Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures Study
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

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List of Abbreviations/Acronyms

Abbreviation/Acronym	Definition
AOC	area of concern
ARI	Analytical Resources, Inc.
ASTM	American Society for Testing and Materials
bgs	below ground surface
Boeing	The Boeing Company
BTEX	benzene, toluene, ethylbenzene, and xylene
cm	centimeters
CMS	Corrective Measures Study
COC	constituent of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DO	dissolved oxygen
DRPH	diesel-range petroleum hydrocarbons
Ecology	Washington State Department of Ecology
ft/day	feet per day
gpm	gallons per minute
GRPH	gasoline-range petroleum hydrocarbons
HAZMAT	hazardous materials
HSA	hollow-stem auger
IM	interim measure
mg/kg	milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
NAPL	non-aqueous phase liquid
NFA	No Further Action
NTU	nephelometric turbidity unit
OA	other area
Order	Administrative Order on Consent
ORP	oxidation-reduction potential
ORPH	motor oil-range petroleum hydrocarbons
PAH	polycyclic aromatic hydrocarbons

Abbreviation/Acronym	Definition
PCB	polychlorinated biphenyl
PCE	tetrachlorethene
Plant 2	Boeing Plant 2
PMCL	preliminary media cleanup level
ppm	parts per million
PTFE	polytetrafluoroethylene
PID	photo-ionization detector
PQL	practical quantitation limit
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	reporting limit
SL	screening limit
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
µg/L	micrograms per liter
µg/kg	micrograms per kilogram
µS/cm	microsiemens per centimeter
Uplands	Uplands CMS
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USDOT	U.S. Department of Transportation
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
WAC	Washington Administrative Code

Foreword

This Volume VIIIa Corrective Measures Study work plan (Work Plan) presents the scope and methodology for a data gap investigation in the 2-31 Area of Boeing Plant 2. The need for this investigative work was identified by The Boeing Company (Boeing) during the preparation of the Uplands Corrective Measures Study (Uplands CMS), well after the completion of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). The RFI used a RCRA unit-by-unit approach to investigate the site; when corrective measures were being evaluated for groundwater. This approach was found to be inadequate for remedy selection due to the more integrated nature of groundwater contaminant distributions. Boeing, with the concurrence of the United States Environmental Protection Agency (USEPA) and Washington State Department of Ecology (Ecology), has embarked on a series of focused investigations to enable the Uplands CMS to proceed. The results of these investigations will be reported in the Corrective Measures Study (CMS) report.

As coordinated with the USEPA, this data gap investigation Work Plan, which covers the 2-31 Area at Boeing Plant 2, is designated Volume VIIIa of the CMS. Volume VIIIb will present the results of the data gap investigation for the 2-31 Area when they are available and Volume VIIIc will evaluate and select the remedies for the 2-31 Area. Similar processes are being implemented simultaneously for the other areas at Boeing Plant 2. This volume (VIIIa) will be preceded in the CMS report by Volume I – Introduction, Volume II – Cleanup Level Evaluation Technical Memorandum, and Volumes IIIa, IIIb, and IIIc – South Yard Area through Volumes VIIa, VIIb, and VIIc – North Area. Volume I will contain introductory text explaining Plant 2 history, the RCRA CMS process, the Plant 2 physical conceptual site model, a description of the study areas, and a discussion of the site-wide RCRA and non-RCRA unit accounting process. Volume II will contain the Cleanup Level Evaluation Technical Memorandum and Volume's III through VIII will contain the South Yard Area through 2-31 Area, respectively. The final volume (VI) will address the 2-10 Area.

The Work Plan and the CMS are being performed under the Administrative Order on Consent (Order) issued by USEPA to Boeing under the authority of Section 3008(h) of the RCRA of 1976, as amended, [42 USC 6928(h)]. This Order [RCRA Docket Number 1092-01-22-3008(h)] became effective on January 18, 1994. The Order specifies activities necessary to correct actual or potential threats to human health and the environment resulting from the release or potential release of hazardous constituents from the Boeing Plant 2 Facility located at 7755 East Marginal Way South, Seattle/Tukwila, Washington.

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1.0 2-31 Area Description

1.1 DESCRIPTION AND SETTING

The Boeing Plant 2 facility (Plant 2) is located on the east bank of the Duwamish Waterway in Seattle and Tukwila, Washington (Figure 1-1). Historically, Plant 2 has specialized in manufacturing aluminum alloy, steel alloy, and titanium alloy parts for airplanes. Plant 2 was built on farmland in the late 1930s, and became a significant manufacturing facility during World War II. In recent years, the character of Plant 2 has shifted toward research and administration.

Plant 2 is bounded on the east by East Marginal Way South, a four-lane arterial, on the south by Jorgensen Forge, an active steel and aluminum forge, on the north by Slip 4 and Emerald Services, Inc., and on the west, by the Duwamish Waterway. The Duwamish Waterway is a federally maintained shipping channel of the Duwamish River; Slip 4 is an off-channel extension of the waterway. Plant 2 is served by both truck and rail, and was historically accessible from the waterway. Plant 2 is divided into northern and southern sections by an arterial, 16th Ave South, which services the 16th Ave South Bridge over the Duwamish Waterway.

Plant 2 occupies approximately 107 acres of developed topographically flat land covered by buildings and paved yards. Most buildings are slab on grade with below grade utilities.

The soils in the upper 100 feet beneath the 2-31 Area consist of four major geologic units. The first approximately 3 to 12 feet of soil are comprised of yellowish brown to brown sand fill that is a loose to very dense, fine to medium sand and gray to grayish-brown gravel. Much of the fill appears to be alluvial in nature and probably reflects dredge spoils from modifications to the Duwamish River channel at the beginning of the 20th century; some debris exists within the fill. The fill is underlain by a discontinuous layer of dark brownish gray to greenish-gray to black silt and soft organic silt that is approximately 2 feet thick.

Beneath the silt is the shallow portion of the upper aquifer that consists of poorly-graded, dark gray, fine to medium sand with varying amounts of silt. This alluvial unit extends from approximately 10 feet below ground surface (bgs) to 40 to 50 feet bgs. Underlying this unit are the older Duwamish River alluvial deposits consisting of thick coarsening-upward sequences of inter-bedded sand and silty sand. These alluvial deposits extend from approximately 40 to 50 bgs to 80 feet bgs.

At approximately 80 feet bgs, well logs from Plant 2 describe a distinctive marine silt layer with shell fragments. The contact between the overlying silty sand and the marine silt is sharp and is readily noted in the field. The marine silt layer is underlain by a dense gray glacial till unit. These two low-permeability deposits form an aquitard that isolates the shallow aquifer (upper 80 to 100 feet) from the deeper aquifers beneath Plant 2.

Groundwater occurs in the alluvial aquifer generally starting at 9 to 12 feet bgs. The approximate groundwater flow direction is southwest toward the Duwamish Waterway. Groundwater from Plant 2 flows directly to the waterway without crossing other properties, except for possible migration across the southern property line and onto the northern portion of the Jorgensen Forge Facility in the South Yard Area of Plant 2. Even in that location, the

dominant flow direction appears to be parallel to the fence line and towards the Duwamish Waterway (FSM, 2004).

The Duwamish Waterway near Plant 2 is a tidally-controlled marine embayment with a fresh water lens of outgoing river water on top of the denser (saltier) marine waters. The sediments, while alluvial in nature, have salinities consistent with the marine waters from Elliott Bay. A saltwater lens extends into the Uplands from the river, and deeper deposits (greater than 60 feet) show zones of high salinity due to trapped seawater that was present at the time of sedimentation. The water column is brackish, ranging from saline at depth to fresh on the top (Boeing, 2003).

1.1.1 Corrective Measures Study (CMS) Areas at Boeing Plant 2

Plant 2 has been divided into seven "CMS Study Areas" to facilitate the development and screening of RCRA corrective measures. These areas are, from south to north:

- South Yard Area
- 2-60s Area
- 2-66 Area
- 2-40s Area
- 2-31 Area
- 2-10 Area
- North Area

These areas are shown in Figure 1-2, Site Plan with CMS Study Areas.

1.1.1.1 The 2-31 Area

The 2-31 Area of Boeing Plant 2 consists of approximately 13 acres and is bordered on the east by East Marginal Way South, on the south by the 2-40s Area, on the west by the Duwamish Commercial Waterway, and on the north by the 2-10 Area. The 2-31 Area is separated from the 2-10 Area by 16th Avenue South. The 2-31 Area contains Buildings 2-22, 2-25, 2-27, 2-28, 2-29, 2-30, 2-31 and 2-36. Several of the RCRA Units are referenced to these buildings.

1.1.2 Previous Investigations

Numerous investigations of Plant 2 have been carried out by Boeing consultants, including Roy F. Weston, Inc. (Weston) and Landau Associates Inc. (Landau). Key site-wide investigations include the following:

- *RCRA Facility Investigation Work Plan, Boeing – Plant 2, Seattle/Tukwila, Washington* (Weston, 1994a)

- *RCRA Facility Investigation – Phase 1A Completion Report Volumes I to II Soil and Groundwater Presentation, Boeing – Plant 2, Seattle/Tukwila, Washington* (Weston, 1994b)
- *RCRA Facility Investigation – Phase 1B Completion Report, Boeing – Plant 2, Seattle/Tukwila, Washington* (Weston, 1995)
- *RCRA Facility Investigation - Groundwater Investigation Interim Report* (Weston, 1996)
- *RCRA Facility Investigation – Soil Investigation Interim Report, Boeing – Plant 2, Seattle/Tukwila, Washington* (Weston, 1997)
- *Comprehensive RCRA Facility Investigation Report* (Weston, 1998a)
- *RCRA Facility Investigation Health Evaluation for Upland Soil* (Weston, 1998b)
- *RCRA Facility Investigation Groundwater Human Health and Environmental Evaluation* (Weston, 1998c)
- *Technical Memorandum SWMU/AOC/OA-Specific Data Presentation, RCRA Corrective Measures Study Volumes I, II, III.* (Weston, 2000a)
- *Draft Phase I Environmental Site Assessment - Boeing Plant 2* (EPI, 2002)
- *Report of Boeing Plant 2 – Parcel Disposition Phase II Environmental Investigation* (Golder/EPI, 2003)

Investigations specific to the 2-31 Area in addition to Plant 2 site-wide studies are listed in Table 1-1. These documents fall into the following categories: RCRA Facility Investigation work plans and reports, closure documents, Corrective Measures Study (CMS) technical memoranda justifying No Further Action (NFA) decisions on units, interim measures (IMs) work plans and reports and other environmental assessments and investigations.

1.1.2.1 Scope of Information Available

All of the information gathered above has been combined into a comprehensive database, which includes groundwater analytical results since 1988 and soil analytical results for existing soil. When an IM removed soil from a unit, samples representing the removed material were identified as “removed” in the database and post-removal confirmatory samples were added to the database.

Thirteen groundwater monitoring wells have been installed in the 2-31 Area (one well has been decommissioned). Approximately 65 soil borings and direct-push probes have been advanced throughout the 2-31 Area. Constituent groups of interest in the 2-31 Area have included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals, as well as total petroleum hydrocarbons (TPHs). VOCs, SVOCs, PCBs, and metals are evaluated using standard US Environmental Protection Agency (USEPA) Methods, while TPHs are analyzed using a variety of USEPA, American Society for Testing and Materials (ASTM), and Washington State methods. Attachment A contains maps and tables displaying the groundwater data for groundwater constituents of concern (COCs) in the

2-31 Area; Attachment B contains maps and tables for soil COCs in the 2-31 Area. The introductory section of each attachment provides an explanation of how the information is displayed. The maps in Attachment A show current and historical groundwater sampling locations.

1.2 RCRA REGULATED UNITS

During the RFI and early stages of the CMS process, Plant 2 was evaluated following RCRA guidance and the RCRA Order for Plant 2, which generally uses a unit-by-unit approach. This has been modified to an area-by-area approach for consideration of groundwater remedies; however, many of the soil remedies in the CMS will continue to be considered on a unit-by-unit basis. Therefore, it is critical that the original RCRA Units continue to be tracked through the process. The following sections and Table 1-2, provide a description of each RCRA Unit in the 2-31 Area, including its location, historical use and status, and potential soil and/or groundwater COCs. RFI sampling history, including constituents analyzed and those identified as requiring "further consideration", is also summarized for each unit. The "further consideration" designation most often refers to exceedences of Preliminary Media Cleanup Levels (PMCLs), and does not necessarily define a soil or groundwater COC as identified via the data gaps process detailed in Section 2. The data gaps process employs screening levels developed using current input parameters and toxicity data, as well as exposure pathways additional to those considered in the historical PMCL-based evaluations presented in Section 1.

Within the 2-31 Area there are 9 identified RCRA units (see Figure 1-3), which are categorized as follows:

- 2 solid waste management units (SWMUs) that were treatment, storage, and disposal (TSD) units.
- 5 SWMUs that were not TSD units but were defined in the Order as "any discernable unit at which solid wastes have been placed at any time."
- One area of concern (AOC), a category of units defined in the Order as "any area of the facility where a release to the environment of a hazardous waste or hazardous constituents has occurred, is suspected to have occurred, or may occur."
- One other area (OA), a category of units not defined within the Order, but which by practice are treated identically as an AOC.

1.2.1 RCRA Units: Closed Units

Within the 2-31 Area, one RCRA Unit was recognized as a TSD unit. Surface and subsurface closure were completed for this unit in 1993 and 1994, respectively. The TSD unit is identified as SWMU 2-31.20 (Deactivated Cyanide Hold Area). For this unit, the SWMU designation refers to the aboveground TSD structures, and to subsurface soil and groundwater.

1.2.1.1 SWMU 2-31.20 – Deactivated Cyanide Hold Area

SWMU 2-31.20 is a roofed brick and concrete containment area located in the northern portion of Building 2-31 formerly used to store 5- to 900-gallon containers of cyanide waste. The floor

contained a 1,500-gallon blank concrete sump covered with a steel grate. The cyanide hold area was designed so that any release would drain to the sump, where it would be contained and then transferred by pump or vacuum to a new container for storage. The unit operated from 1941 until it was decommissioned during RCRA closure activities in 1993. Potential soil and groundwater COCs associated with the wastes stored at the unit are metals and cyanide.

During the RFI in 1994, soil samples were collected from one boring located within the central portion of the sump to confirm that a release had not occurred in this unit. Cyanide and other soil COCs with the exception of mercury were not detected at concentrations requiring further consideration. Mercury was detected in one 7.5 feet bgs sample at a concentration of 0.100 milligrams per kilogram (mg/kg) (Weston, 1997).

One borehole was advanced downgradient of the unit in 2003 as part of the Phase II investigation (Golder/EPI, 2003). Soil samples were collected at depths of 8, 10, and 15 feet bgs, and analyzed for metals and cyanide. Although several metals were detected at low concentrations, none were detected at concentrations requiring further consideration (Golder/EPI, 2003). Cyanide was not detected in any samples. A groundwater sample was also collected from a depth of 13 feet bgs within this boring, and analyzed for metals and cyanide. Cyanide was not detected. A number of metals were detected in the sample, but only arsenic and copper were present at concentrations requiring further consideration.

A “No Further Action” (NFA) determination was requested for this unit in 1999 (Weston, 1999a) and 2000 (Weston, 2000b). USEPA granted the request for NFA in 2000. At this time, USEPA has requested that groundwater and soil at this unit be further evaluated during the CMS.

1.2.2 RCRA Units: No Further Action (NFA) Determination

There are six RCRA Units in the 2-31 Area where the USEPA has already determined that “no further action” is needed for vadose zone soils. These units are as follows:

- OA 17.4 (Transformer Vault 4)
- SWMU 2-31.22 (Brush Plating Area)
- SWMU 2-31.23 (Ammonium Persulfate Tank)
- SWMU 2-31.24 (Sodium Hydroxide Developer Room)
- SWMU 2-31.25 (Anodize Aluminum Room)
- SWMU 2-31.20 (Deactivated Cyanide Hold Area)

Having been granted “NFA status for soils”, these units will not be evaluated further in the CMS with respect to soil remedies. A discussion of SWMU 2-31.20 (Deactivated Cyanide Hold Area) and NFA status was provided in Section 1.2.1.1. As discussed below, groundwater associated with these units will be evaluated further in the CMS.

1.2.2.1 OA 17 – Transformer Vaults

OA 17 consists of seven below grade transformer vaults (Vaults 2, 4, 5, 6, 7, 8, and 13) located in the tunnel system below Building 2-25 in the 2-31 Area, below Buildings 2-40, 2-41, and 2-44 in the 2-40s Area and Building 2-49 in the 2-66 Area. The floor grade of the tunnel system coincides with the seasonably variable water table at 10 feet bgs. The floor level of each transformer vault is 3 to 4 feet below the tunnel floor / water table level. The design of the transformer vaults includes a blind sump to protect the transformers in the event that water is introduced to the vaults. The blind sumps are 4 to 5 feet deeper than the floor of each vault, and also extend below the water table.

The vaults and sumps experience 1 to 5 feet of hydrostatic pressure because they are below the water table. During RFI inspection, the sumps and vaults did not contain any water, indicating high integrity and leak tightness. Surface wipe and concrete chip samples collected during vault decontamination indicated that PCBs were present in the floor and sump structure concrete. Soil and groundwater COCs associated with the transformer vaults included PCBs and petroleum hydrocarbons associated with transformer coolants.

Watertight polyvinyl chloride (PVC) risers were used to advance explorations through the containment because the units were below the water table. The risers were installed adjacent to and downgradient of the vault sumps, which were too small to contain them. The risers were bolted to the floor of the vaults and sealed. Explorations were then advanced in each riser. Soil samples were collected by direct-push probe.

Two soil samples were collected at each of the seven borings associated with each vault at depths corresponding to the bottom of the sump and 5 feet below the bottom of the sump, with the exception of GS-04123 (where only one sample was collected). PCBs and oil-range petroleum hydrocarbons (ORPH) were reported in the RFI as not being detected at concentrations requiring further consideration. Groundwater samples collected at nine locations near the OA 17 vaults were analyzed for PCBs and TPH; no analytes were detected at concentrations reported in the RFI as requiring further consideration.

USEPA has determined that “no further action” is needed for vadose zone soil at these units; therefore, soil remedies for this unit will not be evaluated further in the CMS.

1.2.2.2 SWMU 2-31.22 – Brush Plating Area

SWMU 2-31.22 was a brush plating area located in Building 2-31. The unit was installed in 1984 and decommissioned in 1995. This area was used for manual cleaning, plating, anodizing and alodining of parts. Liquids used for cleaning were poured into a sink, and subsequently drained onto a sloped concrete slab and into the sump, from which they were drained to the holding tank. There are no known releases from this unit. Process chemicals associated with this unit include plating solutions, paints, oils, cleaners, anodizing and alodining solutions, etchants, inorganic and organic acids, alkaline solutions, metallic salts, organics, solvents, paraffin and mineral spirits. Potential soil and groundwater COCs include VOCs, petroleum hydrocarbons, and metals / inorganics (including cyanide and hexavalent chromium).

Soil samples were collected from one boring location in the Brush Plating Area during the RFI in January 1995 (Weston, 1997). The boring was located immediately downgradient from and adjacent to the sump in the southwest corner of the unit. Analysis of soil samples indicated that metals and ORPH were present. ORPH was not detected at a concentration reported in the RFI as requiring further consideration. Copper was the only inorganic analyte detected at a concentration reported in the RFI as requiring further consideration.

As part of the Phase II investigations, one groundwater and three soil samples were collected from a single location downgradient from the Brush Plating Area. Soil samples were collected from 5, 10, and 15 feet bgs and analyzed for VOCs, gasoline-through motor oil-range petroleum hydrocarbons, metals, cyanide, hexavalent chromium and pH. Soil pH values ranged from 6.37 to 7.10 standard pH units. Diesel- through motor oil range-petroleum hydrocarbons and VOCs were detected in soil samples below concentrations requiring further consideration. Several metals were detected in soil at concentrations reported in the RFI as not requiring further consideration. Cyanide was not detected in soil. Groundwater was sampled from a depth of 13 feet bgs and analyzed for VOCs, gasoline- through motor oil-range petroleum hydrocarbons, metals, cyanide, hexavalent chromium and pH. Cyanide, hexavalent chromium, and gasoline-range petroleum hydrocarbons (GRPH) were not detected. A number of inorganic analytes were detected in groundwater, but only arsenic, chromium, copper, mercury, and vanadium were present at concentrations reported in the RFI as requiring further consideration (Golder/EPI, 2003).

An NFA decision was requested for this unit in 1999 (Weston, 1999a) and 2000 (Weston, 2000b), and was granted by USEPA in 2000. Regardless, soil and groundwater at this unit will be further evaluated during the CMS.

1.2.2.3 SWMU 2-31.23 – Ammonium Persulfate Tank

SWMU 2-31.23 consisted of an aboveground ammonium persulfate tank and a sulfuric acid storage tank that were maintained in a curbed concrete secondary containment. The process chemicals used at this unit included ammonium persulfate and sulfuric acid. According to the RFI work plan (Weston, 1994a), the tanks and containment were in good condition (Weston 1999a). Although there was no indication of a release from this unit, the soil and groundwater COCs include pH and metals because of the past use of strong acids.

As part of Phase II investigations, one groundwater and three soil samples were collected and analyzed for soil and groundwater COCs to confirm that the unit had not been impacted by an unreported release or past activities associated with the storage tanks (Golder/EPI, 2003). Samples were collected from a borehole downgradient of the tanks, close to the edge of the secondary containment. Soil samples were collected from 5, 10, and 15 feet bgs. Although 17 inorganic analytes were detected in the soil samples, none were present at concentrations reported in the RFI as requiring further consideration. The pH of soil samples ranged from 5.8 (5 feet bgs) to 7.1 (15 feet bgs). One groundwater sample was taken from a depth of 13 feet bgs and analyzed for metals and pH. The pH of this sample was 6.7. Although several metals were detected, only arsenic, chromium, copper, and nickel were present at concentrations reported in the RFI as requiring further consideration.

An NFA determination was requested for this unit in 1999 (Weston, 1999a) and 2000 (Weston, 2000b), and was granted by USEPA in 2000. Regardless, soil and groundwater at this unit will be further evaluated during the CMS.

1.2.2.4 SWMU 2-31.24 – Sodium Hydroxide Developer Room

SWMU 2-31.24 is a sodium hydroxide developer room in Building 2-31, which was used from 1982 to 1995. The unit contained a large rotating metal wheel within a tank drip pan, two aboveground processing tanks, and miscellaneous hoses and pumps within a 15-foot by 5-foot by 7-inch deep fiberglass-lined blind floor sump. In 1992, the sump was relined with fiberglass and shields were placed on the walls. The purpose of the unit was to spray developer and etchant from the tanks onto electromagnetic pulse screens for military aircraft. The screens were sprayed with rinse water that collected and returned to the processing tanks. Process chemicals included sulfuric acid, chromic acid and ammonium chloride in the etchant, and sodium hydroxide in the developer. Metals were considered as the COCs for soil and groundwater (Weston, 2000b).

Floors and walls outside the bermed area were reported to be “heavily stained”, but no breaches were observed. No staining or visible release points were observed in the tunnel roof and floor. According to RFI protocol, collection of soil samples and groundwater investigation were not required (Weston, 2000b). Any releases from the unit would have been discharged to the building floor or through the floor to the basement tunnel, and staining would have been evident on the ceiling, walls, and floors.

An NFA determination was requested for this unit in 1999 (Weston, 1999a) and 2000 (Weston, 2000b), and was granted by USEPA in 2000. Regardless, soil and groundwater at this unit will be further evaluated during the CMS.

1.2.2.5 SWMU 2-31.25 – Anodize Aluminum Room

SWMU 2-31.25 is an anodized aluminum room located in Building 2-31 that contained several 10- to 30-gallon polypropylene and steel processing tanks located above shallow rubber-lined steel secondary containment pans. The unit was used for plating, and occasionally for anodizing. Rinse water was channeled to the anodizing tank line sump (SWMU 2-31.26) using polypropylene piping in the aisle south of the unit. Acids and bases were removed from airborne fumes using a scrubber system located on the roof. The unit was used for 10 to 15 years before being decommissioned in 1994 and removed in 1995. Chemicals associated with process solutions used at this unit consist of metals (including cyanide and hexavalent chromium), and therefore are the soil and groundwater COCs for this unit.

No releases from this unit were documented, and visual inspection of the rubber-lined steel secondary containment pans revealed no visible breaches. The roof and floor of the tunnel under the footprint of the unit were inspected, and no release points were observed. Therefore, following RFI protocols, no soil samples were collected and a groundwater investigation was not required.

An NFA determination was requested for this unit in 1999 (Weston, 1999a) and 2000 (Weston, 2000b), and was granted by USEPA in 2000. Regardless, soil and groundwater at this unit will be further evaluated during the CMS.

1.2.3 RCRA Units: Historical Interim Measures

No historical interim measures were conducted in the 2-31 Area.

1.2.4 RCRA Units: Ongoing Interim Measures

There are currently no ongoing IMs in the 2-31 Area.

1.2.5 RCRA Units: Planned Interim Measures

A groundwater IM using enhanced reductive dechlorination (ERD) is planned for groundwater impacted by trichloroethene (TCE) and its breakdown products associated with the AOC 2-31.21 TCE Degreaser. The IM injection and monitoring well network and nutrient substrate injection rates will be designed based on groundwater data obtained during this 2-31 Area Data Gaps Investigation. Baseline sampling of existing and new monitoring wells is planned before nutrient substrate injection and subsequent quarterly performance monitoring is planned to track IM progress.

1.2.6 RCRA Units: Remaining for Consideration

The USEPA has determined that the following three RCRA units in the 2-31 Area need further consideration.

- AOC 2-31.21 (TCE Degreaser)
- SWMU 2-31.18 (Area B Acid Waste Hold Tank)
- SWMU 2-31.26 (Anodizing Tank Line)

Having not been granted “NFA status”, these units will be further evaluated further in the CMS with respect to soil and groundwater, as appropriate.

1.2.6.1 AOC 2-31.21 – TCE Degreaser

AOC 2-31.21 was a TCE degreaser unit in the northwest corner of Building 2-31 that operated from 1945 to 1995. The unit consisted of a 10-foot-long by 3-foot-wide tank within a 15-foot by 14-foot by 5-foot-deep concrete secondary containment pit equipped with a sump. The unit was replaced in 1991 before decommissioning and removal in 1995. During operation, the tank was partially filled with heated TCE. Parts were placed in a basket and lowered into the solvent vapors for cleaning. The used TCE and residual oil mixture was discharged to a still where the TCE was recovered for reuse. The residual oil was placed in drums and the recovered TCE was transferred to a 900-gallon storage tank, where it was held until it was transferred back to the degreaser. Potential soil and groundwater COCs included TCE and its degradation products (dichloroethene and vinyl chloride), metals, and petroleum hydrocarbons.

Under the RFI, nine soil samples were collected from three boreholes and analyzed for soil COCs (Weston, 2000a). The extent of this soil sampling effort was restricted by building construction. TCE was detected at a concentration requiring further consideration in one sample collected immediately downgradient of the degreaser (Weston, 2000a). During Phase II investigations, soil samples were collected from 5 to 15 feet bgs in three boreholes located both upgradient and downgradient of the TCE Degreaser. Samples were analyzed for VOCs. Higher concentrations of VOCs were detected in samples collected from the 10-foot interval than in those from the 15-foot interval. However, VOCs were not detected at concentrations reported in the RFI as requiring further consideration.

Sixty-two groundwater samples were collected from six monitoring wells and ten direct-push probe locations during the RFI on various occasions between 1993 and 1996 (Weston, 2000a). Sampling points were placed downgradient of the AOC, and samples were collected from depths ranging from the water table to 65 feet bgs. Groundwater samples were analyzed for VOCs and metals. TCE and vinyl chloride were detected at concentrations reported in the RFI as requiring further consideration. Groundwater was analyzed for total metals, a more conservative estimate of water quality than dissolved metals. Arsenic, copper, lead, nickel, selenium, and thallium were detected at concentrations reported in the RFI as requiring further consideration (Weston, 2000a). During the Phase II investigations, groundwater samples were collected from a depth of 13 feet bgs within the three borings sampled for soil. Groundwater was analyzed for VOCs. TCE was detected in groundwater below a concentration reported in the RFI as requiring further consideration (Golder/EPI, 2003).

At this time, USEPA has requested that groundwater and soil at this unit be further evaluated during the CMS.

1.2.6.2 SWMU 2-31.18 – Area B Acid Waste Hold Tank

SWMU 2-31.18 represents a former dangerous waste management unit comprising an acid waste hold tank (AHT) system installed in the 1960s. The unit was located at the north end of Building 2-31, and consisted of an acid hold tank, sump, floor drain, and associated piping and pumps. The unit was decommissioned in 1993 during TSD closure activities. Wastes handled at this unit included inorganic acids and metal-bearing solutions. The soil and groundwater COCs at this unit include metals, pH, VOCs and PCBs.

Five soil borings were advanced and four near-surface soil samples were collected and analyzed for metals and PCBs during the 1994 RFI activities. Metals were detected at concentrations reported in the RFI as requiring further consideration in all soil boring samples collected from beneath and adjacent to the secondary containment structure. However, the concentrations of metals in soil benearth the AHT were higher than those outside the tank footprint. RCRA sampling indicated that signature metals, such as hexavalent chromium, were not present at concentrations reported in the RFI as requiring further consideration outside the tank footprint. The PCB Aroclor 1260 was detected at a concentration reported in the RFI as requiring further consideration in one sample. The RFI claimed that the PCBs detected in this boring were likely associated with scattered instances of PCBs in soil (known as OA 4). During the RFI, groundwater was collected from two monitoring wells and three direct-push probe locations. Vinyl chloride and TCE were detected at concentrations reported in the RFI as requiring further consideration.

The soil and groundwater COCs for the subsequent Phase II investigation were determined based on the results of previous investigations, and included pH, metals, VOCs, and PCBs. One boring was advanced within the unit, and two more were placed upgradient and downgradient of the unit. Soil samples were collected from depths ranging from 5 to 15 feet bgs. All soil samples were analyzed for PCBs, metals, pH, and VOCs. SVOCs and polycyclic aromatic hydrocarbons (PAHs) were added to the analyte list because of strong creosote odors noted in some soil samples. Nineteen metals were detected in soil collected from the three borings. Metals detected at concentrations requiring further consideration were arsenic and copper. PAHs detected at concentrations requiring further consideration included benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene. Soil pH values ranged from 6.43 to 8.54 standard pH units.

Groundwater samples were collected from a depth of 13 feet bgs within the three borings. The groundwater samples were analyzed for metals, PCBs, pH, VOCs, SVOCs and PAHs. PCBs were not detected in any of the groundwater samples. Various VOCs and metals were detected. Arsenic was the only metal and vinyl chloride was the only VOC detected in groundwater at a concentration requiring further consideration.

At this time, USEPA has requested that groundwater and soil at this unit be further evaluated during the CMS.

1.2.6.3 SWMU 2-31.26 – Anodizing Tank Line

SWMU 31.26 is an anodizing tank line located in the southern portion of Buidling 2-31 that was installed in 1979, cleaned and relined in 1992, decommissioned in 1994, and removed in 1995. The unit consisted of a series of 25 tanks ranging in capacity from 15 to 500 gallons, and used for cadmium-, chromium- and nickel-plating activities, as well as anodizing, alodining, cleaning and etching. The tanks were placed above a series of on-grade secondary containment structures that collected spills, drips, and leaks from the process lines and received process rinse water. Potential soil and groundwater COCs associated with this unit consist of pH and metals, including cyanide and chromium.

No releases to the environment were documented in hazardous materials (HAZMAT) incident files, but minor staining was observed on the rinse water sump pit liner during the RFI. In January 1995, soil samples were collected from depths of 9 and 12 feet bgs in two boreholes located adjacent to and 10 feet downgradient of the rinse water sump. Arsenic, mercury, and cyanide were detected in soil at concentrations reported in the RFI as requiring further consideration. Groundwater was not collected during the RFI because constituent concentrations in soil were relatively low.

During Phase II investigations, two boreholes were advanced at locations upgradient and downgradient of the anodizing tank line. Soil samples were collected from 6, 10, and 13 feet bgs at both locations. Soil samples were analyzed for pH and metals, including chromium and total cyanide. Several metals were detected in the soil samples; however, none were present at concentrations requiring further consideration. Total cyanide and hexavalent chromium were not detected above analytical detection limits. Soil pH values ranged between 7.3 and 8.3 in all samples except for the one collected from a depth of 6 feet at the upgradient location. Groundwater samples were collected from each of the two borings at a depth of 13 feet bgs and

were analyzed for pH and metals / inorganics, including cyanide and hexavalent chromium. Several metals were detected in solution, but only arsenic and copper were present at concentrations requiring further consideration. Hexavalent chromium was not detected in any of the groundwater samples. Cyanide was detected at concentrations requiring further consideration in both samples.

At this time, USEPA has requested that groundwater and soil at this unit be further evaluated during the CMS.

1.3 NON-RCRA UNITS

1.3.1 PL-12 and PL-13

PL-12 and PL-13 were 25,000-gallon and 20,000-gallon (respectively) underground storage tanks (USTs) installed in 1952 and removed in 1986. They were used for storage of PS400 (Bunker C) that supplied the boiler in Building 2-25. The Boeing UST files indicated product was observed on the surface of excavation water during tank removals in April 1986. Primary soil and groundwater COCs include diesel to heavy oil range petroleum hydrocarbons and cPAHs.

Although groundwater was sampled following the UST closures, there was no documentation of collection or analysis of soil or groundwater samples. Four monitoring wells were subsequently installed upgradient, downgradient, and in the footprint of the former USTs to characterize soil and groundwater. Soil samples were collected from depths ranging from 6 to 30 feet bgs, and were analyzed for diesel-range petroleum hydrocarbons (DRPH) through ORPH, PAHs and SVOCs. DRPH through ORPH were detected in one or more of the soil samples collected from all borings. Soil samples collected from 15 feet bgs at the downgradient location, and from 20 feet bgs in the footprint of the former USTs contained DRPH to ORPH and SVOCs, including benzo(a)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene, at concentrations requiring further consideration.

Groundwater samples were collected from a depth of 13 feet bgs at the upgradient and downgradient locations, and from 18 feet bgs within the footprint of the UST. Groundwater samples were analyzed for SVOCs, PAHs and DRPH through ORPH. DRPH through ORPH were detected in groundwater at concentrations requiring further consideration. No SVOC or PAH constituents were present in groundwater at concentrations requiring further consideration.

Soil and groundwater at this former UST area will be further evaluated during the CMS.

1.3.2 PL-14

PL-14 was a 110-gallon UST installed in 1967 and used for gasoline storage. According to Boeing UST files, the tank was removed in 1986. Primary soil and groundwater COCs included GRPH and benzene, toluene, ethylbenzene and total xylenes (BTEX).

Soil and groundwater samples were collected from 2 boreholes to determine whether a release occurred in association with UST PL-14 before removal. Soil samples were analyzed for GRPH and BTEX; no analyte from either set of constituents was detected.

Groundwater samples were collected from a depth of 13 feet bgs within the borings and were analyzed for GRPH; analytes were not detected above reporting limits.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.3 PL-15

PL-15 was a 2,000-gallon diesel UST located outside the northeast corner of Building 2-40. It was installed in 1976 and removed in 1986. The primary soil and groundwater COCs were DRPH to ORPH.

Soil and groundwater samples were collected from two boreholes advanced to the north and south of the former UST to assess whether a release occurred. Soil samples were collected from depths ranging from 9 to 14 feet bgs, and were analyzed for DRPH to ORPH. Low levels of these constituents were detected in a few samples, but not at concentrations requiring further consideration. Groundwater samples were collected from a depth of 13 feet bgs and analyzed for DRPH through ORPH; no target constituents were detected.

Soil and groundwater at this former UST will be further evaluated in the CMS.

1.3.4 PL-29

PL-29 was a 500-gallon UST used to store the hydraulic oil used in Building 2-29. The UST was located inside Building 2-41, near the north end of the building in the transportation aisle. The installation date is unknown; the unit was removed in March 1986. The tank was reportedly completely dry when removed. The primary soil and groundwater COCs were DRPH to ORPH and PCBs.

Soil and groundwater samples were collected from two boreholes upgradient and downgradient of the former UST location. Soil samples were collected from depths ranging from 6 to 14 feet bgs and were analyzed for DRPH through ORPH and PCBs. PCBs were not detected. DRPH through ORPH were detected at concentrations below those requiring further consideration.

Groundwater samples were collected from 13 feet bgs at both locations and were analyzed for PCBs and DRPH through ORPH; no target constituents were detected.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.5 PL-36

PL-36 was a 110-gallon UST used for the storage of diesel grade fuel. Boeing files indicated the UST was removed in 1986; the installation date was not identified. The primary soil and groundwater COCs are diesel through motor oil range petroleum hydrocarbons.

Soil and groundwater samples were collected from two borings located upgradient and downgradient of the UST. Soil samples were collected from depths ranging from 5 to 15 feet bgs and analyzed for diesel through motor oil range petroleum hydrocarbons. Samples from 7.5 feet bgs (upgradient) and 10 feet bgs (downgradient) contained diesel range petroleum

hydrocarbons at concentrations requiring further consideration. Diesel through motor oil petroleum hydrocarbons were either not detected or detected at low concentrations in all remaining soil samples.

Groundwater samples were collected from 13 feet bgs at both locations and analyzed for diesel through motor oil range petroleum hydrocarbons. No target constituents were detected.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.6 PL-39

PL-39 was a single wall steel 1,500-gallon UST used for the storage of diesel grade fuel. Boeing files indicated the UST was installed in 1962 and closed and removed in 1992. An "Underground Storage Tank SiteCheck/Site Assessment Checklist" and closure report were submitted to Ecology in 1992 for PL-39. The primary soil and groundwater COCs are diesel through motor oil range petroleum hydrocarbons.

The tank was removed and the excavation extended to eight feet bgs, no groundwater was observed in the excavation. Inspection of the tank indicated that the tank had maintained integrity and no holes were observed. A total of nine soil samples were collected in accordance with state guidelines from the bottom of the excavation and four sidewalls, underneath piping and stockpiled excavation soil. Samples were analyzed for diesel through motor oil range petroleum hydrocarbons by the NWTPH Diesel extended (Dx) method. Petroleum hydrocarbons were detected in only one sample. Diesel was only detected in a single sample at a concewntration of 5.5 mg/kg all other samples were reported ans non-detect for petroleum hydrocarbons for the diesel through motor oil range petroleum hydrocarbons.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.7 PL-40

PL-40 was a 640-gallon UST located on the north side of Building 2-31 and used to store autoclave blow-down oil. The UST was installed in 1956 and removed in 1986. According to Boeing files, there was visual evidence of a release from this UST. Approximately 8 cubic yards of material associated with the UST were subsequently removed. The primary soil and groundwater COCs were DRPH to ORPH.

Soil and groundwater were collected from borings located upgradient and downgradient of the UST. Soil samples were collected from depths ranging from 5 to 15 feet bgs and analyzed for DRPH through ORPH. Low concentrations of DRPH were detected in most samples; ORPH was detected at a concentration requiring further consideration in one sample collected upgradient from the former UST. One groundwater sample was collected from a depth of 13 feet bgs from the borehole downgradient from the UST and analyzed for DRPH through ORPH; no analytes were detected in groundwater.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.8 PL-56

PL-56 was a 1,000-gallon gasoline UST located approximately 75 feet northwest of Building 2-31. PL-56 was installed in 1940 and removed in February 1986. The primary soil and groundwater COCs in this unit were GRPH and BTEX.

Soil and groundwater samples were collected from two borings advanced upgradient and downgradient of the former UST location. Soil samples were collected from depths of 6, 10, and 14 feet bgs, and analyzed for GRPH; no target constituents were detected. Groundwater samples were collected from 13 feet bgs in each boring, and analyzed for GRPH; no target constituents were detected.

1.3.9 PL-57

PL-57 was a 3,200-gallon solvent UST just outside the northwest end of Building 2-31. The UST was installed in 1956; during the 1986 Plant 2 UST closure activities, PL-57 could not be located. Based on the presumed contents of the UST, VOCs and SVOCs were designated soil and groundwater COCs for this area. Soil and groundwater samples were collected from borings advanced to the east (upgradient), southwest, and northwest of the approximate UST location. Soil samples were collected from 6, 10, and 14 feet bgs and analyzed for PAHs, SVOCs and VOCs. Benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene were detected at concentrations requiring further consideration in the soil sample collected from northwest of the UST at a depth of 4 feet bgs. Other SVOCs as well as VOC constituents were detected in this sample at concentrations not requiring further consideration. Groundwater was sampled from a depth of 13 feet bgs in all borings and analyzed for VOCs, PAHs and SVOCs. SVOCs were not detected in any groundwater sample. VOCs were detected at low concentrations that did not require further consideration.

Soil and groundwater at this former UST will be further evaluated during the CMS.

1.3.10 PL-65

PL-65 is an active 1,100-gallon diesel UST located in Building 2-31 that was installed in 1988. The primary soil and groundwater COCs are DRPH through ORPH.

Soil and groundwater samples were collected from borings advanced upgradient and downgradient of the UST location. Soil samples were collected from depths ranging from 5 to 15 feet bgs, and analyzed for DRPH through ORPH. DRPH were detected below the concentration requiring further consideration in the sample collected from 6 feet bgs downgradient of the UST. DRPH or ORPH were not detected in any other soil samples. Groundwater was collected from depths of 15 feet bgs (upgradient) and 13 feet bgs (downgradient) and analyzed for DRPH through ORPH. No analytes were detected above reporting limits.

Because PL-65 is an active UST groundwater and soil downgradient of this area will be further evaluated during the CMS.

1.3.11 100 Gallon (approximate) TCE Release

At approximately 8:00 am on July 31, 1985, a TCE product supply line was punctured during construction excavation work underneath the 16th Avenue South Bridge releasing approximately 100 gallons of TCE to the soil. The line was punctured west of the 2-41 Building's Door 1 at access gate B-54 in the top-of-bank fencing. Boeing personnel immediately shut down the supply line, contacted EPA and Ecology, and hired an environmental contractor to excavate the impacted soil. The contractor and representatives from EPA and Ecology were onsite by 11:30 am. By 9:30 pm that night, soil in the spill area had been excavated to a depth of approximately 11 feet to a clay material. Excavated soil was placed in 20 85-gallon barrels for disposal (Marschall 1985).

Figure 1-4 shows the location of the TCE spill as presented in the 2002 Draft *Phase I Environmental Site Assessment Boeing Plant 2 7755 East Marginal Way South Seattle, Washington* (EPI, 2002) (Phase I ESA). This figure was presented as *Figure 4 - Parcel Areas of Potential Concern* in the Phase I ESA and was based on the original Roy F. Weston project files developed from the RFA and RFI Corrective Action phases.

During investigations of the release a groundwater sample was collected from one direct-push probe location just south of the release area. TCE was present at a concentration requiring further consideration. Based on these results, VOCs are the primary soil and groundwater COCs in this location.

Four additional locations were sampled to determine the extent of impacts to soil and groundwater. Two borings were advanced to the north of the initial direct-push probe location, at distances of 15 and 25 feet, respectively. A third boring was placed adjacent to the initial location, and a fourth was advanced 15 feet to its south. Soil samples were collected from depths of 5, 9 to 10, and 15 feet bgs and analyzed for VOCs. VOCs were not detected in soil at concentrations requiring further consideration. Groundwater samples were collected from 13 feet bgs at all borings and analyzed for VOCs. VOCs were present in groundwater at concentrations requiring further consideration.

Groundwater and soil at this location will be further evaluated during the CMS.

2.0 Data Gap Analysis

2.1 APPROACH

During the CMS remedy selection for groundwater, it became increasingly evident that several key data gaps existed that were limiting the evaluation of corrective measures. These data gaps had not been as evident when the unit-by-unit approach was applied to identify corrective measures for soil. This section is designed to identify those data gaps that are limiting the ability to proceed with the CMS, and to propose investigative solutions to those data gaps. Section 3.0 outlines the specific field methods, in the form of a sampling and analysis plan, to fill those gaps in a focused manner. This volume of the CMS is limited to the 2-31 Area; other volumes of the CMS will address data gaps, if any, in the remaining areas of Plant 2.

The data gap analysis presented in this section is focused on those data gaps that must be filled to proceed with the corrective measure analysis in the remainder of the CMS. Uncertainties in contaminant extent alone are not considered to be a data gap unless the information is required to select or conceptually design a corrective measure for a RCRA Unit or Remediation Action Area. That is, this information is intended to allow for remedy selection and conceptual design in the CMS, and to support the Statement of Basis for the decision; further information may be necessary for planning a specific remedy in a specific area for final design or for performance monitoring purposes during the Corrective Measures Implementation (CMI). Data gaps were identified by considering the following CMS questions:

- **Physical Conceptual Site Model for 2-31 Area:** Is there any area-specific information that is needed to support the physical conceptual site model?
    - **Geologic Data:** Is additional geologic information needed in order to screen or conceptually design remedies?
    - **Hydrogeologic Data:** Is additional hydrogeologic information needed in order to screen or conceptually design groundwater remedies?
- **Current Data:** Are the existing groundwater data sufficiently current to allow for the identification of existing groundwater plumes, a designation of their current extent, and evaluation of whether they are likely to grow, remain steady, or reduce over time? Finally, are there sufficient nature and extent data to screen and conceptually design groundwater remedies?
- **Source Control:** Does sufficient information exist to select source control remedies?
    - **Hot Spots:** Are RCRA units characterized in sufficient detail to select and conceptually design source control remedies?
    - **New Sources:** Have areas of contamination been identified outside of existing RCRA Units that need further definition in order to select and conceptually design source control remedies, and to assign RCRA unit designation, if appropriate?

- **Completed Pathways:** Do sufficient data exist at specific units to determine whether a specific pathway from one media to another is complete? Complete means that the pathway has the potential to impact the affected media above screening levels.
    - What are the physical properties governing transport/migration of the constituent through the subsurface? What is its relative distance from the waterway?
    - Are any other constituents present that may facilitate the migration of the constituent? For example, TPH and other solvents can affect the solubility of PCBs and facilitate their transport through soil and groundwater.
    - **Soil to Groundwater Pathway:** Are COCs present in soil that impact groundwater at concentrations greater than screening levels? Is there adequate groundwater data indicating that groundwater has not been impacted by soil at, or downgradient of, the location?
    - **Groundwater to Surface Water Pathway:** Are COCs present in groundwater that reaches surface water at concentrations that are greater than screening levels?
- **Background Data:** Background levels for some metal COCs in soil have been adjusted to Puget Sound Basin background levels set by Washington State Department of (Ecology) (Ecology, 1994). Site-specific background levels for three metals, arsenic, copper, and manganese, in groundwater have been calculated using data supplied by USEPA. These background concentrations for arsenic, copper, and manganese in groundwater were accepted by USEPA in 2006. No other adjustments for background conditions are planned as part of this CMS.
- **Exceedance of Screening Levels by Analytical RLs:** For the analytical results reported as not detected ("U" qualified) for the individual soil and/or groundwater COCs, do the reporting limits (RLs) exceed the screening levels (SLs)? For constituents where RLs for non-detects ("U" qualified results) exceeded the SLs, the following questions were considered on a case-by-case basis to determine whether the circumstances present a data gap for CMS purposes:
    - Is the RL sufficiently close to the SL that soil or groundwater impacts for that COC can be adequately delineated and quantified for CMS purposes? Note that RLs for total PCBs may be biased high due to the practice of using the highest individual reported Aroclor RL for the total PCBs RL.
    - Are the soil RLs for non-detected metal constituents below Ecology's (Ecology, 1994) Puget Sound Basin natural background concentrations. For example, the RL for arsenic in soil is greater than its SL, but is commonly less than its Puget Sound natural background concentration.
    - Are there additional data from adjacent locations or subsequent samples from the same location supporting either the presence or absence of the constituent in the groundwater or soil?

- Are there other analytical results associated with the sample that render further consideration unnecessary? For example, Aroclor 1260 in soil is reported as not detected at an elevated RL (>33 micrograms per kilogram [µg/kg]), but Aroclor 1254 is detected at a concentration above the screening level in the same sample.

In the 2-31 Area, consideration of these questions resulted in the following data gaps:

- **Physical Conceptual Site Model for the 2-31 Area**
  - **Geologic Data:** No geologic data gaps have been identified.
  - **Hydrogeologic Data:** Groundwater flow directions across the 2-31 Area are generally toward the Duwamish Waterway.
- **Current Data:** Current groundwater data are needed. This data gap is discussed in Section 2.3.1.
- **Source Control**
  - **Hot Spots:** A subset of RCRA units in the 2-31 Area were found to be insufficiently characterized resulting in hot spot data gaps. These data gaps are identified and discussed in Sections 2.3 and 2.4.
  - **New Sources:** Some data gaps potentially related to new source areas were identified and are discussed in Sections 2.3 and 2.4.
- **Completed Pathways**
  - **Soil to Groundwater:** Some soil to groundwater data gaps have been identified, and are discussed in Section 2.4.
  - **Groundwater to Surface Water:** Groundwater from the 2-31 Area extends to surface water in the Duwamish Waterway. Some groundwater to surface water data gaps have been identified, and are discussed in Section 2.3.
- **Background Data:** This data gap has been filled as part of the CMS process. As noted above, background levels for some metal COCs in soil were adjusted to Puget Sound Basin background levels set by Ecology (Ecology, 1994). Site-specific background levels for three metals, arsenic, copper, and manganese, in groundwater were calculated using data supplied by USEPA. These site-specific background groundwater levels were accepted by USEPA in 2006. No other adjustments for background conditions are planned as part of this CMS.
- **Exceedance of Screening Levels by Analytical Reporting Limits:** Some data gaps associated with elevated RLs have been identified for specific soil and/or groundwater COCs, and are discussed in Sections 2.3 and 2.4.

The 2-31 Area has been the subject of numerous separate investigations. As a result of these investigations:

- Thirteen monitoring wells have been installed; one monitoring well, PL2506A, was decommissioned.
- Groundwater was collected and analyzed at 62 locations (includes all intervals for multi-level probe samples).
- Soil was collected and analyzed at 65 locations.

Samples were analyzed for VOCs, SVOCs, PCBs, TPHs, and inorganics (metals and cyanide) in both groundwater and soil, but not all constituent groups were analyzed at all locations.

The 2-31 Area COCs for both groundwater and soil were identified using the same methodology presented in Volume II of the CMS, but applied to only the data from the 2-31 Area. A 2-31 Area COC for groundwater or soil is defined as any constituent detected at concentrations greater than the lowest screening level. As noted in Volume II of the CMS, screening levels were developed for the following pathways:

Media: Groundwater	Media: Soil
Surface Water Pathways	**Surface Water Pathways**
Ingestion of Aquatic Organisms Protection of Aquatic Organisms	Ingestion of Aquatic Organisms Protection of Aquatic Organisms
Direct Exposure Pathways	**Direct Exposure Pathways**
Dermal Exposure by Fishermen or Recreational Swimmers Trenching (Direct Exposure during construction)	Dermal Exposure by Industrial Workers Ingestion Exposure by Industrial Workers Trenching (Direct Exposure during construction)
Air Exposure Pathways	**Air Exposure Pathways**
Indoor Air Inhalation by Industrial Workers Outdoor Air Inhalation by Industrial Workers Trenching (inhalation during construction)	Indoor Air Inhalation by Industrial Workers Outdoor Air Inhalation by Industrial Workders Trenching (inhalation during construction)

Risk-based screening levels were initially developed in 2004 for the surface water, direct contact and air exposure pathways. The values were used to support the pathway evaluation and identify data gaps as outlined above. As the data gap process has proceeded, the initial pathway-specific screening levels developed in 2004 have been corrected or revised as follows:

- Revision 1 – In July 2005, an error was discovered in the calculations used to develop soil and groundwater screening levels for the protection of surface water. The averaging time (AT) was changed in the surface water quality equations (WAC 173-340-730), a correction that resulted in new surface water pathway screening levels (for both soil and groundwater) for 22 constituents.

- Revision 2 – Soil screening levels for protection of the surface water pathway were identified as being below the Puget Sound Basin natural background concentrations calculated by Ecology (1994) for five metals: arsenic, copper, manganese, mercury and nickel. In September 2005, USEPA approved adjusting the screening levels for these metals to the calculated natural background concentrations with the acknowledgement that they exceeded the risk-based values.
- Revision 3 – Groundwater screening levels for the protection of the surface water pathway were revised for three metals (arsenic, copper and manganese) based on Duwamish Basin groundwater data provided by USEPA. In May 2006, USEPA approved adjusting the screening levels for these metals to calculated background values based on data provided by USEPA with the acknowledgement that the calculated values exceeded the risk-based values.
- Revision 4 – The 2004 site-wide screening levels for the air exposure pathway were revised using the results of the advanced J&E model with site-specific input data. Air exposure screening levels were developed for each Plant 2 sub-area for site-wide VOC soil and groundwater COCs, and mercury. USEPA approved the air exposure screening levels for Plant 2 sub-areas with modifications in October 2006 (USEPA, 2006).

The above risk-based exposures were then grouped by general pathway applicable at Plant 2: Surface Water, Direct Contact, and Air. This grouping greatly clarifies the CMS evaluation by grouping discussions regarding fate and transport, points of compliance, remedy selection, and compliance monitoring according to respective pathways. For the soil and groundwater COC analysis, the lowest screening level for a specific exposure is used as the screening level for the general pathway to ensure that the analysis is complete. As indicated in Volume II of the CMS, one adjustment made to risk calculations to arrive at screening levels has included increasing individual COC screening levels to laboratory reporting limits assuming a “clean” matrix. This is considered the practical quantitation limit (PQL), as discussed in Volume II.

The 2-31 Area soil and groundwater COCs and screening levels are summarized in Table 2-1. There are COCs representing all but one of the major analytical groups: VOCs, SVOCs, TPHs and inorganics (metals and cyanide). PCBs were not detected at concentrations greater than screening levels in groundwater and PCBs are therefore not COCs for groundwater in the 2-31 Area but are COCs for soil in the 2-31 Area because they were detected in soil above the soil screening level.

To determine whether or not a specific data gap exists, COC concentrations in groundwater and soil are first compared to screening levels. Data gaps are then identified if there were insufficient data to answer any of the general data gap questions outlined previously.

Data gap analysis criteria are applied to each COC for each general pathway for each medium to ensure the analysis is complete.

The following sections present this data gap analysis and the results for the 2-31 Area.

2.2 DATA GAPS: PHYSICAL CONCEPTUAL SITE MODEL

Foreword to Section 2.2.1:

This section is identical to Section 2.2.1 Plant 2 Hydrogeological Description in Volume III of the CMS. In the Draft Final version of the CMS, this section will appear in Volume I of the CMS within the description of the Conceptual Site Model for Plant 2. It is included here at this time to assist the reader in reviewing Volume VI as a stand alone discussion of investigative data gaps for the 2-31 Area.

2.2.1 Plant 2 Hydrogeologic Description

Plant 2 is located in the central portion of the Duwamish Valley adjacent to the tidally-influenced Duwamish Waterway, as noted in Figure 1-1. The Duwamish Valley is bounded to the east by Beacon Hill, rising to an elevation of 300 feet and separating the valley from the Lake Washington drainage basin. The western boundary of the Duwamish Valley is a topographic divide that separates the valley from the Puget Sound.

The historic Duwamish River was dredged and realigned to form the current channel of the Duwamish Waterway. This realignment was completed in approximately 1918 and moved the river from its former location at the present day King County International Airport to its current location to the west (Weston, 1996). Industrial development of the area beginning in the 1930s resulted in pavement or buildings covering a large portion of Plant 2.

The topographic divides that bound the Duwamish Valley to the west and east are composed of sedimentary bedrock of Tertiary age overlain by Quaternary glacial deposits. The Duwamish Valley consists of recent sediments underlain and bounded by older Quaternary glacial deposits and, locally, Tertiary bedrock. The near-surface sediments of the Duwamish Valley are set within the trough of the Duwamish estuary, carved by glacial ice and subsequently in-filled by river sediment. The lower boundary of that trough is reached sporadically by deep borings, particularly in the southern half of the study area. The pattern of those data indicate that the trough lies roughly 200 feet below the modern ground surface along the axis of the valley, generally becoming more shallow to the south and also towards the east and west valley walls. The boundary of these deposits is marked either by bedrock (where present to the south) or by very dense sediment that has been glacially overridden (Booth and Herman, 1998).

Above this boundary, the geologic history of the area suggests that a sequence of estuarine deposits, typically fine sands and silts with shells, should be found and should progress up into a more complex interbedded river-dominated sequence of sand, silt, and gravel marking the advance of the sedimentary wedge fed by the Osceola Mudflow and later deposits. The mudflow itself would have been very thin and subaqueous along the Duwamish Valley when first deposited, so the chances of intersecting (and recognizing) that layer by drill cores is probably low. The upper part of the river-deposited sediment should, and does, show the classic signs of continued slow overbank deposition by fine sand and silt, colonization by marshland plants, and occasional erosion and refilling by coarser sediment associated with the main channel of the migrating Duwamish River (Booth and Herman, 1998).

The most recent phase of the valley's geologic history includes the filling of tideflats and floodplains, and the subsequent dredging of a straightened channel of the meandering Duwamish River. Completed between approximately 1913 and 1918 by the Duwamish Waterway District, the new channel was 4-1/2 miles in length south from the East and West Waterways. As a result of waterway development, 12-1/2 miles of old river bed was abandoned. The excavated waterway material was used to fill the old channel areas and the lowlands above flood levels. Subsequent filling for land development purposes has resulted in a surficial layer of fill over most of the lower Duwamish Valley. The heterogeneous nature of fill materials can locally affect both infiltration characteristics and groundwater flow where the water table is below these fill materials. Because much of the thicker fills that occur below the water table are dredged from the Duwamish River, the silts and sands are difficult to distinguish from the native alluvium and have the same general hydrogeologic properties (Booth and Herman, 1998).

A generalized cross sectional diagram of the stratigraphy beneath Plant 2 is presented in Volume I of the CMS. The oldest (deepest) sediments encountered during the RFI consist of marine silt (the lower silt unit) deposited on the underlying glacial till unit. These two low-permeability deposits form an aquitard that isolates the shallow aquifer from the deeper aquifers beneath Plant 2. Above the lower silt unit is a thick, water-bearing, coarsening-upward sequence consisting of interbedded sand and silty sand. A thin layer of fill material consisting of coarse sand with varying amounts of silt overlies the naturally-deposited sand that makes up the upper aquifer beneath Plant 2. The shallow portion of the upper aquifer consists of medium sand with varying amounts of silt. This includes an approximate 2-foot-thick layer of brownish to greenish-gray to black silt and soft organic silt at depths typically ranging from approximately 4 to 11 feet bgs. This silt layer appears in many boring logs throughout the site, though it appears to vary in thickness and depth.

Shallow wells, generally in the upper 30 feet, are referred to as A level wells. Wells installed deeper in this sand unit, (generally from 30 to 60 feet bgs) are referred to as B level wells. At approximately 60 feet bgs, the silt content increases in a gradational change that can be distinguished based on field observations (Weston, 1996). The aquifer material below this layer is hereafter referred to as the C level of the upper aquifer, and wells installed below 60 feet are referred to as C level wells. At approximately 80 feet bgs, a distinctive marine silt layer with shell fragments is noted in well logs from Plant 2. The contact between the silty sand and the marine silt is sharp and is readily noted in the field.

