State of Oregon
Department of Environmental Quality Memorandum

Date: 5/14/2024

To: ECSI FILE #271

Through: Kevin Parrett, Manager
Northwest Region Cleanup Section, DEQ

From: David Lacey, Project Manager
Northwest Region Cleanup Section

Subject: Swan Island Upland Facility-Operable Unit 2, ECSI # 271
Staff Memorandum in support of a No Further Action determination

This document presents the basis for the Oregon Department of Environmental Quality's (DEQ's) recommended No Further Action (NFA) determination for the Swan Island Upland Facility-Operable Unit 2, in Portland. As discussed in this report, contaminant concentrations in soil and groundwater are below acceptable risk levels.

The proposed NFA determination meets the requirements of Oregon Administrative Rules Chapter 340 Division 122, Sections 010 to 0140 and Oregon Revised Statutes 465.200 through 465.455.

The proposal is based on information documented in the administrative record for this site. A copy of the administrative record index is presented at the end of this report.

1. BACKGROUND

Site location.
The site's location can be described as follows:

- Address: 5225 North Channel Avenue, Portland, Oregon.

- Latitude 45.5598º North, longitude -122.7128º West

- Tax lot(s): 3 TL 105 and 108, Township 1 North, Range 1 East, Section 20

Swan Island Upland Facility Setting.
Operable Unit 2 was evaluated as part of an agreement between the Port of Portland (the Port) and DEQ for the Swan Island Upland Facility – *Voluntary Agreement for Remedial Investigation, Source Control Measures, and Feasibility Study* – dated July 24, 2006 (DEQ, 2006). For the purposes of the work conducted under this agreement, the Swan Island Upland Facility has been divided into five operable units designated as follows:

- Operable Unit 1- Approximately 57 acres of upland property, formerly known as the Portland Shipyard, owned by Shipyard Commerce Center, LLC (formerly Cascade

General), and operated as the Vigor Marine (Vigor) Ship Repair Yard. DEQ issued a Final Source Control Decision for Operable Unit 1 on November 24, 2014.

- Operable Unit 2- Approximately 19 acres of upland property owned by the Port south of North Channel Avenue. Currently there are two leaseholds: 1) Heidelberg Materials plant (formerly Pacific Rock Products, formerly CEMEX) and 2) the Daimler Trucks North America LLC (Daimler) temporary truck staging area. DEQ issued a Final Source Control Decision for Operable Unit 2 on January 12, 2023.
- Operable Unit 3- Approximately 2.5 acres of upland property owned by the Port on North Lagoon Avenue that includes the property at 5420 North Lagoon Avenue and the adjacent property to the north that provides access to Berths 308 and 309. DEQ issued a Final Source Control Decision for Operable Unit 3 on April 4, 2013, and a NFA on July 10, 2013.
- Operable Unit 4- Approximately 7.8 acres of upland property between Operable Unit 1 and Operable Unit 2. Until 2008, Operable Unit 4 was part of Operable Unit 2, but was designated a separate operable unit to facilitate the sale of the property from the Port to Shipyard Commerce Center LLC. DEQ issued a Final Source Control Decision for Operable Unit 4 on February 26, 2015.
- Operable Unit 5- Approximately 5 acres of upland property that includes the riverbank adjacent to Operable Unit 2 and Operable Unit 4. Until 2014, Operable Unit 5 was part of Operable Unit 2, but was designated a separate operable unit to facilitate the potential sale of the Operable Unit 2 property. DEQ issued a Final Source Control Decision for Operable Unit 5 on April 4, 2016.

Site setting.
Figures showing the location of the Swan Island Facility and the layout of Operable Unit 2 are presented in Attachment 1. The property covers approximately 19 acres of upland property at the Swan Island Upland Facility and is owned by the Port. As discussed above, a portion of Operable Unit 2 (the riverbank) was separated into Operable Unit 5 in 2014. Therefore, figures in Attachment 1 that were prepared prior to 2014 show an older version of Operable Unit 2.

Operable Unit 2 is comprised of two leaseholds. One portion of the site is leased to Heidelberg Materials for a concrete batch plant and aggregate storage. The Heidelberg Leasehold includes approximately 12.1 acres at the northwest end of the site. The other portion is leased to Daimler and is used for temporary staging of trucks and trailers. The Daimler Leasehold covers approximately 7 acres at the southeast end of Operable Unit 2.

Operable Unit 2 does not include any riverbank property. The adjacent riverbank is part of Swan Island Upland Facility Operable Unit 5 and is being evaluated separately.

Physical setting.
Operable Unit 2 is relatively flat with land surface elevations generally ranging between 34 and 38 feet (NAVD88). The subsurface soils beneath the site are mixtures of silt, sandy silt, silty sand, sand, and sand with gravel. In general, sand and occasional gravel are encountered to a depth of approximately 20 feet below ground surface (bgs). These materials represent Willamette

River dredged materials that were placed on Swan Island when it was reconfigured and raised in elevation in the 1920s. Underlying the fill is recent alluvium associated with the original Swan Island, consisting of variable mixtures of silt, sandy silt, silty sand, and sand.

Shallow groundwater occurs under water table conditions. The depth to groundwater ranges from approximately 18 to 30 feet bgs. The shallow groundwater flow direction is southwesterly, toward the Willamette River.

There are no surface water features at the site. The Willamette River is located 100 to 150 feet to the southwest.

Site history.
Operable Unit 2 was developed in the 1920s, and has been used for a variety of light industrial uses since, including:

- 1923 to 1931 – Development of Swan Island.
- 1931 to 1941 – Portland Airport.
- 1942 to 1949 – Support services for military-era ship building and related industries.
- 1950 to Present – Variety of light industrial uses.

Figures identifying historical features relevant to potential contamination at Operable Unit 2 are presented in Attachment 1.

The Port developed Swan Island beginning in 1923, when the main navigation channel of the Willamette River was relocated to the west side of the island. River sediments dredged as part of the project were deposited on Swan Island to raise the surface elevation and construct a causeway connecting the island to the eastern shore of the river. This filling prepared the island for development into the first Portland Airport. Airport construction was completed, and operations started in 1931. The airport operated until 1941, when it was relocated to northeast Portland. Based on historical research conducted by the Port, the only airport facilities that were located on Operable Unit 2 was a paved takeoff runway.

Between 1942 and 1949, the United States used Operable Unit 2 to support military-era ship building and related industries. Electrical substations that may have contained equipment with polychlorinated biphenyls (PCBs) were installed during this period. Two Kaiser Shipyard substations, designated substation Sub P and Sub Q, were located on Operable Unit 2.

Between 1950 and 1978, Operable Unit 2 was primarily used for material receiving and storage.

In 1978, Operable Unit 2 was used as the staging and pre-cast concrete construction site for the new ballast water treatment plant constructed at the shipyard (in OU1).

From 1985 to 1990, the site was used by Atlantic Richfield Company for construction of modular units used for oil processing on Alaska's North Slope. The modules were fabricated and painted in the central portion. An oil storage area and aboveground fuel tanks were located south of a small wooden building (Building 83) located on the east side of the site during this period.

Facility inspections at the end of this period identified petroleum staining on the ground surface in several areas.

After 1990, Operable Unit 2 was used for materials and equipment storage for ship repair activities conducted on OU1 (outdoor storage of equipment, steel, cable drums, empty portable tanks and totes, other materials); sand, gravel, and rock storage; concrete batch plant; and truck parking. In 1993, sandblast sand and yard sweepings were observed and removed from an area near the northern corner.

Currently, Daimler has the leasehold for approximately 7 acres at the southeast end of Operable Unit 2. The leased property is used to temporarily stage trucks and trailers. This portion of the site is almost entirely covered with compacted gravel. Heidelberg Materials plant (formerly Pacific Rock Products, formerly CEMEX) has a leasehold on 12.1 acres in the northwest end to operate a concrete batch plant and store rock products. Operational features include the concrete mixing plant, truck scale, mixer truck parking area, aggregate storage piles, a stormwater treatment swale, and a process water storage/settling pond. Process water and stormwater from the batch plant are collected and used in the concrete manufacturing process. In the eastern corner, near North Channel Avenue, is a truck fueling area. The fueling area uses an aboveground storage tank, which is covered and completely contained. Areas near North Channel Avenue around the truck scale and the batch plant are paved. The remainder of the ground surface is compacted gravel.

2. BENEFICIAL LAND AND WATER USE DETERMINATIONS

Land use.
The current and reasonably likely future land use for the site is industrial. It is currently zoned industrial and lies within the City of Portland Industrial Sanctuary and Swan Island Plan District. The Swan Island Upland Facility is expected to continue to be used for industrial purposes, consistent with goals and policies stated in the City of Portland's Comprehensive Plan.

Groundwater use.
The only current and reasonably likely future beneficial groundwater use at the site is discharge to surface water. Other beneficial uses of groundwater on the site are unlikely because: a public water supply system already exists and is the source of water supply to the site; there is no trend toward groundwater being developed as a source of water supply in the area; the owners of properties around the site have indicated that they have no plans for future use of groundwater; and the public water suppliers, including the City of Portland, have no plans to develop groundwater on or near the site to meet future increases in water demand.

Surface water use.
The Willamette River is less than 200 feet from the boundary of the Facility. It is used mainly for habitat (e.g., anadromous and resident fish species), commercial/industrial activities (e.g., navigation), and recreational activities (e.g., boating, sport fishing). Also, local Indigenous tribes have fishing rights on the lower Willamette River.

Historically several catch basins connected to outfalls along the riverbank. Currently there is one active catch basin on the Daimler portion which is connected to outfall WR-163. Stormwater on

the remainder of the Daimler portion pools in low lying areas and infiltrates. Stormwater on the Heidelberg portion is directed to a stormwater treatment/infiltration swale.

3. INVESTIGATION AND CLEANUP WORK

Appendix F of the Supplemental Preliminary Assessment Swan Island Facility (Port, 2006) presents a list of known and potential releases that occurred across the entire Swan Island Upland Facility. No spills or potential releases were identified in Operable Unit 2. However, elevated levels of metals thought to be associated with sand blasting grit were detected in surface soils on the Daimler Leasehold. On the Heidelberg Leasehold, low level volatile organic compounds (VOCs) were detected in groundwater, and PCBs/petroleum hydrocarbons were detected in soil samples.

3.1 Site Investigations

Since 2000, the Port has completed Remedial Investigation activities throughout the five operable units of the Swan Island Upland Facility, including Phase I Remedial Investigation soil and groundwater investigations, Phase II Remedial Investigation groundwater monitoring well installation, four quarters of groundwater sampling, and five years of annual groundwater sampling.

The Port and others also performed operable unit-specific investigation activities. Shipyard Commerce LLC performed sampling of soil and groundwater on Operable Unit 2 prior to purchase of the property from the Port (Bridgewater Group, 2000, 2001, 2002, 2003, 2004, 2005, 2006a, 2007, and 2008). The Port completed sampling of former substations (Ash Creek, 2007a and 2007b), sampling in the area where CEMEX (now Heidelberg) constructed a stormwater swale (Ash Creek. 2009), sampling of stormwater solids (Ash Creek, 2008), a soil removal to address an occupational worker arsenic hot spot (Bridgewater Group, 2006b), a Level I Scoping Ecological Risk Assessment (New Fields, 2006), a Level II Screening Ecological Risk Assessment (Formation Environmental, 2010), a Human Health Risk Assessment (Ash Creek, 2009), and soil removal to address arsenic risk to occupational workers (Ash Creek, 2015).

The following sections summarize the previous investigations for Operable Unit 2. Attachment 2 presents a sample location figure.

Pre-Remedial Investigation

In 1998, surface (0 to 2 feet bgs) and subsurface (between 14 and 22 feet bgs) soil samples were collected on the Swan Island Upland Facility to establish baseline conditions prior to the sale of the shipyard to Shipyard Commerce Center LLC. Five borings (designated Boring 2 through 6) were located on Operable Unit 2. The soil samples were analyzed for petroleum hydrocarbons, PCBs, and metals; select soil samples were analyzed for VOCs. The results of the assessment are summarized in the Remedial Investigation/Feasibility Study Work Plan (Bridgewater Group, 2000).

- Barium, chromium, mercury, silver, and selenium were not detected above their respective DEQ regional background value. Arsenic concentrations ranged from 2.14 to 49.8 milligrams per kilogram (mg/kg): one sample was above the DEQ regional background concentration of 8.8 mg/kg. Cadmium was detected in one sample with a reported concentration of 0.935 mg/kg, above the DEQ regional background

concentration of 0.63 mg/kg. Lead concentrations ranged from not detected to 267 mg/kg: the detected concentration in one sample was above DEQ regional background concentration of 79 mg/kg.

- Heavy oil range hydrocarbons were detected in four of the ten samples with concentrations ranging from 146 to 3,010 mg/kg.
- VOCs were detected in one of four samples. Methylene chloride was detected with a reported concentration of 1.21 micrograms per kilogram (µg/kg).
- PCBs were detected in one of ten samples. Aroclor 1260 was detected with a reported concentration of 133 µg/kg.

Remedial Investigation Soil Sampling

***2001 Phase IA Remedial Investigation*.** In January 2001, the Port collected 44 soil samples from 16 borings (B-13 through B-28) and six surface soil locations (S-1 through S-16). Samples were generally collected from the borings at a depth of 2 feet bgs and just above the water table which ranged in depths from 29 to 31 feet bgs. Sample locations were a mixture of random locations and biased locations based on potential release areas.

- Antimony, arsenic, cadmium, copper, lead, nickel, silver, and zinc were detected in one or more samples at concentrations above their respective DEQ regional background concentration. Chromium and mercury were not detected above their respective DEQ regional background concentration. Antimony concentrations ranged from not detected to 7.2 mg/kg; the detected concentrations are above DEQ regional background concentration of 0.53 mg/kg in five samples. Arsenic concentrations ranged from 1.5 to 652 mg/kg; the detected concentrations were above DEQ regional background concentration of 8.8 mg/kg in two samples. Cadmium concentrations ranged from not detected to 8.1 mg/kg; the detected concentrations were above DEQ regional background concentration of 0.63 mg/kg in two samples. Copper concentrations ranged from 14 to 1,800 mg/kg; the detected concentrations were above the DEQ regional background value of 34 mg/kg in 20 samples. Lead concentrations ranged from 2.7 to 602 mg/kg; the detected concentrations were above the DEQ regional background value of 79 mg/kg in three samples. Nickel concentrations ranged from 6.6 to 69.8 mg/kg; the detected concentrations were above the DEQ regional background value of 47 mg/kg in one sample. Silver was detected in one sample with a detected concentration of 1.9 mg/kg, which was above the DEQ background value of 0.82 mg/kg. Zinc concentrations ranged from 44 to 7,410 mg/kg; the detected concentrations were above the DEQ regional background value of 180 mg/kg in eleven samples.
- Residual range hydrocarbons were detected in six of 44 samples with concentrations ranging from 90 to 3,500 mg/kg.
- Diesel range hydrocarbons were detected in seven of 44 samples with concentrations ranging from 20 to 6,500 mg/kg.

