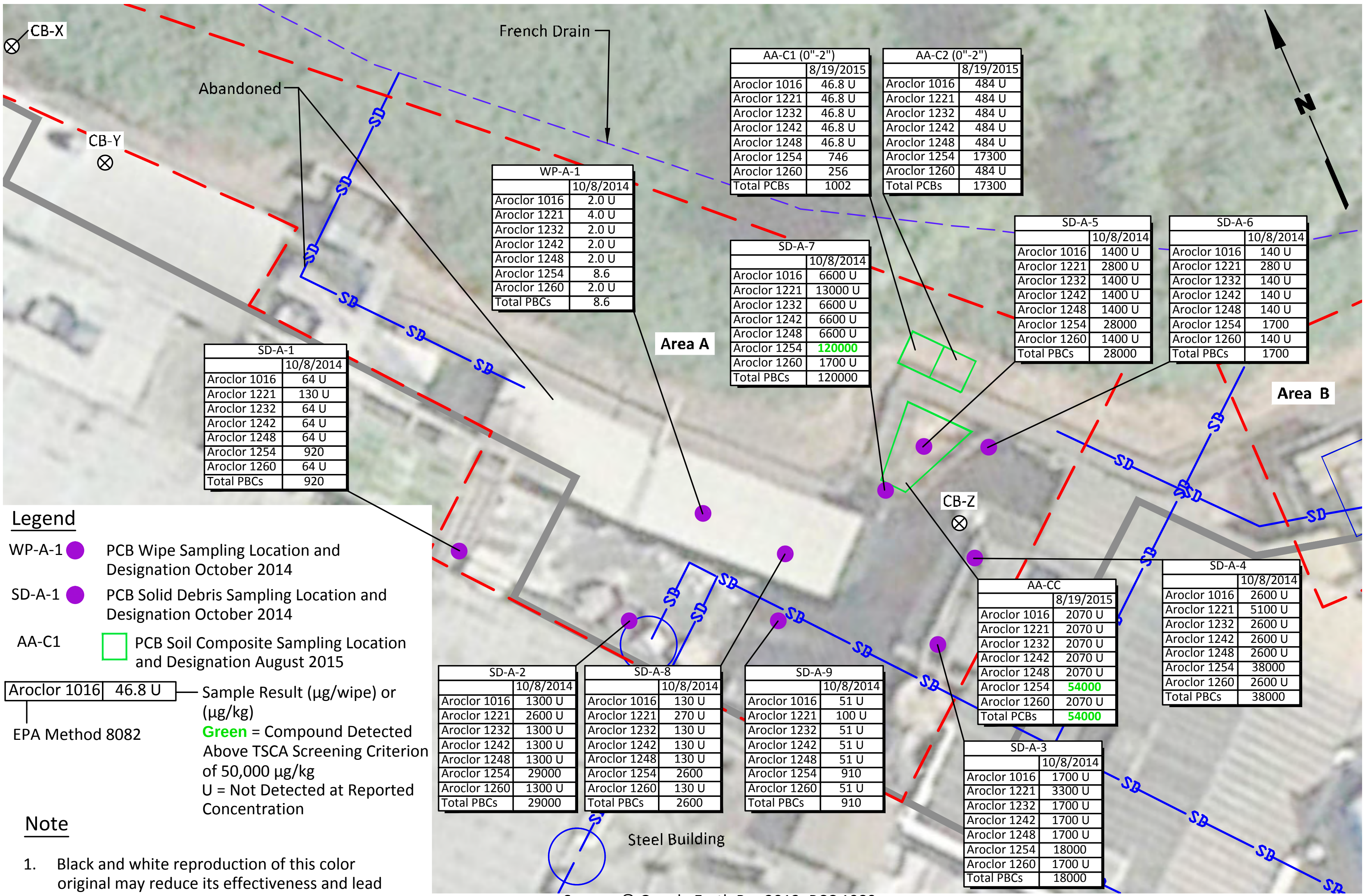
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

PCB Source Area Investigation Sampling Locations

Figure 1

LANDAU ASSOCIATES



AA-C1 (0"-2")	8/19/2015
Aroclor 1016	46.8 U
Aroclor 1221	46.8 U
Aroclor 1232	46.8 U
Aroclor 1242	46.8 U
Aroclor 1248	46.8 U
Aroclor 1254	746
Aroclor 1260	256
Total PCBs	1002

AA-C2 (0"-2")	8/19/2015
Aroclor 1016	484 U
Aroclor 1221	484 U
Aroclor 1232	484 U
Aroclor 1242	484 U
Aroclor 1248	484 U
Aroclor 1254	17300
Aroclor 1260	484 U
Total PCBs	17300

WP-A-1	10/8/2014
Aroclor 1016	2.0 U
Aroclor 1221	4.0 U
Aroclor 1232	2.0 U
Aroclor 1242	2.0 U
Aroclor 1248	2.0 U
Aroclor 1254	8.6
Aroclor 1260	2.0 U
Total PBCs	8.6

SD-A-7	10/8/2014
Aroclor 1016	6600 U
Aroclor 1221	13000 U
Aroclor 1232	6600 U
Aroclor 1242	6600 U
Aroclor 1248	6600 U
Aroclor 1254	120000
Aroclor 1260	1700 U
Total PBCs	120000

SD-A-5	10/8/2014
Aroclor 1016	1400 U
Aroclor 1221	2800 U
Aroclor 1232	1400 U
Aroclor 1242	1400 U
Aroclor 1248	1400 U
Aroclor 1254	28000
Aroclor 1260	1400 U
Total PBCs	28000

SD-A-6	10/8/2014
Aroclor 1016	140 U
Aroclor 1221	280 U
Aroclor 1232	140 U
Aroclor 1242	140 U
Aroclor 1248	140 U
Aroclor 1254	1700
Aroclor 1260	140 U
Total PBCs	1700

SD-A-1	10/8/2014
Aroclor 1016	64 U
Aroclor 1221	130 U
Aroclor 1232	64 U
Aroclor 1242	64 U
Aroclor 1248	64 U
Aroclor 1254	920
Aroclor 1260	64 U
Total PBCs	920

AA-CC	8/19/2015
Aroclor 1016	2070 U
Aroclor 1221	2070 U
Aroclor 1232	2070 U
Aroclor 1242	2070 U
Aroclor 1248	2070 U
Aroclor 1254	54000
Aroclor 1260	2070 U
Total PCBs	54000

SD-A-4	10/8/2014
Aroclor 1016	2600 U
Aroclor 1221	5100 U
Aroclor 1232	2600 U
Aroclor 1242	2600 U
Aroclor 1248	2600 U
Aroclor 1254	38000
Aroclor 1260	2600 U
Total PBCs	38000

SD-A-2	10/8/2014
Aroclor 1016	1300 U
Aroclor 1221	2600 U
Aroclor 1232	1300 U
Aroclor 1242	1300 U
Aroclor 1248	1300 U
Aroclor 1254	29000
Aroclor 1260	1300 U
Total PBCs	29000

SD-A-8	10/8/2014
Aroclor 1016	130 U
Aroclor 1221	270 U
Aroclor 1232	130 U
Aroclor 1242	130 U
Aroclor 1248	130 U
Aroclor 1254	2600
Aroclor 1260	130 U
Total PBCs	2600

SD-A-9	10/8/2014
Aroclor 1016	51 U
Aroclor 1221	100 U
Aroclor 1232	51 U
Aroclor 1242	51 U
Aroclor 1248	51 U
Aroclor 1254	910
Aroclor 1260	51 U
Total PBCs	910

SD-A-3	10/8/2014
Aroclor 1016	1700 U
Aroclor 1221	3300 U
Aroclor 1232	1700 U
Aroclor 1242	1700 U
Aroclor 1248	1700 U
Aroclor 1254	18000
Aroclor 1260	1700 U
Total PBCs	18000

Legend

WP-A-1 ● PCB Wipe Sampling Location and Designation October 2014

SD-A-1 ● PCB Solid Debris Sampling Location and Designation October 2014

AA-C1 □ PCB Soil Composite Sampling Location and Designation August 2015

Aroclor 1016	46.8 U

Sample Result (µg/wipe) or (µg/kg)

EPA Method 8082

Green = Compound Detected Above TSCA Screening Criterion of 50,000 µg/kg

U = Not Detected at Reported Concentration

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

0 20 40

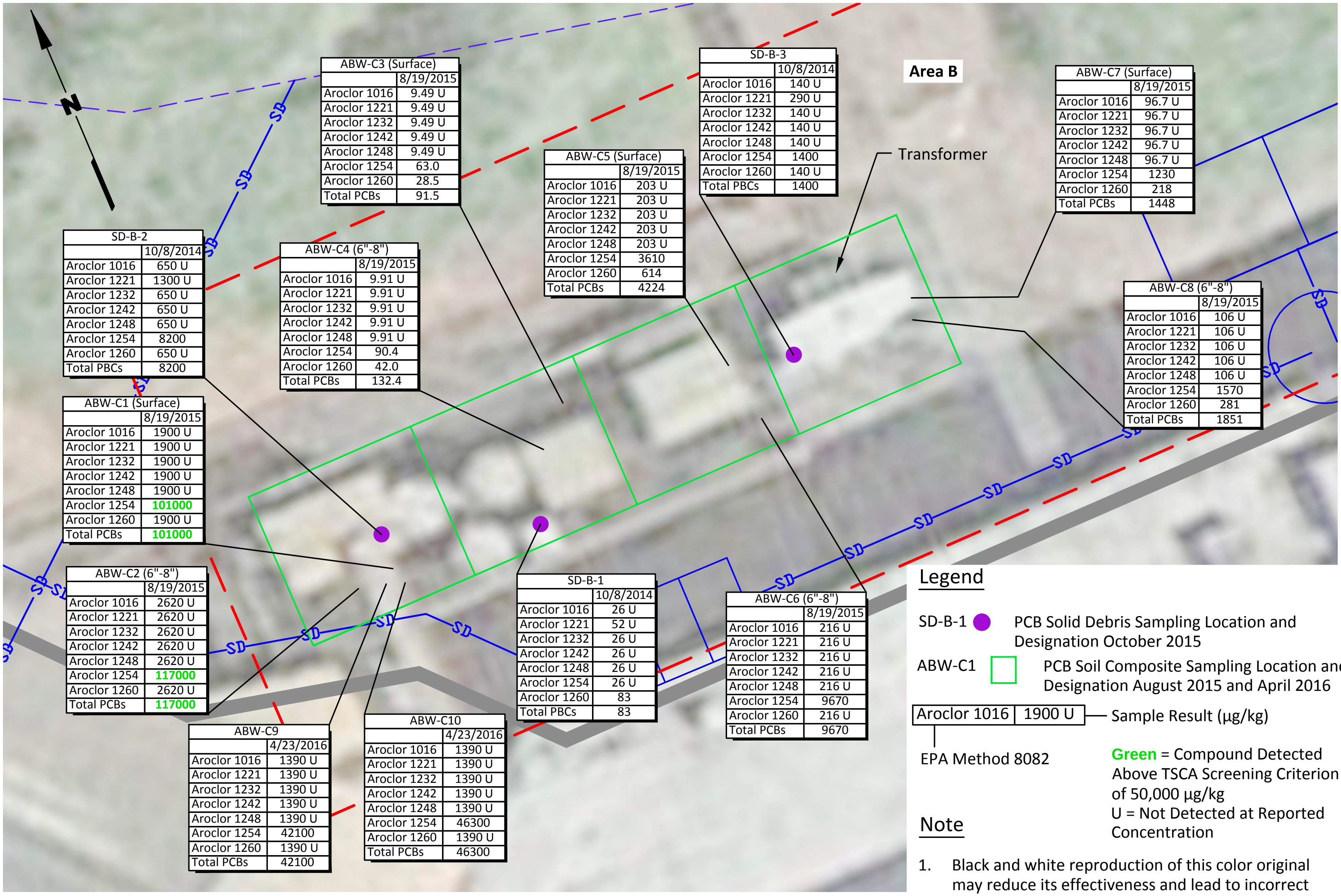
Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area A
PCB Analytical Results

Figure
2



SD-B-2	10/8/2014
Aroclor 1016	650 U
Aroclor 1221	1300 U
Aroclor 1232	650 U
Aroclor 1242	650 U
Aroclor 1248	650 U
Aroclor 1254	8200
Aroclor 1260	650 U
Total PBCs	8200

ABW-C3 (Surface)	8/19/2015
Aroclor 1016	9.49 U
Aroclor 1221	9.49 U
Aroclor 1232	9.49 U
Aroclor 1242	9.49 U
Aroclor 1248	9.49 U
Aroclor 1254	63.0
Aroclor 1260	28.5
Total PCBs	91.5

ABW-C4 (6"-8")	8/19/2015
Aroclor 1016	9.91 U
Aroclor 1221	9.91 U
Aroclor 1232	9.91 U
Aroclor 1242	9.91 U
Aroclor 1248	9.91 U
Aroclor 1254	90.4
Aroclor 1260	42.0
Total PCBs	132.4

ABW-C5 (Surface)	8/19/2015
Aroclor 1016	203 U
Aroclor 1221	203 U
Aroclor 1232	203 U
Aroclor 1242	203 U
Aroclor 1248	203 U
Aroclor 1254	3610
Aroclor 1260	614
Total PBCs	4224

SD-B-3	10/8/2014
Aroclor 1016	140 U
Aroclor 1221	290 U
Aroclor 1232	140 U
Aroclor 1242	140 U
Aroclor 1248	140 U
Aroclor 1254	1400
Aroclor 1260	140 U
Total PBCs	1400

ABW-C7 (Surface)	8/19/2015
Aroclor 1016	96.7 U
Aroclor 1221	96.7 U
Aroclor 1232	96.7 U
Aroclor 1242	96.7 U
Aroclor 1248	96.7 U
Aroclor 1254	1230
Aroclor 1260	218
Total PCBs	1448

ABW-C8 (6"-8")	8/19/2015
Aroclor 1016	106 U
Aroclor 1221	106 U
Aroclor 1232	106 U
Aroclor 1242	106 U
Aroclor 1248	106 U
Aroclor 1254	1570
Aroclor 1260	281
Total PCBs	1851

ABW-C1 (Surface)	8/19/2015
Aroclor 1016	1900 U
Aroclor 1221	1900 U
Aroclor 1232	1900 U
Aroclor 1242	1900 U
Aroclor 1248	1900 U
Aroclor 1254	101000
Aroclor 1260	1900 U
Total PCBs	101000

ABW-C2 (6"-8")	8/19/2015
Aroclor 1016	2620 U
Aroclor 1221	2620 U
Aroclor 1232	2620 U
Aroclor 1242	2620 U
Aroclor 1248	2620 U
Aroclor 1254	117000
Aroclor 1260	2620 U
Total PCBs	117000

SD-B-1	10/8/2014
Aroclor 1016	26 U
Aroclor 1221	52 U
Aroclor 1232	26 U
Aroclor 1242	26 U
Aroclor 1248	26 U
Aroclor 1254	26 U
Aroclor 1260	83
Total PBCs	83

ABW-C6 (6"-8")	8/19/2015
Aroclor 1016	216 U
Aroclor 1221	216 U
Aroclor 1232	216 U
Aroclor 1242	216 U
Aroclor 1248	216 U
Aroclor 1254	9670
Aroclor 1260	216 U
Total PCBs	9670

ABW-C9	4/23/2016
Aroclor 1016	1390 U
Aroclor 1221	1390 U
Aroclor 1232	1390 U
Aroclor 1242	1390 U
Aroclor 1248	1390 U
Aroclor 1254	42100
Aroclor 1260	1390 U
Total PCBs	42100

ABW-C10	4/23/2016
Aroclor 1016	1390 U
Aroclor 1221	1390 U
Aroclor 1232	1390 U
Aroclor 1242	1390 U
Aroclor 1248	1390 U
Aroclor 1254	46300
Aroclor 1260	1390 U
Total PCBs	46300

Legend

SD-B-1 ● PCB Solid Debris Sampling Location and Designation October 2015

ABW-C1 □ PCB Soil Composite Sampling Location and Designation August 2015 and April 2016

Aroclor 1016 | 1900 U — Sample Result (µg/kg)

EPA Method 8082

Green = Compound Detected Above TSCA Screening Criterion of 50,000 µg/kg

U = Not Detected at Reported Concentration

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

0 10 20

Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area B West
PCB Analytical Results

Figure
3

Legend

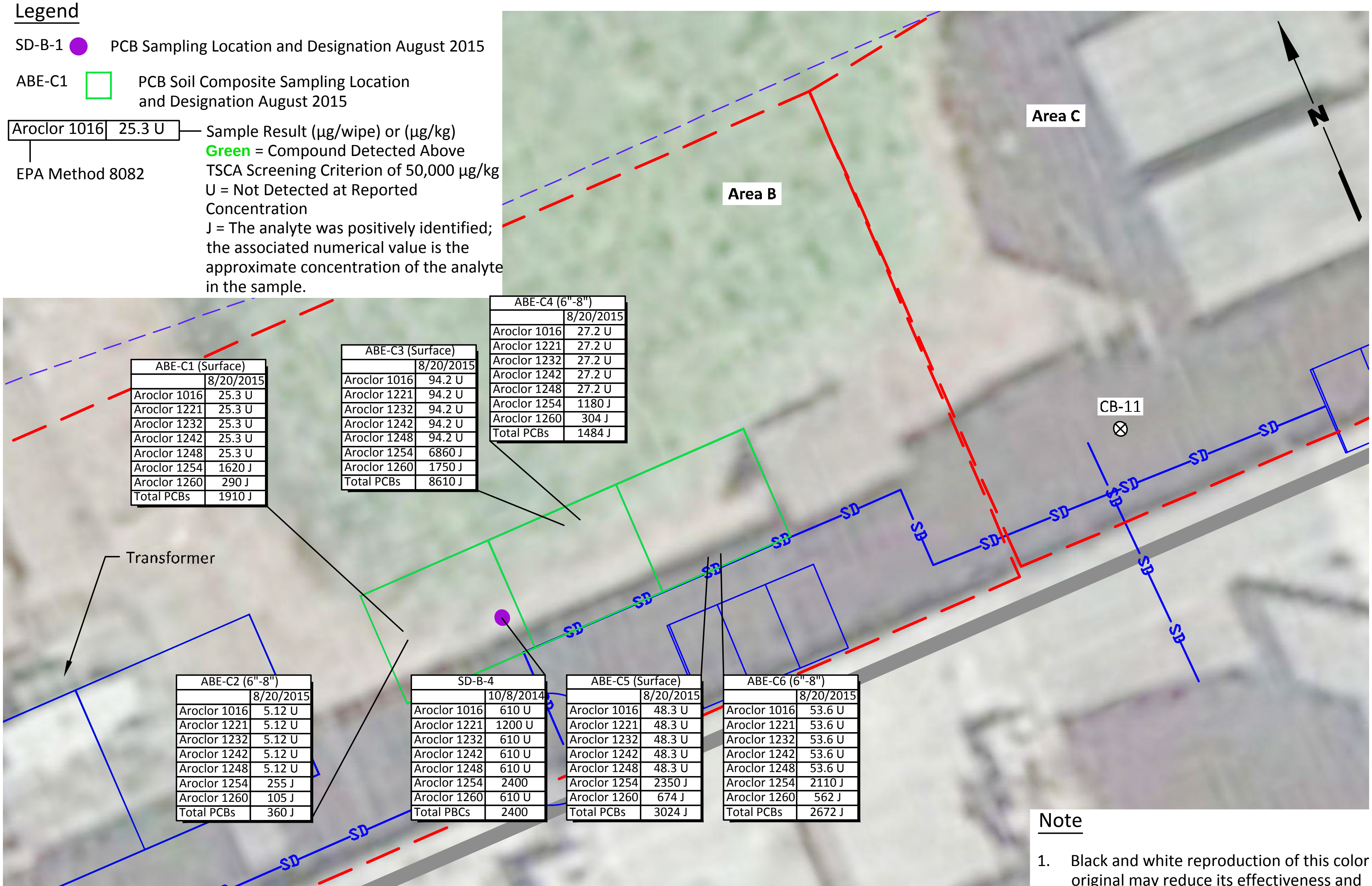
SD-B-1 ● PCB Sampling Location and Designation August 2015

ABE-C1 □ PCB Soil Composite Sampling Location and Designation August 2015

Aroclor 1016	25.3 U

Sample Result (µg/wipe) or (µg/kg)
Green = Compound Detected Above TSCA Screening Criterion of 50,000 µg/kg
U = Not Detected at Reported Concentration
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

EPA Method 8082



ABE-C1 (Surface)	8/20/2015
Aroclor 1016	25.3 U
Aroclor 1221	25.3 U
Aroclor 1232	25.3 U
Aroclor 1242	25.3 U
Aroclor 1248	25.3 U
Aroclor 1254	1620 J
Aroclor 1260	290 J
Total PCBs	1910 J