The distinction between the upper A and B levels and C level is supported by increasing silt content and decreasing hydraulic conductivity with depth. The sand unit in the A and B ievels is generally more permeable than the deeper silty sand unit by approximately one order of magnitude. Hydraulic conductivity values, based multiple-well aquifer test data and tracer studies, in the A level and B level wells are generally 10^{-2} to 10^{-1} centimeters per second (200 to 400 feet per day [ft/day]) while measured hydraulic conductivity levels in the C level wells are generally 10^{-4} centimeters per second (cm/sec) (approximately 0.3 to 2.6 ft/day).

Groundwater in C level wells is also distinctly more saline and electrically conductive than water in the A and B level wells. Field data indicate that groundwater becomes more saline and conductive with depth. Groundwater in A level wells generally exhibit conductivity values less than 500 microsiemens per centimeter (µS/cm). Conductivity values for most B level wells

generally range between 1,000 and 4,000 µS/cm, while C level wells generally range between 5,000 and 10,000 µS/cm. Wells closer to the Duwamish Waterway are generally more saline and conductive possibly due to influence from the saline groundwater wedge beneath the Duwamish Waterway.

Vertical hydraulic conductivities in each unit are consistently three to four orders of magnitude less than horizontal hydraulic conductivities and are generally 10^{-5} cm/sec in A and B level wells and 10^{-7} cm/sec in C level wells indicating a high degree of anisotropy in all of the geologic units making up the A, B, and C levels of the upper aquifer.

There are two major influences that control much of the groundwater flow beneath Plant 2. These two influences are as follows:

- Tidal influences from the Duwamish Waterway, which is affected by tidal levels in Elliott Bay and Puget Sound
- Groundwater levels in the ridges flanking the Duwamish Valley

Groundwater flows from areas of higher hydraulic head to areas with lower hydraulic head. The hydraulic head of groundwater in the Duwamish Valley is less than in the surrounding ridges flanking the valley, but is higher than the net level of the Duwamish Waterway. Groundwater ultimately discharges into the Duwamish Waterway because the waterway has lower hydraulic head than the Duwamish Valley or the ridges flanking the valley. The Duwamish Waterway acts as a long linear groundwater sink along the axis of the valley, causing groundwater at Plant 2 to flow toward the waterway rather than down the valley northward toward Elliott Bay (Weston, 1996).

Recharge to the shallow sand/silty sand aquifer is mainly from the surrounding ridges and direct infiltration in areas that are not paved or covered by buildings. Subsurface flow to valley aquifers from the adjacent uplands is expected to be uniform throughout the valley. Direct recharge to the shallow aquifer beneath Plant 2 is limited due to the high density of buildings and paved surfaces with most runoff directed to storm drains leading to the waterway.

Depth to groundwater at Plant 2 is generally within 9 to 12 feet of ground surface. On an area-wide scale, the water table reflects the topography of the Duwamish Valley, with groundwater flowing toward the Duwamish Waterway. Groundwater close to the waterway is strongly influenced by tidal fluctuations. Tidal influence diminishes with increasing distance from the waterway and is negligible (less than 1 percent) at approximately 800 to 900 feet from the waterway in the A level of the aquifer and 600 feet from the waterway in the B and C levels of the aquifer. Tidal efficiency (i.e., the ratio of water-level fluctuation in monitoring wells divided by water level fluctuations in the waterway) appears to be similar in both the A and B levels. C level tidal efficiency has only been investigated at the south end of Plant 2. Existing tidal efficiency data from the south end of Plant 2 appear to be similar to data from the shallower A and B levels of the aquifer.

Groundwater flow at Plant 2 is primarily horizontal with a calculated average flow velocity of 876 feet per year in the upper A and B levels of the aquifer. This is based on a hydraulic conductivity of 300 ft/day, a horizontal gradient of 0.002 and an effective porosity of 0.25. The

calculated average groundwater flow velocity for the C level of the aquifer is 13 feet per year based on a hydraulic conductivity of 3 ft/day, a horizontal gradient of 0.003, and an effective porosity of 0.25. The difference in groundwater flow rate is due mainly to differences in hydraulic conductivity, which is lower in the C level of the aquifer. Horizontal hydraulic gradients continually change in tidally-influenced areas in tidal fluctuation in the Duwamish Waterway.

Groundwater flow directions temporarily reverse during high tide in areas immediately adjacent to the waterway. This phenomenon is temporary and does not prevent the eventual discharge of groundwater to the waterway. Groundwater discharge rates from Plant 2 to the waterway have been calculated at approximately 475 gallons per minute (gpm). This calculation is based on a hydraulic conductivity of 300 ft/day, a gradient of 0.002 and a seepage face area of 152,000 ft^2 (based on 3,800 feet by 40 feet seepage face).

Groundwater flow is also influenced by the presence of saline water that has intruded from the Duwamish Waterway. Following the initial dredging and realignment of the waterway in 1918, saline surface water extended back into the waterway and, driven by density differences, intruded downward below the waterway into the aquifer. As a result of this saltwater intrusion, a "saline groundwater wedge" has formed beneath the waterway. The presence of the salt water in the aquifer has been observed in several monitoring wells adjacent to the waterway and in deep wells, as indicated by very high specific conductance measurements and extremely elevated concentrations of dissolved sodium, chloride, bromide, and total dissolved solids (Weston, 1996). Saltwater intrusion has been well documented in other tidally-influenced aquifers, and the same processes are expected to apply in the aquifers underlying Plant 2.

Saline groundwater has also been observed in deeper C level monitoring wells at locations that are not immediately adjacent to the waterway. This saline water is similar in composition to seawater; however concentrations of dissolved ions are substantially less than seawater. Isotope studies indicate that tritium was not detected in deeper C level groundwater samples, but was detected in the upper A and B levels of the aquifer (Weston, 1996). This study suggests that the saline groundwater in the C level of the aquifer may be significantly older than the fresh groundwater found in the upper A and B levels of the aquifer.

The apparent salinity stratification of the aquifer is not likely due to the intrusion of salt water from the Duwamish Waterway. If that were the case, the position of the saltwater/freshwater interface would be closer to the waterway. Groundwater mixing may be limited by density differences between the deeper, more-saline water, and the overlying fresh water and also by the two orders of magnitude lower vertical hydraulic conductivity of the C level portion of the aquifer relative to the A and B levels.

The presence of a saline groundwater wedge will affect the movement of groundwater near the waterway with the saline groundwater wedge acting as a dense stable mass that is in dynamic equilibrium with the surrounding, less-saline and therefore less dense, groundwater. The less dense fresh groundwater that migrates toward the waterway will be forced to move upward over the dense saline groundwater wedge. Limited mixing between the saline and fresh groundwater would be expected along this interface.

Data gap analysis associated with the geology and hydrogeology specific to the 2-31 Area are presented in Sections 2.2.2 and 2.2.3 below.

2.2.2 Geology Data Gaps

The geology underlying the 2-31 Area has been investigated and documented in sufficient extent and detail for the purposes of the CMS. Numerous monitoring wells, soil borings, and direct-push probe locations drilled throughout the area provide adequate geologic data coverage, both vertically and laterally, to proceed with the CMS. No additional geologic investigation, other than geologic logging during well and probe installation, is planned for the 2-31 Area data gap investigation.

2.2.3 Hydrogeology Data Gaps

Groundwater flow directions at Plant 2 were investigated as part of the RCRA Facility Investigation (RFI) (Weston, 1996). Groundwater flow directions in the 2-31 Area were shown to flow generally toward the Duwamish Waterway with the groundwater flow path approximately perpendicular to the waterway.

The current level of understanding of groundwater flow directions in the 2-31 Area is adequate for the purposes of the CMS. There are no property boundary issues or potential receptors, other than the Duwamish Waterway, for groundwater from the 2-31 Area to potentially impact. Therefore, additional groundwater flow direction characterization is not warranted for this area.

Vertical groundwater gradient directions and magnitudes have been evaluated in the 2-31 Area at the PL2-501 well cluster. Net groundwater level data, corrected for tidal fluctuations using the Serfes (1991) Method, from the PL2-501 well cluster indicate a net upward vertical groundwater flow direction with a gradient of 0.005. These data are presented in the *Conceptual Hydrogeologic Model Data Gap Investigation Results – Boeing Plant 2* (EPI, 2005).

2.3 GROUNDWATER QUALITY DATA GAPS

The following sections present the data gaps analysis and evaluation for groundwater in the 2-31 Area. In Section 2.3 and its subsections the term COC(s) will refer to groundwater COC(s) unless otherwise specifically stated. The analysis is organized by COC rather than by unit because this allows for a better understanding of area-wide groundwater issues.

Area-specific COCs are identified using the following steps: If a site-wide COC was detected in the 2-31 Area existing analytical data at concentrations greater than or equal to the respective screening level, the site-wide COC is considered an area-specific COC for the 2-31 Area. Resulting Area-specific COCs are listed and summarized in Tables 2-1 and A-2 (in Attachment A). Table A-2 also identifies the number of samples with COC detections at concentrations greater than screening levels for each exposure pathway.

2.3.1 Current Data - Data Gap

During the course of site investigation at Plant 2 and in the 2-31 Area, a large portion of groundwater samples were collected on a unit-by-unit basis. This unit-by-unit approach is consistent with RCRA procedures and works well for soils. The unit-by-unit approach can also work well for groundwater if the groundwater plumes do not commingle. However, in the 2-31 Area, and indeed over much of Plant 2, groundwater plumes commingle and lose their ties

to any individual RCRA Unit. In these cases, an area-wide sampling approach provides the data necessary to gain a current view of groundwater conditions in the area and to more accurately delineate and track the commingled plumes.

Some of the data associated with the 2-31 Area of Plant 2 are more current than data for other areas of the site because an extensive area-wide soil and groundwater sampling event was performed in the 2-31 Area and, to a greater extent, the adjacent 2-40s Area in 2002 as part of the parcel disposition Phase II environmental investigation (Parcel Investigation) (Golder/EPI, 2003). Six site-wide probe locations associated with the Parcel Investigation are located in the 2-31 Area. In addition, monitoring well PL2-233A in the 2-31 Area was sampled quarterly from 2003 to 2008 as part of the Shoreline Monitoring Program. Beginning in 2008 the shoreline monitoring schedule was modified to semi-annually for well PL2-233A.

Data from the Parcel Investigation and Shoreline Monitoring Program are both relatively current but do not provide adequate coverage of the 2-31 Area for the purposes of remedy selection under the CMS. Therefore, one round of groundwater sampling in 11 of the 12 existing 2-31 Area monitoring wells and in the two new monitoring well will be performed in coordination with the existing Shoreline Monitoring Program to provide the data necessary to make decisions regarding corrective measures for use in the CMS. In addition, 50 direct-push probes will be driven to investigate soil and groundwater quality downgradient of several known areas of impacted groundwater and soils that are not adequately covered by the existing monitoring well network.

Although all but one of the 12 existing 2-31 Area Plant 2 monitoring wells and both new wells will be sampled, they will be sampled for different constituents depending on their locations and history of detected constituents. Well PL2-508A will not be sampled because it is in an area adequately monitored by well PL2-509A.

2.3.2 Inorganics

Analytical results for all site-wide metals and cyanide COCs were screened to determine which site-wide constituents are also COCs for the 2-31 Area. The screening levels used for site-wide COCs are summarized in Table A-1 in Attachment A. If a site-wide COC was detected in the 2-31 Area analytical data at concentrations greater than or equal to the respective screening level, the site-wide COC is considered an area-specific COC for the 2-31 Area. Resulting Area-specific COCs are listed and summarized in Table 2-1. Isoconcentration maps and tables of maximum inorganics concentrations in the 2-31 Area are presented in Attachment A.

Five inorganic compounds (metals and cyanide) are included on the 2-31 Area area-specific COC list. The inorganic compounds on the 2-31 Area COC list are:

Arsenic	Copper	Mercury
Nickel (soluble salts)	Cyanide	

The occurrence of these inorganic compounds in the 2-31 Area is evaluated for the surface water exposure pathway in the Sections 2.3.2.1 through 2.3.2.6. These five constituents are also COCs for soils in the 2-31 Area and will be analyzed at wells located near where they have been detected at concentrations greater than screening levels in the soil. Although cadmium,

silver and zinc are COCs for soils but not for groundwater in the 2-31 Area; these metals will also be analyzed to evaluate the soil to groundwater pathway.

The exposure pathway for air is not evaluated for most inorganics because most metals and cyanide are not volatile and will not partition to that media. Mercury is the only inorganic COC that has the potential to enter the air pathway and therefore mercury concentrations are compared to its air screening level. The direct contact pathway is valid for inorganics, but screening levels calculated for the direct contact pathway are greater than those for the protection of surface water and therefore do not drive cleanup considerations.

2.3.2.1 Arsenic

Arsenic was analyzed in 44 2-31 Area groundwater samples and detected in 42 of those samples. Boeing has established a site-specific background level for arsenic in groundwater of 8.0 micrograms per liter (µg/L). Five of the 42 arsenic detections were at concentrations greater than the background level for arsenic.

Arsenic is detected at concentrations greater than its background level of 8.0 µg/L at two locations immediately downgradient of SWMU 2-31.22 (Brush Plating Area), SWMU 2-31.23 (Ammonium Persulfate Tank), SWMU 2-31.24 (Sodium Hydroxide Developer), SWMU 2-31.25 (Anodize Aluminum Room), SWMU 2-31.36 (Anodizing Tank Line), at one location downgradient of OA-17.4 (Transformer Vaults), and at two locations downgradient of East Marginal Way South that are not associated with a RCRA unit. The greatest arsenic concentrations are noted at the two sample locations downgradient of SWMU 2-31.22 and SWMU 2-31.23. Arsenic was not adequately characterized in B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of high arsenic concentrations in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for sampling locations where arsenic was detected.

Data gaps for arsenic are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the arsenic groundwater plume; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at every sampling location. This information will then be combined with historical data to develop inferences regarding whether the arsenic plume has reached steady state. Total organic carbon (TOC) and redox parameters will be added to the constituent list to assist in remedy selection for arsenic.
- Hot Spots: Groundwater in areas around RCRA units appears to be adequately characterized for arsenic in terms of the number and locations of groundwater samples in the A level of the aquifer. However, there are two areas in the A level of the aquifer with arsenic concentrations greater than 8.0 µg/L that are not associated with RCRA units. In addition, arsenic was not adequately characterized in the B and C levels of the aquifer and will be further investigated during this data gap

investigation in both the B and C levels of the aquifer. Arsenic will be analyzed in the B level of the aquifer at 11 of the 50 direct-push probe locations in the 2-31 Area and in all B and C level monitoring wells to address this data gap.

- New Sources: Arsenic was detected at concentrations greater than its background level in samples from SW-1 and SW-2 in an area not associated with a RCRA unit. Arsenic concentrations will be investigated further with samples from PL2-507A and direct-push probes in the area. The occurrence of elevated arsenic concentrations in this area is considered a "new source" data gap.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway may be complete for arsenic in the 2-31 Area. Concentrations of arsenic greater than its background level were noted in groundwater sampling locations in the upland area approximately 600 feet or farther upgradient of the waterway. However, arsenic concentrations from sampling locations closer to the waterway were all less than the arsenic background level. Additional groundwater samples will be obtained in monitoring wells and direct-push probes installed along the Duwamish Waterway during the 2-31 Area data gap investigation to provide the additional data needed to evaluate this pathway.
- Background: Site-specific background concentrations have been calculated for arsenic in groundwater and have been accepted by USEPA. The calculated background concentration of 8.0 µg/L for total arsenic in groundwater will be used to delineate arsenic plumes based on analytical results from this data gap investigation.
- Exceedance of Background Levels by Analytical Reporting Limits: The reporting limit for arsenic in groundwater samples in the 2-31 Area is 1.0 µg/L, which is less than the background level of 8.0 µg/L. Therefore, there is no analytical reporting limit data gap for arsenic in the 2-31 Area.

2.3.2.2 Copper

Copper was analyzed in 44 2-31 Area groundwater samples and detected in 31 of those samples. Boeing has established a site-specific background level for copper in groundwater of 8.0 µg/L. Four copper detections were greater than the background level of 8.0 µg/L for copper.

Copper concentrations greater than the background level in the A level of the aquifer were generally noted in the south central portion of the 2-31 Area beneath Building 2-31. Probe locations DP-3105 and DP-3106 produced samples with the greatest copper concentrations. These two probe locations are potentially associated with SWMU 2-31.22 (Brush Plating Area), and SWMU 2-31.23 (Ammonium Persulfate Tank), and SWMU 2-31.24 (Sodium Hydroxide Developer). Copper concentrations exceeding the background level were also noted at PL2-507A in the northeast corner of the 2-31 Area. Copper-impacted groundwater in samples from well PL2-504A and probe SW-05 are not associated with a RCRA regulated unit. Copper was not analyzed in the B or C levels of the aquifer

RCRA units located in or near areas of copper at concentrations greater than the background level in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for sampling locations where copper was detected.

Data gaps for copper are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing copper data are insufficient to give a current view of the distribution of copper in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at every sampling location. This information will then be combined with historical data to develop inferences regarding whether the copper distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units appears to be adequately characterized for copper in terms of the number and locations of groundwater samples in the A level of the aquifer. There do not appear to be any hot spot data gaps for copper in the A level of the aquifer. Copper was not characterized in the B and C levels of the aquifer and will be investigated in the B and C levels of the aquifer during this data gap investigation.
- New Sources: Copper at concentrations greater than screening levels in areas not associated with RCRA units will be investigated further with samples from PL2-504A and direct-push probes. The occurrence of elevated copper concentrations in this area is considered to be a “new source” data gap.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway currently appears to be incomplete for copper in the 2-31 Area. Concentrations of copper greater than its background level were noted in groundwater sampling locations in the upland area approximately 600 feet or farther upgradient of the waterway. However, copper concentrations from sampling locations closer to the waterway were all less than the copper background level. Additional groundwater samples will be obtained in monitoring wells and direct-push probes installed along the Duwamish Waterway during the 2-31 Area data gap Investigation to provide the additional data needed to evaluate this pathway.
- Background: Site-specific background concentrations have been calculated for copper in groundwater and have been accepted by USEPA. The calculated background concentration of 8.0 µg/L for copper in groundwater will be used to delineate copper plumes based on analytical results from this data gap investigation.
- Exceedance of Background Levels by Analytical Reporting Limits: The reporting limit for copper in groundwater samples throughout much of the 2-31 Area is 2.0 µg/L, which is less than the background level of 8.0 µg/L. Therefore, a reporting limit data gap does not exist for copper in the 2-31 Area.

2.3.2.3 Mercury

Mercury was analyzed in 44 2-31 Area groundwater samples and detected in six of those samples. Only two of the six mercury detections were greater than the screening level for the protection of surface water of 0.025 µg/L and neither of the two mercury detections was greater than the air screening level of 184 µg/L.

The occurrence of mercury concentrations greater than the screening level in the A level of the aquifer is limited to locations DP-3105, which is downgradient of SWMU 2-31.22 (Brush Plating

Area) SWMU 2-31.23 (Ammonium Persulfate Tank) and also at PL2-504A, which is not associated with a particular RCRA unit. The greatest detection of mercury in the 2-31 Area is at DP-3105 with a concentration of 0.1 µg/L. Mercury was not analyzed in groundwater samples from the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of high mercury concentrations in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for sampling locations where mercury was detected.

Data gaps for mercury are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: Existing data for mercury are insufficient to give a current view of the distribution of mercury in groundwater in the 2-31 Area. Therefore, mercury will be included as a constituent in the sampling event described in Section 2.3.1. This information will then be combined with historical data to develop inferences regarding whether the mercury distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units appears to be adequately characterized for mercury in terms of the number and locations of groundwater samples in the A level of the aquifer; however, the reporting limit for mercury was generally 0.1 µg/L, which is greater than its screening level of 0.025 µg/L. There do not appear to be any hot spot data gaps for mercury in the A level of the aquifer. However, mercury was not characterized in the B and C levels of the aquifer and will be investigated during this data gap investigation in both the B and C levels of the aquifer.
- New Sources: Mercury concentrations above screening levels were noted in groundwater samples from PL2-504A. This well is in an area not associated with RCRA units. The occurrence of elevated mercury concentrations in this area is considered to be a “new source” data gap. This data gap will be addressed with samples from PL2-503A, PL2-504A, PL2-505A, and from direct-push probes.
- The detection limit for mercury in existing groundwater sample data throughout much of the 2-31 Area is 0.1 µg/L, which is above the screening level of 0.025 µg/L. Sampling for mercury during the data gap investigation will yield additional data with a reporting limit of 0.025 µg/L to address this data gap.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway currently appears to be incomplete for mercury in the 2-31 Area. Concentrations of mercury greater than its screening level are not noted in samples from locations along the Duwamish Waterway. However, this potential data gap was difficult to evaluate because of the reporting limit data gap noted below. Additional groundwater samples will be obtained in monitoring wells and direct-push probes installed along the Duwamish Waterway during the 2-31 Area data gap investigation to provide the additional data needed to evaluate this pathway.
- Background Data: The occurrences of mercury at concentrations greater than its groundwater screening level do not appear to be related to a background issue;

therefore, background concentrations will not be established for mercury in groundwater at Plant 2.

- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for mercury in groundwater samples throughout much of the 2-31 Area is 0.1 µg/L, which is greater than the screening level of 0.025 µg/L. Sampling for mercury during the data gap investigation will yield additional data with a reporting limit of 0.025 µg/L to address this data gap.

2.3.2.4 Nickel

Nickel was analyzed in 44 2-31 Area groundwater samples and detected in 27 of those samples. One of the 27 nickel detections, for a sample from well PL2-505A, was greater than the screening level for the protection of surface water of 8.2 µg/L.

The occurrence of nickel at a concentration greater than the screening level in the A Level of the aquifer is limited to PL2-505A, which is downgradient of UST PL-12 and UST PL-13 but is not associated with any particular RCRA unit. Nickel was not detected at concentrations greater than its screening level in samples collected at any other location in the 2-31 Area. Nickel was not analyzed in groundwater samples from the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of high nickel concentrations in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for sampling locations where nickel was detected.

Data gaps for nickel are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of nickel in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at every sampling location. This information will then be combined with historical data to develop inferences regarding whether the nickel distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units appears to be adequately characterized for nickel in terms of the number and locations of groundwater samples in the A level of the aquifer; however, the reporting limit for nickel was generally 10.0 µg/L, which is greater than its screening level of 8.2 µg/L. There do not appear to be any hot spot data gaps for nickel in the A level of the aquifer. Nickel was not characterized in the B and C levels of the aquifer and will be investigated during this data gap investigation in both the B and C levels of the aquifer.
- New Sources: A sample from PL2-505A was the single occurrence of a nickel concentration in groundwater greater than its screening level in the 2-31 Area. This location is not associated with a RCRA unit; however, it is directly downgradient of underground storage tanks PL-12 and PL-13. This data gap will be addressed with samples from PL2-503A, PL2-504A, PL2-505A, and from direct-push probes

- Groundwater to Surface Water Pathway: The groundwater to surface water pathway currently might be complete for nickel in the 2-31 Area. Nickel was detected at a concentration greater than its screening level in the sample from location PL2-505A, approximately 700 feet upgradient of the Duwamish Waterway. However, this potential data gap was difficult to fully evaluate because of the reporting limit data gap noted below. Additional groundwater samples will be obtained in monitoring wells and direct-push probes installed along the Duwamish Waterway during the 2-31 Area data gap investigation to provide the additional data needed to evaluate this pathway.
- Background Data: The occurrences of nickel at concentrations greater than its groundwater screening level do not appear to be related to a background issue; therefore, background concentrations will not be established for nickel in groundwater at Plant 2.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for nickel in groundwater samples throughout much of the 2-31 Area is 10 µg/L, which is greater than the screening level of 8.2 µg/L. Sampling for nickel during the data gap investigation will yield additional data with a reporting limit of 0.5 µg/L to provide further confidence that nickel impacts to groundwater are adequately delineated for CMS purposes.

2.3.2.5 Cyanide

Cyanide was analyzed in 8 2-31 Area groundwater samples and detected in one of those samples. The single cyanide detection in the 2-31 Area was in a sample from direct-push probe SW-01 at a concentration 15 µg/L, which is greater than the screening level for the protection of surface water of 5.0 µg/L. The SW-01 location is not associated with a RCRA unit. Cyanide was not analyzed in the B or C levels of the aquifer in the 2-31 Area. Refer to the isoconcentration map in Attachment A for the sampling locations where cyanide was detected.

Data gaps for cyanide are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of cyanide in groundwater, particularly at the north corner of the area; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the cyanide distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units appears to be adequately characterized for cyanide in terms of the number and locations of groundwater samples in the A level of the aquifer. There do not appear to be any hot spot data gaps for cyanide in the A level of the aquifer. However, cyanide was not analyzed in samples from the B and C levels of the aquifer. The potential presence of cyanide at concentrations greater than its screening level in groundwater will be investigated during this data gap investigation in both the B and C levels of the aquifer.

- New Sources: Cyanide was detected at a concentration greater than its screening level in the groundwater sample from probe SW-01. SW-01 is in an area not associated with a RCRA unit. The occurrence of elevated cyanide concentrations in this area is considered to be a "new source" data gap. This data gap will be addressed with samples from PL2-507A and direct-push probe locations.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway might be complete for cyanide in the 2-31 Area. The single occurrence of cyanide at a concentration greater than its screening level is at location SW-01 in the north corner of the 2-31 Area. This location is not adjacent to the waterway and the 2-10 Area is immediately downgradient of the SW-01 location (see cyanide isoconcentration map in Attachment A). Additional groundwater samples will be obtained in monitoring wells and direct-push probes along the Duwamish Waterway during the 2-31 Area data gap investigation to provide the additional data needed to further evaluate this pathway.
- Background Data: The occurrences of cyanide at concentrations greater than its groundwater screening level do not appear to be related to a background issue; therefore, background concentrations will not be established for cyanide in groundwater at Plant 2.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for cyanide in groundwater samples throughout much of the 2-31 Area is equal to the cyanide screening level of 5.0 µg/L. Therefore, there is not a reporting limit data gap for cyanide in the 2-31 Area.

2.3.3 Semivolatile Organic Compounds and Polychlorinated Biphenyls

Analytical results for all site-wide SVOC and PCB COCs were screened to determine which site-wide constituents are also COCs for the 2-31 Area. The screening levels used for site-wide COCs are summarized in Table A-1. If a site-wide COC was detected in the 2-31 Area groundwater analytical data at concentrations greater than or equal to the respective screening level, the site-wide COC is considered a COC for the 2-31 Area.

Based on the existing data, there are eight SVOC COCs for groundwater in the 2-31 Area; however, there are no PCB COCs for groundwater in the 2-31 Area.

The eight SVOC compounds included on the 2-31 Area-specific COC list are:

Benzo(a)anthracene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene
Benzo(a)pyrene	bis(2-Ethylyhexyl)phthalate	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Chrysene	

Resulting Area-specific COCs are listed and summarized in Table 2-1. Isoconcentration maps and tables of maximum SVOCs concentrations in the 2-31 Area are presented in Attachment A.

The occurrence of these SVOC compounds in the 2-31 Area is evaluated for the surface water exposure pathway in the sections below. All eight of these constituents are COCs for soils in the 2-31 Area and will be analyzed at wells located near where they have been detected above screening levels in the soil.

It should be noted that the calculated screening levels for all eight of the 2-31 Area-specific SVOCs are less than achievable laboratory reporting limits and the screening levels used in the data gap process are set at the lowest achievable laboratory reporting limit.

The exposure pathway for air is not evaluated for SVOCs because these compounds are not volatile and will not partition to that media. The direct contact pathway is valid for SVOCs, but screening levels calculated for the direct contact pathway are greater than those for surface water and air and therefore do not drive cleanup.

Unlike some of the inorganic constituents, none of the SVOC constituents are naturally-occurring; therefore, there is no background data gap for any of the SVOCs so this potential data gap will not be addressed for SVOCs.

2.3.3.1 Benzo(a)anthracene

Benzo(a)anthracene was analyzed in 17 2-31 Area groundwater samples and detected in the samples from probes DP-2802 and DP-2803. Both benzo(a)anthracene detections in the 2-31 Area were at concentrations greater than the screening level for the protection of surface water of 0.1 µg/L, although the detected value from the groundwater sample collected from probe location DP-2802 has a J-qualifier indicating it is an estimated concentration.

The occurrences of benzo(a)anthracene at concentrations greater than the screening level in the A level of the aquifer are at probe locations DP-2802 and DP-2803 in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. These locations are not associated with a RCRA unit. Benzo(a)anthracene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of benzo(a)anthracene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where benzo(a)anthracene was detected.

Data gaps for benzo(a)anthracene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of benzo(a)anthracene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the benzo(a)anthracene distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for benzo(a)anthracene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, benzo(a)anthracene was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility,

benzo(a)anthracene is not expected to be found in the B or C-levels of the aquifer. If benzo(a)anthracene is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.

- New Sources: There is one small area of benzo(a)anthracene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for benzo(a)anthracene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrences of benzo(a)anthracene concentrations greater than its screening level are at probe locations DP-2802 and DP-2803 which are in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for benzo(a)anthracene; therefore, it appears that currently, there is not a completed pathway issue for benzo(a)anthracene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for benzo(a)anthracene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for benzo(a)anthracene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods. Due to this analytical limitation, the screening level has been set to the reporting limit of 0.1 µg/L; therefore, a reporting limit data gap does not exist.

2.3.3.2 Benzo(a)pyrene

Benzo(a)pyrene was analyzed in 17 2-31 Area groundwater samples and detected in the samples from probes DP-2802 and DP-2803. Both benzo(a)pyrene detections in the 2-31 Area were at concentrations greater than the screening level for the protection of surface water of 0.1 µg/L, although the detected value from the groundwater sample collected from probe location DP-2802 has a J-qualifier indicating it is an estimated concentration.

The occurrences of benzo(a)pyrene at concentrations greater than the screening level in the A level of the aquifer are at probe locations DP-2802 and DP-2803 in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. These locations are not associated with a RCRA unit. Benzo(a)pyrene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of benzo(a)pyrene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where benzo(a)pyrene was detected.

Data gaps for benzo(a)pyrene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of benzo(a)pyrene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected

monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the benzo(a)pyrene distribution has reached steady state.

- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for benzo(a)pyrene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, benzo(a)pyrene was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility, benzo(a)pyrene is not expected to be found in the B or C levels of the aquifer. If benzo(a)pyrene is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.
- New Sources: There is one small area of benzo(a)pyrene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for benzo(a)pyrene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrences of benzo(a)pyrene concentrations greater than its screening level are at probe locations DP-2802 and DP-2803, which are in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for benzo(a)pyrene; therefore, it appears that currently, there is not a completed pathway issue for benzo(a)pyrene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for benzo(a)pyrene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for benzo(a)pyrene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods. Due to this analytical limitation, the screening level has been set to the reporting limit of 0.1 µg/L; therefore, a reporting limit data gap does not exist.

2.3.3.3 Benzo(b)fluoranthene

Benzo(b)fluoranthene was analyzed in 17 2-31 Area groundwater samples and detected in the samples from probes DP-2802 and DP-2803. Both benzo(b)fluoranthene detections in the 2-31 Area were at concentrations greater than the screening level for the protection of surface water of 0.1 µg/L, although the detected value from the groundwater sample collected from probe location DP-2802 has a J-qualifier indicating it is an estimated concentration.

The occurrences of benzo(b)fluoranthene at concentrations greater than the screening level in the A level of the aquifer are at probe locations DP-2802 and DP-2803 in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. These locations are not associated with a RCRA unit. Benzo(b)fluoranthene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of benzo(b)fluoranthene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where benzo(b)fluoranthene was detected.

Data gaps for benzo(b)fluoranthene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of benzo(b)fluoranthene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the benzo(b)fluoranthene distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for benzo(b)fluoranthene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, benzo(b)fluoranthene was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility, benzo(b)fluoranthene is not expected to be found in the B or C levels of the aquifer. If benzo(b)fluoranthene is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.
- New Sources: There is one small area of benzo(b)fluoranthene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for benzo(b)fluoranthene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrences of benzo(b)fluoranthene at concentrations greater than its screening level are at probe locations DP-2802 and DP-2803, which are in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for benzo(b)fluoranthene; therefore, it appears that currently, there is not a completed pathway issue for benzo(b)fluoranthene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for benzo(b)fluoranthene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for benzo(b)fluoranthene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods. Due to this analytical limitation, the screening level has been set to the reporting limit of 0.1 µg/L; therefore, a reporting limit data gap does not exist.

2.3.3.4 Benzo(k)fluoranthene

Benzo(k)fluoranthene was analyzed in 17 2-31 Area groundwater samples and detected in the sample from probe DP-2803. The single benzo(k)fluoranthene detection in the 2-31 Area was at a concentration greater than the screening level for the protection of surface water of 0.1 µg/L. However, it should be noted that the analytical result from nearby probe DP-2802 had an elevated reporting limit of 0.5 µg/L, which is greater than its screening level.

The occurrence of benzo(k)fluoranthene at a concentration greater than the screening level in the A level of the aquifer is at probe location DP-2803 in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. This location is not associated with a RCRA unit. Benzo(k)fluoranthene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of benzo(k)fluoranthene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where benzo(k)fluoranthene was detected.

Data gaps for benzo(k)fluoranthene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of benzo(k)fluoranthene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the benzo(k)fluoranthene distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for benzo(k)fluoranthene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, benzo(k)fluoranthene was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility, benzo(k)fluoranthene is not expected to be found in the B or C levels of the aquifer. If benzo(k)fluoranthene is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.
- New Sources: There is one small area of benzo(k)fluoranthene in groundwater at a concentration greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for benzo(k)fluoranthene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The single occurrence of a benzo(k)fluoranthene concentration greater than its screening level is at probe location DP-2803, which is in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for benzo(k)fluoranthene; therefore, it appears that currently, there is not a completed pathway issue for benzo(k)fluoranthene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for benzo(k)fluoranthene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for benzo(k)fluoranthene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods. Due to this analytical limitation, the screening level has been set to the reporting limit of 0.1 µg/L; therefore, a reporting limit data gap does not exist.

2.3.3.5 bis(2-Ethylhexyl)phthalate

bis(2-Ethylhexl)phthalate was analyzed in 17 2-31 Area groundwater samples and detected in the sample from monitoring well PL2-505A at a concentration of 4.0 µg/L, which is greater than the screening level for the protection of surface water of 3.0 µg/L. The reporting limit for bis(2-ethylhexl)phthalate was 4 µg/L throughout most of the 2-31 Area and was 20 µg/L at probe location DP-2802, which is very close to well PL2-505A.

The occurrence of bis(2-ethylhexl)phthalate at a concentration greater than the screening level in the A level of the aquifer is at monitoring well location PL2-505A in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. This location is not associated with a RCRA unit. bis(2-Ethylhexl)phthalate was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of bis(2-ethylhexl)phthalate concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling location where bis(2-ethylhexl)phthalate was detected.

Data gaps for bis(2-ethylhexl)phthalate are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of bis(2-ethylhexl)phthalate in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the bis(2-ethylhexl)phthalate distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for bis(2-ethylhexl)phthalate in terms of the number and locations of groundwater samples in the A level of the aquifer. However, bis(2-ethylhexl)phthalate was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility, bis(2-ethylhexl)phthalate is not expected to be found in the B or C levels of the aquifer. If bis(2-ethylhexl)phthalate is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.
- New Sources: There is one small area of bis(2-ethylhexl)phthalate in groundwater at a concentration greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for bis(2-ethylhexl)phthalate and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The single occurrence of a bis(2-ethylhexl)phthalate concentration greater than its screening level is in a sample from well PL2-505A, which is in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for bis(2-ethylhexl)phthalate; therefore,

it appears that currently there is not a completed pathway issue for bis(2-ethylhexl)phthalate in the 2-31 Area.

- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for bis(2-ethylhexl)phthalate in groundwater samples throughout much of the 2-31 Area is 4 µg/L, which is above the screening level of 3 µg/L. However, the detection limit is sufficiently close to the screening level to provide reasonable confidence that the area of bis(2-ethylhexl)phthalate impacted groundwater is adequately delineated. Sampling for bis(2-ethylhexl)phthalate during the data gap investigation will yield additional data with a reporting limit of 3.0 µg/L, or less, to provide further confidence that bis(2-ethylhexl)phthalate impacts to groundwater are adequately delineated for CMS purposes.

2.3.3.6 Chrysene

Chrysene was analyzed in 17 2-31 Area groundwater samples and detected in the samples from probes DP-2802 and DP-2803. Both chrysene detections in the 2-31 Area were at concentrations greater than the screening level for the protection of surface water of 0.1 µg/L, although the detected value from the groundwater sample collected from probe location DP-2802 has a J-qualifier indicating that it is an estimated concentration.

The occurrences of chrysene at a concentration greater than the screening level in the A level of the aquifer is at probe locations DP-2802 and DP-2803 in the center of the 2-31 Area adjacent to USTs PL-12 and PL-13. This location is not associated with a RCRA unit. Chrysene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of chrysene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where chrysene was detected.

Data gaps for chrysene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of chrysene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the chrysene distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for chrysene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, chrysene was not analyzed in the B or C levels of the aquifer during previous sampling. Because of its low solubility, chrysene is not expected to be found in the B or C levels of the aquifer. If chrysene is detected at concentrations greater than its screening level in data gap samples from the A level of the aquifer, B and C level monitoring wells will be sampled during a subsequent sampling event to address this data gap.

- New Sources: There is one small area of chrysene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for chrysene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrences of chrysene at concentrations greater than its screening level are at probe locations DP-2802 and DP-2803 which are in the center of the 2-31 Area. The sample from shoreline well PL2-233A was non-detect for chrysene; therefore, it appears that currently there is not a completed pathway issue for chrysene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for chrysene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for chrysene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods so the reporting limit has been set equal to the screening level of 0.1 µg/L. Therefore, a reporting limit data gap does not exist.

2.3.3.7 Dibenz(a,h)anthracene

Dibenz(a,h)anthracene was analyzed in 17 2-31 Area groundwater samples and detected in the sample from probe DP-2803. The single dibenz(a,h)anthracene detection in the 2-31 Area was 0.19 µg/L, which is greater than the screening level for the protection of surface water of 0.1 µg/L. It should be noted that the analytical result from probe DP-2802 had an elevated reporting limit of 0.5 µg/L, which is greater than its screening level.

The occurrence of dibenz(a,h)anthracene at a concentration greater than the screening level in the A level of the aquifer is at probe location DP-2803 in the center of the 2-31 adjacent to USTs PL-12 and PL-13. This location is not associated with a RCRA unit. Dibenz(a,h)anthracene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of dibenz(a,h)anthracene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where dibenz(a,h)anthracene was detected.

Data gaps for dibenz(a,h)anthracene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of dibenz(a,h)anthracene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the dibenz(a,h)anthracene distribution has reached steady state.

- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for dibenz(a,h)anthracene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, dibenz(a,h)anthracene was not analyzed in the B or C levels of the aquifer during previous sampling. However, because of its low solubility, dibenz(a,h)anthracene is not expected to be found in the B or C levels of the aquifer. If dibenz(a,h)anthracene is detected at concentrations greater than its screening level in data gap samples collected from the A level of the aquifer B and C level monitoring wells will be sampled to address this data gap.
- New Sources: There is one small area of dibenz(a,h)anthracene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for dibenz(a,h)anthracene and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrence of a dibenz(a,h)anthracene concentration elevated above its screening level is at probe location DP-2803 in the center of the 2-31 Area. This location is not adjacent to the waterway, and it appears that currently there is not a completed pathway issue for dibenz(a,h)anthracene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for dibenz(a,h)anthracene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for dibenz(a,h)anthracene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods so the reporting limit has been set equal to the screening level of 0.1 µg/L. Therefore, a reporting limit data gap does not exist.

2.3.3.8 Indeno(1,2,3-cd)pyrene

Indeno(1,2,3-cd)pyrene was analyzed in 17 2-31 Area groundwater samples and detected in the sample from probe DP-2803. The single indeno(1,2,3-cd)pyrene detection in the 2-31 Area was 0.29 µg/L, which is greater than the screening level for the protection of surface water of 0.1 µg/L. It should be noted that the analytical result from probe DP-2802 had an elevated reporting limit of 0.5 µg/L, which is above its screening level.

The occurrence of indeno(1,2,3-cd)pyrene at a concentration greater than the screening level in the A Level of the aquifer is at probe location DP-2803 in the center of the 2-31 adjacent to USTs PL-12 and PL-13. This location is not associated with a RCRA unit. Indeno(1,2,3-cd)pyrene was not analyzed in the B or C levels of the aquifer in the 2-31 Area.

RCRA units located in or near areas of indeno(1,2,3-cd)pyrene concentrations exceeding their screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration map in Attachment A for the sampling locations where indeno(1,2,3-cd)pyrene was detected.

Data gaps for indeno(1,2,3-cd)pyrene are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of indeno(1,2,3-cd)pyrene in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent in selected monitoring wells and probe locations (see Table 2-2). This information will then be combined with historical data to develop inferences regarding whether the indeno(1,2,3-cd)pyrene distribution has reached steady state.
- Hot Spots: Groundwater in areas around RCRA units is adequately characterized for indeno(1,2,3-cd)pyrene in terms of the number and locations of groundwater samples in the A level of the aquifer. However, indeno(1,2,3-cd)pyrene was not analyzed in the B or C levels of the aquifer during previous sampling. However, because of its low solubility, indeno(1,2,3-cd)pyrene is not expected to be found in the B or C levels of the aquifer. If indeno(1,2,3-cd)pyrene is detected above its screening level in data gap samples collected from the A level of the aquifer B and C level monitoring wells will be sampled to address this data gap.
- New Sources: There is one small area of indeno(1,2,3-cd)pyrene in groundwater at concentrations greater than its screening level in the 2-31 Area and this area is not associated with a specific RCRA unit. This new source data gap will be further investigated using groundwater samples obtained with direct-push probes. Monitoring wells and direct-push probes that will be sampled for indeno(1,2,3-cd)pyrene, and other SVOCs are summarized in Table 2-2.
- Groundwater to Surface Water Pathway: The isolated occurrence of a indeno(1,2,3-cd)pyrene concentration elevated above its screening level is at probe location DP-2803 in the center of the 2-31 Area. This location is not adjacent to the waterway, and it appears that currently there is not a completed pathway issue for indeno(1,2,3-cd)pyrene in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for indeno(1,2,3-cd)pyrene is 0.1 µg/L throughout most of the 2-31 Area. The calculated screening level for indeno(1,2,3-cd)pyrene is 0.00586 µg/L; however, the calculated screening level is not achievable by available analytical methods so the reporting limit has been set equal to the screening level of 0.1 µg/L. Therefore, a reporting limit data gap does not exist.

2.3.4 Volatile Organic Compounds

Analytical results for all site-wide volatile organic compound (VOC) COCs were screened to determine which site-wide constituents are also COCs for the 2-31 Area. The screening levels used for site-wide COCs are summarized in Table A-1. If a site-wide COC was detected in the 2-31 Area analytical data at concentrations greater than or equal to the respective screening level, the site-wide COC is considered a COC for the 2-31 Area. Resulting 2-31 Area-specific COCs are listed and summarized in Table 2-1. Isoconcentration maps and tables of maximum VOC concentrations in the 2-31 Area are presented in Attachment A.

Two VOCs are included on the 2-31 Area-specific COC list based on their occurrence greater than screening levels for the protection of surface water or air. The two VOCs that are COCs for the 2-31 Area are:

Trichloroethene Vinyl Chloride

The occurrence of these constituents in the 2-31 Area is evaluated for the surface water and air exposure pathways in the sections below. The direct contact pathway and the air pathway are both valid for VOCs but screening levels calculated for the direct contact pathway and the air pathway are consistently greater than those for surface water and therefore the data gap evaluation is based on the protection of surface water.

2.3.4.1 Trichloroethene

Trichloroethene (TCE) was analyzed in 103 2-31 Area groundwater samples and detected in 25 of those samples. All 25 of the detected values for TCE were greater than the surface water screening level of 0.302 µg/L. Eight of the detected TCE concentrations were greater than the air screening level of 62 µg/L.

The occurrence of TCE at concentrations greater than the surface water screening level in the A level of the aquifer is limited to two areas; in wells and probes downgradient of AOC 2-31.21 (TCE Degreaser) and SWMU 2-31.18 (Area B Acid Waste Hold Tank). A small area of elevated TCE concentrations occurs within the TCE plume originating at SWMU 2-31.18 and may be associated with a known approximate 100-gallon release of TCE at the surface. In the B level of the aquifer, TCE detected at concentrations greater than its screening level is limited to one area; in wells and probes downgradient of AOC 2-31.21 (TCE Degreaser). TCE was detected at only one location in the C level of the aquifer in the 2-31 Area; in the sample from probe GP-03101. This C level TCE detection is fully delineated by non-detects at four downgradient and one cross-gradient location. The greatest detected value of TCE in the 2-31 Area was 590 µg/L in the B level groundwater sample from GP-03101, downgradient of AOC 2-31.21 (TCE Degreaser).

RCRA units located in or near areas of TCE concentrations greater than its screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for the sampling locations where TCE was detected.

Data gaps for TCE are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the distribution of TCE in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent. This information will then be combined with historical data to develop inferences regarding whether the TCE distribution has reached steady state.
- Hot Spots: TCE detections in the 2-31 Area are associated with RCRA units or known releases and were well characterized during previous investigations; therefore, no hot spot data gaps are noted.

- New Sources: The known release of approximately 100 gallons of TCE is a potential source for TCE impacts to groundwater but is not directly associated with a RCRA unit resulting in a new source data gap for TCE. This area of groundwater impacts will be evaluated by direct-push probes, as noted in Figure 2-1 and Table 2-2.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway is likely complete for TCE in the A level of the aquifer in the 2-31 Area. The A level TCE plume extending from SWMU 2-31.18 (Area B Acid Waste Hold Tank) extends to wells and probes installed within 20 to 30 feet of the Duwamish Waterway (see TCE plume figure in Attachment A). The B and C level portions of this plume do not currently appear to reach the Duwamish Waterway based on existing data. Groundwater sampling, as discussed in Section 2.3.1, will provide data which will allow Boeing to evaluate if this pathway is completed. The TCE plume associated with AOC 2-31.21 (TCE Degreaser) does not currently have a completed pathway to the Duwamish Waterway.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for TCE in groundwater samples throughout much of the 2-31 Area is 1 µg/L. This reporting limit is greater than the TCE screening level of 0.302 µg/L. However, in most cases, the reporting limit is sufficiently close to the screening level to provide reasonable confidence that areas of TCE-impacted groundwater are adequately delineated. Sampling for TCE during the data gap investigation will yield additional data with a reporting limit of 0.2 µg/L to provide further confidence that TCE impacts to groundwater are adequately delineated for CMS purposes.

2.3.4.2 Vinyl Chloride

Vinyl chloride (VC) was analyzed in 103 2-31 Area groundwater samples and detected in 45 of those samples. There were 21 detections of VC at concentrations greater than the surface water screening level of 0.731 µg/L but none of the detected VC concentrations were greater than the air screening level of 371 µg/L.

The detected values for VC at concentrations greater than its surface water screening level are at the following locations within the A level 2-31 Area: AOC 2-31.21 (TCE Degreaser), SWMU 2-31.18 (Area B Acid Waste Hold Tank) and also at the location of the approximately 100-gallon TCE release, which is not a RCRA unit. The greatest concentration of VC in the 2-31 Area is 74 µg/L from the A level sample collected at probe location GP-03103 downgradient of AOC 2-31.21 (TCE Degreaser).

RCRA units located in or near areas of VC concentrations greater than its screening level in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for the sampling locations where VC was detected.

Data gaps for VC are identified using the criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the VC distribution in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent. This information will then be combined

with historical data to develop inferences regarding whether the VC distribution has reached steady state.

- Hot Spots: VC detections in the 2-31 Area are associated with RCRA units or known releases and were well characterized during previous investigations; therefore, no hot spot data gaps are noted.
- New Sources: The known release of approximately 100-gallons of TCE is a potential source for VC (a breakdown product of TCE) impacts to groundwater but this release is not associated with a RCRA unit resulting in a new source data gap for VC. This area of groundwater impacts will be evaluated by direct push probes as noted in Figure 2-1 and Table 2-2.
- Groundwater to Surface Water Pathway: The groundwater to surface water pathway is likely complete for VC in the A level of the aquifer in the 2-31 Area. The A level VC plume extending from the approximately 100-gallon TCE release extends to probes installed within 20 to 30 feet of the Duwamish Waterway (see VC plume figure in Attachment A). The B level portion of the VC plume currently does not appear to reach the waterway based on existing data. Groundwater sampling as discussed in Section 2.3.1 will provide data, which will allow Boeing to evaluate if this pathway is completed. The VC plume associated with AOC 2-31.21 (TCE Degreaser) does not currently have a completed pathway to the Duwamish Waterway.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for VC in groundwater samples throughout much of the 2-31 Area is 1 µg/L. This reporting limit is greater than the VC screening level of 0.731 µg/L. However, in most cases, the reporting limit is sufficiently close to the screening level to provide reasonable confidence that areas of VC-impacted groundwater are adequately delineated. Sampling for VC during the data gap investigation will yield additional data with a reporting limit of 0.2 µg/L to provide further confidence that VC impacts to groundwater are adequately delineated for CMS purposes.

2.3.5 Total Petroleum Hydrocarbons

Analytical results for all site-wide total petroleum hydrocarbon (TPH) COCs were screened to determine which site-wide constituents are also COCs for the 2-31 Area. The screening levels used for site-wide COCs are summarized in Table A-1. If a site-wide COC was detected in the 2-31 Area analytical data at concentrations greater than or equal to the respective screening level, the site-wide COC is considered a COC for the 2-31 Area. Resulting 2-31 Area area-specific COCs are listed and summarized in Table 2-1. Isoconcentration maps and tables of maximum VOC concentrations in the 2-31 Area are presented in Attachment A.

Three classes of TPHs are included on the 2-31 Area-specific COC list based on their occurrence greater than screening levels. The TPHs that are COCs for the 2-31 Area are diesel-range petroleum hydrocarbons (DRPH), motor oil-range petroleum hydrocarbons (ORPH), and TPH oil and grease.

2.3.5.1 Diesel-Range Petroleum Hydrocarbons

DRPH was analyzed in 20 2-31 Area groundwater samples and detected in four of those samples. Three of the four detected concentrations of diesel-range TPH were greater than the screening level of 500 µg/L.

DRPH was detected at concentrations greater than its screening level at two direct-push probe sampling points and one monitoring well adjacent to former USTs PL-12 and PL-13, which held petroleum hydrocarbons. This area is not associated with a RCRA unit but the former USTs are a known source of petroleum hydrocarbon releases.

Areas of high DRPH concentrations in groundwater are summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for the sampling locations where DRPH was detected.

Data gaps for DRPH are identified using the five criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the DRPH distribution in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at selected monitoring well and direct-push probe locations. This information will then be combined with historical data to develop inferences regarding whether the DRPH distribution has reached steady state.
- Hot Spots: RCRA units in the 2-31 Area have been adequately investigated for potential DRPH impacts in terms of the number and locations of groundwater samples in the A level of the aquifer. DRPH was not analyzed in samples from the B and C levels of the aquifer in the 2-31 Area. This does not necessarily indicate a data gap because DRPH is less dense than water and is expected to remain in the A level of the aquifer. For completeness, DRPH will be analyzed for in the B level sample from direct-push probe 2-31-DP-2, which is located in the area impacted by DRPH in groundwater.
- New Sources: The single area of DRPH concentrations greater than the groundwater screening level in the 2-31 Area is not associated with a RCRA unit; however, based on its proximity, the source of DRPH impacts are thought to be associated with former USTs PL-12 and PL-13.
- Groundwater to Surface Water Pathway: The isolated occurrences of DRPH at concentrations greater than its screening level are at USTs PL-12 and PL-13 near the center of the 2-31 Area. This location is not adjacent to the waterway, and it appears that currently there is not a completed pathway issue for DRPH in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for DRPH throughout the 2-31 Area is 250 µg/L, which is less than the screening level of 500 µg/L, indicating that there is not a reporting limit data gap.

2.3.5.2 Motor Oil-Range Petroleum Hydrocarbons

ORPH was analyzed in 19 2-31 Area groundwater samples and detected in one of those samples. The single detection of ORPH was at probe DP-2802 with a J-qualified concentration of 590 µg/L, which is greater than its screening level of 500 µg/L.

ORPH was detected above its screening level at one direct-push probe sampling point adjacent to former USTs PL-12 and PL-13, which held petroleum hydrocarbons. This area is not associated with a RCRA unit but the former USTs are a known source of petroleum hydrocarbon releases.

The area containing the high ORPH concentration in groundwater is summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for the sampling location where ORPH was detected.

Data gaps for ORPH are identified using the five criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the ORPH distribution in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at selected monitoring well and direct-push probe locations. This information will then be combined with historical data to develop inferences regarding whether the ORPH distribution has reached steady state.
- Hot Spots: RCRA units in the 2-31 Area have been adequately investigated for potential ORPH impacts in terms of the number and locations of groundwater samples in the A level of the aquifer. ORPH was not analyzed in samples from the B and C levels of the aquifer in the 2-31 Area. This does not necessarily indicate a data gap because ORPH is less dense than water and is expected to remain in the A level of the aquifer. For completeness, ORPH will be analyzed for in the B level sample from direct-push probe 2-31-DP-2, which is located in the area impacted by ORPH in groundwater.
- New Sources: The single ORPH concentration greater than the groundwater screening level in the 2-31 Area is not associated with a RCRA unit; however, based on its proximity, the source of ORPH impacts are thought to be associated with former USTs PL-12 and PL-13.
- Groundwater to Surface Water Pathway: The isolated occurrence of ORPH at a concentration greater than its screening level is at USTs PL-12 and PL-13 near the center of the 2-31 Area. This location is not adjacent to the waterway and it appears that currently there is not a completed pathway issue for ORPH in the 2-31 Area.
- Exceedance of Screening Levels by Analytical Reporting Limits: The reporting limit for ORPH throughout the 2-31 Area is 500 µg/L, which is equal to the screening level of 500 µg/L, indicating that there is not a reporting limit data gap.

2.3.5.3 TPH – Oil and Grease

Oil and grease range TPH was analyzed in four 2-31 Area groundwater samples and detected in all four of those samples. All four detections of oil and grease range TPH exceeded the screening level of 500 µg/L.

Sample locations where oil and grease range TPH was detected at concentrations greater than its screening level are located the in four monitoring wells, PL2-503A through PL2-506A, adjacent to former USTs PL-12 and PL-13, which held petroleum hydrocarbons. This area is not associated with a RCRA unit but the former USTs are a known source or petroleum hydrocarbon releases.

The area containing the oil and grease range TPH at concentrations greater than its screening level in groundwater is summarized in Table 2-3. Refer to the isoconcentration maps in Attachment A for the sampling location where oil and grease range TPH was detected.

Data gaps for oil and grease range TPH are identified using the five criteria from Section 2.1 and are summarized below.

- Current Data: The existing data are insufficient to give a current view of the oil and grease range TPH distribution in groundwater; therefore, the sampling event discussed in Section 2.3.1 will include this COC as a constituent at selected monitoring well and direct-push probe locations. This information will then be combined with historical data to develop inferences regarding whether the oil and grease range TPH distribution has reached steady state.
- Hot Spots: RCRA units in the 2-31 Area have not been adequately investigated for potential oil and grease range TPH impacts in terms of the number and locations of groundwater samples. In addition, oil and grease range TPH was not analyzed in samples from the B and C levels of the aquifer in the 2-31 Area. This does not necessarily indicate a data gap because oil and grease range TPH is less dense than water and is expected to remain in the A level of the aquifer. Oil and grease range TPH is no longer a separate analytical method. For completeness, oil and grease range TPH will be analyzed for as part of the DRPH and ORPH analyses in the B level sample from direct-push probe 2-31-DP-2. This probe is located in the oil and grease range TPH detections as indicated in Figure 2-1.
- New Sources: Oil and grease range TPH was only analyzed for at four locations in the 2-31 Area. The four oil and grease range TPH concentrations greater than the groundwater screening level in the 2-31 Area are not associated with a RCRA unit; however, based on their proximity, the source of oil and grease range TPH impacts are thought to be associated with former USTs PL-12 and PL-13. Oil and grease range TPH will be reported as part of the DRPH and ORPH results in the 2-31 Area data gap investigation to provide additional and current oil and grease range TPH data for the area.
- Groundwater to Surface Water Pathway: The isolated occurrence of oil and grease range TPH at concentrations greater than its screening level is at USTs PL-12 and PL-13 in the center of the 2-31 Area. This location is not adjacent to the waterway,

and it appears that currently there is not a completed pathway issue for oil and grease range TPH in the 2-31 Area.

- Exceedance of Screening Levels by Analytical Reporting Limits: Oil and grease range TPH was detected at all four of the sampling locations in which this constituent was analyzed. There are no non-detected results at reporting limits greater than the screening level of 500 μg/L. Therefore, there is not a reporting limit data gap for oil and grease range TPH.

2.3.6 Summary of Investigation Scope for Groundwater Data Gaps

The groundwater data gap investigation of the 2-31 Area will be performed to fill data gaps identified above. The three main work elements associated with the 2-31 Area data gap investigation are summarized on the following page.

Element	Scope	Rationale
1	Installation of two groundwater monitoring wells, PL2-507B and PL2-507C, in the north corner of the 2-31 Area. The two new wells will be installed near existing well PL2-507A to complete a well cluster capable of monitoring groundwater in all three levels of the aquifer.	The PL2-507 well cluster will provide a monitoring location for A, B, and C level groundwater entering the site. A corresponding downgradient cluster well location will be proposed in the 2-10 Area to evaluate groundwater leaving the area.
2	Installation of 50 direct-push probes downgradient of groundwater impacts at noted in existing analytical data as well as downgradient of COCs detected in vadose zone soils.	Groundwater, particularly in the area south of AOC 2-31.21, is impacted by VOCs and requires sampling locations in addition to existing monitoring wells to adequately delineate impacted areas. In addition, probes are needed near TPH impacts at USTs PL-12 and PL-13 and at the cyanide plume noted in the north corner of the 2-31 Area. Sampling at probe 2-31-DP-39 will be extended to the B and C levels of the aquifer to evaluate historical VOC detections at depth.
3	Groundwater sampling for VOCs and metals at all existing monitoring wells as well as at 50 new direct-push probe locations.	A current groundwater sampling event will clarify many questions discussed above regarding the distribution of groundwater plumes.
4	Focused sampling at selected monitoring wells and direct-push probe locations in the 2-31 Area for TPH, SVOCs, cyanide, and redox parameters.	Current groundwater sampling data around historical isolated groundwater concentrations above screening levels will clarify whether the groundwater impacts are still present and help delineate the current extent of their impacts. Data from this task will also be used to confirm fate and transport modeling results for selected metals, cyanide, SVOCs, and PCBs. Data from this task may also be used to develop fate and transport modeling for TPHs for CMS remedy evaluation, if it is needed. Redox parameters will be used provide geochemical data for evaluating redox conditions in the aquifer.

A summary table showing the wells and probes to be sampled, constituent groups analyzed, and which general data gaps will be filled by the sampling is presented in Table 2-2. The rationale for the analytical suite to be sampled at each of the wells and probes is provided in the right hand column of the table.

2.4 SOIL DATA GAPS

Data gaps associated with the geology and the nature and extent of chemical constituents in 2-31 Area soils are presented in this section. In Section 2.4 and its subsections the term COC(s) will refer to soil COC(s) unless otherwise specifically stated.