- VOCs were detected in five of eight samples. Acetone was detected in five samples with concentrations ranging from 75 to 190 µg/kg.
- PCBs were detected in nine of 44 samples. Aroclor 1254 was detected in two samples with concentrations ranging from 20 to 290 µg/kg. Aroclor 1260 was detected in eight samples with concentrations ranging from 12 to 410 µg/kg.

***2001 Phase IB and II Remedial Investigation*.** In December 2001, the Port collected three surface soil samples (S-48, S-49, and S-50) to further delineate the extent of soils containing arsenic concentrations above DEQ's highly concentrated hot spot levels.

Chromium, mercury, nickel, and silver were not detected above their respective DEQ regional background concentrations. Antimony concentrations ranged from 38.6 to 49.5 mg/kg; the detected concentrations were above DEQ regional background concentration of 0.53 mg/kg in all three samples. Arsenic concentrations ranged from 595 to 652 mg/kg; the detected concentrations were above DEQ regional background concentration of 8.8 mg/kg in all three samples. Cadmium concentrations ranged from 1.9 to 4.4 mg/kg; the detected concentrations were above DEQ regional background concentration of 0.63 mg/kg in two samples. Copper concentrations ranged from 959 to 1,810 mg/kg; the detected concentrations were above the DEQ regional background value of 34 mg/kg in all three samples. Lead concentrations ranged from 326 to 605 mg/kg; the detected concentrations were above the DEQ regional background value of 79 mg/kg in all three samples. Nickel concentrations ranged from 12.1 to 18.8 mg/kg; the detected concentrations were above the DEQ regional background value of 47 mg/kg in all three samples. Zinc concentrations ranged from 4,350 to 7,110 mg/kg; the detected concentrations were above the DEQ regional background value of 180 mg/kg in all three samples.

Historical Electrical Substations. In 2007, soil samples were collected from the two substations located on Operable Unit 2 (Sub P and Sub Q). The soil samples were analyzed for total petroleum hydrocarbons (TPH) and PCBs. No TPH was detected. PCBs as Arcolcor 1260 were detected in three samples from Sub Q with a maximum concentration of 48 µg/kg.

Groundwater Investigations

Groundwater data were collected between 2001 and 2020.

2001 Phase IA Remedial Investigation. In 2001 groundwater grab samples were collected from three borings located (B-13, B-15, and B-17). The samples were analyzed for metals, butyltins, and VOCs.

- Metals – Antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were detected.
- Butyltins – No butyltins were detected.
- VOCs – No VOCs were detected.

2001 Through 2007 Monitoring Well MW-11 Sampling. In December 2001, the Port installed monitoring well MW-11. One year of quarterly sampling was conducted. For the quarterly

monitoring, groundwater samples were analyzed for metals, tributyltin (TBT), VOCs, and polycyclic aromatic hydrocarbons (PAHs). In addition, five years of annual sampling of MW-11 was conducted between 2001 and 2007. The annual monitoring included one additional round for VOCs and five rounds of metals. The shift from quarterly to annual sampling coincided with the implementation of low flow sampling methods to reduce sample turbidity and provide more representative results.

- Metals - Arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc were detected.
- TBT – TBT was not detected.
- VOCs – Vinyl chloride, chloroform, cis-1,2-Dichloroethene, trans-1,2-dichloropropane and toluene were detected with maximum concentrations of 6.5 micrograms per liter (µg/L), 1.1 µg/L, 11 µg/L, 0.32 µg/L and 0.76 µg/L, respectively.
- PAHs – Naphthalene and 2-methylnaphthalene were detected in one event with concentrations of 0.093 µg/L and 0.29 µg/L, respectively.

2007 Groundwater Grab Sampling. In 2007, groundwater sampling was completed for additional VOCs data in groundwater surrounding monitoring well MW-11 to investigate the extent of vinyl chloride. Five groundwater samples (GW-1 through GW-5) were collected from just below the water table, ranging in depth from 18 to 30 feet bgs. The samples were analyzed for VOCs.

- VOCs – Vinyl chloride was detected at GW-3 with a concentration of 7.0 µg/L. Cis-1,2-dichlroethene was detected at GW-3 with a concentration of 14 µg/L.

2017 Monitoring Well MW-11 Sampling. In January 2017 the Port sampled monitoring well MW-11 for VOCs to confirm vinyl chloride concentrations in groundwater were below Portland Harbor Cleanup Levels (APEX, 2017). No VOCs were detected.

2019-2021 Monitoring Wells MW-11 Sampling. In January 2019, the Port sampled monitoring well MW-11 for PCBs and TPH to support the source control evaluation. The well was sampled again in February 2021 for aliphatic and aromatic petroleum hydrocarbons. TPH, and aliphatic and aromatic petroleum hydrocarbons were not detected above the reporting limits. Several PCB congeners were detected.

- PCBs – Total PCB congeners were detected at 1.8 nanograms per liter (ng/L).

3.2 Removal Actions

Five surface soil removal actions have been completed at OU2.

2006 Removal Action Verification Samples RA-1 through RA-5. In December 2005, a removal action was performed to address surface soil containing arsenic above the soil hot spot concentration of 160 mg/kg. Confirmation samples RA-1 through RA-5 were collected and analyzed for metals.

2006 Surface Samples S-51 through S-56. In September 2006, supplemental surface soil sampling was conducted to supplement the risk assessment. Six surface soil samples (S-51 through S-56) were collected and analyzed for metals.

2007 Cemex Development (formerly Rinker, now Heidelberg). In 2007, approximately 415 tons of impacted soil were removed during swale construction. Grab and composite soil samples were collected (Rink-001 through Rink-008 and RINK-015) and analyzed for metals, TPHs, VOCs, and PCBs.

- Metals - Antimony, copper, lead, and zinc were detected above their respective DEQ regional background values.
- TPH - Gasoline Range Organics concentrations ranged from 5.04 to 27.6 mg/kg. Diesel Range Organics concentrations ranged from 80.1 to 2,750 mg/kg. Residual Range Organics concentrations ranged from 209 to 10,600 mg/kg.
- VOCs – No VOCs were detected.
- PCBs – Aroclor 1254 concentrations ranged from not detected to 140 µg/kg. Aroclor 1260 concentrations ranged from not detected to 103 µg/kg.

In addition, six soil samples (RINK-009 through RINK-014) were collected from the bottom and side walls of an area where visually impacted soil was removed during construction of a stormwater swale.

- Metals – Antimony, cadmium, copper, lead, and zinc were detected above their respective DEQ regional background values.
- TPH - Gasoline Range Organics concentrations ranged from not detected to 125 mg/kg. Diesel Range Organics concentrations ranged from not detected to 1,380 mg/kg. Residual Range Organics concentrations ranged from not detected to 2,720 mg/kg.
- VOCs – Naphthalene was detected at RINK-010 with a concentration of 43 µg/kg. n-Propylbenzene was detected at RINK-010 with a concentration of 19.4 µg/kg. 1,2,4-trimethylbenzene was detected at RINK-010 with a concentration of 20.1 µg/kg.
- PCBs - Aroclor 1260 concentrations ranged from not detected to 6,700 µg/kg.

2012 Feasibility Study Surface Soil Sampling. In 2012, surface soil sampling was conducted to inform the feasibility study and remedial design to address unacceptable risk from arsenic in surface soil associated with sand blasting grit used during construction of the oil processing modular units. Thirty-five direct-push explorations (FS-1 through FS-35) were completed. Each sample was analyzed for arsenic. Results were presented in *Feasibility Study Operable Unit 2 Swan Island Upland Facility* (Ash Creek, 2013) and are included in Attachment 3.

2015 Removal Action Verification Sampling. In 2015, a removal action was completed to address unacceptable risk associated with arsenic in surface soil. Figure 4 from the Removal Action Completion Report Swan Island Upland Facility Operable Unit 2 (APEX, 2015) shows

the removal area and Figure 5 shows the verification sampling locations. Both figures and data summary tables are included in Attachment 3.

4. RISK EVALUATION

No spills or potential releases were identified in Operable Unit 2. However, elevated levels of metals thought to be associated with sand blasting grit were detected in surface soils on the Daimler Leasehold. On the Heidelberg Leasehold, low level VOCs were detected in groundwater, and PCBs/petroleum hydrocarbons were detected in soil samples.

To evaluate exposure to residual chemical contamination requires an assessment of the type and extent of that exposure. This is based on current and reasonably likely future site use. DEQ publishes risk-based concentrations (RBCs) for contaminants commonly encountered, for different types of exposure scenarios. These RBCs are conservative estimates of protective levels of contaminants in soil, groundwater, and air. Table 1 shows potential exposure pathways and receptors for this site. Based on this, applicable RBCs are identified and used for risk screening.

Table 1. Identification of applicable RBCs, based on pertinent pathways and receptors

Pathway	Receptor	Applicable RBC?	Basis for selection/exclusion
SOIL			
Ingestion, dermal contact, and inhalation	Residential	No	See Note 1
	Urban residential	No	
	Occupational	Yes	
	Construction worker	Yes	
	Excavation worker	Yes	
Volatilization to outdoor air	Residential	No	See Note 1.
	Urban residential	No	
	Occupational	Yes	
Vapor intrusion into buildings	Residential	No	See Note 1.
	Urban residential	No	
	Occupational	Yes	
Leaching to groundwater	Residential	No	See Note 2.
	Urban residential	No	
	Occupational	No	
GROUNDWATER			
Ingestion and inhalation from tap water	Residential	No	See Note 3.
	Urban residential	No	
	Occupational	No	
Volatilization to outdoor air	Residential	No	See Note 1.
	Urban residential	No	
	Occupational	Yes	
Vapor intrusion into buildings	Residential	No	See Note 1.
	Urban residential	No	
	Occupational	Yes	

Pathway	Receptor	Applicable RBC?	Basis for selection/exclusion
Groundwater in excavation	Construction and excavation worker	No	See Note 4.
Ecological			
Soil		No	
Groundwater		Yes	See Note 5.
Surface water		No	

Notes:
1. Site is zoned heave industrial and future residential use is unlikely.
2. Groundwater is not used for drinking. This pathway is therefore not considered, in accordance with DEQ's Risk-Based Decision Making guidance.
3. City of Portland water is provided. Local groundwater is not currently used for drinking water and is not likely to be used for this purpose in the future.
4. Groundwater is approximately 18-30 feet bgs. Construction and excavation work are generally limited to a depth of approximately 15 feet bgs. Risk of construction and excavation workers to contaminated groundwater has therefore not been evaluated.
5. Groundwater discharge to Willamette River evaluated as part of Source Control Evaluation

Contaminant concentrations.
Investigation included chemical analysis of soil and groundwater samples to support the human health and ecological risk assessment. These data were determined to be of sufficient quality for use in a risk assessment.

A screening of the soil and groundwater chemical data was completed to identify human health chemicals of potential concern (COPCs) by the Port and was presented in Table 1 of the Baseline Human Health Risk Assessment, Operable Unit 2 (Ash Creek, 2009). The screening presented the Contaminants of Interest (COIs), maximum detected values, and RBC. This table is included in Attachment 4. The Port screened using residential RBC for direct contact and occupational RBC for vapor intrusion. This approach was intended to include chemicals that may contribute small but significant portions to overall risk. The following COPCs were identified: diesel-range organics, antimony, arsenic, chromium, copper, lead, nickel, Aroclor 1260, Total PCBs, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracne, benzo(g,h,i)perylene, vinyl, chloride, and chloroform. DEQ reviewed the RBCs used in the 2009 risk assessment for consistency with the 2017 RBC updates and no additional COPCs were identified.

Exposure point concentrations (EPCs) were evaluated using the United States Environmental Protection Agency's (EPA's) ProUCL to calculate a 90% upper confidence limit (UCL) for each COPC. Table 2 of the Baseline Human Health Risk Assessment summarized these results and is included in Attachment 4.

Human health risk.
The results of the baseline human health risk assessment are summarized as follows.

- For non-carcinogens, hazards for receptors and pathways evaluated met the acceptable hazard level.

- For carcinogens, receptors and pathways evaluated had excess lifetime cancer risk that met the acceptable risk levels in the Heidelberg (former CEMEX) area.
- For carcinogens in the Daimler area, unacceptable risk was identified for occupational and construction worker direct contact with soil containing arsenic.
- An arsenic soil hot spot was identified in the Daimler area.

Risk characterization for non-carcinogens and carcinogens were presented in Tables 4 and 5 of the Baseline Human Health Risk Assessment which are included in Attachment 4.

Ecological risk.
A Level 1 Scoping Ecological Risk Assessment (New Fields, 2006) and a Level II Screening Ecological Risk Assessment (Formation Environmental, 2010) were prepared for Operable Unit 2. These risk assessments concluded that potential ecological risk was associated with the riverbanks only. In 2013, the riverbank portion of Operable Unit 2 was separated into the new Operable Unit 5. Therefore, Operable Unit 2 no longer contains ecological habitat.

5. Focused Feasibility Study and Final Removal Action

Based on the unacceptable risk identified in the risk assessment, a feasibility study was conducted (Ash Creek, 2013). The feasibility study recommended excavation and off-site disposal of soil to address hot spot and unacceptable concentrations of arsenic.

In late 2014 and early 2015, a removal action was conducted at Operable Unit 2 for off-site disposal of soil containing hot spot and unacceptable concentrations of arsenic. Over 6,700 tons of soil were removed from the site and disposed of at a Subtitle D landfill. Confirmation sampling verified that concentrations remaining on-site are consistent with arsenic background concentrations. Figures that present the final removal action and confirmation sample locations are included in Attachment 3.

6. Source Control Decision

Based on the remedial investigation data summarized above and prior source control measures, including abandonment of three inactive stormwater outfalls and a stormwater system cleanout of outfall WR-163, the Port prepared a Source Control Evaluation (Ash Creek, 2010). DEQ requested additional information on soil concentrations surrounding the on-site catch basins. The data was collected and included in an addendum to the Source Control Evaluation (Ash Creek, 2011). Based on comments the DEQ received on the proposed Source Control Decision, DEQ requested supplemental sampling to support the final Source Control Decision. This additional sampling included the following.

- In 2017, a groundwater sample was collected from MW-11 and analyzed for VOCs (APEX, 2017).
- In 2019 through 2021, additional sampling was conducted at MW-11, the single catch basin on Operable Unit 2, and the outfall (WR-163) from the Operable Unit 2 catch basin to the Willamette River (APEX, 2021).

With this supplemental information, the DEQ prepared the final Source Control Decision (DEQ, 2023). The Operable Unit 2 Source Control Decision concluded the following.