ABE-C3 (Surface)	8/20/2015
Aroclor 1016	94.2 U
Aroclor 1221	94.2 U
Aroclor 1232	94.2 U
Aroclor 1242	94.2 U
Aroclor 1248	94.2 U
Aroclor 1254	6860 J
Aroclor 1260	1750 J
Total PCBs	8610 J

ABE-C4 (6"-8")	8/20/2015
Aroclor 1016	27.2 U
Aroclor 1221	27.2 U
Aroclor 1232	27.2 U
Aroclor 1242	27.2 U
Aroclor 1248	27.2 U
Aroclor 1254	1180 J
Aroclor 1260	304 J
Total PCBs	1484 J

ABE-C2 (6"-8")	8/20/2015
Aroclor 1016	5.12 U
Aroclor 1221	5.12 U
Aroclor 1232	5.12 U
Aroclor 1242	5.12 U
Aroclor 1248	5.12 U
Aroclor 1254	255 J
Aroclor 1260	105 J
Total PCBs	360 J

SD-B-4	10/8/2014
Aroclor 1016	610 U
Aroclor 1221	1200 U
Aroclor 1232	610 U
Aroclor 1242	610 U
Aroclor 1248	610 U
Aroclor 1254	2400
Aroclor 1260	610 U
Total PBCs	2400

ABE-C5 (Surface)	8/20/2015
Aroclor 1016	48.3 U
Aroclor 1221	48.3 U
Aroclor 1232	48.3 U
Aroclor 1242	48.3 U
Aroclor 1248	48.3 U
Aroclor 1254	2350 J
Aroclor 1260	674 J
Total PCBs	3024 J

ABE-C6 (6"-8")	8/20/2015
Aroclor 1016	53.6 U
Aroclor 1221	53.6 U
Aroclor 1232	53.6 U
Aroclor 1242	53.6 U
Aroclor 1248	53.6 U
Aroclor 1254	2110 J
Aroclor 1260	562 J
Total PCBs	2672 J

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

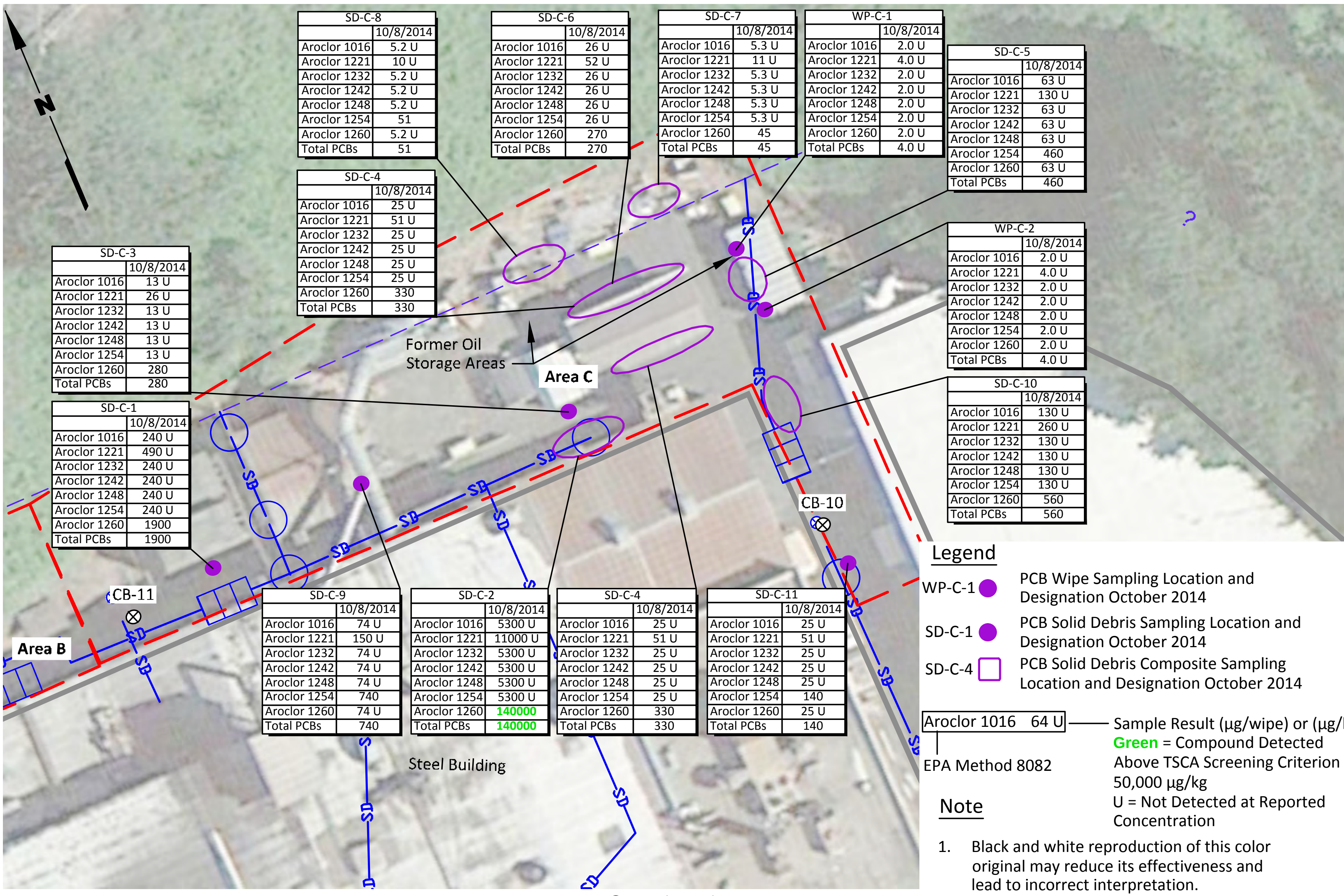
0 10 20
Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area B East
PCB Analytical Results

Figure 4



Analyte	SD-C-8 10/8/2014	SD-C-6 10/8/2014	SD-C-7 10/8/2014	WP-C-1 10/8/2014	SD-C-5 10/8/2014	SD-C-4 10/8/2014	SD-C-3 10/8/2014	WP-C-2 10/8/2014	SD-C-1 10/8/2014	SD-C-10 10/8/2014	SD-C-9 10/8/2014	SD-C-2 10/8/2014	SD-C-4 10/8/2014	SD-C-11 10/8/2014
Aroclor 1016	5.2 U	26 U	5.3 U	2.0 U	63 U	25 U	13 U	2.0 U	240 U	130 U	74 U	5300 U	25 U	25 U
Aroclor 1221	10 U	52 U	11 U	4.0 U	130 U	51 U	26 U	4.0 U	490 U	260 U	150 U	11000 U	51 U	51 U
Aroclor 1232	5.2 U	26 U	5.3 U	2.0 U	63 U	25 U	13 U	2.0 U	240 U	130 U	74 U	5300 U	25 U	25 U
Aroclor 1242	5.2 U	26 U	5.3 U	2.0 U	63 U	25 U	13 U	2.0 U	240 U	130 U	74 U	5300 U	25 U	25 U
Aroclor 1248	5.2 U	26 U	5.3 U	2.0 U	63 U	25 U	13 U	2.0 U	240 U	130 U	74 U	5300 U	25 U	25 U
Aroclor 1254	51	26 U	5.3 U	2.0 U	460	25 U	13 U	2.0 U	240 U	130 U	740	5300 U	25 U	140
Aroclor 1260	5.2 U	270	45	2.0 U	63 U	330	280	2.0 U	1900	560	74 U	140000	330	25 U
Total PCBs	51	270	45	4.0 U	460	330	280	4.0 U	1900	560	740	140000	330	140

Legend

- WP-C-1 ● PCB Wipe Sampling Location and Designation October 2014
- SD-C-1 ● PCB Solid Debris Sampling Location and Designation October 2014
- SD-C-4 ▭ PCB Solid Debris Composite Sampling Location and Designation October 2014

Aroclor 1016 64 U — Sample Result (µg/wipe) or (µg/kg)

EPA Method 8082

Green = Compound Detected Above TSCA Screening Criterion of 50,000 µg/kg

U = Not Detected at Reported Concentration

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

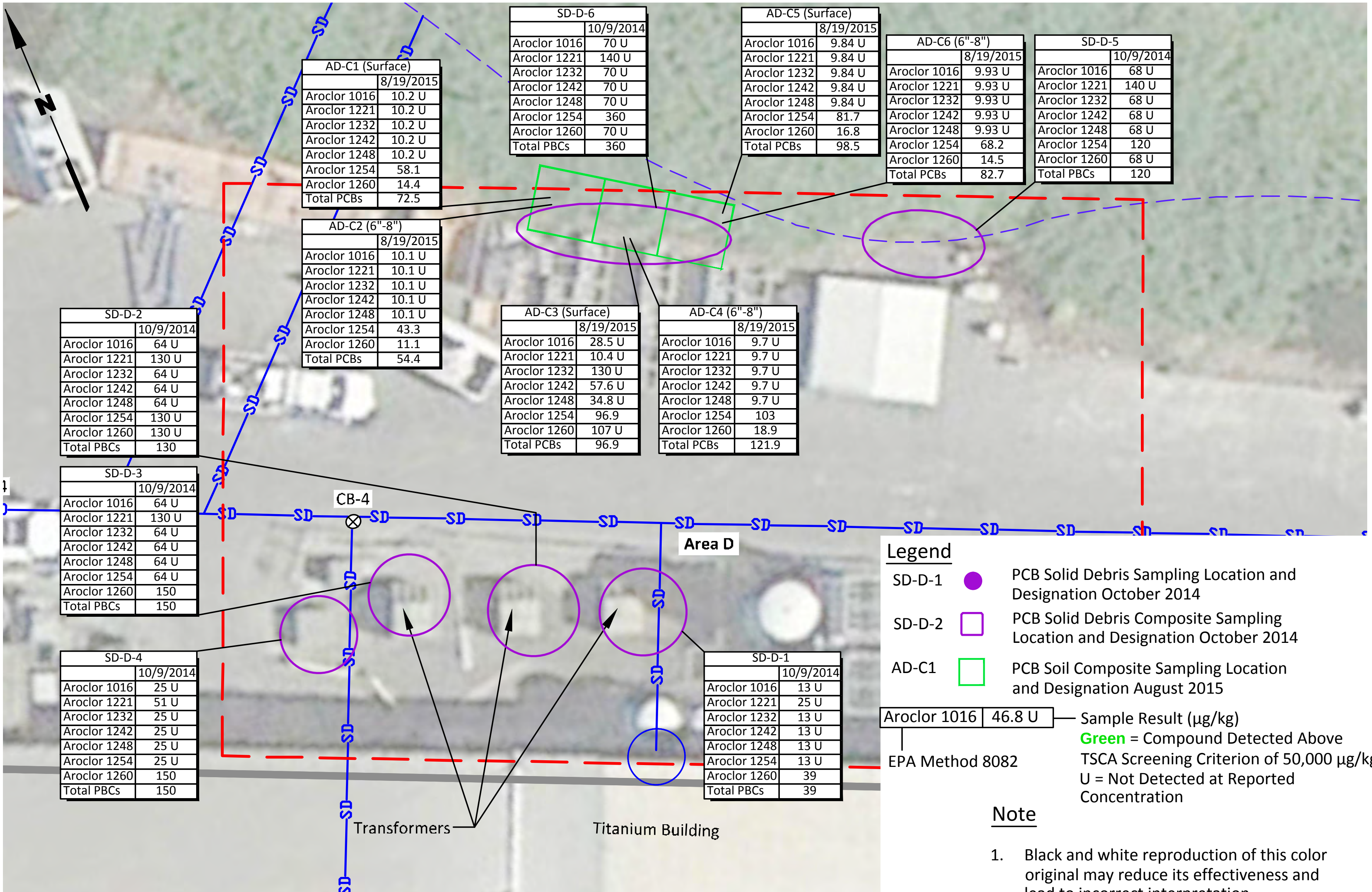
0 30 60
Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area C
PCB Analytical Results

Figure
5



SD-D-6	10/9/2014
Aroclor 1016	70 U
Aroclor 1221	140 U
Aroclor 1232	70 U
Aroclor 1242	70 U
Aroclor 1248	70 U
Aroclor 1254	360
Aroclor 1260	70 U
Total PBCs	360

AD-C5 (Surface)	8/19/2015
Aroclor 1016	9.84 U
Aroclor 1221	9.84 U
Aroclor 1232	9.84 U
Aroclor 1242	9.84 U
Aroclor 1248	9.84 U
Aroclor 1254	81.7
Aroclor 1260	16.8
Total PCBs	98.5

AD-C6 (6"-8")	8/19/2015
Aroclor 1016	9.93 U
Aroclor 1221	9.93 U
Aroclor 1232	9.93 U
Aroclor 1242	9.93 U
Aroclor 1248	9.93 U
Aroclor 1254	68.2
Aroclor 1260	14.5
Total PCBs	82.7

SD-D-5	10/9/2014
Aroclor 1016	68 U
Aroclor 1221	140 U
Aroclor 1232	68 U
Aroclor 1242	68 U
Aroclor 1248	68 U
Aroclor 1254	120
Aroclor 1260	68 U
Total PBCs	120

AD-C1 (Surface)	8/19/2015
Aroclor 1016	10.2 U
Aroclor 1221	10.2 U
Aroclor 1232	10.2 U
Aroclor 1242	10.2 U
Aroclor 1248	10.2 U
Aroclor 1254	58.1
Aroclor 1260	14.4
Total PCBs	72.5

AD-C2 (6"-8")	8/19/2015
Aroclor 1016	10.1 U
Aroclor 1221	10.1 U
Aroclor 1232	10.1 U
Aroclor 1242	10.1 U
Aroclor 1248	10.1 U
Aroclor 1254	43.3
Aroclor 1260	11.1
Total PCBs	54.4

SD-D-2	10/9/2014
Aroclor 1016	64 U
Aroclor 1221	130 U
Aroclor 1232	64 U
Aroclor 1242	64 U
Aroclor 1248	64 U
Aroclor 1254	130 U
Aroclor 1260	130 U
Total PBCs	130

AD-C3 (Surface)	8/19/2015
Aroclor 1016	28.5 U
Aroclor 1221	10.4 U
Aroclor 1232	130 U
Aroclor 1242	57.6 U
Aroclor 1248	34.8 U
Aroclor 1254	96.9
Aroclor 1260	107 U
Total PCBs	96.9

AD-C4 (6"-8")	8/19/2015
Aroclor 1016	9.7 U
Aroclor 1221	9.7 U
Aroclor 1232	9.7 U
Aroclor 1242	9.7 U
Aroclor 1248	9.7 U
Aroclor 1254	103
Aroclor 1260	18.9
Total PCBs	121.9

SD-D-3	10/9/2014
Aroclor 1016	64 U
Aroclor 1221	130 U
Aroclor 1232	64 U
Aroclor 1242	64 U
Aroclor 1248	64 U
Aroclor 1254	64 U
Aroclor 1260	150
Total PBCs	150

SD-D-4	10/9/2014
Aroclor 1016	25 U
Aroclor 1221	51 U
Aroclor 1232	25 U
Aroclor 1242	25 U
Aroclor 1248	25 U
Aroclor 1254	25 U
Aroclor 1260	150
Total PBCs	150

SD-D-1	10/9/2014
Aroclor 1016	13 U
Aroclor 1221	25 U
Aroclor 1232	13 U
Aroclor 1242	13 U
Aroclor 1248	13 U
Aroclor 1254	13 U
Aroclor 1260	39
Total PBCs	39

Source: © Google Earth Pro 2012; PCC 1989

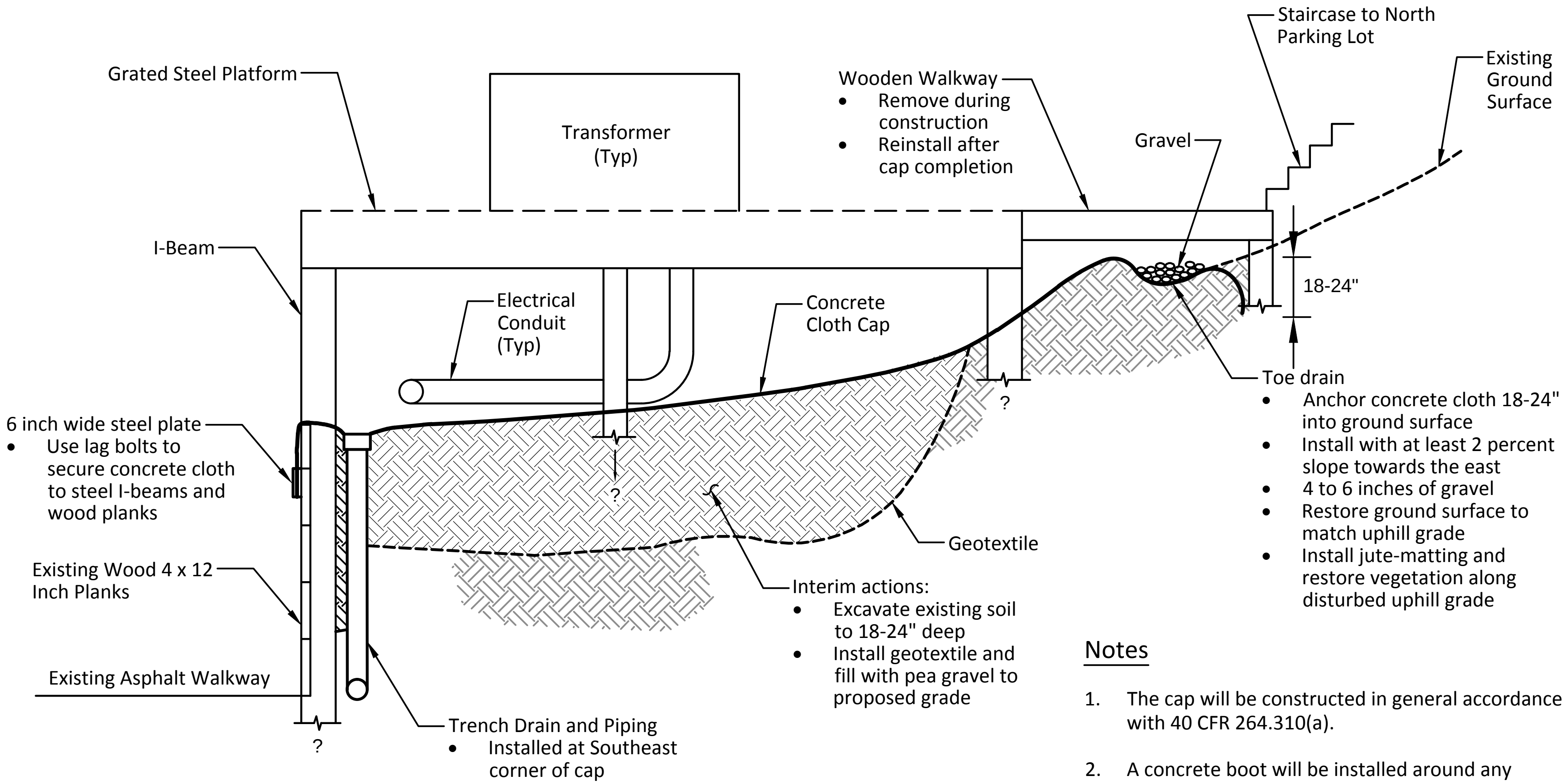
0 20 40
Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area D
PCB Analytical Results

Figure 6



Notes

1. The cap will be constructed in general accordance with 40 CFR 264.310(a).
2. A concrete boot will be installed around any concrete cloth penetrations.
3. Cap will be installed with at least a 2 percent slope downward toward the southeast trench drain.
4. Section shown typical; modify to accommodate conditions encountered.