Analytical results for all site-wide COCs were screened to identify COCs for the 2-31 Area. The screening levels for site-wide COCs are summarized in Table B-1. If a site-wide COC was detected in the 2-31 Area analytical data at concentrations greater than or equal to its respective screening level, the site-wide COC is considered a COC for the 2-31 Area. 2-31 Area-specific soil COCs are listed and summarized in Tables 2-1 and B-2. Table 2-1 lists the 2-31 Area COCs and exposure pathway-specific screening levels. Table B-2 lists the 2-31 Area soil COCs and identifies the number of exceedances for each exposure pathway.

Soil concentration maps for selected COCs are presented in Attachment B. The maps present the data for three intervals (0 to 1 foot bgs, greater than 1 foot to 6 feet bgs, and greater than 6 feet to 12 feet bgs) within the “vadose zone” soil column from 0 to 12 feet bgs. Data tables summarizing all COC concentrations (including duplicate sample analysis results) in the 2-31 Area are also provided in Attachment B. Table 2-4 provides a list of the COCs associated with specific RCRA units. Soil COC groups in the 2-31 Area are discussed by constituent in the Sections 2.4.1 through 2.4.4.

2.4.1 Inorganics

Analytical results for all site-wide metal COCs and cyanide were screened to determine which are COCs for the 2-31 Area. Chemical analysis was conducted for one or more inorganic constituents on 57 soil samples collected in the 2-31 Area from 12 feet bgs or less. Metals analysis comprised 23 constituents; screening levels have been established for 18 of these. The risk-based soil screening levels protective of surface water for five metals (arsenic, copper, manganese, mercury, and nickel) were below the Puget Sound Basin natural background concentration calculated by Ecology (1994), and were therefore set at the background concentrations for data gap evaluation purposes (with acknowledgment that they exceed the risk-based screening levels). Chemical analysis for cyanide was also conducted on 22 soil samples collected in the 2-31 Area. The following nine inorganic compounds comprise the 2-31 Area-specific soil COC list:

Arsenic	Cadmium	Copper
Mercury	Nickel	Silver
Zinc	Cyanide	

The presence of these inorganic compounds in the 2-31 Area is evaluated with respect to the surface water and direct contact exposure pathways in the Sections 2.4.1.1 through 2.4.2.8. In

addition, arsenic, cadmium, and mercury are evaluated with respect to the air pathway. Data gaps are identified using the Source Control, Complete Pathway, and Exceedance of Screening Levels by Analytical Reporting Limits criteria presented in Section 2.1. Soil will be analyzed for metals in all samples collected and submitted to the analytical laboratory for the 2-31 Area data gap investigation. Cyanide will be analyzed in samples from selected locations. Otherwise, all soil and groundwater locations, in addition, to those associated with data gaps in the Sections 2.4.1.1 through 2.4.2.8, will be sampled for metals as part of the work plan.

The exposure pathway for air is not evaluated for most metals or for cyanide because metals (except for arsenic, cadmium, mercury, and hexavalent chromium) and cyanide are not volatile. Development of the indoor air pathway screening level for mercury was completed for each Plant 2 sub-area using the advanced Johnson & Ettinger Model. Both commercial (office) building and industrial (larger) building parameters were input to the model; however, as a conservative measure, screening levels were developed using model results based on office building parameters. Results for both office building and (for comparison purposes) industrial building parameters for constituent concentrations in soil at 20 centimeters (cm) and 150 cm bgs are presented in the Uplands CMS Volume II: Attachment C, Johnson and Ettinger Site-specific Data and Model Report (Floyd|Snider, 2006). The mercury screening level for the data gaps evaluation is based on the results for mercury concentrations in soil at the 20 cm depth using office building parameters.

Arsenic and cadmium are the only 2-31 Area inorganic COCs for which there are screening levels for the fugitive dust inhalation exposure pathway; these metals are evaluated accordingly. There were no exceedances of air screening levels by inorganic constituents within the 2-31 Area. The direct contact pathway is valid for metals, but for all inorganic COCs the direct contact pathway screening levels are higher than the maximum concentration detected. Therefore, in the foregoing discussion of inorganic COCs, the term “screening level” will refer to the soil screening level protective of surface water, unless otherwise noted.

2.4.1.1 Arsenic

Arsenic was analyzed in 55 2-31 Area soil samples and detected in 35 of those samples. Nine of the 35 detected concentrations exceeded the screening level (7.3 mg/kg), which is based on the Puget Sound Basin natural background concentration calculated by Ecology (1994). Concentrations detected above the screening level ranged from 8 to 12 mg/kg. The maximum concentration of arsenic within the 2-31 Area (12 mg/kg) was detected in two samples from different locations; one sample was collected from DMSB-02 at 7 feet bgs and the second was collected from NS-02-31 at 0.5 feet bgs. None of the detected concentrations exceeded the direct contact exposure pathway screening level (33.3 mg/kg) or the air pathway screening level (32,200 mg/kg) for inhalation (fugitive dust). The air pathway is not considered a viable exposure pathway for arsenic with respect to indoor air.

SWMU 2-31.18 Area B Acid Waste Hold Tank: Arsenic was detected above the screening level in four samples from between 0.5 and 3 feet bgs at four locations (NS-01-31, NS-02-31, NS-03-31, and W1-NS-01) near SWMU 2-31.18 Area B Acid Waste Hold Tank. Arsenic was either not detected or detected below the screening level in 19 samples from 0.5 to 12 feet bgs at 10 surrounding locations. The extent of arsenic in soil has been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. Arsenic has not been detected

above the groundwater screening level in this area. However, groundwater near this RCRA Unit will be sampled and analyzed for metals (including arsenic).

West Side of Building 2-25: Arsenic was detected above the screening level in a single sample with a concentration of 12 mg/kg collected from 7 feet bgs at DMSB-02, on the west side of the Building 2-25. The extent of arsenic in soil has not been adequately delineated for CMS purposes near this location based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including arsenic) to delineate the vertical and horizontal extent of arsenic. Arsenic has not been detected above the groundwater screening level in this area. Groundwater in this area will be analyzed for metals (including arsenic) and the data will be evaluated to determine whether arsenic has impacted groundwater.

Southeast Side of Building 2-22: Arsenic was detected above the screening level in two samples from 2.5 and 7 feet bgs at DMSB-01 on the southeast side of the Building 2-22, east of UST PL-35. The extent of arsenic in soil has not been adequately delineated for CMS purposes near this location based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including arsenic) to delineate the vertical and horizontal extent of arsenic. The analytical groundwater data indicate that arsenic exceeds the groundwater background concentration northwest of this area. Groundwater in this area will be analyzed for metals (including arsenic) and the data will be evaluated to determine if arsenic has impacted groundwater.

North Side of Building 2-22: Arsenic was detected at 11 mg/kg and 8 mg/kg in two samples from a single location (DMSB-03) on the north side of Building 2-22, at 2 feet bgs and 11 feet bgs, respectively. The extent of arsenic in soil has not been adequately delineated for CMS purposes near this location based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including arsenic) to delineate the vertical and horizontal extent of arsenic. The analytical groundwater data indicate that arsenic exceeds the groundwater background concentration to the east of this area. Groundwater in this area will be analyzed for metals (including arsenic) and the data will be evaluated to determine if arsenic has impacted groundwater.

Soil and groundwater data for arsenic were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of arsenic in 2-31 Area RCRA units have been adequately characterized for CMS purposes.
    - **New Sources:** Arsenic detected above the soil screening level west of Building 2-25, southeast of Building 2-22, and north of Building 2-22 have the potential to impact groundwater.

      Lateral and vertical delineation of arsenic is incomplete on the west side of Building 2-25. Arsenic will be analyzed in soil samples from three direct-push locations to the north, southeast, and southwest of DMSB-02.

Lateral and vertical delineation of arsenic is incomplete southeast of Building 2-22. Arsenic will be analyzed in soil samples from three direct-push locations to the north, east, and southwest of DMSB-01.

Lateral and vertical delineation of arsenic is incomplete on the north side of Building 2-22. Arsenic will be analyzed in soil samples from three direct-push locations to the north, southeast, and southwest of DMSB-03.

- **Completed Pathways:**
  - **Direct Contact:** Arsenic was not detected above the direct contact pathway screening level (33.3 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway screening level for arsenic is based on inhalation of fugitive dust. Arsenic was not detected above the air pathway screening level (32,200 mg/kg) in 2-31 Area soil.
  - **Soil to Groundwater Pathway:** The data indicate that arsenic is present in soil near SWMU 2-31.18, to the west of the Building 2-25, to the southeast of the Building 2-22, and to the north of the Building 2-22 at concentrations that could impact groundwater. Metals, including arsenic, will be analyzed in soil and groundwater samples from direct push locations around SWMU 2-31.18, adjacent to the Building 2-25, and southeast and north of the Building 2-22. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of arsenic in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Reporting limits for all non-detect arsenic results are below applicable screening levels.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for arsenic as follows:

Soil sampling and analysis will be conducted at the following locations:

West of Building 2-25

- 2-31-DP-21
- 2-31-DP-22
- 2-31-DP-23

Southeast Side of Building 2-22/East of UST PL-35

- 2-31-DP-18
- 2-31-DP-19
- 2-31-DP-20

North Side of Building 2-22

- PL2-507B
- PL2-507C
- 2-31-DP-16
- 2-31-DP-17

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-34 through 2-31-DP-41

West of Building 2-25

- 2-31-DP-21
- 2-31-DP-22
- 2-31-DP-23

Southeast Side of Building 2-22

- 2-31-DP-18
- 2-31-DP-19
- 2-31-DP-20

North Side of Building 2-22

- PL2-507A
- 2-31-DP-16
- 2-31-DP-17

Laboratory analyses are presented in Table 2-2, and sample locations are presented on Figure 2-1.

2.4.1.2 Cadmium

Cadmium was analyzed in 55 2-31 Area soil samples and detected in 21 of those samples. Thirteen of the 21 detected concentrations exceeded the soil screening level protective of surface water (1.21 mg/kg). Concentrations detected above the screening level ranged from 1.3 to 83.3 mg/kg. None of the detected concentrations exceeded the direct contact exposure pathway screening level (667 mg/kg) or the air pathway screening level (77,000 mg/kg) for inhalation (fugitive dust).

SWMU 2-31.18 Area B Acid Waste Hold Tank: Cadmium was detected above the 1.21 mg/kg screening level in 12 samples from between 0.5 and 10 feet bgs at 11 locations near SWMU 2-31.18 Area B Acid Waste Hold Tank. The extent of cadmium in soil has not been adequately delineated in this area for CMS purposes based on the criteria in Section 2.1. Soil in

this area will be analyzed for metals (including cadmium) to delineate the vertical and horizontal extent of cadmium. Cadmium has not been detected in groundwater in the 2-31 Area. However, groundwater samples from this area will be analyzed for metals (including cadmium) and the data will be evaluated to determine if cadmium has impacted groundwater.

UST PL-57: Cadmium was detected (3 mg/kg) above the screening level in a single sample from 0.5 feet bgs at NS-07-31, on the west side of the south end of the Building 2-31 near UST PL-57. The extent of cadmium in soil has not been adequately delineated in the vicinity of this sample location for CMS purposes based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including cadmium) to delineate the vertical and horizontal extent of cadmium. Cadmium has not been detected in groundwater in the 2-31 Area. However, groundwater in this area will be analyzed for metals (including cadmium) and the data will be evaluated to determine if cadmium has impacted groundwater.

Soil and groundwater data for cadmium were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of cadmium in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

    Lateral and vertical delineation of cadmium is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank. Cadmium will be analyzed in soil samples from eight direct-push locations around SMWU 2-31.18.
  - **New Sources:** Cadmium detected above the soil screening on the west side of the south end of the Building 2-31 has the potential to impact groundwater.

    Lateral and vertical delineation of arsenic is incomplete on the west side of the south end of the Building 2-31, adjacent to UST PL-57. Cadmium will be analyzed in soil samples from three direct-push locations to the south, east, and west of NS-07-31.
- **Completed Pathways:**
  - **Direct Contact:** Cadmium was not detected above the direct contact pathway screening level (667 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway screening level for cadmium is based on inhalation of fugitive dust. Cadmium was not detected above the air pathway screening level (77,000 mg/kg) in 2-31 Area soil.
  - **Soil to Groundwater Pathway:** The data indicate that cadmium is present in soil near SWMU 2-31.18 and near UST PL-57 at concentrations that could impact groundwater. Metals, including cadmium, will be analyzed in soil and groundwater samples from direct push locations around SWMU 2-31.18 and UST PL-57. The data will be used to determine if the pathway is currently

complete, and if groundwater has been impacted by elevated concentrations of cadmium in the soil.

- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Reporting limits for all non-detect cadmium results are below applicable screening levels.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for cadmium as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-34 through 2-31-DP-39

West Side, South End of Building 2-31/UST PL-57

- 2-31-DP-40
- 2-31-DP-41
- 2-31-DP-42

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-34 through 2-31-DP-39

West Side, South End of Building 2-31/UST PL-57

- 2-31-DP-40
- 2-31-DP-41
- 2-31-DP-42

Laboratory analyses are presented in Table 2-2, and sample locations are presented on Figure 2-1.

2.4.1.3 Copper

Copper was analyzed in 48 2-31 Area soil samples and detected in all 48 samples. Five of the 48 detected concentrations exceeded the screening level (36.4 mg/kg), which is based on the Puget Sound Basin natural background concentration calculated by Ecology (1994). Concentrations detected above the screening level ranged from 40.1 mg/kg to 428 mg/kg.

The maximum concentration of copper within the 2-31 Area (428 mg/kg) was detected in a sample collected from NS-03-31 at 0.5 feet bgs in the southern portion of SWMU 2-31.18 Area B Acid Waste Hold Tank. The maximum detected concentration is below the direct contact

pathway screening level for copper (49,300 mg/kg). The air pathway is not considered a viable exposure pathway for copper.

SWMU 2-31.18 Area B Acid Waste Hold Tank: Copper was detected above the screening level in four samples from 0.5 to 10.5 feet bgs at four locations (NS-02-31, NS-03-31, NS-10-31, and DP-3103) near SWMU 2-31.18. Copper was not detected or detected below the screening level in 16 samples from 0.5 to 12 feet at 12 surrounding locations. The extent of copper in soil has been adequately delineated in this area for CMS purposes, except to the east of NS-02-31 and NS-10-31 and west of NS-02-31. Soil in this area will be analyzed for metals (including copper) to delineate the vertical and horizontal extent of copper. The analytical groundwater data indicate that copper concentrations in this area exceed the background level. Groundwater in this area will be analyzed for metals (including copper) and the data will be evaluated to determine if copper has impacted groundwater.

Western Portion of Building 2-31: Copper was detected at 43.4 mg/kg in a sample from 11 feet bgs at SB-03115, near SWMU 2-31.22 Brush Plating Area. The extent of copper in soil has not been adequately delineated for CMS purposes to the southeast and southwest of SB-03115. Soil in this area will be analyzed for metals (including copper) to delineate the vertical and horizontal extent of copper. The analytical groundwater data indicate that copper exceeds the groundwater background concentration in this area. Groundwater in this area will be analyzed for metals (including copper), and the data will be evaluated to determine if copper has impacted groundwater.

Soil and groundwater data for copper were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of copper in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

      Lateral and vertical delineation of copper is incomplete west and east of SMWU 2-31.18 Area B Acid Waste Hold Tank. Copper will be analyzed in soil samples from three direct-push location east of SMWU 2-31.18 area.

      Lateral and vertical delineation of copper is incomplete south of SMWU 2-31.22 Brush Plating Area. Copper will be analyzed in soil samples from two direct-push locations to the southeast and southwest of SB-03115.
    - **New Sources:** All concentrations of copper detected above soil screening levels are from within or immediately adjacent to RCRA units. Therefore, there are no new source data gaps for copper in the 2-31 Area.
- **Completed Pathways:**
    - **Direct Contact:** Copper was not detected above the direct contact pathway screening level (49,300 mg/kg) in 2-31 Area soil.

- **Air Pathway:** The air pathway is not considered a viable exposure pathway for copper.
- **Soil to Groundwater Pathway:** The data indicate that copper is present in soil near SWMU 2-31.18 and in the western portion of the Building 2-31 near SWMU 2-31.22 at concentrations that could impact groundwater. Metals, including copper, will be analyzed in soil and groundwater samples from direct push locations around SWMU 2-31.18 and SWMU 2-31.22. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of copper in the soil.

- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Copper was detected in all 2-31 Area soil samples; therefore, there were no exceedances of screening levels by analytical reporting limits.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for copper as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-34 through 2-31-DP-41

Western Portion of Building 2-31/SWMU 2-31.22

- 2-31-DP-27
- 2-31-DP-48

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502 A
- 2-31-DP-34 through 2-31-DP-41

Western Portion of Building 2-31/SWMU 2-31.22

- 2-31-DP-25
- 2-31-DP-27
- 2-31-DP-48

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.1.4 Mercury

Mercury was analyzed in 46 2-31 Area soil samples and detected in six of those samples. Five of the six detected concentrations exceeded the screening level (0.07 mg/kg), which is based on

the Puget Sound Basin natural background concentration calculated by Ecology (1994). Concentrations above the screening level ranged from 0.1 mg/kg to 0.17 mg/kg. The maximum concentration of mercury within the 2-31 Area (0.17 mg/kg) was detected in two samples from the same location (SB-03112); one sample was collected from 6 feet bgs and the second was collected from 8 feet bgs. The maximum concentration of mercury detected in the 2-31 Area did not exceed the direct contact exposure pathway screening level (41.9 mg/kg) or area-specific air pathway screening level (2.57 mg/kg).

SWMU 2-31.18 Area B Acid Waste Hold Tank: Mercury was detected above the 0.07 mg/kg screening level at 0.17 mg/kg in two samples from 6 and 8 feet bgs at SB-03112 near SWMU 2-31.18 Area B Acid Waste Hold Tank. Mercury was not detected or detected below the screening level in nine samples from 1.5 to 12 feet bgs at five locations to the north, east, and southeast of SB-03112. The extent of mercury in soil has not been adequately delineated for CMS purposes to the west and southwest of SB-03112. Soil in this area will be analyzed for metals (including mercury) to delineate the vertical and horizontal extent of mercury. Mercury has not been detected above the groundwater screening level in this area. However, groundwater in this area will be analyzed for metals (including mercury), and the data will be evaluated to determine whether mercury has impacted groundwater.

West Side of Building 2-31/AST APL-042: Mercury was detected at 0.1 mg/kg in a single sample from 7.5 feet bgs at SB-03116 on the west side of Building 2-31, at AST APL-042. Mercury was not detected in a sample from 8.5 feet bgs at DP-3104, to the immediate southwest of SB-03116. The extent of mercury in soil has not been adequately delineated to the northeast, northwest, and southeast of SB-03116 based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including mercury) to delineate the vertical and horizontal extent of mercury. Mercury has not been detected above the groundwater screening level in this area. Groundwater in this area will be analyzed for metals (including mercury), and the data will be evaluated to determine whether mercury has impacted groundwater.

East Side of Building 2-31/SWMU 2-31.22 and SWMU 2-31.23: Mercury was detected above the screening level at concentrations of 0.15 mg/kg in a sample from DP-3105, to the southeast of SWMU 2-31.22, and at 0.14 mg/kg in a sample from DP-3106, to the east of SWMU 2-31.23. Both samples were collected from 10 feet bgs. The extent of mercury in soil has not been adequately delineated for CMS purposes to the north, west, east, and southeast of this area based on the criteria in Section 2.1. Soil in this area will be analyzed for metals (including mercury) to delineate the vertical and horizontal extent of mercury. The analytical data indicate that mercury is present in groundwater in this area at concentrations above the screening level. Groundwater in this area will be analyzed for metals (including mercury), and the data will be evaluated to determine whether mercury has impacted groundwater.

Soil and groundwater data for mercury were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of mercury in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

    Lateral and vertical delineation of mercury is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank. Mercury will be analyzed in soil samples from two direct-push locations to the west and southwest of SB-03112.

    Lateral and vertical delineation of mercury is incomplete near SWMU 2-31.22 Brush Plating Area and SWMU 2-31.23 Ammonium Persulfate Tank. Mercury will be analyzed in soil samples from four direct-push locations to the north, west, east, and southeast of this area.
  - **New Sources:** Mercury detected above the soil screening near AST APL-042 has the potential to impact groundwater.

    Lateral and vertical delineation of mercury is incomplete near AST APL-042. Mercury will be analyzed in soil samples from three direct-push locations to the northeast, northwest, and southeast SB-03116.
- **Completed Pathways:**
  - **Direct Contact:** Mercury was not detected above the direct contact pathway screening level (41.9 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway screening level for mercury is based on indoor air. Mercury has not been detected above the area-specific J&E air pathway screening level of 2.57 mg/kg.
  - **Soil to Groundwater Pathway:** The data indicate that mercury is present in soil near SWMU 2-31.18, on the west side of the 2-31 Building, and on the east of the Building 2-31 at concentrations that could impact groundwater. Metals, including mercury, will be analyzed in soil and groundwater samples from direct push locations around SWMU 2-31.18 and on the west and east sides of the Building 2-31. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of mercury in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Reporting limits for all non-detect mercury results are below applicable screening levels.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for mercury as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-37
- 2-31-DP-39

West Side of Building 2-31/AST APL-042

- 2-31-DP-03
- 2-31-DP-28
- 2-31-DP-29
- 2-31-DP-49

East Side of Building 2-31/SWMU 2-31.22 and SWMU 2-31.23

- 2-31-DP-24 through 2-31-DP-27 and
- 2-31-DP-48

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-37
- 2-31-DP-39

West Side of Building 2-31/AST APL-042

- PL2-509A
- 2-31-DP-03
- 2-31-DP-28
- 2-31-DP-29
- 2-31-DP-49

East Side of Building 2-31/SWMU 2-31.22 and SWMU 2-31.23

- 2-31-DP-24 through 2-31-DP-27 and
- 2-31-DP-48

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.1.5 Nickel

Nickel was analyzed in 48 2-31 Area soil samples and detected in all of them. Three of the 48 detected concentrations exceeded the soil screening level (47.8 mg/kg), which is based on the Puget Sound Basin natural background concentration calculated by Ecology (1994). Concentrations above the screening level ranged from 130 mg/kg to 373 mg/kg. The maximum

concentration of nickel in the 2-31 Area soil (373 mg/kg) was detected in a sample collected from NS-02-31 at 0.5 ft bgs at SWMU 2-31.18 Area B Acid Waste Hold Tank. This concentration does not exceed the direct contact exposure pathway screening level for nickel (26,700 mg/kg). The air pathway is not considered a viable exposure pathway for nickel.

SWMU 2-31.18 Area B Acid Waste Hold Tank: Nickel was detected above the screening level in three samples collected from 0.5 feet bgs at three locations (NS-01-31, NS-02-31, NS-03-31) near SWMU 2-31.18 Area B Acid Waste Hold Tank. However, nickel was detected below the screening level in 21 samples from 0.5 to 12 feet bgs at 12 surrounding locations. The extent of nickel in soil has been adequately delineated for CMS purposes in this area, except to the west and east of NS-01-31, NS-02-31, and NS-03-31. Soil in this area will be analyzed for metals (including nickel) to delineate the vertical and horizontal extent of nickel. Nickel has not been detected above the groundwater screening level in this area. Groundwater in this area will be analyzed for metals (including nickel) and the data will be evaluated to determine if nickel has impacted groundwater.

Soil and groundwater data for nickel were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of nickel in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

    Delineation of nickel is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank to the west and east of NS-10-31. Nickel will be analyzed in soil samples from two direct-push locations in this area.
  - **New Sources:** All concentrations of nickel detected above soil screening levels are from within or immediately adjacent to RCRA units. Therefore, there are no new source data gaps for nickel in the 2-31 Area.
- **Completed Pathways:**
  - **Direct Contact:** Nickel was not detected above the direct contact pathway screening level (26,700 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for nickel.
  - **Soil to Groundwater Pathway:** The data indicate that nickel is present in soil in the SWMU 2-31.18 area at concentrations in shallow soils 0 to 1 foot bgs above the soil to groundwater pathway screening level. Nickel was not detected at concentrations exceeding the screening level below 1 foot bgs. However metals, including nickel, will be analyzed in soil and groundwater samples from direct push locations around SWMU 2-31.18. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of nickel in the soil.

Exceedances of Screening Levels by Analytical Reporting Limits:

- Nickel was detected in all 2-31 Area soil samples; therefore, there were no exceedances of screening levels by analytical reporting limits.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for nickel as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-34 through 2-31-DP-41

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-34 through 2-31-DP-41

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.1.6 Silver

Silver was analyzed in 46 2-31 Area soil samples and detected in four of those samples. All four detected concentrations exceeded the soil screening level protective of surface water (0.32 mg/kg). Ecology (1994) did not present a background concentration for silver. Silver concentrations above the soil screening level ranged from 0.6 mg/kg to 0.9 mg/kg. The maximum concentration of silver detected in 2-31 Area soil (0.9 mg/kg) was detected in a sample collected from DP-3101 at 10.5 feet bgs at SWMU 2-31.18 Area B Acid Waste Hold Tank. This concentration does not exceed the direct contact exposure pathway screening level for silver (6,670 mg/kg). The air pathway is not considered a viable exposure pathway for silver.

SWMU 2-31.18 Area B Acid Waste Hold Tank: Silver was detected above the screening level in two samples from 5.5 and 10.5 feet bgs at two locations, DP-3103 and DP-3101, near SWMU 2-31.18 Area B Acid Waste Hold Tank. Concentrations in these samples were 0.7 and 0.9 mg/kg, respectively. Silver was not detected in a sample collected from 10.5 feet at DP-3103. Silver was analyzed and not detected in 12 samples from 1.5 to 12 feet bgs at five surrounding locations. In addition, several of the non-detect samples, the RL slightly exceeded the screening level. Therefore, the extent of silver in soil has not been adequately delineated in this area for CMS purposes. Soil in this area will be analyzed for metals (including silver) to delineate the vertical and horizontal extent of silver. Silver has not been detected in groundwater in this area. Groundwater in this area will be analyzed for metals (including silver) and the data will be evaluated to determine if silver has impacted groundwater.

East Side of Building 2-31/SWMU 2-31.22: Silver was detected at 0.6 mg/kg in a sample from 5.7 feet bgs at DP-3105 on the east side of Building 2-31, southeast of SWMU 2-31.22 Brush Plating Area. Silver was not detected in a deeper sample (10 feet bgs) from this location. In addition, silver was analyzed and not detected in five samples from 5 to 11 feet bgs at two locations (DP-3106 and SB-03115) to the northwest and southwest of DP-3105. The extent of silver in soil has adequately delineated for CMS purposes in this area, except laterally to the north and east of DP-3105. Soil in this area will be analyzed for metals (including silver) to delineate the vertical and horizontal extent of silver. Silver has not been detected in groundwater in this area. Groundwater in this area will be analyzed for metals (including silver), and the data will be evaluated to determine whether silver has impacted groundwater.

Northeast Corner of Building 2-31: Silver was detected at 0.8 mg/kg in a sample from 4.4 feet bgs at SW-04, in the northeast corner of Building 2-31. Silver was analyzed and not detected in a sample from 10 feet bgs at this location. The lateral extent of silver in soil has not been adequately delineated for CMS purposes near this location. SW-04 was positioned at the far end of a hallway leading to a central portion of the 2-31 Building that is a fully functioning professional office area with numerous employees and associated equipment. Soil is presently protected from infiltrating precipitation and subsequent transport by the overlying building. Therefore, since the silver detected at SW-04 only exceeded the soil to groundwater pathway groundwater will be analyzed for metals (including silver) at three downgradient sample locations to evaluate the pathway and determine whether silver has impacted groundwater. If present conditions change and the building is demolished delineation of soil impacts will be required and can be better conducted.

Soil and groundwater data for silver were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of silver in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

      Lateral and vertical delineation of silver is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank. Silver will be analyzed in soil samples from four direct-push locations to the north, east, southwest, and west of the SWMU 2-31.18 area.

      Additional lateral delineation of silver is required on the east side of Building 2-31, southeast of SWMU 2-31.22 Brush Plating Area. Silver will be analyzed in soil samples from two direct-push locations to the northeast and southeast of DP-3105.

    - **New Sources:** Silver detected above the soil screening level in the northeast corner of Building 2-31 has the potential to impact groundwater.

Lateral delineation of silver is incomplete on the northeast side of Building 2-31. Silver will be analyzed in groundwater at a distance downgradient to the southwest and west of SW-04 from three direct-push locations soil will also be collected from these locations.

- **Completed Pathways:**
  - **Direct Contact:** Silver was not detected above the direct contact pathway screening level (6,670 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for silver.
  - **Soil to Groundwater Pathway:** The data indicate that silver is present in soil in the SWMU 2-31.18 area, on the east side of Building 2-31 at the SWMU 2-31.22 area, and in the northeast corner of Building 2-31 at concentrations that could impact groundwater. Metals, including silver, will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of silver in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - The RLs for silver were slightly above the soil screening level protective of surface water for 15 soil samples from throughout the 2-31 Area, specifically near SWMU 2-31.18, the west side of Building 2-31, near SWMU 2-31.22 and SWMU 2-31.23, and in and north of Building 2-22. Metals, including silver will be analyzed in all soil and/or groundwater samples from direct-push and monitoring well locations in and adjacent to these areas. The data will be used to determine whether groundwater has been impacted by silver in these areas.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for silver as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-35 through 2-31-DP-39

East Side of Building 2-31/SWMU 2-31.22

- 2-31-DP-24
- 2-31-DP-48

Northeast Corner of Building 2-31

- 2-31-DP-15 (Sub-grade in Tunnel K)
- 2-31-DP-30 (Sub-grade in Tunnel K)
- 2-31-DP-47

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-35 through 2-31-DP-39

East Side of Building 2-31/SWMU 2-31.22

- 2-31-DP-24
- 2-31-DP-25
- 2-31-DP-48

Northeast Corner of Building 2-31

- 2-31-DP-15 (Sub-grade in Tunnel K)
- 2-31-DP-30 (Sub-grade in Tunnel K)
- 2-31-DP-47

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.1.7 Zinc

Zinc was analyzed in 48 2-31 Area soil samples and detected in all 48. Five of the 48 detected concentrations exceeded the soil screening level protective of surface water (101 mg/kg). Ecology (1994) did not calculate a background concentration for zinc. Concentrations above the soil screening level ranged from 110 mg/kg to 823 mg/kg.

The maximum concentration of zinc in the 2-31 Area (823 mg/kg) was detected in a sample collected from NS-07-31 at 0.5 feet bgs at SWMU 2-31.18 Area B Acid Waste Tank. This concentration does not exceed the direct contact exposure pathway screening level for zinc (40,000 mg/kg). The air pathway is not considered a viable exposure pathway for zinc.

SWMU 2-31.18 Area B Acid Waste Tank: Zinc was detected above the screening level protective of surface water in four samples (NS-02-31, NS-03-31, NS-08-31, and NS-11-31) from 0.5 foot bgs at four locations near SWMU 2-31.18 Area B Acid Waste Hold Tank. Concentrations in these samples ranged from 110 mg/kg to 809 mg/kg. The extent of zinc in soil has not been adequately laterally delineated in shallow soil this area to the northeast, west, and southwest. Soil in this area will be analyzed for metals (including zinc) to delineate the horizontal extent of zinc in shallow soils. Zinc has not been detected above the screening level in groundwater in this area. Groundwater in this area will be analyzed for metals (including zinc) and the data will be evaluated to determine whether zinc has impacted groundwater.

UST PL-57: Zinc was detected above the 101 mg/kg screening level at 823 mg/kg in a sample from 0.5 foot bgs at NS-07-31, near UST PL-57. The extent of zinc in soil has not been adequately delineated for CMS purposes to the south, east, and west of this location. Soil in this area will be analyzed for metals (including zinc) to delineate the vertical and horizontal

extent of zinc. Zinc has not been detected above the screening level in groundwater in this area. Groundwater in this area will be analyzed for metals (including zinc) and the data will be evaluated to determine whether zinc has impacted groundwater.

Soil and groundwater data for zinc were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of zinc in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

    Lateral delineation of zinc is incomplete in shallow soils to the northeast, west, and southwest of SMWU 2-31.18 Area B Acid Waste Hold Tank. Zinc will be analyzed in soil samples from seven direct-push locations in this area.
  - **New Sources:** Zinc detected above the soil screening on the south side of Building 2-31, near UST PL-57 has the potential to impact groundwater.

    Lateral and vertical delineation of zinc is incomplete on the south side of Building 2-31, near UST PL-57. Zinc will be analyzed in soil samples from three direct-push locations to the south, east, and west of NS-07-31.
- **Completed Pathways:**
  - **Direct Contact:** Zinc was not detected above the direct contact pathway screening level (40,000 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for zinc.
  - **Soil to Groundwater Pathway:** The data indicate that zinc is present in soil in the SWMU 2-31.18 area and to the south of Building 2-31 near UST PL-57 at concentrations in shallow soils 0 to 1 foot bgs above the soil to groundwater pathway screening level. Zinc was not detected at concentrations exceeding the screening level below 1 foot bgs. However, metals, including zinc, will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of zinc in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Zinc was detected in all 2-31 Area soil samples; therefore, there were no exceedances of screening levels by analytical reporting limits.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for zinc as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-35 through 2-31-DP-39

South of Building 2-31/UST PL-57

- 2-31-DP-40
- 2-31-DP-41
- 2-31-DP-42

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-35 through 2-31-DP-39

South of Building 2-31/UST PL-57

- 2-31-DP-40
- 2-31-DP-41
- 2-31-DP-42

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.1.8 Cyanide

Cyanide was analyzed in 22 2-31 Area soil samples and detected in two of those samples. One of the samples was reported with a concentration of 0.31 mg/kg, which is above the soil screening level protective of surface water (0.2 mg/kg). This sample with the single detection exceeding the screening level was collected in the north corner of the property as sample location SW-01. This concentration does not exceed the direct contact exposure pathway screening level for cyanide (26,700 mg/kg). The air pathway is not considered a viable exposure pathway for cyanide.

North Side of Building 2-22: Cyanide was detected at 0.31 mg/kg in a sample from 10.5 feet bgs at SW-01 on the north side of Building 2-22 adjacent to the East Marginal Way South right of away. Cyanide was detected below the screening level at 0.075 mg/kg in a shallower (5.5 feet bgs) soil sample from this location. The extent of cyanide in soil has not been adequately delineated for CMS purposes in this area. Soil in this area will be analyzed for inorganics (including cyanide) to delineate the vertical and horizontal extent of cyanide. The analytical groundwater data indicate that cyanide is present above the screening level in groundwater in this area. Groundwater in this area will be analyzed for inorganics (including cyanide) and the data will be evaluated to determine whether cyanide has impacted groundwater.

Soil and groundwater data for cyanide were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of

Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of cyanide in the 2-31 Area related to any RCRA units have been adequately characterized for CMS purposes.
  - **New Sources:** Cyanide detected above the soil screening level north of Building 2-22 has the potential to impact groundwater.

    Lateral and vertical delineation of cyanide is incomplete on the north side of Building 2-22. Cyanide will be analyzed in soil samples from three direct-push locations to the northwest, west, and south of SW-01.
- **Completed Pathways:**
  - **Direct Contact:** Cyanide was not detected above the direct contact pathway screening level (26,700 mg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for cyanide.
  - **Soil to Groundwater Pathway:** The data indicate that cyanide is present in soil on the north side of Building 2-22 at concentrations that could impact groundwater. Inorganics, including cyanide, will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of cyanide in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - The RLs for cyanide were above the soil screening level protective of surface water for five soil samples from the 2-31 Area, specifically in the central portion of Building 2-31. Cyanide will be analyzed in soil and groundwater samples from direct-push locations in and adjacent to this area. The data will be used to determine whether groundwater has been impacted by cyanide in this area.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for cyanide as follows:

Soil sampling and analysis will be conducted at the following locations:

North Side of Building 2-22

- PL2-507B
- PL2-507C
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Central Portion of Building 2-31

- 2-31-DP-03
- 2-31-DP-24
- 2-31-DP-25
- 2-31-DP-27
- 2-31-DP-28
- 2-31-DP-29
- 2-31-DP-48
- 2-31-DP-49

Groundwater sampling and analysis will be conducted at the following locations:

North Side of Building 2-22

- PL2-507A
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Central Portion of Building 2-31

- PL2-509A
- 2-31-DP-03
- 2-31-DP-24
- 2-31-DP-25
- 2-31-DP-27
- 2-31-DP-28
- 2-31-DP-29
- 2-31-DP-48
- 2-31-DP-49

Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.2 Semivolatile Organic Compounds and Polychlorinated Biphenyls

Analytical results for all site-wide SVOC and PCB COCs were screened to identify COCs for the 2-31 Area. Analysis for SVOCs was conducted on 47 soil samples. PCB analyses (Aroclors 1016, 1221, 1232 1242, 1248, 1254, and 1260) were conducted on 30 samples. Aroclors 1254 and 1260, and total PCBs, as well as the following two SVOCs, both of which are carcinogenic polycyclic aromatic hydrocarbons (cPAHs), were identified as COCs for the 2-31 Area:

Benzo(a)anthracene Chrysene

The presence of these constituents in 2-31 Area soil is evaluated for the soil to surface water and direct contact pathways in the Sections 2.4.2.1 and 2.4.2.2. The exposure pathway for air is not evaluated because SVOCs and PCBs are not volatile. In the foregoing discussion of SVOC and PCB COCs, the term "screening level" will refer to the soil screening level protective of surface water, unless otherwise noted.

2.4.2.1 Carcinogenic Polycyclic Aromatic Hydrocarbons

SVOCs, including the cPAH constituents, were analyzed in 47 soil samples. Of the samples analyzed for SVOCs, only two cPAHs (benzo[a]anthracene and chrysene) were detected above their respective soil screening levels protective of surface water.

Detected concentrations of benzo(a)anthracene above the soil screening level (41.9 µg/kg) were 42 µg/kg and 57 µg/kg. The single detected concentration of chrysene above the soil screening level (46.6 µg/kg) was 68 µg/kg. Neither concentration exceeds the direct contact screening level (3,420 µg/kg for both benzo[a]anthracene and chrysene).

SWMU 2-31.18 Area B Acid Waste Hold Tank: Benzo(a)anthracene was detected above the screening level in a sample from 10.5 feet bgs at DP-3102, near SWMU 2-31.18 Area B Acid Waste Hold Tank. The extent of cPAHs in soil has not been adequately delineated for CMS purposes to the northeast, south, and east of DP-3102. Soil in this area will be analyzed for cPAHs (including benzo(a)anthracene) to delineate the vertical and horizontal extent of cPAHs. cPAHs have not been detected above groundwater screening levels in this area. Groundwater downgradient of this area will be analyzed for cPAHs (including benzo(a)anthracene) and the data will be evaluated to determine whether cPAHs have impacted groundwater.

North Side of Building 2-22: Benzo(a)anthracene and chrysene were both detected above their screening levels in a sample from 5.5 feet bgs at SW-01. Concentrations of benzo(a)anthracene and chrysene were 57 µg/kg and 68 µg/kg, respectively. In a subsequent sample from 10.5 feet bgs at this location, benzo(a)anthracene was not detected, and chrysene was detected below the screening level. The lateral extent of cPAHs in soil has not been adequately delineated for CMS purposes near SW-01 based on the criteria in Section 2.1. Soil in this area will be analyzed for cPAHs (including benzo(a)anthracene and chrysene) to delineate the vertical and horizontal extent of cPAHs. cPAHs have not been detected above groundwater screening levels in this area. Groundwater in this area will be analyzed for cPAHs (including benzo(a)anthracene and chrysene) and the data will be evaluated to determine whether cPAHs have impacted groundwater.

Soil and groundwater data for cPAHs (including benzo(a)anthracene and chrysene) were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of cPAHs in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

Lateral and vertical delineation of benzo(a)anthracene is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank. cPAHs (including benzo(a)anthracene) will be analyzed in soil samples from three direct-push locations to the northeast, south, and east of DP-3102.

- **New Sources:** cPAHs detected above the soil screening level north of Building 2-22 have the potential to impact groundwater.

  Lateral delineation of benzo(a)anthracene and chrysene is incomplete on the north side of Building 2-22. cPAHs (including benzo(a)anthracene and chrysene) will be analyzed in soil samples from three direct-push locations to the northwest, west, and south of SW-01of SW-01.

- **Completed Pathways:**
  - **Direct Contact:** cPAHs were not detected above the direct contact pathway screening level (3,240 µg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for cPAHs.
  - **Soil to Groundwater Pathway:** The data indicate that cPAHs are present in soil in the SWMU 2-31.18 area and to the north of Building 2-22 at concentrations that could impact groundwater. cPAHs, including benzo(a)anthracene and chrysene, will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of cPAHs in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Reporting limits for all non-detect cPAHs results are below applicable screening levels.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for cPAHs as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-38 through 2-31-DP-41

North of Building 2-22

- PL2-507B
- PL2-507C
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-38 through 2-31-DP-41

North of Building 2-22

- PL2-507A
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Laboratory analyses are presented in Table 2-2, and sample locations are presented on Figure 2-1.

2.4.2.2 Total Polychlorinated Biphenyls

PCBs (reported as Aroclors) were analyzed in 30 2-31 Area soil samples. The total PCB concentration is the sum of the individual aroclor concentrations detected within a single sample. PCBs were detected at concentrations greater than the soil screening level (33 µg/kg) in six samples. The screening level protective of surface water was adjusted to the laboratory's RL for data gap evaluation purposes (with the acknowledgment that it exceeds the risk-based level). A direct contact screening level has been established for Aroclor 1254 (13,300 µg/kg). Aroclor 1254 was not detected above the direct contact screening level in 2-31 Area soil samples. The air pathway is not considered a viable exposure pathway for PCBs.

Tables of the analytical results for individual aroclors (1254 and 1260) identified as 2-31 Area COCs are provided in Attachment B, along with maps presenting total PCB concentrations. Concentrations of total PCBs exceeding the adjusted surface water pathway screening level (33 µg/kg) ranged from 39 µg/kg to 1,300 µg/kg, 1.2 to 39 times the screening level.

The maximum concentration was detected in a sample collected from 6 feet bgs at SB-03112 near SWMU 2-31.18 Area B Acid Waste Hold Tank. There were a number of samples in which aroclors were not detected with RLs above the surface water screening level.

Analytical Reporting Limits. There were 24 samples, from three general areas, in which aroclors were not detected, with RLs above the screening level protective of surface water.

- RLs (36 to 96 µg/kg) were reported for samples collected in and around SWMU 2-31.18 Area B Acid Waste Hold Tank.
- RLs (70 to 96 µg/kg) exceeded the screening level in soil samples collected between 3.5 to 10.8 feet bgs in the central portion of the 2-31 Area throughout Building 2-31.
- RLs (70 to 92 µg/kg) exceeded the screening level in soil samples collected between 5.5 to 11 feet bgs in Building 2-22.

The RLs for Aroclor 1254 did not exceed the direct contact screening level.

SWMU 2-31.18 Area B Acid Waste Hold Tank: PCBs were detected above the screening level in three samples from 5.5 to 8 feet bgs at two locations (DP-3103 and SB-03112) near SWMU 2-31.18 Area B Acid Waste Hold Tank. Concentrations in these samples ranged from 120 µg/kg to 1,300 µg/kg. The extent of PCBs in soil has been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. However, the exceedances of screening level by analytical reporting limits identified above necessitate sampling for PCBs in the area (see additional discussion under the Exceedances of Screening Levels by Analytical Reporting Limits section below). PCBs have not been detected in groundwater in this area. However, groundwater in this area will be analyzed for PCBs and the data will be evaluated to determine whether PCBs have impacted groundwater in association with the elevated analytical reporting limits

Building 2-25 Atrium: PCBs were detected above the screening level in two samples from 5.4 feet and 10.5 feet bgs at a single location (SW-03) in the atrium of the Building 2-25. PCBs were detected at 66 µg/kg and 280 µg/kg, respectively. The extent of PCBs in soil has not been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. Soil in this area will be analyzed for PCBs (reported as aroclors) to delineate the vertical and horizontal extent. PCBs have not been detected in groundwater in this area. However, groundwater in this area will be analyzed for PCBs in coordination with soil sampling and the data will be evaluated to determine whether PCBs have impacted groundwater.

North of Building 2-22: PCBs were detected at 39 µg/kg in a sample from 5.5 feet bgs at SW-01, to the north of Building 2-22. PCBs were not detected in a deeper sample (10.5 feet bgs) from this location. However, the RL for this result (80 µg/kg) exceeded the screening level. The extent of PCBs in soil has not been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. Soil in this area will be analyzed for PCBs (reported as aroclors) to delineate the vertical and horizontal extent. PCBs have not been detected in groundwater in this area. However, groundwater in this area will be analyzed for PCBs in coordination with soil sampling and the data will be evaluated to determine whether PCBs have impacted groundwater.

Soil and groundwater data for PCBs were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of PCBs in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

      Lateral and vertical delineation of PCBs is incomplete near SMWU 2-31.18 Area B Acid Waste Hold Tank. PCBs will be analyzed in soil samples from three direct-push location to the north, east, and west of SB-03112.
    - **New Sources:** PCBs detected above the soil screening level in the atrium of Building 2-25 and north of Building 2-22 have the potential to impact groundwater.

Lateral and vertical delineation of PCBs is incomplete in the Building 2-25 atrium area. PCBs will be analyzed in soil samples from three direct-push locations to the northeast, northwest, and southeast of SW-03.

Lateral and vertical delineation of PCBs is incomplete on the north side of Building 2-22. PCBs will be analyzed in soil samples from three direct-push locations to the northwest, west, and south of SW-01.

- **Completed Pathways:**
  - **Direct Contact:** PCBs were not detected above the direct contact pathway screening level (13,300 µg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for PCBs.
  - **Soil to Groundwater Pathway:** The data indicate that PCBs are present in soil near the SWMU 2-31.18 area, in the atrium area of Building 2-25, and to the north of Building 2-22 at concentrations that could impact groundwater. PCBs will be analyzed in soil and groundwater samples from direct-push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of PCBs in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - The RLs for PCBs were above the soil screening level protective of surface water for numerous soil samples from throughout the 2-31 Area, specifically near SWMU 2-31.18, throughout Building 2-31, and in Building 2-22. PCBs will be analyzed in soil and groundwater from direct-push locations in and adjacent to these areas. The data will be used to confirm groundwater has not been impacted by PCBs in these areas.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for PCBs as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-36
- 2-31-DP-37
- 2-31-DP-38
- 2-31-DP-39

Atrium Portion of Building 2-25

- 2-31-DP-44
- 2-31-DP-45
- 2-31-DP-46

North of Building 2-22

- PL2-507B
- PL2-507C
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Building 2-31

- 2-31-DP-05
- 2-31-DP-15
- 2-31-DP-28
- 2-31-DP-30
- 2-31-DP-31
- 2-31-DP-47

Building 2-22

- 2-31-DP-50

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- PL2-502A
- 2-31-DP-36
- 2-31-DP-37
- 2-31-DP-38
- 2-31-DP-39

Atrium Portion of Building 2-25

- 2-31-DP-44
- 2-31-DP-45
- 2-31-DP-46

North of Building 2-22

- PL2-507A
- 2-31-DP-13
- 2-31-DP-14
- 2-31-DP-17

Building 2-31

- 2-31-DP-05
- 2-31-DP-15
- 2-31-DP-28
- 2-31-DP-30
- 2-31-DP-31
- 2-31-DP-47

Laboratory analyses are presented in Table 2-2, and sample locations are presented on Figure 2-1.

2.4.3 Volatile Organic Compounds

Analytical results for all site-wide VOC COCs were screened to identify COCs for the 2-31 Area. Chemical analysis was conducted for one or more VOC constituents on 62 soil samples collected in the 2-31 Area. VOC analyses included 21 constituents for which screening levels were established. The following two VOCs have been identified as COCs for the 2-31 Area:

Trichloroethene Vinyl Chloride

The occurrence of these VOCs in the 2-31 Area is evaluated for the surface water exposure pathway in the sections below. The screening levels for the air exposure pathway are still under development, and adjustments to the Johnson & Ettinger Model are ongoing. The air pathway will be evaluated and the results presented in an addendum to this work plan. The direct contact pathway is valid for VOCs, but neither of the two VOC COCs was detected above its direct contact pathway screening level.

2.4.3.1 Trichloroethene

Trichloroethene was analyzed in 53 2-31 Area soil samples and detected in 13 of those samples. Twelve of the 13 detected concentrations exceeded the soil screening level protective of surface water (2.0 µg/kg). Concentrations of trichloroethene above this soil screening level ranged from 7.6 µg/kg to 16,000 µg/kg. The maximum concentration of trichloroethene in the 2-31 Area located within the AOC 2-31-21 TCE Degreaser area does not exceed the direct contact screening level (136,000 µg/kg). Eight of the 13 detected concentrations of trichloroethene exceeded the air pathway screening level.

South of UST PL-56: Trichloroethene was detected at 9.9 µg/kg in a single sample from 5.3 feet bgs at DP-4132, to the south of UST PL-56. Trichloroethene was not detected in a subsequent sample from 10.3 feet bgs at DP-4132, or in six samples from 5.5 to 10.5 feet bgs at three locations to the west. The extent of trichloroethene in soil has not been adequately delineated for CMS purposes to the north, east, and south of DP-4132. Soil in these areas will be analyzed for VOCs (including trichloroethene) to delineate the vertical and horizontal extent of trichloroethene. The analytical groundwater data indicate that trichloroethene exceeds the groundwater screening level in this area. Groundwater in this area will be analyzed for

trichloroethene and the data will be evaluated to determine whether trichloroethene has impacted groundwater.

AOC 2-31.21 TCE Degreaser: Trichloroethene was detected above the screening level protective of surface water in eleven samples from between 1.5 feet and 10.5 feet bgs at five locations (SB-03103, SB-03104, DP-3110, DP-3111, and PL2-501A) in the general vicinity of AOC 2-31.21 TCE Degreaser. Seven of the samples also exceeded the screening level for the air exposure pathway. The extent of trichloroethene in soil has not been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. Soil in this area will be analyzed for VOCs (including trichloroethene) to delineate the vertical and horizontal extent of trichloroethene. The analytical groundwater data indicate that trichloroethene exceeds the groundwater screening level in this area. Groundwater in this area will be analyzed for trichloroethene and the data will be evaluated to determine whether trichloroethene has impacted groundwater.

Soil and groundwater data for trichloroethene were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of trichloroethene in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

      Lateral and vertical delineation of trichloroethene is incomplete near AOC 2-31.21 TCE Degreaser. Trichloroethene will be analyzed in soil samples from seven direct-push locations around AOC 2-31.21.
    - **New Sources:** Trichloroethene detected above the soil screening level to the south of UST PL-56 has the potential to impact groundwater.

      Lateral and vertical delineation of trichloroethene is incomplete to the south of UST PL-56. Trichloroethene will be analyzed in soil samples from three direct-push locations to the north, east, and south of DP-4132.
- **Completed Pathways:**
    - **Direct Contact:** Trichloroethene was not detected above the direct contact pathway screening level (136,000 µg/kg) in 2-31 Area soil.
    - **Air Pathway:** The air pathway screening level for trichloroethene is based on indoor air. Trichloroethene has been detected above the area-specific Johnson & Ettinger air pathway screening level of 29 µg/kg.
    - **Soil to Groundwater Pathway:** The data indicate that trichloroethene is present in soil south of UST PL-56 and near AOC 2-31.21 at concentrations that could impact groundwater. Trichloroethene will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if

groundwater has been impacted by elevated concentrations of trichloroethene in the soil.

- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Trichloroethene RLs were elevated above the screening level in a single sample collected from DP-3114 at a depth of 6 feet bgs. Trichloroethene was analyzed and not detected, at an RL below the screening level, in a subsequent sample from 11 feet bgs at this location. Trichloroethene will be analyzed in both soil and groundwater from all sampling locations in the 2-31 Area. The data will be used to confirm that the soil to groundwater pathway is not complete in this area.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for trichloroethene as follows:

Soil sampling and analysis will be conducted at the following locations:

South of UST PL-56

- 2-31-DP-43

AOC 2-31.21 TCE Degreaser

- 2-31-DP-03
- 2-31-DP-04
- 2-31-DP-26
- 2-31-DP-28
- 2-31-DP-31
- 2-31-DP-32
- 2-31-DP-33

Groundwater sampling and analysis will be conducted at the following locations:

South of UST PL-56

- 2-31-DP-43

AOC 2-31.21 TCE Degreaser

- PL2-501A
- PL2-509A
- 2-31-DP-03
- 2-31-DP-04
- 2-31-DP-26
- 2-31-DP-28
- 2-31-DP-31
- 2-31-DP-32
- 2-31-DP-33

In addition, VOCs, including trichloroethene, will be analyzed in both soil and groundwater from all sampling locations in the 2-31 Area. The data will be used to further evaluate the soil to groundwater and air exposure pathways. Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.3.2 Vinyl Chloride

Vinyl Chloride was analyzed in 53 2-31 Area soil samples and detected in five of those samples. Concentrations in all five samples exceeded the soil screening level protective of surface water (4.59 µg/kg), ranging from 5.1 µg/kg to 65 µg/kg. The maximum concentration of vinyl chloride in the 2-31 Area is located within the AOC 2-31-21 TCE Degreaser area and does not exceed either the direct contact soil screening level (49,700 µg/kg) or the 2-31 Area specific air pathway soil screening level of 130 µg/kg for vinyl chloride.

SWMU 2-31.18 Area B Acid Waste Hold Tank: Vinyl chloride was detected above the screening level, at 11 µg/kg, in a single sample from 10.5 feet bgs in DP-3101, on the north side of SMWU 2-31.18 Area B Acid Waste Hold Tank. Vinyl chloride was not detected in samples from 6.5 and 10.5 feet bgs to the west and southwest of this location. The extent of vinyl chloride in soil has not been adequately delineated to the north, northeast, and southeast of DP-3101. Soil in this area will be analyzed for VOCs (including vinyl chloride) to delineate the vertical and horizontal extent of vinyl chloride. The analytical groundwater data indicate that vinyl chloride exceeds the groundwater screening level to the south of this area. Groundwater in this area will be analyzed for vinyl chloride and the data will be evaluated to determine whether vinyl chloride has impacted groundwater.

AOC 2-31.21 TCE Degreaser: Vinyl chloride was detected above the screening level in four samples from between 8 and 10 feet bgs at three locations (SB-3103, SB-3104, and PL2-501A) near AOC 2-31.21. Concentrations in these samples ranged from 5.1 µg/kg to 65 µg/kg. The extent of vinyl chloride in soil has not been adequately delineated for CMS purposes in this area based on the criteria in Section 2.1. Soil in this area will be analyzed for VOCs (including vinyl chloride) to delineate the vertical and horizontal extent of vinyl chloride. The analytical groundwater data indicate that vinyl chloride exceeds the groundwater screening level in this area. Groundwater in this area will be analyzed for vinyl chloride and the data will be evaluated to determine whether vinyl chloride has impacted groundwater.

Soil and groundwater data for vinyl chloride were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
    - **Hot Spots:** Potential sources of vinyl chloride in 2-31 Area RCRA units have been adequately characterized for CMS purposes with the following exceptions:

      Lateral and vertical delineation is incomplete near SWMU 2-31.18 Area B Acid Waste Hold Tank. Vinyl chloride will be analyzed in soil samples from three direct-push locations to the north, northeast, and southeast of DP-3101.

Lateral and vertical delineation of vinyl chloride is incomplete near AOC 2-31.21 TCE Degreaser. Vinyl chloride will be analyzed in soil samples from seven direct-push locations around AOC 2-31.21.

- **New Sources:** All concentrations of vinyl chloride detected above soil screening levels are from within or immediately adjacent to RCRA units. Therefore, there are no new source data gaps for vinyl chloride in the 2-31 Area.

- **Completed Pathways:**
  - **Direct Contact:** Vinyl chloride was not detected above the direct contact pathway screening level (49,700 µg/kg) in 2-31 Area soil.
  - **Air Pathway:** The air pathway screening level for vinyl chloride is based on indoor air. Vinyl chloride was not detected above the 2-31 Area specific air pathway screening level (130 µg/kg) in 2-31 Area soil.
  - **Soil to Groundwater Pathway:** The data indicate that vinyl chloride is present in soil on the north side of SWMU 2-31.18 and near AOC 2-31.21 at concentrations that could impact groundwater. Vinyl chloride will be analyzed in soil and groundwater samples from direct push locations around these locations. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of vinyl chloride in the soil.

- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Vinyl chloride RLs were elevated above the screening level in a single sample collected from DP-3114 at a depth of 6 feet bgs. Vinyl chloride was analyzed and not detected, at an RL below the screening level, in a subsequent sample from 11 feet bgs at this location. Vinyl chloride will be analyzed in both soil and groundwater from all sampling locations in the 2-31 Area. The data will be used to determine whether the soil to groundwater pathway is complete in this area.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for vinyl chloride as follows:

Soil sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-34 through 2-31-DP-37

AOC 2-31.21 TCE Degreaser

- 2-31-DP-03
- 2-31-DP-04
- 2-31-DP-26
- 2-31-DP-28
- 2-31-DP-31

- 2-31-DP-32
- 2-31-DP-33

Groundwater sampling and analysis will be conducted at the following locations:

SWMU 2-31.18 Area B Acid Waste Hold Tank

- 2-31-DP-34 through 2-31-DP-37

AOC 2-31.21 TCE Degreaser

- PL2-501A
- PL2-509A
- 2-31-DP-03
- 2-31-DP-04
- 2-31-DP-26
- 2-31-DP-28
- 2-31-DP-31
- 2-31-DP-32
- 2-31-DP-33

In addition, VOCs, including vinyl chloride, will be analyzed in both soil and groundwater from all sampling locations in the 2-31 Area. The data will be used to further evaluate both the soil to groundwater and air exposure pathways. Laboratory analyses are presented in Table 2-2 and sample locations are presented on Figure 2-1.

2.4.4 Petroleum Hydrocarbons

Analytical results for all site-wide petroleum hydrocarbon COCs were screened to identify COCs for the 2-31 Area. Chemical analysis was conducted for four categories of petroleum hydrocarbons: TPH (diesel-range through oil-range), GRPH, DRPH, and ORPH.

DRPH was identified as a COC for the 2-31 Area. The presence of petroleum hydrocarbons in the 2-31 Area is evaluated for the surface water exposure pathway in the following Section 2.4.4.1. The direct contact and air pathways are not evaluated for specific petroleum hydrocarbon categories. They are, however, taken into account by the evaluation of individual VOC constituents that are their components.

2.4.4.1 Diesel-Range Petroleum Hydrocarbons

DRPH was analyzed in 40 soil samples in the 2-31 Area and detected in 21 of those samples. Two of those 21 samples were reported at concentrations (2,700 mg/kg and 6,100 mg/kg) greater than the soil screening level protective of surface water (2,000 mg/kg). The maximum concentration of DRPHs in the 2-31 Area (6,100 mg/kg) was detected in a sample collected from DP-3002 at 10.0 feet bgs near UST PL-36. The direct contact and air exposure pathways are not considered viable exposure pathways for DRPHs

UST PL-36: DRPH was detected above the screening level at 2,700 mg/kg and 6,100 mg/kg in two samples from two locations near UST PL-36 on the south side of Building 2-30. The samples were collected from 7.5 and 10 feet bgs at DP-3001 and DP-3002, respectively. The extent of DRPH in soil has not been adequately delineated in this area for CMS purposes based on the criteria in Section 2.1. Soil in this area will be analyzed for DRPH to delineate the vertical and horizontal extent.

Soil and groundwater data for DRPH were evaluated to identify data gaps for CMS purposes using criteria from Section 2.1: Source Control, Completed Pathways, and Exceedances of Screening Levels by Analytical Reporting Limits. Results of this evaluation are summarized below.