- The site has been adequately characterized;
- The sources, nature, and extent of contamination are understood; and
- Contaminant transport pathways do not pose a significant current or likely future threat to the Willamette River.

7. RECOMMENDATION

Following the removal of contaminated soil at Operable Unit 2, remaining concentrations of contaminants of concern do not exceed acceptable risk levels, and a No Further Action determination is recommended for this site. The No Further Action determination should be recorded in DEQ's Environmental Cleanup Site Information (ECSI) database (ECSI # 271).

8. ADMINISTRATIVE RECORD AND REFERANCES

APEX, 2015. *Removal Action Completion Report Swan Island Upland Facility Operable Unit 2*, prepared for the Port of Portland, April 23, 2015.

APEX, 2017. *MW-11 Groundwater Sampling Results Operable Unit 2-Swan Island Upland Facility*, prepared for the Port of Portland, March 14, 2017.

APEX, 2021. Letter from S. Misner/APEX to D. Lacey/ODEQ regarding Revised Supplemental Source Control Sampling Results, March 31, 2021.

Ash Creek, 2006. *Draft Supplemental Preliminary Assessment, Swan Island Upland Facility*, prepared for the Port of Portland, December 2006.

Ash Creek, 2007a. Letter from M. Pickering/Ash Creek to N. LaFranchise/Port regarding former substation sampling results, Swan Island Upland Facility, July 24, 2007.

Ash Creek, 2007b. Letter from M. Pickering/Ash Creek to N. LaFranchise/Port regarding former substation and Berth 305 sampling results addendum, Swan Island Upland Facility, November 14, 2007.

Ash Creek, 2008. Letter from M. Pickering/Ash Creek to K. Madalinski/Port regarding OU2 storm water system cleanout, March 24, 2008.

Ash Creek, 2009. *Baseline Human Health Risk Assessment, Operable Unit 2, Swan Island Upland Facility, Portland, Oregon*, prepared for the Port of Portland, September 1, 2009.

Ash Creek, 2010. *Source Control Evaluation Operable Unit 2 Swan Island Upland Facility*, prepared for the Port of Portland. April 15, 2010.

Ash Creek, 2011. *Source Control Evaluation Addendum Operable Unit 2 Swan Island Upland Facility*, prepared for the Port of Portland, December 27, 2011.

Ash Creek, 2013. *Feasibility Study Operable Unit 2 Swan Island Upland Facility*, prepared for the Port of Portland, January 2013.

Ash Creek, 2015. *Removal Action Completion Report Swan Island Upland Facility Operable Unit 2 Swan Island Upland Facility*, prepared for the Port of Portland, April 23, 2015

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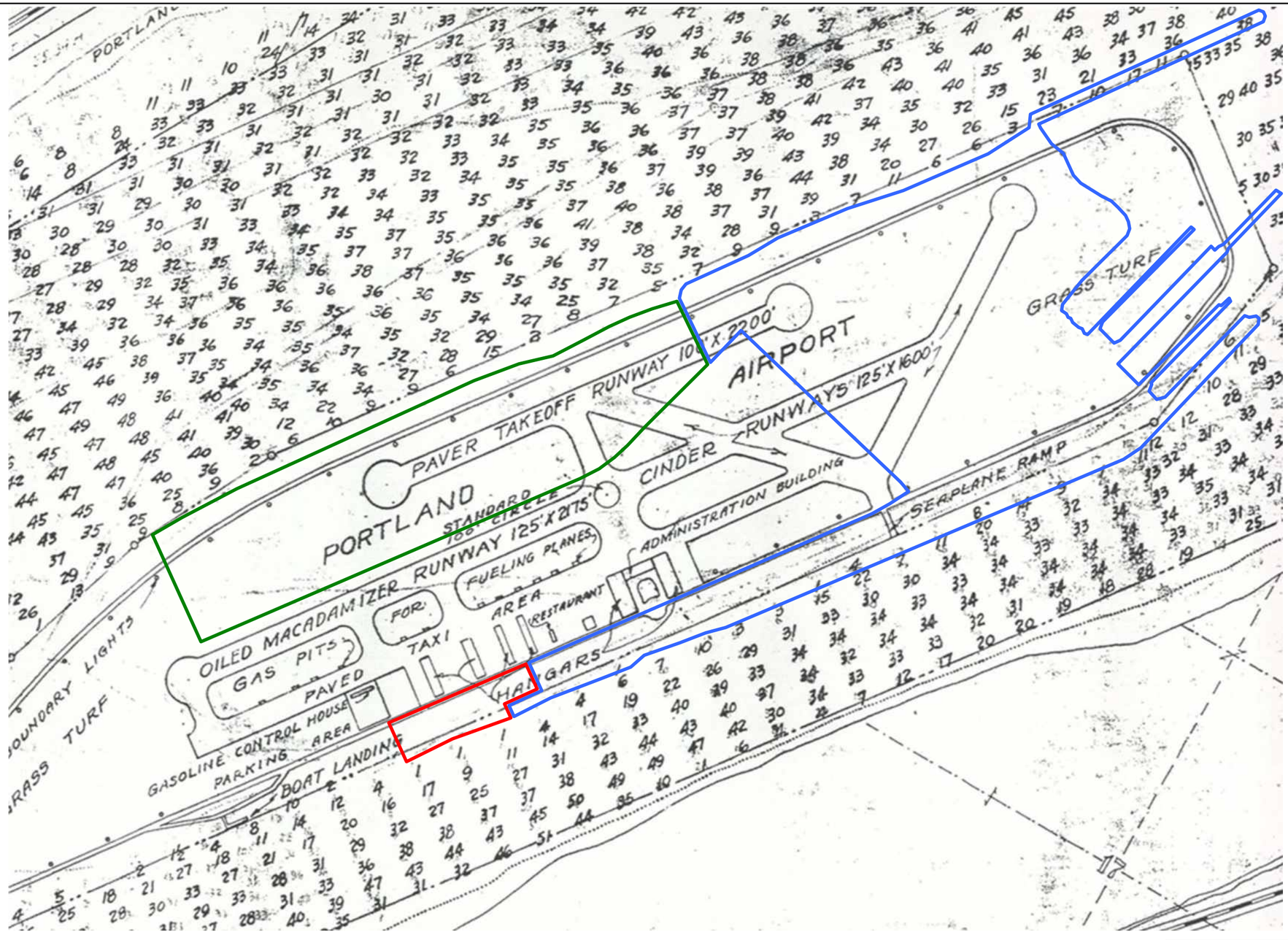
9. ATTACHMENTS

1. Location Map, Facility Plan and Historical Features
2. Soil Sampling Locations
3. Soil Removal Areas and Confirmation Sampling
4. Human Health Risk Assessment Tables

Attachment 1 - Location Map, Facility Plan and Historical Features



Legend:

- Operable Unit 1 Boundary
- Operable Unit 2 Boundary
- Operable Unit 3 Boundary

Source:
The Port of Portland
Portland Harbor Willamette River from South City Boundary to West Oregon Lumber Co's Mill, 1932

Original Portland Airport Layout

Supplemental PA
Swan Island Upland Facility
Portland, Oregon

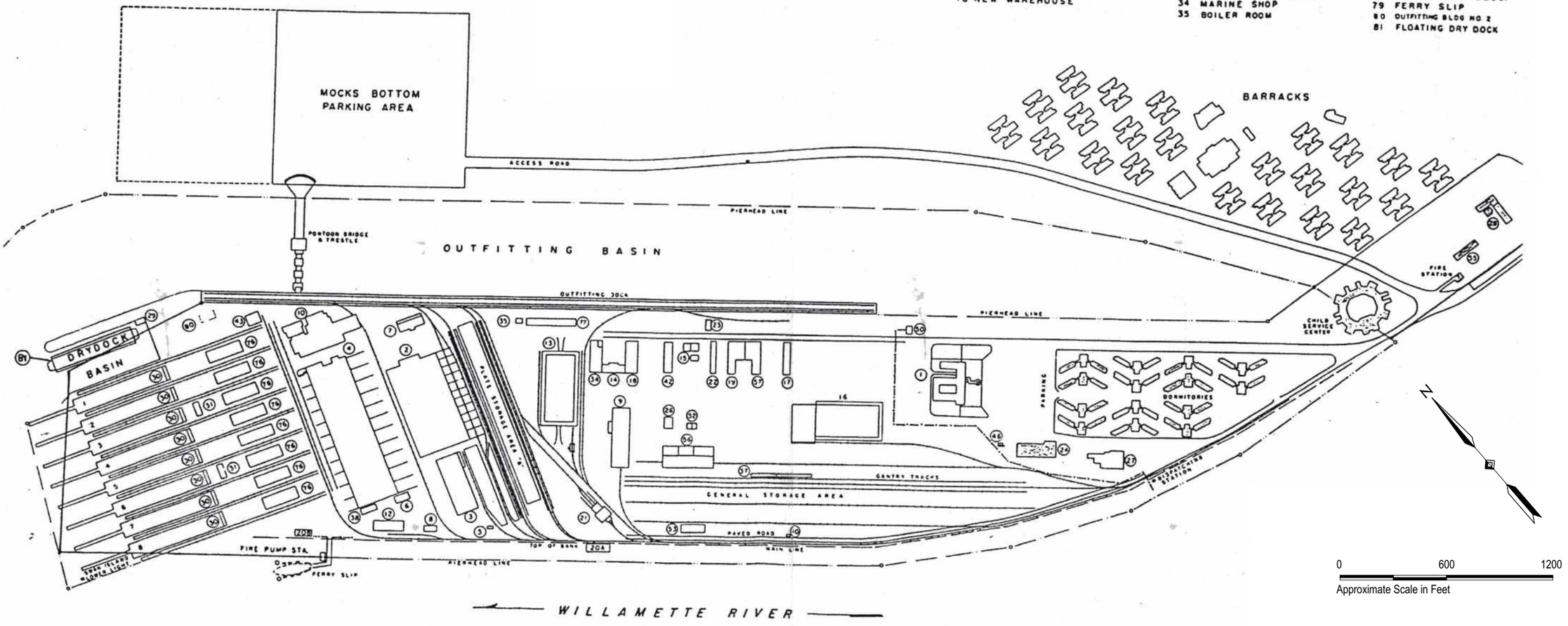
DRAFT

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1115-03	Figure
December 2006		8

DESCRIPTION

1 MAIN ADMINISTRATION BLDG.
2 PLATE SHOP
3 MOLD LOFT
4 ASSEMBLY BLDG.
5 OXYGEN HOUSE
6 COMPRESSOR HOUSE
7 FIELD OFFICE
8 ACETYLENE BLDG.
9 MACHINE SHOP
10 PIPE SHOP & WELDING
12 CARPENTER SHOP
13 GENERAL STORES
14 OLD ADMINISTRATION BLDG.
15 PAINT SHOP & SPRAY PAINT BLDG
16 NEW WAREHOUSE
17 RIGGING LOFT
18 ELECTRIC SHOP
19 SHEET METAL SHOP
20 SUBSTATIONS
21 BOILER ERECTION BLDG.
22 JOINER BLDG.
23 LUNCH ROOM
24 I. B. M. & PERSONNEL BLDG.
26 REPAIR GARAGE
27 CAFETERIA
28 WELDING SCHOOL
29 SUB STATION
30 WAY END BUILDINGS
31 UTILITY BUILDINGS
34 MARINE SHOP
35 BOILER ROOM
37 MOTOR SHED
38 EQUIPMENT MAINTENANCE
40 LUMBER YARD OFFICE
42 CABLE CUTTING BLDG.
43 PIPE ASSEMBLY BLDG.
46 A.F. OF L. LABOR JOB OFFICE
50 GUARD OFFICE
52 OIL HOUSE
53 SALVAGE DEPOT
55 VOCATIONAL SCHOOL
56 MACHINERY STORAGE
57 COPPER SHOP
76 STORAGE PLATFORMS
77 OUTFITTING BLDG.
79 FERRY SLIP
80 OUTFITTING BLDG NO. 2
81 FLOATING DRY DOCK



Kaiser Shipyard Layout - 1945

Supplemental PA
Swan Island Upland Facility
Portland, Oregon

DRAFT

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number 1115-03	Figure 9
	December 2006	

NOTE: Base map prepared from USGS 7.5-minute quadrangles as provided by Topozone. (1990)

0 2,000 4,000

Approximate Scale in Feet

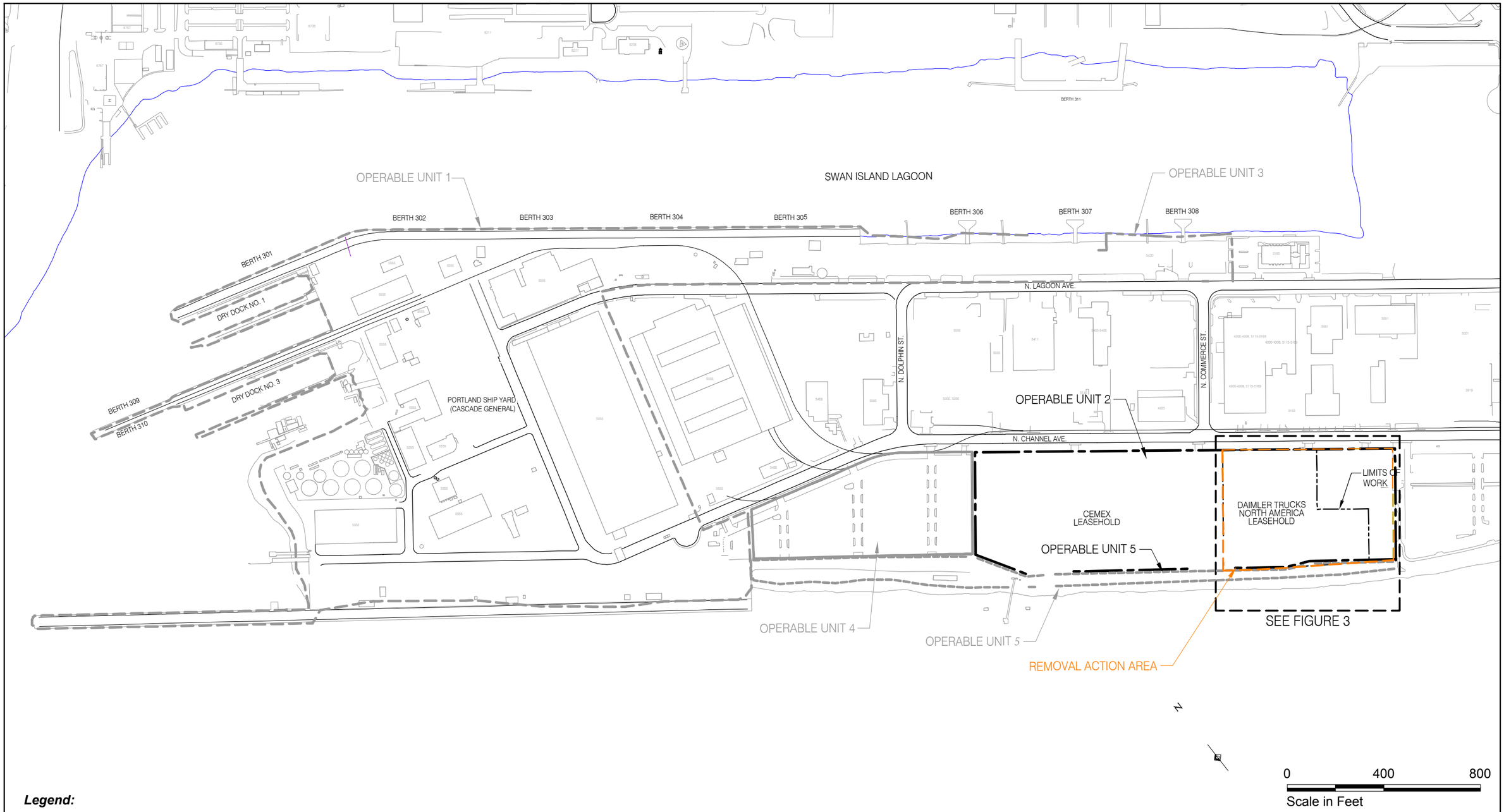
N

Facility Location Map

Removal Action Design Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1115-16.003	Figure
November 2013		1