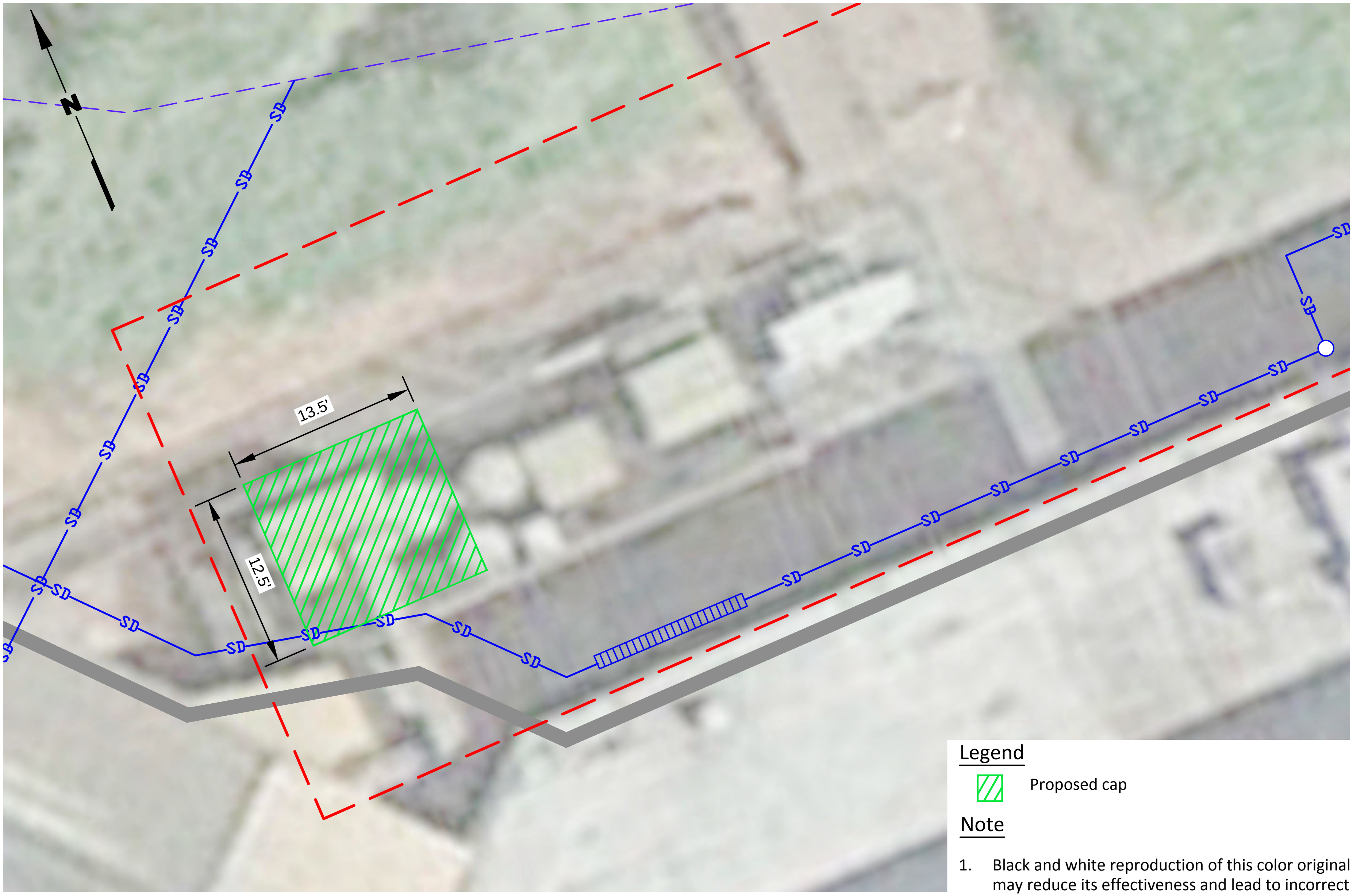
LANDAU ASSOCIATES

0 3 6
Approximate Scale in Feet

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area B West Cap Plan

Figure
7



Legend

Proposed cap

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

LANDAU ASSOCIATES

0 10 20
Scale in Feet

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area B West
Cap Plan - Plan View

Figure
8

Table 1
2014 Surface Debris and Wipe Sample PCB Analytical Results
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Sample Identification	SD-A-1	SD-A-2	SD-A-3	SD-A-4	SD-A-5	SD-A-6	SD-A-7	SD-A-8	SD-A-9	SD-B-1	SD-B-2	SD-B-3	SD-B-4
Lab Identifcation	250-291981-1	250-291981-2	250-291981-3	250-291981-4	250-291981-5	250-291981-6	250-291981-7	250-291981-8	250-291981-9	250-291981-13	250-291981-14	250-291981-15	250-291981-16
Sample Date	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014
Analysis Date	10/15/2014	10/15/2014	10/15/2014	10/15/2014	10/15/2014	10/15/2014	10/15/2014	10/15/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014
Polychlorinated Biphenyls (µg/kg)													
EPA Method 8082													
Aroclor 1016	64 U	1300 U	1700 U	2600 U	1400 U	140 U	6600 U	130 U	51 U	26 U	650 U	140 U	610 U
Aroclor 1221	130 U	2600 U	3300 U	5100 U	2800 U	280 U	13000 U	270 U	100 U	52 U	1300 U	290 U	1200 U
Aroclor 1232	64 U	1300 U	1700 U	2600 U	1400 U	140 U	6600 U	130 U	51 U	26 U	650 U	140 U	610 U
Aroclor 1242	64 U	1300 U	1700 U	2600 U	1400 U	140 U	6600 U	130 U	51 U	26 U	650 U	140 U	610 U
Aroclor 1248	64 U	1300 U	1700 U	2600 U	1400 U	140 U	6600 U	130 U	51 U	26 U	650 U	140 U	610 U
Aroclor 1254	**920**	**29000**	**18000**	**38000**	**28000**	**1700**	**120000**	**2600**	**910**	26 U	**8200**	**1400**	**2400**
Aroclor 1260	64 U	1300 U	1700 U	2600 U	1400 U	140 U	6600 U	130 U	51 U	**83**	650 U	140 U	610 U
Total PCBs (a)	**920**	**29000**	**18000**	**38000**	**28000**	**1700**	**120000**	**2600**	**910**	**83**	**8200**	**1400**	**2400**

Table 1
2014 Surface Debris and Wipe Sample PCB Analytical Results
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Sample Identification	SD-C-1	SD-C-2	SD-C-3	SD-C-4	SD-C-5	SD-C-6	SD-C-7	SD-C-8	SD-C-9	SD-C-10	SD-C-11	SD-D-1
Lab Identifcation	250-291981-17	250-291981-18	250-291981-19	250-291981-20	250-291981-21	250-291981-22	250-291981-23	250-291981-24	250-291981-25	250-291981-26	250-291981-27	250-291981-28
Sample Date	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/8/2014	10/9/2014
Analysis Date	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/16/2014	10/20/2014	10/16/2014	10/20/2014	10/17/2014
Polychlorinated Biphenyls (µg/kg)												
EPA Method 8082												
Aroclor 1016	240 U	5300 U	13 U	25 U	63 U	26 U	5.3 U	5.2 U	74 U	130 U	25 U	13 U
Aroclor 1221	490 U	11000 U	26 U	51 U	130 U	52 U	11 U	10 U	150 U	260 U	51 U	25 U
Aroclor 1232	240 U	5300 U	13 U	25 U	63 U	26 U	5.3 U	5.2 U	74 U	130 U	25 U	13 U
Aroclor 1242	240 U	5300 U	13 U	25 U	63 U	26 U	5.3 U	5.2 U	74 U	130 U	25 U	13 U
Aroclor 1248	240 U	5300 U	13 U	25 U	63 U	26 U	5.3 U	5.2 U	74 U	130 U	25 U	13 U
Aroclor 1254	240 u	5300 U	13 U	25 U	**460**	26 U	5.3 U	**51**	**740**	130 U	**140**	13 U
Aroclor 1260	**1900**	**140000**	**280**	**330**	63 U	**270**	**45**	5.2 U	74 U	**560**	25 U	**39**
Total PCBs (a)	**1900**	**140000**	**280**	**330**	**460**	**270**	**45**	**51**	**740**	**560**	**140**	**39**

Table 1
2014 Surface Debris and Wipe Sample PCB Analytical Results
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Sample Identification	SD-D-2	SD-D-3	SD-D-4	SD-D-5	SD-D-6	SD-E-1	SD-E-2	SD-E-3	SD-E-4	SD-E-5	SD-F-1	SD-F-2
Lab Identifcation	250-291981-29	250-291981-30	250-291981-31	250-291981-32	250-291981-33	250-291981-34	250-291981-35	250-291981-36	250-291981-37	250-291981-38	250-291981-39	250-291981-40
Sample Date	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014
Analysis Date	10/20/2014	10/17/2014	10/20/2014	10/17/2014	10/17/2014	10/20/2014	10/20/2014	10/17/2014	10/17/2014	10/17/2014	10/17/2014	10/17/2014
Polychlorinated Biphenyls (µg/kg)												
EPA Method 8082												
Aroclor 1016	64 U	64 U	25 U	68 U	70 U	660 U	4.9 U	10 U	2.7 U	5.7 U	12 U	5.0 U
Aroclor 1221	130 U	130 U	51 U	140 U	140 U	1300 U	9.9 U	21 U	5.4 U	11 U	25 U	9.9 U
Aroclor 1232	64 U	64 U	25 U	68 U	70 U	660 U	4.9 U	10 U	2.7 U	5.7 U	12 U	5.0 U
Aroclor 1242	64 U	64 U	25 U	68 U	70 U	660 U	4.9 U	10 U	2.7 U	5.7 U	12 U	5.0 U
Aroclor 1248	64 U	64 U	25 U	68 U	70 U	660 U	4.9 U	10 U	2.7 U	5.7 U	12 U	5.0 U
Aroclor 1254	130 U	64 U	25 U	**120**	**360**	660 U	4.9 U	10 U	2.7 U	5.7 U	**56**	5.0 U
Aroclor 1260	130 U	**150**	**150**	68 U	70 U	660 U	**6.8**	**16**	**14**	**15**	12 U	**29**
Total PCBs (a)	130 U	**150**	**150**	**120**	**360**	660 U	**6.8**	**16**	**14**	**15**	**56**	**29**

Table 1
2014 Surface Debris and Wipe Sample PCB Analytical Results
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Sample Identification	SD-F-3	SD-F-4	SD-F-5	SD-F-6	SD-G-1	SD-H-1	SD-H-2	SD-H-3	WP-A-1 (b)	WP-C-1 (b)	WP-C-2 (b)
Lab Identifcation	250-291981-41	250-291981-42	250-291981-43	250-291981-44	250-291981-45	250-291981-46	250-291981-47	250-291981-48	250-291981-10	250-291981-11	250-291981-12
Sample Date	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/9/2014	10/8/2014	10/8/2014	10/8/2014
Analysis Date	10/17/2014	10/17/2014	10/17/2014	10/17/2014	10/17/2014	10/17/2014	10/20/2014	10/20/2014	10/15/2014	10/15/2014	10/15/2014
Polychlorinated Biphenyls (µg/kg)											
EPA Method 8082											
Aroclor 1016	4.9 U	9.9 U	5.0 U	25 U	12 U	10 U	11 U	9.9 U	2.0 U	2.0 U	2.0 U
Aroclor 1221	9.9 U	20 U	9.9 U	50 U	25 U	20 U	22 U	20 U	4.0 U	4.0 U	4.0 U
Aroclor 1232	4.9 U	9.9 U	5.0 U	25 U	12 U	10 U	11 U	9.9 U	2.0 U	2.0 U	2.0 U
Aroclor 1242	4.9 U	9.9 U	5.0 U	25 U	12 U	10 U	11 U	9.9 U	2.0 U	2.0 U	2.0 U
Aroclor 1248	4.9 U	9.9 U	5.0 U	25 U	12 U	10 U	11 U	9.9 U	2.0 U	2.0 U	2.0 U
Aroclor 1254	**10**	**25**	**15**	**71**	**18**	**26**	**30**	**66**	**8.6**	2.0 U	2.0 U
Aroclor 1260	4.9 U	9.9 U	5.0 U	25 U	12 U	10 U	11 U	9.9 U	2.0 U	2.0 U	2.0 U
Total PCBs (a)	**10**	**25**	**15**	**71**	**18**	**26**	**30**	**66**	**8.6**	4.0 U	4.0 U

Bold = Detected compound
Box = Detected above the EPA remediation waste threshold criterion of 50,000 µg/kg
EPA = United States Environmental Protection Agency
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
µg/kg = micrograms per kilogram
µg/wipe = micrograms per wipe
PCB = polychlorinated biphenyls
U = The compound was not detected at the reported concentration
(a) Total PCB concentration is the sum of individual detected PCB Aroclors
(b) Units in µg/wipe

Table 2
August 2015 Upland Soil PCB Analytical Results
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

	AA-C1 A5H0542-01 8/19/2015	AA-C2 A5H0542-02 8/19/2015	AA-CC A5H0542-03 8/19/2015	ABE-C1 A5H0552-01 8/20/2015	ABE-C2 A5H0552-02 8/20/2015	ABE-C3 A5H0552-03 8/20/2015	ABE-C4 A5H0552-04 8/20/2015	ABE-C5 A5H0552-05 8/20/2015	ABE-C6 A5H0552-06 8/20/2015	ABW-C1 A5H0542-04 8/19/2015	ABW-C2 A5H0542-05 8/19/2015
Polychlorinated Biphenyls (µg/kg) **EPA Method 8082**											
Aroclor 1016	46.8 U	484 U	2070 U	25.3 U	5.12 U	94.2 U	27.2 U	48.3 U	53.6 U	1900 U	2620 U
Aroclor 1221	46.8 U	484 U	2070 U	25.3 U	5.12 U	94.2 U	27.2 U	48.3 U	53.6 U	1900 U	2620 U
Aroclor 1232	46.8 U	484 U	2070 U	25.3 U	5.12 U	94.2 U	27.2 U	48.3 U	53.6 U	1900 U	2620 U
Aroclor 1242	46.8 U	484 U	2070 U	25.3 U	5.12 U	94.2 U	27.2 U	48.3 U	53.6 U	1900 U	2620 U
Aroclor 1248	46.8 U	484 U	2070 U	25.3 U	5.12 U	94.2 U	27.2 U	48.3 U	53.6 U	1900 U	2620 U
Aroclor 1254	**746**	**17300**	**54000**	**1620 J**	**255 J**	**6860 J**	**1180 J**	**2350 J**	**2110 J**	**101000**	**117000**
Aroclor 1260	**256**	484 U	2070 U	**290 J**	**105 J**	**1750 J**	**304 J**	**674 J**	**562 J**	1900 U	2620 U
Total PCBs (a)	**1002**	**17300**	**54000**	**1910 J**	**360 J**	**8610 J**	**1484 J**	**3024 J**	**2672 J**	**101000**	**117000**

	ABW-C3 A5H0542-06 8/19/2015	ABW-C4 A5H0542-07 8/19/2015	ABW-C5 A5H0542-08 8/19/2015	ABW-C6 A5H0542-09 8/19/2015	ABW-C7 A5H0542-10 8/19/2015	ABW-C8 A5H0542-11 8/19/2015	AD-C1 A5H0542-12 8/19/2015	AD-C2 A5H0542-13 8/19/2015	AD-C3 A5H0542-14 8/19/2015	AD-C4 A5H0542-15 8/19/2015	AD-C5 A5H0542-16 8/19/2015	AD-C6 A5H0542-17 8/19/2015
Polychlorinated Biphenyls (µg/kg) **EPA Method 8082**												
Aroclor 1016	9.49 U	9.91 U	203 U	216 U	96.7 U	106 U	10.2 U	10.1 U	28.5 U	9.70 U	9.84 U	9.93 U
Aroclor 1221	9.49 U	9.91 U	203 U	216 U	96.7 U	106 U	10.2 U	10.1 U	10.4 U	9.70 U	9.84 U	9.93 U
Aroclor 1232	9.49 U	9.91 U	203 U	216 U	96.7 U	106 U	10.2 U	10.1 U	130 U	9.70 U	9.84 U	9.93 U
Aroclor 1242	9.49 U	9.91 U	203 U	216 U	96.7 U	106 U	10.2 U	10.1 U	57.6 U	9.70 U	9.84 U	9.93 U
Aroclor 1248	9.49 U	9.91 U	203 U	216 U	96.7 U	106 U	10.2 U	10.1 U	34.8 U	9.70 U	9.84 U	9.93 U
Aroclor 1254	**63.0**	**90.4**	**3610**	**9670**	**1230**	**1570**	**58.1**	**43.3**	**96.9**	**103**	**81.7**	**68.2**
Aroclor 1260	**28.5**	**42.0**	**614**	216 U	**218**	**281**	**14.4**	**11.1**	107 U	**18.9**	**16.8**	**14.5**
Total PCBs (a)	**91.5**	**132.4**	**4224**	**9670**	**1448**	**1851**	**72.5**	**54.4**	**96.9**	**121.9**	**98.5**	**82.7**

Bold = Detected compound

Box = Detected above the EPA remediation waste threshold criterion of 50,000 µg/kg

EPA = United States Environmental Protection Agency

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

µg/kg = micrograms per kilogram

PCB = polychlorinated biphenyls

U = The compound was not detected at the reported concentration

(a) Total PCBs is the sum of individual detected PCB Aroclors

APPENDIX A

Interim Soil Removal Measure – Area B West

Technical Memorandum

TO: Dave Bartus - U.S. Environmental Protection Agency, Region 10

cc: Chris Myers, PCC Structurals, Inc.

FROM: Della Fawcett, RG and Jay P. Bower, PE

DATE: July 18, 2016

RE: **Interim Soil Removal Measure – Area B West**
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon
Project No. 883002.040.044

Introduction

This technical memorandum (memorandum) has been prepared on behalf of PCC Structurals, Inc. (PCC) to document the interim soil removal measure conducted at Area B West located at PCC's Large Parts Campus, 4600 SE Harney Drive in Portland, Oregon. The scope of work for the interim removal is described in the April 19, 2016 PCB Self-Implementing Interim Cleanup Plan (LAI 2016).

The purpose of conducting this interim soil removal measure was to remove soil that contained elevated concentrations of polychlorinated biphenyls (PCBs) in the area identified as Area B West (Figure 1). This area is beneath transformer assemblies that are located on metal grated decking. High-voltage lines associated with the transformers are direct-buried (i.e., without conduit) in the soil beneath the metal grated decking. Soil excavation beneath the transformers could only be safely conducted when the surrounding electrical system and associated equipment were de-energized; therefore, this interim soil removal measure was conducted to coincide with an annual PCC-scheduled transformer shutdown on April 23, 2016.

Interim Measure Activities

On April 23, 2016, an interim soil removal measure was conducted within the westernmost portion of Area B West, where the concentrations of total PCBs exceeding 100,000 micrograms per kilogram (µg/kg) were identified in August 2015 (Figure 2). Photographs of the interim soil removal measure are provided in Appendix A. During this interim measure, which was conducted to coincide with scheduled transformer and associated electrical equipment shutdown, the following activities were completed:

- The locations of the direct-buried, high-voltage electrical lines were visually marked on the soil surface the day prior to the equipment shutdown. Soil within 2 feet (ft) of the identified high-voltage electrical lines was not graded or removed, to avoid any potential damage to the high-voltage lines.

- Soil within the westernmost area (approximately 12.5 ft by 13.5 ft area) of Area B West was removed to a maximum depth of 18 inches below ground surface. Approximately 11 cubic yards of soil were removed.
- No soil with visible staining was observed during the removal.
- Two post-removal confirmation samples were collected for subsequent analysis (sampling approach discussed further below). Soil confirmation samples were collected using a clean stainless-steel spoon. The samples were homogenized in a clean stainless-steel bowl, placed into 8-ounce glass sample jars, labeled, and stored on ice.
- Limited grading was completed west of the removed area (but not within 2 ft of the identified high-voltage electrical lines) to promote drainage away from Area B West.

Confirmation sampling was performed as follows. A grid pattern was established across the surface of the western portion of Area B West to support collection of composite samples that would be representative of average concentrations of PCBs in soil at the newly-exposed soil surface. Because of the limited size of the area where soil was removed, a similar grid pattern approach as that used for the August 2015 sampling of Area B West (as discussed with U.S. Environmental Protection Agency [EPA] on August 18, 2015) was utilized to collect confirmation samples.

The excavation area was divided into nine sub-grids, and discrete samples from within each of the sub-grids were collected from the newly-exposed surface. The discrete soil samples were then thoroughly combined in a stainless steel bowl, and two composite soil samples from the mixture (ABW-C9 and ABW-C10) were prepared for analysis (i.e., one primary and one replicate sample). The composite samples were sent to Apex Laboratories of Tigard, Oregon, (a licensed laboratory) under chain-of-custody procedures for analysis by EPA Method 8082 for PCB Aroclors.

Analytical Results

The analytical data were reviewed for quality assurance purposes through EPA equivalent Level IIa data validation. The results of the review indicate that data were acceptable for investigation purposes, and no qualification of the data was necessary. Laboratory reports are provided in Appendix B.

The analytical results from this interim soil removal measure are summarized in Table 1. Total PCB Aroclors were detected in both composite soil samples ABW-C9 and ABW-C10 at concentrations of 42,100 µg/kg and 46,300 µg/kg, respectively.

Following soil removal and confirmation sampling, the area of excavation was backfilled, graded to promote drainage, and temporarily “capped” as follows: a nonwoven filter fabric was placed over the excavation area to serve as a demarcation layer between the new soil surface and the backfill. Clean pea gravel was placed on top of the filter fabric to a final grade that promoted surface drainage to the east (i.e., parallel to the retaining wall, following the pre-excavation drainage pattern). The pea gravel was covered with a 30 millimeter high density polyethylene liner material to prevent surface water infiltration and promote drainage. This "cap" is considered temporary and will be replaced with a more permanent cap following approval of the design by EPA.