- **Source Control:**
  - **Hot Spots:** Potential sources of DRPH in the 2-31 Area related to any RCRA units have been adequately characterized for CMS purposes.
  - **New Sources:** DRPH detected above the soil screening level on the south side of the 2-30 Building near UST PL-36 have the potential to impact groundwater.

    Lateral and vertical delineation is incomplete on the south side of Building 2-30 at UST PL-36. DRPH will be analyzed in soil samples from two direct-push locations to the southeast and northwest of DP-3001 and DP-3002.

    Lateral and vertical confirmation is desired near former UST PL-56. DRPH will be analyzed in soil samples from a direct-push location south of UST PL-56.
- **Completed Pathways:**
  - **Direct Contact:** The direct contact pathway is not considered a viable exposure pathway for DRPH.
  - **Air Pathway:** The air pathway is not considered a viable exposure pathway for DRPH.
  - **Soil to Groundwater Pathway:** The data indicate that DRPH are present in soil near UST PL-36 to the south of Building 2-30 at concentrations that could impact groundwater. DRPH will be analyzed in soil and groundwater samples from direct push locations in this area. The data will be used to determine if the pathway is currently complete, and if groundwater has been impacted by elevated concentrations of DRPH in the soil.
- **Exceedances of Screening Levels by Analytical Reporting Limits:**
  - Reporting limits for all non-detected DRPHs results are below applicable screening levels.

The data gaps identified above will be addressed by analyzing soil and groundwater samples for DPRHs as follows:

Soil sampling and analysis will be conducted at the following locations:

UST PL-36

- 2-31-DP-01
- 2-31-DP-29
- 2-31-DP-49

Groundwater sampling and analysis will be conducted at the following locations:

UST PL-36

- 2-31-DP-01
- 2-31-DP-29
- 2-31-DP-49

Laboratory analyses are presented in Table 2-2, and sample locations are presented on Figure 2-1.

2.4.5 Summary of Investigative Scope for Soil Data Gaps

The soil data gap investigation of the 2-31 Area will be conducted to fill the data gaps identified above. The main elements associated with the 2-31 Area soil data gap investigation are as follows:

Scope Item	Rationale
Installation and sampling of 50 direct-push probes in the 2-31 Area for additional inorganics, SVOCs, PCBs, VOCs, and TPH analyses.	Better define the extent of soil impacted by one or more metal, SVOC, PCB, VOC, TPH constituent, or cyanide in association with RCRA Units SWMU 2-31.18 (Area B Acid Waste Hold Tank), SWMU 2-31.21 (TCE Degreaser), SWMU 2-31.22 (Brush Plating Area), and SWMU 2-31.23 (Ammonium Persulfate Tank). Better define the extent of impacted soil not associated with existing RCRA units, including metal impacts near UST PL-35; DRPH impacts near UST PL-36; VOC constituents near UST PL-56; metal impacts near UST PL-57; metal impacts near AST APL-042; metals, SVOCs, and PCB impacts on the north side of Building 2-22;metals and PCBs impacts on the west side of Building 2-25; and metals impacts on the north side of Building 2-31.
Installation and sampling of direct-push probes and selected groundwater monitoring wells to determine if the soil to groundwater portion of the surface water pathway is complete, and to identify whether COCs related to sources in the soil are present in groundwater at concentrations that exceed the surface water pathway screening levels.	Groundwater sampling throughout the 2-31 Area to evaluate whether the soil to groundwater portion of the surface water pathway is complete.

Groundwater and soil sampling will be conducted at 50 direct-push probe locations and selected monitoring wells downgradient of potential source areas and RCRA Units. Groundwater samples for evaluation of soil data gaps will be collected from the A level only. Groundwater sampling conducted in support of soil data gap investigations will be coordinated with the

groundwater sampling activities under the groundwater data gaps evaluation presented Section 2.1.

A summary table showing the wells and probes to be sampled, constituent groups analyzed, and the general soil data gaps that will be filled by the sampling is presented in Table 2-2. The rationale for sampling at each location is provided in the right hand column of the table.

Locations of existing wells, new wells, and new probes to be sampled as part of both the groundwater and soil 2-31 Area data gap investigation are presented in Figure 2-1.

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3.0 Data Gap Investigation Methods

This section specifies investigation methods for sampling groundwater and soil in the 2-31 Area to fill the data gaps discussed in Section 2.0. In general, the methods cover the following:

- Installation of wells PL2-507B and PL2-507C next to existing well PL2-507A in the north corner of the 2-31 Area to provide sampling points for A, B, and C level groundwater entering Plant 2.
- Installation of 50 direct-push probe sampling locations located adjacent to and down gradient of existing SWMU/AOC/OA units and areas of soil impacts located in the 2-31 Area. Probes will be used to sample groundwater in the A and B levels of the aquifer only. Potentially impacted groundwater in the C level of the aquifer will be evaluated by sampling existing C level monitoring wells.
- Soil sampling where probes are installed. Soil sampling is conducted for two purposes: 1) to provide data to support characterization of the extent of impacted soil, and 2) to indicate if overlying soils could impact the groundwater samples versus impacts from upgradient sources that the wells/probes are intended to monitor.

Sample analysis and quality assurance plans that cover standard operating procedures at Plant 2 are referenced from the *Compendium of Sampling and Analysis Plans and Quality Assurance Project Plans for Boeing Plant 2, Seattle/Tukwila Washington* (Golder, 2008).

3.1 MONITORING WELL INSTALLATION

Two new groundwater monitoring wells will be installed in the 2-31 Area at locations noted on Figure 2-1. The two new monitoring wells are as follows:

- PL2-507B will be installed near existing well PL2-507A to provide data regarding B level groundwater quality as it enters Plant 2 from upgradient areas and to help fill data gaps identified in Sections 2.2 and 2.3.
- PL2-507C will be installed near existing well PL2-507A to provide data regarding C level groundwater quality as it enters Plant 2 from upgradient areas and to help fill data gaps identified in Sections 2.2 and 2.3.

New monitoring wells will be installed at the locations shown in Figure 2-1. The wells will be installed using standard hollow-stem-auger (HSA) drilling, air rotary drilling, or sonic drilling techniques as required by the well depth and geology. All borings will be logged and sampled following the guidance described in Technical Procedure TP-1.2-5, Drilling, Sampling, and Logging of Soils referenced in Section 21 of Golder (2008).

3.1.1 Monitoring Well Construction

Monitoring wells will be drilled and installed to meet resource protection well construction standards found in WAC 173-160-420, Minimum Standards for Construction and Maintenance of Wells. The monitoring wells will be installed generally following the guidance documented in

Standard Operating Procedure 4.3 in Section 1 of Golder (2008). The wells will be constructed of 2-inch diameter, flush-threaded, Schedule 40 PVC well casing and screened in conformance with WAC 173-160-430. Well screens for PL2-507B and PL2-507C will be constructed with 0.01-inch (10-slot) flush-threaded, machine-slotted, Schedule 40 PVC, or pre-packed 10-slot well screen, installed from 35 to 45 feet bgs for PL2-507B and approximately 75 to 85 feet bgs for PL2-507C. The borehole for PL2-507C will be terminated in the silt or clay layer underlying the C level of the aquifer. If necessary for well construction, the bottom of the borehole will be adjusted to the top of the low permeability layer by backfilling with sand.

The well design for both B and C level wells includes a 0.5-foot-long flush-threaded Schedule 40 PVC sump with a flush-threaded end cap. Flush-threaded, Schedule 40 PVC well casing extends from the top of the screened interval to approximately 6 inches bgs. A 2-inch diameter, locking, watertight PVC well cap will be installed to secure the well casing. Stainless steel centralizers will be installed immediately above and below the screened interval with additional stainless steel centralizers installed at 20-foot intervals on both wells.

Well screens will be set in 20-40 CSSI, 2/12 Monterey or equivalent silica sand filter pack. The sand filter pack will extend from the bottom of the well screen to 1 foot above the top of the screened interval. A minimum 2-foot-thick seal of hydrated bentonite chips will be installed in the annular space immediately above the sand filter pack. The remainder of the annular space will be sealed with bentonite grout or bentonite chips, hydrated in place, to within approximately 1 foot of the ground surface. The new monitoring wells will be secured in flush-completion steel protective monument set in concrete. The monuments will be raised approximately 1 inch above the existing grade with a sloping concrete pad to minimize the potential for surface water entering the monument. A generalized construction diagram for the B and C level wells is presented in Figure 3-1.

All downhole well components will be either factory-decontaminated and in their original sealed packaging or decontaminated to the satisfaction of the on-site Environmental Partners, Inc. (EPI) engineer before installation. All downhole drilling equipment will be decontaminated as discussed in Section 3.8. and in accordance with the approved quality assurance project plan.

3.1.2 Monitoring Well Development

New monitoring wells will be developed by the drilling subcontractor using a combination of surging and overpumping generally following the guidance documented in Standard Operating Procedure 4.4 in Section 1 of Golder (2008). Well development will be completed by continuous pumping at a steady rate using a submersible pump, or equivalent. Well development equipment used inside a well will be either new single-use equipment, or will be decontaminated to the satisfaction of the EPI engineer by pressure washing before use and between wells.

In general, well development should be performed soon after installation but ideally no sooner than 24 hours after grouting. Well development will be performed until the well is free of sediment and the appropriate water volumes have been removed. Sediment free is considered achieved when turbidity measurement is 5 nephelometric turbidity units (NTUs) or less. For wells where installation is completed without the use of drilling fluid such as water, a minimum of five volumes of standing water in the well (volume of the water inside the well screen and casing plus saturated annulus) will be removed. For wells where drilling fluid was used, five times the

volume of added water shall be removed along with five times the standing water volume in the well.

For instances where groundwater recharge is insufficient to produce water for removal, clean potable water may be introduced into the wells to facilitate sediment removal, at the approval of EPI engineer. An equivalent of five volumes of the water added must be removed to ensure that all the water introduced into well has been removed. Wells should be allowed to recover for approximately one week before sampling for analytical parameters.

The field parameters pH, temperature, conductivity, and turbidity will be measured and recorded during well development. In addition, color changes of water before, during, and after development will be observed and recorded. Removed water from wells will be kept in closed containers pending disposal. Characterization and disposal of well development water will be completed by Boeing following the procedures noted in Section 3.9.

3.2 PROBE INSTALLATION

A series of 50 locations will be sampled by direct-push or hand auger (were direct-push is limited by physical constraints) methods at the locations shown in Figure 2-1. The actual location of the probes placed in the field may be moved in association with conflicts with overhead or underground utilities, physical constraints, building limitations or for safety related reasons. The distances probe(s) are moved from intended Figure 2-1 locations will be minimized to <20 feet when possible and the rationale for the sample location(s) considered.

Soil samples will be collected from three depths in the vadose zone; 0 to 1 foot, 4 to 5 feet, and 9 to 10 feet bgs. Intervals sampled may be extended beyond the 1 foot target zone if additional sample volume is required to meet analysis requirements. Groundwater samples will be collected from the A level of the aquifer at all 50 probe locations with a target depth for the screened interval of 10 to 14 feet bgs. B level groundwater will be sampled at 11 of the probe locations with a target depth for the screened interval of 40 to 44 feet bgs. If the screened interval is located within a low water producing zone (e.g. clayey silt) that makes it impractical to collect a quality groundwater sample, the depth of the screened interval will be advanced in 2-foot increments until an adequate water producing zone is encountered.

Groundwater samples will be collected and analyzed to determine current COC concentrations and to conduct confirmation data analysis of fate and transport modeling results. A summary of locations, sampling intervals, and sampling requirements for the probe locations is presented in Table 2-2.

3.3 GROUNDWATER SAMPLING

Groundwater sampling procedures include water-level measurements (from monitoring wells only), well purging, collection of field parameter data during purging, and sample collection for laboratory analysis. Sampling procedures that are common for all data gap investigation sampling events at the site are listed in the Technical Procedure TP-1.2-20, Collection of Groundwater Quality Samples and Technical Procedure TP-1.0 in Section 21 of Golder (2008). Construction details for wells sampled as part of the 2-31 data gap investigation are summarized in Table A-3.

One 2-31 Area well is also part of the Shoreline Monitoring Program and data gap sampling will be coordinated with that program to the extent possible. Well PL2-233A, the Shoreline Monitoring well located in the 2-31 Area, will be sampled following the procedures specified for the Shoreline Monitoring Program, which are equivalent to the data gap sampling protocols.

Monitoring wells and probe locations will be purged before sampling using low-flow (minimal drawdown) purging procedures. Low-flow purging procedures are used to minimize disturbance associated with turbidity and to provide quicker stabilization time for the measured field parameters pH, dissolved oxygen (DO), temperature, conductivity, and oxidation-reduction potential (ORP). Procedures and guidance for low flow purging and sampling are in the document titled *Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures* (USEPA, 1996).

In general, purging should start at a low-flow rate and increase to a rate of approximately 0.5 liters per minute (L/min). The depth to water in the well being purged will be measured periodically, approximately every 3 to 5 minutes. If drawdown is more than 0.3 foot below the original static water level, reduce the pumping rate to stabilize drawdown. Typical pumping rates range between 0.2 L/min and 0.5 L/min. Purging will continue until field parameters are stabilized, as discussed in Section 3.3.2. To the extent possible, wells will not be purged to dryness. However, if a well exhibits very slow water level recovery and is purged to dryness, groundwater samples will be collected upon sufficient recovery. Sufficient recovery is considered as recovery to at least 80 percent of original static water level prior to purging.

Wells that are anticipated to be low yield and are likely to be purged to dryness based on past sampling records or well development data (in the case of new wells) will be sampled for VOCs prior to purging using no-purge sampling techniques. VOC samples that are obtained using the no-purge sampling method will be noted in the field logbook. The preceding sampling protocol would also be applicable to samples collected for NWTPH-gas.

Following collection of the VOC and NWTPH-gas (as applicable) sample aliquot(s), the low yield well will be purged using the low-flow purging procedures noted in the previous paragraph. Low-flow purging is necessary to obtain representative field parameter measurements, which are important data for evaluating the applicability of groundwater remedies. The remaining non VOC sample aliquots will be obtained using the low-flow sampling techniques described in the following paragraphs.

Purge water will be temporarily contained in the 5-gallon buckets. After purging, the buckets will be sealed and labeled at which time purge water will be collected for disposition.

Readings for ORP and DO will be collected at the end of low-flow purging and recorded as part of the redox parameter suite. A flow-through cell will be used to the extent possible during field parameter measurements to minimize the effects of atmospheric gases on field parameter results.

Following field parameter stabilization after purging, groundwater samples will be collected following low-flow well sampling procedures. For wells that are purged to dryness, sample collection will occur after sufficient recovery to at least 80 percent of the original water level before purging. Procedures for groundwater sampling are in the technical procedure document

TP-1.2-20 in Section 21 of Golder (2008). The appropriate use of field equipment and decontamination protocols will be followed to minimize or eliminate the potential for cross-contamination. Nitrile gloves, or equivalent, will be changed, at a minimum, between wells and whenever the potential for cross contamination is suspected.

Groundwater samples from direct-push probes will be field-filtered for metal analyses. In-line 0.45 micron filters will be used to avoid introduction of oxygen into the sample. This will be critical, as ferrous iron is expected to be present in some samples and its precipitation before filtering and preservation can result in low bias in metal concentrations due to co-precipitation. Groundwater samples from monitoring wells will use total (unfiltered) and dissolved (filtered) samples for metal analyses. In addition, both filtered and unfiltered samples will be collected at all locations where redox parameters are analyzed (see Table 2-2). Filtering will be accomplished in the field using the same method as for the direct-push samples.

Groundwater samples will be collected into laboratory-cleaned, pre-labeled sample bottles and preserved as appropriate for the analytical parameters. Table 3-1 lists requirements for sample containers, preservatives, and related handling instructions. Sample bottles should be filled starting with the most sensitive sample aliquot and ending with the least sensitive aliquot. The sample bottles will be filled in the following order:

1. VOCs
2. Ferrous Iron (Field kit)
3. Inorganic Redox Parameters (sulfide, sulfate, nitrate, nitrite, and ammonia)
4. TPH-G
5. TPH-Dx
6. Cyanide
7. SVOCs
8. PCBs
9. Total Organic Carbon (TOC)
10. Total Metals – Wells only (arsenic, cadmium, copper, iron, lead, manganese, low-level mercury, nickel, selenium, silver, thallium, vanadium, and zinc)
11. Dissolved Metals – Wells and Probes (arsenic, cadmium, copper, iron, lead, manganese, low-level mercury, nickel, selenium, silver, thallium, vanadium, and zinc)

Some groundwater sample locations and depth intervals may yield groundwater at such a low rate that all sample bottles cannot be filled by the end of the day. At these locations groundwater sampling will resume within the same monitoring well or probe the following day. When sample volumes are collected on a second day they will be assigned an appended sample identification number (see Section 3.6.1.).

3.3.1 Surveying and Water Level Measurements

After installation, the new direct-push probe locations and new wells will be surveyed. Elevations will be surveyed from the National Geodetic Datum 1929 (NGVD, 1929) or the North American Vertical Datum (NAVD. 1988) to an accuracy of within 0.01 foot. Horizontal control accuracy will be within 0.1 foot. Probe sampling locations will only be surveyed for horizontal control and ground surface elevation. Monitoring wells will be surveyed for horizontal control, ground surface elevation, and measuring point elevation.

Groundwater level measurements will be obtained before sampling at each well. Technical procedures for water-level measurements are in the technical procedure documents TP-1.4-6a and -6b in Section 21 of Golder (2008).

In general, groundwater levels will be measured to the top of the well casing, a marked measuring point or to the north side of the casing if no measuring point is visible. Water-level measurements, accurate to 0.01 foot, will be recorded in the 2-31 Area Data Gaps Investigation Field Book.

3.3.2 Field Parameter Measurements

Temperature, DO, ORP, pH, specific conductance, and the turbidity of the purged water will be measured during purging and recorded in the field notebook approximately every 3 to 5 minutes. In addition, notes will be taken describing the appearance or odor of the water. The purge stabilization criteria are based on three successive readings of the field water quality parameters. The following are the stabilization criteria for low-flow purging:

- pH ± 0.1 pH units
- Specific conductance ± 3 percent
- ORP ± 10 millivolts (optional)
- Turbidity ± 10 percent (when turbidity is greater than 10 NTUs)
- Dissolved oxygen ± 0.3 µg/L (optional)
- Temperature ± 0.1°C

When the above stabilization criteria have been met, groundwater at the sampling point is stabilized and sample collection can begin. ORP and DO may not always be appropriate stabilization parameters and their use as stabilization parameters will depend on site-specific conditions.

The total volume of water purged from each well will be recorded in the field notebook. However, if a well exhibits very slow water-level recovery and is purged to dryness, groundwater samples at that well will be collected upon sufficient recovery defined as 80 percent recovery of the pre-purge water column.

Before measurements, field instruments will be calibrated according to instructions in EPIs TP-1.0 Standard Procedures for Field Parameter Measurement in Section 21 of Golder

(2008) and provided as Attachment D. The probes for ORP and DO will be housed in a flow-through cell to avoid entrainment of atmospheric gases during measurement, which can affect results.

3.3.3 Groundwater Laboratory Analysis

The proposed constituent groups for chemical laboratory analysis are based primarily on the groundwater COCs historically present at the wells and the need to fill data gaps due to the lack of concurrent and recent data. This statement is generally applicable to VOCs, SVOCs, cyanide, TPH, and metals. For PCBs, data needs are based on the previously considered likelihood of potential migration pathway to individual well locations from impacted soil sources.

Table 2-2 provides an overall summary of the groundwater laboratory analyses for this sampling event. In general, VOCs and metals are proposed for all sampled wells and direct-push locations. SVOCs, TPH, and cyanide analyses are proposed for selected wells and probes in and around known areas of historical SVOC, TPH, and cyanide detections to confirm current site conditions. Redox parameters (part of natural attenuation parameters) are proposed in selected wells to better define geochemical conditions related to the arsenic and manganese plumes and to also define the degradation of chlorinated VOCs. Locations selected for redox parameters were intended to provide good spatial coverage of the 2-31 Area and include groundwater from areas with a wide range in the degree of contamination suspected.

PCB analyses are specified for selected wells and probes to confirm current conditions and fate and transport modeling results. Generally, these analyses are limited to areas downgradient of PCB impacts in soil for confirmation of fate and transport modeling.

3.4 SOIL SAMPLING

Soil samples will be collected for laboratory analysis and geologic logging as part of the monitoring well installation and direct-push probe sampling tasks. Soil samples will be obtained using decontaminated split-spoon samplers or equivalent. The split-spoon sampler (or equivalent) will be equipped with new single-use liners, unless the samples are intended for geologic logging purposes only. Soil samples intended for geologic logging only may be obtained without the use of liners in the sampler.

Soil samples obtained for laboratory analysis will be collected from direct-push probe locations at three intervals in the vadose zone. Soil sampling intervals will be 0 to 1, 4 to 5, and 9 to 10 feet bgs. The split-spoon sampler will be decontaminated before use and between each sample as discussed in Section 3.8.2.

For VOC samples, the bottommost of the intact and relatively undisturbed sample (i.e., generally the bottommost section of liner) will be submitted for laboratory analysis. In those instances when a sand catcher is used in the sampler, the portion of the sample above the sample catcher will be retained for laboratory analysis of VOCs. Samples for VOC analysis will be collected using USEPA Method 5035A. Immediately upon collection, all samples will be labeled and placed in an iced cooler pending submittal to the laboratory, Analytical Resources, Inc., for analysis by USEPA Method 8260B. Sample labeling will follow procedures under the Sample Identification section of this Work Plan (Section 3.6.1). A portion of the sample,

commonly the soil retained in the drive shoe of the sampler or the unused portion of the liner, will be retained for geologic logging and field screening purposes.

For metals, cyanide, TPH, SVOC, and PCB analyses, soil samples will be collected into 2-oz, 4-oz, or 8-oz wide-mouth borosilicate glass jars as appropriate. All collected samples will be labeled and stored in a cooler filled with bagged ice until transported to the laboratory. Table 3-1 lists requirements for sample containers, preservatives, and related handling instructions.

3.4.1 Geologic Soil Logging

Soils encountered will be logged in accordance with the Unified Soil Classification System (USCS) Standard Practice Description and Identification of Soils (Visual Manual procedure) (ASTM 2488D-00) as documented in Technical Procedure TP1.2-6 in Section 21 of Golder (2008). Samples for geologic logging only will be taken at 5-foot intervals (at a minimum) or whenever a change in drilling rate, noise, or drill cuttings signals a possible change in the geology. Samples collected for geologic logging only will be obtained using decontaminated split spoon samplers, or equivalent, with or without a liner. The direct-push probe will be advanced to the top of the desired sample interval and the probe rod will be removed. A decontaminated split-spoon sampler, or equivalent, is then inserted into the probe hole. The split-spoon sampler, or equivalent, will be driven through the desired sample interval using the hydraulic hammer on the probe rig. Observed soil information at each probe location will be recorded on a soil log sheet.

3.4.2 Field Screening

For all soil samples, the non-slough portion of the soil samples will be field screened to check for indications of the presence of VOCs or separate-phase hydrocarbons. Field personnel will use a photoionization detector (PID) to test for the presence of VOCs. Field personnel will also use sheen testing to screen for the presence of separate-phase hydrocarbons. The PID will be calibrated with 100 parts per million (ppm) isobutylene calibration gas before use each day following the calibration guidelines documented in Quality Procedure QP-11.1 in Section 21 of Golder (2008).

For PID screening, a portion of the soil sample will be placed in a sealable plastic bag, disaggregated, and allowed to equilibrate for approximately 5 to10 minutes. The PID inlet tube will then be inserted into the bag and the highest observed reading will be recorded in the field logbook and on the boring logs. The PID will be calibrated with 100 ppm isobutylene calibration gas before use each day following the calibration guidelines documented in Quality Procedure QP-11.1 in Section 21 of Golder (2008).

For sheen testing, a portion of the sample will be placed in a clean polytetrafluoroethylene (PTFE)-coated pan, or equivalent, sprayed with a small amount of distilled or deionized water and a qualitative assessment of any observed sheen or non-aqueous-phase-liquid (NAPL) will be recorded. The results of field screening will be noted in the field logbook and on the boring logs.

3.4.3 Soil Laboratory Analysis

Soil samples will be collected into pre-cleaned laboratory-provided containers. Constituent groups for laboratory analysis of soil samples are VOCs, SVOCs, PCBs, metals, cyanide, and TPH. Refer to Table 3-1 for laboratory methods associated with these constituent groups. Table 3-1 also lists the anticipated number of field samples and quality control (QC) samples include equipment blanks, trip blanks, matrix spikes and matrix spike duplicates (MS/MSD).

3.5 QUALITY CONTROL SAMPLES

QC measures will be taken to evaluate laboratory precision, potential matrix interferences, and potential contamination from the ambient air.

Field duplicates, equipment blanks, trip blanks, and MS/MSD samples will be collected as part of the field QC program. Each of these sample types is described in the following sections along with their purpose and collection frequency.

3.5.1 Trip Blank Samples

The potential for contamination from the ambient air will be evaluated using trip blank samples. The trip blank will originate at the contract laboratory and be relabeled on arrival at the site. Trip blank samples accompany one cooler of samples during sampling and shipping for each day during a sampling event. Trip blank samples will be analyzed for VOCs and GRPH only.

3.5.2 Equipment Blank Samples

The potential for cross contamination from non-dedicated multiple-use sampling devices will be evaluated using equipment blank samples. Some examples of multiple-use non-dedicated sampling devices potentially used for this investigation are the split-spoon samplers used to obtain soil samples during probing or non-dedicated sampling pumps used in monitoring wells. One equipment blank sample will be taken for each type of non-dedicated sampling equipment to evaluate the effectiveness of the decontamination steps. The equipment blank sample will be analyzed for all 2-31 Area groundwater and soil COC constituent groups.

3.5.3 Field Duplicate Samples

Laboratory and field sampling precision of the groundwater sampling task will be evaluated by collecting blind field duplicate samples. Field duplicate samples will be collected at a rate of 10 percent, or a fraction thereof, of the total number of groundwater samples. Field duplicate samples will be collected under conditions as nearly identical as possible to the original sample. Field duplicate samples will be analyzed for the same constituent groups as the original sample. Field duplicate samples will not be collected for soils because it is not possible to homogenize soil samples sufficiently to produce representative duplicate sample volumes.

3.5.4 Co-located Samples

To asses possible effects of sample heterogeneity and source variability of the soil, co-located soil samples will be collected at a rate of 10 percent, or fraction thereof, of the total number of

soil samples collected for VOC analysis. Co-located samples will be analyzed for VOCs only. Co-located samples will be collected within one foot of one another and will not be homogenized. Co-located samples will not be collected for groundwater.

3.5.5 Matrix Spike/Matrix Spike Duplicate Samples

Potential interferences from the sample matrix will be evaluated with MS/MSD samples. Triplicate volumes of samples will be collected at locations specified on the sample matrix. One MS/MSD sample will be obtained at a rate of 5 percent, or a fraction thereof, of the total number of samples collected per event. MS/MSD samples will be analyzed for the same constituent groups as the original sample. MS/MSD samples will be collected for both groundwater and soils. Ferrous iron samples in groundwater are field analyzed, therefore no MS/MSD samples will be performed for this constituent.

3.6 SAMPLE HANDLING AND SHIPPING

After collection, all samples will be placed in coolers with enough bagged ice to maintain an internal temperature of 4°C for the duration of the sampling and transportation to the laboratory. Samples will be delivered to Analytical Resources, Inc. (ARI) for analysis after each day of sampling following the procedures outlined in TP-1.2-23 of Section 21 of Golder (2008). ARI's address is given below.

Analytical Resources, Inc.
4611 South 134th Place
Suite 100
Tukwila, WA 98168
Contact: Ms. Kelly Bottem, (206) 695-6211

3.6.1 Sample Identification

All soil and groundwater samples collected will be assigned a unique identification code based on a consistent sample designation scheme. A sample tracking record will be kept as each sample is collected.

3.6.1.1 Monitoring Well Samples

Monitoring well soil and groundwater samples will be designated with unique alphanumeric sample identifiers (sample numbers) as follows:

2-31-PL2-507A-XX-Z-T(-X)

Where:

2-31	2-31 Area (project area)
PL2	Boeing Plant 2 monitoring well
507A	Specific well ID in the project area
Z	Media code: S = soil, W = water
XX	Top depth of sampler in ft. (soil only, not used for groundwater)

T	Sample type 0 = primary field sample, 1 = field duplicate, 2- trip blank, 3 = equipment blank, and 4 = co-located
X	In cases where a sample must be split in two to be collected over the course of two days, the second sample will be assigned the sample identifier of the first, with an "X" appended to end.

3.6.1.2 Probe Samples

Probe soil and groundwater samples will be designated with unique alphanumeric sample identifiers (sample numbers) as follows:

2-31-DP-YY-XX-Z-T(-X)

Where:

2-31	2-31 Area (project area)
DP	Sample collected from a direct-push sampling location
YY	Unique numeric location for a direct-push sampling location
XX	Top depth of sampler for soil or top of screened interval for groundwater
Z	Media code: S = soil, W = water
T	Sample type 0 = primary field sample, 1 = field duplicate, 2- trip blank, 3 = equipment blank, and 4 = co-located
X	In cases where a sample must be split in two to be collected over the course of two days, the second sample will be assigned the sample identifier of the first, with an "X" appended to end.

Sample numbers will be recorded in the field notebook, on sample container labels, and chain-of-custody forms. Other information recorded on the sample container label includes the following:

- Time and date of sample collection
- Initials of sampler(s)
- Laboratory analyses to be performed
- Preservatives used

More detailed information regarding sample labels, sample handling, chain-of-custody, custody seals, and sample shipping are documented in Technical Procedure TP1.2-20 in Section 21 of Golder (2008).

3.7 LABORATORY ANALYTICAL METHODS

Laboratory analytical methods for soil and groundwater samples collected for the 2-31 Area data gap investigation are listed in Tables 3-1.

In general, laboratory methods are selected based on:

- The media being sampled
- The constituent being analyzed
- The reporting limit necessary for comparison to constituent risk based screening level

Table 3-2 presents a list of constituents, which includes all of the soil and groundwater COCs that are commonly tested for at Boeing Pant 2 and the associated laboratory reporting limits. The laboratory reporting limits are compared to the lowest risk calculation or applicable background concentration (various metal concentrations in soil) to determine what analysis may be limiting evaluation of the site. Risk calculations were not completed for constituents that were never detected at the site or for constituents where USEPA or Ecology does not provide toxicological data necessary for the risk calculations (e.g., aluminum and iron).

Based on this analysis, as presented in Table 3-2, the laboratory reporting limit for PCBs (33 µg/kg) was the only set of reporting limits greater than the lowest associated risk based calculation for soil. This reporting limit is the same value as the PQL presented in the Technical Memorandum: *Appropriateness Evaluation Corrective Measure Study*, Boeing Plant 2, completed by Roy F. Weston in March 1999 (Weston, 1999b).

Groundwater reporting limits for arsenic (0.2 µg/L), cyanide (5.0 µg/L), PCBs (0.01 µg/L), various PAHs (0.1 µg/L) and bis(2-ethylhexyl)phthalate (3 µg/L) are greater than the respective lowest risk based calculation. Of these constituents, the arsenic, PCB, and bis(2-ethylhexyl)phthalate reporting limits are less than the Practical Quantitation Limits PQLs presented in the 1999 technical memorandum (Weston, 1999a). The arsenic reporting limit is also less than the expected background concentration for arsenic concentrations in groundwater; therefore, it is not expected to limit the utility of the analyses. The reporting limit used above is the standard reporting limit for PAHs using USEPA Method 8070 as modified for larger sample volumes and lower detection limits.

Table 3-1 lists the estimated number of samples collected for each analytical constituent group and the number of QC samples collected for each constituent group by media (soil or groundwater) along with sample handling, bottle type, preservation, and holding time requirements.

3.8 DECONTAMINATION PROCEDURES

Purging and sampling equipment that comes into direct contact with sample media, sample containers, or the inside of a probe or monitoring well will ideally be single-use disposable equipment that is replaced between each sampling event, or will be dedicated equipment, assigned to and used at only one well or probe location. If the sampling equipment is not single-use disposable equipment or dedicated equipment, it will be decontaminated between each sampling location using the procedures described in Section 3.8.1.

Drill augers and direct-push probe components will be decontaminated before use and between locations by hot water pressure washing or steam cleaning using potable water. Particulate

matters and surface film will be removed using a brush. Split-spoon samplers and other soil sampling devices will be decontaminated between sampling locations and intervals using the procedures summarized in Section 3.8.2.

3.8.1 Aqueous Sampling Equipment Decontamination

If non-dedicated multiple-use sampling equipment is used for groundwater sampling, it will be decontaminated before use and between each sample location according to the steps noted below. Examples of non-dedicated multiple-use groundwater sampling equipment include submersible pumps and bladder pumps. The steps for aqueous sampling equipment decontamination are as follows:

1. Wash in a solution of Liquinox™ (or equivalent) and potable tap water.
2. Rinse with potable tap water.
3. Rinse with distilled water.

3.8.2 Nonaqueous Sampling Equipment Decontamination

If non-dedicated multiple-use sampling equipment is used for soil sampling, it will be decontaminated before use and between each sample location and interval according to the steps noted below. Examples of non-dedicated, multiple-use soil sampling equipment include split-spoon samplers, sample catchers, scoops, spoons, and stainless steel bowls. The steps for non-aqueous sampling equipment decontamination are as follows:

1. Wash in solution of Liquinox™ (or equivalent) and potable tap water.
2. Rinse with potable tap water.
3. Rinse with 10 percent nitric acid (trace metal or higher grade HNO_3
4. Rinse with distilled water.

Note: If visual contamination persists, or gross contamination is suspected, the decontamination steps used for aqueous sampling equipment (Section 3.8.1) will be used.

Decontamination fluids generated onsite will be retained in U.S. Department of Transportation (USDOT)-approved steel drums, properly labeled and stored on-site pending characterization and disposal.

3.8.3 Decontamination of Workers and Personal Protective Equipment

It is anticipated that all work associated with monitoring well installation, direct push probing, soil sampling, and groundwater sampling at the 2-31 Area at Boeing Plant 2 will be conducted in modified Level D protection. Requirements for upgrading to Level C protection are outlined in the health and safety plan, which is provided in Attachment C.

Modified Level D protection includes the following components:

- Cotton or Tyvek™ coveralls
- Steel-toed, steel-shank rubber, or waterproof leather boots
- Safety glasses or equivalent
- Nitrile inner and outer gloves
- Hearing protection when appropriate (i.e., while drilling, probing or working around blowers, generators or other loud noises)
- Hard hat (when working around drilling rigs, probe rigs, or other heavy equipment)

After completion of each day's activities, personnel will wash and rinse their boots in a solution of Liquinox™ (or equivalent) and potable tap water followed by a tap water rinse. Boot wash containers will contain brushes to facilitate removal of soil and other contaminants. Following the boot wash station sampling personnel will remove their outer gloves, remove their boots, remove their coveralls, and then remove their inner gloves. Personnel will then wash their hands and faces with soap and water before eating or leaving the site.

Inner and outer gloves and Tyvek™ coveralls will be discarded as solid waste. Cotton coveralls will be laundered as needed or replaced if excessive contamination is suspected. Hard hats will be washed when visibly dirty or as necessary.

3.8.4 Decontamination of Sample Containers

All sample containers will be laboratory-prepared and pre-cleaned to standards, as required under USEPA SW846 protocols found in Section 4 of SW846.

3.9 DISPOSAL OF INVESTIGATION DERIVED WASTE

Drill cuttings, sample spoils, and other Investigation Derived Waste will be retained onsite in properly labeled DOT-approved steel drums pending characterization for disposal. Boeing will coordinate characterization of drum contents and disposal according to established procedures. Disposal of well development water and purge water will be coordinated with Boeing. Hazardous wastes are managed per the requirements in *Dangerous Wastes Regulations*, Chapter 173-303 WAC. Wastes are either manifested to a treatment, storage, and disposal (TSD) facility permitted to accept the material or treated onsite in Boeing's Clean Water Act-permitted Groundwater Treatment System. Toxic Substance Control Act (TSCA)-regulated PCB wastes are managed per the requirements in *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions*, 40 CFR 761. TSCA-regulated PCB wastes will be shipped to facilities meeting the requirements of 40 CFR 761.

3.10 QUALITY ASSURANCE PROJECT PLAN

Laboratory quality assurance procedures and requirements documented in the ARI Laboratory Quality Assurance Plan (ARI, 2008). Additional quality requirements are documented in the

QAPP provided in Attachment D which will be followed for the scopes of work related to well installation, soil, and groundwater sampling at the 2-31 Area.

3.11 DATA VALIDATION AND USABILITY

The data validation review of analytical data packages will consist of a Level I QC Review. If problems with the data are identified during the Level I review, a more thorough Level II QC Review will be conducted. Level I and Level II QC review requirements are outlined in the QAPP provided in Attachment D. QC review will include a review of laboratory reporting limits against risk levels for site-wide soil and groundwater COCs. Table 3-2 provides a summary of reporting limits compared to risk levels for site-wide soil and groundwater COCs.

3.12 HEALTH AND SAFETY PLAN

A copy of the Health and Safety Plan is included in Attachment C.

3.13 SCHEDULE AND DELIVERABLES

USEPA is reviewing this Work Plan in an expedited manner to facilitate an aggressive field schedule designed to collect data necessary for the CMS as quickly as possible. The following schedule and process is intended to support this aggressive schedule:

Task		Due Date
1.	2-31 Area Work Plan submitted to EPA	April 10, 2009
2.	Receive EPA approval	TBD
3.	Field Mobilization	To begin within 10 work days (2 weeks) after EPA Approval of Work Plan
4.	Completion of Sample Collection	35 work days (7 weeks) after field mobilization is completed
5.	Completion of sample analysis, data validation and database entry	70 work days (14 weeks) after completion of sampling
6.	Draft Data Gaps Report and Final 2-31 Area Work Plan (see below for content)	30 work days (6 weeks) after completion of Task 5.

Notes:

Task 1: The Work Plan for the 2-31 Area comprises Volume VIIIa of the Uplands CMS.

Task 6: The Draft Data Gaps Report for the 2-31 Area comprises Volume VIIIb of the Uplands CMS, which presents the results and findings of the Data Gap Investigation for the area. In addition, Volume VIIIb presents the revised list of soil and groundwater COCs, units, and groundwater plumes for the 2-31 Area that will be carried into the CMS for remedy selection (Volume VIIIc).

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4.0 References

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Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Tables

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Table 1-1 Previous Investigations
2-31 Area
Boeing Plant 2

Document Title	Date	Consultant
RCRA Facility Investigation – Phase 1A Completion Report Volume I Soil and Groundwater Presentation	December 1994	Roy F. Weston, Inc.
RCRA Facility Investigation – Phase 1A Completion Report Volume II Soil and Groundwater Presentation	December 1994	Roy F. Weston, Inc.
RCRA Facility Investigation Work Plan	November 1994	Roy F. Weston, Inc.
RCRA Facility Investigation – Soil Investigation Interim Report Volumes I to V	January 1996	Roy F. Weston, Inc.
RCRA Facility Investigation – Groundwater Investigation Interim Report Volumes I to IV	January 1996	Roy F. Weston, Inc.
RFI Health Evaluation for Upland Soil	May 1996	Roy F. Weston, Inc.
RCRA Facility Investigation Soil Investigation Interim Report	August 1997	Roy F. Weston, Inc.
RCRA Facility Investigation Groundwater Investigation Interim Report	August 1997	Roy F. Weston, Inc.
Comprehensive RCRA Facility Investigation Report	August 1998	Roy F. Weston, Inc.
RCRA Facility Investigation – Groundwater Human Health and Environmental Evaluation	August 1998	Roy F. Weston, Inc
Technical Memorandum Justification for No Further Action SWMUs/AOCs/OAs RCRA Corrective Measures Study	March 1999	Roy F. Weston, Inc.
Technical Memorandum Justification for No Further Action RCRA Corrective Measures Study	April 2000	Roy F. Weston, Inc.
Technical Memorandum SWMU/AOC/OA, Specific Data Presentation, RCRA Corrective Measures Study Volumes I, II, III	April 2000	Roy F. Weston, Inc.
Technical Memo – Direct Push Groundwater Sampling	March 2001	Roy F. Weston, Inc.
CMS Phase Quarterly Groundwater Monitoring Report – 1st Quarterly Event April/May 2001	August 2001	Roy F. Weston, Inc.
CMS Phase Quarterly Groundwater Monitoring Report – 2nd Quarterly Event July/August 2001	October 2001	Roy F. Weston, Inc.
Technical Memorandum Justification for No Further Action # 2 SWMUs/AOCs/OAs RCRA Corrective Measures Study	October 2001	Roy F. Weston, Inc.
CMS Phase Quarterly Groundwater Monitoring Report – 3rd Quarterly Event Oct/Nov 2001	January 2002	Roy F. Weston, Inc.

Table 1-1 Previous Investigations
2-31 Area
Boeing Plant 2

Document Title	Date	Consultant
CMS Phase Final Groundwater Monitoring Report – 4th Quarterly Event Jan/Feb 2002	March 2002	Roy F. Weston, Inc.
Draft Phase I Environmental Site Assessment Boeing Plant 2, 7755 East Marginal Way, Seattle, Washington	May 2002	Environmental Partners, Inc.
Upland Area Groundwater Sampling Report	December 2002	Roy F. Weston, Inc.
Treatment, Storage, and Disposal Facility Closure Certification	January 2003	Roy F. Weston, Inc.
Compendium of Sampling and Analysis Plans and Quality Assurance Plans for Boeing Plant 2, Seattle / Tukwila, Washington	July 2003	Golder Associates Inc.
Report of Boeing Plant 2 – Parcel Disposition Phase II Environmental Investigation for Boeing Plant 2, Seattle / Tukwila, Washington	July 2003	Golder Associates Inc.
Shoreline Well Sampling Data Validation QA/QC Review	September 2003	Weston Solutions, Inc.
Shoreline QA/QC Memo June 2003 Sampling Event	September 2003	Weston Solutions, Inc.
Shoreline QA/QC Memo June 2003 Sampling Event (Republished)	October 2003	Weston Solutions, Inc.
Shoreline Well Sampling Data Validation QA/QC Review	November 2003	Weston Solutions, Inc.
CMS Phase Shoreline Ground Water Monitoring Report, December 2003	March 2004	Environmental Partners, Inc.
CMS Phase Shoreline Ground Water Monitoring Report, February 2004	April 2004	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, May 2004	August 2004	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, August 2004	October 2004	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, November 2004	January 2005	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, February 2005	April 2005	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, May 2005	August 2005	Environmental Partners, Inc.

Table 1-1 Previous Investigations
2-31 Area
Boeing Plant 2

Document Title	Date	Consultant
CMS Phase Shoreline Groundwater Monitoring Report, August 2005	November 2005	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, November 2005	January 2006	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, February 2006	May 2006	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, May 2006	August 2006	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, August 2006	November 2006	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, November 2006	February 2007	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, February 2007	May 2007	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, May 2007	August 2007	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, August 2007	November 2007	Environmental Partners, Inc.
CMS Phase Shoreline Groundwater Monitoring Report, November 2007	February 2008	Environmental Partners, Inc.

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Table 1-2 Summary of Available Unit Information
2-31 Area
Boeing Plant 2

RCRA Unit	Unit Description	Years of Use	Function	Soil Samples	Groundwater Samples	Analytes
AOC 2-31.21	TCE Degreaser	1945 - 1995	Remove oil from metal parts	1994: Nine samples from three boreholes	1993 - 1996: 62 samples from six monitoring wells and ten Geoprobe locations	VOCs, TPH, and metals
SWMU 2-31.18	Area B Acid Waste Hold Tank	1960s - 1993	Containment of inorganic acids and metal-bearing solutions	1994: Five soil borings and four near-surface samples 2003: Samples collected from 5-15 ft bgs in three borings	2003: Samples collected from 13 ft bgs in three borings	VOCs, PCBs, SVOCs, and Inorganics
SWMU 2-31.26	Anodizing Tank Line	1979 - 1994	Used for cadmium-, chromium- and nickel-plating activities, as well as anodizing, alodining, cleaning and etching	1995: Samples from 9 and 12 ft bgs in two borings 2003: Samples from 6, 10, and 13 ft bgs in two borings	None	Inorganics
OA 17.4	Transformer Vault 4	1940s - 2002	Contained transformers and a sump to remove groundwater	Seven borings, two samples collected from each	9 samples collected from locations near unit	PCBs and TPH
SWMU 2-31.20	Deactivated Cyanide Hold Area	1941 - 1993	Used to store 5- to 900-gallon containers of cyanide waste	1994: Samples from one boring 2003: Samples collected from 8, 10, and 15 ft bgs in one boring	None	Inorganics
SWMU 2-31.22	Brush Plating Area	1984 - 1995	Manual cleaning, plating, anodizing and alodining of parts	1995: Samples from one boring 2003: Three samples from 5, 10, and 15 ft bgs in one boring	2003: Sample from one boring location	TPH, VOCs, Inorganics
SWMU 2-31.23	Ammonium Persulfate Tank		Storage of ammonium persulfate and sufuric acid	2003: Three soil samples from 5, 10, and 15 ft bgs at one boring location	2003: Sample from one boring location	Inorganics
SWMU 2-31.24	Sodium Hydroxide Developer Room	1982 - 1995	Used to spray developer and etchant onto electromagnetic pulse screens for military aircraft	None	None	None
SWMU 2-31.25	Anodize Aluminum Room	1980s - 1994	Plating and anodizing	None	None	None

Notes:

ft bgs	feet below ground surface
PCBs	Polychlorinated biphenyls
SVOCs	Semivolatile organic compounds
TPHs	Total petroleum hydrocarbons
VOCs	Volatile organic compounds

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Table 2-1 Screening Levels for Constituents of Concern
2-31 Area
Boeing Plant 2

CAS Number	Sitewide Constituent of Concern	Soil (see maximum detect units)								Groundwater (ug/L)					
		Sitewide Soil COC?	Area Soil COC?	Maximum Detect[1] in 2-31 Area		Minimum Screening Level	Direct Contact Screening Level	Air Screening Level	Surface Water Screening Level	Sitewide GW COC?	Area GW COC?	Maximum Detect[1] in 2-31 Area	Minimum Screening Level	Air Screening Level	Surface Water Screening Level
Metals															
7440-36-0	Antimony	X		7 U	mg/kg	4.64E+02	5.33E+02	- -	4.64E+02		Not a Site-Wide COC in Groundwater				
7440-38-2	Arsenic	X	X	**1.20E+01**	mg/kg	7.30E+00**	3.33E+01	3.22E+04	5.00E+00*	X	X	**5.20E+01**	8.00E+00**	- -	2.00E-01*
7440-43-9	Cadmium	X	X	**8.33E+01**	mg/kg	1.21E+00	6.67E+02	7.70E+04	1.21E+00	X		2 U	8.80E+00	- -	8.80E+00
18540-29-9	Chromium (VI)	X		1 UJH	mg/kg	1.92E+01	4.00E+03	1.06E+04	1.92E+01		Not a Site-Wide COC in Groundwater				
7440-50-8	Copper	X	X	**4.28E+02**	mg/kg	3.64E+01**	4.93E+04	- -	1.38E+00	X	X	**5.50E+01**	8.00E+00**	- -	3.10E+00
7439-92-1	Lead	X		1.08E+02	mg/kg	1.00E+03	1.00E+03	- -	1.62E+03	X		2.00E+00	8.10E+00	- -	8.10E+00
7439-96-5	Manganese	X		3.07E+02	mg/kg	1.15E+03**	1.87E+05	- -	1.30E+02	X		9.67E+02	2.00E+03**	- -	1.00E+02
7439-97-6	Mercury	X	X	**1.70E-01**	mg/kg	7.00E-02**	4.19E+01	2.57E+00	5.00E-02*	X	X	**1.00E-01**	2.50E-02	7.00E+01	2.50E-02
7440-02-0	Nickel (soluble salts)	X	X	**3.73E+02**	mg/kg	4.78E+01**	2.67E+04	- -	1.07E+01	X	X	**1.73E+01**	8.20E+00	- -	8.20E+00
7782-49-2	Selenium	X		6.00E+00	mg/kg	7.38E+00	6.67E+03	- -	7.38E+00	X		6.00E+01	7.10E+01	- -	7.10E+01
7440-22-4	Silver	X	X	**9.00E-01**	mg/kg	3.23E-01	6.67E+03	- -	3.23E-01	X		3 U	1.90E+00	- -	1.90E+00
7440-28-0	Thallium (soluble salts)	X		7 U	mg/kg	6.69E-01	8.64E+01	- -	6.69E-01	X		50 U	4.70E-01	- -	4.70E-01
7440-66-6	Zinc	X	X	**8.23E+02**	mg/kg	1.01E+02	4.00E+05	- -	1.01E+02	X		1.30E+01	8.10E+01	- -	8.10E+01
57-12-5	Cyanide	X	X	**3.10E-01**	mg/kg	2.02E-01	2.67E+04	- -	2.02E-01	X	X	**1.50E+01**	5.00E+00*	- -	5.00E+00*
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs)															
56-55-3	Benzo(a)anthracene	X	X	**5.70E+01**	µg/kg	4.19E+01	3.42E+03	- -	4.19E+01	X	X	**3.30E+00**	1.00E-01*	- -	1.00E-01*
205-99-2	Benzo(b)fluoranthene	X		3.60E+01	µg/kg	1.44E+02	3.42E+03	- -	1.44E+02	X	X	**8.50E-01**	1.00E-01*	- -	1.00E-01*
207-08-9	Benzo(k)fluoranthene	X		3.80E+01	µg/kg	1.44E+02	3.42E+03	- -	1.44E+02	X	X	**2.80E-01**	1.00E-01*	- -	1.00E-01*
50-32-8	Benzo(a)pyrene	X		5.70E+01	µg/kg	1.13E+02	3.42E+03	7.95E+07	1.13E+02	X	X	**1.50E+00**	1.00E-01*	- -	1.00E-01*
218-01-9	Chrysene	X	X	**6.80E+01**	µg/kg	4.66E+01	3.42E+03	- -	4.66E+01	X	X	**6.20E+00**	1.00E-01*	- -	1.00E-01*
53-70-3	Dibenz(a,h)anthracene	X		8.50E+00	µg/kg	2.10E+02	3.42E+03	- -	2.10E+02	X	X	**1.90E-01**	1.00E-01*	- -	1.00E-01*
105-67-9	2,4-Dimethylphenol	X		340 U	µg/kg	2.24E+03	1.33E+07	- -	2.24E+03	X		15 U	2.73E+02	- -	2.73E+02
131-11-3	Dimethylphthalate	X		110 U	µg/kg	1.69E+05	6.67E+08	- -	1.69E+05		Not a Site-Wide COC in Groundwater				
117-81-7	bis(2-Ethylhexyl)phthalate	X		4.90E+02	µg/kg	1.57E+03	1.79E+06	- -	1.57E+03	X	X	**4.00E+00**	3.00E+00*	- -	3.00E+00*
206-44-0	Fluoranthene	X		2.00E+02	µg/kg	4.40E+04	2.67E+07	- -	4.40E+04		Not a Site-Wide COC in Groundwater				
193-39-5	Indeno(1,2,3-cd)pyrene	X		3.30E+01	µg/kg	4.06E+02	3.42E+03	- -	4.06E+02	X	X	**2.90E-01**	1.00E-01*	- -	1.00E-01*
-	Aroclor 1016/1242	X		81 U	µg/kg	3.30E+01*	4.67E+04	- -	3.30E+01*	X		1 U	1.00E-02*	- -	1.00E-02*
12672-29-6	Aroclor 1248	X		81 U	µg/kg	3.30E+01*	- -	- -	3.30E+01*		Not a Site-Wide COC in Groundwater				
11097-69-1	Aroclor 1254	X	X	**3.90E+01**	µg/kg	3.30E+01*	1.33E+04	- -	3.30E+01*	X		1 U	1.00E-02*	- -	1.00E-02*
11096-82-5	Aroclor 1260	X	X	**1.30E+03**	µg/kg	3.30E+01*	- -	- -	3.30E+01*	X		1 U	1.00E-02*	- -	1.00E-02*
	Total PCBs	X	X	**1.30E+03**	µg/kg	3.30E+01*	- -	- -	3.30E+01*	X		2.1 U	1.00E-02*	- -	1.00E-02*
Volatile Organic Compounds (VOCs)															
71-43-2	Benzene	X		7.00E-01	µg/kg	2.53E+01	1.36E+06	4.22E+02	2.53E+01	X		5 U	4.48E+00	8.55E+02	4.48E+00
56-23-5	Carbon Tetrachloride			Not a Site-Wide COC in Soil						X		5 U	5.26E-01	8.00E+01	5.26E-01
108-90-7	Chlorobenzene	X		9.6 U	µg/kg	1.85E+03	2.91E+07	1.85E+03	1.40E+04		Not a Site-Wide COC in Groundwater				
74-87-3	Chloromethane			Not a Site-Wide COC in Soil						X		5 U	2.63E+01	1.89E+03	2.63E+01
104-51-8	n-Butylbenzene	X		19 U	µg/kg	4.64E+03	- -	4.64E+03	- -		Not a Site-Wide COC in Groundwater				
135-98-8	sec-Butylbenzene	X		9.6 U	µg/kg	7.86E+03	- -	7.86E+03	- -		Not a Site-Wide COC in Groundwater				
67-66-3	Chloroform	X		9.6 U	µg/kg	1.41E+02	7.03E+06	1.41E+02	2.98E+02		Not a Site-Wide COC in Groundwater				
75-35-4	1,1-Dichloroethene	X		9.6 U	µg/kg	2.73E+00	1.24E+05	6.40E+01	2.73E+00	X		5 U	3.82E-01	2.50E+01	3.82E-01
107-06-2	1,2-Dichloroethane			Not a Site-Wide COC in Soil						X		5 U	1.17E+01	1.43E+03	1.17E+01
156-59-2	cis-1,2-Dichloroethene	X		8.20E+01	µg/kg	7.94E+02	7.99E+06	7.94E+02	7.73E+03	X		2.00E+01	1.55E+03	1.51E+04	1.55E+03

Table 2-1 Screening Levels for Constituents of Concern
2-31 Area
Boeing Plant 2

CAS Number	Sitewide Constituent of Concern	Soil (see maximum detect units)								Groundwater (ug/L)					
		Sitewide Soil COC?	Area Soil COC?	Maximum Detect[1] in 2-31 Area		Minimum Screening Level	Direct Contact Screening Level	Air Screening Level	Surface Water Screening Level	Sitewide GW COC?	Area GW COC?	Maximum Detect[1] in 2-31 Area	Minimum Screening Level	Air Screening Level	Surface Water Screening Level
VOCs (cont'd)															
156-60-5	trans-1,2-Dichloroethene	X		2.70E+00	µg/kg	9.12E+03	1.31E+07	9.12E+03	5.43E+04		Not a Site-Wide COC in Groundwater				
100-41-4	Ethylbenzene	X		66 U	µg/kg	2.52E+03	1.45E+08	- -	1.81E+04	X		5 U	2.10E+03	- -	2.10E+03
98-82-8	Isopropylbenzene	X		9.6 U	µg/kg	5.01E+04	1.45E+08	5.01E+04	- -		Not a Site-Wide COC in Groundwater				
75-09-2	Methylene Chloride	X		5.70E+00	µg/kg	8.28E+02	9.94E+06	7.11E+03	8.28E+02	X		10 U	1.90E+02	3.42E+04	1.90E+02
91-20-3	Naphthalene	X		3.70E+02	µg/kg	4.04E+04	1.44E+07	4.04E+04	6.80E+04		Not a Site-Wide COC in Groundwater				
103-65-1	n-Propylbenzene	X		9.6 U	µg/kg	1.36E+04	- -	1.36E+04	- -		Not a Site-Wide COC in Groundwater				
79-34-5	1,1,2,2-Tetrachloroethane	X		9.6 U	µg/kg	7.19E+00	2.73E+05	5.09E+02	7.19E+00		Not a Site-Wide COC in Groundwater				
127-18-4	Tetrachloroethene	X		9.6 U	µg/kg	8.72E+00	1.07E+06	5.43E+02	8.72E+00	X		5 U	8.22E-01	3.65E+02	8.22E-01
108-88-3	Toluene	X		1.30E+01	µg/kg	1.90E+04	1.34E+08	- -	1.09E+05		Not a Site-Wide COC in Groundwater				
71-55-6	1,1,1-Trichloroethane	X		1.40E+00	µg/kg	2.78E+04	4.12E+08	- -	1.63E+06		Not a Site-Wide COC in Groundwater				
79-00-5	1,1,2-Trichloroethane	X		3.50E+00	µg/kg	2.78E+01	9.57E+05	4.63E+02	2.78E+01	X		5 U	5.00E+00	2.70E+03	5.00E+00
79-01-6	Trichloroethene	X	X	**1.60E+04**	µg/kg	2.00E+00	1.36E+05	2.90E+01	2.00E+00	X	X	**5.90E+02**	3.02E-01	3.30E+01	3.02E-01
95-63-6	1,2,4-Trimethylbenzene	X		9.6 U	µg/kg	4.13E+03	7.27E+07	4.13E+03	- -		Not a Site-Wide COC in Groundwater				
108-67-8	1,3,5-Trimethylbenzene	X		9.6 U	µg/kg	4.32E+03	7.27E+07	4.32E+03	- -		Not a Site-Wide COC in Groundwater				
75-01-4	Vinyl Chloride	X	X	**6.50E+01**	µg/kg	4.59E+00	4.97E+04	3.67E+02	4.59E+00	X	X	**7.40E+01**	7.31E-01	1.30E+02	7.31E-01
Total Petroleum Hydrocarbons (TPH)															
-	TPH (range not defined)	X		66	mg/kg	2.00E+03	2.00E+03			X		1000 U	5.00E+02	5.00E+02	
-	TPH - Gasoline Range	X		20 U	mg/kg	3.00E+01	3.00E+01			X		250 U	8.00E+02	800	
-	TPH - Diesel Range	X	X	**6.10E+03**	mg/kg	2.00E+03	2.00E+03			X	X	**7.00E+03**	5.00E+02	500	
-	TPH - Mineral Spirits Rang	X		**--**	--	2.00E+03	2.00E+03				Not a Site-Wide COC in Groundwater				
-	TPH - Oil and Grease	X		20 U	mg/kg	2.00E+03	2.00E+03			X	X	**2.30E+03**	5.00E+02	5.00E+02	
-	TPH - Oil Range	X		4.60E+02	mg/kg	2.00E+03	2.00E+03			X	X	**5.90E+02**	5.00E+02	5.00E+02	

Notes:

[1] In some cases, no detections were reported, therefore the maximum non-detect value is reported with a "U" qualifier (example: 1,1,2,2-Tetrachloroethane at 9.6 U µg/kg)

Bold indicates maximum detect exceeds minimum screening level.

All maximum detections for metals in groundwater represent dissolved metals.

Data qualifiers are defined in Attachment B, Table B-3 and Attachment A, Table A-3 .

- No CAS Number available.

- - Not calculated (generally, the exposure pathway is incomplete; refer to CMS Volume II for details).

* Screening level was adjusted to the reporting limit as referenced in Table 3-2.