Legend:

- Operable Unit 1 Boundary
- Operable Unit 2 Boundary
- Operable Unit 3 Boundary
- Operable Unit 4 Boundary.
- Operable Unit 5 Boundary

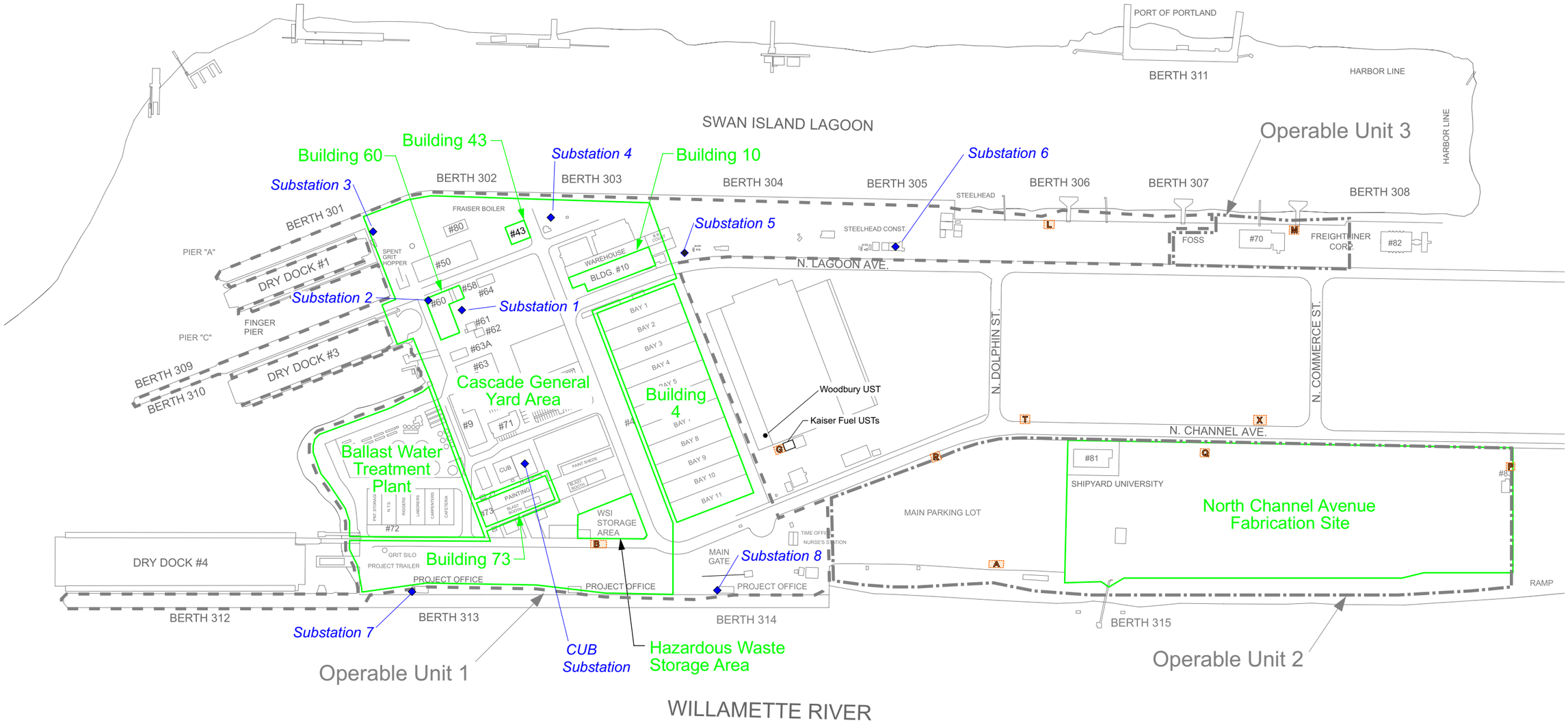
NOTE:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

Site Vicinity Plan

Removal Action Design Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1115-16.003	Figure
November 2013		2



Legend:

- Operable Unit 1 Boundary
- Operable Unit 2 Boundary
- Operable Unit 3 Boundary
- Kaiser Shipyard Substation Location - 1942 Plan (Locations Approximate)
- *Substation 1* ◆ Portland Shipyard Substation Location

0 400 800

Scale in Feet

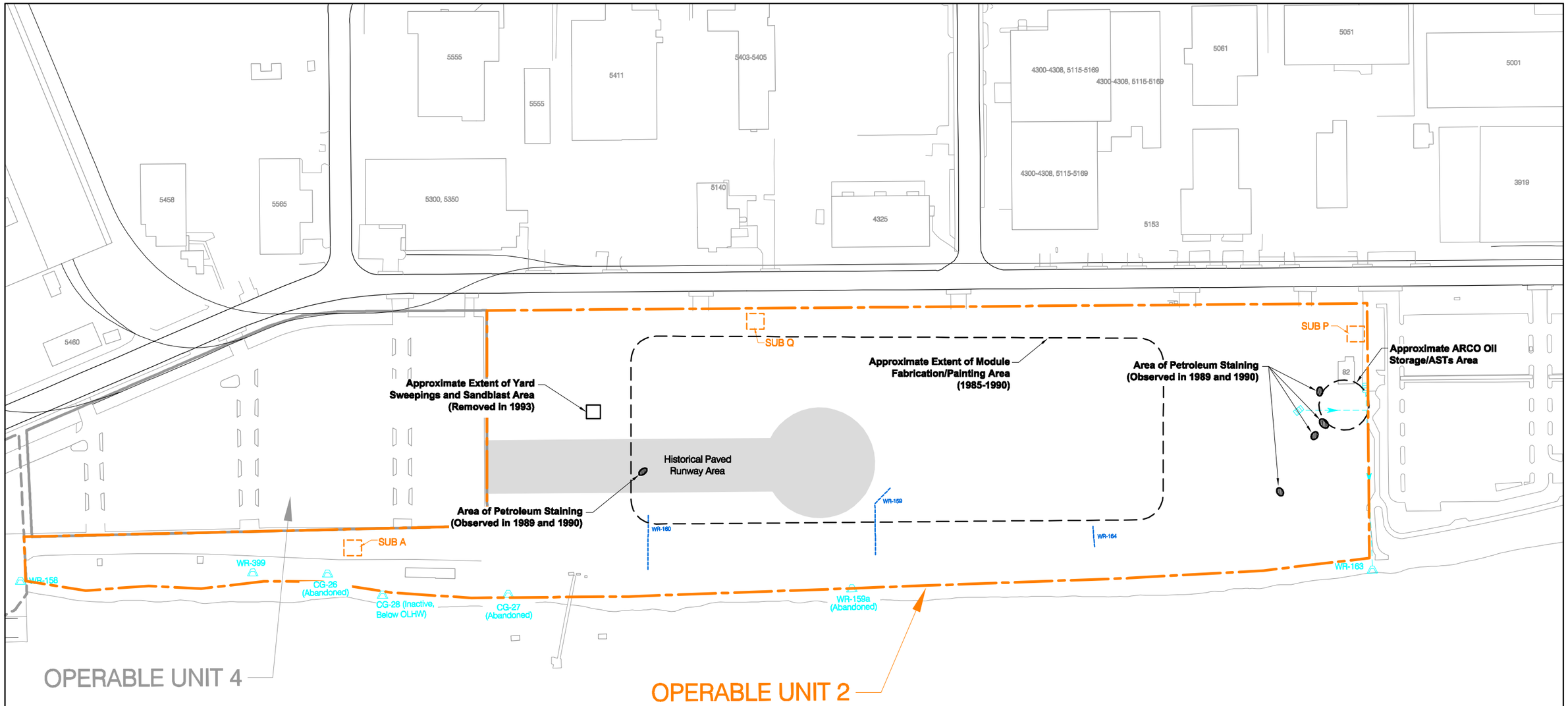
Potential Areas of Concern

Supplemental PA
Swan Island Upland Facility
Portland, Oregon

DRAFT

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number	1115-03	Figure
December 2006		43



Legend:

WR-399 — Outfall Location and Designation

SUB A — Kaiser Shipyard Substation Location - 1942 Plan (Locations Approximate)

N E W S — Substation soil samples collected at North, South, East, and West corners (5/2007)

Storm Sewer Line and Flow Direction

Catch Basin

WR-160 ---------- Storm Water Pipe Location and Designation (Abandoned July 2006)

N

0 200 400

Scale in Feet

NOTES:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.
2. Outfall locations from Integral Consulting, Inc. GIS Export received by email on November 21, 2007. Outfall location CG-28 estimated with a hand-held global positioning system (GPS) device.

Historical Features

Source Control Evaluation Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1115-05

April 2010

Figure 3

Attachment 2 - Soil Sampling Locations

Legend:

RB-4 (Soil Sample Only) — Outfall Riverbank Soil Sample Location

WR-399 — Outfall Location and Designation

MW-11 — Monitoring Well Location

OU2-GW-1 — Grab Groundwater Sampling Location (5/2007)

Boring 1 — Soil Sampling Locations -

- **Boring 1** through **Boring 6** (1998)
- **S4** through **S6** (1998)
- **B-13** through **B-28** (1/2001 and 2/2001)
- **S-48** through **S-50** (12/2001)
- **RA1** through **RA5** (12/2005)
- **S-51** through **S-56** (9/2006)

RB-1 — Riverbank Soil Sampling Location (RB-1 through RB-3, 8/2006; RB-4 through RB-7 10/2008)

RINK-009 — Rinker Sampling Location (3/2007)

SUB A — Kaiser Shipyard Substation Location - 1942 Plan (Locations Approximate)

N E W S — Substation soil samples collected at North, South, East, and West corners (5/2007)

Storm Sewer Line and Flow Direction

Catch Basin

WR-160 — Storm Water Pipe Location and Designation (Abandoned July 2006)

NOTES:

1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.
2. Outfall locations from Integral Consulting, Inc. GIS Export received by email on November 21, 2007. Outfall location CG-28 estimated with a hand-held global positioning system (GPS) device.
3. Outfall Riverbank Soil Samples (RB- Series Samples): Three soil samples were collected from the riverbank below each outfall. The "a" sample was collected just below the end of the outfall. The "c" sample was collected at an elevation corresponding to OLLW, or approximately one to two feet above the river, whichever was higher. The "b" sample was collected approximately halfway down the riverbank between the "a" and "c" samples.

N

0 200 400

Scale in Feet

Upland Sample Location Plan

Source Control Evaluation Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

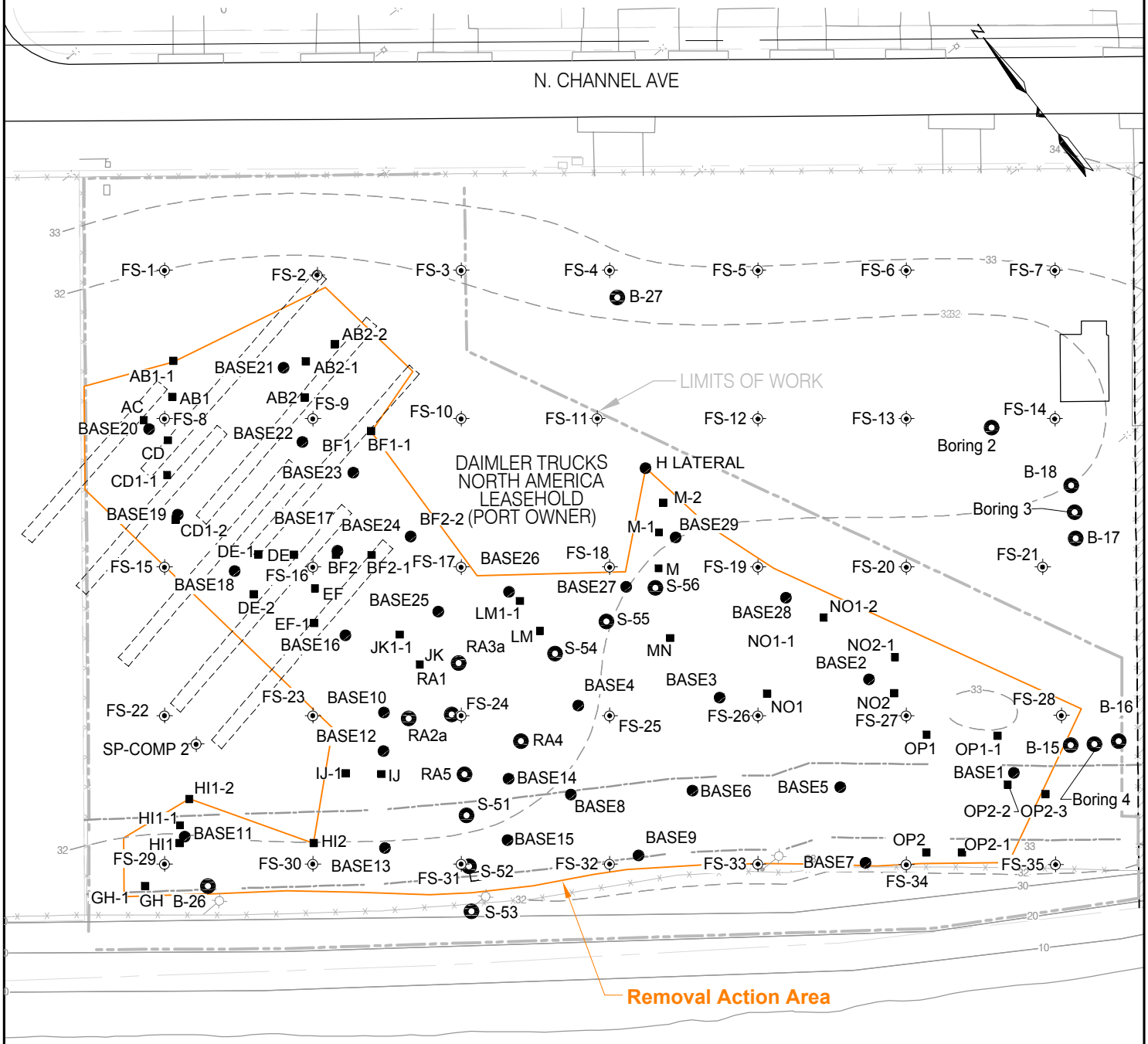
Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1115-05