Limitations

This technical memorandum has been prepared for the exclusive use of PCC Structurals, Inc. and regulatory agencies providing oversight on the work. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates, Inc. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, Inc., shall be at the user's sole risk. Landau Associates, Inc. warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.

Della M Fawcett

Della Fawcett, RG
Senior Project Geologist

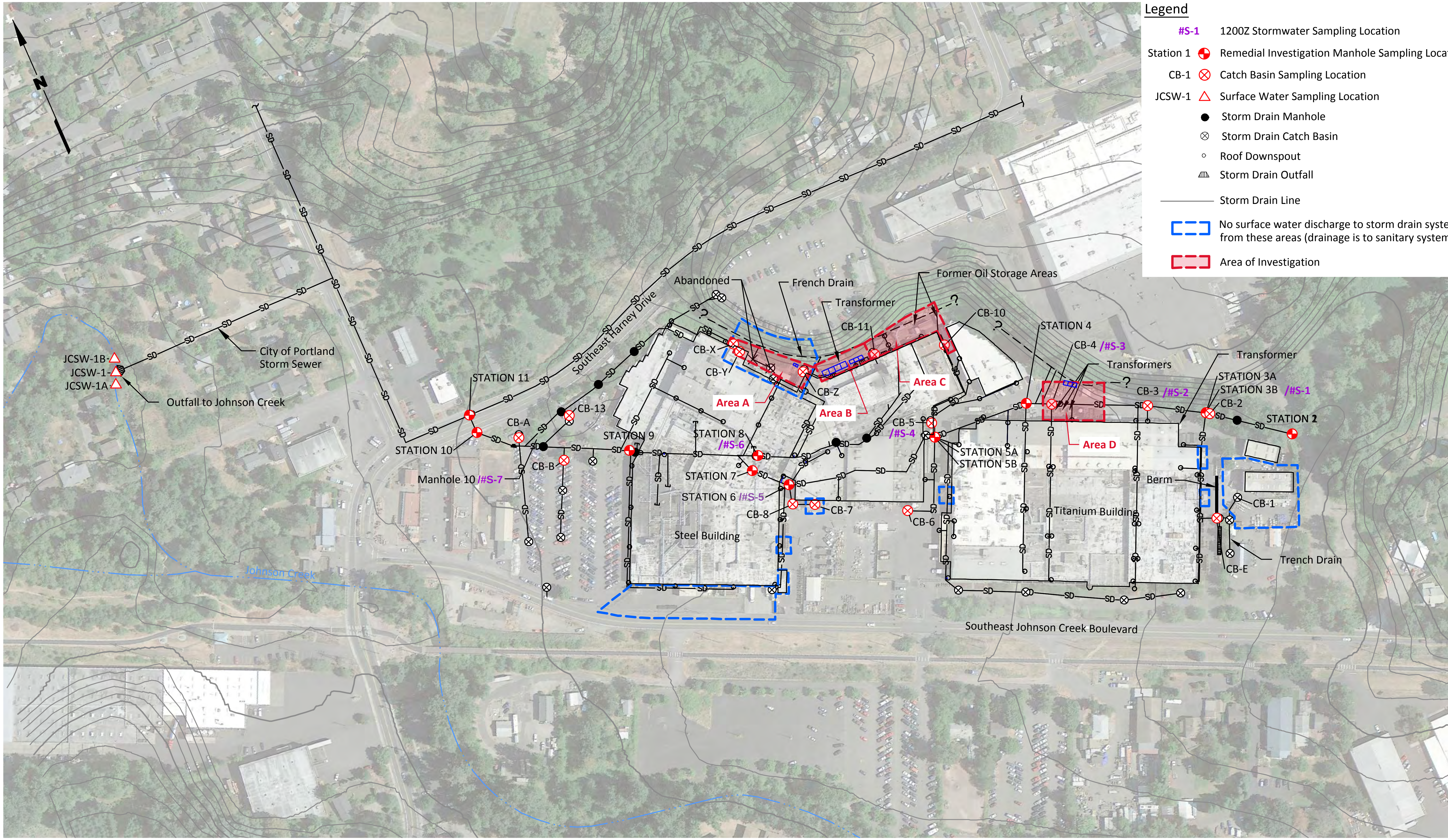
Jay P. Bower, PE
Principal

DMF/JPB/JAF/jln
I:\Projects\883\002\FileRm\R\040\Upland PCBs\April 2015 Area B West TM\Technical Memorandum Area B West Remove_71816.docx

Attachments: Figure 1 – PCB Source Area Investigation Sampling Locations
Figure 2 – Area B West PCB Analytical Results
Table 1 – Interim Soil Removal Measure Analytical Results – Area B West
Appendix A – Selected Site Photographs
Appendix B – Soil Laboratory Report

References

LAI. 2016. PCB Self-Implementation Interim Cleanup Plan, PCC Large Parts Campus, Portland Oregon. Portland, Oregon: Landau Associates, Inc.



Source: © Google Earth Pro 2012; PCC 1989

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400

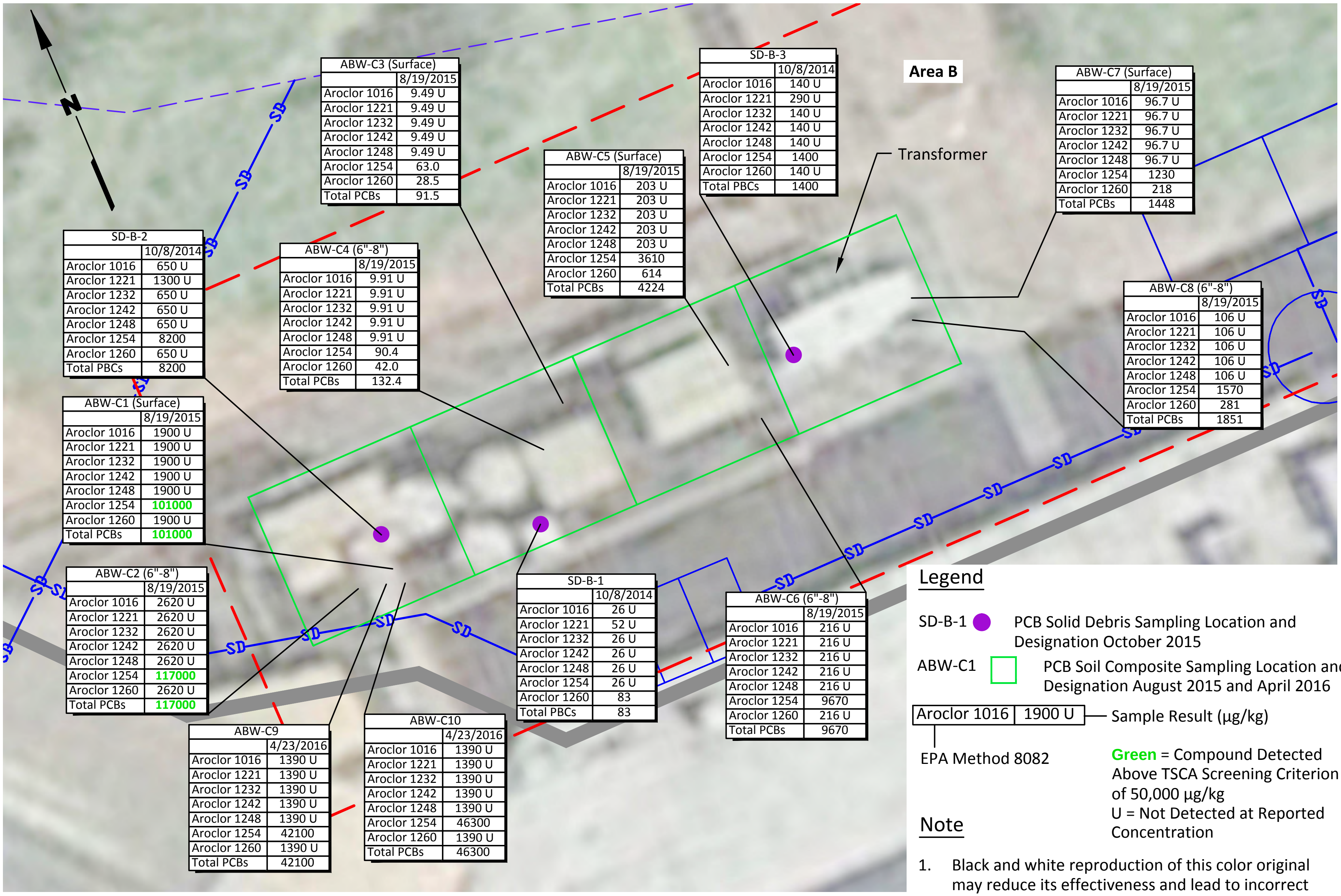
Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

PCB Source Area Investigation Sampling Locations

Figure 1



ABW-C3 (Surface)	8/19/2015
Aroclor 1016	9.49 U
Aroclor 1221	9.49 U
Aroclor 1232	9.49 U
Aroclor 1242	9.49 U
Aroclor 1248	9.49 U
Aroclor 1254	63.0
Aroclor 1260	28.5
Total PCBs	91.5

SD-B-3	10/8/2014
Aroclor 1016	140 U
Aroclor 1221	290 U
Aroclor 1232	140 U
Aroclor 1242	140 U
Aroclor 1248	140 U
Aroclor 1254	1400
Aroclor 1260	140 U
Total PBCs	1400

ABW-C7 (Surface)	8/19/2015
Aroclor 1016	96.7 U
Aroclor 1221	96.7 U
Aroclor 1232	96.7 U
Aroclor 1242	96.7 U
Aroclor 1248	96.7 U
Aroclor 1254	1230
Aroclor 1260	218
Total PCBs	1448

ABW-C5 (Surface)	8/19/2015
Aroclor 1016	203 U
Aroclor 1221	203 U
Aroclor 1232	203 U
Aroclor 1242	203 U
Aroclor 1248	203 U
Aroclor 1254	3610
Aroclor 1260	614
Total PCBs	4224

SD-B-2	10/8/2014
Aroclor 1016	650 U
Aroclor 1221	1300 U
Aroclor 1232	650 U
Aroclor 1242	650 U
Aroclor 1248	650 U
Aroclor 1254	8200
Aroclor 1260	650 U
Total PBCs	8200

ABW-C4 (6"-8")	8/19/2015
Aroclor 1016	9.91 U
Aroclor 1221	9.91 U
Aroclor 1232	9.91 U
Aroclor 1242	9.91 U
Aroclor 1248	9.91 U
Aroclor 1254	90.4
Aroclor 1260	42.0
Total PCBs	132.4

ABW-C8 (6"-8")	8/19/2015
Aroclor 1016	106 U
Aroclor 1221	106 U
Aroclor 1232	106 U
Aroclor 1242	106 U
Aroclor 1248	106 U
Aroclor 1254	1570
Aroclor 1260	281
Total PCBs	1851

ABW-C1 (Surface)	8/19/2015
Aroclor 1016	1900 U
Aroclor 1221	1900 U
Aroclor 1232	1900 U
Aroclor 1242	1900 U
Aroclor 1248	1900 U
Aroclor 1254	101000
Aroclor 1260	1900 U
Total PCBs	101000

ABW-C2 (6"-8")	8/19/2015
Aroclor 1016	2620 U
Aroclor 1221	2620 U
Aroclor 1232	2620 U
Aroclor 1242	2620 U
Aroclor 1248	2620 U
Aroclor 1254	117000
Aroclor 1260	2620 U
Total PCBs	117000

SD-B-1	10/8/2014
Aroclor 1016	26 U
Aroclor 1221	52 U
Aroclor 1232	26 U
Aroclor 1242	26 U
Aroclor 1248	26 U
Aroclor 1254	26 U
Aroclor 1260	83
Total PBCs	83

ABW-C6 (6"-8")	8/19/2015
Aroclor 1016	216 U
Aroclor 1221	216 U
Aroclor 1232	216 U
Aroclor 1242	216 U
Aroclor 1248	216 U
Aroclor 1254	9670
Aroclor 1260	216 U
Total PCBs	9670

ABW-C9	4/23/2016
Aroclor 1016	1390 U
Aroclor 1221	1390 U
Aroclor 1232	1390 U
Aroclor 1242	1390 U
Aroclor 1248	1390 U
Aroclor 1254	42100
Aroclor 1260	1390 U
Total PCBs	42100

ABW-C10	4/23/2016
Aroclor 1016	1390 U
Aroclor 1221	1390 U
Aroclor 1232	1390 U
Aroclor 1242	1390 U
Aroclor 1248	1390 U
Aroclor 1254	46300
Aroclor 1260	1390 U
Total PCBs	46300

Legend

SD-B-1 ● PCB Solid Debris Sampling Location and Designation October 2015

ABW-C1 □ PCB Soil Composite Sampling Location and Designation August 2015 and April 2016

Aroclor 1016 | 1900 U — Sample Result (µg/kg)

EPA Method 8082

Green = Compound Detected Above TSCA Screening Criterion of 50,000 µg/kg

U = Not Detected at Reported Concentration

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © Google Earth Pro 2012; PCC 1989

0 10 20

Scale in Feet

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Area B West
PCB Analytical Results

Figure
2

Table 1
Interim Soil Removal Measure Analytical Results
Area B West - April 2016
PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Sample Identification Lab Identifcation Sample Date Analysis Date	ABW-C9 A6E0074-01 4/23/2016 5/7/2016	ABW-C10 A6E0074-02 4/23/2016 5/7/2016
Polychlorinated Biphenyls (µg/kg) EPA Method 8082		
Aroclor 1016	1,390 U	1,390 U
Aroclor 1221	1,390 U	1,390 U
Aroclor 1232	1,390 U	1,390 U
Aroclor 1242	1,390 U	1,390 U
Aroclor 1248	1,390 U	1,390 U
Aroclor 1254	**42,100**	**46,300**
Aroclor 1260	1,390 U	1,390 U
Total PCBs (a)	**42,100**	**46,300**

(a) Total PCBs is the sum of individual detected PCB Aroclors
U = The compound was not detected at the reported concentration
Bold = Detected compound
EPA = U.S. Environmental Protection Agency
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyls

APPENDIX A

Selected Site Photographs

1. Looking northwest under the transformer platform following utility locating and prior to excavation activities.

2. Looking east following excavation of the westernmost grid of Area B West.

3. Looking northwest at the westernmost sampling grid in Area B West.

4. Looking west at the westernmost grid in Area B West. Unexcavated area surrounding the underground utilities is visible in the background.

LANDAU ASSOCIATES

PCC Structurals, Inc. Large Parts Campus Portland, Oregon	**Selected Site Photographs**	Figure A-2

5. Composite sample preparation from the nine discrete grid sampling locations.

6. Looking west at the limited grading of Area B West for drainage.

APPENDIX B

Soil Laboratory Report

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Tuesday, May 10, 2016

Della Fawcett
Landau Associates
333 SW 5th Ave. Suite 700
Portland, OR 97204

RE: PCC LPC / 883002.040.

Enclosed are the results of analyses for work order A6E0074, which was received by the laboratory on 5/3/2016 at 3:26:00PM.

Thank you for using Apex Labs. We appreciate your business and strive to provide the highest quality services to the environmental industry.

If you have any questions concerning this report or the services we offer, please feel free to contact me by email at: ldomenighini@apex-labs.com, or by phone at 503-718-2323.

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

ANALYTICAL REPORT FOR SAMPLES

SAMPLE INFORMATION

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ABW-C9	A6E0074-01	Soil	04/23/16 13:40	05/03/16 15:26
ABW-C10	A6E0074-02	Soil	04/23/16 13:40	05/03/16 15:26

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

ANALYTICAL SAMPLE RESULTS

Polychlorinated Biphenyls -- EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
ABW-C9 (A6E0074-01RE1)			**Matrix: Soil**		**Batch: 6050128**			**C-07**
Aroclor 1016	ND	---	1390	ug/kg dry	400	05/07/16 12:29	EPA 8082A	
Aroclor 1221	ND	---	1390	"	"	"	"	
Aroclor 1232	ND	---	1390	"	"	"	"	
Aroclor 1242	ND	---	1390	"	"	"	"	
Aroclor 1248	ND	---	1390	"	"	"	"	
Aroclor 1254	**42100**	---	1390	"	"	"	"	
Aroclor 1260	ND	---	1390	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)		*Recovery: 122 %*	*Limits: 44-111 %*		"	"	"	*S-01*
ABW-C10 (A6E0074-02RE1)			**Matrix: Soil**		**Batch: 6050128**			**C-07**
Aroclor 1016	ND	---	1370	ug/kg dry	400	05/07/16 13:05	EPA 8082A	
Aroclor 1221	ND	---	1370	"	"	"	"	
Aroclor 1232	ND	---	1370	"	"	"	"	
Aroclor 1242	ND	---	1370	"	"	"	"	
Aroclor 1248	ND	---	1370	"	"	"	"	
Aroclor 1254	**46300**	---	1370	"	"	"	"	
Aroclor 1260	ND	---	1370	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)		*Recovery: 118 %*	*Limits: 44-111 %*		"	"	"	*S-01*

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

ANALYTICAL SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
ABW-C9 (A6E0074-01)			**Matrix: Soil**		**Batch: 6050156**			
% Solids	**75.8**	---	1.00	% by Weight	1	05/06/16 08:04	EPA 8000C	
ABW-C10 (A6E0074-02)			**Matrix: Soil**		**Batch: 6050156**			
% Solids	**76.4**	---	1.00	% by Weight	1	05/06/16 08:04	EPA 8000C	

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

QUALITY CONTROL (QC) SAMPLE RESULTS

Polychlorinated Biphenyls -- EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 6050128 - EPA 3546							**Soil**					
Blank (6050128-BLK1)						Prepared: 05/05/16 07:06	Analyzed: 05/05/16 16:43					**C-07**
EPA 8082A												
Aroclor 1016	ND	---	1.29	ug/kg wet	1	---	---	---	---	---	---	
Aroclor 1221	ND	---	1.29	"	"	---	---	---	---	---	---	
Aroclor 1232	ND	---	1.29	"	"	---	---	---	---	---	---	
Aroclor 1242	ND	---	1.29	"	"	---	---	---	---	---	---	
Aroclor 1248	ND	---	1.29	"	"	---	---	---	---	---	---	
Aroclor 1254	ND	---	1.29	"	"	---	---	---	---	---	---	
Aroclor 1260	ND	---	1.29	"	"	---	---	---	---	---	---	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 102 %*	*Limits: 44-111 %*		*Dilution: 1x*						
LCS (6050128-BS1)						Prepared: 05/05/16 07:06	Analyzed: 05/05/16 17:01					**C-07**
EPA 8082A												
Aroclor 1016	163	---	4.00	ug/kg wet	1	250	---	65	47-134%	---	---	
Aroclor 1260	241	---	4.00	"	"	"	---	96	53-140%	---	---	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 98 %*	*Limits: 44-111 %*		*Dilution: 1x*						

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

QUALITY CONTROL (QC) SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Batch 6050156 - Total Solids (Dry Weight) **Soil**

No Client related Batch QC samples analyzed for this batch. See notes page for more information.

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

SAMPLE PREPARATION INFORMATION

Polychlorinated Biphenyls -- EPA 8082A

Prep: EPA 3546

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 6050128							
A6E0074-01RE1	Soil	EPA 8082A	04/23/16 13:40	05/05/16 07:22	15.14g/2mL	10g/2mL	0.66
A6E0074-02RE1	Soil	EPA 8082A	04/23/16 13:40	05/05/16 07:22	15.26g/2mL	10g/2mL	0.66

Percent Dry Weight

Prep: Total Solids (Dry Weight)

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 6050156							
A6E0074-01	Soil	EPA 8000C	04/23/16 13:40	05/05/16 14:36	1N/A/1N/A	1N/A/1N/A	NA
A6E0074-02	Soil	EPA 8000C	04/23/16 13:40	05/05/16 14:36	1N/A/1N/A	1N/A/1N/A	NA

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

Notes and Definitions

Qualifiers:

C-07	Extract has undergone Sulfuric Acid Cleanup by EPA 3665A, Sulfur Cleanup by EPA 3660B, and Florisil Cleanup by EPA 3620B in order to minimize matrix interference.
S-01	Surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interference.