** Screening level was adjusted to the background concentration.

COC Consituent of concern

N/A Not available or not analyzed

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Groundwater					Other Constituent Groups		Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total and Dissolved Metals	Total and WAD Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	Redox Parameters	
GROUNDWATER SAMPLING SUMMARY									
New Wells									
PL2-507B	35 - 45	●	●	●	●		●	●	Constituent list to match PL2-507A.
PL2-507C	75 - 85	●	●	●	●		●	●	Constituent list to match PL2-507A.
Existing Wells									
PL2-233A	10 - 25	●	●	●	●	●		●	PCBs not a GW COC for 2-31 Area. Analyze all 2-31 Area COCs.
PL2-501A	10 - 20	●		●	●			●	Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list. PCBs not a GW COC for 2-31 Area. SVOCs and TPH ND near well. Cyanide detected in the A-level near well.
PL2-501B	40 - 50	●		●	●			●	PCBs not a GW COC for 2-31 Area. SVOCs and TPH ND in A-level near well. Cyanide detected in the A-level near well.
PL2-501C	68 - 78	●		●				●	PCBs not a GW COC for 2-31 Area. SVOCs and TPH ND in A-level near well. Cyanide will be analyzed at a later time if detected > SL in the B-level.
PL2-502A	8 - 18	●	●	●	●	●	●	●	Evaluate the soil to groundwater pathway for selected soil COCs from the metals and SVOC analyte lists and PCBs. Cyanide detected near well. TPH never analyzed at or near well.
PL2-503A	7 - 17.5	●	●	●		●		●	PCBs not a GW COC for 2-31 Area. SVOCs detected near well. Cyanide ND near well. TPH detected in samples from well.
PL2-504A	4.2 - 14.7	●	●	●		●		●	PCBs not a GW COC for 2-31 Area. SVOCs detected near well. Cyanide ND near well. TPH detected in samples from well.
PL2-505A	9 - 24.5	●	●	●		●		●	PCBs not a GW COC for 2-31 Area. SVOCs detected near well. Cyanide ND near well. TPH detected in samples from well.
PL2-507A	8 - 18	●	●	●	●		●	●	Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and PCBs. SVOCs and TPH ND near well.
PL2-508A	9 - 19	Not Sampled							Redundant sampling location with PL2-509A.
PL2-509A	8 - 18	●	●	●	●	●		●	Evaluate the soil to groundwater pathway for selected soil COCs from the metals and SVOC analyte lists and cyanide. PCBs not a GW COC for 2-31 Area. TPH not analyzed near well.
PL2-509B	40 - 50	●		●	●			●	PCBs not a GW COC for 2-31 Area. SVOCs and TPH ND in A-level near well. Cyanide detected in the A-level near well.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Groundwater					Other Constituent Groups		Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total and Dissolved Metals	Total and WAD Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	Redox Parameters	
GROUNDWATER SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-01	10 - 14	•		•		•			Evaluate the soil to groundwater pathway for TPH.
2-31-DP-02	10 - 14 40 - 44	•	•	•	•	•			Evaluate GW quality at former PL2-506A location. SVOCs detected near probe location. TPH detected in sample from PL2-506A.
2-31-DP-03	10 - 14 40 - 44	•		•	•				Near PL2-509A to determine the lateral extent of VOC impacts from AOC 2-31.21. Evaluate the soil to groundwater pathway for selected soil COCs from the metals and VOC analyte lists and cyanide.
2-31-DP-04	10 - 14 40 - 44	•		•	•				Near PL2-509A to determine the lateral extent of VOC impacts from AOC 2-31.21. Cyanide detected nearby. Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list.
2-31-DP-05	10 - 14 40 - 44	•		•	•		•		Downgradient of PL2-501A to determine extent of VOC impacts from AOC 2-31.21. Cyanide detected nearby. Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-06	10 - 14 40 - 44	•		•	•				Downgradient of PL2-501A to determine extent of VOC impacts from AOC 2-31.21. Cyanide detected nearby.
2-31-DP-07	10 - 14 40 - 44	•		•	•				Downgradient of PL2-501A to determine extent of VOC impacts from AOC 2-31.21. Cyanide detected nearby.
2-31-DP-08	10 - 14 40 - 44	•		•					Downgradient of PL2-502A to determine extent of VOC impacts from AOC 2-31.21.
2-31-DP-09	10 - 14 40 - 44	•		•					Downgradient of PL2-502A to determine extent of VOC impacts from AOC 2-31.21.
2-31-DP-10	10 - 14 40 - 44	•		•					Downgradient of PL2-502A to determine extent of VOC impacts from AOC 2-31.21.
2-31-DP-11	10 - 14 40 - 44	•		•					Downgradient of PL2-502A to determine extent of VOC impacts from AOC 2-31.21.
2-31-DP-12	10 - 14 40 - 44	•		•	•				Evaluate TCE release downgradient of AOC 2-31.21. Probe data from 1995 and 2002 indicate VOCs in this area. Cyanide detected nearby.
2-31-DP-13	10 - 14	•	•	•	•		•		Evaluate the soil to groundwater pathway for selected soil COCs from the SVOC analyte list and cyanide and PCBs.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Groundwater					Other Constituent Groups		Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total and Dissolved Metals	Total and WAD Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	Redox Parameters	
GROUNDWATER SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-14	10 - 14	•	•	•	•		•		Evaluate the soil to groundwater pathway for selected soil COCs from the SVOC analyte list and cyanide and PCBs.
2-31-DP-15	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-16	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-17	10 - 14	•	•	•	•		•		Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide.
2-31-DP-18	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-19	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-20	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-21	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-22	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-23	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-24	10 - 14	•		•	•				Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide.
2-31-DP-25	10 - 14	•		•	•				Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide.
2-31-DP-26	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals and VOC analyte lists.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Groundwater					Other Constituent Groups		Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total and Dissolved Metals	Total and WAD Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	Redox Parameters	
GROUNDWATER SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-27	10 - 14	•		•	•				Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide.
2-31-DP-28	10 - 14	•		•	•		•		Evaluate the soil to groundwater pathway for selected soil COCs from the metals and VOC analyte lists and cyanide and PCBs.
2-31-DP-29	10 - 14	•		•	•	•			Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide and TPH.
2-31-DP-30	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-31	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list and PCBs.
2-31-DP-32	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list.
2-31-DP-33	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list.
2-31-DP-34	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-35	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-36	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and PCBs.
2-31-DP-37	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and PCBs.
2-31-DP-38	10 - 14	•	•	•			•		Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and PCBs.
2-31-DP-39	10 - 14 40 - 44 C-level (top of silt)	•	•	•	•	•	•	•	Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and PCBs. Evaluate the potential for chlorinated VOCs at depth. Match analyses for PL2-502A.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Groundwater					Other Constituent Groups		Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total and Dissolved Metals	Total and WAD Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	Redox Parameters	
GROUNDWATER SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-40	10 - 14	•	•	•					Constituent list to match groundwater list. Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-41	10 - 14	•	•	•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals and SVOC analyte lists.
2-31-DP-42	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list.
2-31-DP-43	10 - 14	•		•					Evaluate the soil to groundwater pathway for selected soil COCs from the VOC analyte list.
2-31-DP-44	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-45	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-46	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-47	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.
2-31-DP-48	10 - 14	•		•	•				Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide.
2-31-DP-49	10 - 14	•		•	•	•			Evaluate the soil to groundwater pathway for selected soil COCs from the metals analyte list and cyanide and TPH.
2-31-DP-50	10 - 14	•		•			•		Evaluate the soil to groundwater pathway for PCBs.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Soil						Other	Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total Metals	Total Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	TOC	
SOIL SAMPLING SUMMARY									
New Wells									
PL2-507B	0 to 1 4 to 5 9 to 10	•	•	•	•		•		Constituent list to match groundwater at PL2-507A. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
PL2-507C	0 to 1 4 to 5 9 to 10	•	•	•	•		•		Constituent list to match groundwater at PL2-507A. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
Direct Push Locations									
2-31-DP-01	0 to 1 4 to 5 9 to 10	•		•		•			Constituent list to match groundwater at this location. Evaluate extent of TPH in soil.
2-31-DP-02	0 to 1 4 to 5 9 to 10	•	•	•	•	•			Constituent list to match groundwater at this location.
2-31-DP-03	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list. Verify cyanide non-detect associated with elevated RLs.
2-31-DP-04	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater at this location.
2-31-DP-05	0 to 1 4 to 5 9 to 10	•		•	•		•		Constituent list to match groundwater at this location. Verify PCB non-detect associated with elevated RLs.
2-31-DP-06	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater at this location.
2-31-DP-07	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater at this location.
2-31-DP-08	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater at this location.
2-31-DP-09	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater at this location.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Soil						Other	Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total Metals	Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	TOC	
SOIL SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-10	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater at this location.
2-31-DP-11	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater at this location.
2-31-DP-12	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater at this location.
2-31-DP-13	0 to 1 4 to 5 9 to 10	•	•	•	•		•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the SVOC analyte list and cyanide and PCBs.
2-31-DP-14	0 to 1 4 to 5 9 to 10	•	•	•	•		•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the SVOC analyte list and cyanide and PCBs.
2-31-DP-15	9 to10 In Tunnel K	•		•			•		Verify PCB non-detect associated with elevated RLs. Placement of location is respective of building limitations and proximity of functioning professional office space. Groundwater will be sampled to support the pathway evaluation for silver.
2-31-DP-16	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-17	0 to 1 4 to 5 9 to 10	•	•	•	•		•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list and cyanide.
2-31-DP-18	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-19	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-20	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Soil						Other	Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total Metals	Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	TOC	
SOIL SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-21	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-22	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-23	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-24	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list. Verify cyanide non-detect associate with elevated RLs.
2-31-DP-25	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater list at this location. Verify cyanide non-detect associated with elevated RLs.
2-31-DP-26	0 to 1 4 to 5 9 to 10	•		•					Evaluate extent of selected soil COCs from the VOC analyte list. Placement of location is respective of building limitations and proximity of functioning professional office space.
2-31-DP-27	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list. Verify cyanide non-detect associated with elevated RLs.
2-31-DP-28	0 to 1 4 to 5 9 to 10	•		•	•		•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list. Verify cyanide and PCB non-detect associated with elevated RLs.
2-31-DP-29	0 to 1 4 to 5 9 to 10	•		•	•	•			Constituent list to match groundwater list at this location. Verify cyanide non-detect associated with elevated RLs. Evaluate extent of TPH in soil.
2-31-DP-30	9 to10 In Tunnel K	•		•			•		Verify PCB non-detect associated with elevated RLs. Placement of location is respective of building limitations and proximity of functioning professional office space. Groundwater will be sampled to support the pathway evaluation for silver.
2-31-DP-31	0 to 1 4 to 5 9 to 10	•		•			•		Verify PCB non-detect associated with elevated RLs.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Soil						Other	Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total Metals	Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	TOC	
SOIL SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-32	0 to 1 4 to 5 9 to 10	•		•					Evaluate extent of selected soil COCs from the VOC analyte list.
2-31-DP-33	0 to 1 4 to 5 9 to 10	•		•					Evaluate extent of selected soil COCs from the VOC analyte list.
2-31-DP-34	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-35	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.
2-31-DP-36	0 to 1 4 to 5 9 to 10	•		•			•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
2-31-DP-37	0 to 1 4 to 5 9 to 10	•		•			•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
2-31-DP-38	0 to 1 4 to 5 9 to 10	•	•	•			•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
2-31-DP-39	0 to 1 4 to 5 9 to 10	•	•	•			•		Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list and PCBs.
2-31-DP-40	0 to 1 4 to 5 9 to 10	•	•	•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals and SVOC analyte lists.
2-31-DP-41	0 to 1 4 to 5 9 to 10	•	•	•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals and SVOC analyte lists.
2-31-DP-42	0 to 1 4 to 5 9 to 10	•		•					Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list.

Table 2-2
2-31 Area Proposed CMS Data Gaps Sampling
Boeing Plant 2

Location	Sample Interval (ft bgs)	Constituent Groups with 2-31 Area COCs in Soil						Other	Rationale for Selection of Laboratory Analyses
		VOCs	SVOCs (cPAHs)	Total Metals	Cyanide	TPH-G, TPH-Dx, TPH-O	PCBs	TOC	
SOIL SAMPLING SUMMARY									
Direct Push Locations									
2-31-DP-43	0 to 1 4 to 5 9 to 10	•		•					Evaluate extent of selected soil COCs from the VOC analyte list.
2-31-DP-44	0 to 1 4 to 5 9 to 10	•		•			•		Evaluate extent of PCBs in soil.
2-31-DP-45	0 to 1 4 to 5 9 to 10	•		•			•		Evaluate extent of PCBs in soil.
2-31-DP-46	0 to 1 4 to 5 9 to 10	•		•			•		Evaluate extent of PCBs in soil.
2-31-DP-47	0 to 1 4 to 5 9 to 10	•		•			•		Verify PCB non-detect associated with elevated RLs. Placement of location is respective of building limitations and proximity of functioning professional office space. Groundwater will be sampled to support the pathway evaluation for silver.
2-31-DP-48	0 to 1 4 to 5 9 to 10	•		•	•				Constituent list to match groundwater list at this location. Evaluate extent of selected soil COCs from the metals analyte list. Verify cyanide non-detect associated with elevated RLs.
2-31-DP-49	0 to 1 4 to 5 9 to 10	•		•	•	•			Constituent list to match groundwater list at this location. Verify cyanide non-detect associated with elevated RLs. Evaluate extent of TPH in soil.
2-31-DP-50	0 to 1 4 to 5 9 to 10	•		•			•		Verify PCB non-detect associated with elevated RLs.

Notes:

`	Not applicable
PCBs	Polychlorinated biphenyls
SVOCs	Semivolatile organic compounds
TPH	Total petroleum hydrocarbon
VOCs	Volatile organic compounds
Note on sample intervals	For existing wells, sample interval is the installed screen interval. For new wells, sample interval is the planned approximate screened interval. For soil samples, sample interval is the planned sampling depth.

Table 2-3 Area Locations of Constituents of Concern Detected at Concentrations Greater than Screening Levels in Groundwater
2-31 Area
Boeing Plant 2

CAS Number	Constituent of Concern	Range of Detects above Screening Levels (µg/L)	RCRA Unit Potentially Associated with COC Detection at Concentrations Greater than Screening Levels							Non-RCRA Areas
			SWMU 2-31.22 Brush Plating Area	SWMU 2-31.23 Amonium Persulfate Tank	SWMU 2-31.36 Anodizing Tank Line	SWMU 2-31.25 Anodize Aluminum Room	AO-17.8 Tranformer Vaults	AOC 2-31.21 TCE Degreaser	SWMU 2-31.18 Area B Acid Waste Hold Tank	COC Detect Not Associated with a RCRA Unit
Metals and Cyanide										
7440-38-2	Arsenic	9 to 52	Max	X	X	X	X			X
7440-50-8	Copper	11.1 to 55	Max	X						X
7439-97-6	Mercury	0.00104 to 0.1	Max	X						X
7440-02-0	Nickel (soluble salts)	17.3								Max
57-12-5	Cyanide	15								Max
Semivolatile Organic Compounds (SVOCs)										
56-55-3	Benzo(a)anthracene	1.4 and 3.3								Max
50-32-8	Benzo(a)pyrene	0.81 and 1.5								Max
205-99-2	Benzo(b)fluoranthene	0.61 and 0.85								Max
207-08-9	Benzo(k)fluoranthene	0.28								Max
117-81-7	bis(2-Ethylhexyl)phthalate	4								Max
218-01-9	Chrysene	2.3 and 6.2								Max
53-70-3	Dibenz(a,h)anthracene	0.19								Max
193-39-5	Indeno(1,2,3-cd)pyrene	0.29								Max
VOCs										
79-01-6	Trichloroethene	1.2 to 590						Max	X	
75-01-4	Vinyl Chloride	0.81 to 74						Max	X	
Petroleum Hydrocarbons										
-	TPH-Diesel Range	2200 to 7000								Max
-	TPH-Motor Oil Range	590								Max
-	TPH- Oil and Grease	700 to 2300								Max

NOTES:

X = COC detected at concentrations greater than screening levels in this area

Max = Maximum COC detection noted at this unit

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Table 2-4 Locations of COCs Detected Above Screening Levels in Soil
2-31 Area
Boeing Plant 2

CAS Number	Constituent of Concern	Range of Detects Above Soil Screening Levels Protective of Surface Water and/or Direct Contact	RCRA Units									Non-RCRA Units											
			SWMU 2-31.18 Area B Acid Waste Hold Tank	SWMU 2-31.20 Deactivated Cyanide Hold Area	SWMU 2-31.22 Brush Plating Area	SWMU 2-31.23 Ammonium Persulfate Tank	SWMU 2-31.24 Sodium Hydroxide Developer Room	SWMU 2-31.25 Anodize Aluminum Room	SWMU 2-31.26 Anodizing Tank Line	AOC 2-31.21 TCE Degreaser	OA 17.4 Transformer Vault 4	AST APL-042	USTs PL 12 & PL 13	UST PL 14	UST PL 15	UST PL 29	UST PL 36	UST PL 39	UST PL 40	UST PL 56	UST PL 57	UST PL 65	100-Gallon TCE Release
Metals and Cyanide (mg/kg)																							
7440-38-2	Arsenic	8 - 12	Max																				
7440-43-9	Cadmium	1.3 - 83.3	Max																		X		
7440-50-8	Copper	40.1 - 428	Max		X																		
7439-97-6	Mercury	0.1 - 0.17	Max		X	X						X											
7440-02-0	Nickel	130 - 373	Max																				
7440-22-4	Silver	0.6 - 0.9	Max		X																		
7440-66-6	Zinc	110 - 823	Max																		X		
57-12-5	Cyanide	0.31																					
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs), (µg/kg)																							
56-55-3	Benzo(a)anthracene	42 - 57	X																				
218-01-9	Chrysene	68																					
11097-69-1	Aroclor 1254	39																					
11096-82-5	Aroclor 1260	66 - 1300	Max																				
1336-36-3	Total PCB	39 - 1300	Max																				
Volatile Organic Compounds (VOCs), (µg/kg)																							
79-01-6	Trichloroethene	7.6 - 16000								Max									X				
75-01-4	Vinyl Chloride	5.1 - 65			X					Max													
Petroleum Hydrocarbons (TPH)																							
68334-30-5	TPH - Diesel Range	2700 - 6100															Max						

Notes:

a	COC unit or area association is based on concentrations being exhibited above the Puget Sound Basin Ecology (1994) calculated background concentration.
X	COC detected above screening levels
Max	Maximum COC detection noted at this unit
*	COC status is based solely on preliminary soil to air pathway screening level. An air pathway evaluation will be performed in the addendum to the work plan.

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Table 3-1 Laboratory Methods and Sample Requirements
2-31 Area
Boeing Plant 2

Constituent Group	Method	Estimated Number of Samples[4]	Containers per Sample	Handling & Preservation	Holding Time
Soil Samples					
VOCs	5035 (sampling) USEPA 8260B (analysis)	146 field samples, 15 co-located samples 2 equipment blanks (water), 8 MS, 8 MSD, 2 trip blank per cooler (163 total)	(3) 40 mL VOA vials, (1) 2-oz wide-mouth jar for percent solids	(1) with methanol* (2) with sodium bisulfate* Stored at 4°C	14 days
Metals[1]	USEPA 200.8 3500, 6010- and 7000-Series	146 field samples, 2 equipment blanks (water), 8 MS, 8 MSD (148 total)	4-oz wide-mouth jar[2]	Stored at 4°C	6 months 28 days for mercury
Cyanide	SW-846 9010c MOD with midi distillation. Analysis by USEPA 335.4 Mod	37 field samples, 2 equipment blanks (water), 3 MS, 3 MSD (39 total)	4-oz wide-mouth jar[2]	Stored at 4°C	14 days
Gasoline-range Petroleum Hydrocarbons	5035 (sampling) NWTPH-Gx (analysis)	12 field samples, 2 equipment blanks (water), 1 MS, 1 MSD (14 total)	(2) 40 mL VOA vials, (1) 2-oz wide-mouth jar for percent solids[2]	(2) with methanol* Stored at 4°C	14 days
Diesel-range Petroleum Hydrocarbons	NWTPH-Dx with silica jel cleanup	12 field samples, 2 equipment blanks (water), 1 MS, 1 MSD, 1 trip blank vial per cooler (14 total)	4-oz wide-mouth jar[2]	Stored at 4°C	14 days to extract 40 days to analyze extracts
SVOCs and SIM PAHs	USEPA 8270D and 8270 sim	30 field samples, 2 equipment blanks (water), 1 MS, 1 MSD (32 total)	8-oz wide-mouth jar[2]	Stored at 4°C	14 days to extract 40 days to analyze extracts

Table 3-1 Laboratory Methods and Sample Requirements
2-31 Area
Boeing Plant 2

Constituent Group	Method	Estimated Number of Samples[4]	Containers per Sample	Handling & Preservation	Holding Time
Soil Samples Continued					
PCBs	USEPA 8082	37 field samples, 2 equipment blanks (water), 2 MS, 2 MSD (39 total)	4-oz wide-mouth jar[2]	Stored at 4°C	14 days (40 days to analyze extract)
Groundwater Samples					
VOCs	USEPA 8260B	76 field samples, 8 duplicates, 4 MS, 4 MSD, 2 trip blank vials per cooler, (84 total)	Three 40-mL vials	Preserved with HCl to pH less than 2.0* No headspace Stored at 4°C, If vials with HCl preservative effervesce with water VOC samples will be submitted unpreserved	14 days (preserved) 7 days (unpreserved)
Dissolved Metals[1] (wells and probes)	USEPA 200.8, 3500, 6010- and 7000-Series	76 field samples, 8 duplicates, 4 MS, 4 MSD (84 total)	One 1-liter HDPE bottle and one 500mL HDPE for LL Hg	Filtered Preserved with HNO_3 * Stored at 4°C	6 months 28 days for mercury
Total Metals[1] (wells only)	USEPA 200.8, 3500, 6010- and 7000-Series	13 field samples, 1 duplicate, 1 MS, 1 MSD (14 total)	One 1-liter HDPE bottle and one 500 mL HDPE for LL Hg	Preserved with HNO_3 * Stored at 4°C	6 months 28 days for mercury

Table 3-1 Laboratory Methods and Sample Requirements
2-31 Area
Boeing Plant 2

Constituent Group	Method	Estimated Number of Samples[4]	Containers per Sample	Handling & Preservation	Holding Time
Groundwater Samples Continued					
Total Cyanide WAD Cyanide	USEPA 335.4 Mod SM 4500 CN	36 field samples, 4 duplicates, 2 MS, 2 MSD (40 total)	One 500-mL HDPE bottle	Field or lab test for residual chlorine and sulfide[3] NaOH to pH of 12 Stored at 4°C	14 days (preserved) 48 hours (unpreserved)
Diesel Range Petroleum Hydrocarbons	NWTPH-Dx with silica gel cleanup	14 field samples, 1 duplicate, 1 MS, 1 MSD (15 total)	Two 500-mL amber glass bottles	Stored at 4°C	7 days to extract 40 days to analyze extracts
Gasoline Range Petroleum Hydrocarbons	NWTPH-Gx	14 field samples, 1 duplicate, 1 trip blank vial per cooler, 1 MS, 1 MSD (15 total)	Two 40-mL vials	Preserved with HCl to pH less than 2.0* No headspace Stored at 4°C If vials with HCl preservative effervesce with water gasoline samples will be submitted unpreserved	14 days (preserved) 7 days (unpreserved)
SVOCs and SIM PAHs	USEPA 8270D and 8270 SIM	19 field samples, 2 duplicates, 1 MS, 1 MSD, (21 total)	Four 500-mL amber glass bottles (2) per analysis	Stored at 4°C	14 days to extract 40 days to analyze extracts
PCBs low level	USEPA 8082	23 field samples, 2 duplicates, 1 MS, 1 MSD (25 total)	Two 1-liter amber glass bottles	Stored at 4°C	7 days (40 days for extract)

Table 3-1 Laboratory Methods and Sample Requirements
2-31 Area
Boeing Plant 2

Constituent Group	Method	Estimated Number of Samples[4]	Containers per Sample	Handling & Preservation	Holding Time
Groundwater Samples Continued					
TDS	USEPA 160.1	16 field samples, 2 duplicates (18 total)	One 1-liter HDPE bottle	Stored at 4°C	7 days
Density	Standard Methods	16 field samples, 2 duplicates (18 total)	One 1-liter HDPE bottle	Stored at 4°C	7 days
Redox Parameters: Nitrate, Nitrite, Sulfate,	Various methods including USEPA 300-series	16 field samples, 2 field duplicates, 1 MS, 1 MSD (18 total)	One 500 mL HDPE bottle	Stored at 4°C	48 hours for nitrate, nitrite 28 days for sulfate
Ammonia	USEPA 350.1	16 field samples, 2 field duplicates, 1 MS, 1 MSD (18 total)	One 500 mL HDPE bottle	Preserved with H_2SO_4* to pH of < 2 Stored at 4°C	28 days
Ferrous Iron	Hach Kit or equivalent	16 field samples, 2 field duplicates, (18 total)	Analysis performed in the field	Analysis performed in the field	Analysis performed in the field
Sulfide	376.2	16 field samples, 2 field duplicates, 1 MS, 1 MSD (18 total)	One 500-mL HDPE bottle	Preserved with NaOH to pH greater than 9, Zinc Acetate (2N 4 drops/100 mL), no headspace Stored at 4°C	7 days

Table 3-1 Laboratory Methods and Sample Requirements
2-31 Area
Boeing Plant 2

Constituent Group	Method	Estimated Number of Samples[4]	Containers per Sample	Handling & Preservation	Holding Time
Groundwater Samples Continued					
Total Organic Carbon	USEPA 415.1	16 field samples, 2 field duplicates, 1 MS, 1 MSD (18 total)	250-mL amber glass bottle	Preserved with H_2SO_4* to pH of < 2 Stored at 4°C	28 days

Notes:

*	Sample containers provided by the laboratory are pre-preserved.
MS	Matrix spike
MSD	Matrix spike duplicate
PCBs	Polychlorinated biphenyls
SVOCs	Semivolatile organic compounds
TOC	Total organic carbon
VOCs	Volatile organic compounds, Co-located samples will be collected at a rate of 10 % for soil VOC samples
1	Metals analysis to include all Plant 2 site-wide groundwater and soil constituents of concern
2	When both SVOCs and PCBs are to be analyzed a single 8-oz wide-mouth jar may be collected and submitted for analysis. When sample volume is limited (for any analyses) the field team may consult with the lab in order to minimize or combine sample jars
3	Remove residual chlorine with 0.6 grams of ascorbic acid. Test for sulfide using lead acetate paper. If sulfide is present, remove with cadmium nitrate powder until a lead acetate paper spot test is negative. If sulfide is removed, field filter sample using a 0.45μm filter prior to pH adjustment.
4	Trip blanks and MS/MSD samples are not included in estimated number of samples

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Table 3-2 Reporting Limits Compared to Screening Levels for Sitewide Constituents of Concern
2-31 Area
Boeing Plant 2

		Soil (refer to Laboratory RL Units)										Groundwater (µg/L)						
CAS Number	Analytes	Analytical Method	Laboratory RL		Sitewide Soil COC	2-31 Area Soil COC	Background (Metals)	Minimum Calculated Soil Screening Level	Direct Contact Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level	Analytical Method	Laboratory RL	Sitewide Groundwater COC	2-31 Area Groundwater COC	Minimum Calculated Groundwater Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level
Metals and Cyanide																		
7429-90-5	Aluminum	6010	5.0	mg/kg			*	- -	- -	- -	- -	6010	50.0			- -	- -	- -
7440-36-0	Antimony	6010	5.0	mg/kg	X		*	4.64E+02	5.33E+02	- -	4.64E+02	6010	50.0			5.13E+02	- -	5.13E+02
7440-38-2	**Arsenic**	6010	**5.0**	mg/kg	X	X	7.3	1.13E-02	3.33E+01	3.22E+04	1.13E-02	200.8	**0.2**	X	X	1.94E-02	- -	1.94E-02
7440-39-3	Barium	6010	0.3	mg/kg			*	9.33E+04	9.33E+04	4.62E+05	- -	6010	3.0			- -	- -	- -
7440-41-7	Beryllium	6010	0.1	mg/kg			*	2.22E+02	2.67E+03	2.64E+04	2.22E+02	6010	1.0			1.35E+02	- -	1.35E+02
7440-43-9	Cadmium	6010	0.2	mg/kg	X	X	1	1.21E+00	6.67E+02	7.70E+04	1.21E+00	6010	2.0	X		8.80E+00	- -	8.80E+00
16065-83-1	Chromium (III)			mg/kg			*	- -	2.00E+06	- -	- -					8.82E+04	- -	8.82E+04
18540-29-9	Chromium (VI)	3500	0.2	mg/kg	X		*	1.92E+01	4.00E+03	1.06E+04	1.92E+01	3500	10.0			5.00E+01	- -	5.00E+01
7440-47-3	Chromium (Total)	6010	0.5	mg/kg			*	- -	- -	- -	- -	6010	5.0			- -	- -	- -
7440-48-4	Cobalt	6010	0.3	mg/kg			*	- -	- -	- -	- -	6010	3.0			- -	- -	- -
7440-50-8	Copper	6010	0.2	mg/kg	X	X	36	1.38E+00	4.93E+04	- -	1.38E+00	200.8	0.5	X	X	3.10E+00	- -	3.10E+00
7439-89-6	Iron	6010	5.0	mg/kg			*	- -	- -	- -	- -	6010	50.0			- -	- -	- -
7439-92-1	Lead	6010	2.0	mg/kg	X		24	1.00E+03	1.00E+03	- -	1.62E+03	200.8	1.0	X		8.10E+00	- -	8.10E+00
7439-95-4	Magnesium	6010	5.0	mg/kg			*	- -	- -	- -	- -	6010	50.0			- -	- -	- -
7439-96-5	Manganese	6010	0.1	mg/kg	X		1,146	1.30E+02	1.87E+05	- -	1.30E+02	6010	1.0	X		1.00E+02	- -	1.00E+02
7439-97-6	**Mercury**	7471	**0.05**	mg/kg	X	X	0.07	2.61E-02	4.19E+01	2.57E+00	2.61E-02	1631	0.03	X	X	2.50E-02	7.00E+01	2.50E-02
7439-98-7	Molybdenum	6010	0.5	mg/kg			*	6.67E+03	6.67E+03	- -	- -	6010	5.0			- -	- -	- -
7440-02-0	Nickel (soluble salts)	6010	1.0	mg/kg	X	X	48	1.07E+01	2.67E+04	- -	1.07E+01	200.8	0.5	X	X	8.20E+00	- -	8.20E+00
7782-49-2	Selenium	6010	5.0	mg/kg	X		*	7.38E+00	6.67E+03	- -	7.38E+00	6010	50.0	X		7.10E+01	- -	7.10E+01
7440-22-4	Silver	6010	0.3	mg/kg	X	X	*	3.23E-01	6.67E+03	- -	3.23E-01	200.8	0.5	X		1.90E+00	- -	1.90E+00
7440-28-0	Thallium (soluble salts)	200.8	0.2	mg/kg	X		*	6.69E-01	8.64E+01	- -	6.69E-01	200.8	0.2	X		4.70E-01	- -	4.70E-01
7440-31-5	Tin	6010	1.0	mg/kg			*	- -	8.00E+05	- -	- -	6010	10.0			- -	- -	- -
7440-62-2	Vanadium	6010	0.3	mg/kg			*	9.33E+03	9.33E+03	- -	5.61E+04	6010	3.0			2.81E+03	- -	2.81E+03
7440-66-6	Zinc	6010	0.6	mg/kg	X	X	85	1.01E+02	4.00E+05	- -	1.01E+02	6010	6.0	X		8.10E+01	- -	8.10E+01
57-12-5	**Cyanide**	335.2	0.1	mg/kg	X	X	*	2.02E-01	2.67E+04	- -	2.02E-01	335.2	**5.0**	X	X	1.00E+00	- -	1.00E+00
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs)																		
83-32-9	Acenaphthene	8270 (SIM)	6.7	µg/kg			*	3.24E+04	- -	- -	3.24E+04	8270 (SIM)	0.1			3.18E+02	- -	3.18E+02
208-96-8	Acenaphthylene	8270 (SIM)	6.7	µg/kg			*	- -	- -	- -	- -	8270 (SIM)	0.1			- -	- -	- -
120-12-7	Anthracene	8270 (SIM)	6.7	µg/kg			*	6.08E+06	- -	- -	6.08E+06	8270 (SIM)	0.1			1.28E+04	- -	1.28E+04
56-55-3	**Benzo(a)anthracene**	8270 (SIM)	6.7	µg/kg	X	X	*	4.19E+01	3.42E+03	- -	4.19E+01	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
205-99-2	**Benzo(b)fluoranthene**	8270 (SIM)	6.7	µg/kg	X		*	1.44E+02	3.42E+03	- -	1.44E+02	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
207-08-9	**Benzo(k)fluoranthene**	8270 (SIM)	6.7	µg/kg	X		*	1.44E+02	3.42E+03	- -	1.44E+02	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
191-24-2	Benzo(g,h,i)perylene	8270 (SIM)	6.7	µg/kg			*	- -	- -	- -	- -	8270 (SIM)	0.1			- -	- -	- -
50-32-8	**Benzo(a)pyrene**	8270 (SIM)	6.7	µg/kg	X		*	1.13E+02	3.42E+03	7.95E+07	1.13E+02	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
65-85-0	Benzoic Acid	8270	670.0	µg/kg			*	- -	- -	- -	- -	8270	10.0			- -	- -	- -
100-51-6	Benzyl alcohol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
101-55-3	4-Bromophenyl-phenylether	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
85-68-7	Butylbenzylphthalate	8270	67.0	µg/kg			*	1.73E+05	1.33E+08	- -	1.73E+05	8270	1.0			6.20E+02	- -	6.20E+02
86-74-8	Carbazole	8270	67.0	µg/kg			*	1.25E+06	1.25E+06	- -	- -	8270	1.0			- -	- -	- -
106-47-8	4-Chloroaniline	8270	200.0	µg/kg			*	- -	- -	- -	- -	8270	3.0			- -	- -	- -
111-91-1	bis(2-Chloroethoxy) Methane	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
111-44-4	Bis-(2-Chloroethyl) Ether	8270	130.0	µg/kg			*	- -	- -	- -	- -	8270	2.0			- -	- -	- -
59-50-7	4-Chloro-3-methylphenol	8270	130.0	µg/kg			*	4.76E+05	- -	- -	4.76E+05	8270	2.0			1.83E+04	- -	1.83E+04
91-58-7	2-Chloronaphthalene	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
95-57-8	2-Chlorophenol	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
7005-72-3	4-Chlorophenyl-phenylether	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
218-01-9	**Chrysene**	8270 (SIM)	6.7	µg/kg	X	X	*	4.66E+01	3.42E+03	- -	4.66E+01	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
53-70-3	**Dibenzo(a,h)anthracene**	8270 (SIM)	6.7	µg/kg	X		*	2.10E+02	3.42E+03	- -	2.10E+02	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
132-64-9	Dibenzofuran	8270 (SIM)	6.7	µg/kg			*	- -	- -	- -	- -	8270 (SIM)	0.1			- -	- -	- -
84-74-2	Di-n-butylphthalate	8270	67.0	µg/kg			*	5.09E+04	6.67E+07	- -	5.09E+04	8270	1.0			1.44E+03	- -	1.44E+03

Table 3-2 Reporting Limits Compared to Screening Levels for Sitewide Constituents of Concern
2-31 Area
Boeing Plant 2

		Soil (refer to Laboratory RL Units)										Groundwater (µg/L)						
CAS Number	Analytes	Analytical Method	Laboratory RL		Sitewide Soil COC	2-31 Area Soil COC	Background (Metals)	Minimum Calculated Soil Screening Level	Direct Contact Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level	Analytical Method	Laboratory RL	Sitewide Groundwater COC	2-31 Area Groundwater COC	Minimum Calculated Groundwater Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level
SVOC's and PCB's (cont'd)																		
91-94-1	3,3'-Dichlorobenzidine	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
120-83-2	2,4-Dichlorophenol	8270	200.0	µg/kg			*	- -	- -	- -	- -	8270	10.0			- -	- -	- -
84-66-2	Diethylphthalate	8270	67.0	µg/kg			*	7.93E+04	5.33E+08	- -	7.93E+04	8270	1.0			1.41E+04	- -	1.41E+04
105-67-9	2,4-Dimethylphenol	8270	200.0	µg/kg			*	2.24E+03	1.33E+07	- -	2.24E+03	8270	3.0	X		2.73E+02	- -	2.73E+02
131-11-3	Dimethylphthalate	8270	67.0	µg/kg			*	1.69E+05	6.67E+08	- -	1.69E+05	8270	1.0			3.56E+04	- -	3.56E+04
534-52-1	4,6-Dinitro-2-methylphenol	8270	670.0	µg/kg			*	- -	- -	- -	- -	8270	10.0			- -	- -	- -
117-84-0	Di-n-octylphthalate	8270	67.0	µg/kg			*	1.33E+07	1.33E+07	- -	- -	8270	1.0			- -	- -	- -
51-28-5	2,4-Dinitrophenol	8270	670.0	µg/kg			*	- -	- -	- -	- -	8270	10.0			- -	- -	- -
121-14-2	2,4-Dinitrotoluene	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
606-20-2	2,6-Dinitrotoluene	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
117-81-7	**bis(2-Ethylhexyl)phthalate**	8270	67.0	µg/kg	X		*	1.57E+03	1.79E+06	- -	1.57E+03	8270	**3.0**	X	X	7.05E-01	- -	7.05E-01
206-44-0	Fluoranthene	8270 (SIM)	6.7	µg/kg	X		*	4.40E+04	2.67E+07	- -	4.40E+04	8270 (SIM)	0.1			4.46E+01	- -	4.46E+01
86-73-7	Fluorene	8270 (SIM)	6.7	µg/kg			*	2.70E+05	2.67E+07	- -	2.70E+05	8270 (SIM)	0.1			1.71E+03	- -	1.71E+03
118-74-1	Hexachlorobenzene	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
77-47-4	Hexachlorocyclopentadiene	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
67-72-1	Hexachloroethane	8270	130.0	µg/kg			*	- -	- -	- -	- -	8270	2.0			- -	- -	- -
193-39-5	**Indeno(1,2,3-cd)pyrene**	8270 (SIM)	6.7	µg/kg	X		*	4.06E+02	3.42E+03	- -	4.06E+02	8270 (SIM)	**0.1**	X	X	5.86E-03	- -	5.86E-03
78-59-1	Isophorone	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
91-57-6	2-Methylnaphthalene	8270 (SIM)	6.7	µg/kg			*	- -	- -	- -	- -	8270 (SIM)	0.1			- -	- -	- -
95-48-7	2-Methylphenol	8270	67.0	µg/kg			*	5.93E+04	3.33E+07	- -	5.93E+04	8270	1.0			1.02E+04	- -	1.02E+04
106-44-5	4-Methylphenol	8270	67.0	µg/kg			*	1.31E+04	3.33E+06	- -	1.31E+04	8270	1.0			1.03E+03	- -	1.03E+03
88-74-4	2-Nitroaniline	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
99-09-2	3-Nitroaniline	8270	400.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
100-01-6	4-Nitroaniline	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
98-95-3	Nitrobenzene	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
88-75-5	2-Nitrophenol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
100-02-7	4-Nitrophenol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
621-64-7	N-Nitroso-di-n-propylamine	8270	130.0	µg/kg			*	- -	- -	- -	- -	8270	2.0			- -	- -	- -
86-30-6	N-Nitrosodiphenylamine	8270	67.0	µg/kg			*	5.10E+06	5.10E+06	- -	- -	8270	5.0			- -	- -	- -
108-60-1	2,2'-Oxybis(1-Chloropropane)	8270	67.0	µg/kg			*	- -	- -	- -	- -	8270	1.0			- -	- -	- -
87-86-5	Pentachlorophenol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
85-01-8	Phenanthrene	8270 (SIM)	6.7	µg/kg			*	- -	- -	- -	- -	8270	0.1			- -	- -	- -
108-95-2	Phenol	8270	130.0	µg/kg			*	1.26E+06	2.00E+08	- -	1.26E+06	8270	2.0			2.75E+05	- -	2.75E+05
129-00-0	Pyrene	8270 (SIM)	6.7	µg/kg			*	1.75E+06	2.00E+07	- -	1.75E+06	8270 (SIM)	0.1			1.28E+03	- -	1.28E+03
95-95-4	2,4,5-Trichlorophenol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
88-06-2	2,4,6-Trichlorophenol	8270	330.0	µg/kg			*	- -	- -	- -	- -	8270	5.0			- -	- -	- -
12674-11-2	Aroclor 1016	8082	33.0	µg/kg			*	- -	- -	- -	- -	8082	0.01			- -	- -	- -
-	**Aroclor 1016/1242**	8082	**33.0**	µg/kg	X		*	1.38E-01	4.67E+04	- -	1.38E-01	8082	**0.01**	X		6.40E-05	- -	6.40E-05
11104-28-2	Aroclor 1221	8082	33.0	µg/kg			*	- -	- -	- -	- -	8082	0.01			- -	- -	- -
11141-16-5	Aroclor 1232	8082	33.0	µg/kg			*	- -	- -	- -	- -	8082	0.01			- -	- -	- -
53469-21-9	Aroclor 1242	8082	33.0	µg/kg			*	- -	4.67E+04	- -	- -	8082	0.01			- -	- -	- -
12672-29-6	**Aroclor 1248**	8082	**33.0**	µg/kg	X		*	- -	- -	- -	- -	8082	0.01			- -	- -	- -
11097-69-1	**Aroclor 1254**	8082	**33.0**	µg/kg	X	X	*	1.08E+00	1.33E+04	- -	1.08E+00	8082	**0.01**	X		6.40E-05	- -	6.40E-05
11096-82-5	**Aroclor 1260**	8082	**33.0**	µg/kg	X	X	*	1.05E+00	- -	- -	1.05E+00	8082	**0.01**	X		6.40E-05	- -	6.40E-05
37324-23-5	Aroclor 1262	8082	33.0	µg/kg			*	- -	- -	- -	- -	8082	0.01			- -	- -	- -
11100-14-4	**Aroclor 1268**	8082	33.0	µg/kg			*	- -	- -	- -	- -	8082	**0.01**			6.40E-05	- -	6.40E-05
-	**Total PCBs**	8082	**33.0**	µg/kg	X	X	*	- -	- -	- -	3.96E-01	8082	**0.01**	X		6.40E-05	- -	6.40E-05
Volatile Organic Compounds (VOCs)																		
67-64-1	Acetone	8260	5.0	µg/kg			*	3.55E+05	3.05E+08	3.55E+05	- -	8260	1.0			6.43E+06	6.43E+06	- -
107-02-8	Acrolein	8260	50.0	µg/kg			*	- -	- -	- -	- -	8260	5.0			- -	- -	- -

Table 3-2 Reporting Limits Compared to Screening Levels for Sitewide Constituents of Concern
2-31 Area
Boeing Plant 2

		Soil (refer to Laboratory RL Units)										Groundwater (µg/L)						
CAS Number	Analytes	Analytical Method	Laboratory RL		Sitewide Soil COC	2-31 Area Soil COC	Background (Metals)	Minimum Calculated Soil Screening Level	Direct Contact Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level	Analytical Method	Laboratory RL	Sitewide Groundwater COC	2-31 Area Groundwater COC	Minimum Calculated Groundwater Screening Level	Air Pathway Screening Level	Surface Water Pathway Screening Level
VOC's (cont'd)																		
107-13-1	Acrylonitrile	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
71-43-2	Benzene	8260	1.0	µg/kg	X		*	2.53E+01	1.36E+06	4.22E+02	2.53E+01	8260	0.2	X		4.48E+00	8.55E+02	4.48E+00
108-86-1	Bromobenzene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
74-97-5	Bromochloromethane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
75-27-4	Bromodichloromethane	8260	1.0	µg/kg			*	2.88E+01	8.80E+05	1.49E+02	2.88E+01	8260	0.2			5.52E+00	2.69E+03	5.52E+00
74-96-4	Bromoethane	8260	2.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
75-25-2	Bromoform	8260	1.0	µg/kg			*	2.84E+02	8.11E+07	1.33E+06	2.84E+02	8260	0.2			4.33E+01	1.19E+05	4.33E+01
74-83-9	Bromomethane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
78-93-3	2-Butanone	8260	5.0	µg/kg			*	8.02E+05	1.19E+09	8.02E+05	- -	8260	1.0			1.49E+07	1.49E+07	- -
104-51-8	n-Butylbenzene	8260	1.0	µg/kg	X		*	4.64E+03	- -	4.64E+03	- -	8260	0.2			8.63E+06	8.63E+06	- -
135-98-8	sec-Butylbenzene	8260	1.0	µg/kg	X		*	7.86E+03	- -	7.86E+03	- -	8260	0.2			4.40E+08	4.40E+08	- -
98-06-6	tert-Butylbenzene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
75-15-0	Carbon Disulfide	8260	1.0	µg/kg			*	3.64E+03	6.40E+07	3.64E+03	- -	8260	0.2			3.43E+04	3.43E+04	- -
56-23-5	Carbon Tetrachloride	8260	1.0	µg/kg			*	4.84E+00	5.73E+05	2.15E+02	4.84E+00	8260	0.2	X		5.26E-01	8.00E+01	5.26E-01
108-90-7	Chlorobenzene	8260	1.0	µg/kg	X		*	1.85E+03	2.91E+07	1.85E+03	1.40E+04	8260	0.2			1.60E+03	1.00E+04	1.60E+03
75-00-3	Chloroethane	8260	1.0	µg/kg			*	2.77E+02	- -	2.77E+02	- -	8260	0.2			4.05E+03	4.05E+03	- -
67-66-3	Chloroform	8260	1.0	µg/kg	X		*	1.40E+02	7.03E+06	1.41E+02	2.98E+02	8260	0.2			5.61E+01	4.11E+02	5.61E+01
110-75-8	2-Chloroethylvinylether	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	0.5			- -	- -	- -
74-87-3	Chloromethane	8260	1.0	µg/kg			*	1.78E+03	4.63E+08	1.79E+03	- -	8260	0.2	X		2.63E+01	1.89E+03	2.63E+01
95-49-8	2-Chlorotoluene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
106-43-4	4-Chlorotoluene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
124-48-1	Dibromochloromethane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
74-95-3	Dibromomethane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
96-12-8	1,2-Dibromo-3-chloropropane	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	2.0			- -	- -	- -
95-50-1	1,2-Dichlorobenzene	8260	1.0	µg/kg			*	1.52E+04	1.54E+08	1.67E+06	1.52E+04	8260	0.2			1.30E+03	- -	1.30E+03
541-73-1	1,3-Dichlorobenzene	8260	1.0	µg/kg			*	1.24E+04	- -	1.14E+05	1.24E+04	8260	0.2			9.60E+02	- -	9.60E+02
106-46-7	1,4-Dichlorobenzene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
110-57-6	trans-1,4-Dichloro-2-butene	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	1.0			- -	- -	- -
75-34-3	1,1-Dichloroethane	8260	1.0	µg/kg			*	4.56E+04	6.69E+07	4.56E+04	- -	8260	0.2			9.06E+04	9.06E+04	- -
107-06-2	1,2-Dichloroethane	8260	1.0	µg/kg			*	5.67E+01	8.19E+05	1.71E+02	5.67E+01	8260	0.2	X		1.17E+01	1.43E+03	1.17E+01
75-35-4	1,1-Dichloroethene	8260	1.0	µg/kg	X		*	2.73E+00	1.24E+05	6.40E+01	2.73E+00	8260	0.2	X		3.82E-01	2.50E+01	3.82E-01
156-59-2	cis-1,2-Dichloroethene	8260	1.0	µg/kg	X		*	7.94E+02	7.99E+06	7.94E+02	7.73E+03	8260	0.2	X		1.55E+03	1.51E+04	1.55E+03
156-60-5	trans-1,2-Dichloroethene	8260	1.0	µg/kg	X		*	9.06E+03	1.31E+07	9.12E+03	5.43E+04	8260	0.2			1.00E+04	1.08E+04	1.00E+04
540-59-0	1,2-Dichloroethene (total)	8260	-	µg/kg			*	1.79E+07	1.79E+07	- -	- -	8260	-			- -	- -	- -
78-87-5	1,2-Dichloropropane	8260	1.0	µg/kg			*	2.36E+01	8.02E+05	6.92E+01	2.36E+01	8260	0.2			4.60E+00	- -	4.60E+00
142-28-9	1,3-Dichloropropane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
594-20-7	2,2-Dichloropropane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
563-58-6	1,1-Dichloropropene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
10061-01-5	cis-1,3-Dichloropropene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
10061-02-6	trans-1,3-Dichloropropene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
100-41-4	Ethylbenzene	8260	1.0	µg/kg	X		*	2.52E+03	1.45E+08	- -	1.81E+04	8260	0.2	X		2.10E+03	- -	2.10E+03
106-93-4	Ethylene Dibromide	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
87-68-3	Hexachlorobutadiene	8260	5.0	µg/kg			*	6.38E+03	2.91E+05	8.89E+03	6.38E+03	8260	0.5			5.91E+00	- -	5.91E+00
591-78-6	2-Hexanone	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	1.0			- -	- -	- -
98-82-8	Isopropylbenzene	8260	1.0	µg/kg	X		*	5.01E+04	1.45E+08	5.01E+04	- -	8260	0.2			4.93E+04	4.93E+04	- -
99-87-6	4-Isopropyltoluene	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
75-09-2	Methylene Chloride	8260	2.0	µg/kg	X		*	8.28E+02	9.94E+06	7.11E+03	8.28E+02	8260	0.3	X		1.90E+02	3.42E+04	1.90E+02
74-88-4	Methyl Iodide	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
108-10-1	4-Methyl-2-Pentanone	8260	5.0	µg/kg			*	3.55E+04	1.16E+08	3.55E+04	- -	8260	1.0			1.56E+09	1.56E+09	- -
91-20-3	Naphthalene	8260	5.0	µg/kg	X		*	4.04E+04	1.44E+07	4.04E+04	6.80E+04	8260	0.5			2.44E+03	1.18E+04	2.44E+03

Table 3-2 Reporting Limits Compared to Screening Levels for Sitewide Constituents of Concern
2-31 Area
Boeing Plant 2

		Soil (refer to Laboratory RL Units)										Groundwater (µg/L)						
CAS Number	**Analytes**	**Analytical Method**	**Laboratory RL**		**Sitewide Soil COC**	**2-31 Area Soil COC**	**Background (Metals)**	**Minimum Calculated Soil Screening Level**	**Direct Contact Screening Level**	**Air Pathway Screening Level**	**Surface Water Pathway Screening Level**	**Analytical Method**	**Laboratory RL**	**Sitewide Groundwater COC**	**2-31 Area Groundwater COC**	**Minimum Calculated Groundwater Screening Level**	**Air Pathway Screening Level**	**Surface Water Pathway Screening Level**
VOC's (cont'd)																		
103-65-1	n-Propylbenzene	8260	1.0	µg/kg	X		*	1.36E+04	- -	1.36E+04	- -	8260	0.2			4.00E+04	4.00E+04	- -
100-42-5	Styrene	8260	1.0	µg/kg			*	7.10E+01	1.82E+06	4.65E+05	7.10E+01	8260	0.2			3.17E+00	- -	3.17E+00
630-20-6	1,1,1,2-Tetrachloroethane	8260	1.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
79-34-5	1,1,2,2-Tetrachloroethane	8260	1.0	µg/kg	X		*	7.19E+00	2.73E+05	5.09E+02	7.19E+00	8260	0.2			1.28E+00	2.12E+03	1.28E+00
127-18-4	Tetrachloroethene	8260	1.0	µg/kg	X		*	8.72E+00	1.07E+06	5.43E+02	8.72E+00	8260	0.2	X		8.22E-01	3.65E+02	8.22E-01
108-88-3	Toluene	8260	1.0	µg/kg	X		*	1.90E+04	1.34E+08	- -	1.09E+05	8260	0.2			1.50E+04	5.25E+05	1.50E+04
87-61-6	1,2,3-Trichlorobenzene	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	0.5			- -	- -	- -
120-82-1	1,2,4-Trichlorobenzene	8260	5.0	µg/kg			*	4.19E+03	1.45E+07	- -	4.19E+03	8260	0.5			1.12E+02	- -	1.12E+02
71-55-6	1,1,1-Trichloroethane	8260	1.0	µg/kg	X		*	2.78E+04	4.12E+08	- -	1.63E+06	8260	0.2			2.06E+05	8.97E+05	2.06E+05
79-00-5	1,1,2-Trichloroethane	8260	1.0	µg/kg	X		*	2.78E+01	9.57E+05	4.63E+02	2.78E+01	8260	0.2	X		5.00E+00	2.70E+03	5.00E+00
79-01-6	Trichloroethene	8260	1.0	µg/kg	X	X	*	2.00E+00	1.36E+05	2.90E+01	2.00E+00	8260	0.2	X	X	3.02E-01	3.30E+01	3.02E-01
75-69-4	Trichlorofluoromethane	8260	1.0	µg/kg			*	5.71E+03	5.96E+08	5.71E+03	- -	8260	0.2			1.16E+04	1.16E+04	- -
76-13-1	1,1,2-Trichlorotrifluoroethane	8260	2.0	µg/kg			*	8.76E+05	5.96E+10	8.76E+05	- -	8260	0.2			1.17E+05	1.17E+05	- -
95-63-6	1,2,4-Trimethylbenzene	8260	1.0	µg/kg	X		*	4.13E+03	7.27E+07	4.13E+03	- -	8260	0.2			1.76E+03	1.76E+03	- -
108-67-8	1,3,5-Trimethylbenzene	8260	1.0	µg/kg	X		*	4.32E+03	7.27E+07	4.32E+03	- -	8260	0.2			- -	- -	- -
108-05-4	Vinyl Acetate	8260	5.0	µg/kg			*	- -	- -	- -	- -	8260	0.2			- -	- -	- -
75-01-4	Vinyl Chloride	8260	1.0	µg/kg	X	X	*	4.59E+00	4.97E+04	3.67E+02	4.59E+00	8260	0.2	X	X	7.31E-01	1.30E+02	7.31E-01
-	m,p-Xylene	8260	1.0	µg/kg			*	2.91E+09	2.91E+09	- -	- -	8260	0.4			- -	- -	- -
95-47-6	o-Xylene	8260	1.0	µg/kg			*	1.43E+05	3.92E+08	1.43E+05	- -	8260	0.2			4.01E+04	4.01E+04	- -
1330-20-7	Total Xylenes	8260	-	µg/kg			*	2.91E+08	2.91E+08	- -	- -	8260	-			- -	- -	- -
Total Petroleum Hydrocarbons (TPH)																		
-	TPH - Diesel Range	NWTPH-D	5	mg/kg	X	X	*	2.00E+03	2.00E+03			NWTPH-D	500	X	X	5.00E+02	5.00E+02	
-	TPH - Mineral Spirits Range	NWTPH-Dx	5	mg/kg	X		*	2.00E+03	2.00E+03			NWTPH-Dx	250			5.00E+02	5.00E+02	
-	TPH - Motor Oil Range	NWTPH-Dx	10	mg/kg	X		*	2.00E+03	2.00E+03			NWTPH-Dx	500	X	X	5.00E+02	5.00E+02	
-	TPH - Oil and Grease	TPH HCID	20	mg/kg			*	2.00E+03	2.00E+03			UNK	500	X	X	5.00E+02	5.00E+02	
-	TPH - Gasoline Range	NWPTH-G	5	mg/kg	X		*	3.00E+01	3.00E+01			NWPTH-G	250	X		8.00E+02	8.00E+02	

Notes:

Bolded analytes have reporting limits above lowest risk based calculation. Screening levels were adjusted on Table 2-1 accordingly. Analytes measured by the 8270 (SIM) method are also included in the 8270 analysis, but at a higher RL.

\- No CAS number available

UNK Historic data, analytical method unknown.