April 2010

Figure 4

Attachment 3 - Soil Removal Areas and Confirmation Sampling



Historical Data:

FS-1 ⊙ 2012 Exploration Location

B-26 ◎ RI and 2005 Removal Action Soil Sampling Location

Pre-Construction Confirmation Data:

HI1-2 ■ Lateral Sampling Location

Post-Excavation Confirmation Samples:

BASE1 ● 2014 Exploration Location

0 100 200

Scale in Feet

Sampling Locations

Removal Action Completion Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

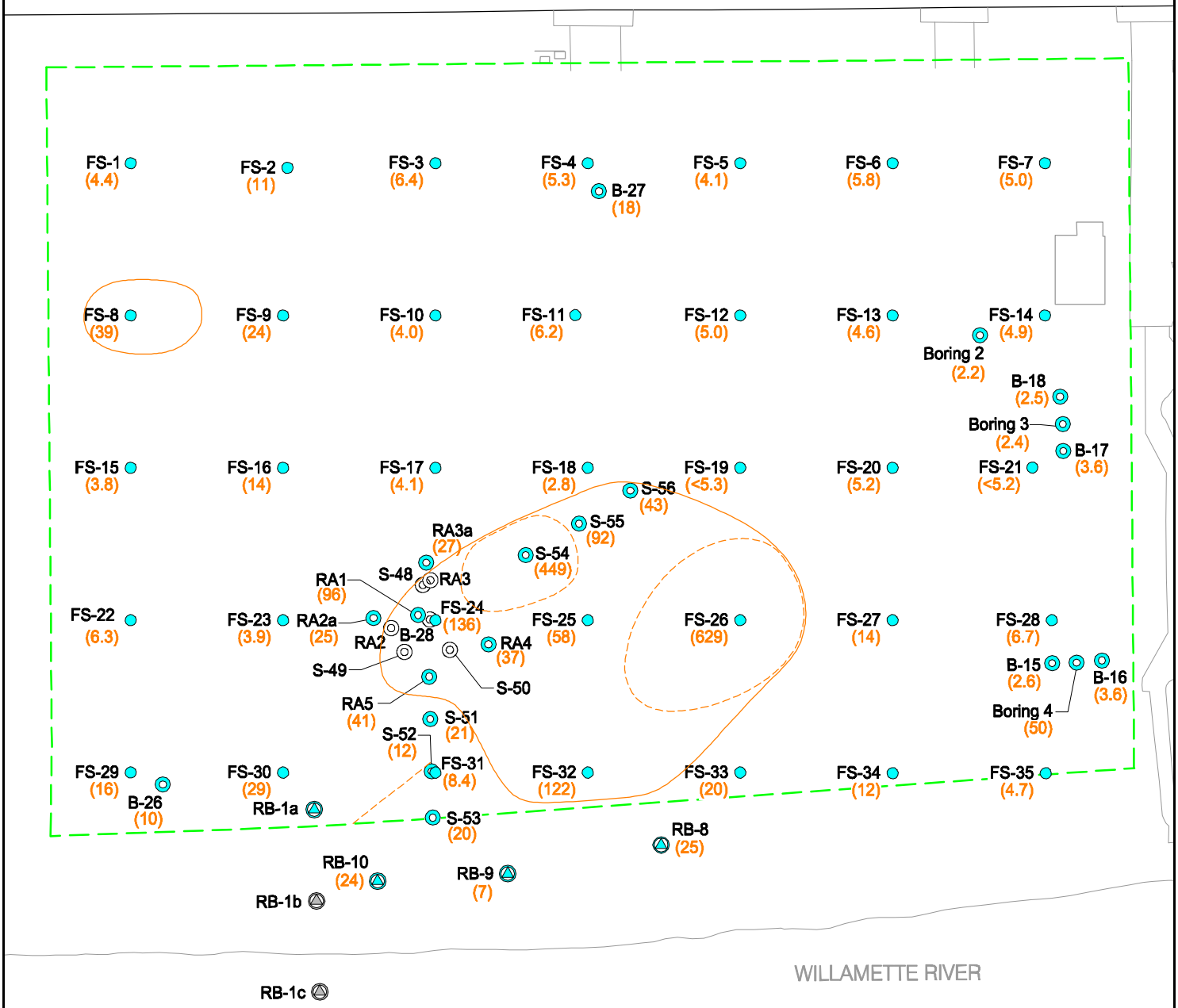
Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number	1115-18	Figure 5
	April 2015		

Table 5 - Confirmation Samples - Base
Operable Unit 2, Daimler Leasehold
Swan Island Upland Facility
Portland, Oregon

Sample Name	Depth (inches)	Sample Date	Arsenic Concentration in mg/kg (ppm)
Base 1	6 - 12	10/29/2014	3.11
Base 2	6 - 12	10/31/2014	7.27
Base 3	6 - 12	10/31/2014	6.67
Base 4	6 - 12	10/31/2014	27.2
Base 4 (8")	8 - 14	11/5/2014	37.8
Base 4 (10")	10 - 16	11/10/2014	87.5 *
Base 4 (12")	12 - 18	11/14/2014	1.94
Base 5	6 - 12	11/5/2014	3.52
Base 6	6 - 12	11/5/2014	3.53
Base 7	6 - 12	11/7/2014	4.22 *
Base 8	6 - 12	11/7/2014	19.8 *
Base 8 (8")	8 - 14	11/12/2014	47.7
Base 8 (10")	10 - 16	11/19/2014	<1.17
Base 9	6 - 12	11/10/2014	13.3 *
Base 9 (8") **	8 - 14	11/14/2014	14.9
Base 9 (10")	10 - 16	11/20/2014	4.08
Base 10	6 - 12	11/10/2014	12.0 *
Base 10 (8")	8 - 14	11/14/2014	65.3
Base 10 (10")	10 - 16	11/18/2014	2.94
Base 11	6 - 12	11/12/2014	10.3
Base 11 (8")	8 - 14	11/19/2014	7.69
Base 12	6 - 12	11/17/2014	3.81
Base 13	6 - 12	11/17/2014	3.28
Base 14	6 - 12	11/17/2014	16.6
Base 14 (8")	8 - 14	11/19/2014	1.63
Base 15	6 - 12	11/17/2014	50.4
Base 15 (8")	8 - 14	11/19/2014	5.01
Base 16 (6")	6 - 12	11/20/2014	1.28
Base 17	6 - 12	12/3/2014	2.71
Base 18	6 - 12	12/3/2014	18.7
Base 18 (8")	8 - 14	12/5/2014	1.24
Base 19	6 - 12	12/3/2014	57.2
Base 19 (8")	8 - 14	12/5/2014	15.9
Base 19 (10")	10 - 16	12/9/2014	1.35
Base 20	6 - 12	12/4/2014	35.6
Base 20 (10")	10 - 16	12/9/2014	2.47
Base 21	6 - 12	12/4/2014	76.9
Base 21 (10")	10 - 16	12/9/2014	1.85
Base 22 (6")	6 - 12	12/5/2014	47.6
Base 22 (12")	20 - 26	12/9/2014	3.17
Base 23	6 - 12	12/12/2014	8.84
Base 24	6 - 12	12/12/2014	19.0
Base 24 (8")	8 - 14	12/16/2014	2.22
Base 25	6 - 12	12/12/2014	34.0
Base 25 (8")	8 - 14	12/16/2014	3.24
Base 26 (10")	10 - 16	12/22/2014	2.31
Base 27 (10")	10 - 16	12/22/2014	2.23
Base 28 (8")	8 - 14	12/23/2014	9.38
Base 28 (10")	10 - 16	12/29/2014	2.82
Base 29 (6")	6 - 12	12/23/2014	26.6
Base 29 (8")	8 - 14	12/29/2014	10.1
Base 29 (12")	12 - 18	12/31/2014	4.35
SP - COMP 1		12/1/2014	31.1
SP - COMP 2		12/3/2014	4.13

Notes:

1. mg/kg (ppm) = Milligrams per kilogram (parts per million).
2. J = Estimated concentration.
3. Arsenic is analyzed by EPA Method 6020.
5. * = Samples inadvertently pulverized by the laboratory.
6. ** = Sample depth mislabeled. Sample ID in lab report is Base 9 (10").
7. **Bold** values exceed DEQ default background concentration of 8.8 mg/kg.
8. Shaded values indicate samples that were removed by excavation.



Legend:

(10) Arsenic Concentration in mg/kg

Remediation Level (33 mg/kg)

Hot Spot Level (170 mg/kg)

FS-1 2012 Exploration Location

B-26 Soil Sampling Location

RB-1a Riverbank Soil Sampling Location

B-28 Soil Sampling Location (Soil Removed During 2006 Removal)

Daimler Trucks North America Lease Area (Approximate)

NOTES:

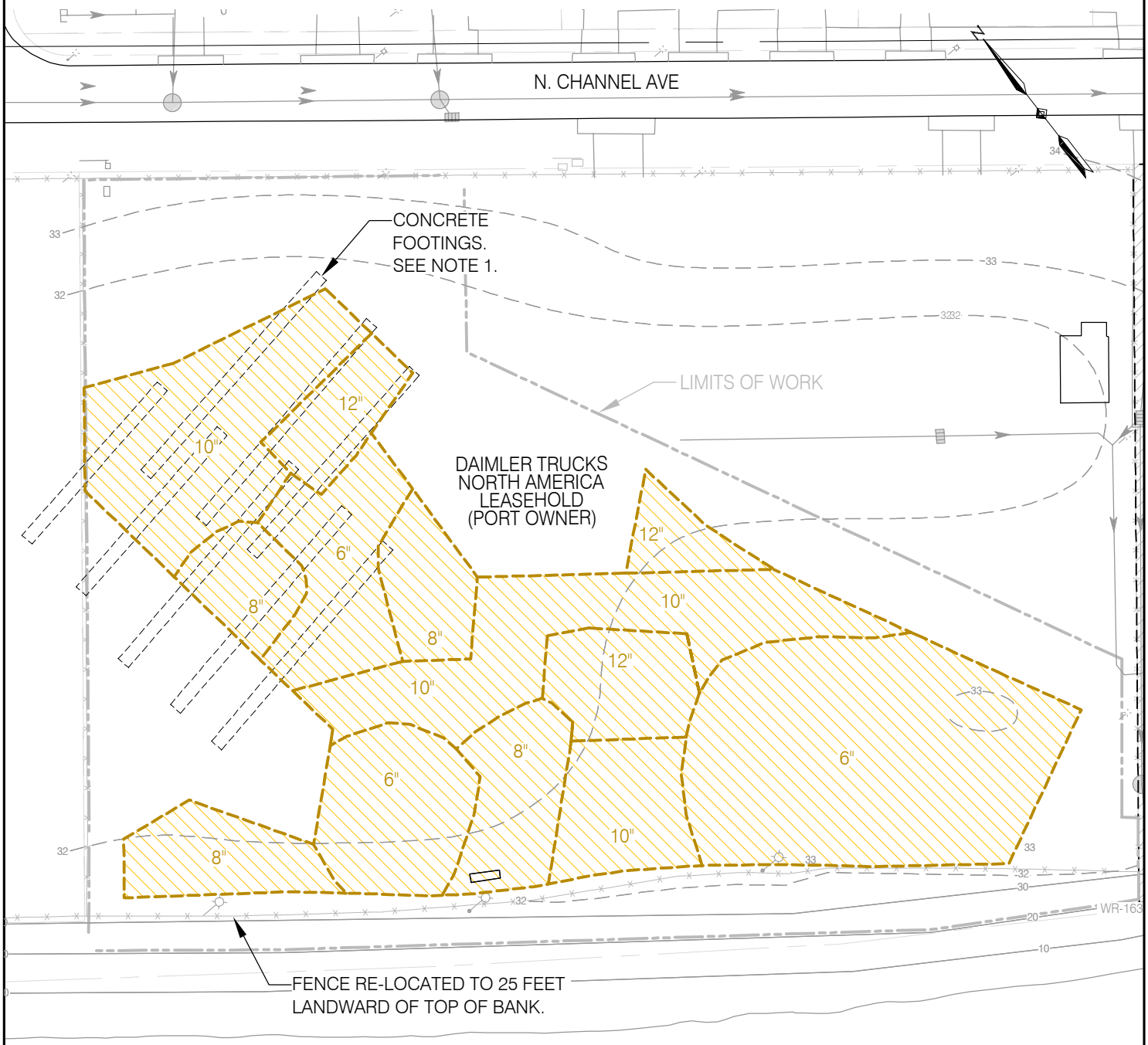
1. Where multiple samples collected at a location, concentration shown is maximum in the depth interval of 0-3 feet.
2. Arsenic concentrations greater than the Remediation Level detected only in the 0-1 foot interval.

Arsenic in Surface Soil

Feasibility Study
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-15	Figure
January 2013		3



NOTE:
1. EXISTING CONCRETE FOOTINGS LEFT IN PLACE. DEPTH TO CONCRETE FOOTINGS 4 INCHES OR LESS.