Notes and Conventions:

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis. Results listed as 'wet' or without 'dry'designation are not dry weight corrected.
RPD	Relative Percent Difference
MDL	If MDL is not listed, data has been evaluated to the Method Reporting Limit only.
WMSC	Water Miscible Solvent Correction has been applied to Results and MRLs for volatiles soil samples per EPA 8000C.
Batch QC	Unless specifically requested, this report contains only results for Batch QC derived from client samples included in this report. All analyses were performed with the appropriate Batch QC (including Sample Duplicates, Matrix Spikes and/or Matrix Spike Duplicates) in order to meet or exceed method and regulatory requirements. Any exceptions to this will be qualified in this report. Complete Batch QC results are available upon request. In cases where there is insufficient sample provided for Sample Duplicates and/or Matrix Spikes, a Lab Control Sample Duplicate (LCS Dup) is analyzed to demonstrate accuracy and precision of the extraction and analysis.
Blank Policy	Apex assesses blank data for potential high bias down to a level equal to ½ the method reporting limit (MRL), except for conventional chemistry and HCID analyses which are assessed only to the MRL. Sample results flagged with a B or B-02 qualifier are potentially biased high if they are less than ten times the level found in the blank for inorganic analyses or less than five times the level found in the blank for organic analyses. For accurate comparison of volatile results to the level found in the blank; water sample results should be divided by the dilution factor, and soil sample results should be divided by 1/50 of the sample dilution to account for the sample prep factor. Results qualified as reported below the MRL may include a potential high bias if associated with a B or B-02 qualified blank. B and B-02 qualifications are not applied to J qualified results reported below the MRL.
---	QC results are not applicable. For example, % Recoveries for Blanks and Duplicates, % RPD for Blanks, Blank Spikes and Matrix Spikes, etc.
***	Used to indicate a possible discrepancy with the Sample and Sample Duplicate results when the %RPD is not available. In this case, either the Sample or the Sample Duplicate has a reportable result for this analyte, while the other is Non Detect (ND).

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

LANDAU ASSOCIATES

☐ Seattle/Edmonds (425) 778-0907
☐ Tacoma (253) 926-2493
☐ Spokane (509) 327-9737
☒ Portland (503) 542-1080
☐

A6E0074

Chain-of-Custody Record

Date 4/23/2016
Page 1 of 1

Project Name PCC LPC   Project No. 883002.040
Project Location/Event PCC
Sampler's Name DMF
Project Contact DMF
Send Results To dfawcett@landauinc.com

Testing Parameters

Turnaround Time
~~Standard~~ X
☐ Accelerated
X 5 DAY

Sample I.D.	Date	Time	Matrix	No. of Containers	PCBs
ABW-C9	4/23/16	1340	SOIL	1	X
ABW-C10	↓	1340	SOIL	1	X

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion
X NWTPH-Dx - run acid wash/silica gel cleanup
___ run samples standardized to ___ product
___ Analyze for EPH if no specific product identified
VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt
___ Dissolved metal water samples field filtered
Other ___

Special Shipment/Handling or Storage Requirements: DIRECT BILL TO PCC

Method of Shipment

Relinquished by	Received by	Relinquished by	Received by
Signature: Della Fawcett	Signature: [signature]	Signature	Signature
Printed Name: Della Fawcett	Printed Name: Adam Peterson	Printed Name	Printed Name
Company: LAI	Company: Apex	Company	Company
Date: 5/3/2016 Time: 1526	Date: 5-3-16 Time: 15:26	Date Time	Date Time

WHITE COPY - Project File   YELLOW COPY - Laboratory   PINK COPY - Client Representative

Rev 8/09

Landau Associates	Project: **PCC LPC**	
333 SW 5th Ave. Suite 700	Project Number: 883002.040.	**Reported:**
Portland, OR 97204	Project Manager: Della Fawcett	05/10/16 08:57

APEX LABS COOLER RECEIPT FORM

Client: Landau Element WO#: A6 E0074

Project/Project #: PCC LPC / 883002-040

Delivery info:

Date/Time Received: 5-3-16 @ 15:26 By: ATP

Delivered by: Apex Courier___ Client X FedEx___ UPS___ Swift___ Senvoy___ SDS___ Other___

Cooler Inspection Inspected by: ATP : 5-3-16 @ 19:05

Chain of Custody Included? Yes X No ___

Signed/Dated by Client? Yes X No ___

Signed/Dated by Apex? Yes X No ___

	Cooler #1	Cooler #2	Cooler #3	Cooler #4	Cooler #5	Cooler #6	Cooler #7
Temperature (deg. C)	4.6						
Received on Ice? (Y/N)							
Temp. Blanks? (Y/N)							
Ice Type: (Gel/Real/Other)							
Condition:	good						

Cooler out of temp? (Y/N) Possible reason why: ___
If some coolers are in temp and some out, were green dot applied to out of temperature samples Yes/No/NA

Samples Inspection: Inspected by: [illegible] : 8:16 @ 5/4/16

All Samples Intact? Yes X No ___ Comments: ___

Bottle Labels/COCs agree? Yes X No ___ Comments: ___

Containers Appropriate for Analysis? Yes X No ___ Comments: ___

Do VOA Vials have Visible Headspace? Yes ___ No ___ NA X

Comments ___

Water Samples: pH Checked and Appropriate (except VOAs): Yes___No___NA X

Comments: ___

Additional Information: ___

Labeled by: [illegible] Cooler Inspected by: KT See Project Contact Form: Y

APPENDIX B

Proposed Concrete Cloth Specifications

CONCRETE CANVAS®

Concrete Impregnated Fabric

1510.EN.IG

MADE IN UK

CONCRETECANVAS

INSTALLATION GUIDE: REMEDIATION

RAIL ROAD MINING PETROCHEM AGRO UTILITIES MUNICIPAL DEFENCE DESIGN

2014 Fast Track 100 16th fastest growing company in the UK.

2014 Queen's Award for Enterprise in Innovation

2013 Macrobert Award Finalist

2013 Innovation Award Winner Railtex Exhibition

2012 R&D 100 Award winner R&D Magazine

2011 Expert's Choice Winner Most Innovative Product

2011 Brit Insurance Designs of the Year Nominee

2009 Winner Material Connexion Medium Award Material of the Year

2007 Winner D&AD Yellow Pencil Award Product Design

INSTALLATION GUIDE: REMEDIATION

Concrete Canvas® GCCM* (CC) can be used to create a hard wearing surface as an effective remediation for old or damaged concrete. CC is typically used where existing concrete structures have experienced cracking or spalling, and would otherwise require extensive repair or complete replacement.

The following guide provides information for installers, customers and specifiers of CC and an overview of the installation techniques required for using CC for concrete remediation. The versatile nature of CC means that this document is not exhaustive and is intended for guidance purposes only.

Here are some key questions you may need to consider before specifying or purchasing CC.

Which Thickness?

CC is available in three thicknesses; CC5™ (5mm), CC8™ (8mm), and CC13™ (13mm).

- CC5™ is most commonly used to line concrete structures that will not be regularly trafficked (e.g. by maintenance contractors). CC5™ is the most commonly specified thickness for concrete remediation projects.
- CC8 and CC13™ are recommended for remediating water courses with high flow rates, areas of highly turbulent flow (e.g. the base of a weir), where there is expected to be regular traffic, or when lining access points.

Which Format?

CC is available as large bulk rolls (1.5T to 1.6T) or as smaller man-portable batched rolls (60-70kg CC5™ & CC8™ only). Installation is fastest using bulk rolls dispensed using a spreader beam (available for hire/purchase from Concrete Canvas Ltd). For sites where heavy lifting equipment is not available or access is limited the batched, man-portable rolls should be used. See the table below for exact specifications.

CC Type	Thickness (mm)	Roll Width (m)	Dry Weight (kg/sqm)	Batched Roll Coverage (sqm)	Batched Roll Length (m)	Bulk Roll Coverage (sqm)	Bulk Roll Length (m)
CC5™	5	1.0	7	10	10	200	200
CC8™	8	1.1	12	5	4.55	125	114
CC13™	13	1.1	19	N/A	N/A	80	73

Table 1

Batched rolls

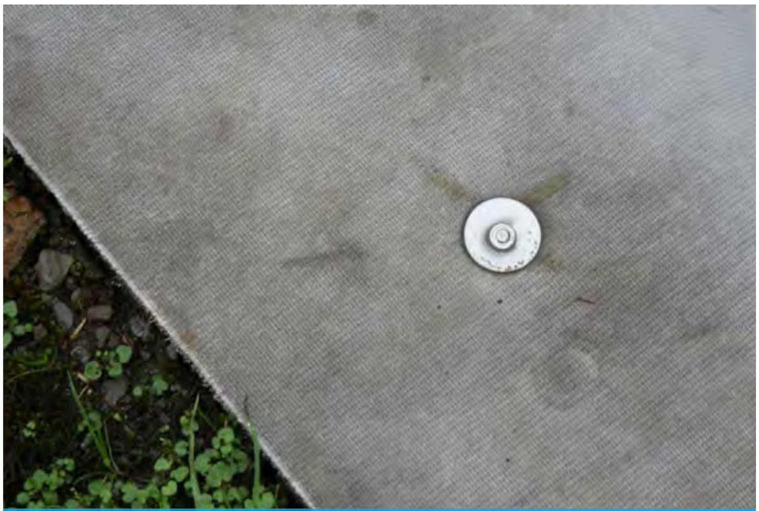

Bulk roll

*Geosynthetic Cementitious Composite Mat

Which Fixing Method?

When installing over a smooth, rigid substrate such as poured/pre-cast concrete or asphalt, CC must be firmly anchored to the substrate to mitigate the potential effects of drying shrinkage. The most secure method for fixing the end of a length of CC is with a poured concrete anchor trench. Where this is not practical, appropriate concrete fixings such as fired concrete 'Hilti' nails, wedge anchors or masonry bolts can be used (see figure 1).

CC captured with a poured concrete curb



CC anchored using a fired concrete nail with a 20mm washer

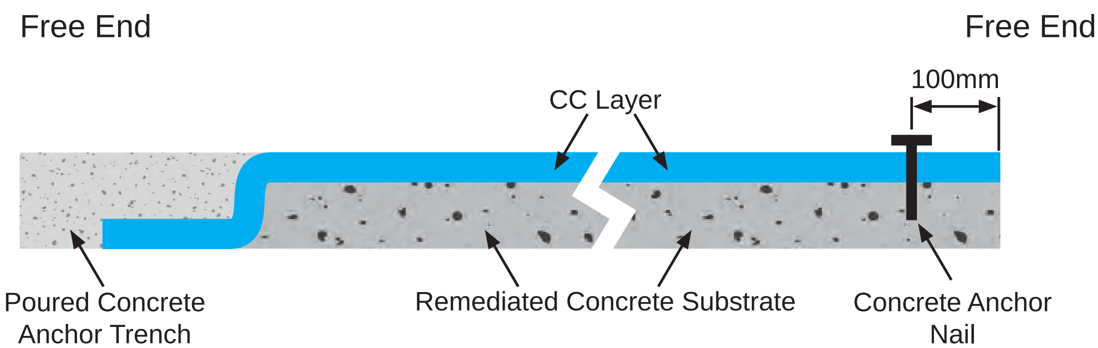


Figure 1. Typical installation of a continuous long section of CC over an extensive concrete substrate. Where anchoring is required either poured concrete anchor trenching or concrete anchor nailing may be used as appropriate

The following rules should be followed to determine the location of fixings:

1. Fixings are required at the 'free-ends' of all lengths of CC.

2. Intermediate fixings are required at a 'concave profile change' when the distance from the profile change to the next fixing is greater than 5m. The fixings should be located approximately 100mm from the profile change (see examples below).

+44 (0) 345 680 1908 info@concretecanvas.com www.concretecanvas.com

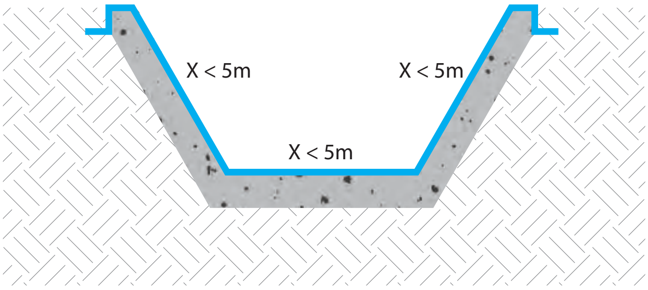


Figure 2.1 Fixing only of free ends.

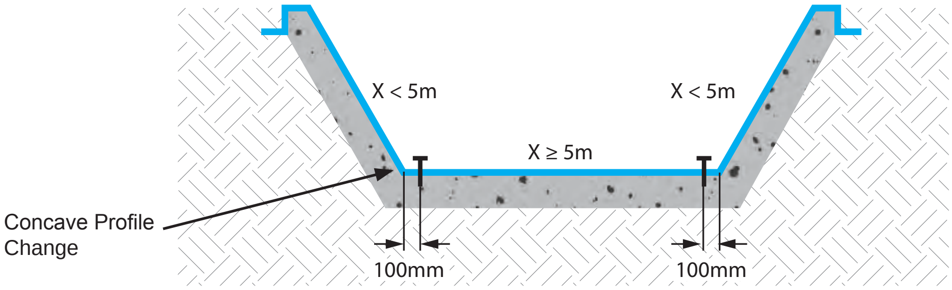


Figure 2.2 Base ≥ 5m fixing at 100mm from concave profile change.

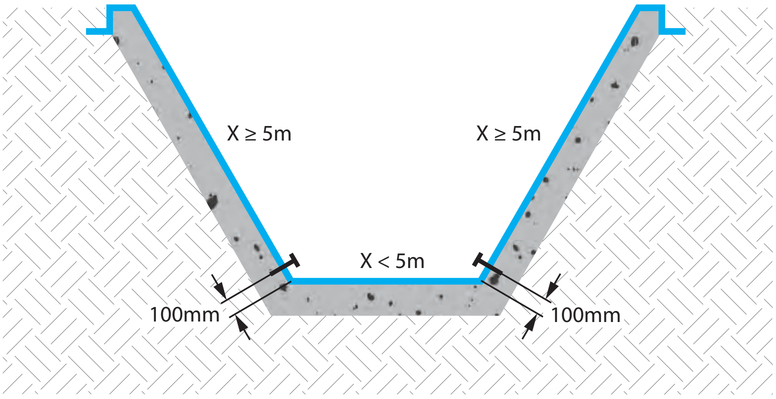


Figure 2.3 Sides ≥ 5m fixing at 100mm from concave profile change.

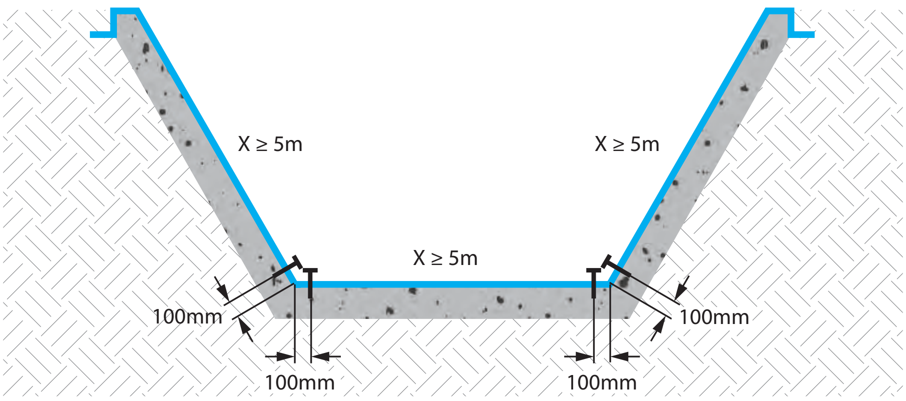


Figure 2.4
Sides and base ≥ 5m fixing at 100mm from both sides of concave profile change.

Fixing Specification

- CC must always be fixed with a poured concrete anchor trench or in accordance with the following:
- The fixings must have a shank Ø>3mm, washer Ø>16mm.
- The minimum number of fixings required for a given thickness of CC is shown in table 2.
- More fixings may be required as a sufficient number of fixings must be used to withstand a total shear force (V_{REC}/m) per 1m width of CC, as shown in the table 2 below. See fixing manufacturers specification for V_{REC} per fixing in a given strength of concrete.
- The fixings should be 100mm from the end of the CC or the apex of the concave profile change.

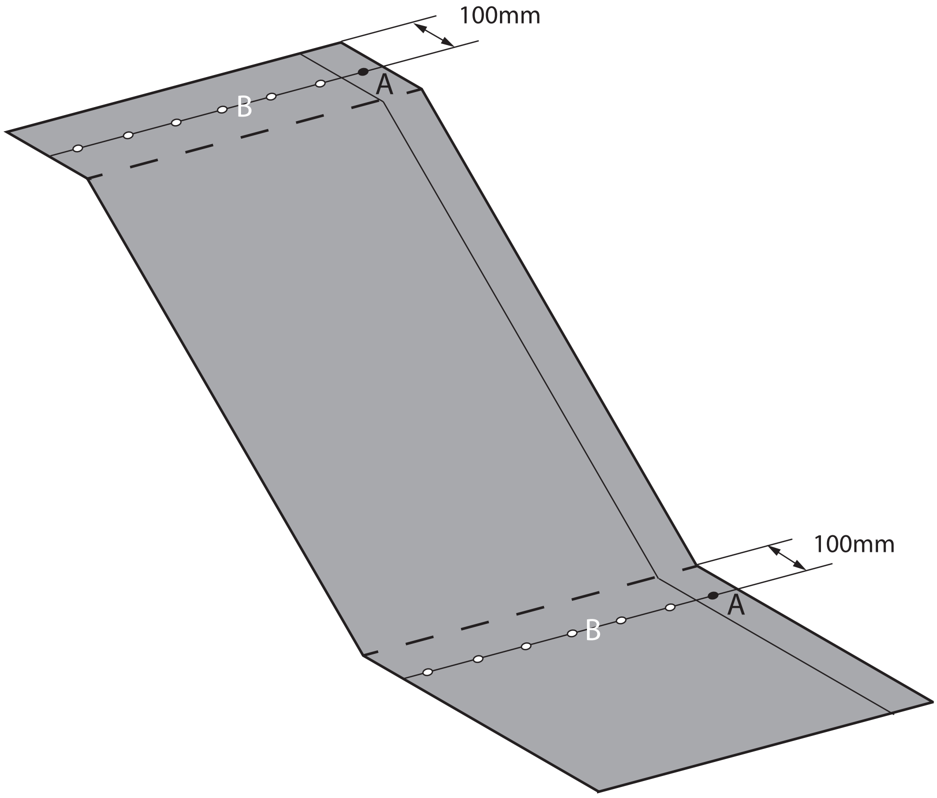
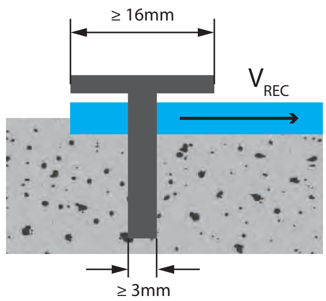


Figure 3. Anchoring at terminal ends and at concave profile changes, should include a fixing through the overlap joint abutting the adjacent strip of CC (A) and the number of fixings (B) shown in the table 2 below for the thickness of CC, equally spaced across the remaining width.

	Number of Fixings (A)	(B)	V_{REC}/width (total shear force per width of CC - A + B)
CC5™	1	5	8 kN
CC8™	1	7	16 kN
CC13™	1	9	25 kN
Total profile length <3.0m (CC5, CC8, CC13)	1	3	N/A

Table 2. Minimum bolt requirements for the three CC thicknesses', and their total shear capacity. Ensure sufficient fixings are used to resist hydraulic sheer forces resulting from peak designed flow velocity (Mannings No. n = 0.011). Additional fixings may be required in areas of turbulent flow.



For example: to fix a width of CC8™ to a 20MPa concrete structure. Table 1 shows a minimum of 1 fixing through the 100mm overlap joint (A) and a minimum of 7 fixings through the body of the CC. It is proposed to use Hilti DBZ 6/35 Wedge Anchors as these have a 6mm shank and a 16mm washer. The Design Resistance (V_{REC}) of this fixing in 20MPa concrete is 2.2kN and table 2 shows a total shear force requirement of 16kN per 1.1m width of CC. Therefore: 16kN/2.2kN = 7.3 fixings required per width of CC8™. 7.3 is rounded up to give a total of 8 fixings that will be required: 1 through the joint (A) and 7 evenly spaced through the body of the CC (B).

Ensure sufficient fixings are used to resist the hydraulic shear force resulting from the peak design flow velocity. (mannings no n=0.011). Additional fixings may be required in areas of turbulent flow.

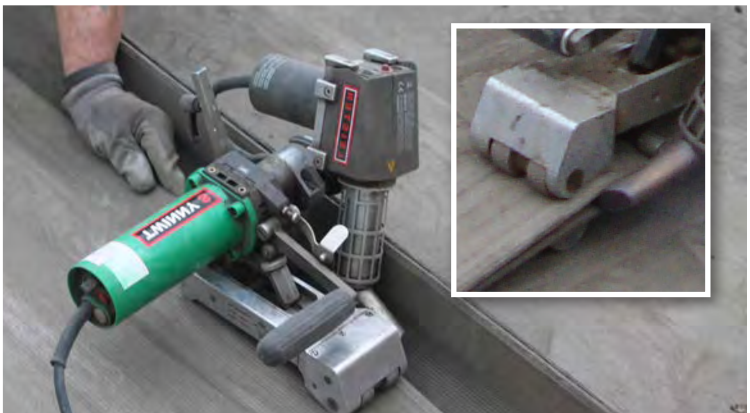
Which Jointing Method?