* 1994 Ecology calculated one natural background concentration for the Puget sound basin. Does not apply to constituent

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Figures

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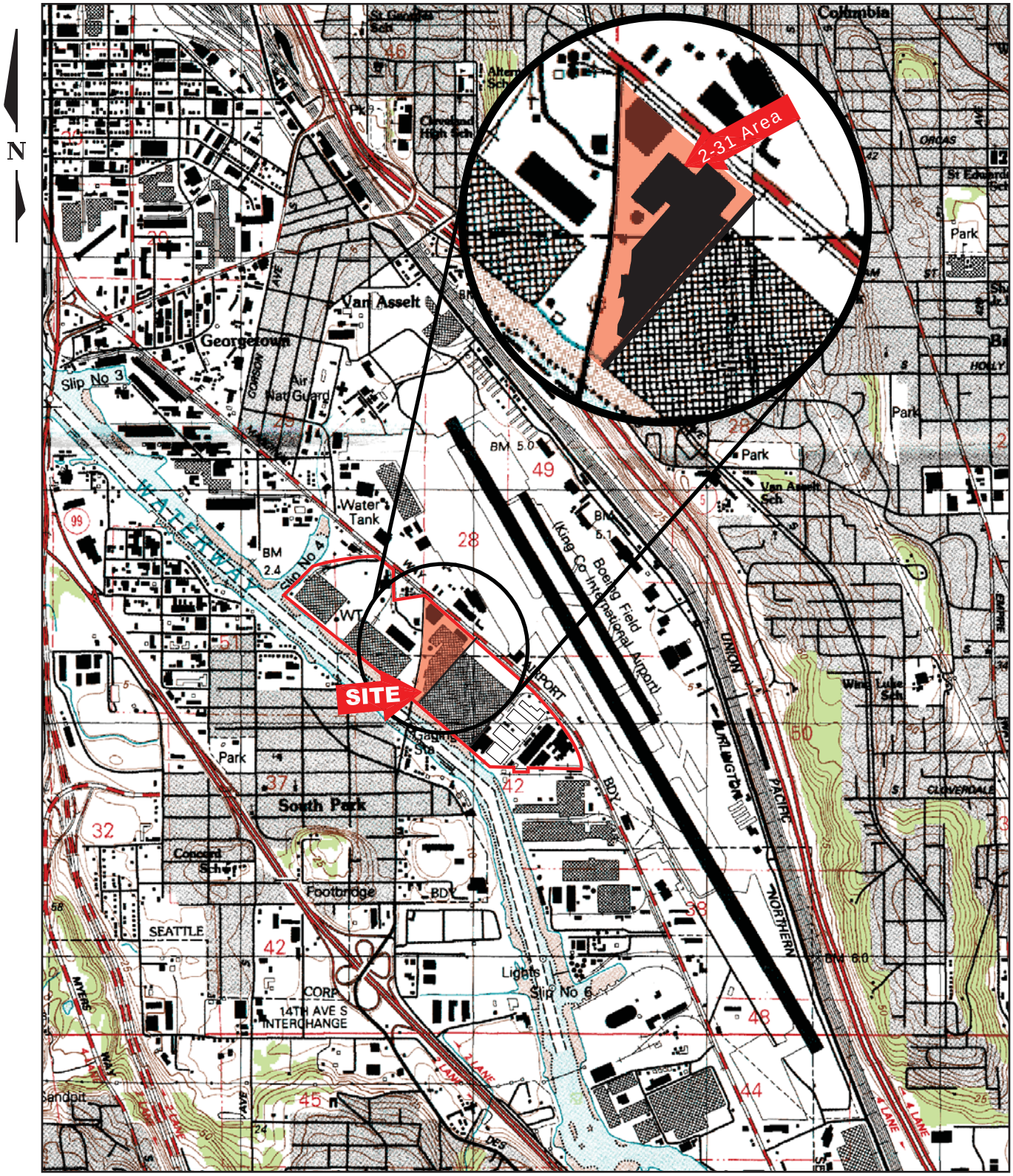

Golder Associates

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	AMP	TN	01/30/08

Data Gaps Investigation Work Plan
2-31 Area
Boeing Plant 2
Seattle/Tukwila, Washington

Figure 1-1
Vicinity Map

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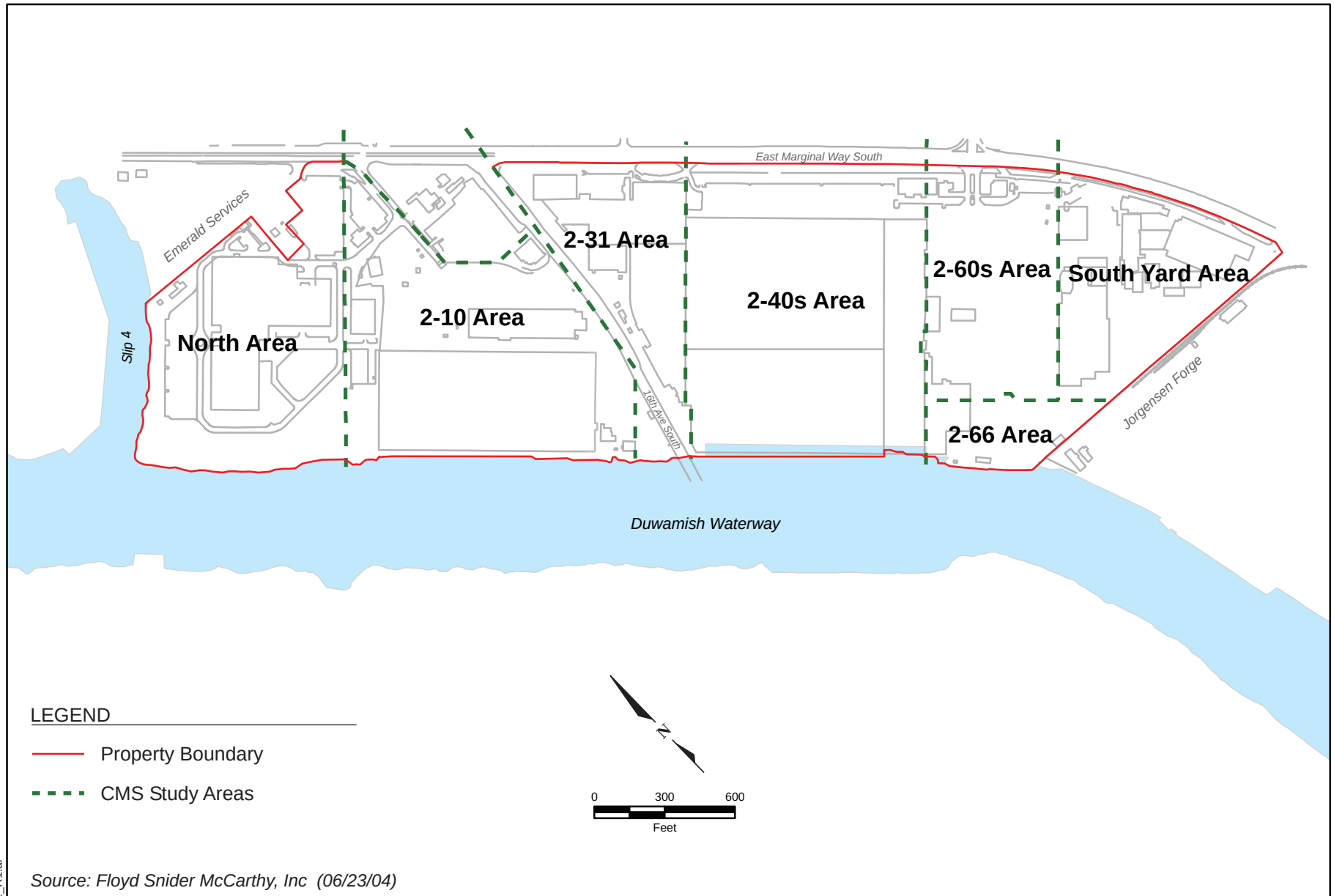

Source: Floyd Snider McCarthy, Inc (06/23/04)

Golder Associates	SHEET 1 OF 1	DRAWN BY AMP	**Data Gaps Investigation Work Plan** **2-31 Area** **Boeing Plant 2** **Seattle/Tukwila, Washington**
	REVIEWED BY TN	DATE Sept 2008	

Figure 1-2
Site Plan with CMS Study Areas

0131646008100fig1-2_R1.ai

Boeing Plant 2

East Marginal Way South
16th Avenue South
2-10 AREA
2-10 AREA
2-31 AREA
Bldg 2-22
Bldg 2-25
Bldg 2-28
Bldg 2-29
Bldg 2-31
Bldg 2-36
Bldg 2-34
Bldg 2-30
Bldg 2-27
Bldg 2-15
Bldg 2-37
Bldg 2-10
Bldg 2-09
Duwamish Waterway
UST PL-35
OA 17.4 Transformer Vault
UST PL-15
UST PL-14
SWMU 2-31.26 Anodizing Tank Line
SWMU 2-31.25 Anodize Aluminum Room
UST PL-12
UST PL-13
SWMU 2-31.24 Sodium Hydroxide Developer
UST PL-40
SWMU 2-31.22 Brush Plating Area
UST PL-65
SWMU 2-31.23 Ammonium Persulfate Tank
OA 15 Building 2-15 Steam Clean Sump
SWMU 2-15.13 Boiler Valve Pit
AST APL-042
AOC 2-31.21 TCE Degreaser
Sumps SPL-0 thru SPL-040
UST PL-36
SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank
Sumps S thru SPL
SWMU 78.A Oil/Water Separators
UST PL-39
OA 4 Scattered PCB Exceedances
SWMU 2-31.20 Deactivated Cyanide Hold Area
AOC 2-41.32 Deactivated Paint Booths and Sump
AOC 2-10.2A Decommissioned Machine Sumps
AST PLA-5
OA 4 Scattered PCB Exceedances
SWMU 2-31.18 Area B Acid Waste Hold Tank
AOC 2-10.6A Quench Tank
AST PLA-43
SWMU 2-4 Deactivate Tank/Line
AST PLA-44
AOC 2-10.4A South TCE Degreaser
SWMU 2-10.7 Paint Strip/Tank Line
SWMU 2 Tunnel A
SHEETPILE CONTAINMENT STRUCTURE
AOC 2-10.5 Paint Booth Area
100 Gallon TCE Spill
Sum SPL
SWMU 2-4 Underflow
AOC 2-10.1AB Hydraulic Stamp Machine and Sumps
SWMU 2-10.4 Zyglo Penetrant Spray Booth
SWMU 2-10.8 Anodic and Alodine Tank/Lines
OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)
0 120
Scale 1" = 120 Feet

LEGEND

- RCRA Unit Carried Through to Corrective Measures Study (CMS)
- NFA Approved RCRA Unit (Soil)
- Plant 2 Sub-Area Boundary

SHEET	DRAWN BY
1 OF 1	TH
REVIEWED BY	DATE
TN	04/07/09

DATA GAPS INVESTIGATION WORK PLAN
2-31 AREA
BOEING PLANT 2
SEATTLE / TUKWILA, WASHINGTON

Figure 1-3
2-31 Area

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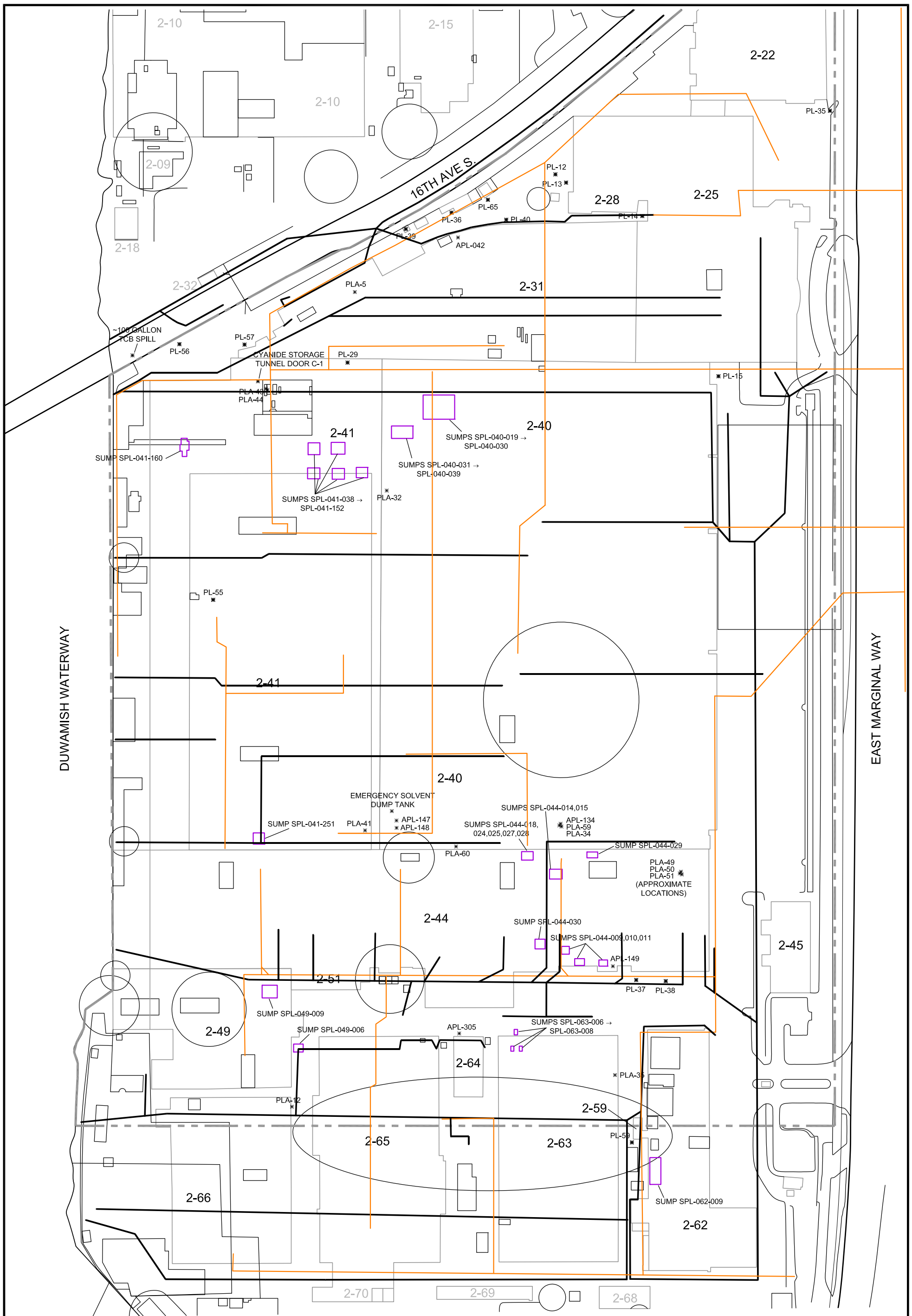


KEY

- SUMP LOCATIONS
- UST LOCATIONS
- AST LOCATIONS
- STORM DRAINS
- SANITARY SEWERS
- OUTLINE OF RCRA UNITS

PROJECT N

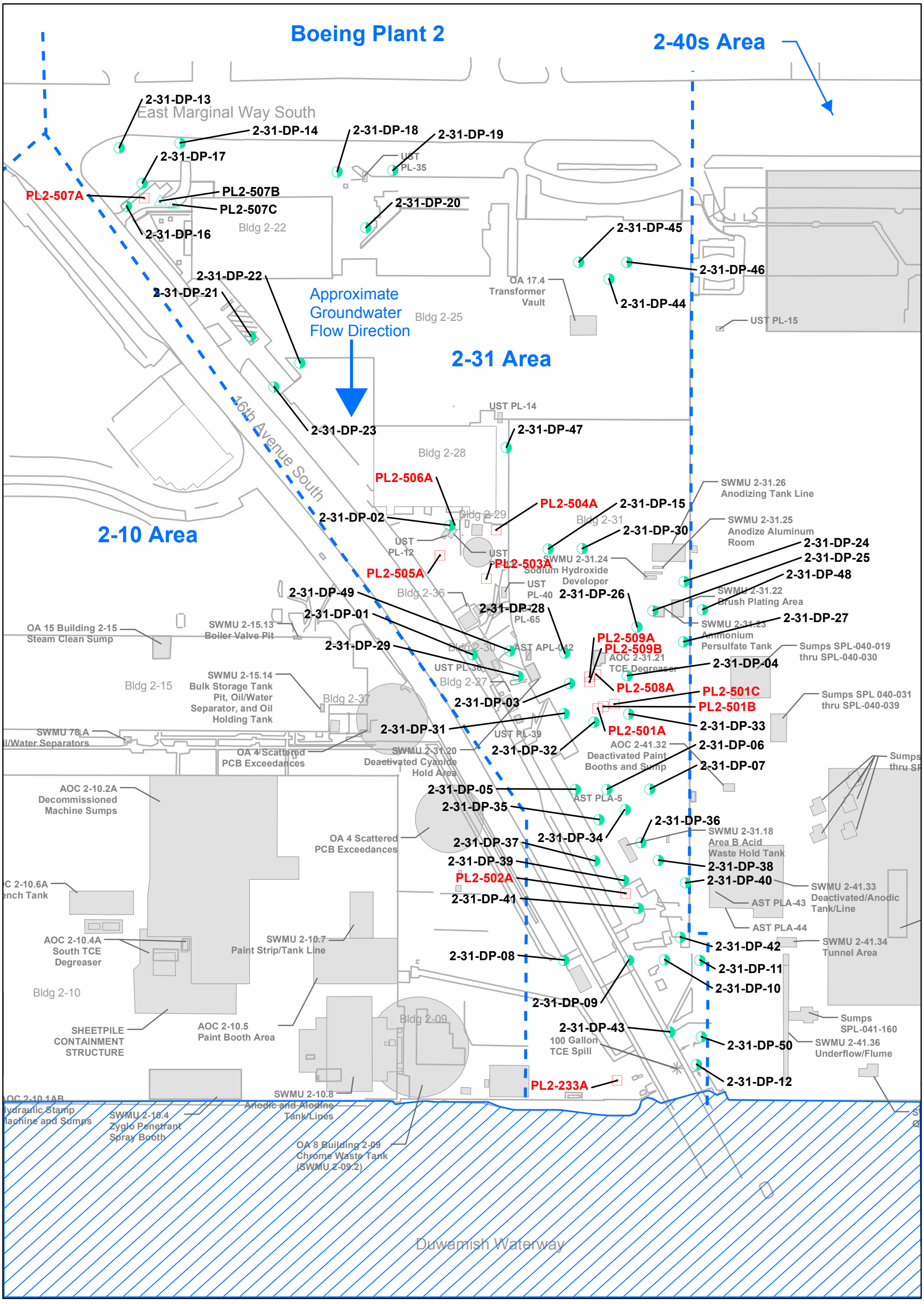
SCALE: 1:150

ENVIRONMENTAL PARTNERS INC

FIGURE 1-4
PARCEL AREAS OF
POTENTIAL CONCERN

PROJECT	17503.0
PREPARED FOR	THE BOEING CO.
LOCATION	BOEING PLANT 2 SEATTLE, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	BPS	DFK	5/14/02



LEGEND

- New Probe Location
- Wells Sampled for Data Gaps
- New Well Location
- Plant 2 Sub-Area Boundary

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

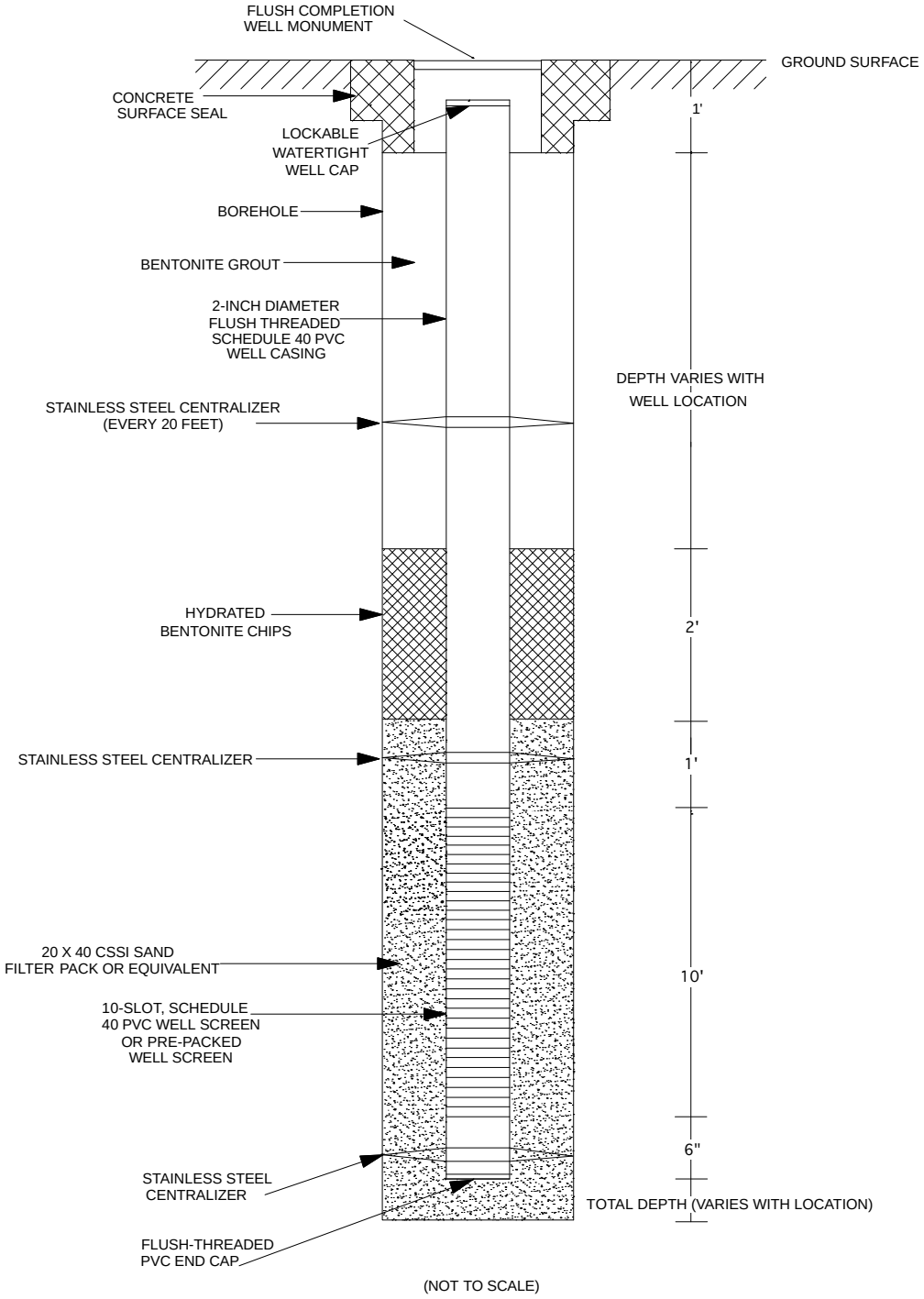
Source: Weston, Golder Associates

2-31 Area
Groundwater and Soil Data Gap
Sampling Locations

Drawn: TH	Revision: 5	Date: Apr 2009	Figure: 2-1

0131646008100_MXDs_Area_2_31_RO5.mxd

Golder Associates



ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

Data Gaps Investigation Work Plan
2-31 Area
Boeing Plant 2
Seattle/Tukwila, Washington

Figure 3-1
Generalized Deeper Monitoring Well
Construction Drawing

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	ARM	DCK	03/25/09

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment A
Groundwater Constituents of Concern

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Copper Concentrations (Dissolved) in A Level Groundwater

Mercury Concentrations (Dissolved) in A Level Groundwater

Nickel Concentrations (Dissolved) in A Level Groundwater

Cyanide Concentrations in A Level Groundwater

Benzo(a)anthracene Concentrations in A Level Groundwater

Benzo(a)pyrene Concentrations in A Level Groundwater

Benzo(b)fluoranthene Concentrations in A Level Groundwater

Benzo(k)fluoranthene Concentrations in A Level Groundwater

Bis(2-Ethylhexyl)phthalate Concentrations in A Level Groundwater

Chrysene Concentrations in A Level Groundwater

Dibenz(a,h)anthracene in Level A Groundwater

Indeno(1,2,3-cd)pyrene in Level A Groundwater

Trichloroethene Concentrations in A Level Groundwater

Trichloroethene Concentrations in B Level Groundwater

Trichloroethene Concentrations in C Level Groundwater

Vinyl Chloride Concentrations in A Level Groundwater

Vinyl Chloride Concentrations in B Level Groundwater

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2-31 Area – Maximum Benzo(a)pyrene Concentrations in Groundwater
2-31 Area – Maximum Benzo(b)fluoranthene Concentrations in Groundwater
2-31 Area – Maximum Benzo(k)fluoranthene Concentrations in Groundwater
2-31 Area – Maximum Bis(2-Ethylhexyl)phthalate Concentrations in Groundwater
2-31 Area – Maximum Chrysene Concentrations in Groundwater
2-31 Area – Maximum Dibenz(a,h)anthracene in Groundwater
2-31 Area – Maximum Indeno(1,2,3-cd)pyrene in Groundwater
2-31 Area – Maximum Trichloroethene Concentrations in Groundwater
2-31 Area – Maximum Vinyl Chloride Concentrations in Groundwater
2-31 Area – Maximum TPH-Diesel Range Concentrations in Groundwater
2-31 Area – Maximum TPH-Motor Oil Concentrations in Groundwater
2-31 Area – Maximum TPH-Oil and Grease Concentrations in Groundwater

A1.0 Groundwater Constituents of Concern

This attachment includes groundwater data information for the 2-31 Area of Boeing Plant 2 (Plant 2). This information was used to prepare Section 2, Data Gap Analysis, of this Data Gap Investigation Work Plan and includes: tables summarizing site-wide and 2-31 Area groundwater COCs, maps showing the distribution of COCs in the different groundwater zones of the 2-31 Area, and data tables for each groundwater COC.

A1.1 IDENTIFICATION OF COCS

Table A-1 summarizes the screening levels for the site-wide groundwater COCs. All accepted groundwater data including any qualified data compiled since 1986 were used to prepare the table. A COC was identified when laboratory analysis of a sample resulted in a concentration greater than the screening level at least once in any groundwater zone at the site. Table A-1 also includes the risk calculation for the groundwater-to-air and groundwater-to-surface water pathways. As discussed in detail in Volume II, screening levels for groundwater are the same as risk calculation results. At the time of this submittal, background metal concentrations for Plant 2 have not been determined, so a blank column is included in the table as a placeholder. Background metals concentrations will be used to revise screening levels when the values are available later in the CMS process. Because no risk information is available, the TPH screening level was established according to the Model Toxics Control Act (MTCA) Method A.

Table A-2 presents the current groundwater COCs for the 2-31 Area. COCs were identified by the same method as described above for Table A-1. All accepted groundwater data, including any qualified data compiled from the 2-31 Area since 1989 collected under the agreed order, were used to prepare the table.

A1.2 SPATIAL DISTRIBUTION OF COCS

Included in this attachment are maps showing the spatial distribution of each COC in Level A groundwater of the 2-31 Area. Maps are also included that show the distribution of a COC in Levels B or C if there were enough detections to interpret a groundwater plume. The accepted maximum concentration of each COC was used to generate the maps. If a constituent was never detected at a particular location, then the reporting limit and date for the most recent non-detects is presented along with the number of times the constituent was sampled at that location. All maps are oriented according to “plant” north.

A1.3 DATA TABLES

The data tables show all of the accepted maximum concentrations for each groundwater COC and the three soil COCs mentioned above. The data tables include data from the A level groundwater regardless of the frequency of detection. The data tables include data from all three groundwater levels, regardless of the frequency of detection.

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Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment A
Tables

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Table A-1 Screening Levels for Constituents of Concern in Site-wide Groundwater
North Area
Boeing Plant 2

CAS Number	Constituent of Concern	Maximum Detect (µg/l)	Laboratory RL (µg/l)	Air Screening Level (µg/l)	Lowest Air Screening Level (µg/l)	Surface Water Screening Level (µg/l)	Lowest Surface Water Screening Level (µg/l)
Metals and Cyanide							
7440-38-2	Arsenic	1.30E+02	2.00E-01	- -	- -	***1.94E-02***	***2.00E-01***
7440-43-9	Cadmium	1.89E+02	2.00E+00	- -	- -	***8.80E+00***	***8.80E+00***
7440-50-8	Copper	1.35E+02	5.00E-01	- -	- -	***3.10E+00***	***3.10E+00***
7439-92-1	Lead	1.20E+01	1.00E+00	- -	- -	***8.10E+00***	***8.10E+00***
7439-96-5	Manganese	7.61E+03	1.00E+00	- -	- -	***1.00E+02***	***1.00E+02***
7439-97-6	Mercury	3.60E+00	2.50E-02	4.64E+02	4.64E+02	***2.50E-02***	***2.50E-02***
7440-02-0	Nickel (soluble salts)	3.40E+02	5.00E-01	- -	- -	***8.20E+00***	***8.20E+00***
7782-49-2	Selenium	3.00E+02	5.00E+01	- -	- -	***7.10E+01***	***7.10E+01***
7440-22-4	Silver	7.60E+01	5.00E-01	- -	- -	***1.90E+00***	***1.90E+00***
7440-28-0	Thallium (soluble salts)	7.00E+01	2.00E-01	- -	- -	***4.70E-01***	***4.70E-01***
7440-66-6	Zinc	1.21E+04	6.00E+00	- -	- -	***8.10E+01***	***8.10E+01***
57-12-5	Cyanide	5.80E+02	5.00E+00	- -	- -	***1.00E+00***	***5.00E+00***
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs)							
56-55-3	Benzo(a)anthracene	3.30E+00	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
205-99-2	Benzo(b)fluoranthene	8.50E-01	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
207-08-9	Benzo(k)fluoranthene	2.80E-01	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
50-32-8	Benzo(a)pyrene	1.50E+00	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
218-01-9	Chrysene	6.20E+00	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
53-70-3	Dibenz(a,h)anthracene	1.90E-01	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
105-67-9	2,4-Dimethylphenol	5.20E+02	3.00E+00	- -	- -	***2.73E+02***	***2.73E+02***
117-81-7	bis(2-Ethylhexyl)phthalate	1.30E+01	3.00E+00	- -	- -	***7.05E-01***	***3.00E+00***
193-39-5	Indeno(1,2,3-cd)pyrene	2.90E-01	1.00E-01	- -	- -	***5.86E-03***	***1.00E-01***
-	Aroclor 1016/1242	1.10E-01	1.00E-02	- -	- -	***6.40E-05***	***1.00E-02***
11097-69-1	Aroclor 1254	1.90E+00	1.00E-02	- -	- -	***6.40E-05***	***1.00E-02***
11097-69-1	Aroclor 1260	8.90E+00	1.00E-02	- -	- -	***6.40E-05***	***1.00E-02***
-	Total PCBs	8.90E+00	1.00E-02	- -	- -	***6.40E-05***	***1.00E-02***
Volatile Organic Compounds (VOCs)							
71-43-2	Benzene	6.20E+03	2.00E-01	***3.83E+03***	***3.83E+03***	***4.48E+00***	***4.48E+00***
56-23-5	Carbon Tetrachloride	2.20E+00	2.00E-01	4.08E+02	4.08E+02	***5.26E-01***	***5.26E-01***
74-87-3	Chloromethane	4.80E+01	2.00E-01	8.02E+03	8.02E+03	***2.63E+01***	***2.63E+01***

Table A-1 Screening Levels for Constituents of Concern in Site-wide Groundwater
North Area
Boeing Plant 2

CAS Number	Constituent of Concern	Maximum Detect (µg/l)	Laboratory RL (µg/l)	Air Screening Level (µg/l)	Lowest Air Screening Level (µg/l)	Surface Water Screening Level (µg/l)	Lowest Surface Water Screening Level (µg/l)
VOCs continued							
107-06-2	1,2-Dichloroethane	2.30E+01	2.00E-01	4.91E+03	4.91E+03	***1.17E+01***	***1.17E+01***
75-35-4	1,1-Dichloroethene	5.00E+02	2.00E-01	***1.23E+02***	***1.23E+02***	***3.82E-01***	***3.82E-01***
156-59-2	cis-1,2-Dichloroethene	4.60E+05	2.00E-01	***1.51E+04***	***1.51E+04***	***1.55E+03***	***1.55E+03***
100-41-4	Ethylbenzene	2.30E+03	2.00E-01	noc	noc	***2.10E+03***	***2.10E+03***
75-09-2	Methylene Chloride	5.10E+02	3.00E-01	1.32E+05	1.32E+05	***1.90E+02***	***1.90E+02***
127-18-4	Tetrachloroethene	3.60E+01	2.00E-01	1.88E+03	1.88E+03	***8.22E-01***	***8.22E-01***
79-00-5	1,1,2-Trichloroethane	4.40E+02	2.00E-01	9.40E+03	9.40E+03	***5.00E+00***	***5.00E+00***
79-01-6	Trichloroethene	5.70E+05	2.00E-01	***1.58E+02***	***1.58E+02***	***3.02E-01***	***3.02E-01***
75-01-4	Vinyl Chloride	9.80E+04	2.00E-01	***5.94E+02***	***5.94E+02***	***7.31E-01***	***7.31E-01***
Total Petroleum Hydrocarbons (TPH)							
-	TPH-D	1.10E+04	5.00E+02	***5.00E+02***			
-	TPH-G	6.50E+04	2.50E+02	***8.00E+02***			
-	TPH-O (Motor Oil)	3.00E+03	5.00E+02	***5.00E+02***			
-	TPH-O (Oil and Grease)	1.20E+04	5.00E+02	***5.00E+02***			

Notes

The screening level for used for evaluating and identfying COCs is the lower value between the lowest air screening value and the lowest surface water screening value.

All maximum detections for metals represent dissolved metals.

Screening levels adjust risk calculations up to RL where applicable.

Bolded **Bolded** risk based and screening level concentrations are below maximum detect.

[a] Lowest groundwater concentration protective of indoor air, outdoor air, and trenching.

[b] Lowest groundwater concentration protective of human ingestion of aquatic organisms and protection of aquatic organisms.

RL Reporting Limit as detailed in Analytical Resources Inc. Laboratory Quality Assurance Plan, Version 11-022, dated 5/17/04 (generally equivalent to the practical quantitation limit in a clean matrix).

TPH Total Petroleum Hydrocarbons

- - Not calculated.

noc Not of concern. No groundwater concentration is able to produce an unacceptable air concentration.

No predicted air concentration can exceed the indoor air screening level. (Boeing Plant 2 Uplands CMS Vol.II Att. C)

Table A-2: Constituents of Concern Detected in Groundwater
2-31 Area
Boeing Plant 2

CAS Number	Constituent of Concern	Maximum Detect (µg/l)	Samples Analyzed	Detects	Samples above Air Screening Level	Samples above Surface Water Screening Level
Metals and Cyanide						
7440-38-2	Arsenic	52	44	42	--	5
7440-50-8	Copper	55	44	31	--	4
7439-97-6	Mercury	0.1	44	6	0	2
7440-02-0	Nickel	17.3	44	27	--	1
57-12-5	Cyanide	15	8	1	--	1
Semivolatile Organic Compounds (SVOCs)						
56-55-3	Benzo(a)anthracene	3.3	17	2	--	2
50-32-8	Benzo(a)pyrene	1.5	17	2	--	2
205-99-2	Benzo(b)fluoranthene	0.85	17	2	--	2
207-08-9	Benzo(k)fluoranthene	0.28	17	1	--	1
117-81-7	bis(2-Ethylhexyl)phthalate	4	17	1	--	1
218-01-9	Chrysene	6.2	17	2	--	2
53-70-3	Dibenz(a,h)anthracene	0.19	17	1	--	1
193-39-5	Indeno(1,2,3-cd)pyrene	0.29	17	1	--	1
Volatile Organic Compounds (VOCs)						
79-01-6	Trichloroethene	590	103	25	8	25
75-01-4	Vinyl chloride	74	103	45	0	21
Petroleum Hydrocarbons (TPH)						
68334-30-5	TPH - Diesel Range	7000	20	4	3	
TPH_MotorOil	TPH - Motor Oil Range	590	19	1	1	
	TPH - Oil and Grease	2300	4	4	4	

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Table A-3 Explanation of Data Qualifiers
2-31 Area
Boeing Plant 2

Data Qualifier	Explanation
Data Qualifiers Used by the Contract Laboratory – Analytical Resources, Inc.	
U	The compound was analyzed for, but not detected at the reported concentration.
J	Indicates an estimated concentration when a value is less than the calculated reporting limit.
D	Indicates the surrogate/spike(s) was not detected, due to dilution of extract.
NR	Indicates the surrogate recovery cannot be reported due to matrix interference.
E	Indicates a value above the linear range of the detector, sample dilution is required.
S	Indicates no value reported due to saturation of the detector, sample dilution required.
NA	Indicates compound was not analyzed for.
M	Indicates an estimated value of analyte found and confirmed by the analyst but with a low spectral match (GC-MS).
B	Indicates possible/probable blank contamination. Flagged when the analyte is detected in the blank as well as in the sample.
Y	Indicates raised reporting limit due to background interference or to activity in the instrument. Compound is still not detected at or above the raised level.
C	Indicates a probably detection that cannot be confirmed due to matrix interferences.
P	Indicates a high RPD between detected concentrations for dual column GC analyses without obvious interference.
Data Validation Qualifiers for Organic Analyses	
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Table A-3 Explanation of Data Qualifiers
2-31 Area
Boeing Plant 2

Data Qualifier	Explanation
Data Validation Qualifiers for Inorganic Analyses	
U	The compound was analyzed for, but was not detected above the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment A
Maps

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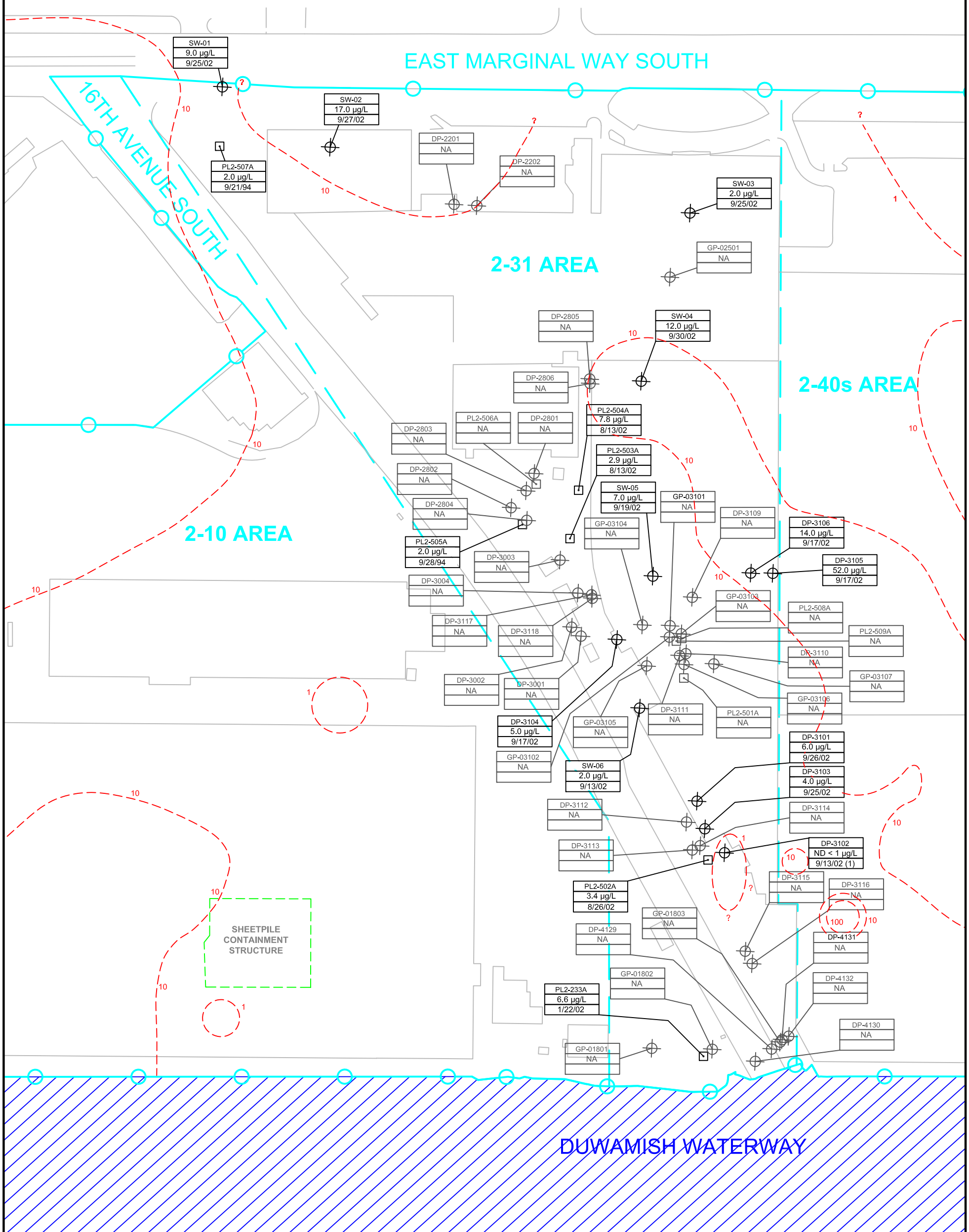


KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SITE SPECIFIC BACKGROUND LEVEL (2006) = 8.0 µg/L
PROPOSED TMCL (2007) = 8.0 µg/L

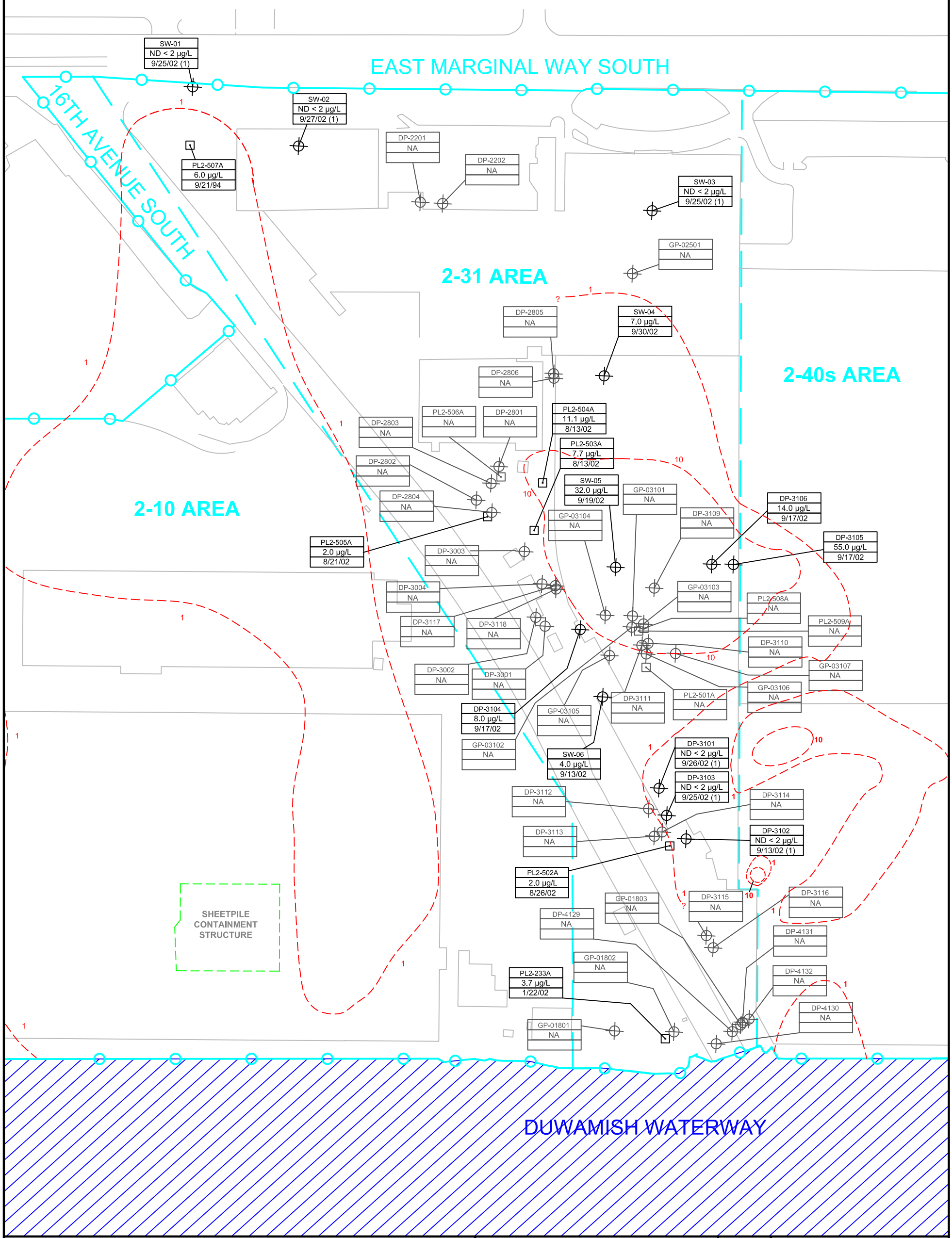
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

EPI ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
ARSENIC CONCENTRATIONS (DISSOLVED) IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SITE SPECIFIC BACKGROUND LEVEL (2006) = 8.0 µg/L
PROPOSED TMCL (2007) = 8.0 µg/L

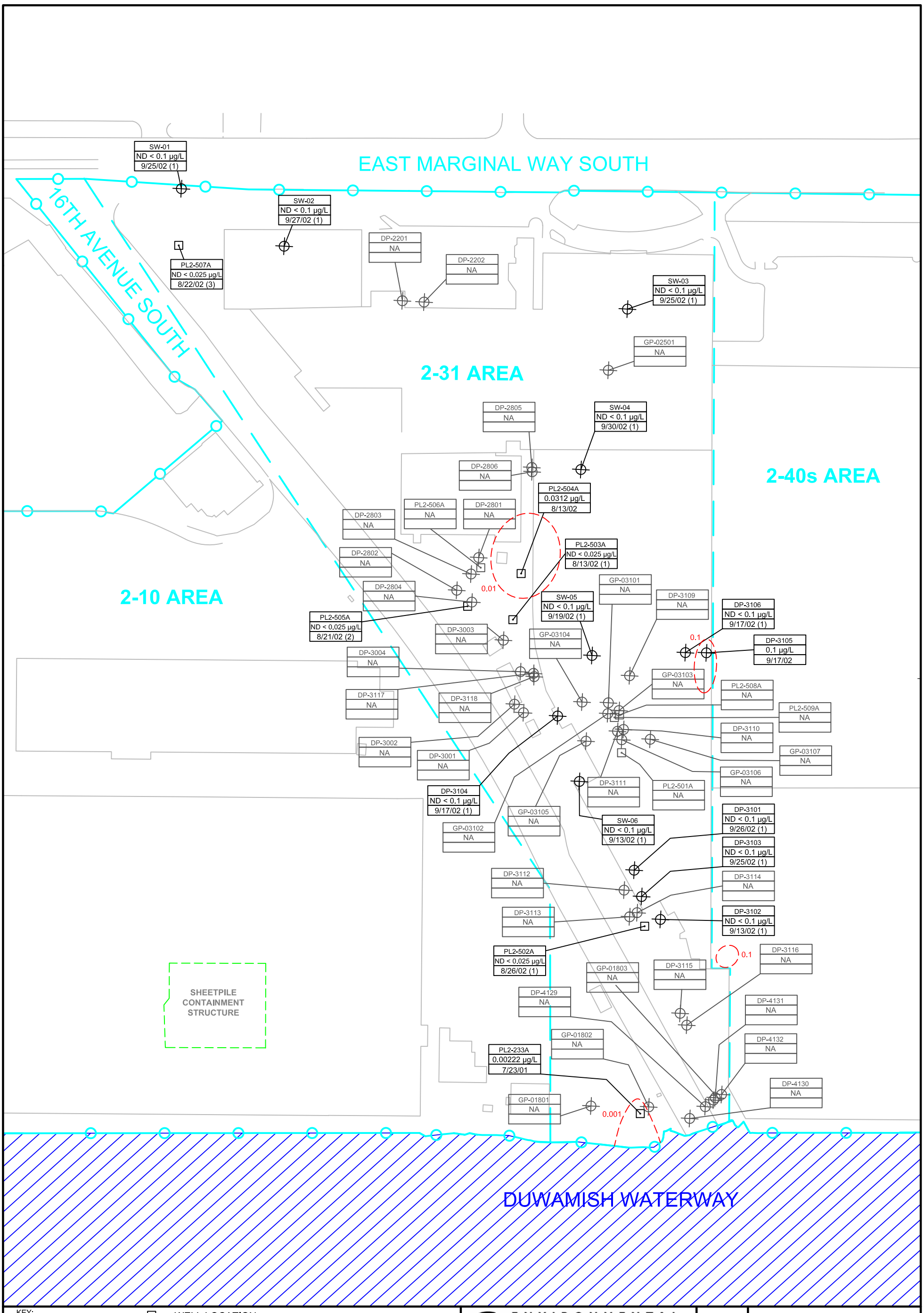
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
COPPER CONCENTRATIONS (DISSOLVED) IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/05/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.025 µg/L
PROPOSED TMCL (2007) = 0.025 µg/L

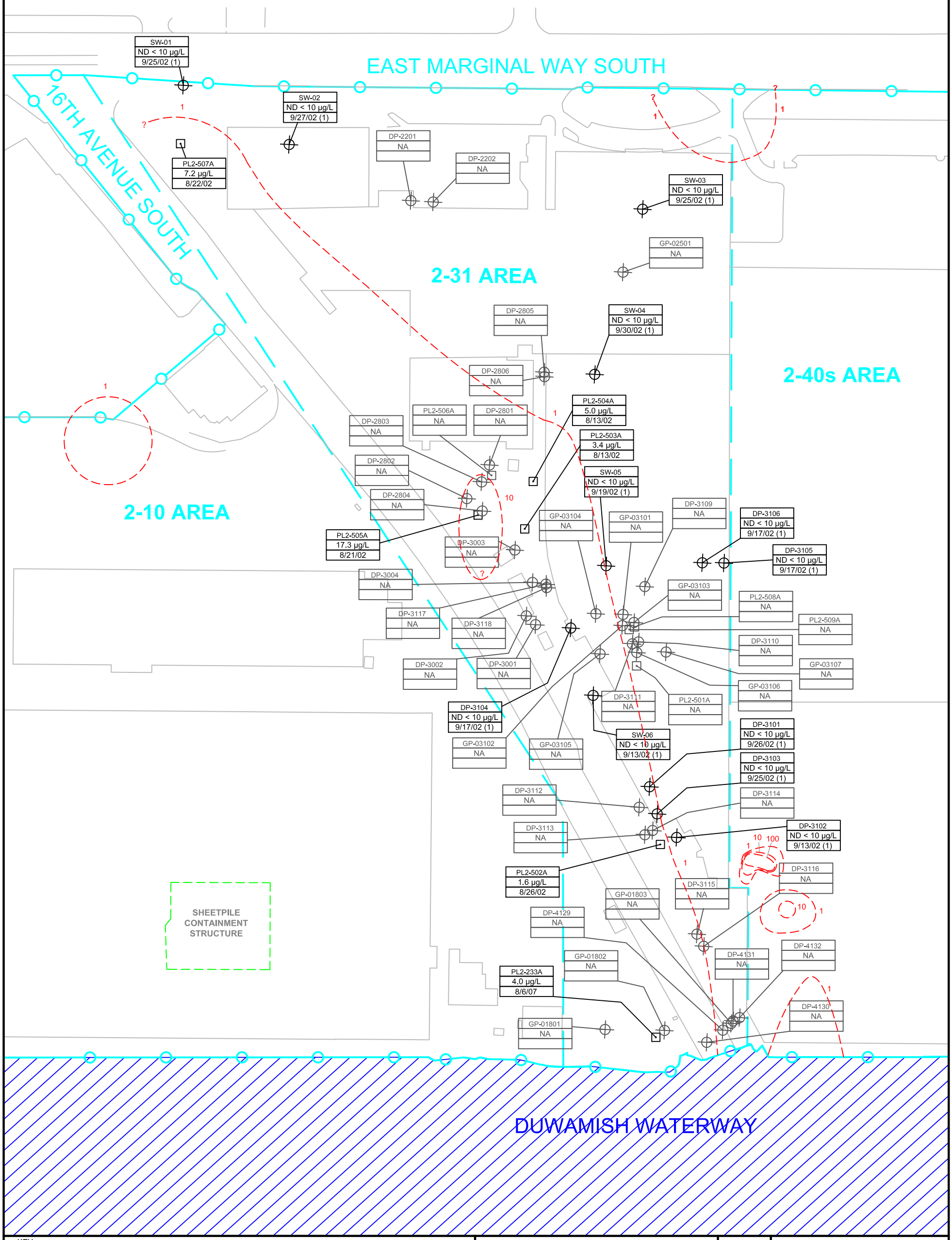
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
MERCURY CONCENTRATIONS (DISSOLVED)
IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 8.2 µg/L
PROPOSED TMCL (2007) = 8.2 µg/L

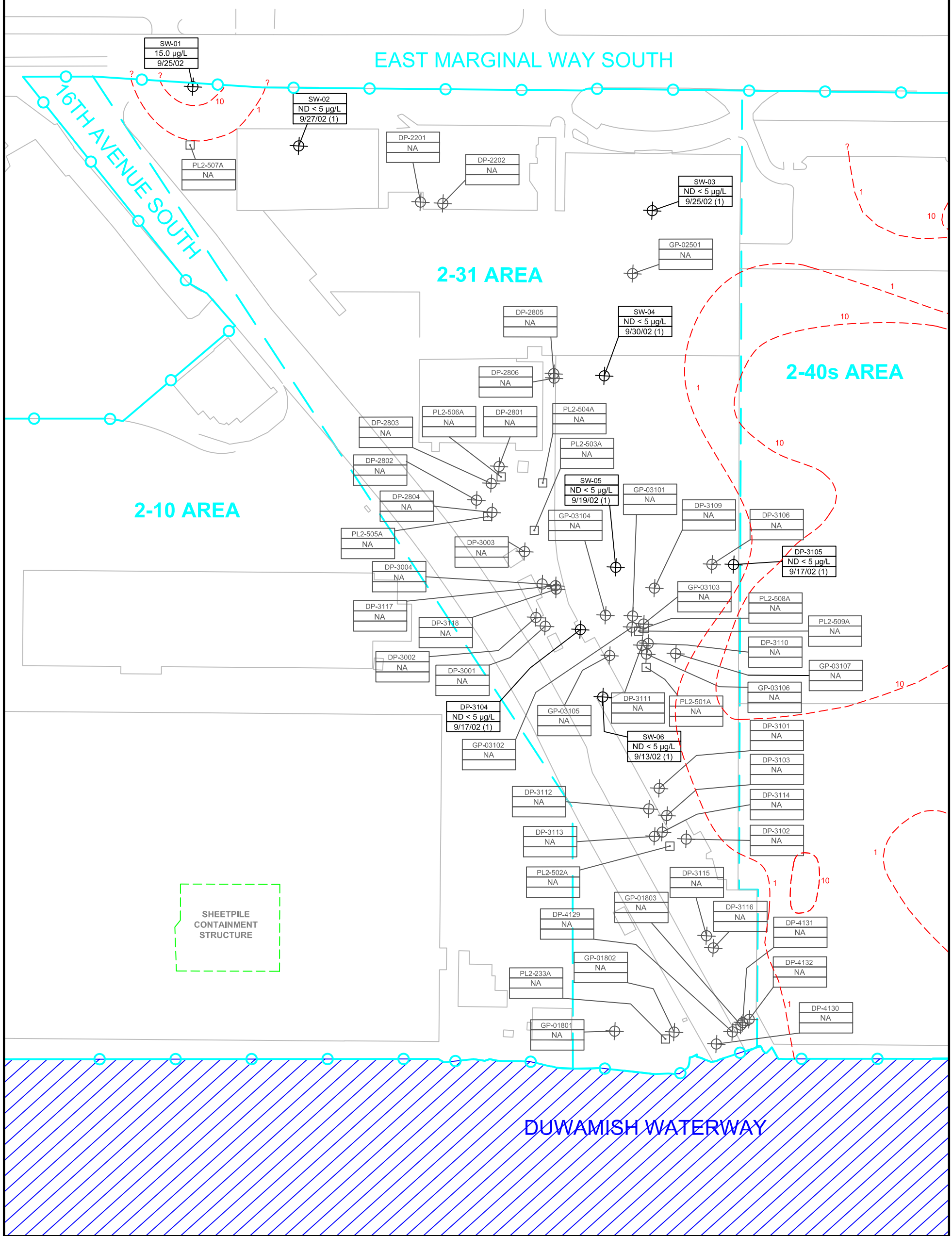
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
NICKEL CONCENTRATIONS (DISSOLVED)
IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/06/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 5.0 µg/L
PROPOSED TMCL (2007) = 5.0 µg/L

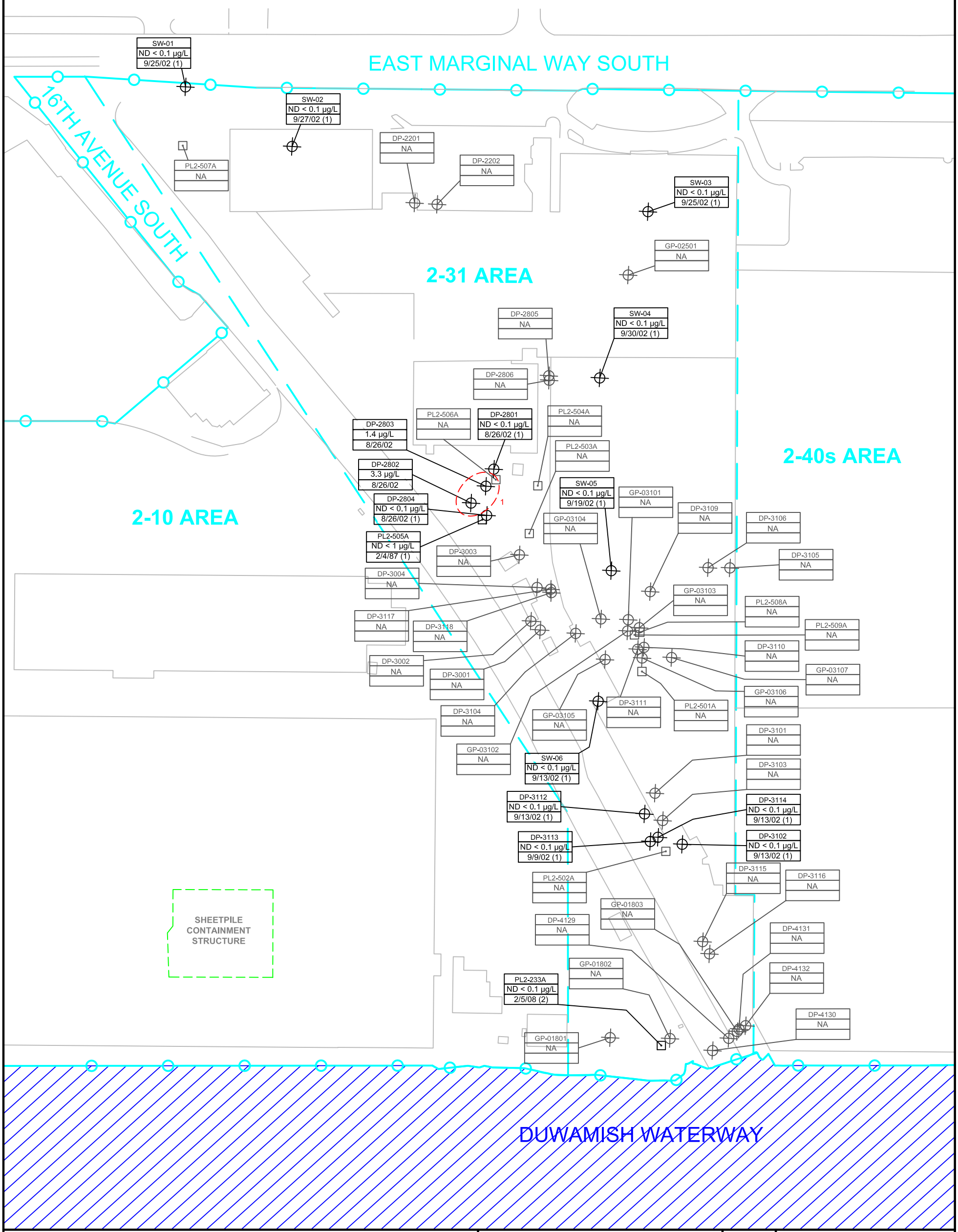
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
CYANIDE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/05/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

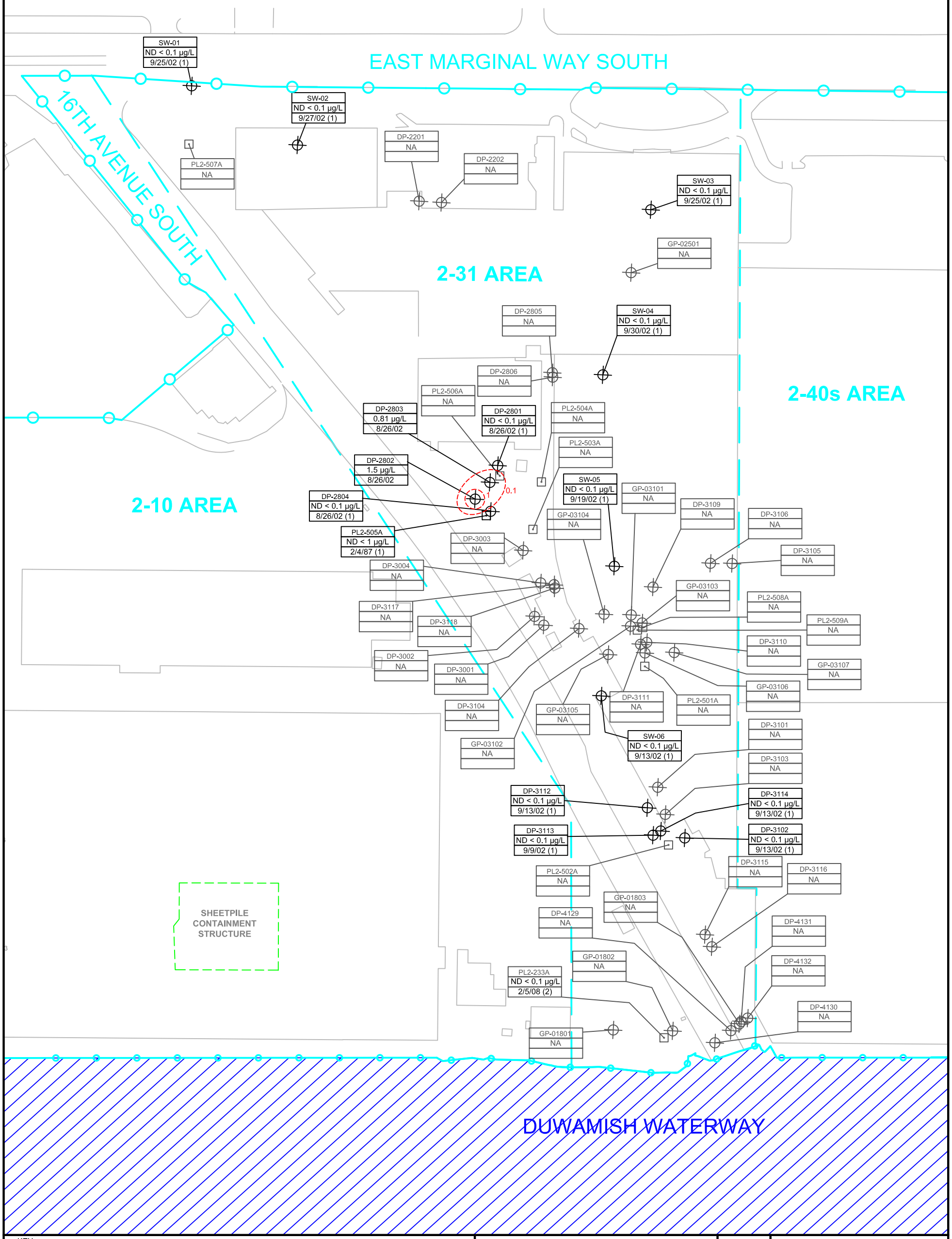
0 30' 60' 120'
SCALE: 1" = 120'