0 100 200
Scale in Feet

Legend:

6" Removal Area and Depth in Inches

Final Removal Area

Removal Action Completion Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number	1115-18	Figure 4
	April 2015		

Table 2 - Confirmation Samples - Lateral
Operable Unit 2, Daimler Leasehold
Swan Island Upland Facility
Portland, Oregon

Sample Name	Depth (inches)	Sample Date	Arsenic Concentration in mg/kg (ppm)
AB1	0 - 6	7/24/2014	21.2
AB1-1	0 - 6	8/26/2014	1.70
AB2	0 - 6	7/24/2014	32.7
AB2-1	0 - 6	8/26/2014	82.6
AB2-2	0 - 6	10/1/2014	133
AC	0 - 6	7/24/2014	127
BF1	0 - 6	7/24/2014	22.9
BF1-1	0 - 6	8/26/2014	6.30
BF2	0 - 6	7/24/2014	99.1
BF2-1	0 - 6	8/26/2014	31.1
BF2-2	0 - 6	10/1/2014	13.2
CD	0 - 6	7/24/2014	33.5
CD1-1	0 - 6	8/26/2014	35.9
CD1-2	0 - 6	10/1/2014	73.5
DE	0 - 6	7/24/2014	60.2
DE-1	0 - 6	8/27/2014	14.5
DE-2	0 - 6	10/1/2014	60.5
EF	0 - 6	7/24/2014	43.7
EF-1	0 - 6	8/27/2014	44.2
GH	0 - 6	7/24/2014	11.0
GH-1	0 - 6	8/27/2014	5.20
HI1	0 - 6	7/24/2014	17.3
HI1-1	0 - 6	8/27/2014	13.6
HI1-2	0 - 6	10/1/2014	8.29
HI2	0 - 6	7/24/2014	6.12
IJ	0 - 6	7/24/2014	22.2
IJ-1	0 - 6	8/27/2014	19.6
JK	0 - 6	7/24/2014	19.8
JK1-1	0 - 6	8/26/2014	24.5
LM	0 - 6	7/24/2014	124
LM1-1	0 - 6	8/26/2014	65.8
M	0 - 6	7/24/2014	38.2
M-1	0 - 6	8/26/2014	14.2
M-2	0 - 6	10/1/2014	16.7
H	0 - 6	12/23/2014	13.9
H Lateral	0 - 6	12/23/2014	3.30
MN	0 - 6	7/24/2014	24.0
NO1	0 - 6	7/24/2014	138
NO1-1	0 - 6	8/27/2014	100
NO1-2	0 - 6	10/1/2014	16.8
NO2	0 - 6	7/24/2014	106
NO2-1	0 - 6	8/26/2014	13.5
OP1	0 - 6	7/24/2014	314
OP1-1	0 - 6	8/26/2014	360
OP2	0 - 6	7/24/2014	25.5
OP2-1	0 - 6	8/26/2014	19.3
OP2-2	0 - 6	10/1/2014	117
OP2-3	0 - 6	10/1/2014	5.95

Notes:

1. mg/kg (ppm) = Milligrams per kilogram (parts per million).
2. J = Estimated concentration.
3. Arsenic is analyzed by EPA Method 6020.
4. **Bold** values exceed DEQ default background concentration of 8.8 mg/kg.
5. Shaded values indicate samples that were removed by excavation.

Attachment 4 - Human Health Risk Assessment Tables

Table 1
Chemicals of Potential Concern
Swan Island Upland Facility - OU2

Chemicals of Interest	Soil (see units below)												Groundwater (µg/L)												Multiple Media Screening		Chemicals of Potential Concern [4]
	Detection Frequency			Detection Limit Range		COPC Screening							Detection Frequency			Detection Limit Range		COPC Screening									
	Det.	/	Total	%	Min.	Max.	SL	Cij	Rij	COPC?	Rij/Rj	COPC?	Det.	/	Total	%	Min.	Max.	SL	Cij	Rij	COPC?	Rij/Rj	COPC?	SRij	COPC?	
Total Petroleum Hydrocarbons							mg/kg																				
Gasoline-Range Organics	1	/	37	3%	4	57	7.2E+02	1.3E+02	1.7E-01	No	9.7E-05	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Diesel-Range Organics	16	/	73	22%	14	140	3.9E+03	6.5E+03	1.7E+00	Yes	9.3E-04	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	Diesel-Range Organics
Residual-Range Organics	17	/	73	23%	27	280	3.9E+03	3.5E+03	9.0E-01	No	5.0E-04	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
TPH-418.1	4	/	12	33%	100	100	3.9E+03	3.0E+03	7.7E-01	No	4.3E-04	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Metals							mg/kg																				
Antimony	22	/	68	32%	2	14	3.1E+01	7.3E+01	2.4E+00	Yes	1.3E-03	No	3	/	14	21%	0.05	0.25	1.5E+01	4.9E-01	3.4E-02	No	3.7E-05	No	2.4E+00	Yes	Antimony
Arsenic[3]	87	/	87	100%	--	--	5.8E+00	6.5E+02	1.7E+03	Yes	9.3E-01	Yes	13	/	14	93%	0.5	0.5	6.6E-02	3.9E+01	5.9E+02	Yes	6.5E-01	Yes	2.3E+03	Yes	Arsenic
Cadmium	20	/	80	25%	1	1	1.5E+03	8.1E+00	5.4E-03	No	3.0E-06	No	10	/	14	71%	0.02	0.25	1.8E+01	3.9E+00	2.2E-01	No	2.4E-04	No	2.2E-01	No	
Chromium (total)	80	/	80	100%	--	--	2.8E+02	3.9E+01	1.4E-01	No	7.7E-05	No	13	/	14	93%	0.02	0.4	1.1E+02	9.5E+02	8.6E+00	Yes	9.5E-03	No	8.8E+00	Yes	Chromium
Copper	73	/	73	100%	--	--	2.9E+03	1.8E+03	6.2E-01	No	3.5E-04	No	14	/	14	100%	--	--	1.4E+03	1.3E+03	9.4E-01	No	1.0E-03	No	1.6E+00	Yes	Copper
Lead	93	/	97	96%	5	5	4.0E+02	6.1E+02	1.5E+00	Yes	8.4E-04	No	12	/	14	86%	0.02	0.04	1.5E+01	2.3E+02	1.5E+01	Yes	1.7E-02	No	1.7E+01	Yes	Lead
Mercury	33	/	61	54%	0.02	0.10	2.3E+01	2.3E-01	1.0E-02	No	5.6E-06	No	3	/	14	21%	0.02	0.2	1.1E+01	2.1E+00	1.9E-01	No	2.1E-04	No	2.0E-01	No	
Nickel	68	/	68	100%	--	--	1.6E+03	7.0E+01	4.4E-02	No	2.4E-05	No	14	/	14	100%	--	--	7.3E+02	9.2E+02	1.3E+00	Yes	1.4E-03	No	1.3E+00	Yes	Nickel
Silver	14	/	74	19%	0.5	2.8	3.9E+02	1.9E+00	4.9E-03	No	2.7E-06	No	7	/	14	50%	0.020	0.04	1.8E+02	2.8E+00	1.5E-02	No	1.7E-05	No	2.0E-02	No	
Zinc	73	/	73	100%	--	--	2.3E+04	7.4E+03	3.2E-01	No	1.8E-04	No	14	/	14	100%	--	--	1.1E+04	2.3E+03	2.1E-01	No	2.3E-04	No	5.3E-01	No	
Barium	12	/	12	100%	--	--	1.6E+04	1.7E+02	1.1E-02	No	6.0E-06	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Selenium	0	/	12	0%	0.5	0.5	3.9E+02	--	--	No	--	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
PCBs							µg/kg																				
Aroclor 1254	4	/	85	5%	10	95	2.2E+02	2.9E+02	1.3E+00	No	7.3E-04	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Aroclor 1260	23	/	85	27%	10	55	2.2E+02	6.7E+03	3.0E+01	Yes	1.7E-02	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	Aroclor 1260
Total PCBs	23	/	85	27%	10	55	2.2E+02	6.7E+03	3.1E+01	Yes	1.7E-02	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	Total PCBs
PAHs							µg/kg																				
Naphthalene	16	/	24	67%	5.30	7	3.8E+03	2.3E+01	6.1E-03	No	3.4E-06	No	2	/	10	20%	0.019	0.020	1.2E-01	9.3E-02	7.8E-01	No	8.6E-04	No	7.8E-01	No	
2-Methylnaphthalene	14	/	24	58%	2.60	7	3.1E+05	2.3E+01	7.4E-05	No	4.1E-08	No	1	/	10	10%	0.019	0.020	1.5E+02	2.9E-02	1.9E-04	No	2.1E-07	No	2.7E-04	No	
Acenaphthylene[1]	18	/	24	75%	5.30	7	3.1E+05	8.4E+01	2.7E-04	No	1.5E-07	No	0	/	10	0%	0.019	0.020	1.5E+02	--	--	No	--	No	--	--	
Acenaphthene	11	/	24	46%	2.60	7	2.9E+06	1.7E+01	5.9E-06	No	3.3E-09	No	0	/	10	0%	0.019	0.020	3.7E+02	--	--	No	--	No	--	--	
Dibenzofuran[1]	10	/	24	42%	2.60	7	3.1E+05	1.5E+01	4.8E-05	No	2.7E-08	No	0	/	10	0%	0.019	0.020	1.5E+02	--	--	No	--	No	--	--	
Fluorene	12	/	24	50%	2.60	7	2.6E+06	1.0E+01	3.8E-06	No	2.1E-09	No	0	/	10	0%	0.019	0.020	2.4E+02	--	--	No	--	No	--	--	
Phenanthrene[1]	18	/	24	75%	5.70	27	3.1E+05	1.9E+02	6.1E-04	No	3.4E-07	No	1	/	10	10%	0.019	0.025	1.5E+02	2.2E-02	1.5E-04	No	1.6E-07	No	7.6E-04	No	
Anthracene	18	/	24	75%	5.30	7	2.1E+07	4.9E+01	2.3E-06	No	1.3E-09	No	0	/	10	0%	0.019	0.020	1.8E+03	--	--	No	--	No	--	--	
Fluoranthene	21	/	24	88%	7.00	7	2.3E+06	5.0E+02	2.2E-04	No	1.2E-07	No	0	/	10	0%	0.019	0.020	1.5E+03	--	--	No	--	No	--	--	
Pyrene	21	/	24	88%	7.00	7	1.7E+06	6.9E+02	4.1E-04	No	2.3E-07	No	1	/	10	10%	0.019	0.037	1.1E+03	2.8E-02	2.5E-05	No	2.8E-08	No	4.3E-04	No	
Benzo(a)anthracene	21	/	24	88%	7.00	7	1.5E+02	2.3E+02	1.6E+00	Yes	8.6E-04	No	0	/	10	0%	0.019	0.020	2.9E-02	--	--	No	--	No	--	--	Benzo(a)anthracene
Chrysene	21	/	24	88%	7.00	7	1.5E+04	4.3E+02	2.9E-02	No	1.6E-05	No	0	/	10	0%	0.019	0.020	2.9E+00	--	--	No	--	No	--	--	
Benzo(b)fluoranthene	19	/	24	79%	5.70	7	1.5E+02	5.2E+02	3.5E+00	Yes	1.9E-03	No	0	/	10	0%	0.019	0.020	2.9E-02	--	--	No	--	No	--	--	Benzo(b)fluoranthene
Benzo(k)fluoranthene	20	/	24	83%	5.70	7	1.5E+03	3.8E+02	2.5E-01	No	1.4E-04	No	0	/	10	0%	0.019	0.020	2.9E-01	--	--	No	--	No	--	--	
Benzo(a)pyrene	20	/	24	83%	5.70	7	1.5E+01	5.2E+02	3.5E+01	Yes	1.9E-02	No	0	/	10	0%	0.019	0.020	2.9E-03	--	--	No	--	No	--	--	Benzo(a)pyrene
Indeno(1, 2, 3-cd)pyrene	20	/	24	83%	5.70	7	1.5E+02	6.6E+02	4.4E+00	Yes	2.4E-03	No	0	/	10	0%	0.019	0.020	2.9E-02	--	--	No	--	No	--	--	Indeno(1, 2, 3-cd)pyrene
Dibenz(a,h)anthracene	18	/	24	75%	5.30	7	1.5E+01	7.7E+01	5.1E+00	Yes	2.9E-03	No	0	/	10	0%	0.019	0.020	2.9E-03	--	--	No	--	No	--	--	Dibenz(a,h)anthracene
Benzo(g, h, i)perylene[2]	20	/	24	83%	5.70	7	1.5E+02	7.2E+02	4.8E+00	Yes	2.7E-03	No	1	/	10	10%	0.019	0.020	2.9E-02	2.0E-02	6.9E-01	No	7.6E-04	No	5.5E+00	Yes	Benzo(g, h, i)perylene2
Butyltins							µg/kg																				
Tri-n-butyltin	8	/	12	67%	5	5	1.8E+04	5.8E+02	3.2E-02	No	1.8E-05	No	0	/	8	0%	0.02	0.42	1.1E+01	--	--	No	--	No	--	--	
Volatile Organic Compounds							µg/kg																				
Vinyl chloride	0	/	18	0%	0	14	3.4E+02	--	--	No	--	No	6	/	14	43%	0.5	0.5	2.5E-02	7.0E+00	2.8E+02	Yes	3.1E-01	Yes	--	--	Vinyl chloride
Acetone	5	/	18	28%	2	3500	6.1E+07	1.9E+02	3.1E-06	No	1.7E-09	No	0	/	14	0%	20	20	2.2E+04	--	--	No	--	No	--	--	
Dichloromethane (Methylene Chloride)	1	/	18	6%	1	70	2.0E+04	1.2E+00	6.1E-05	No	3.4E-08	No	0	/	14	0%	1	2	4.1E+00	--	--	No	--	No	--	--	
cis-1,2-Dichloroethene	0	/	18	0%	0.1	14	1.1E+05	--	--	No	--	No	6	/	14	43%	0.5	0.5	6.1E+01	1.4E+01	2.3E-01	No	2.5E-04	No	--	--	
Chloroform	0	/	18	0%	0.1	14	3.9E+02	--	--	No	--	No	1	/	14	7%	0.5	0.5	1.8E-01	1.1E+00	6.1E+00	Yes	6.7E-03	No	--	--	Chloroform
Toluene	0	/	39	0%	0.1	1100	5.4E+06	--	--	No	--	No	1	/	14	7%	0.5	0.5	2.3E+03	7.6E-01	3.3E-04	No	3.6E-07	No	--	--	
1,2,4-Trimethylbenzene	1	/	18	6%	0.1	29	4.9E+04	2.0E+01	4.1E-04	No	2.3E-07	No	0	/	14	0%	2	2	1.2E+01	--	--	No	--	No	--	--	
Naphthalene	1	/	18	6%	0.1	29	3.8E+03	4.3E+01	1.1E-02	No	6.3E-06	No	0	/	14	0%	2	2	1.2E-01	--	--	No	--	No	--	--	
n-Propylbenzene	1	/	18	6%	0.1	29	2.1E+05	1.9E+01	9.2E-05	No	5.1E-08	No	0	/	14	0%	2	2	6.1E+01	--	--	No	--	No	--	--	
Phthalates							µg/kg																				
Diethyl Phthalate	1	/	3	33%	100.0	100	4.9E+07	2.1E+00	4.3E-08	No	2.4E-11	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Butyl Benzyl Phthalate	2	/	3	67%	100.0	100	2.6E+05	1.2E+02	4.6E-04	No	2.6E-07	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
Bis(2-ethylhexyl) Phthalate	3	/	3	100%	--	--	3.5E+04	3.6E+02	1.0E-02	No	5.7E-06	No	--	/	--	--	--	--	--	--	--	--	--	--	--	--	
								Rj	1.8E+03											Rj	9.1E+02						
								Nij	45											Nij	19						
								1/Nij	2.2E-02											1/Nij	5.3E-02						

Acronyms:
SL = Screening Level.
Soil: Lower of DEQ RBC for Residential Direct Contact or Occupational Vapor Intrusion (October 2008). If RBC not available, EPA Regional Screening Levels (September 2008).
for naturally occuring metals, screening level is not less than background as defined by Washington Department of Ecology for Clark County.
Groundwater: DEQ RBC for Residential Tapwater (October 2008). If RBC not available, EPA Regional Screening Levels (September 2008).
Except:
-- = Not applicable.
COPC = Chemical of Potential Concern.