Adjacent layers of CC should be overlapped by a minimum of 100mm in the direction of water flow and CC can be jointed in the in the length or width direction along the overlap using masonary fixings, adhesive sealant, grout or by thermal welding. Typically an adhesive sealant joint is used for remediation applications. Please see the CC *User Guide: Jointing and Fixing* for the full range of jointing methods available.

Masonry fixings

Double bead of adhesive sealant

Grouted joint applied using a hand tool



Automatic thermal welding machine

Installation

1. Ground Preparation

Failing concrete must be cleaned and mortar applied to larger cracks (typically anything larger than 50mm in any direction) to eliminate voids under the CC. Any loose soil, rocks, concrete debris, and vegetation should be removed.

2. Laying CC

Unroll the CC onto the surface to be remediated, with the fibrous surface facing up and the PVC membrane in contact with the ground. Tuck the CC into any corners, ensuring there is intimate contact with the substrate - once in position cut the material to length.

3. Positioning and Fixing

Ensure a minimum overlap of 100mm in the direction of water flow when jointing adjacent layers of CC. Apply fixings as per the guidance above.

4. Jointing

Adhesive sealant is the most commonly used method of jointing for remediation projects. *See CC User Guide: Jointing and Fixing* for detailed instructions and alternative jointing methods. Where possible CC should be hydrated under the overlaps prior to jointing.

5. Hydration

Once positioned, CC should be hydrated by spraying with water (sea water may be used). Refer to the CC *Hydration Guide* for full hydration and setting instructions.

CONCRETE CANVAS

DATA SHEET

Concrete Canvas® GCCM Material Data

Concrete Canvas® GCCM Physical Properties*

Product	Thickness (mm)	Batch Roll Size (sqm)	Bulk Roll Size (sqm)	Roll Width (m)
CC5™	5	10	200	1.0
CC8™	8	5	125	1.1
CC13™	13	N/A	80	1.1

Product	Mass (unset) (kg/m²)	Density (unset) (kg/m³)	Density (set) (kg/m³)
CC5™	7	1500	+30-35%
CC8™	12	1500	+30-35%
CC13™	19	1500	+30-35%

Pre-Set Concrete Canvas® GCCM Properties

Setting

Working Time
1-2 hours subject to ambient temperature
CC will achieve 80% strength at 24 hours after hydration.

Method of Hydration

Spray the fibre surface with water until it feels wet to touch for several minutes after spraying.

Re-spray the CC again after 1 hour if:
- Installing CC5™
- Installing on a steep or vertical surface

Notes:
- An excess of water is always recommended. CC will set underwater and in seawater.
- CC must be actively hydrated. For example do not rely on rainfall or snowmelt.
- Use a spray nozzle for the best results (see CC equipment list). Do not jet high pressure water directly onto the CC as this may wash a channel in the unset CC.
- CC has a working time of 1-2 hours after hydration. Do not move or traffic CC once it has begun to set.
- Working time will be reduced in hot climates and increased in very cold climates.
- CC will set hard in 24 hours but will continue to gain strength over time.
- If CC is not sufficiently wetted, or dries out in the first 5 hours, the set may be delayed and strength reduced. If the set is delayed avoid trafficking the material and re-wet with an excess of water.

Refer to the *Concrete Canvas Hydration Guide* for installation in low temperatures or drying conditions.

- Low Temperature Conditions occur the ground surface temperature is between 0 and 5°C and rising or is expected to fall below 0°C in the 8 hours following hydration.
- Drying Conditions occur when there is one or more of: high air temperature (>22°C), wind (> 12km/h), strong direct sunlight or low humidity (<70%).

Post Set Concrete Canvas® GCCM Properties

Based on Concrete Canvas GCCM ® hydrated in accordance with the Concrete Canvas® Hydration Guide.

Strength

Very high early strength is a fundamental characteristic of CC. Typical strengths and characteristics are as follows:

Compressive tests based on ASTM C109 – 02 (initial crack)
- 10 day compressive failure stress (MPa) — 40

Bending tests based on BS EN 12467:2004 (initial crack)
- 10 day bending failure stress (MPa) — 3.4

Tensile data (initial crack)

	Length direction (kN/m)	Width direction (kN/m)
CC5™	6.7	3.8
CC8™	8.6	6.6
CC13™	19.5	12.8

Reaction to Fire

CC has achieved **Euroclass B certification**:
BS EN 13501-1:2007+A1:2009 — B-s1, d0

Flame Resistance: **MSHA ASTP-5011**
Vertical and Horizontal Certification — Passed

Age Testing (minimum 50 year expected life)

Freeze-Thaw testing (ASTM C1185)	200 Cycles
Freeze-Thaw testing (BS EN 12467:2004 part 7.4.1)	Passed
Soak-Dry testing (BS EN 12467:2004 part 5.5.5)	Passed
Heat-Rain testing (BS EN 12467:2004 part 7.4.2)	Passed
Water impermeability (BS EN 12467:2004 part 5.4.4)	Passed**

Other

Abrasion Resistance (ASTM C-1353)
Approximately 7.5x greater than 17MPa OPC — Passed

Manning's Value (ASTM D6460) — n = 0.011

Root Resistance (DD CEN/TS 14416:2005) — Passed

Chemical Resistance (BS EN 14414)
- Acid (pH 1.0) (56 day immersion at 50°C) — Passed
- Alkaline (pH 13.0) (56 day immersion at 50°C) — Passed
- Hydrocarbon (56 day immersion at 50°C) — Passed
- Sulfate Resistance (28 day immersion at pH 7.2) — Passed

Impact Resistance of Pipeline Coatings
ASTM G13 (CC13™ only) — Passed

Permissible Shear & Velocity CC8™ (ASTM D-6460)
- Shear (Pa) — 1200
- Velocity (m/s) — 10.7

Product exceeded large scale testing capabilities and was not tested to failure.

To achieve these permissible values, the CC material must be properly anchored with a system designed to meet or exceed these values.

Other Information

* Occasionally there will be a Beam Fault (fabric imperfection under 100mm wide running across the width) in a Bulk Roll. This fault is unavoidable due to the manufacturing process and the fault will be clearly marked with a white tag, there will be a maximum of (1) one Beam Fault in any Bulk Roll. A joint may need to be made on site where there is a Beam Fault as the material at a fault will not reach the performance specified in this Data Sheet. The maximum un-useable material due to any Beam Fault will be 100mm. There are no beam faults in standard batched rolls.

* Indicative values

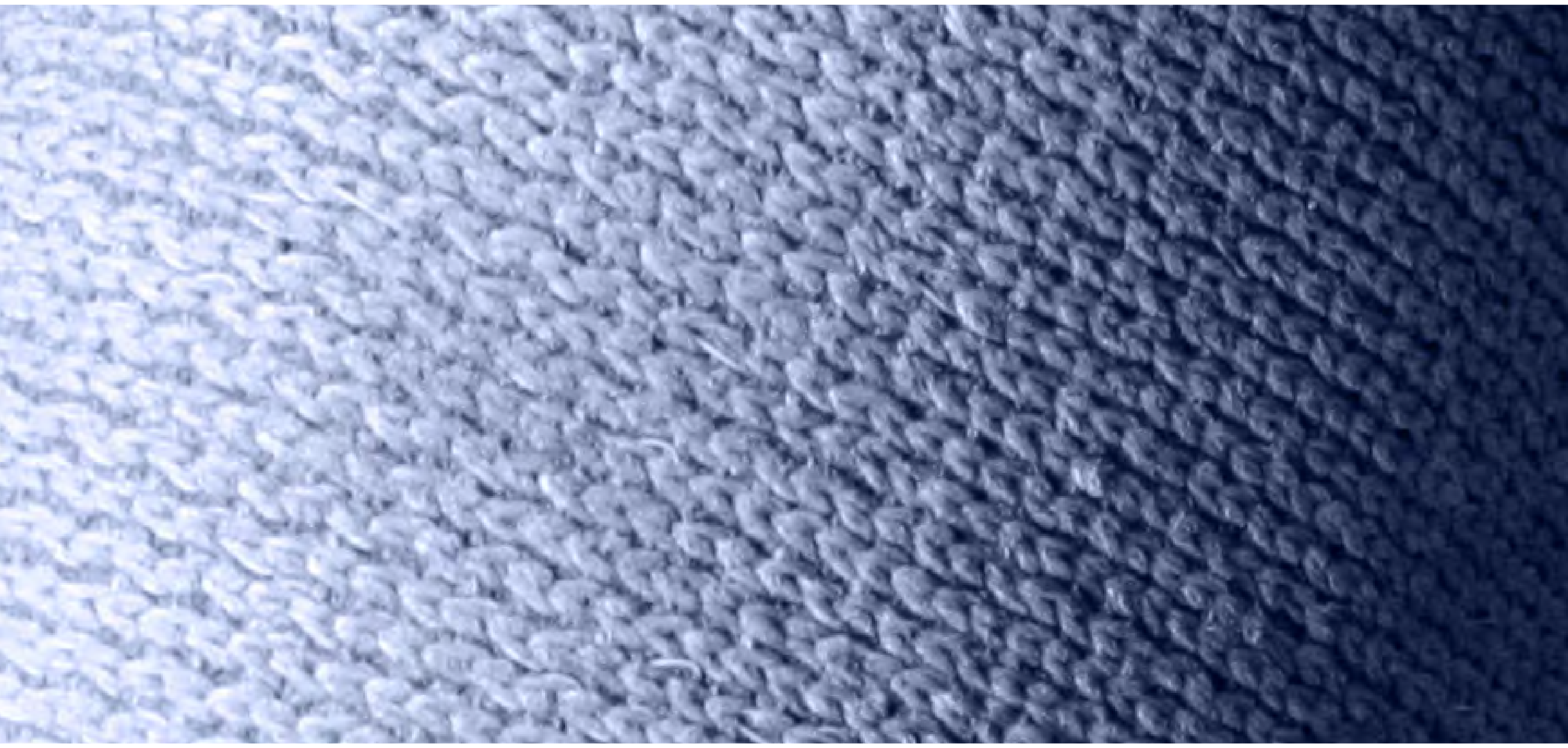
** For containment applications it is recommended to use CC Hydro™

The information contained herein is offered free of charge and is, to the best of our knowledge, accurate. However, since the circumstances and conditions in which such information and the products discussed therein can be used may vary and are beyond our control, we make no warranty, express or implied, of merchantability, fitness or otherwise, or against patent infringement, and we accept no liability, with respect to or arising from use of such information or any such product.

CE
Concrete Canvas Ltd.
CF37 5SP, United Kingdom
11
EN12467:2004
Concrete Canvas:
Fibre cement sheet
NT
Oversize sheets
Class 1, Category A
Reaction to Fire B-s1,d0

14.06.UK

MADE IN UK



CONCRETE CANVAS™

Concrete Impregnated Fabric...

HYDROCARBON IMPERMEABILITY TESTING

ROAD RAIL AGRO POWER PETROCHEM MINING DESIGN OTHER

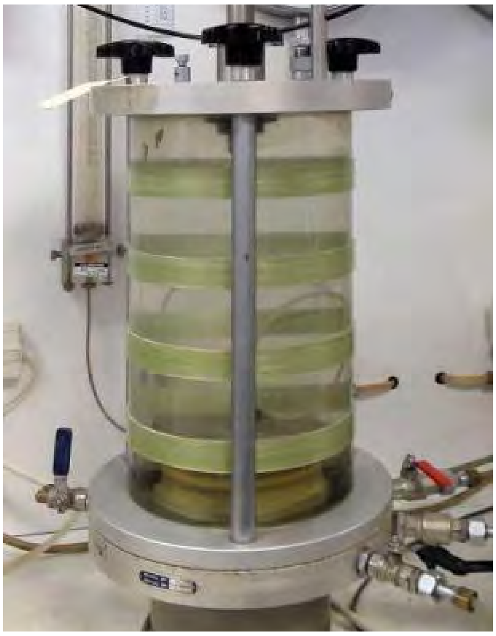
www.concretecanvas.com

Hydrocarbon Impermeability Testing

Based on testing to BS EN 1377 : Part 6 : Clause 6 : 1990 “Determination of Permeability in a Triaxial Cell”.

Concrete Canvas GCCM (Geosynthetic Cementitious Composite Mat) products have been independently tested by Geolabs Ltd UK, to assess the effect of exposure to hydrocarbons on the permeability of 5mm Concrete Canvas GCCL (CC5). The test method used is based on BS EN EN 1377: Part 6: Clause 6: 1990 “Determination of Permeability in a Triaxial Cell”.

The test method involves placing a fully cured sample of CC5 of diameter 100mm and thickness 5mm into a triaxial cell. The cell was loaded with a fluid (in this case water or Benzine*) and then pressurised in order to measure the flow perpendicular to the CC5 disc. Three samples of CC5 were tested using water and three samples of CC5 using Benzine over a period of up to 2 days.



Summary of Results

	Test 1	Test 2	Test 3
CC5 - Water k (m/s)	$1.0x10^{-11}$	$1.3x10^{-11}$	$2.6x10^{-10}$
CC5 - Benzine k (m/s)	$3.0x10^{-11}$	$8.1x10^{-11}$	$2.1x10^{-10}$

Previous testing of the impermeability of CC5, CC8 and CC13 conducted using a large number of samples has shown that Concrete Canvas GCCM can be classified as ‘impervious’ with water proofing properties similar to clay. This is equivalent to an average coefficient of impermeability of $k=1x10^{-9}$ m/s.

The above tests have shown that CC5 when tested for impermeability to Benzine has a k value equivalent to, or better than, $k=1x10^{-9}$ m/s.

* Commercially available unleaded petrol

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 1	Cured CC5 product
Permeant:	Petrol	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in unleaded Petrol under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	101.2	101.2
Height	*mm*	5.1	5.1
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.89	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	0.1

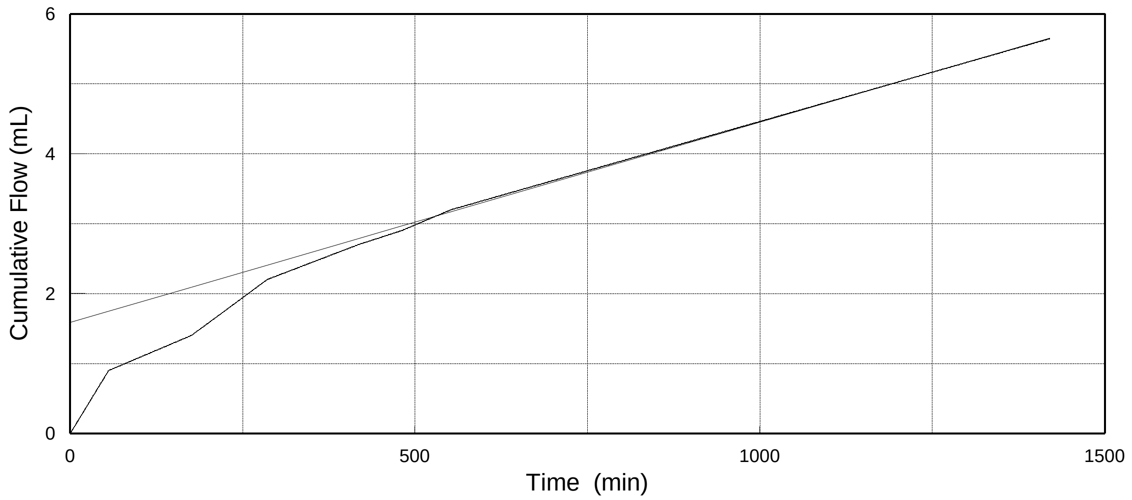
PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20ºC =

3.0×10^{-11} m/s

Hydraulic Gradient = 199.6

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2



The quoted permeability is equivalent to 0.4 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved	Project Number:	**GEO / 21090**
Initials: RJP	Project Name:	**4.5.1CC Chemical Resistance - 56 Day**
Date: 20/05/14		

UKAS TESTING 1982

GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 2	Cured CC5 product
Permeant:	Petrol	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in unleaded Petrol under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	100.4	100.4
Height	*mm*	5.2	5.2
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.91	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	0.1

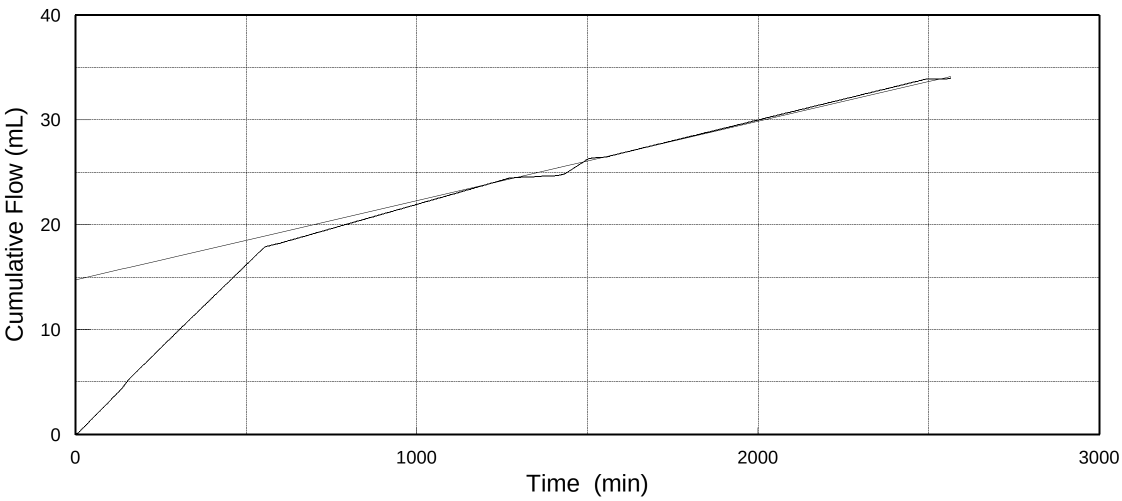
PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20ºC =

8.1×10^{-11} m/s

Hydraulic Gradient = 197.9

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2



The quoted permeability is equivalent to 0.9 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved Initials: RJP Date: 20/05/14	Project Number: **GEO / 21090** Project Name: **4.5.1CC Chemical Resistance - 56 Day**	GEOLABS®

UKAS TESTING 1982

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 3	Cured CC5 product
Permeant:	Petrol	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in unleaded Petrol under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	100.4	100.4
Height	*mm*	5.2	5.2
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.91	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

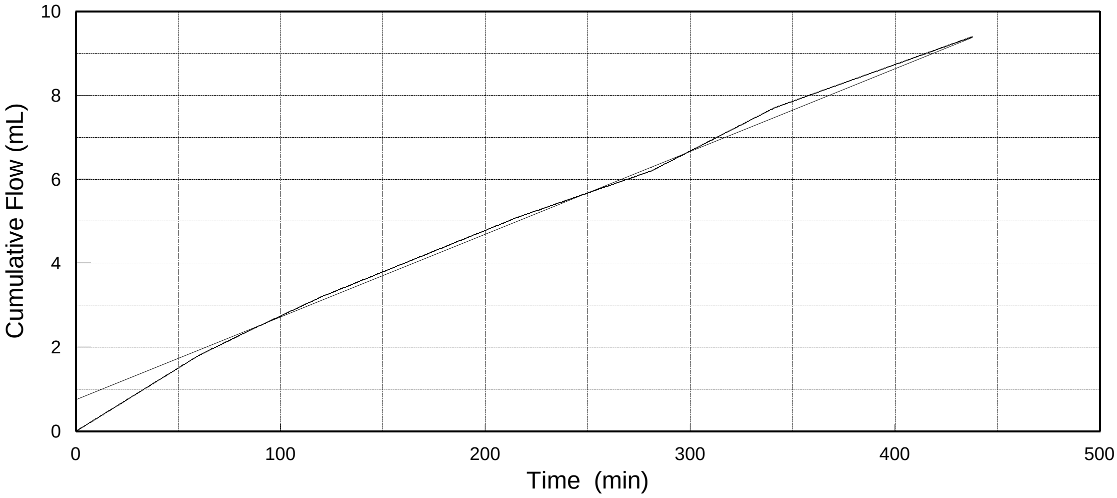
CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	0.0

PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20ºC = 2.1×10^{-10} m/s

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2

Hydraulic Gradient = 197.9



The quoted permeability is equivalent to 2.5 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved	Project Number:	
Initials: RJP	GEO / 21090	
Date: 09/06/14	Project Name: 4.5.1CC Chemical Resistance - 56 Day	GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 4	Cured CC5 product
Permeant:	Water	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in water under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	100.3	100.3
Height	*mm*	5.1	5.1
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.86	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