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
BENZO(A)ANTHRACENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/21/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

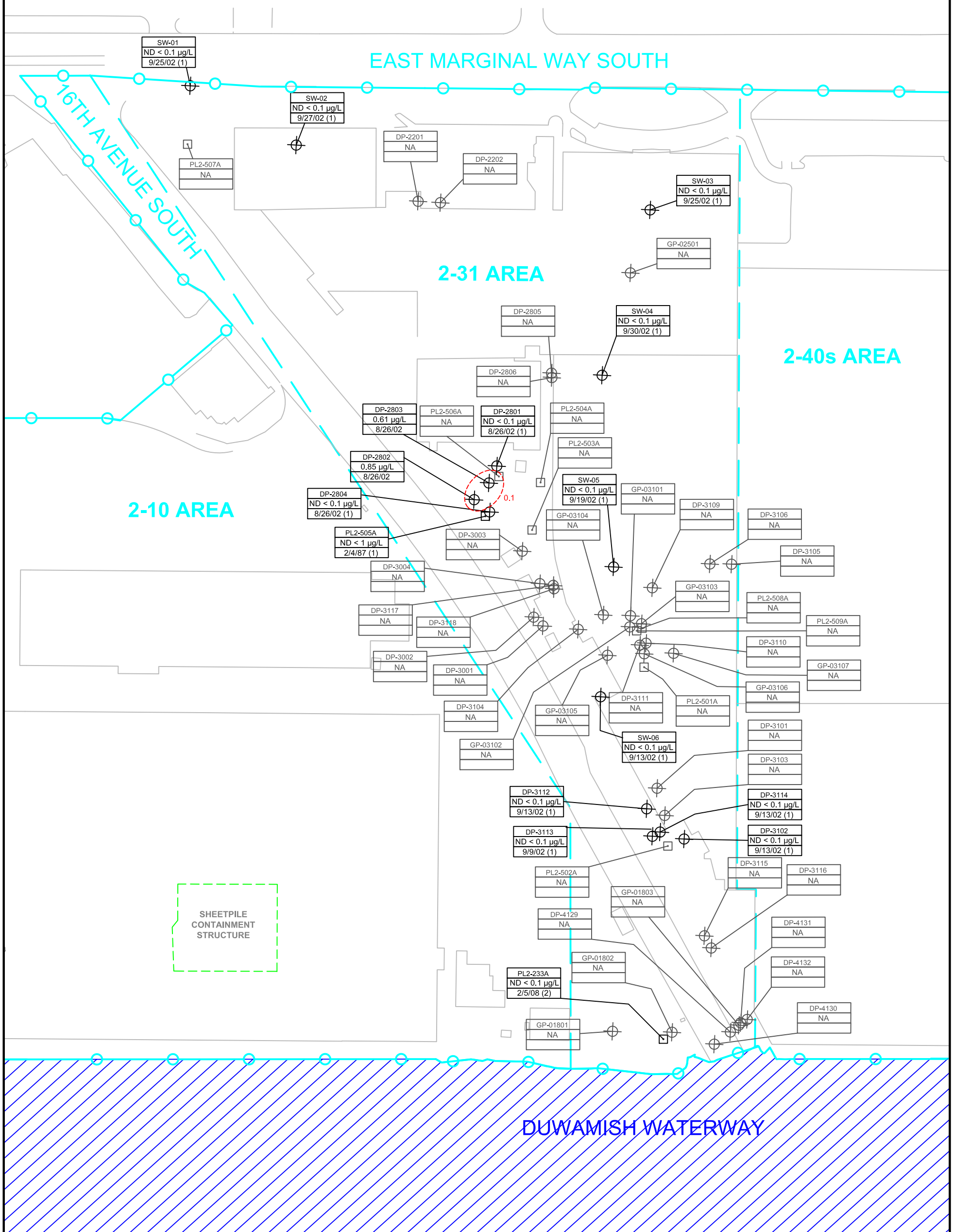
0 30' 60' 120'
SCALE: 1" = 120'

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
BENZO(A)PYRENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

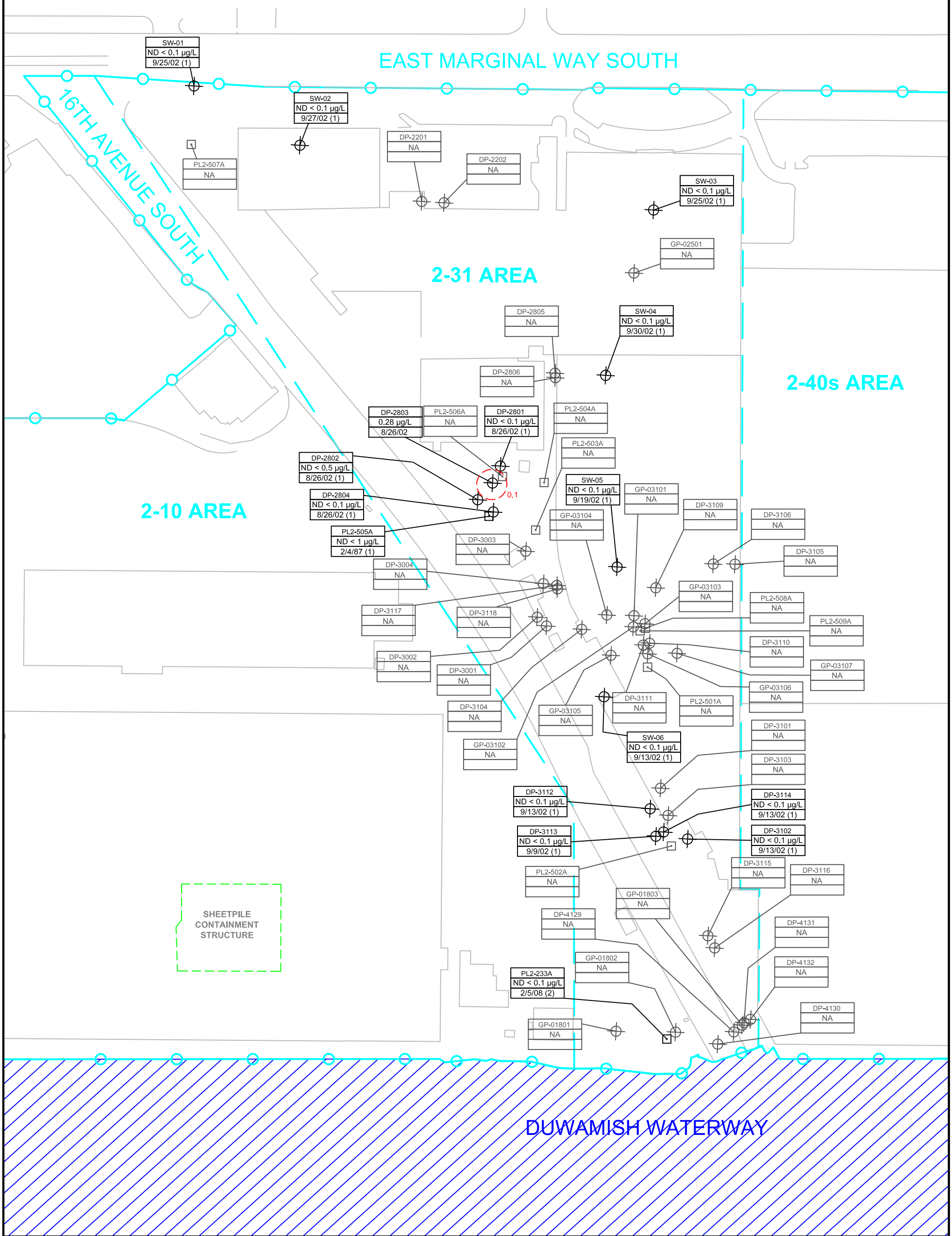
0 30' 60' 120'
SCALE: 1" = 120'

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
BENZO(B)FLUORANTHENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

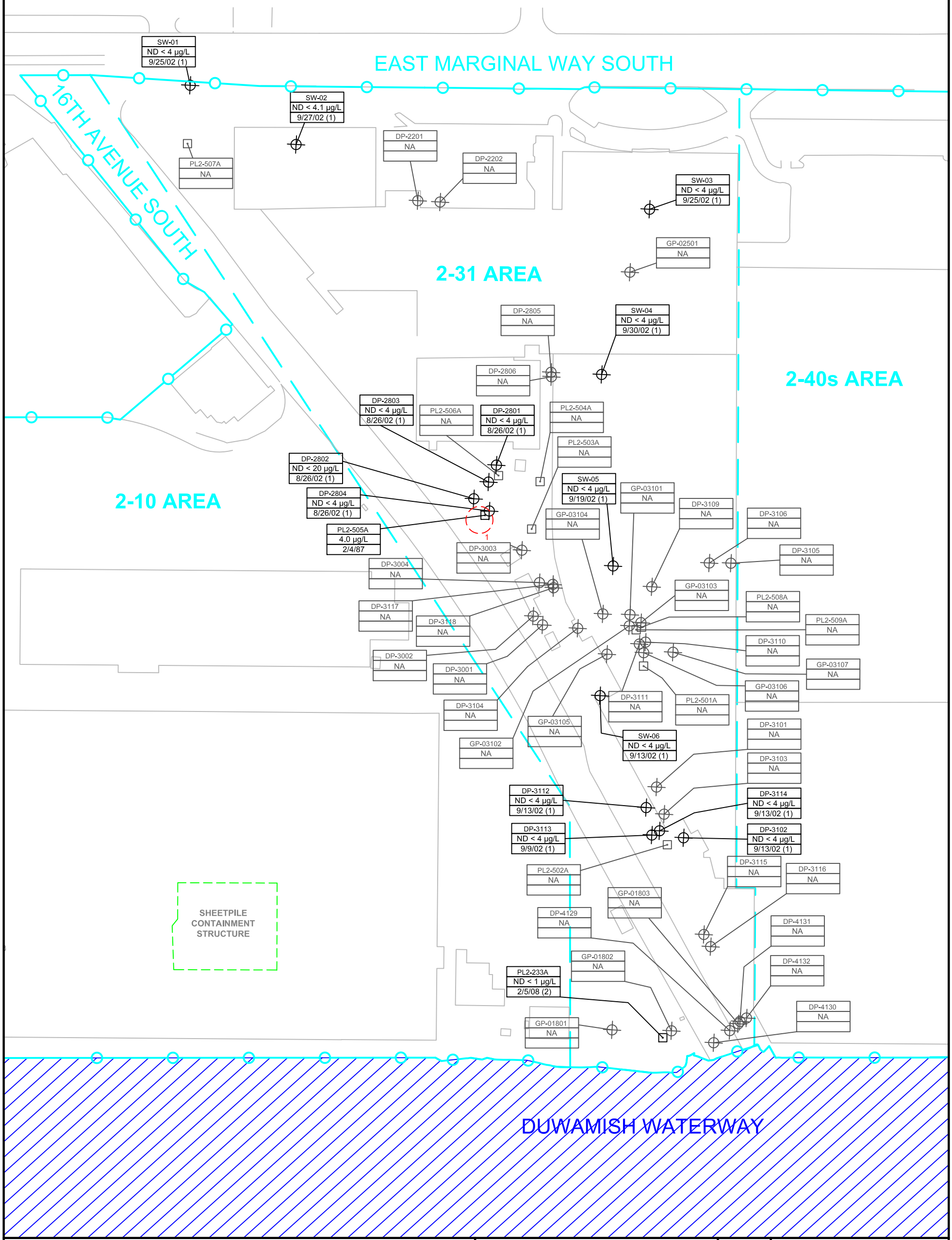
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
BENZO(K)FLUORANTHENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 3.0 µg/L
PROPOSED TMCL (2007) = 3.0 µg/L

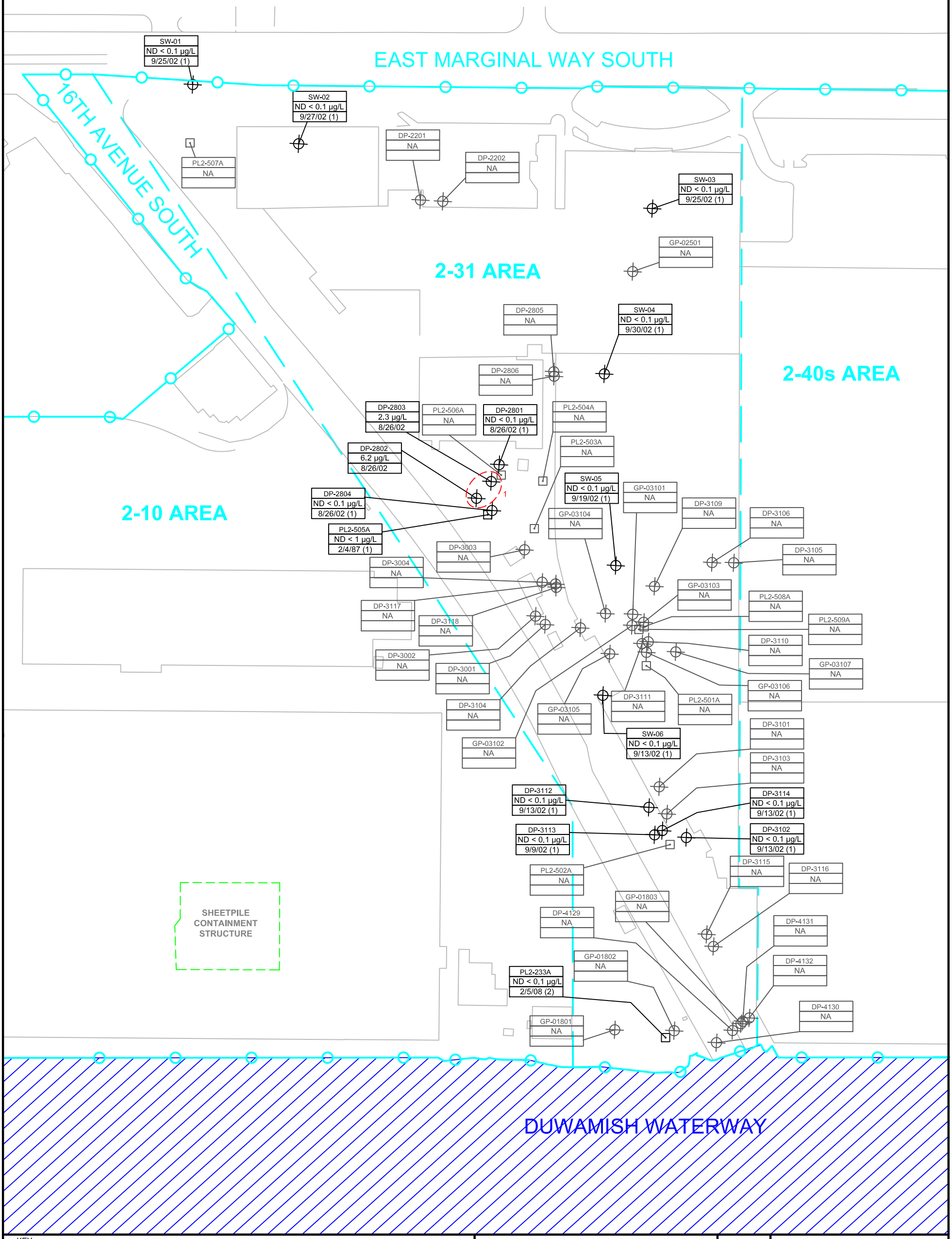
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
BIS(2-ETHYLHEXYL)PHTHALATE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

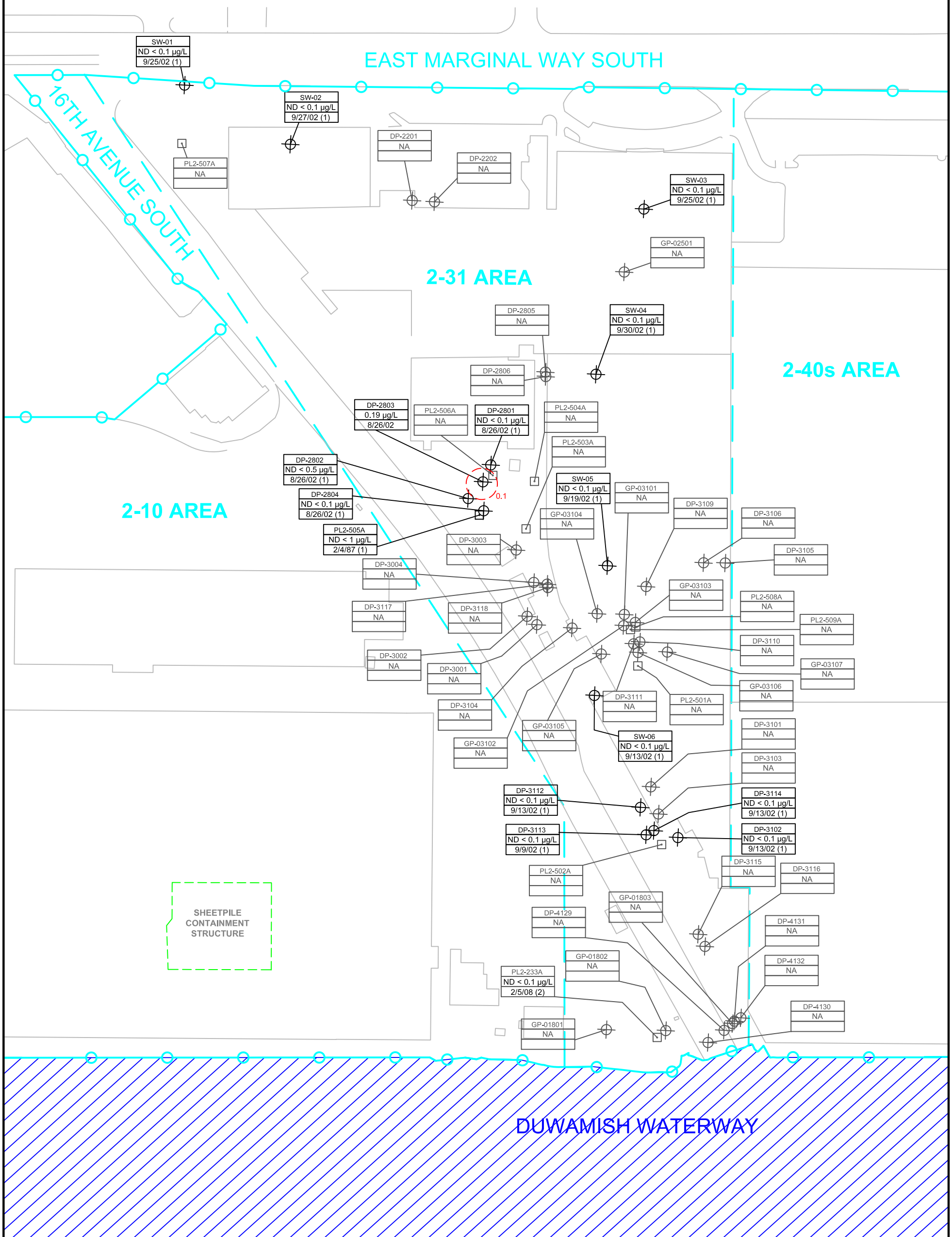
0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
CHRYSENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2
PREPARED FOR	THE BOEING COMPANY
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	MMH	DCK	05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

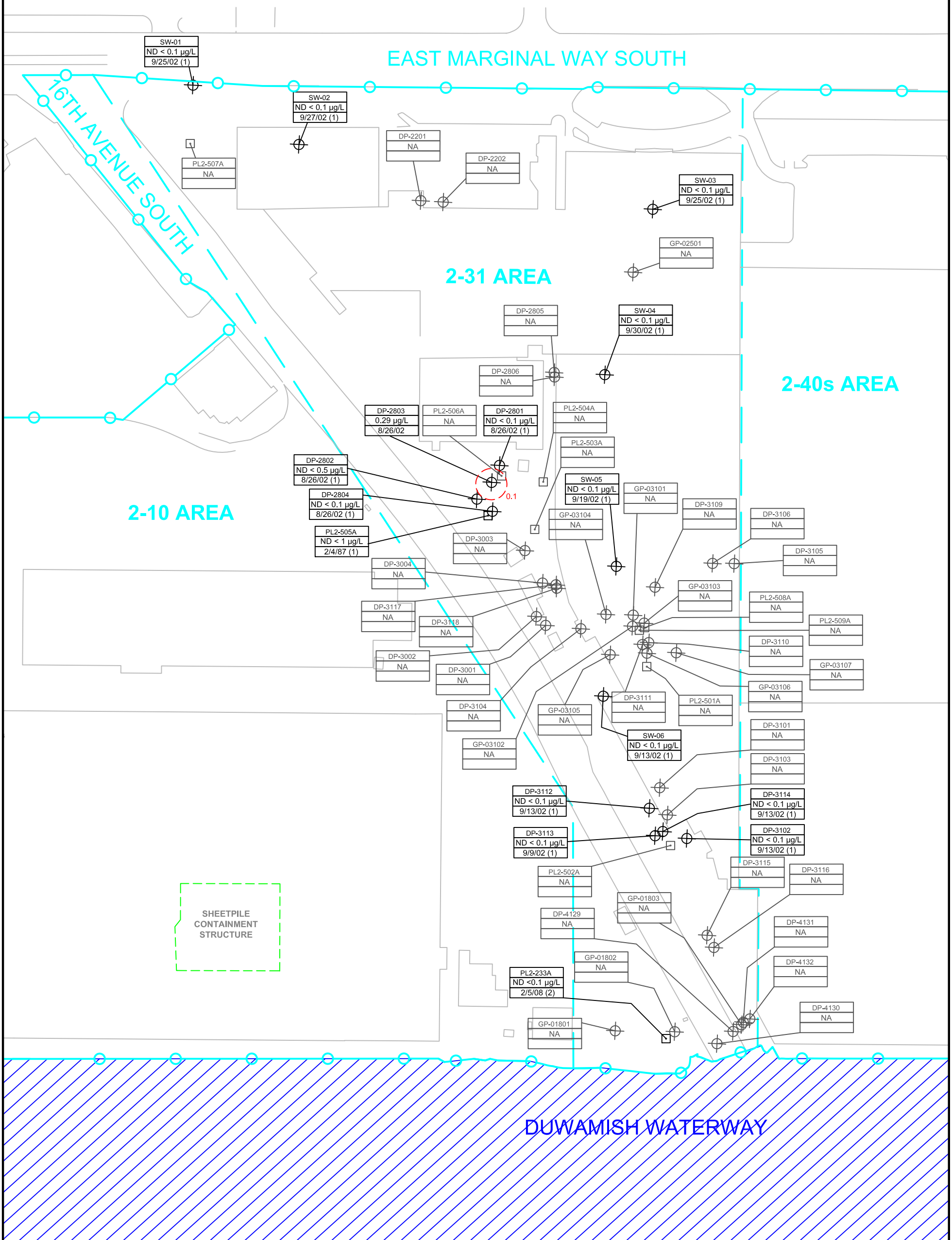
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
DIBENZ(A,H)ANTHRACENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.1 µg/L
PROPOSED TMCL (2007) = 0.1 µg/L

0 30' 60' 120'
SCALE: 1" = 120'

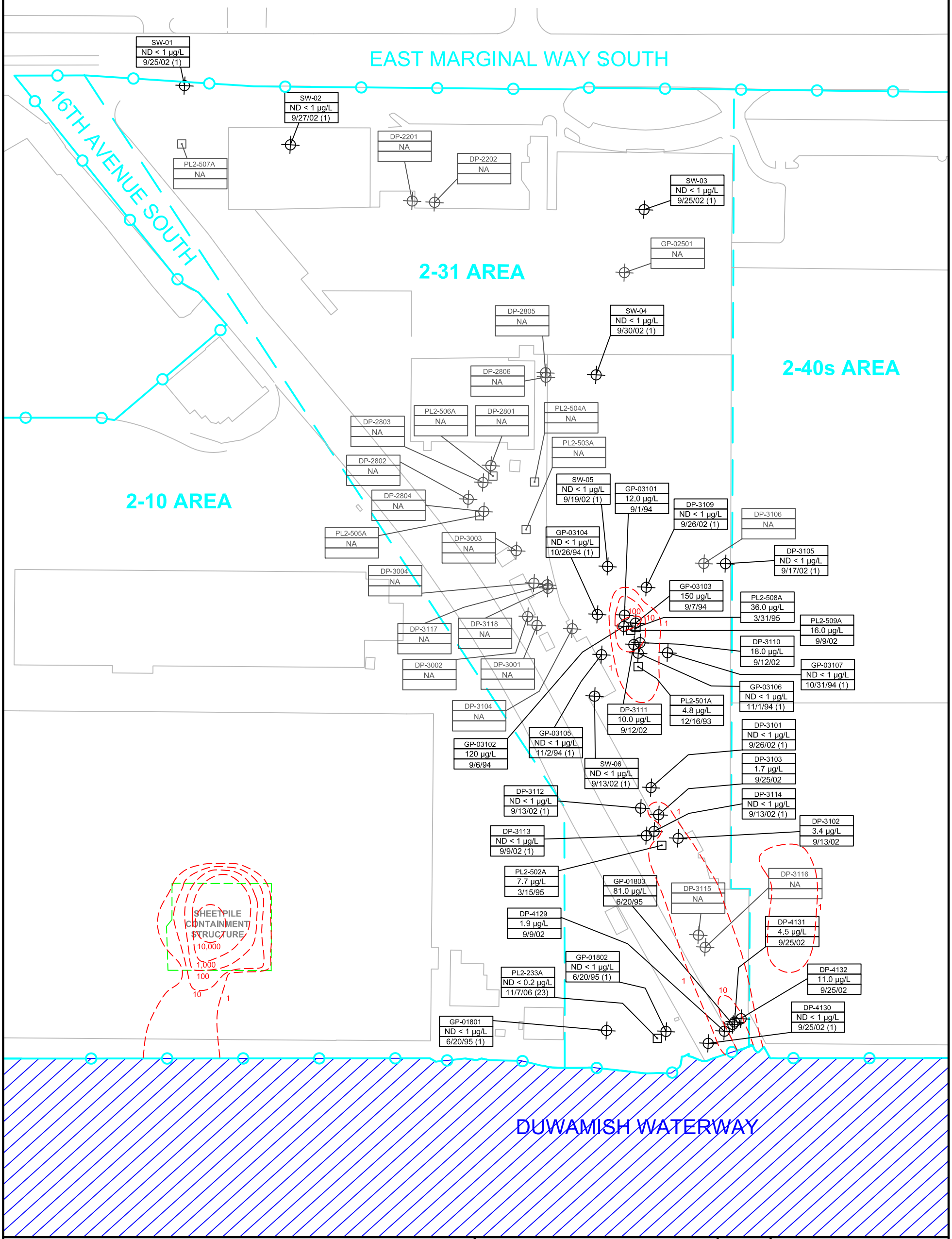
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
INDENO(1,2,3-CD)PYRENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2
PREPARED FOR	THE BOEING COMPANY
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	MMH	DCK	03/26/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.302 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

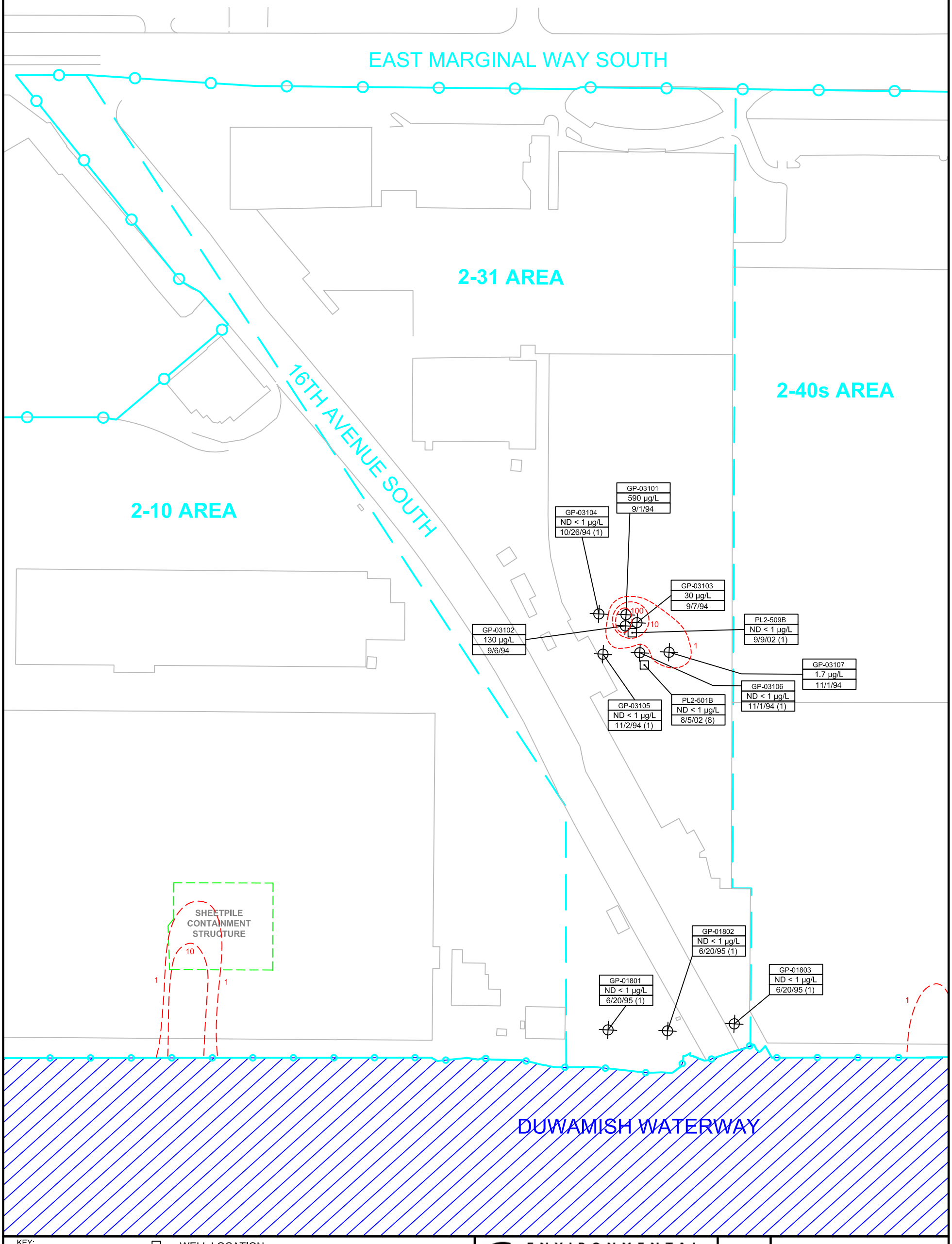
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TRICHLOROETHENE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/06/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.302 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

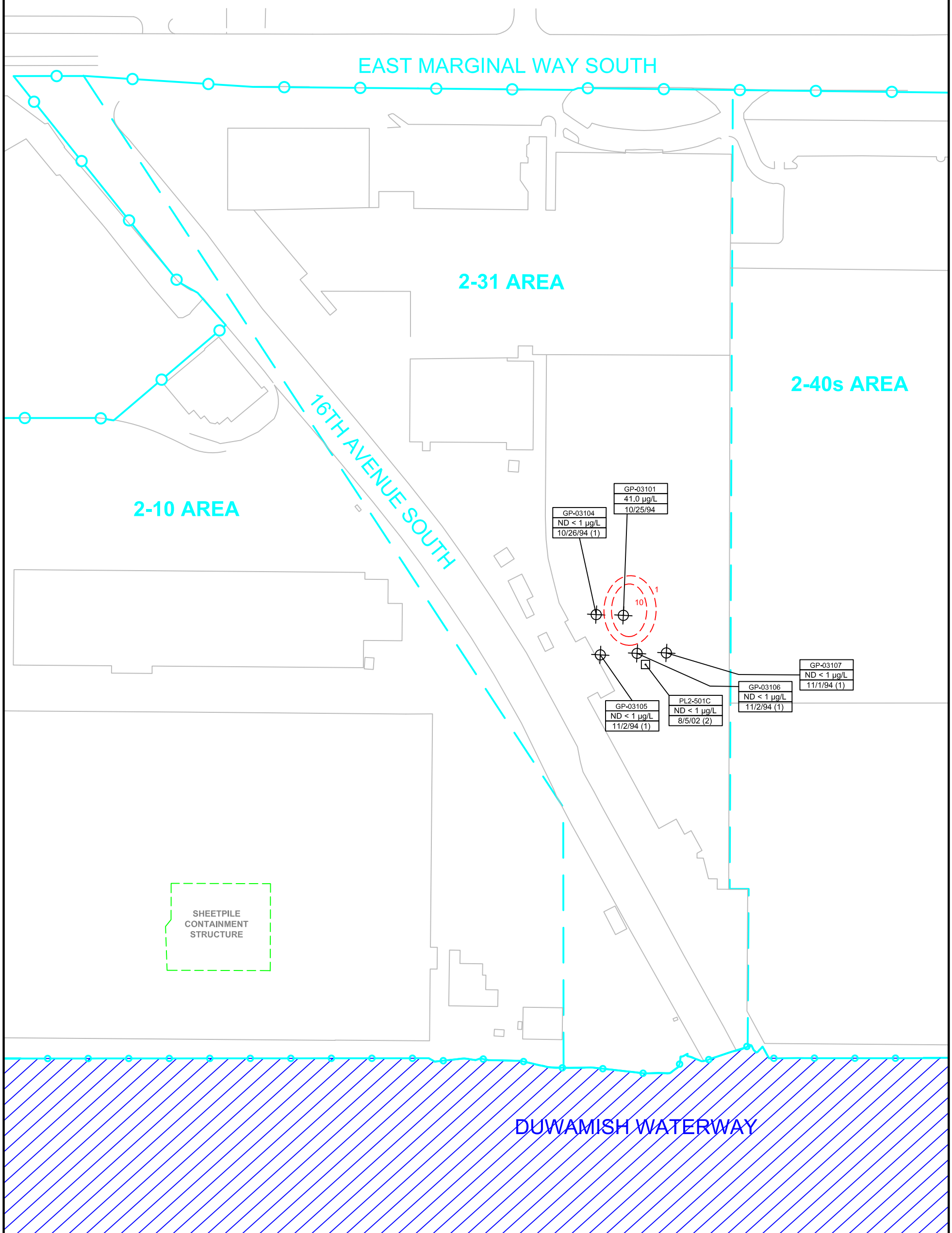
0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TRICHLOROETHENE CONCENTRATIONS IN LEVEL B GROUNDWATER

PROJECT	BOEING PLANT 2
PREPARED FOR	THE BOEING COMPANY
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	MMH	DCK	05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.302 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

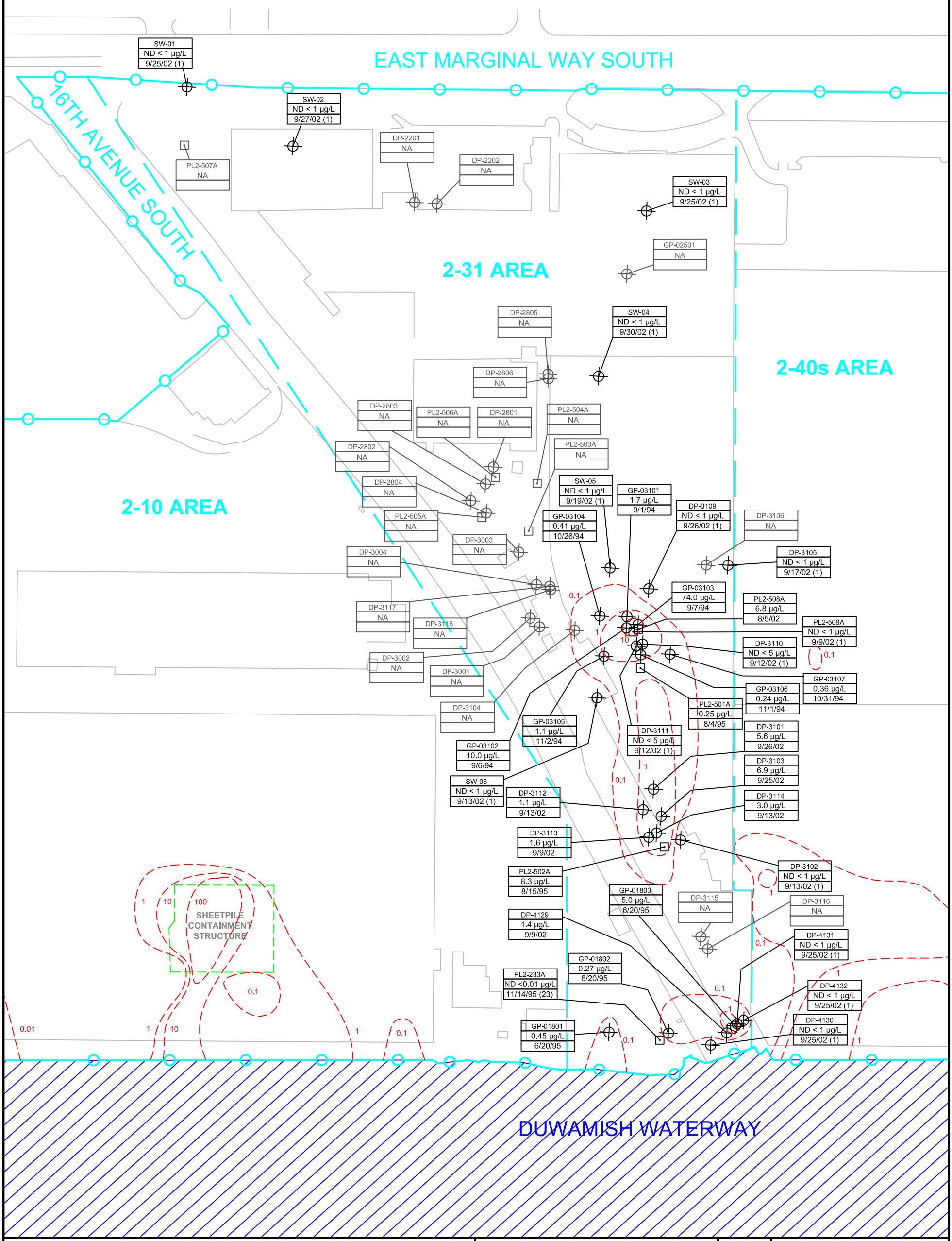
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TRICHLOROETHENE CONCENTRATIONS IN LEVEL C GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 03/27/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.731 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

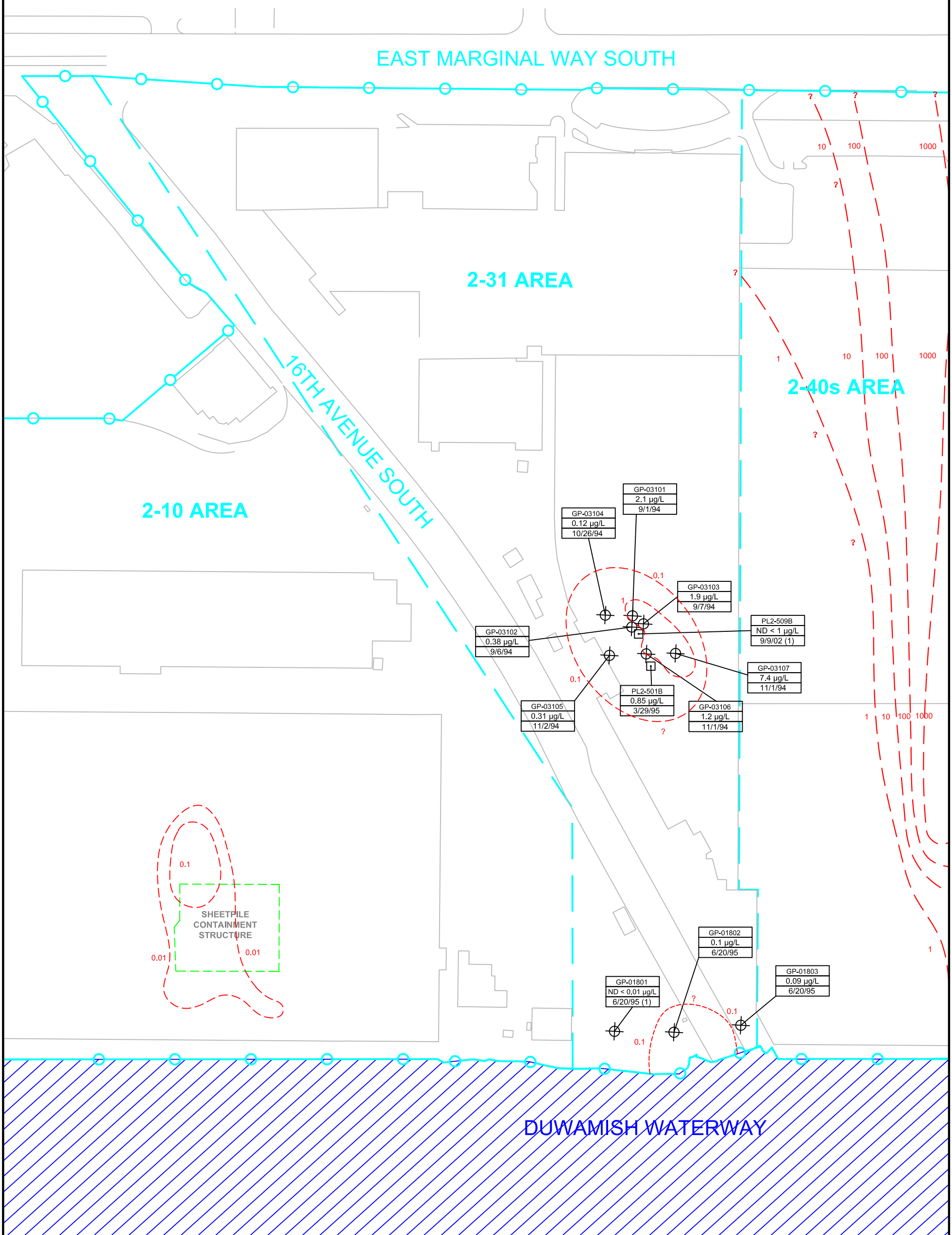
0 30' 60' 120'
SCALE: 1" = 120'

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
VINYL CHLORIDE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/06/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.731 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

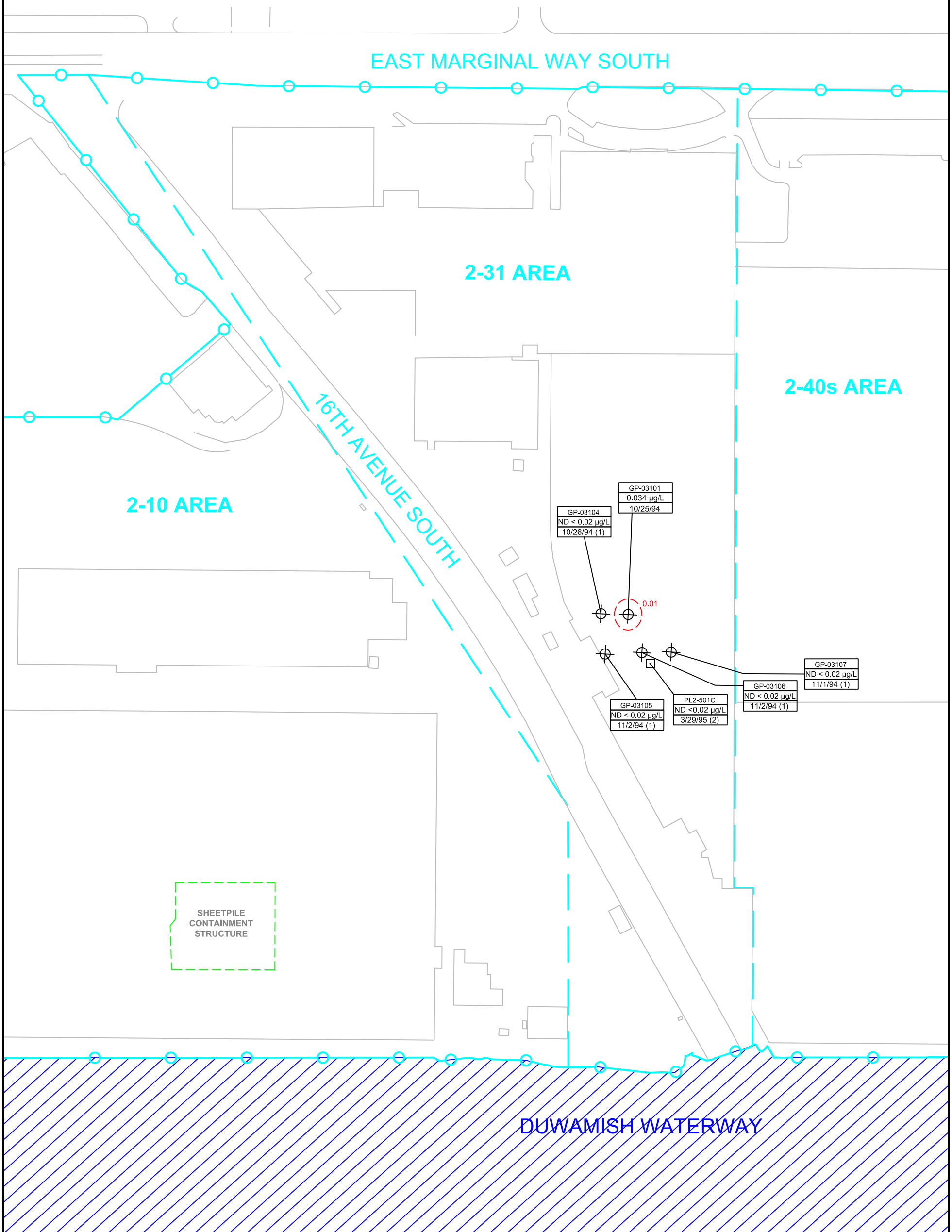
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
VINYL CHLORIDE CONCENTRATIONS IN LEVEL B GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/06/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 0.731 µg/L
PROPOSED TMCL (2007) = 0.2 µg/L

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

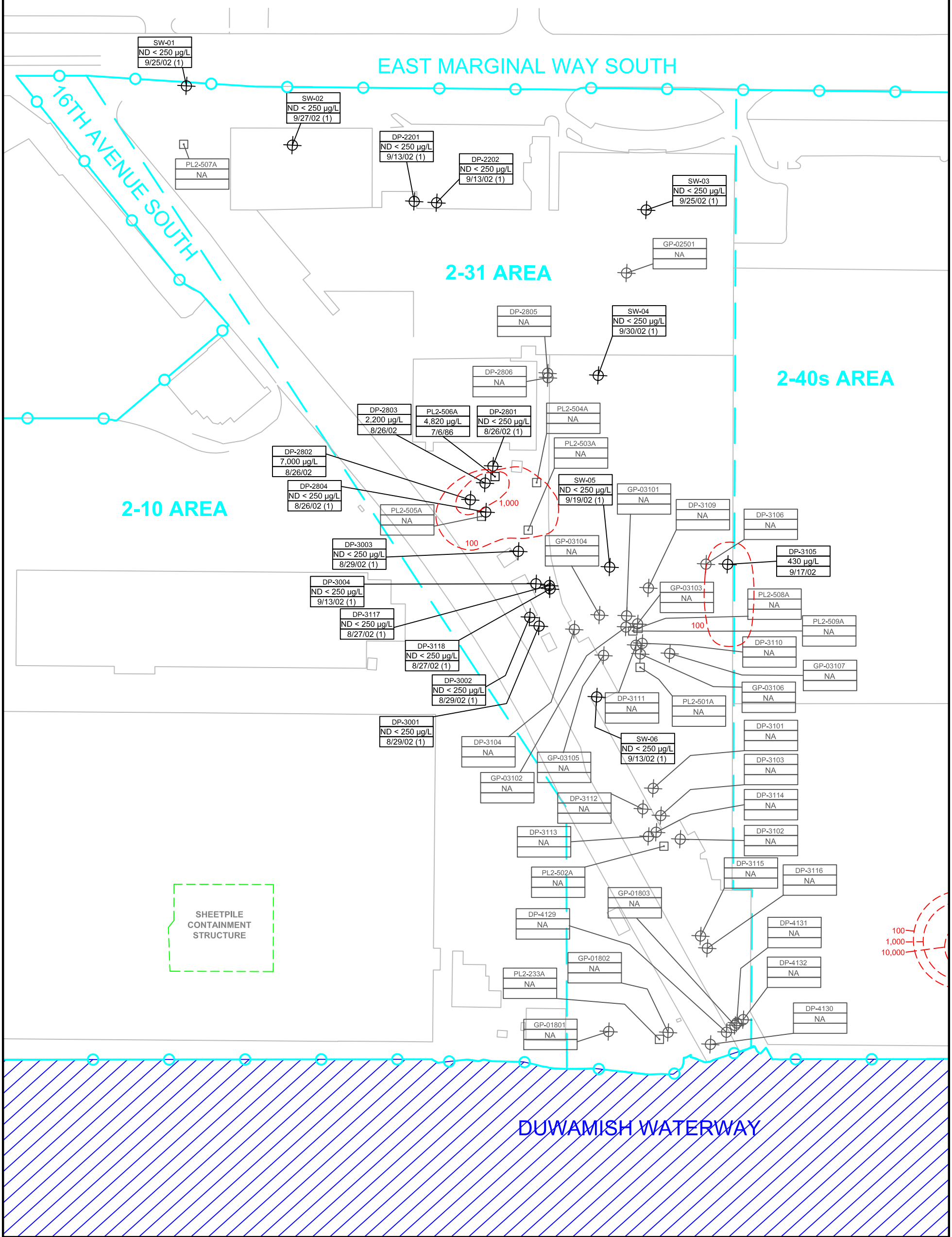
0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
VINYL CHLORIDE CONCENTRATIONS IN LEVEL C GROUNDWATER

PROJECT	BOEING PLANT 2
PREPARED FOR	THE BOEING COMPANY
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	MMH	DCK	03/31/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 500 µg/L
PROPOSED TMCL (2007) = 500 µg/L

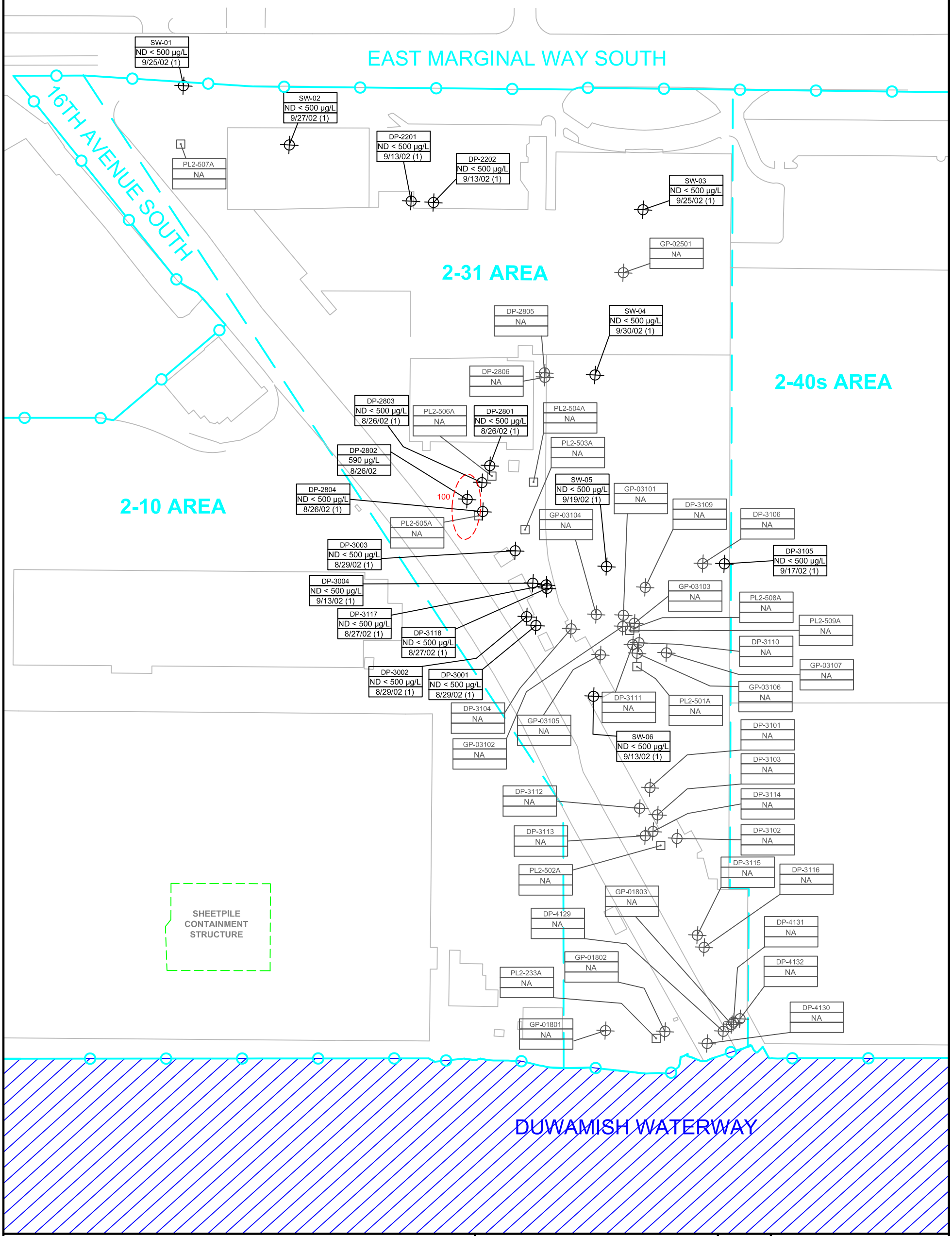
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TPH-DIESEL CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 500 µg/L
PROPOSED TMCL (2007) = 500 µg/L

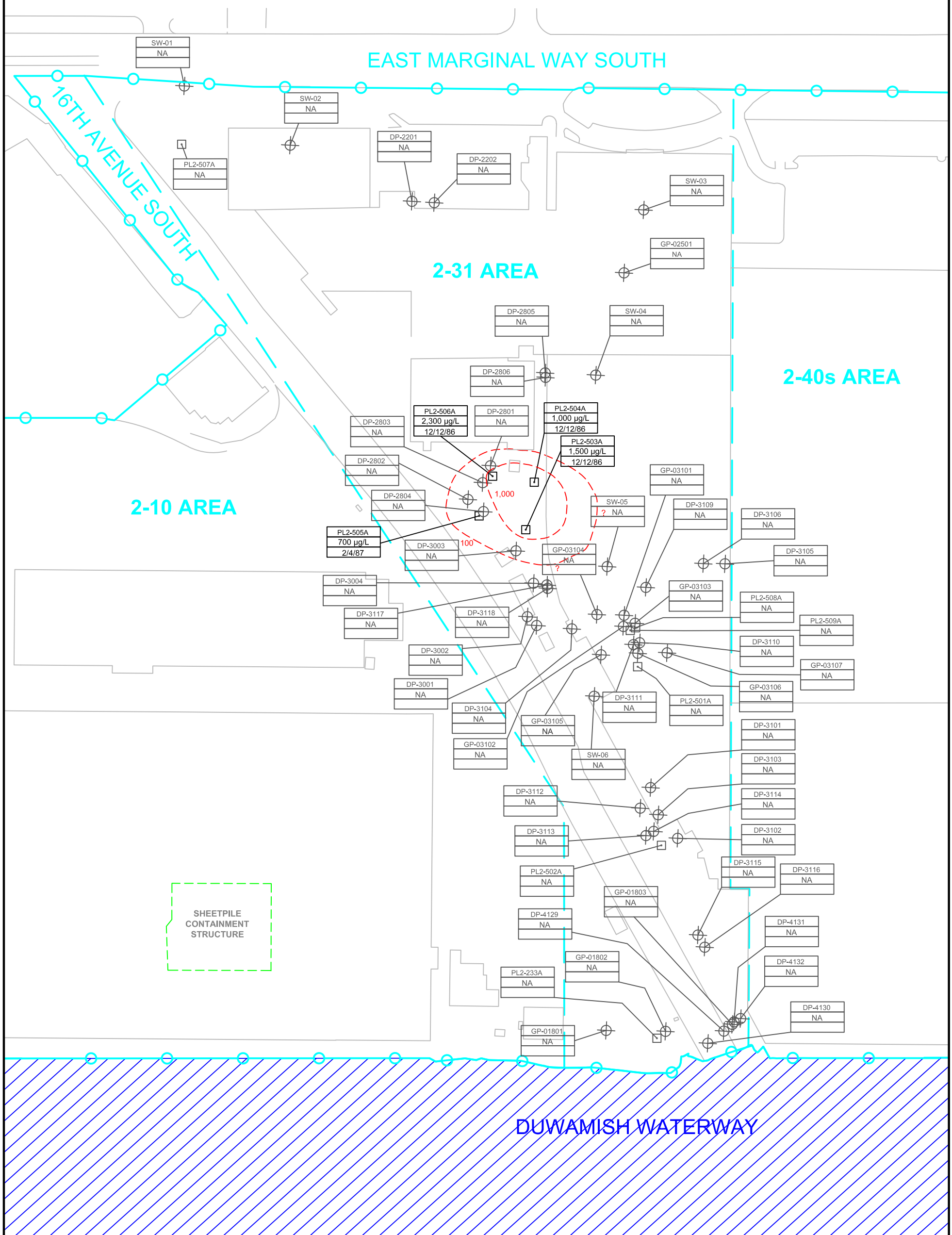
PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TPH-MOTOR OIL CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/02/08



KEY:

- WELL LOCATION
- PROBE LOCATION
- AREA BOUNDARY
- PROPERTY BOUNDARY
- ISOCONCENTRATION LINE
- ONSITE BUILDING AND ROAD STRUCTURE

SCREENING LEVEL (2004) = 500 µg/L
PROPOSED TMCL (2007) = 500 µg/L

PL2-005A	WELL/PROBE NAME
ND < 1 µg/L	MAXIMUM DETECTION OR NON-DETECT WITH DETECTION LIMIT
4/25/04 (2)	DATE (NUMBER OF NON-DETECTS)

0 30' 60' 120'
SCALE: 1" = 120'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

BOEING PLANT 2
2-31 AREA
TPH-OIL AND GREASE CONCENTRATIONS IN LEVEL A GROUNDWATER

PROJECT	BOEING PLANT 2		
PREPARED FOR	THE BOEING COMPANY		
LOCATION	7725 EAST MARGINAL WAY SEATTLE / TUKWILA, WASHINGTON		
SHEET 1 of 1	DRAWN BY MMH	REVIEWED BY DCK	DATE 05/02/08

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment A
Data Tables

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2-31 Area - Maximum Arsenic - Dissolved Concentrations in Groundwater
Boeing Plant 2
Site-Specific Background Level (2006) = 8.0 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101	09/26/02	6			
DP-3102		1 U	09/13/02	ND	1
DP-3103	09/25/02	4			
DP-3104	09/17/02	5			
DP-3105	09/17/02	52			
DP-3106	09/17/02	14			
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A	01/22/02	6.6			
PL2-501A				N/A	
PL2-502A	08/26/02	3.4			
PL2-503A	08/13/02	2.9			
PL2-504A	08/13/02	7.8			