Variables:
Cij = Maximum detected concentration of compound i in medium j.
Rij = Risk ratio for compound i in medium j (Cij/SL); compound is a COPC if Rij is greater than 1.
Rj = Sum of risk ratios for medium j.
Nij = Number of compounds i detected in medium j.
Rij/Rj = Compound is a COPC if this ratio is greater than 1/Nij.
SRij = Summary risk ratio for compound i in all media (total Rij across all media); compound is a COPC if Srij is greater than 1.

Notes:
1. SL for 2-methylnaphthalene used as surrogate SL.
2. SL for indeno(1, 2, 3-cd)pyrene used as surrogate SL.
3. SL for arsenic is background. However, because detected concentration exceeds SL, Rij calculated from risk-based concentration of 0.39 mg/kg.
4. Chemicals with frequency of detection of less than five percent were not retained as COPC per DEQ guidance (DEQ 2000; Section 2.3.2[1]).
5. mg/kg = Milligrams per kilogram.
6. µg/kg = Micrograms per kilogram.
7. µg/L = Micrograms per liter.

Table 2
Summary of Exposure Point Concentrations (EPCs)
Swan Island Upland Facility - OU2

Medium	Location	Chemical	Data Distribution				Concentration				
			Statistical Assessment				Mean	Maximum	90% UCL	EPC	
			Normal	Lognormal	Gamma	Non-Parametric				CT	RME
Soil in mg/kg	0 to 3 feet Freightliner	Diesel Range Organics				90% KM (t)	470	6,500	1,100	470	1,100
		Antimony				90% KM (BCA)	9.3	73	13	9.3	13
		Arsenic			Approx.		38	449	57	38	57
		Chromium	90% Student-t				22	32	24	22	24
		Copper			Approx.		192	1,770	270	192	270
		Lead			Approx.		69	580	96	69	96
		Nickel				90% Student-t	24	70	28	24	28
		Aroclor 1260				90% KM (t)	0.038	0.30	0.067	0.038	0.067
		Total PCBs				90% KM (t)	0.057	0.59	0.11	0.057	0.11
		Benzo(a)anthracene	Limited Samples - Use Maximum				--	0.068	--	0.068	0.068
		Benzo(b)fluoranthene	Limited Samples - Use Maximum				--	0.21	--	0.21	0.21
		Benzo(a)pyrene	Limited Samples - Use Maximum				--	0.17	--	0.17	0.17
		Indeno(1, 2, 3-cd)pyrene	Limited Samples - Use Maximum				--	0.29	--	0.29	0.29
		Dibenz(a,h)anthracene	Limited Samples - Use Maximum				--	0.022	--	0.022	0.022
		Benzo(g, h, i)perylene	Limited Samples - Use Maximum				--	0.36	--	0.36	0.36
		Vinyl Chloride	Not Detected								
		Chloroform	Not Detected								
Soil in mg/kg	0 to 3 feet Pacific Rock Products	Diesel Range Organics				90% KM (t)	43	380	65	43	65
		Antimony				90% KM (t)	1.5	4.8	3.0	1.5	3.0
		Arsenic			Approx.		3.7	8.4	4.2	3.7	4.2
		Chromium	90% Student-t				20	32	22	20	22
		Copper				90% Cheb	93	805	200	93	200
		Lead				90% KM (Cheb)	29	158	50	29	50
		Nickel	90% Student-t				20	28	22	20	22
		Aroclor 1260				90% KM (t)	0.049	0.41	0.074	0.049	0.074
		Total PCBs				90% KM (t)	0.053	0.42	0.08	0.053	0.08
		Benzo(a)anthracene				90% KM (t)	0.046	0.14	0.064	0.046	0.064
		Benzo(b)fluoranthene				90% KM (BCA)	0.083	0.31	0.12	0.083	0.12
		Benzo(a)pyrene				90% KM (t)	0.093	0.32	0.14	0.093	0.14
		Indeno(1, 2, 3-cd)pyrene				90% KM (t)	0.13	0.43	0.18	0.13	0.18
		Dibenz(a,h)anthracene				90% KM (t)	0.012	0.034	0.017	0.012	0.017
		Benzo(g, h, i)perylene				90% KM (t)	0.14	0.49	0.20	0.14	0.20
		Vinyl Chloride	Not Detected								
		Chloroform	Not Detected								

Please refer to notes at end of table.

Table 2
Summary of Exposure Point Concentrations (EPCs)
Swan Island Upland Facility - OU2

Medium	Location	Chemical	Data Distribution				Concentration				
			Statistical Assessment				Mean	Maximum	90% UCL	EPC	
			Normal	Lognormal	Gamma	Non-Parametric				CT	RME
Soil in mg/kg	0 to 3 feet	Diesel Range Organics				90% KM (t)	23	41	34	23	34
	Berth 315 Area	Antimony	Limited Samples - Use Maximum				--	0.37	--	0.37	0.37
		Arsenic	Limited Samples - Use Maximum				--	3.4	--	3.4	3.4
		Chromium	Limited Samples - Use Maximum				--	15	--	15	15
		Copper	Limited Samples - Use Maximum				--	66	--	66	66
		Lead	Limited Samples - Use Maximum				--	58	--	58	58
		Nickel	Limited Samples - Use Maximum				--	18	--	18	18
		Aroclor 1260				90% KM (t)	0.030	0.078	0.064	0.030	0.064
		Total PCBs				90% KM (t)	0.035	0.091	0.073	0.035	0.073
		Benzo(a)anthracene	Limited Samples - Use Maximum				--	0.10	--	0.10	0.10
		Benzo(b)fluoranthene	Limited Samples - Use Maximum				--	0.045	--	0.045	0.045
		Benzo(a)pyrene	Limited Samples - Use Maximum				--	0.070	--	0.070	0.070
		Indeno(1, 2, 3-cd)pyrene	Limited Samples - Use Maximum				--	0.077	--	0.077	0.077
		Dibenz(a,h)anthracene	Limited Samples - Use Maximum				--	0.021	--	0.021	0.021
		Benzo(g, h, i)perylene	Limited Samples - Use Maximum				--	0.081	--	0.081	0.081
		Vinyl Chloride					Not Detected				
		Chloroform					Not Detected				
Soil in mg/kg	0 to 15 feet	Diesel Range Organics				90% KM (t)	380	6,500	850	380	850
	Freightliner	Antimony				90% KM (t)	8.6	73	12	8.6	12
		Arsenic				90% Cheb	33	449	78	33	78
		Chromium	90% Student-t				21	32	23	21	23
		Copper			Approx.		166	1,770	230	166	230
		Lead			Approx.		61	580	84	61	84
		Nickel				90% Student-t	23	70	27	23	27
		Aroclor 1260				90% KM (t)	0.032	0.30	0.058	0.032	0.058
		Total PCBs				90% KM (t)	0.049	0.59	0.094	0.049	0.094
		Benzo(a)anthracene	Limited Samples - Use Maximum				--	0.068	--	0.068	0.068
		Benzo(b)fluoranthene	Limited Samples - Use Maximum				--	0.21	--	0.210	0.210
		Benzo(a)pyrene	Limited Samples - Use Maximum				--	0.17	--	0.170	0.170
		Indeno(1, 2, 3-cd)pyrene	Limited Samples - Use Maximum				--	0.29	--	0.290	0.290
		Dibenz(a,h)anthracene	Limited Samples - Use Maximum				--	0.022	--	0.0220	0.022
		Benzo(g, h, i)perylene	Limited Samples - Use Maximum				--	0.36	--	0.360	0.360
		Vinyl Chloride					Not Detected				
		Chloroform					Not Detected				

Please refer to notes at end of table.

Table 2
Summary of Exposure Point Concentrations (EPCs)
Swan Island Upland Facility - OU2

Medium	Location	Chemical	Data Distribution				Concentration				
			Statistical Assessment				Mean	Maximum	90% UCL	EPC	
			Normal	Lognormal	Gamma	Non-Parametric				CT	RME
Soil in mg/kg	0 to 15 feet	Diesel Range Organics				90% KM (t)	80	1,380	140	80	140
	Pacific Rock Products	Antimony				90% KM (t)	1.5	4.8	1.5	1.5	1.5
		Arsenic				90% Student-t	3.4	8.4	3.8	3.4	3.8
		Chromium	90% Student-t				20	32	22	20	22
		Copper				90% Cheb	74	805	150	74	150
		Lead				90% KM (Cheb)	29	256	56	29	56
		Nickel	90% Student-t				20	28	21	20	21
		Aroclor 1260				90% KM (Cheb)	0.23	6.7	0.82	0.23	0.82
		Total PCBs				90% KM (BCA)	0.24	6.7	0.45	0.24	0.45
		Benzo(a)anthracene				90% KM (Cheb)	0.043	0.14	0.078	0.043	0.078
		Benzo(b)fluoranthene				90% KM (% Boot)	0.076	0.31	0.12	0.076	0.12
		Benzo(a)pyrene				90% KM (t)	0.085	0.32	0.13	0.085	0.13
		Indeno(1, 2, 3-cd)pyrene				90% KM (t)	0.11	0.43	0.17	0.11	0.17
		Dibenz(a,h)anthracene				90% KM (t)	0.011	0.034	0.016	0.011	0.016
		Benzo(g, h, i)perylene				90% KM (t)	0.13	0.49	0.19	0.13	0.19
		Vinyl Chloride					Not Detected				
		Chloroform					Not Detected				
Soil in mg/kg	0 to 15 feet	Diesel Range Organics				90% KM (t)	23	41	34	23	34
	Berth 315 Area	Antimony	Limited Samples - Use Maximum				--	0.37	--	0.37	0.37
		Arsenic	Limited Samples - Use Maximum				--	3.4	--	3.4	3.4
		Chromium	Limited Samples - Use Maximum				--	15	--	15	15
		Copper	Limited Samples - Use Maximum				--	66	--	66	66
		Lead	Limited Samples - Use Maximum				--	58	--	58	58
		Nickel	Limited Samples - Use Maximum				--	18	--	18	18
		Aroclor 1260				90% KM (t)	0.030	0.078	0.064	0.030	0.064
		Total PCBs				90% KM (t)	0.035	0.091	0.073	0.035	0.073
		Benzo(a)anthracene	Limited Samples - Use Maximum				--	0.10	--	0.10	0.10
		Benzo(b)fluoranthene	Limited Samples - Use Maximum				--	0.045	--	0.045	0.045
		Benzo(a)pyrene	Limited Samples - Use Maximum				--	0.070	--	0.070	0.070
		Indeno(1, 2, 3-cd)pyrene	Limited Samples - Use Maximum				--	0.077	--	0.077	0.077
		Dibenz(a,h)anthracene	Limited Samples - Use Maximum				--	0.021	--	0.021	0.021
		Benzo(g, h, i)perylene	Limited Samples - Use Maximum				--	0.081	--	0.081	0.081
		Vinyl Chloride					Not Detected				
		Chloroform					Not Detected				
Groundwater in µg/L	MW-11	Vinyl Chloride	Limited Samples - Use Maximum				--	6.5	--	6.5	6.5
		Chloroform	Limited Samples - Use Maximum				--	1.1	--	1.1	1.1

Notes:

1. See Appendix A for list of data used.
2. See Appendix B for statistical calculations.
3. EPC = Exposure Point Concentration.
4. UCL = Upper Confidence Limit of the Mean.
5. CT = Central Tendency.
6. RME = Reasonable Maximum Exposure.
7. mg/kg = Milligrams per kilogram.
8. µg/L = Micrograms per liter.

Table 3
Summary of Human Health Risk-Based Concentrations (RBCs)
Swan Island Upland Facility - OU2

	General Endpoint Effects	Risk-Based Concentrations[1]				
		Occupational - Direct Contact	Occupational - Vapor Intrusion	Occupational - Outdoor Air	Construction Worker - Direct Contact and Inhalation	Excavation Worker - Direct Contact and Inhalation
Soil in mg/kg						
Diesel-Range Organics	Non-carcinogen	70,000	nv	nv	23,000	130,000
Antimony[5]	Non-carcinogen	410	nv	nv	410	410
Arsenic	Carcinogen	1.7	nv	nv	13	370
Chromium[2]	Non-carcinogen	180	nv	nv	4,600	130,000
Copper[5]	Non-carcinogen	41,000	nv	nv	41,000	41,000
Lead	Non-carcinogen	800	nv	nv	800	800
Nickel	Non-carcinogen	20,000	nv	nv	6,200	170,000
Aroclor 1260[4]	Carcinogen	0.98	nv	nv	4.4	120
Total PCBs	Carcinogen	0.98	nv	nv	4.4	120
Benzo(a)anthracene	Carcinogen	2.7	nv	nv	21	590
Benzo(b)fluoranthene	Carcinogen	2.7	nv	nv	21	590
Benzo(a)pyrene	Carcinogen	0.27	nv	nv	2.1	59
Indeno(1, 2, 3-cd)pyrene	Carcinogen	2.7	nv	nv	21	590
Dibenz(a,h)anthracene	Carcinogen	0.27	nv	nv	2.1	59
Benzo(g, h, i)perylene[3]	--	27	nv	nv	210	5,900
Groundwater in µg/L						
Vinyl Chloride	Carcinogen	--	870	6,400	--	--
Chloroform	Carcinogen	--	1,100	5,200	--	--

Notes:

1. RBDM Guidance (DEQ, 2003) unless noted otherwise. Default values from table updated October 3, 2008.
2. Conservatively uses RBC for chromium VI but in non-carcinogen analysis.
3. RBC for benzo(k)fluoranthene used as a surrogate.
4. RBC for total PCBs used as a surrogate.
5. EPA Industrial Regional Screening Levels (September 2008) used as surrogate.
6. nv = Not volatile so RBC not applicable to this COPC for this pathway.
7. -- = COPC in that medium not applicable to this pathway.
8. mg/kg = Milligrams per kilogram.
9. µg/L = Micrograms per liter.