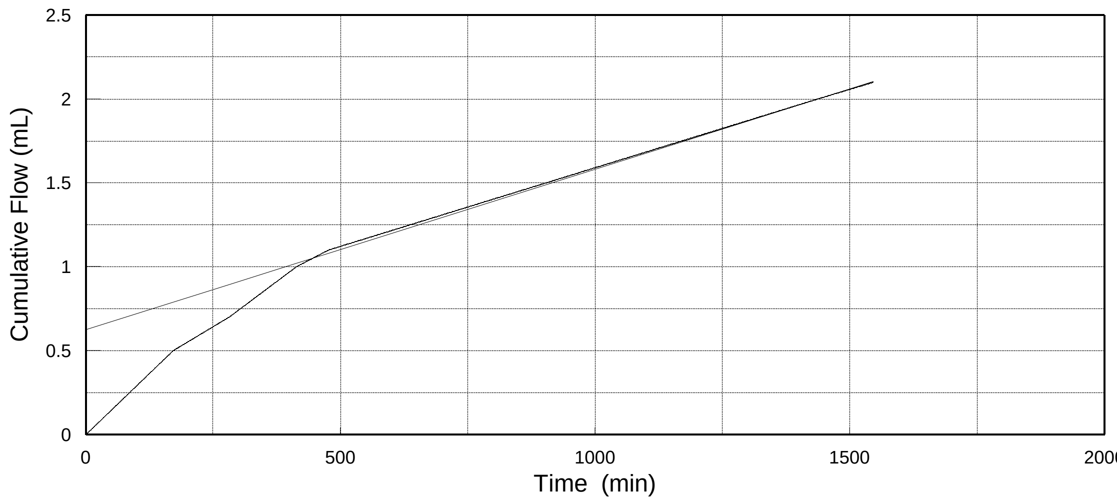
CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	0.8

PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20ºC = 1.0×10^{-11} m/s

Hydraulic Gradient = 198.4

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2



The quoted permeability is equivalent to 0.1 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved	Project Number:	GEO / 21090
Initials: RJP	Project Name:	4.5.1CC Chemical Resistance - 56 Day
Date: 20/05/14		

UKAS TESTING 1982

GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 5	Cured CC5 product
Permeant:	Water	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in water under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	100.5	100.5
Height	*mm*	5.1	5.1
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.90	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

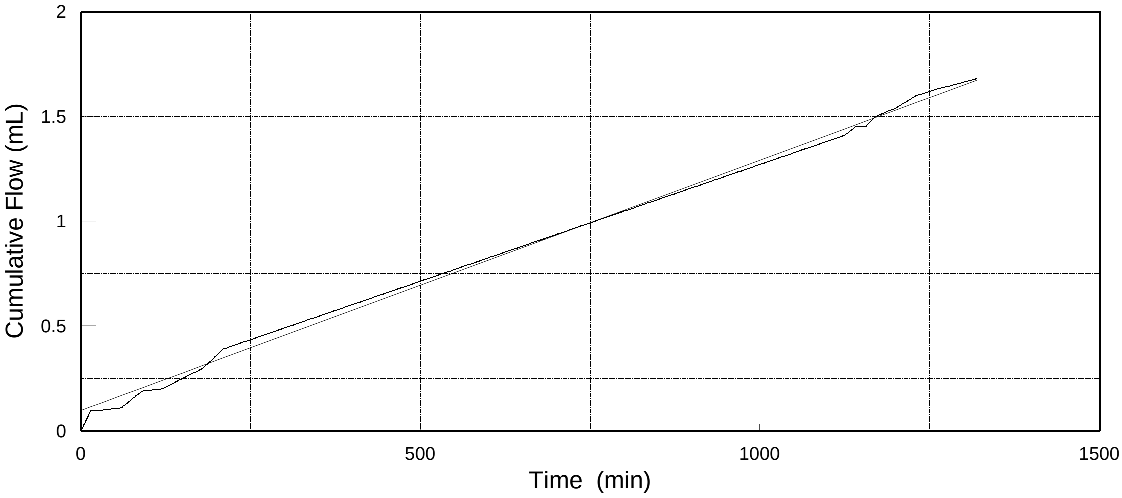
CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	1.6

PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20ºC = 1.3×10^{-11} m/s

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2

Hydraulic Gradient = 198.5



The quoted permeability is equivalent to 0.1 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved	Project Number:	GEO / 21090
Initials: RJP	Project Name:	4.5.1CC Chemical Resistance - 56 Day
Date: 20/05/14		

GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Product Type:	CC5	Description:
Sample ID:	Disk 6	Cured CC5 product
Permeant:	Water	

SPECIMEN DETAILS	
Depth within original sample	n/a
Orientation within original	Flow perpendicular to membrane
Specimen preparation	Prepared disc saturated in water under a vacuum prior to test set up. Periphery of disc sealed with nitrile mebrane.

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	99.9	99.9
Height	*mm*	5.2	5.2
Moisture Content	*%*	n/a	n/a
Bulk Density	*Mg/m³*	1.89	n/a
Dry Density	*Mg/m³*	n/a	n/a

SATURATION STAGE		
Saturation by constant moisture content.		
'B' value	n/a	n/a

CONSOLIDATION STAGE		
Effective pressure	*kPa*	50
Volume change	*mL*	0.0

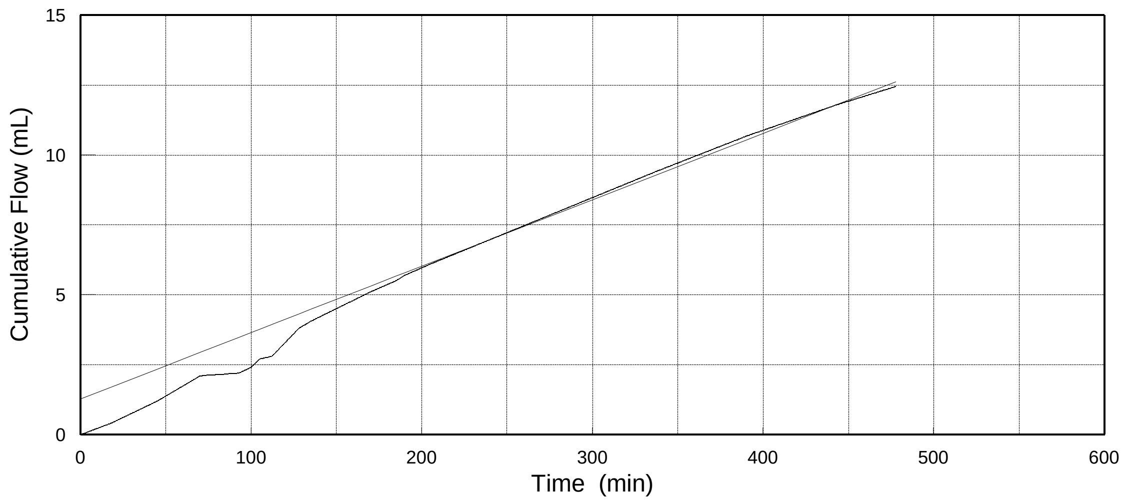
PERMEABILITY STAGE		
Pressure difference across specimen		10
Mean effective stress	*kPa*	45

Coefficient of permeability at 20°C =

2.6×10^{-10} m/s

TEST DURATIONS		
Saturation	*days*	1
Consolidation	*days*	1
Flow	*days*	2

Hydraulic Gradient = 197.8



The quoted permeability is equivalent to 3.0 ml/min flow rate per square metre of product resisting a 1 metre head of water at 20°C

Checked and Approved Initials: RJP Date: 20/05/14	Project Number: **GEO / 21090** Project Name: **4.5.1CC Chemical Resistance - 56 Day**	UKAS TESTING 1982 — GEOLABS®

CONCRETE CANVAS®
Concrete Impregnated Fabric...

ENVIRONMENTAL BENEFITS

Concrete Canvas® is part of a revolutionary new class of construction materials called Geosynthetic Cementitious Composite Mats (GCCMs). It is a flexible, concrete impregnated fabric that hardens on hydration to form a thin, durable, water proof and fire resistant concrete layer. Essentially, it's concrete on a roll.

CO^2 Saving

Concrete Canvas® GCCM (CC) enables up to 150mm of poured concrete to be replaced with just 8mm for many surfacing applications. As a result, material savings of 95% can be achieved for a typical construction project. In addition CC reduces the transportation requirement of construction work. A single pallet of 8mm thick CC (CC8™) material contains 125sqm of concrete surfacing; the same coverage using poured concrete would require 2 seventeen ton ready-mix trucks. In other words, a single truck load of CC Bulk rolls replaces 34 ready-mix trucks.

Low Washout

CC traps dry concrete powder in a 3-dimensional fibre matrix. Testing based on BS8443 to indicate the effect of underwater setting, shows that CC loses only 3% by mass. By comparison, specialist underwater concretes typically lose between 10-15% whilst also requiring much larger initial volumes.

CC has been independently tested by the CTL Group laboratories in the US which measured leachates from CC both during hydration and post-set. All leachate levels were found to be below the levels set by the US Environmental Protection Agency (EPA).

Limited Alkaline Reserve

CC uses a specialist high early strength concrete with a limited alkaline reserve. Unlike most concretes, it is not classified as an irritant and is less damaging to the environment.

EA Approval (UK)

CC was approved for use by the Environment Agency (EA) Biodiversity team in 2010 for the Church Village Bypass Project. Benefits cited included 'surface roughness to provide diversity in the channel's morphology' and its ability to introduce 'sinuosity in the channel line'.

Since 2010 multiple projects have been granted approval on a case-by-case basis including projects for the Environment Agency (EA), Natural Resources Wales (NRW) and Scottish Environmental Protection Agency (SEPA).

Greening

Untreated CC will naturally 'green' over time as the textured top surface allows moss growth, whilst the fibre-reinforced concrete layer will prevent root-growing vegetation, which would otherwise restrict water flow and increase maintenance costs.

Manufacture

Concrete Canvas Ltd is ISO9001 certified; we pride ourselves on the responsible sourcing and production of our products. The manufacture of CC is powered in part by a 90kWp solar array on the roof of the factory and all materials are sourced to minimise environmental impact. For example, the PVC we use is a high grade phthalate free (no DOP) compound. This is designed to maximise the products life expectancy and minimise its impact on the environment.

CONCRETE CANVAS®
Concrete Impregnated Fabric...

+ 44 (0) 845 680 1908   info@concretecanvas.com   www.concretecanvas.com

Nuna Innovations Inc.

Concrete Cloth™

Geosynthetic Cementitious Composite Mat (GCCM)

Licensed from CONCRETE CANVAS

Manufactured by:

Milliken™ | Milliken Infrastructure Solutions, LLC

NUNA

Nuna Innovations Inc.

Nuna Innovations represents and introduces ground-breaking, innovative technologies to the mining, construction, civil, defense, disaster relief and oil & gas industries. Nuna Innovations provides cost effective, safe, alternative product and technology solutions to current industry applications.

Delivering Value

Engineering Expertise

- Assess challenges and recommend customized solutions
- Leverage multiple technology platforms
- Provide in-depth documentation and third-party validation

Technical Support

- Deliver in-field training and support
- Provide responsive and on-demand service

Project Optimization

- Lower total project cost
- Improve contractor productivity
- Reduce user impact
- Extend asset life cycle
- Reduce installation time
- Minimize surface/soil preparation
- Avoid weather-related delays

Applications

Ditch and Channel Lining

Concrete Cloth™ GCCM can be rapidly unrolled to form a ditch or channel lining. When comparing erosion control methods, it is a cost-effective alternative to riprap, cement stabilized soil, plastic inserts, and shotcrete.

Benefits

- Minimizes installation time
- Conforms to ditch geometry
- Lowers total project cost
- Requires no specialized equipment
- Installs at a rate of 20,000 sf per day
- Acts as an effective weed suppressant

Culvert

Ideal as a protective wear surface in metal culvert applications, Concrete Cloth GCCM is a cost-effective alternative to topical invert coatings and relining systems. Additionally, it can be used at the headwall, inlet and outfall to prevent erosion and undermining of the existing structure.

Benefits

- Extends the life of existing culvert asset
- Hydrates with existing water source
- Offers easy handling and installation with a small crew

Slope

Concrete Cloth GCCM can be used to protect slopes as a replacement for shotcrete, riprap, and other hard armor systems. The material is easy to install, requiring limited equipment, and can be used by standard maintenance crews.

Benefits

- Reduces installation time
- Lowers total project cost
- Features small equipment footprint
- Acts as an effective weed suppressant
- Installs in rain, if needed, maximizing schedule flexibility

Berm

Compared to poured or sprayed concrete, Concrete Cloth GCCM is a cost-effective alternative for lining secondary berms. Its ability to be installed quickly reduces time on site, while the availability of man-portable rolls allows for installation in areas with reduced access.

Benefits

- Acts as an effective weed suppressant
- Installs easily around existing structures
- Provides additional levels of impermeability
- Lowers total project costs
- Reduces maintenance costs
- Offers fire protection

Other Applications

- Geosynthetic liner protection
- Irrigation
- Mining
- Remediation

Changing the Way You Think About Concrete

Imagine being able to use concrete on slopes, in water, and in other hard to reach locations - with no forms, no mixing and minimal equipment. Concrete Cloth™ geosynthetic cementitious composite mat (GCCM) is a flexible fabric that will bend and curve, enabling it to follow the natural contours of the land including ditches and slopes.

The material can't be overhydrated, so it can be installed in the rain or under water, even salt water. And, because it comes in a variety of sizes, including rolls small enough for two men to carry, it reduces the need for heavy machinery.

An ideal alternative to rip-rap, shotcrete and poured concrete, Concrete Cloth GCCM can be used in any place that needs protection from erosion or wear, and can be used to channel or contain water or other liquids.

To meet the needs of your application, three thicknesses are available: **CC5** (5 mm or 0.2 inches), **CC8** (8 mm or 0.3 inches) and **CC13** (13 mm or 0.5 inches).

APPLICATION	CC5	CC8	CC13	COMMENT
Ditch Lining	◑	●	◑	**Recommend CC8** CC5 or CC13 may be used depending on specific conditions.
Slope Protection	●	◑		**Recommend CC5** CC8 may be used on unstable ground or for high flow conditions.
Berm Lining	●	◑	◑	**Recommend CC5** CC8 or CC13 may be used for areas of heavy traffic.
Concrete Remediation	●	◑	◑	**Recommend CC5** CC8 or CC13 may be used where voids are large, or end use involves high flow rates or turbulent flow.
Culvert Lining	◑	●	◑	**Recommend CC8** CC13 may be used for flows with high levels of debris or high flow conditions. CC5 may be used for low flow conditions and low levels of debris.
Weed Suppression	●			**Recommend CC5**
Outfalls/Spillways		●	◑	**Recommend CC8** CC13 may be used for outfalls with a high level of debris or with high flow conditions.
Gabion Protection	●	●	◑	**Recommend CC5 or CC8** CC13 may be used for applications with high flow conditions or prone to impacts.
Mining Vent/Blast Walls	●	●		**Recommend CC5** for vent wall applications. **Recommend CC8** for walls exposed to blast, depending on pressure loading.

● **Recommended** ◑ **Recommended for specific applications**

NUNA

Nuna Innovations Inc.

Milliken® Concrete Cloth™

Licensed from CONCRETE CANVAS®

Concrete Cloth™

Geosynthetic Cementitious Composite Mat

STORM + SANITARY BRIDGES + ROADWAYS OIL, GAS, + INDUSTRIAL

The Concrete Cloth™ material is a three-dimensional flexible cement impregnated fabric that hardens after hydration to form a durable concrete layer. Classified as a Geosynthetic Cementitious Composite Mat (GCCM), it is used in a variety of civil infrastructure markets including: transportation, oil & gas, stormwater, landfill, mining, and erosion control. Typical applications for use are ditch lining, slope stabilization, shoreline armor, secondary berm protection, culvert invert protection, and Geosynthetic liner protection.

	MANPORTABLEBATCHROLLS				BULKROLLS			
Product	Roll Width ft (m)	Roll Length ft (m)	Roll Area ft^2 (m^2)	Average Unset Roll Weight lb (kg)	Roll Width ft (m)	Roll Length ft (m)	Roll Area ft^2 (m^2)	Average Unset Roll Weight lb (kg)
CC5	3.63 (~1.1)	30.0 (~9.1)	108.9 (~10.1)	~156 (~71)	3.63 (~1.1)	593.8 (~181.0)	2155.5 (~200)	~3100 (~1400)
CC8	3.50 (~1.1)	15.3 (~4.7)	53.6 (~5)	~130 (~58)	3.50 (~1.1)	385.0 (~117.0)	1347.5 (~125)	~3170 (~1440)
CC13	Not Available				3.60 (~1.1)	239.0 (~72.8)	860.4 (~80)	~3355 (~1520)

Standard production size information is subject to change without notice. Please contact your Nuna Innovations Inc. representative on exact roll size quotes (sales based on ft^2). All test data are typical minimum values unless otherwise noted.

Dimensional Parameters

Product	Thickness in (mm)	Dry Weight lb/ft^2 (kg/m^2)	Cured Weight lb/ft^2 (kg/m^2)
CC5	0.2 (5)	1.3 (6.3)	1.7 (8.5)
CC8	0.3 (8)	2.2 (10.6)	2.8 (14.2)
CC13	0.5 (13)	3.7 (18.0)	5.0 (24.3)

Listed weights are minimum values. Actual product weight may exceed these values

Tensile Strength: ASTM D-5035

Product	Working Strength lb/ft^2 (kg/m^2)		Ultimate Strength lb/ft^2 (kg/m^2)	
	Length	Width	Length	Width
CC5	60 (10)	20 (3.5)	140 (24)	50 (8.5)
CC8	85 (15)	25 (4.4)	190 (33)	100 (17)
CC13	150 (26)	90 (16)	190 (33)	110 (19)

Puncture Resistance: ASTM D-6241

Product	Puncture Strength lb (kg)
CC5	350 (160)
CC8	500 (225)
CC13	720 (325)

CC13 has also passed ASTM G-13 (Impact Resistance of Pipeline Coatings).

Permeability

Coefficient of permeability 2x10-11m/s (CC8)
Permeability of joints will vary dependant on the jointing method, consult Nuna Innovations for more information

Set Time: ASTM C-807

Initial Set: 120 Min
Final Set: 240 Min
CC will achieve -70% strength 24hr after hydration. Working Time 1-2 hrs after hydration

Flex Strength: ASTM C-1185

7 Day Minimum: 475 psi (3.3 MPa)
7 Day Modulus Minimum: 26,000 psi (180 MPa)

Compressive Strength: ASTM C-473

7 Day Minimum: 5600 psi (38 MPa)

Taber Abrasion: ASTM C-1353

Approximately 7.5x Greater than 2500 psi OPC

Freeze Thaw: ASTM C-1185

200 Cycles –Pass

Flame Resistance: MSHA ASTP-5011

n=0.011

Permissible Shear & Velocity CC5: ASTM D-6460

Shear <25 lb/ft2 (1200 Pa)
Velocity <35 ft./sec (10.7m/s)
Product Exceeded Large Scale Testing Capabilities and was not tested to failure

To actually achieve these permissible values, the CC material must be properly anchored with a system designed to meet or exceed these values

Concrete Cloth™

Geosynthetic Cementitious Composite Mat

STORM + SANITARY

BRIDGES + ROADWAYS

OIL, GAS, + INDUSTRIAL

Composition

Concrete Cloth GCCM is a three-dimensional flexible cement impregnated fabric that hardens after hydration. The material has a top surface fabric through which water will penetrate during hydration and a bottom surface consisting of a PVC membrane that acts as permeable barrier.

Characteristics

The dry density of the product before hydration is approximately 95 lbs/ ft3 (1500 kg/ m3). Upon complete hydration the density increases between 30-35% to approximately 125 lbs/ft3 (2000 kg/m3). The exact density will depend slightly on the thickness of material and the relative proportion of PVC membrane to cement.

Storage & Handling

Concrete Cloth matting is sold in three (3) thickness. Standard roll sizes referred to as Bulk or Batch rolls are noted in the product table on the proceeding page. Bulk rolls will be shipped a single roll to a pallet, Batch or Custom rolls maybe shipped multiple stacked rolls to a pallet.

It is important to check the wrapping when the Concrete Cloth rolls arrive on the jobsite. Unopened packages can be stored in a dry location, off the ground, and away from moisture for up to one year. Any damage to the packaging should be repaired prior to storage using plastic wrap and tape to protect the Concrete Cloth GCCM from premature hydration.

Batch rolls are designed to be able to lift by two (2) persons. Bulk rolls will require additional handling equipment rated for the weight of the rolls. Use of a load rated spreader bar is recommended.

Subgrade Preparation

Concrete Cloth matting will generally take the shape and structure of the surface to which it is applied and imperfections in the subgrade will be visible. It is necessary that a compact and smooth subgrade be prepared to engineering specifications prior to placement. Subgrade should be prepared to the lines and tolerances of the engineering drawings for the installation. It should be clear of surface vegetation and debris. To the extent possible Concrete Cloth materials should be in direct contact with the subgrade to which it is being applied.

Installation

Concrete Cloth matting is often overlapped to create joints so installation will typically begin at the lowest point of the project and proceed up the grade. A shingled installation overlapping the rolls is used to reduce any water seepage between the overlapped rolls.

The Concrete Cloth material is designed such that the PVC back of the material will be against the subgrade in most applications. This side is water resistant and will not allow subsequent hydration if the material is installed upside down. The PVC back side is identifiable as the side with a continuous film. It is packaged such that the PVC back will be on the outside of the roll. For this reason it is important when placing Concrete Cloth materials to let the fabric off from the bottom side of the roll.

Temporary anchoring may be used on the leading edge of roll to prevent unrolling. In applications where long lengths will be let off the roll, it is good practice to allow several feet of extra material on the down-slope side of the install to allow for migration of the material in the direction of equipment movement.

After installation of the first roll or cut piece, the leading edge of the second roll or cut piece will typically be shingled over the first. If shingling is not possible, other jointing can be used. Please consult the detailed Concrete Cloth Installation Guide for further details.

Cutting

Concrete Cloth matting is designed to be cut with commonly available cutting tools. A box cutter or razor knife is generally acceptable and rotary cutters are more efficient. Always cut the material from the fabric (top) side down to minimize tearing of the PVC membrane. When possible, use a straight edge. Always wear proper hand PPE when working with cutting tools.

Overlap and Jointing

Four (4) inch overlap is typically recommended for shingling. The most common joint is an overlapped screw joint. A stainless steel #12 screw (coarse threads) is recommended 4-18 inch (typical 6) on center at least 1 inch from the overlap edge. Consult the Installation Guide for additional jointing recommendations.

Anchoring

Along all exterior edges (top, bottom & sides) of the Concrete Cloth installation, it is recommended to install a toe-in trench (minimum of 6 inches in depth) to resist migration of surface water between the Concrete Cloth material and the subgrade. The trench may vary based on the recommendation of a certified design engineer.

Some slopes, soil types and applications may require anchors or nails to stabilize the underling soil mass against internal instability. Concrete Cloth matting may be used as the non-structural facing treatment when internal anchorage conditions are required. Anchors may be installed first or the anchors can be inserted through the cloth.

Hydration

Complete hydration is critical to optimal performance. The Concrete Cloth product cannot be over hydrated and over watering is recommended. Any water source is acceptable in most circumstances.

Saturate the top surface. This will take multiple passes of a moderate spray of water from a garden hose or other source. More water will be needed as the slope of the install increases.

Insure that the material has been saturated by means of the “thumb test”, by pressing a thumb to observe water pooling at the indention.

Wait 30-60 minutes and then put a final dose of water on the material to insure complete hydration.

The material can also be hydrated by submersion for 5-10 minutes but will only have a 1-2 hour working time after hydration.

Do not jet high pressure water directly onto the surface. Do not hydrate if temperature is likely to fall below 25F (-4C) within 24hrs of initial hydration. Do not install on frozen ground. Consult the Installation Guide for additional details and pictures.

Health & Safety

The material contains cement powder which is alkaline and may cause skin irritation.
Always wear proper PPE and consult the SDS for additional information

Sheldon Mine

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • March 2013

Introduction

The U.S. Environmental Protection Agency (US EPA) Region 9 is working to protect the residents living near the Sheldon Mine site in Walker, Arizona. The purpose of this fact sheet is to update you on the progress of the cleanup and invite you to a community meeting.

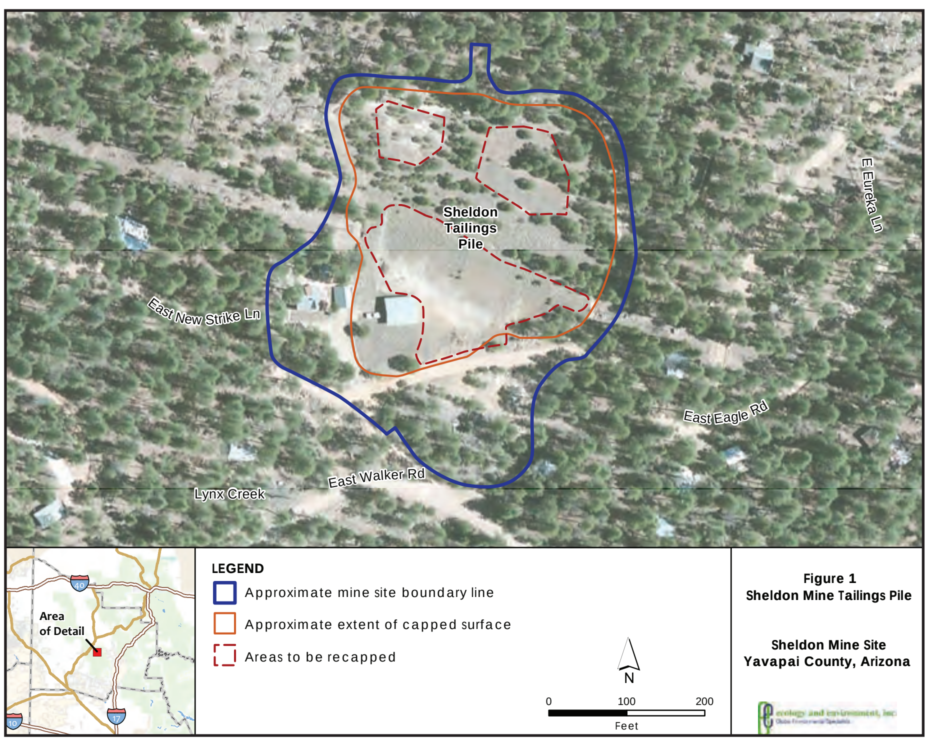
Site Background

The Sheldon Mine site is located approximately 2 miles southeast of the Town of Walker, Yavapai County, Arizona on unincorporated private land within Prescott National Forest, north of the headwaters of Lynx Creek and seven miles upstream from Lynx Lake reservoir. The Sheldon Mine was one of the larger mining operations in the area and it recovered copper, gold, silver lead and zinc from the 1860s through the 1950s. Historical records indicate the site was also the location of a former mill and tailings pond. Abandoned mine waste was left in two areas: the Sheldon Mine Tailings Pile and the Sheldon Mine Waste Rock Pile. The waste rock pile and the tailings pile are sources of heavy metals and Acidic Mine Drainage (AMD) in the Lynx Creek watershed. Acidic Mine Drainage is the formation and movement of highly acidic water containing heavy metals and it can have negative impacts on human health, animals, and plants.

In 2005, EPA collected and analyzed soil samples at the Sheldon Mine site and found elevated levels of lead and arsenic that were above EPA's Regional Screening Levels (RSL). In addition, EPA conducted a geotechnical evaluation to identify options for soil and slope stabilization at Sheldon Mine. In 2012, EPA conducted additional field screenings and evaluated removal alternatives and erosion control for the mine waste.

Cleanup Actions Prior to EPA Involvement

In 1975, the Prescott National Forest and the University of Arizona, School of Renewable Natural Resources graded and covered the Sheldon Mine waste rock and tailings pond. They regraded eroded banks, added limestone and topsoil, and seeded native grasses. This restoration improved erosion control and the landscape, but wind and water erosion have damaged the soil cap over time.



Reasons for Taking Action

High concentrations of heavy metals, including lead and arsenic, are present in tailings, soil and sediments at the Sheldon Mine site. Nearby residents and recreational visitors can be exposed to heavy metals in dust through breathing or touching dust. The removal action will reduce the amount of metals entering Lynx Lake, which is used for recreation.

In order to protect human health and the environment, the US EPA Region 9 Superfund Emergency Response Section plans the following actions for the mine tailings pile. We anticipate that this work will begin in April 2013 and take five weeks.

- Implement erosion control measures to reduce arsenic and lead enriched mine tailings in surface water runoff
- Reduce the infiltration of water into the mine tailings pile to reduce the quantity of mine influenced water
- Remove existing contaminated sediments from the bottom and banks of the seasonal stream leading to Lynx Creek

The waste rock pile will need to be addressed in a separate removal action in the future.

Please stay away from the Sheldon Mine site before and during EPA's removal action. Avoiding the site will prevent exposure to contaminants and possible health risks.

View of the Sheldon Tailings Pile facing north

Community Meeting

EPA will hold a community meeting to discuss and answer questions about the Sheldon mine cleanup on Wednesday, March 6 at 6 PM at the Walker Fire Department.

Wednesday, March 6
6:00-8:00 PM

Walker Fire Department
5881 S. Walker Road
Prescott, AZ 86303

Contact Information

If you have questions or concerns, please contact any of the following individuals:

EPA Contacts

Dan Shane
On-Scene Coordinator
(415) 972-3037
shane.dan@epa.gov

Grace Ma
Community Involvement Coordinator
(415) 947-4212
ma.grace@epa.gov

APPENDIX C

Health and Safety Plan

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

**WORK LOCATION PERSONNEL PROTECTION
AND SAFETY EVALUATION FORM**

**Attach Pertinent Documents/Data
Fill in Blanks As Appropriate**

Job No.:	883002.044		
Prepared by:	Della Fawcett	Reviewed by:	Christine Kimmel
Date:	July 8, 2016	Date:	July 15, 2016
Revised by:		Reviewed by:	
Date:		Date:	

A. WORK LOCATION DESCRIPTION

1. **Project Name:** PCC LPC
2. **Location:** Portland, Oregon
3. **Anticipated Activities:** Shallow excavation (approximately 1-ft bgs) and capping of soils with known PCB contamination in cleanup areas designated Area A and Area B West. Capping activities include shallow excavation of soil to anchor concrete cloth cap, removal of wood retaining wall, and excavation and installation of drainage system at toe of slope and oversight. Groundwater will not be encountered during cleanup activities.
4. **Size:** Approximately 500 ft^2 across two areas: Area A and Area B West
5. **Surrounding Population:** Industrial, commercial, residential
6. **Buildings/Homes/Industry:** Industrial, commercial, residential
7. **Topography:** Sloped hillside to the southeast. A maximum grade of 2% will be excavated during the cleanup process.
8. **Anticipated Weather:** Possible rain, 40 to 80 °F.
9. **Unusual Features:** Capping will be conducted under an active transformer platform known as Area B West.
10. **Site History:** Some of the transformers and capacitors at the LPC historically contained PCBs, and oil stored in LPC oil storage locations may have contained PCBs. PCBs have been found in Area B West during characterization activities in October 2014 and August 2015. In April 2016, PCBs with concentrations above 50 ppm were removed from soil in Area B West.

B. HAZARD DESCRIPTION

1. Background Review: ☒ Complete ☐ Partial

If partial, why?

2. Hazardous Level: ☐ B ☐ C ☒ D ☐ Unknown

Justification: Past work at site: Numerous investigations in and around the LPC.

3. Types of Hazards: (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☐ Explosive

☐ Biological ☒ Ingestion ☐ O2 Def. ☒ Skin Contact

Describe: Direct contact with contaminated soil. Inhalation of dust or vapors. Ingestion of dust.

B. ☒ Physical ☒ Cold Stress ☒ Noise ☒ Heat Stress ☐ Other

Describe: Hazards associated with work around heavy machinery, including street sweeping vehicles, and excavation equipment. Special care must be taken (i.e., placement of reflective cones) when working near or around open storm drain structures to prevent trips and falls. Depending on the weather conditions, heat stress or cold stress may be a factor.

C. ☐ Radiation

Describe:

4. Nature of Hazards:

☒ Air — Describe: Dust from contaminated soil and solids (once dry).

☒ Soil/Sediment — Describe: Dermal contact with or ingestion of contaminated soil and solids.

☒ Surface Water — Describe: Dermal contact with or ingestion of contaminated water in storm drain structures or decontamination water.

☐ Groundwater — Describe: Groundwater will not be encountered during cleanup activities covered under this HASP.

☒ Other — Describe: Dermal contact with or ingestion of possible contaminated building materials.

5. Chemical Contaminants of Concern ☐ N/A

Contaminant	Hazards Encountered Upland or Offshore?	PEL-TWA (mg/cu.m)	I.D.L.H. (mg/cu.m)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
PCBs	Soil and storm drain system solids	0.001	5	Concentrations in soil and solids from non-detect to greater than 50 ppm	Dust Inhalation, Ingestion, Dermal Contact, Absorption	Eye irritation, liver damage, carcinogen	Dust Control Particulate Meter (see air monitoring strategy in Section C[4])

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Slip/trip/falls	Falls or trips into open storm drain structures	At the edges of any storm drain structures	Do not leave storm drain structures open and unattended. Use reflective cones near the edges of open storm drain structures. Maintain good housekeeping and keep debris (trip hazard) to minimum
Noise	Excavating equipment	Near excavations	Wear hearing protection (plugs or muffs)
Excavation Equipment	Crushing by machinery, flying debris	Within the swing radius of equipment and proximity to moving parts	Be observant. Make eye contact with operator prior to approaching operating equipment. Minimize time spent close to the excavation machinery.
Weather Stress	Exposure to hot or cold temperatures, wind, and/or rain	In work area	Have drinking water accessible, wear appropriate clothing (light for heat, warm for cold), were sunscreen protection, avoid caffeine, and take short breaks as needed
Travel to and from project site	Operating motor vehicle in traffic on highways and rural roads	Route to and from site from Landau Associates office	Operate motor vehicle while well rested and physically able to drive safely. Conduct pre-trip vehicle inspection, all vehicles to be maintained and in good working order. Obey all traffic laws including no cell phone use while driving. Secure all cargo properly to avoid shifting. Allow sufficient time to travel to site at safe speeds. Engage emergency brake when parking vehicles. Establish planned route prior to departure.

7. Work Location Instrument Readings – Particulate/Dust Meter ☐ N/A

Location: __________
Percent O_2: __________ Percent LEL: __________
Radioactivity: __________ PID: __________
FID: __________ Other: __________
Other: __________ Other: __________
Other: __________ Other: __________

Location: __________
Percent O_2: __________ Percent LEL: __________
Radioactivity: __________ PID: __________
FID: __________ Other: __________
Other: __________ Other: __________
Other: __________ Other: __________

Location: __________
Percent O_2: __________ Percent LEL: __________
Radioactivity: __________ PID: __________
FID: __________ Other: __________
Other: __________ Other: __________
Other: __________ Other: __________

Location: __________
Percent O_2: __________ Percent LEL: __________
Radioactivity: __________ PID: __________
FID: __________ Other: __________
Other: __________ Other: __________
Other: __________ Other: __________

8. Hazards Expected in Preparation for Work Assignment ☒ N/A

Describe:

C. PERSONAL PROTECTIVE EQUIPMENT

1. Level of Protection During *Cleanup Activities*

☐ A ☐ B ☐ C ☒ D

2. Protective Equipment During *Cleanup Activities* (specify probable quantity required)

Respirator ☐ N/A

☐ SCBA, Airline

☐ Full-Face Respirator

☒ Half-Face Respirator (when working in areas where PCBs have been detected at concentrations greater than or equal to 50 ppm)

☐ Escape mask

☐ None

☐ Other:

☐ Other:

Clothing ☐ N/A

☐ Fully Encapsulating Suit

☐ Chemically Resistant Splash Suit

☐ Apron, Specify:

☒ Tyvek Coverall or Raingear (when working in areas where PCBs have been detected at concentrations greater than or equal to 50 ppm)

☐ Saranex Coverall

☐ Coverall, Specify

☐ Other: life jacket while on boat

Head & Eye ☐ N/A

☒ Hard Hat

☐ Goggles

☐ Face Shield

☒ Safety Eyeglasses

☐ Other:

Hand Protection ☐ N/A

☒ Undergloves; Type: Nitrile

☐ Gloves; Type: Solvex

☒ Overgloves; Type: leather, neoprene, and/or nitrile outer gloves when performing hand work.

☐ None

☐ Other:

Foot Protection ☐ N/A

☒ Neoprene Safety Boots with Steel Toe/Shank

☐ Disposable Over-boots

☒ Other: Steel Toe Work Boots

3. Monitoring Equipment ☐ N/A

☐ CGI

☐ O^2 Meter

☐ Rad Survey

☐ Detector Tubes (optional)

☐ PID

☐ FID

☒ Other – Particulate/Dust Meter (see below)

Type:

Air Monitoring Strategy:

EXPOSURE	METHOD	MONITORING DESCRIPTION	ACTION LEVEL (a)	ACTION
Particulate Contaminants	Dust Meter	Handling samples/ Continuously	<0.001 milligrams per cubic meter (mg/m^{3}) >0.002 mg/m^{3}	Level D Protection Implement Engineering Controls; Upgrade to Level C in Interim

D. PERSONNEL DECONTAMINATION (ATTACH DIAGRAM)

☒ Required- Soap and Water – Hands and face ☐ Not Required

EQUIPMENT DECONTAMINATION

☒ Required ☐ Not Required

If required, describe and list equipment:

Any non-disposable sampling equipment will be washed with tap water and Alconox, and rinsed with tap water, prior to each use. Large equipment will be decontaminated using a pressure washer.

Decontamination of equipment that comes in contact with material containing total PCBs greater than or equal to 50 ppm will be performed using hand-wiping with an appropriate solvent in accordance with the decontamination procedures required under 40 C.F.R. § 761.79, or using the double wash/rinse method for decontaminating non-porous surfaces under 40 CFR 761 Subpart S. Disposable tools or equipment will be discarded as contaminated TSCA-waste and placed 55-gallon drum to be disposed of at a Subtitle C chemical waste landfill permitted to accept TSCA waste under 40 C.F.R. § 761.75. Only parts of the equipment that are reasonably likely to have been in contact with PCB-containing materials will be decontaminated.

E. PERSONNEL

	Name	Work Location Title/Task	Medical Current	Fit Test Current
1.	**Della Fawcett**	**Senior Project Geologist**	☒	☒
2.	**Colette Gaona**	**Project Manager/Senior Scientist**	☒	☒
3.	**James Raspen**	**Project Engineer**	☒	☒
4.	**Erin Waibel**	**Staff GIT**	☒	☒
5.	**Brett Borgeson**	**Project Scientist**	☒	☒
6.	**Tayler Wells**	**Assistant Scientist**	☒	☒
7.			☐	☐
8.			☐	☐
9.			☐	☐
10.			☐	☐

Site Safety Coordinator: **On-site field staff**

F. ACTIVITIES COVERED UNDER THIS PLAN

Task No.	Description	Preliminary Schedule
1	TSCA Self-Implementing / Risk-Based Cleanup	Ongoing
2		
3		
4		

G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

☐ N/A

Name and Address of Subcontractor: Terra Hydra (PCC Contracted)

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	☐	☐	
Personal Protective Equipment Availability	☐	☐	
Onsite Monitoring Equipment Availability	☐	☐	
Safe Working Procedures Specification	☐	☐	
Training Protocols	☐	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☐	☐	
Evacuation Procedures Contingency Plan	☐	☐	
Decontamination Procedures Equipment	☐	☐	
Decontamination Procedures Personnel	☐	☐	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ☐ Adequate ☐ Inadequate

Additional Comments:

Evaluation Conducted By: ______________________________ Date: ______________

EMERGENCY FACILITIES AND NUMBERS

Hospital:
Providence Milwaukie Hospital
10150 SE 32nd Avenue
Milwaukie, OR 97222
(503) 513-8300

Telephone:
Emergency Transportation Systems (Fire, Police, Ambulance) – 911
Providence Milwaukie Hospital – 503-513-8300

Emergency Routes – Map (Attached)

Emergency Contacts:
Landau Associates Project Manager (Colette Gaona) -425-778-0907

In the event of an emergency, do the following:

1. Call for help as soon as possible. Call 911. Give the following information:
   - WHERE the emergency is – use cross streets or landmarks
   - PHONE NUMBER you are calling from
   - WHAT HAPPENED – type of injury
   - WHAT is being done for the victim(s)
   - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

3. Notify the Landau Associates Project Manager.

HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Site Safety Coordinator	Signature	Date
Christine Kimmel	Christine Kimmel	7/19/2016
Landau Health and Safety Manager	Signature	Date
Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

Name	Signature	Date

ROUTE TO HOSPITAL

Route to Providence Milwaukie Hospital

from 4600 Southeast Harney Drive, Portland, OR 97206
to Providence Milwaukie Hospital, 10150 Southeast 3...

6 min (1.8 miles)
via SE Filbert St and SE 32nd Ave
6 min without traffic

4600 Southeast Harney Drive
Portland, OR 97206

- Head west on SE Harney Dr toward SE 45th Ave
  423 ft
- Continue onto SE 45th Pl
  266 ft
- Continue onto SE Johnson Creek Blvd
  0.3 mi
- Turn left onto SE 42nd Ave
  0.3 mi
- Turn right onto SE Filbert St
  0.5 mi
- Turn left onto SE 32nd Ave
  0.5 mi
- Turn left
  Destination will be on the left
  0.1 mi

Providence Milwaukie Hospital
10150 Southeast 32nd Avenue, Milwaukie, OR 97222