Table 4
Risk Characterization: Non-Carcinogen
Swan Island Upland Facility - OU2

Exposure Area	Receptor	Medium and Location	Pathway	Chemical	EPC		RBC	Hazard Quotient		Hazard Index	
					CT	RME		CT	RME	CT	RME
Freightliner	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	470	1,100	70,000	7E-03	2E-02		
				Antimony	9.3	13	410	2E-02	3E-02		
				Chromium	22	24	180	1E-01	1E-01		
				Copper	192	270	41,000	5E-03	7E-03		
				Lead	69	96	800	9E-02	1E-01		
				Nickel	24	28	20,000	1E-03	1E-03		
										2E-01	3E-01
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	380	850	23,000	2E-02	4E-02		
				Antimony	8.6	12	410	2E-02	3E-02		
				Chromium	21	23	4,600	5E-03	5E-03		
				Copper	166	230	41,000	4E-03	6E-03		
				Lead	61	84	800	8E-02	1E-01		
				Nickel	23	27	6,200	4E-03	4E-03		
										1E-01	2E-01
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	380	850	130,000	3E-03	7E-03		
				Antimony	8.6	12	410	2E-02	3E-02		
				Chromium	21	23	130,000	2E-04	2E-04		
				Copper	166	230	41,000	4E-03	6E-03		
				Lead	61	84	800	8E-02	1E-01		
				Nickel	23	27	170,000	1E-04	2E-04		
										1E-01	1E-01
Pacific Rock Products	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	43	65	70,000	6E-04	9E-04		
				Antimony	1.5	3.0	410	4E-03	7E-03		
				Chromium	20	22	180	1E-01	1E-01		
				Copper	93	200	41,000	2E-03	5E-03		
				Lead	29	50	800	4E-02	6E-02		
				Nickel	20	22	20,000	1E-03	1E-03		
										2E-01	2E-01
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	80	140	23,000	3E-03	6E-03		
				Antimony	1.5	1.5	410	4E-03	4E-03		
				Chromium	20	22	4,600	4E-03	5E-03		
				Copper	74	150	41,000	2E-03	4E-03		
				Lead	29	56	800	4E-02	7E-02		
				Nickel	20	21	6,200	3E-03	3E-03		
										5E-02	9E-02
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	80	140	130,000	6E-04	1E-03		
				Antimony	1.5	1.5	410	4E-03	4E-03		
				Chromium	20	22	130,000	2E-04	2E-04		
				Copper	74	150	41,000	2E-03	4E-03		
				Lead	29	56	800	4E-02	7E-02		
				Nickel	20	21	170,000	1E-04	1E-04		
										4E-02	8E-02

Please refer to notes at end of table.

Table 4
Risk Characterization: Non-Carcinogen
Swan Island Upland Facility - OU2

Exposure Area	Receptor	Medium and Location	Pathway	Chemical	EPC		RBC	Hazard Quotient		Hazard Index	
					CT	RME		CT	RME	CT	RME
Berth 315 Area	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	23	34	70,000	3E-04	5E-04		
				Antimony	0.37	0.37	410	9E-04	9E-04		
				Chromium	15	15	180	8E-02	8E-02		
				Copper	66	66	41,000	2E-03	2E-03		
				Lead	58	58	800	7E-02	7E-02		
				Nickel	18	18	20,000	9E-04	9E-04		
										2E-01	2E-01
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	23	34	23,000	1E-03	1E-03		
				Antimony	0.37	0.37	410	9E-04	9E-04		
				Chromium	15	15	4,600	3E-03	3E-03		
				Copper	66	66	41,000	2E-03	2E-03		
				Lead	58	58	800	7E-02	7E-02		
				Nickel	18	18	6,200	3E-03	3E-03		
										8E-02	8E-02
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Diesel-Range Organics	23	34	130,000	2E-04	3E-04		
				Antimony	0.37	0.37	410	9E-04	9E-04		
				Chromium	15	15	130,000	1E-04	1E-04		
				Copper	66	66	41,000	2E-03	2E-03		
				Lead	58	58	800	7E-02	7E-02		
				Nickel	18	18	170,000	1E-04	1E-04		
										8E-02	8E-02

Notes:
1. EPC = Exposure Point Concentration; from Table 2.
2. CT = Central Tendency.
3. RME = Reasonable Maximum Exposure.
4. RBC = Risk-Based Concentration; from Table 3.
5. mg/kg = Milligrams per kilogram.
6. Shaded Cell = Hazard Quotient or Hazard Index exceeds acceptable level of 1.0.

Table 5
Risk Characterization: Carcinogen
Swan Island Upland Facility - OU2

Exposure Area	Receptor	Medium	Pathway	Chemical	EPC		RBC	Individual Chemical Excess Risk		Cumulative Excess Risk	
					CT	RME		CT	RME	CT	RME
Freightliner	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	38	57	1.7	2E-05	3E-05		
				Aroclor 1260	0.038	0.07	0.98	4E-08	7E-08		
				Total PCBs	0.057	0.11	0.98	6E-08	1E-07		
				Benzo(a)anthracene	0.068	0.068	2.7	3E-08	3E-08		
				Benzo(b)fluoranthene	0.21	0.21	2.7	8E-08	8E-08		
				Benzo(a)pyrene	0.17	0.17	0.27	6E-07	6E-07		
				Indeno(1, 2, 3-cd)pyrene	0.29	0.29	2.7	1E-07	1E-07		
				Dibenz(a,h)anthracene	0.022	0.022	0.27	8E-08	8E-08		
				Benzo(g, h, i)perylene	0.36	0.36	27	1E-08	1E-08		
										2E-05	3E-05
		Groundwater, µg/L	Vapor Intrusion	Vinyl Chloride	6.5	6.5	870	7E-09	7E-09		
				Chloroform	1.1	1.1	1,100	1E-09	1E-09		
										8E-09	8E-09
			Outdoor Air	Vinyl Chloride	6.5	6.5	6,400	1E-09	1E-09		
				Chloroform	1.1	1.1	5,200	2E-10	2E-10		
										1E-09	1E-09
		Soil and GW Vapor Intrusion	Ingestion, Direct Contact, Inhalation	(see above)						2E-05	3E-05
		Soil and GW Outdoor Air	Ingestion, Direct Contact, Inhalation	(see above)						2E-05	3E-05
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	33	78	13	3E-06	6E-06		
				Aroclor 1260	0.032	0.06	4.4	7E-09	1E-08		
				Total PCBs	0.049	0.09	4.4	1E-08	2E-08		
				Benzo(a)anthracene	0.068	0.068	21	3E-09	3E-09		
				Benzo(b)fluoranthene	0.21	0.21	21	1E-08	1E-08		
				Benzo(a)pyrene	0.17	0.17	2	8E-08	8E-08		
				Indeno(1, 2, 3-cd)pyrene	0.29	0.29	21	1E-08	1E-08		
				Dibenz(a,h)anthracene	0.022	0.022	2	1E-08	1E-08		
				Benzo(g, h, i)perylene	0.36	0.36	210	2E-09	2E-09		
										3E-06	6E-06
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	33	78	370	9E-08	2E-07		
				Aroclor 1260	0.032	0.06	120	3E-10	5E-10		
				Total PCBs	0.049	0.09	120	4E-10	8E-10		
				Benzo(a)anthracene	0.068	0.068	590	1E-10	1E-10		
				Benzo(b)fluoranthene	0.21	0.21	590	4E-10	4E-10		
				Benzo(a)pyrene	0.17	0.17	59	3E-09	3E-09		
				Indeno(1, 2, 3-cd)pyrene	0.29	0.29	590	5E-10	5E-10		
				Dibenz(a,h)anthracene	0.022	0.022	59	4E-10	4E-10		
				Benzo(g, h, i)perylene	0.36	0.36	5,900	6E-11	6E-11		
										9E-08	2E-07

Please refer to notes at end of table.

Table 5
Risk Characterization: Carcinogen
Swan Island Upland Facility - OU2

Exposure Area	Receptor	Medium	Pathway	Chemical	EPC		RBC	Individual Chemical Excess Risk		Cumulative Excess Risk	
					CT	RME		CT	RME	CT	RME
Pacific Rock Products	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.7	4.2	1.7	2E-06	2E-06		
				Aroclor 1260	0.049	0.07	1.0	5E-08	8E-08		
				Total PCBs	0.053	0.08	1.0	5E-08	8E-08		
				Benzo(a)anthracene	0.046	0.064	2.7	2E-08	2E-08		
				Benzo(b)fluoranthene	0.083	0.12	2.7	3E-08	4E-08		
				Benzo(a)pyrene	0.093	0.14	0.27	3E-07	5E-07		
				Indeno(1, 2, 3-cd)pyrene	0.13	0.18	2.7	5E-08	7E-08		
				Dibenz(a,h)anthracene	0.012	0.017	0.27	4E-08	6E-08		
				Benzo(g, h, i)perylene	0.14	0.20	27	5E-09	8E-09		
										3E-06	3E-06
		Groundwater, µg/L	Vapor Intrusion	Vinyl Chloride	6.5	6.5	870	7E-09	7E-09		
				Chloroform	1.1	1.1	1,100	1E-09	1E-09		
										8E-09	8E-09
			Outdoor Air	Vinyl Chloride	6.5	6.5	6,400	1E-09	1E-09		
				Chloroform	1.1	1.1	5,200	2E-10	2E-10		
										1E-09	1E-09
		Soil and GW Vapor Intrusion	Ingestion, Direct Contact, Inhalation	(see above)						3E-06	3E-06
		Soil and GW Outdoor Air	Ingestion, Direct Contact, Inhalation	(see above)						3E-06	3E-06
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.4	3.8	13	3E-07	3E-07		
				Aroclor 1260	0.23	0.8	4.4	5E-08	2E-07		
				Total PCBs	0.24	0.5	4.4	5E-08	1E-07		
				Benzo(a)anthracene	0.043	0.078	21	2E-09	4E-09		
				Benzo(b)fluoranthene	0.076	0.12	21	4E-09	6E-09		
				Benzo(a)pyrene	0.085	0.13	2.1	4E-08	6E-08		
				Indeno(1, 2, 3-cd)pyrene	0.11	0.17	21	5E-09	8E-09		
				Dibenz(a,h)anthracene	0.011	0.016	2.1	5E-09	8E-09		
				Benzo(g, h, i)perylene	0.13	0.19	210	6E-10	9E-10		
										4E-07	6E-07
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.4	3.8	370	9E-09	1E-08		
				Aroclor 1260	0.23	0.8	120	2E-09	7E-09		
				Total PCBs	0.24	0.5	120	2E-09	4E-09		
				Benzo(a)anthracene	0.043	0.078	590	7E-11	1E-10		
				Benzo(b)fluoranthene	0.076	0.12	590	1E-10	2E-10		
				Benzo(a)pyrene	0.085	0.13	59	1E-09	2E-09		
				Indeno(1, 2, 3-cd)pyrene	0.11	0.17	590	2E-10	3E-10		
				Dibenz(a,h)anthracene	0.011	0.016	59	2E-10	3E-10		
				Benzo(g, h, i)perylene	0.13	0.19	5,900	2E-11	3E-11		
										1E-08	2E-08

Please refer to notes at end of table.

Table 5
Risk Characterization: Carcinogen
Swan Island Upland Facility - OU2

Exposure Area	Receptor	Medium	Pathway	Chemical	EPC		RBC	Individual Chemical Excess Risk		Cumulative Excess Risk	
					CT	RME		CT	RME	CT	RME
Berth 315 Area	Occupational	Soil, 0 to 3 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.4	3.4	1.7	2E-06	2E-06		
				Aroclor 1260	0.030	0.064	1.0	3E-08	7E-08		
				Total PCBs	0.035	0.073	1.0	4E-08	7E-08		
				Benzo(a)anthracene	0.10	0.10	2.7	4E-08	4E-08		
				Benzo(b)fluoranthene	0.045	0.045	2.7	2E-08	2E-08		
				Benzo(a)pyrene	0.070	0.070	0.27	3E-07	3E-07		
				Indeno(1, 2, 3-cd)pyrene	0.077	0.077	2.7	3E-08	3E-08		
				Dibenz(a,h)anthracene	0.021	0.021	0.27	8E-08	8E-08		
				Benzo(g, h, i)perylene	0.081	0.081	27	3E-09	3E-09		
										2E-06	2E-06
		Groundwater, µg/L	Vapor Intrusion	Vinyl Chloride	6.5	6.5	870	7E-09	7E-09		
				Chloroform	1.1	1.1	1,100	1E-09	1E-09		
										8E-09	8E-09
			Outdoor Air	Vinyl Chloride	6.5	6.5	6,400	1E-09	1E-09		
				Chloroform	1.1	1.1	5,200	2E-10	2E-10		
										1E-09	1E-09
		Soil and GW Vapor Intrusion	Ingestion, Direct Contact, Inhalation	(see above)						2E-06	2E-06
		Soil and GW Outdoor Air	Ingestion, Direct Contact, Inhalation	(see above)						2E-06	2E-06
	Construction Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.4	3.4	13	3E-07	3E-07		
				Aroclor 1260	0.030	0.064	4.4	7E-09	1E-08		
				Total PCBs	0.035	0.073	4.4	8E-09	2E-08		
				Benzo(a)anthracene	0.10	0.10	21	5E-09	5E-09		
				Benzo(b)fluoranthene	0.045	0.045	21	2E-09	2E-09		
				Benzo(a)pyrene	0.070	0.070	2.1	3E-08	3E-08		
				Indeno(1, 2, 3-cd)pyrene	0.077	0.077	21	4E-09	4E-09		
				Dibenz(a,h)anthracene	0.021	0.021	2.1	1E-08	1E-08		
				Benzo(g, h, i)perylene	0.081	0.081	210	4E-10	4E-10		
										3E-07	3E-07
	Excavation Worker	Soil, 0 to 15 feet, mg/kg	Ingestion, Direct Contact, Inhalation	Arsenic	3.4	3.4	370	9E-09	9E-09		
				Aroclor 1260	0.030	0.064	120	3E-10	5E-10		
				Total PCBs	0.035	0.073	120	3E-10	6E-10		
				Benzo(a)anthracene	0.10	0.10	590	2E-10	2E-10		
				Benzo(b)fluoranthene	0.045	0.045	590	8E-11	8E-11		
				Benzo(a)pyrene	0.070	0.070	59	1E-09	1E-09		
				Indeno(1, 2, 3-cd)pyrene	0.077	0.077	590	1E-10	1E-10		
				Dibenz(a,h)anthracene	0.021	0.021	59	4E-10	4E-10		
				Benzo(g, h, i)perylene	0.081	0.081	5,900	1E-11	1E-11		
										1E-08	1E-08

Notes:

1. EPC = Exposure Point Concentration; from Table 2.
2. CT = Central Tendency.
3. RME = Reasonable Maximum Exposure.
4. RBC = Risk-Based Concentration; from Table 3.
5. mg/kg = Milligrams per kilogram.
6. µg/L = Micrograms per liter.
7. Shaded Cell = Cumulative excess risk exceeds acceptable level of 1E-06 for individual chemicals or 1E-05 for cumulative risk.