2-31 Area - Maximum Arsenic - Dissolved Concentrations in Groundwater
Boeing Plant 2
Site-Specific Background Level (2006) = 8.0 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A	09/28/94	2			
PL2-506A				N/A	
PL2-507A	09/21/94	2			
PL2-508A				N/A	
PL2-509A				N/A	
SW-01	09/25/02	9			
SW-02	09/27/02	17			
SW-03	09/25/02	2			
SW-04	09/30/02	12			
SW-05	09/19/02	7			
SW-06	09/13/02	2			
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Copper - Dissolved Concentrations in Groundwater
Boeing Plant 2

Site-Specific Background Level (2006) = 8.0 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101		2 U	09/26/02	ND	1
DP-3102		2 U	09/13/02	ND	1
DP-3103		2 U	09/25/02	ND	1
DP-3104	09/17/02	8			
DP-3105	09/17/02	55			
DP-3106	09/17/02	14			
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A	01/22/02	3.7			
PL2-501A				N/A	
PL2-502A	08/26/02	2			
PL2-503A	08/13/02	7.7			
PL2-504A	08/13/02	11.1			

2-31 Area - Maximum Copper - Dissolved Concentrations in Groundwater
Boeing Plant 2

Site-Specific Background Level (2006) = 8.0 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A	08/21/02	2			
PL2-506A				N/A	
PL2-507A	09/21/94	6			
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		2 U	09/25/02	ND	1
SW-02		2 U	09/27/02	ND	1
SW-03		2 U	09/25/02	ND	1
SW-04	09/30/02	7			
SW-05	09/19/02	32			
SW-06	09/13/02	4			
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Mercury - Dissolved Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101		0.1 U	09/26/02	ND	1
DP-3102		0.1 U	09/13/02	ND	1
DP-3103		0.1 U	09/25/02	ND	1
DP-3104		0.1 U	09/17/02	ND	1
DP-3105	09/17/02	0.1			
DP-3106		0.1 U	09/17/02	ND	1
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A	07/23/01	0.00222 J			
PL2-501A				N/A	
PL2-502A		0.025 U	08/26/02	ND	1
PL2-503A		0.025 U	08/13/02	ND	1
PL2-504A	08/13/02	0.0312			

2-31 Area - Maximum Mercury - Dissolved Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		0.025 U	08/21/02	ND	2
PL2-506A				N/A	
PL2-507A		0.025 U	08/22/02	ND	3
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Nickel - Dissolved Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 8.2 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101		10 U	09/26/02	ND	1
DP-3102		10 U	09/13/02	ND	1
DP-3103		10 U	09/25/02	ND	1
DP-3104		10 U	09/17/02	ND	1
DP-3105		10 U	09/17/02	ND	1
DP-3106		10 U	09/17/02	ND	1
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A	09/03/03	4			
PL2-501A				N/A	
PL2-502A	08/26/02	1.6			
PL2-503A	08/13/02	3.4			
PL2-504A	08/13/02	5			

2-31 Area - Maximum Nickel - Dissolved Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 8.2 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A	08/21/02	17.3			
PL2-506A				N/A	
PL2-507A	08/22/02	7.2			
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		10 U	09/25/02	ND	1
SW-02		10 U	09/27/02	ND	1
SW-03		10 U	09/25/02	ND	1
SW-04		10 U	09/30/02	ND	1
SW-05		10 U	09/19/02	ND	1
SW-06		10 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Cyanide Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 5 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102				N/A	
DP-3103				N/A	
DP-3104		5 U	09/17/02	ND	1
DP-3105		5 U	09/17/02	ND	1
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A				N/A	
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Cyanide Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 5 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A				N/A	
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01	09/25/02	15			
SW-02		5 U	09/27/02		1
SW-03		5 U	09/25/02		1
SW-04		5 U	09/30/02		1
SW-05		5 U	09/19/02		1
SW-06		5 U	09/13/02		1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Benzo(a)anthracene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802	08/26/02	3.3 J			
DP-2803	08/26/02	1.4			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Benzo(a)anthracene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Benzo(a)pyrene Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802	08/26/02	1.5 J			
DP-2803	08/26/02	0.81			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Benzo(a)pyrene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Benzo(b)fluoranthene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802	08/26/02	0.85 J			
DP-2803	08/26/02	0.61			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Benzo(b)fluoranthene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Benzo(k)fluoranthene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802		0.5 UJ	08/26/02	ND	1
DP-2803	08/26/02	0.28			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Benzo(k)fluoranthene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Bis(2-Ethylhexyl)phthalate Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 3 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		4 UJ	08/26/02	ND	1
DP-2802		20 U	08/26/02	ND	1
DP-2803		4 U	08/26/02	ND	1
DP-2804		4 UJ	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		4 UJ	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		4 U	09/13/02	ND	1
DP-3113		4 U	09/09/02	ND	1
DP-3114		4 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Bis(2-Ethylhexyl)phthalate Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 3 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A	02/04/87	4			
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		4 U	09/25/02	ND	1
SW-02		4.1 U	09/27/02	ND	1
SW-03		4 U	09/25/02	ND	1
SW-04		4 UJ	09/30/02	ND	1
SW-05		4 UJ	09/19/02	ND	1
SW-06		4 UJ	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Chrysene Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802	08/26/02	6.2 J			
DP-2803	08/26/02	2.3			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Chrysene Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Dibenz(a,h)anthracene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802		0.5 U	08/26/02	ND	q
DP-2803	08/26/02	1.5			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1 U	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Dibenz(a,h)anthracene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Indeno(1,2,3-cd)pyrene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801		0.1 U	08/26/02	ND	1
DP-2802		0.5 UJ	08/26/02	ND	1
DP-2803	08/26/02	0.29			
DP-2804		0.1 U	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102		0.1	09/13/02	ND	1
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112		0.1 U	09/13/02	ND	1
DP-3113		0.1 U	09/09/02	ND	1
DP-3114		0.1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A		0.1 U	02/05/08	ND	2
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Indeno(1,2,3-cd)pyrene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.1 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A		1 U	02/04/87	ND	1
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		0.1 U	09/25/02	ND	1
SW-02		0.1 U	09/27/02	ND	1
SW-03		0.1 U	09/25/02	ND	1
SW-04		0.1 U	09/30/02	ND	1
SW-05		0.1 U	09/19/02	ND	1
SW-06		0.1 U	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum Trichloroethene Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.302 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101		1 U	09/26/02	ND	1
DP-3102	09/13/02	3.4			
DP-3103	09/25/02	1.7			
DP-3104				N/A	
DP-3105		1 U	09/17/02	ND	1
DP-3106				N/A	
DP-3109		1 U	09/26/02	ND	1
DP-3110	09/12/02	18			
DP-3111	09/12/02	10			
DP-3112		1 U	09/13/02	ND	1
DP-3113		1 U	09/09/02	ND	1
DP-3114		1 U	09/13/02	ND	1
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129	09/09/02	1.9			
DP-4130		1 U	09/25/02	ND	1
DP-4131	09/25/02	4.5			
DP-4132	09/25/02	11			
GP-01801		1 U	06/20/95	ND	1
GP-01802		1 U	06/20/95	ND	1
GP-01803	06/20/95	81			
GP-02501				N/A	
GP-03101	09/01/94	12			
GP-03102	09/06/94	120 J			
GP-03103	09/07/94	150 J			
GP-03104		1 U	10/26/94	ND	1
GP-03105		1 U	11/02/94	ND	1
GP-03106		1 U	11/01/94	ND	1
GP-03107		1 U	10/31/94	ND	1
PL2-233A		1 U	02/05/08	ND	23
PL2-501A	12/16/93	4.8			
PL2-502A	03/15/95	7.7			
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Trichloroethene Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 0.302 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A				N/A	
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A	03/31/95	36			
PL2-509A	09/09/02	16			
SW-01		1 U	09/25/02	ND	1
SW-02		1 U	09/27/02	ND	1
SW-03		1 U	09/25/02	ND	1
SW-04		1 U	09/30/02	ND	1
SW-05		1 U	09/19/02	ND	1
SW-06		1 U	09/13/02	ND	1
B-Level					
GP-01801		1 U	06/20/95	ND	1
GP-01802		1 U	06/20/95	ND	1
GP-01803		1 U	06/20/95	ND	1
GP-03101	09/01/94	590 D			
GP-03102	09/06/94	130 J			
GP-03103	09/07/94	30 JH			
GP-03104		1 U	10/26/94	ND	1
GP-03105		1 U	11/02/94	ND	1
GP-03106		1 U	11/01/94	ND	1
GP-03107	11/01/94	1.7			
PL2-501B		1 U	08/05/02	ND	8
PL2-509B		1 U	09/09/02	ND	1
C-Level					
GP-03101	10/25/94	41			
GP-03104		1 U	10/26/94	ND	1
GP-03105		1 U	11/02/94	ND	1
GP-03106		1 U	11/02/94	ND	1
GP-03107		1 U	11/01/94	ND	1
PL2-501C		1 U	08/05/02	ND	2

2-31 Area - Maximum Vinyl Chloride Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.731 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101	09/26/02	5.6 J		N/A	
DP-3102		1 UJ	09/13/02	ND	1
DP-3103	09/25/02	6.9 J			
DP-3104				N/A	
DP-3105		1 U	09/17/02	ND	1
DP-3106				N/A	
DP-3109		1 UJ	09/26/02	ND	1
DP-3110		5 U	09/12/02	ND	1
DP-3111		5 U	09/12/02	ND	1
DP-3112	09/13/02	1.1 J			
DP-3113	09/09/02	1.6			
DP-3114	09/13/02	3 J			
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129	09/09/02	1.4			
DP-4130		1 U	09/25/02	ND	1
DP-4131		1 UJ	09/25/02	ND	1
DP-4132		1 UJ	09/25/02	ND	1
GP-01801	06/20/95	0.45			
GP-01802	06/20/95	0.27			
GP-01803	06/20/95	5			
GP-02501				N/A	
GP-03101	09/01/94	1.7			
GP-03102	09/06/94	10			
GP-03103	09/07/94	74			
GP-03104	10/26/94	0.41			
GP-03105	11/02/94	1.1			
GP-03106	11/01/94	0.24			
GP-03107	10/31/94	0.36			
PL2-233A		0.2 U	02/05/08	ND	23
PL2-501A	08/04/95	0.25			
PL2-502A	08/15/95	8.3			
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum Vinyl Chloride Concentrations in Groundwater
Boeing Plant 2
Draft CMS Screening Level (2004) = 0.731 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A				N/A	
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A		6.8	08/05/02		
PL2-509A		1 U	09/09/02	ND	1
SW-01		1 UJ	09/25/02	ND	1
SW-02		1 UJ	09/27/02	ND	1
SW-03		1 UJ	09/25/02	ND	1
SW-04		1 UJ	09/30/02	ND	1
SW-05		1 U	09/19/02	ND	1
SW-06		1 U	09/13/02	ND	1
B-Level					
GP-01801		0.01 U	06/20/95	ND	1
GP-01802	06/20/95	0.1			
GP-01803	06/20/95	0.09			
GP-03101	09/01/94	2.1			
GP-03102	09/06/94	0.38			
GP-03103	09/07/94	1.9			
GP-03104	10/26/94	0.12			
GP-03105	11/02/94	0.31			
GP-03106	11/01/94	1.2			
GP-03107	11/01/94	7.4			
PL2-501B	03/29/95	0.85			
PL2-509B		1 U	09/09/02	ND	1
C-Level					
GP-03101	10/25/94	0.034			
GP-03104		0.02 U	10/26/94	ND	1
GP-03105		0.02 U	11/02/94	ND	1
GP-03106		0.02 U	11/02/94	ND	1
GP-03107		0.02 U	11/01/94	ND	1
PL2-501C		1 U	08/05/02	ND	2

2-31 Area - Maximum TPH-Diesel Range Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201		250 UJ	09/13/02	ND	1
DP-2202		250 UJ	09/13/02	ND	1
DP-2801		250 UJ	08/26/02	ND	1
DP-2802	08/26/02	7000 J			
DP-2803	08/26/02	2200 J			
DP-2804		250 UJ	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001		250 UJ	08/29/02	ND	1
DP-3002		250 UJ	08/29/02	ND	1
DP-3003		250 UJ	08/29/02	ND	1
DP-3004		250 UJ	09/13/02	ND	1
DP-3101				N/A	
DP-3102				N/A	
DP-3103				N/A	
DP-3104				N/A	
DP-3105	09/17/02	430 J			
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117		250 UJ	08/27/02	ND	1
DP-3118		250 UJ	08/27/02	ND	1
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A				N/A	
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum TPH-Diesel Range Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A				N/A	
PL2-506A	07/06/86	4820			
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		250 U	09/25/02	ND	1
SW-02		250 UJ	09/27/02	ND	1
SW-03		250 U	09/25/02	ND	1
SW-04		250 UJ	09/30/02	ND	1
SW-05		250 U	09/19/02	ND	1
SW-06		250 UJ	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum TPH-Motor Oil Range Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201		500 UJ	09/13/02	ND	1
DP-2202		500 UJ	09/13/02	ND	1
DP-2801		500 UJ	08/26/02	ND	1
DP-2802	08/26/02	590 J			
DP-2803		500 UJ	08/26/02	ND	1
DP-2804		500 UJ	08/26/02	ND	1
DP-2805				N/A	
DP-2806				N/A	
DP-3001		500 UJ	08/29/02	ND	1
DP-3002		500 UJ	08/29/02	ND	1
DP-3003		500 UJ	08/29/02	ND	1
DP-3004		500 UJ	09/13/02	ND	1
DP-3101				N/A	
DP-3102				N/A	
DP-3103				N/A	
DP-3104				N/A	
DP-3105		500 UJ	09/17/02	ND	1
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117		500 UJ	08/27/02	ND	1
DP-3118		500 UJ	08/27/02	ND	1
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A				N/A	
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A				N/A	
PL2-504A				N/A	

2-31 Area - Maximum TPH-Motor Oil Range Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A				N/A	
PL2-506A				N/A	
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01		500 U	09/25/02	ND	1
SW-02		500 UJ	09/27/02	ND	1
SW-03		500 U	09/25/02	ND	1
SW-04		500 UJ	09/30/02	ND	1
SW-05		500 U	09/19/02	ND	1
SW-06		500 UJ	09/13/02	ND	1
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

2-31 Area - Maximum TPH-Oil and Grease Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
DP-2201				N/A	
DP-2202				N/A	
DP-2801				N/A	
DP-2802				N/A	
DP-2803				N/A	
DP-2804				N/A	
DP-2805				N/A	
DP-2806				N/A	
DP-3001				N/A	
DP-3002				N/A	
DP-3003				N/A	
DP-3004				N/A	
DP-3101				N/A	
DP-3102				N/A	
DP-3103				N/A	
DP-3104				N/A	
DP-3105				N/A	
DP-3106				N/A	
DP-3109				N/A	
DP-3110				N/A	
DP-3111				N/A	
DP-3112				N/A	
DP-3113				N/A	
DP-3114				N/A	
DP-3115				N/A	
DP-3116				N/A	
DP-3117				N/A	
DP-3118				N/A	
DP-4129				N/A	
DP-4130				N/A	
DP-4131				N/A	
DP-4132				N/A	
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-02501				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-233A				N/A	
PL2-501A				N/A	
PL2-502A				N/A	
PL2-503A	12/12/86	1500			
PL2-504A	12/12/86	1000			

2-31 Area - Maximum TPH-Oil and Grease Concentrations in Groundwater
Boeing Plant 2

Draft CMS Screening Level (2004) = 500 µg/L

Well or Probe Location	Maximum Concentration Date	Maximum Concentration or Detection Limit (µg/L)	Most Recent Non-Detect Date	Not Analyzed or Not Detected	Number of Non-Detects
A-Level					
PL2-505A	02/04/87	700			
PL2-506A	12/12/86	2300			
PL2-507A				N/A	
PL2-508A				N/A	
PL2-509A				N/A	
SW-01				N/A	
SW-02				N/A	
SW-03				N/A	
SW-04				N/A	
SW-05				N/A	
SW-06				N/A	
B-Level					
GP-01801				N/A	
GP-01802				N/A	
GP-01803				N/A	
GP-03101				N/A	
GP-03102				N/A	
GP-03103				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501B				N/A	
PL2-509B				N/A	
C-Level					
GP-03101				N/A	
GP-03104				N/A	
GP-03105				N/A	
GP-03106				N/A	
GP-03107				N/A	
PL2-501C				N/A	

Boeing Plant 2
Seattle/Tukwila, Washington

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Data Gap Investigation Work Plan

Attachment B
Soil Constituents of Concern

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Arsenic in Soil, 2-31 Area: Depth 1 - 6 Ft.

Arsenic in Soil, 2-31 Area: Depth 6 - 12 Ft.

Cadmium in Soil, 2-31 Area: Depth 0 - 1 Ft.

Cadmium in Soil, 2-31 Area: Depth 1 - 6 Ft.

Cadmium in Soil, 2-31 Area: Depth 6 - 12 Ft.

Copper in Soil, 2-31 Area: Depth 0 - 1 Ft.

Copper in Soil, 2-31 Area: Depth 1 - 6 Ft.

Copper in Soil, 2-31 Area: Depth 6 - 12 Ft.

Mercury in Soil, 2-31 Area: Depth 0 - 1 Ft.

Mercury in Soil, 2-31 Area: Depth 1 - 6 Ft.

Mercury in Soil, 2-31 Area: Depth 6 - 12 Ft.

Nickel in Soil, 2-31 Area: Depth 0 - 1 Ft.

Nickel in Soil, 2-31 Area: Depth 1 - 6 Ft.

Nickel in Soil, 2-31 Area: Depth 6 - 12 Ft.

Silver in Soil, 2-31 Area: Depth 0 - 1 Ft.

Silver in Soil, 2-31 Area: Depth 1 - 6 Ft.

Silver in Soil, 2-31 Area: Depth 6 - 12 Ft.

Zinc in Soil, 2-31 Area: Depth 0 - 1 Ft.
Zinc in Soil, 2-31 Area: Depth 1 - 6 Ft.
Zinc in Soil, 2-31 Area: Depth 6 - 12 Ft.
Cyanide in Soil, 2-31 Area: Depth 0 - 1 Ft.
Cyanide in Soil, 2-31 Area: Depth 1 - 6 Ft.
Cyanide in Soil, 2-31 Area: Depth 6 - 12 Ft.
Benzo(a)anthracene in Soil, 2-31 Area: Depth 0 - 1 Ft.
Benzo(a)anthracene in Soil, 2-31 Area: Depth 1 - 6 Ft.
Benzo(a)anthracene in Soil, 2-31 Area: Depth 6 - 12 Ft.
Chrysene in Soil, 2-31 Area: Depth 0 - 1 Ft.
Chrysene in Soil, 2-31 Area: Depth 1 - 6 Ft.
Chrysene in Soil, 2-31 Area: Depth 6 - 12 Ft.
Total PCBs in Soil, 2-31 Area: Depth 0 - 1 Ft.
Total PCBs in Soil, 2-31 Area: Depth 1 - 6 Ft.
Total PCBs in Soil, 2-31 Area: Depth 6 - 12 Ft.
Trichloroethene in Soil, 2-31 Area: Depth 0 - 1 Ft.
Trichloroethene in Soil, 2-31 Area: Depth 1 - 6 Ft.
Trichloroethene in Soil, 2-31 Area: Depth 6 - 12 Ft.
Vinyl Chloride in Soil, 2-31 Area: Depth 0 - 1 Ft.
Vinyl Chloride in Soil, 2-31 Area: Depth 1 - 6 Ft.
Vinyl Chloride in Soil, 2-31 Area: Depth 6 - 12 Ft.
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TPH - Diesel Range Concentrations in Soil

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B1.0 Soil Constituents of Concern

This attachment includes soil data information for the 2-31 Area of Boeing Plant 2 (Plant 2). This information was used to prepare Section 2, Data Gap Analysis, of this Data Gap Investigation Work Plan and includes: tables summarizing site-wide and 2-31 Area soil COCs, maps showing the distribution of COCs in the 2-31 Area, and data tables for each soil COC.

B1.1 IDENTIFICATION OF COCS

Table B-1 summarizes the screening levels for the site-wide soil COCs. All accepted soil data including any qualified data compiled since 1985 were used to prepare the table with two exceptions:

1. Soil data below 12 feet (generally below the water table) were excluded.
2. Soil data from soil that was removed from the site as a result of interim actions were excluded.

A COC was identified when laboratory analysis of a sample resulted in a concentration greater than the screening level at least once in any soil sample from the site. Table B-1 also includes the risk calculation in soil for the direct, air, and surface water exposure pathways. As discussed in detail in Volume II, screening levels for soil are the same as risk calculations. Because no risk information is available, the direct contact pathway screening level for TPH and lead were established according to MTCA Method A. Background soil concentrations are based on *Natural Background in Soil Metals Concentrations in Washington State* (Ecology Pub #94-115).

Table B-2 presents the current groundwater COCs for the 2-31 Area. COCs were identified by the same method as described above for Table B-1. All accepted soil data, including any qualified data compiled from the 2-31 Area since 1989, were used to prepare the table.

B1.2 SPATIAL DISTRIBUTION OF COCS

Included in this attachment are maps showing the spatial distribution of each COC in soil at the 2-31 Area.

Maps showing the spatial distribution of each COC in soil (at three different depth intervals) in the 2-31 Area are included in this attachment. The maps show the spatial distribution of each COC at three depth intervals: 0 to 1 foot, 1 to 6 feet, and 6 to 12 feet below ground surface. The accepted maximum concentration of each COC for each interval was used to generate the maps. If a constituent was never detected at a particular location, then the reporting limit for the non-detect is presented, with the exception of Total PCBs, where only the sum of all detected aroclors is shown.

B1.3 DATA TABLES

The data tables show all of the accepted maximum concentrations each soil COC. The data tables include data from all soil intervals, regardless of the frequency of detection.

Boeing Plant 2
Seattle/Tukwila, Washington

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Data Gap Investigation Work Plan

Attachment B
Tables

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Table B-1 Screening Levels for Constituents of Concern in Site-wide Soils

CAS Number	Constituent of Concern	Maximum Detected	Soil Units	Laboratory RL	Puget Sound Basin Natural Background Concentration[a]	Direct Contact Risk Calculation[b]	Direct Contact Screening Level	Air Risk Calculation[c]	Air Screening Level	Surface Water Risk Calculation[d]	Surface Water Screening Level
Metals and Cyanide											
7440-36-0	Antimony	9.90E+02	mg/kg	5.00E+00	- -	***5.33E+02***	***5.33E+02***	- -	- -	***4.64E+02***	***4.64E+02***
7440-38-2	Arsenic	7.60E+01	mg/kg	5.00E+00	7.30E+00	***3.33E+01***	***3.33E+01***	3.22E+04	3.22E+04	***1.13E-02***	***5.00E+00***
7440-43-9	Cadmium	3.70E+03	mg/kg	2.00E-01	7.70E-01	***6.67E+02***	***6.67E+02***	7.70E+04	7.70E+04	***1.21E+00***	***1.21E+00***
18540-29-9	Chromium (VI)	1.30E+03	mg/kg	2.00E-01	- -	4.00E+03	4.00E+03	1.06E+04	1.06E+04	***1.92E+01***	***1.92E+01***
7440-50-8	Copper	2.81E+04	mg/kg	2.00E-01	3.64E+01	4.93E+04	4.93E+04	- -	- -	***1.38E+00***	***1.38E+00***
7439-92-1	Lead	1.82E+04	mg/kg	2.00E+00	1.68E+01	***1.00E+03***	***1.00E+03***	- -	- -	***1.62E+03***	***1.62E+03***
7439-96-5	Manganese	4.01E+03	mg/kg	1.00E-01	1.146E+03	1.87E+05	1.87E+05	- -	- -	***1.30E+02***	***1.30E+02***
7439-97-6	Mercury	3.00E+01	mg/kg	5.00E-02	7.00E-02	4.19E+01	4.19E+01	***6.13E+00***	***6.13E+00***	***2.61E-02***	***5.00E-02***
7440-02-0	Nickel (soluble salts)	1.77E+03	mg/kg	1.00E+00	4.78E+01	2.67E+04	2.67E+04	- -	- -	***1.07E+01***	***1.07E+01***
7782-49-2	Selenium	9.00E+00	mg/kg	5.00E+00	- -	6.67E+03	6.67E+03	- -	- -	***7.38E+00***	***7.38E+00***
7440-22-4	Silver	2.74E+02	mg/kg	3.00E-01	- -	6.67E+03	6.67E+03	- -	- -	***3.23E-01***	***3.23E-01***
7440-28-0	Thallium (soluble salts)	5.60E+01	mg/kg	2.00E-01	- -	8.64E+01	8.64E+01	- -	- -	***6.69E-01***	***6.69E-01***
7440-66-6	Zinc	2.60E+04	mg/kg	6.00E-01	8.51E+01	4.00E+05	4.00E+05	- -	- -	***1.01E+02***	***1.01E+02***
57-12-5	Cyanide	4.60E+03	mg/kg	1.00E-01	- -	2.67E+04	2.67E+04	- -	- -	***2.02E-01***	***2.02E-01***
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs)											
56-55-3	Benzo(a)anthracene	2.00E+05	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***4.19E+01***	***4.19E+01***
205-99-2	Benzo(b)fluoranthene	1.00E+05	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***1.44E+02***	***1.44E+02***
207-08-9	Benzo(k)fluoranthene	1.60E+05	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***1.44E+02***	***1.44E+02***
50-32-8	Benzo(a)pyrene	2.10E+05	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	7.95E+07	7.95E+07	***1.13E+02***	***1.13E+02***
218-01-9	Chrysene	2.40E+05	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***4.66E+01***	***4.66E+01***
53-70-3	Dibenz(a,h)anthracene	3.30E+04	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***2.10E+02***	***2.10E+02***
105-67-9	2,4-Dimethylphenol	6.80E+01	µg/kg	2.00E+02	- -	1.33E+07	1.33E+07	- -	- -	2.24E+03	2.24E+03
131-11-3	Dimethylphthalate	ND	µg/kg	6.70E+01	***- -***	***6.67E+08***	***6.67E+08***	***- -***	***- -***	***1.69E+05***	***1.69E+05***
117-81-7	bis(2-Ethylhexyl)phthalate	3.30E+05	µg/kg	6.70E+01	- -	1.79E+06	1.79E+06	- -	- -	***1.57E+03***	***1.57E+03***
206-44-0	Fluoranthene	4.10E+05	µg/kg	6.70E+01	- -	2.67E+07	2.67E+07	- -	- -	***4.40E+04***	***4.40E+04***
193-39-5	Indeno(1,2,3-cd)pyrene	8.30E+04	µg/kg	6.70E+00	- -	***3.42E+03***	***3.42E+03***	- -	- -	***4.06E+02***	***4.06E+02***
12672-29-6	Aroclor 1248	1.30E+05	µg/kg	3.30E+01	- -	- -	- -	- -	- -	- -	***3.30E+01***
-	Aroclor 1016/1242	9.00E+02	µg/kg	3.30E+01	- -	4.67E+04	4.67E+04	- -	- -	***1.38E-01***	***3.30E+01***
11097-69-1	Aroclor 1254	8.10E+04	µg/kg	3.30E+01	- -	***1.33E+04***	***1.33E+04***	- -	- -	***1.08E+00***	***3.30E+01***
11096-82-5	Aroclor 1260	6.60E+05	µg/kg	3.30E+01	- -	- -	- -	- -	- -	***1.05E+00***	***3.30E+01***
37324-23-5	Aroclor 1262	1.60E+03	µg/kg	3.30E+01	- -	- -	- -	- -	- -	- -	***3.30E+01***
11100-14-4	Aroclor 1268	2.10E+02	µg/kg	3.30E+01	- -	- -	- -	- -	- -	- -	***3.30E+01***
-	Total PCBs	6.60E+05	µg/kg	3.30E+01	- -	- -	- -	- -	- -	***3.96E-01***	***3.30E+01***
Volatile Organic Compounds (VOCs)											
71-43-2	Benzene	4.90E+04	µg/kg	1.00E+00	- -	1.36E+06	1.36E+06	***5.05E+02***	***5.05E+02***	***2.53E+01***	***2.53E+01***
104-51-8	n-Butylbenzene	3.70E+04	µg/kg	1.00E+00	- -	- -	- -	***4.64E+03***	***4.64E+03***	- -	- -
135-98-8	sec-Butylbenzene	1.00E+04	µg/kg	1.00E+00	- -	- -	- -	***7.86E+03***	***7.86E+03***	- -	- -
56-23-5	Carbon Tetrachloride	1.50E+01	µg/kg	1.00E+00	- -	5.73E+05	5.73E+05	1.93E+02	1.93E+02	***4.84E+00***	***4.84E+00***
108-90-7	Chlorobenzene	1.90E+03	µg/kg	1.00E+00	- -	2.91E+07	2.91E+07	***1.85E+03***	***1.85E+03***	1.40E+04	1.40E+04
67-66-3	Chloroform	4.80E+02	µg/kg	1.00E+00	- -	7.03E+06	7.03E+06	***2.04E+02***	***2.04E+02***	***2.98E+02***	***2.98E+02***
75-35-4	1,1-Dichloroethene	1.70E+03	µg/kg	1.00E+00	- -	1.24E+05	1.24E+05	***5.80E+01***	***5.80E+01***	***2.73E+00***	***2.73E+00***
156-59-2	cis-1,2-Dichloroethene	7.30E+05	µg/kg	1.00E+00	- -	7.99E+06	7.99E+06	***7.94E+02***	***7.94E+02***	***7.73E+03***	***7.73E+03***
156-60-5	trans-1,2-Dichloroethene	7.10E+03	µg/kg	1.00E+00	- -	1.31E+07	1.31E+07	8.21E+03	8.21E+03	5.43E+04	5.43E+04
100-41-4	Ethylbenzene	2.60E+05	µg/kg	1.00E+00	- -	1.45E+08	1.45E+08	noc	noc	***1.81E+04***	***1.81E+04***
98-82-8	Isopropylbenzene	1.80E+04	µg/kg	1.00E+00	- -	1.45E+08	1.45E+08	noc	noc	- -	- -
75-09-2	Methylene Chloride	2.40E+04	µg/kg	2.00E+00	- -	9.94E+06	9.94E+06	***1.21E+04***	***1.21E+04***	***8.28E+02***	***8.28E+02***
91-20-3	Naphthalene	5.20E+05	µg/kg	5.00E+00	- -	1.44E+07	1.44E+07	***9.82E+04***	***9.82E+04***	***6.80E+04***	***6.80E+04***
103-65-1	n-Propylbenzene	4.20E+04	µg/kg	1.00E+00	- -	- -	- -	***1.36E+04***	***1.36E+04***	- -	- -
79-34-5	1,1,2,2-Tetrachloroethane	1.70E+02	µg/kg	1.00E+00	- -	2.73E+05	2.73E+05	1.39E+03	1.39E+03	***7.19E+00***	***7.19E+00***
127-18-4	Tetrachloroethene	2.00E+04	µg/kg	1.00E+00	- -	1.07E+06	1.07E+06	***4.89E+02***	***4.89E+02***	***8.72E+00***	***8.72E+00***

Table B-1 Screening Levels for Constituents of Concern in Site-wide Soils

CAS Number	Constituent of Concern	Maximum Detected	Soil Units	Laboratory RL	Puget Sound Basin Natural Background Concentration[a]	Direct Contact Risk Calculation[b]	Direct Contact Screening Level	Air Risk Calculation[c]	Air Screening Level	Surface Water Risk Calculation[d]	Surface Water Screening Level
VOCs (cont'd)											
108-88-3	Toluene	6.50E+05	µg/kg	1.00E+00	- -	1.34E+08	1.34E+08	noc	noc	***1.09E+05***	***1.09E+05***
71-55-6	1,1,1-Trichloroethane	1.10E+05	µg/kg	1.00E+00	- -	4.12E+08	4.12E+08	noc	noc	1.63E+06	1.63E+06
79-00-5	1,1,2-Trichloroethane	3.30E+03	µg/kg	1.00E+00	- -	9.57E+05	9.57E+05	***1.31E+03***	***1.31E+03***	***2.78E+01***	***2.78E+01***
79-01-6	Trichloroethene	1.10E+07	µg/kg	1.00E+00	- -	***1.36E+05***	***1.36E+05***	***3.60E+01***	***3.60E+01***	***2.00E+00***	***2.00E+00***
95-63-6	1,2,4-Trimethylbenzene	3.20E+05	µg/kg	1.00E+00	- -	7.27E+07	7.27E+07	***1.01E+04***	***1.01E+04***	- -	- -
108-67-8	1,3,5-Trimethylbenzene	1.20E+05	µg/kg	1.00E+00	- -	7.27E+07	7.27E+07	noc	noc	- -	- -
75-01-4	Vinyl Chloride	1.80E+04	µg/kg	1.00E+00	- -	4.97E+04	4.97E+04	***3.31E+02***	***3.31E+02***	***4.59E+00***	***4.59E+00***
Total Petroleum Hydrocarbons (TPH)											
-	TPH - Diesel Range	1.10E+05	mg/kg	5.00E+00	- -	***2.00E+03***					
-	TPH - Gasoline Range	2.50E+04	mg/kg	5.00E+00	- -	***3.00E+01***					
-	TPH - Mineral Spirits	4.10E+03	mg/kg	5.00E+00	- -	***2.00E+03***					
-	TPH - Motor Oil Range	2.00E+04	mg/kg	1.00E+01	- -	***2.00E+03***					

Notes:

	Screening levels adjust risk calculations up to the reporting limit (RL) where applicable.
Bolded	**Bolded** risk based and screening level concentrations are below maximum detect.
[a]	Source: Ecology, 1994.
[b]	Lowest soil concentration protective of dermal contact, ingestion and trenching.
[c]	Lowest soil concentration protective of indoor and outdoor air (inclusive of fugitive dust).
[d]	Lowest soil concentration protective of human ingestion of aquatic organisms and protection of aquatic organisms.
*	Constituent not listed.
- -	Not calculated.
RL	Reporting Limit as detailed in Analytical Resources Inc. Laboratory Quality Assurance Plan, Version 11-022, dated 5/17/04 (generally equivalent to the practical quantitation limit in a clean matrix).
TPH	Total Petroleum Hydrocarbon.
noc	Not of concern. No soil concentration is able to produce an unacceptable air concentration. No predicted air concentration can exceed the indoor air screening level. (Boeing Plant 2 Uplands CMS Vol.II Att. C)

Table B-2: Constituents of Concern Detected in Soil
2-31 Area
Boeing Plant 2

CAS Number	Constituent of Concern	Soil Units	Maximum Detected	Samples Analyzed	Detects	Samples Above Direct Contact Screening Level	Samples Above Air Screening Level	Samples Above Surface Water Screening Level	Samples above Puget Sound Basin Natural Background Concentration
Metals and Cyanide									
7440-38-2	Arsenic	mg/kg	12	55	35	0	0	--	9
7440-43-9	Cadmium	mg/kg	83.3	55	21	0	0	13	--
7440-50-8	Copper	mg/kg	428	48	48	0	--	--	5
7439-97-6	Mercury	mg/kg	0.17	46	6	0	0	--	5
7440-02-0	Nickel	mg/kg	373	48	48	0	--	--	3
7440-22-4	Silver	mg/kg	0.9	46	4	0	--	4	--
7440-66-6	Zinc	mg/kg	823	48	48	0	--	5	--
57-12-5	Cyanide	mg/kg	0.31	22	2	0	--	1	--
Semivolatile Organic Compounds (SVOCs) and Polychlorinated Biphenyls (PCBs)									
56-55-3	Benzo(a)anthracene	µg/kg	57	27	8	0	--	2	--
218-01-9	Chrysene	µg/kg	68	27	11	0	--	1	--
11097-69-1	Aroclor 1254	µg/kg	39	30	1	0	--	1	--
11096-82-5	Aroclor 1260	µg/kg	1300	30	5	--	--	5	--
1336-36-3	Total PCB	µg/kg	1300	30	6	--	--	6	--
Volatile Organic Compounds (VOCs)									
79-01-6	Trichloroethene	µg/kg	16000	53	13	0	8	12	--
75-01-4	Vinyl Chloride	µg/kg	65	53	5	0	0	5	--
Petroleum Hydrocarbons (TPH)									
68334-30-5	TPH - Diesel Range	mg/kg	6100	40	21	2	2	2	--

Note: Sample population is defined as soil samples collected from within the 2-31 Area, where coordinates of sample station are known.

* MTCA Method C air concentrations were not avalable for site specific data to revise the sitewide 2004 Screening Level for the air exposure pathway for cis-1,2-dichloroethene. cis-1,2-Dichloroethene was however evaluated for data gaps based on exceeding the original 2004 Sitewide Screening Level for the air exposure pathway

Sample population is defined as soil samples collected from within the 2-40s Area, where coordinates of sample station are known.

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Table B-3 Explanation of Data Qualifiers
2-31 Area
Boeing Plant 2

Data Qualifier	Explanation
Data Qualifiers Used by the Contract Laboratory – Analytical Resources, Inc.	
U	The compound was analyzed for, but not detected at the reported concentration.
J	Indicates an estimated concentration when a value is less than the calculated reporting limit.
D	Indicates the surrogate/spike(s) was not detected, due to dilution of extract.
NR	Indicates the surrogate recovery cannot be reported due to matrix interference.
E	Indicates a value above the linear range of the detector, sample dilution is required.
S	Indicates no value reported due to saturation of the detector, sample dilution required.
NA	Indicates compound was not analyzed for.
M	Indicates an estimated value of analyte found and confirmed by the analyst but with a low spectral match (GC-MS).
B	Indicates possible/probable blank contamination. Flagged when the analyte is detected in the blank as well as in the sample.
Y	Indicates raised reporting limit due to background interference or to activity in the instrument. Compound is still not detected at or above the raised level.
C	Indicates a probably detection that cannot be confirmed due to matrix interferences.
P	Indicates a high RPD between detected concentrations for dual column GC analyses without obvious interference.
Data Validation Qualifiers for Organic Analyses	
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Table B-3 Explanation of Data Qualifiers
2-31 Area
Boeing Plant 2

Data Qualifier	Explanation
Data Validation Qualifiers for Inorganic Analyses	
U	The compound was analyzed for, but was not detected above the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment B
Maps

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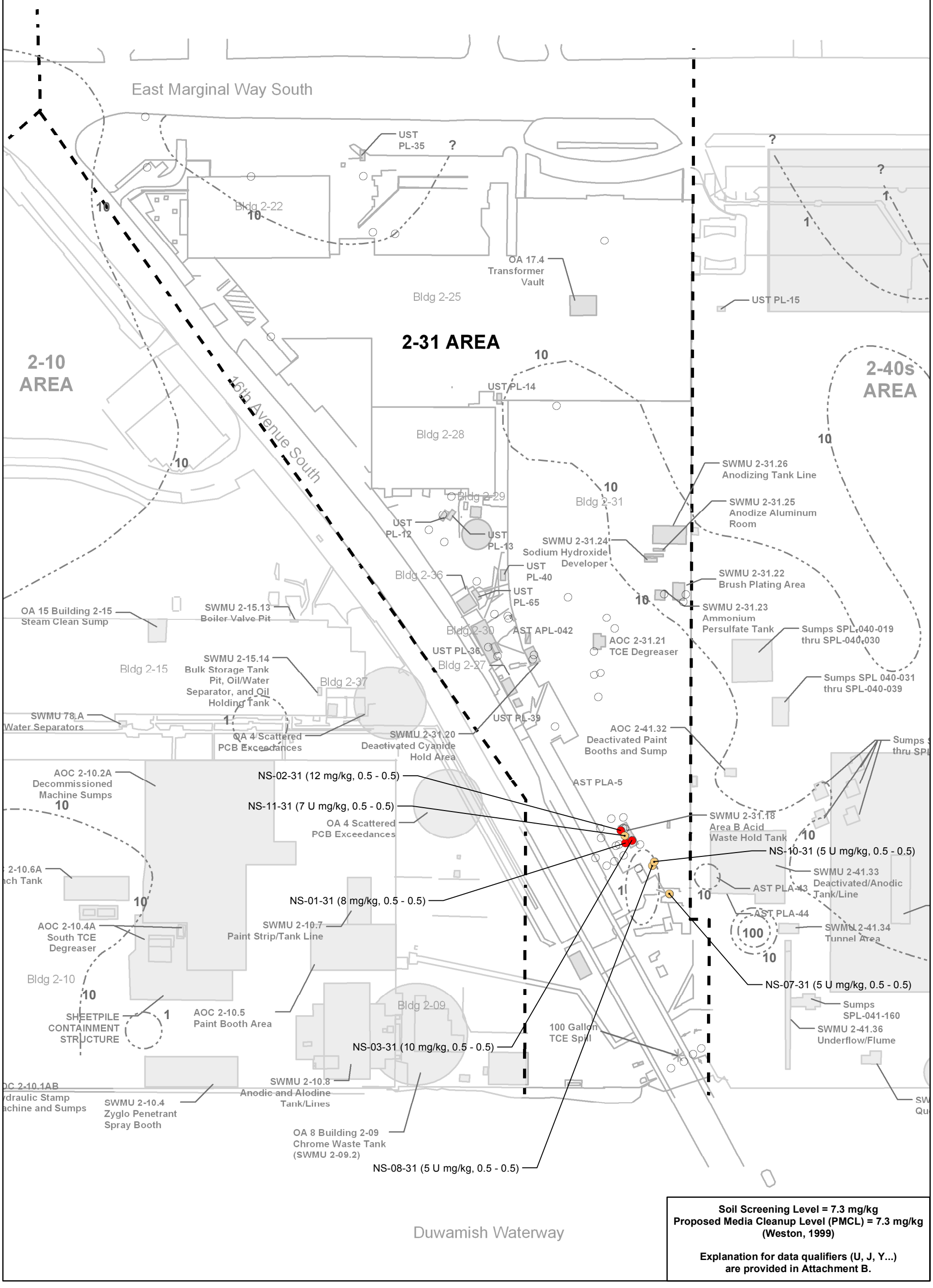


LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

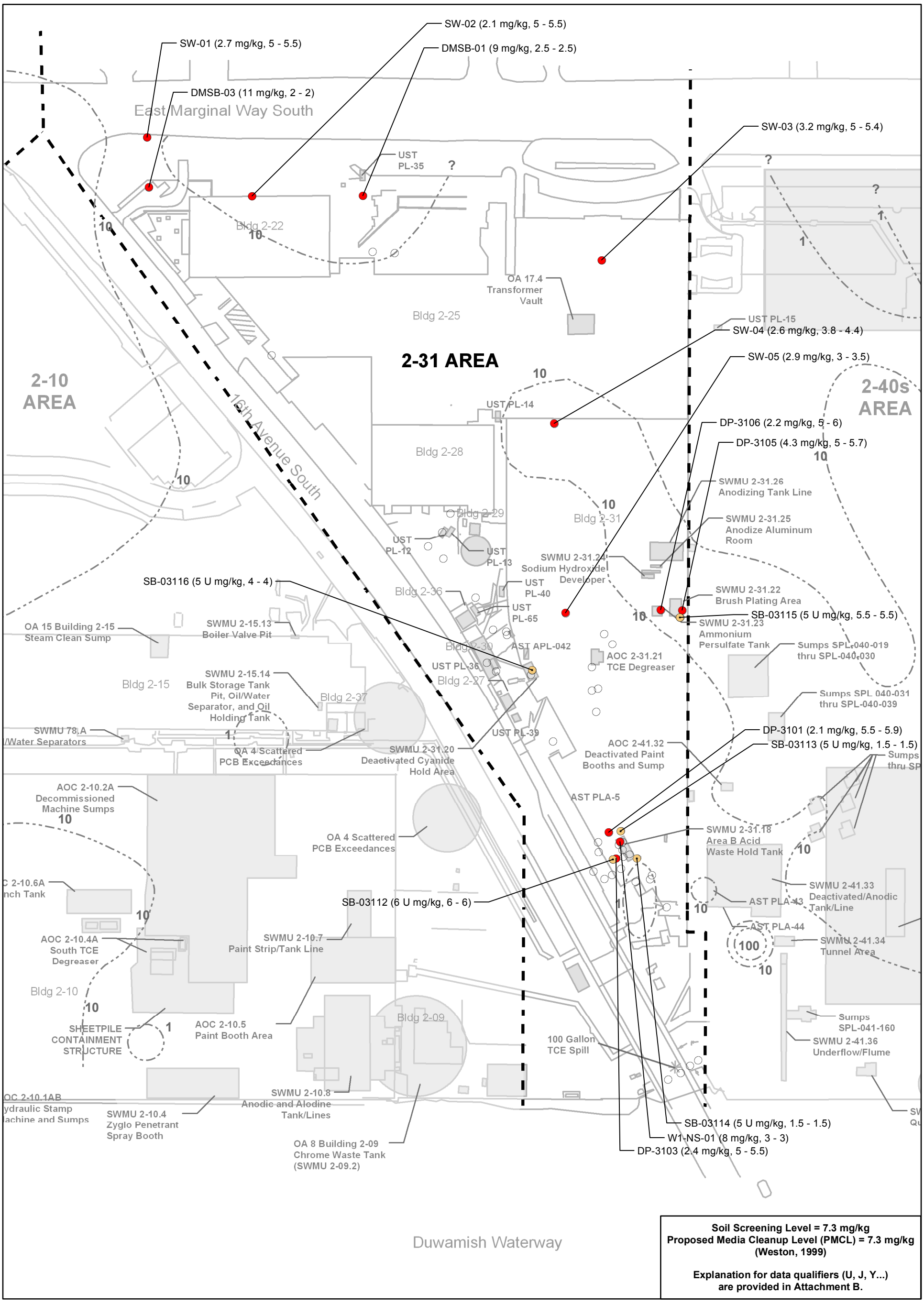
Source: Weston, Golder Associates

2-31 AREA
ARSENIC IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_ARSENIC2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

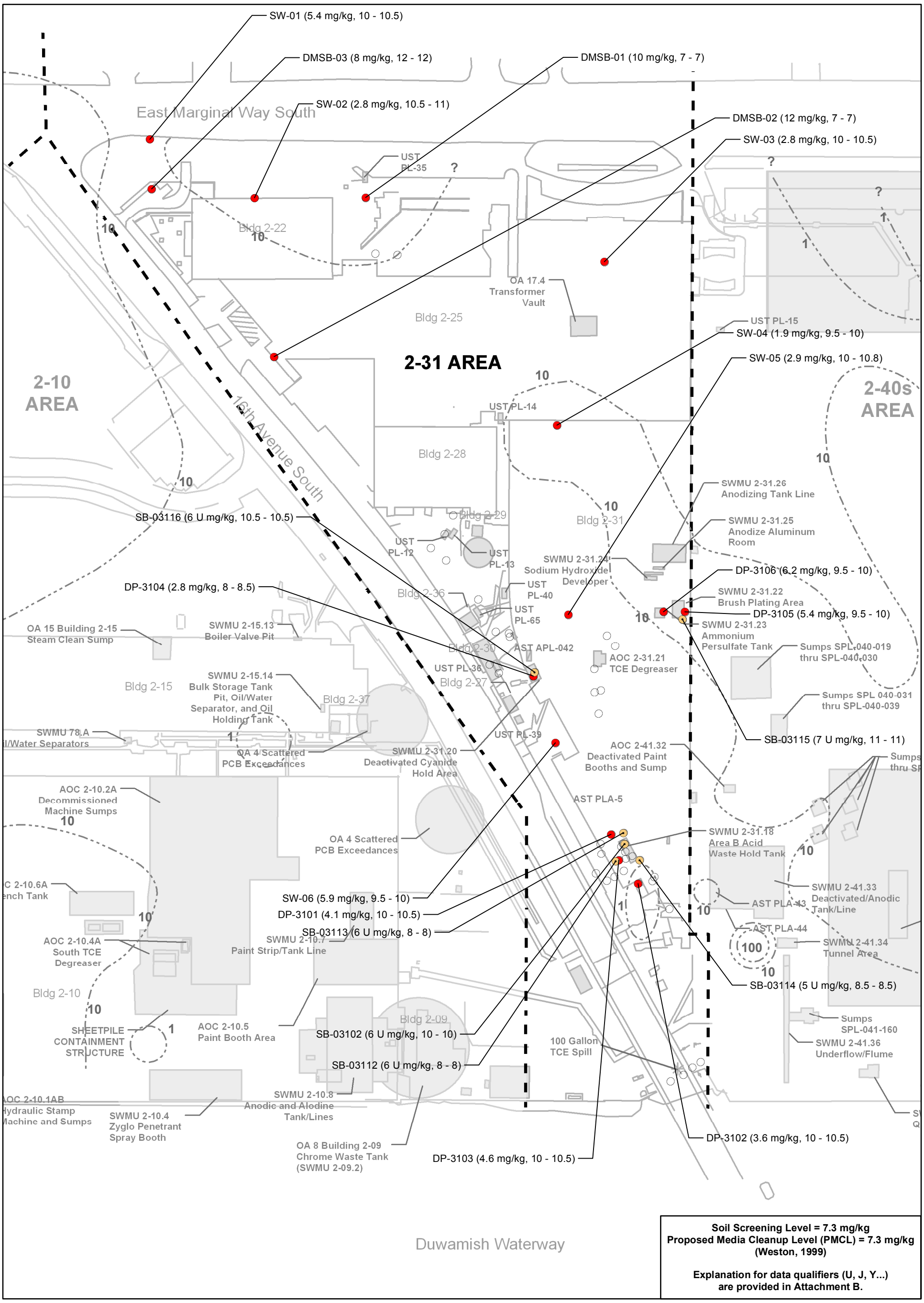
ARSENIC IN SOIL: DEPTH 1 - 6 FT

BOEING PLANT 2

Drawn:TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_ARSENIC2312.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
ARSENIC IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn:TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_ARSENIC2313.mxd

Golder Associates

East Marginal Way South

UST PL-35

Bldg 2-22

OA 17.4 Transformer Vault

Bldg 2-25

UST PL-15

2-31 AREA

2-10 AREA

2-40s AREA

16th Avenue South

UST PL-14

Bldg 2-28

Bldg 2-29

Bldg 2-31

SWMU 2-31.26 Anodizing Tank Line

SWMU 2-31.25 Anodize Aluminum Room

UST PL-12

UST PL-13

SWMU 2-31.24 Sodium Hydroxide Developer

UST PL-40

Bldg 2-36

SWMU 2-31.22 Brush Plating Area

UST PL-65

SWMU 2-31.23 Ammonium Persulfate Tank

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-30

AST APL-042

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

UST PL-36

Bldg 2-27

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

Sumps SPL 040-031 thru SPL-040-039

SWMU 78.A Oil/Water Separators

UST PL-39

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

Sumps thru SP

AOC 2-10.2A Decommissioned Machine Sumps

NS-02-31 (83.3 mg/kg, 0.5 - 0.5)

NS-11-31 (1.6 mg/kg, 0.5 - 0.5)

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

NS-03-31 (60.4 mg/kg, 0.5 - 0.5)

NS-01-31 (14.2 mg/kg, 0.5 - 0.5)

NS-10-31 (2.7 mg/kg, 0.5 - 0.5)

NS-08-31 (1.3 mg/kg, 0.5 - 0.5)

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

SWMU 2-41.34 Tunnel Area

NS-07-31 (3 mg/kg, 0.5 - 0.5)

Bldg 2-10

Bldg 2-09

Sumps SPL-041-160

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

100 Gallon TCE Spill

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.4 Zyglo Penetrant Spray Booth

SWMU 2-10.8 Anodic and Alodine Tank/Lines

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

Duwamish Waterway

Soil Screening Level = 1.21 mg/kg
Proposed Media Cleanup Level (PMCL) = 1.28 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

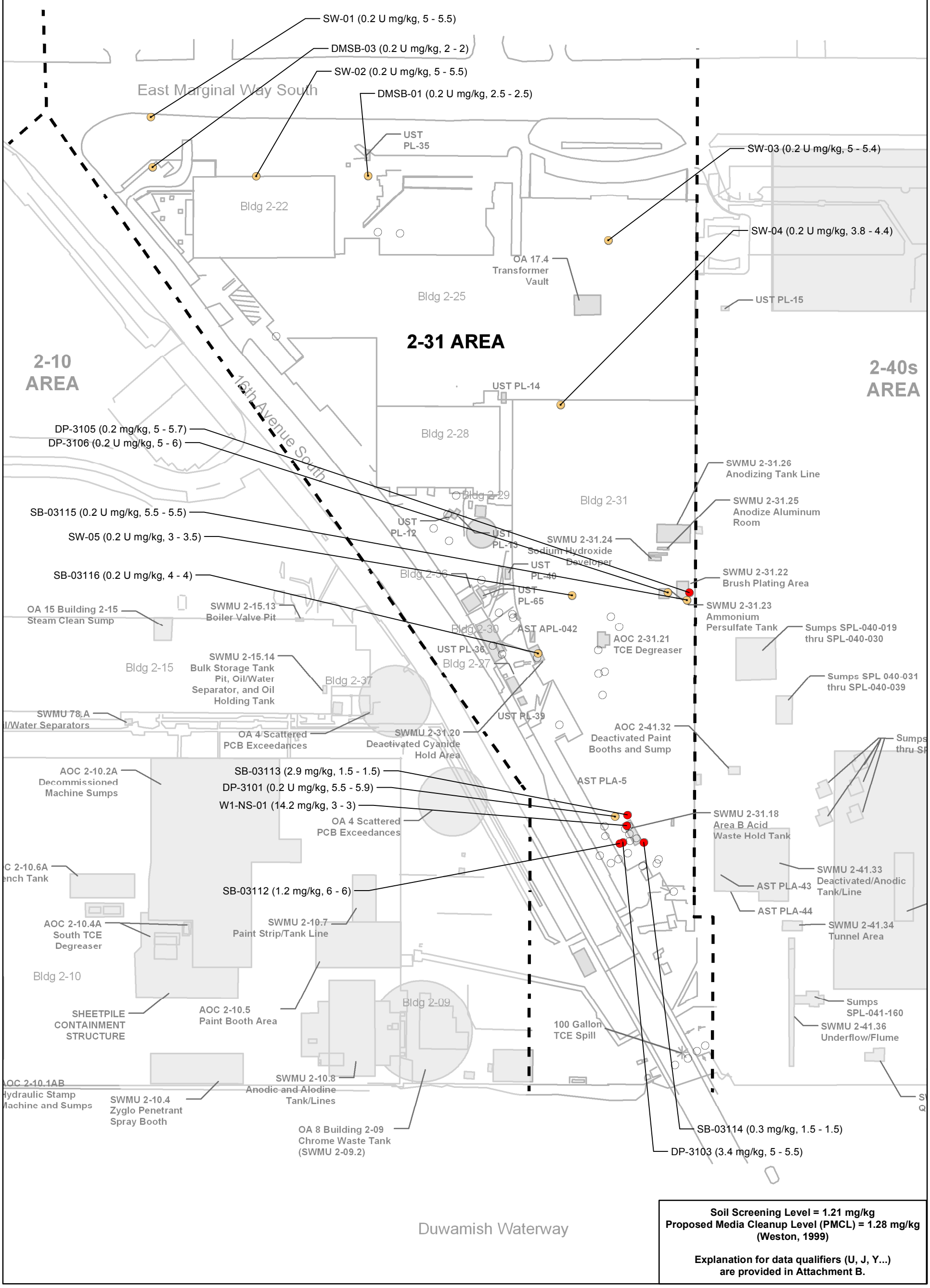
CADMIUM IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_CADMIUM2311.mxd

Golder Associates



Soil Screening Level = 1.21 mg/kg
Proposed Media Cleanup Level (PMCL) = 1.28 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

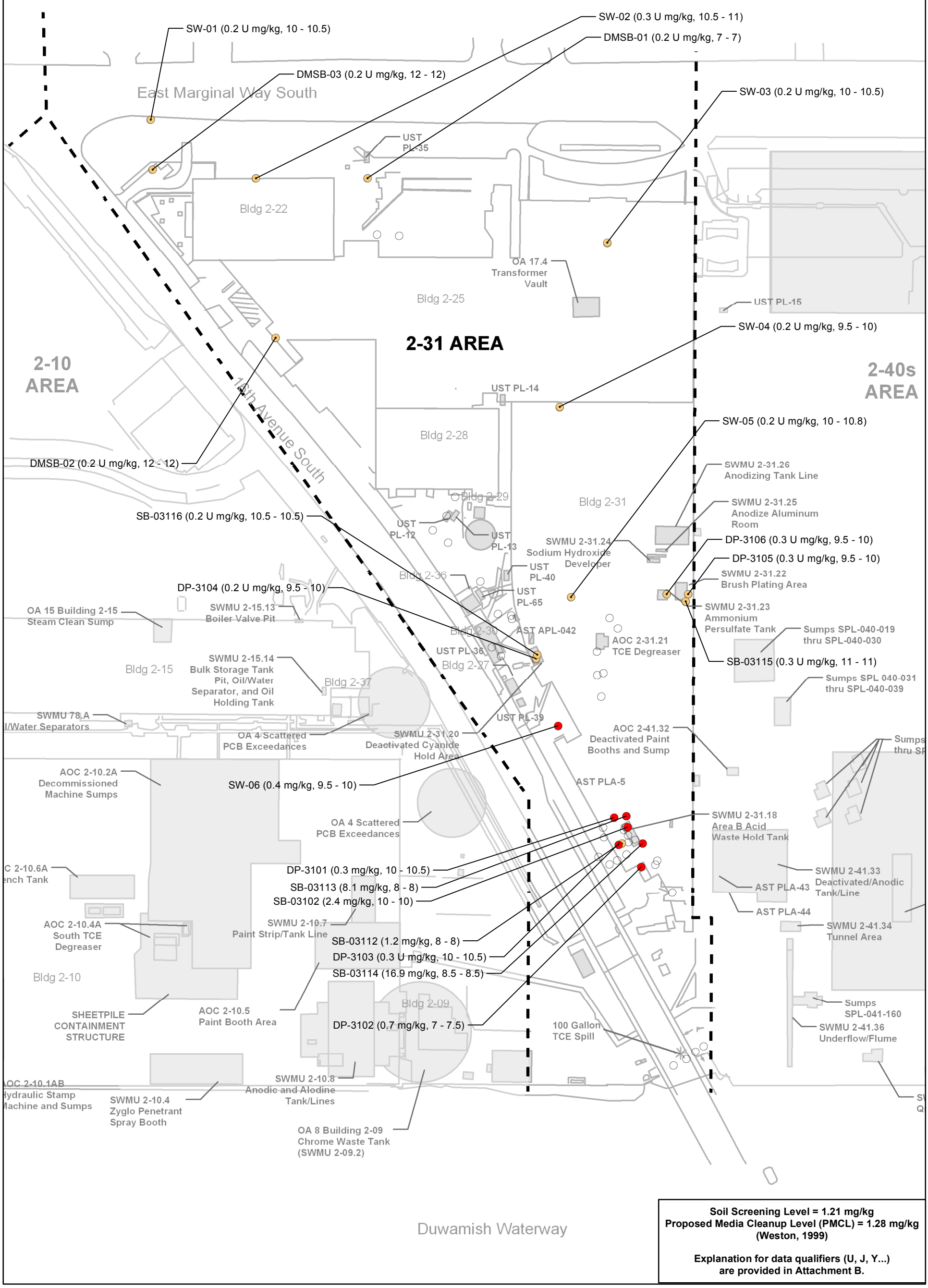
Source: Weston, Golder Associates

2-31 AREA
CADMIUM IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_CADMIUM2312.mxd

Golder Associates



Soil Screening Level = 1.21 mg/kg
Proposed Media Cleanup Level (PMCL) = 1.28 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

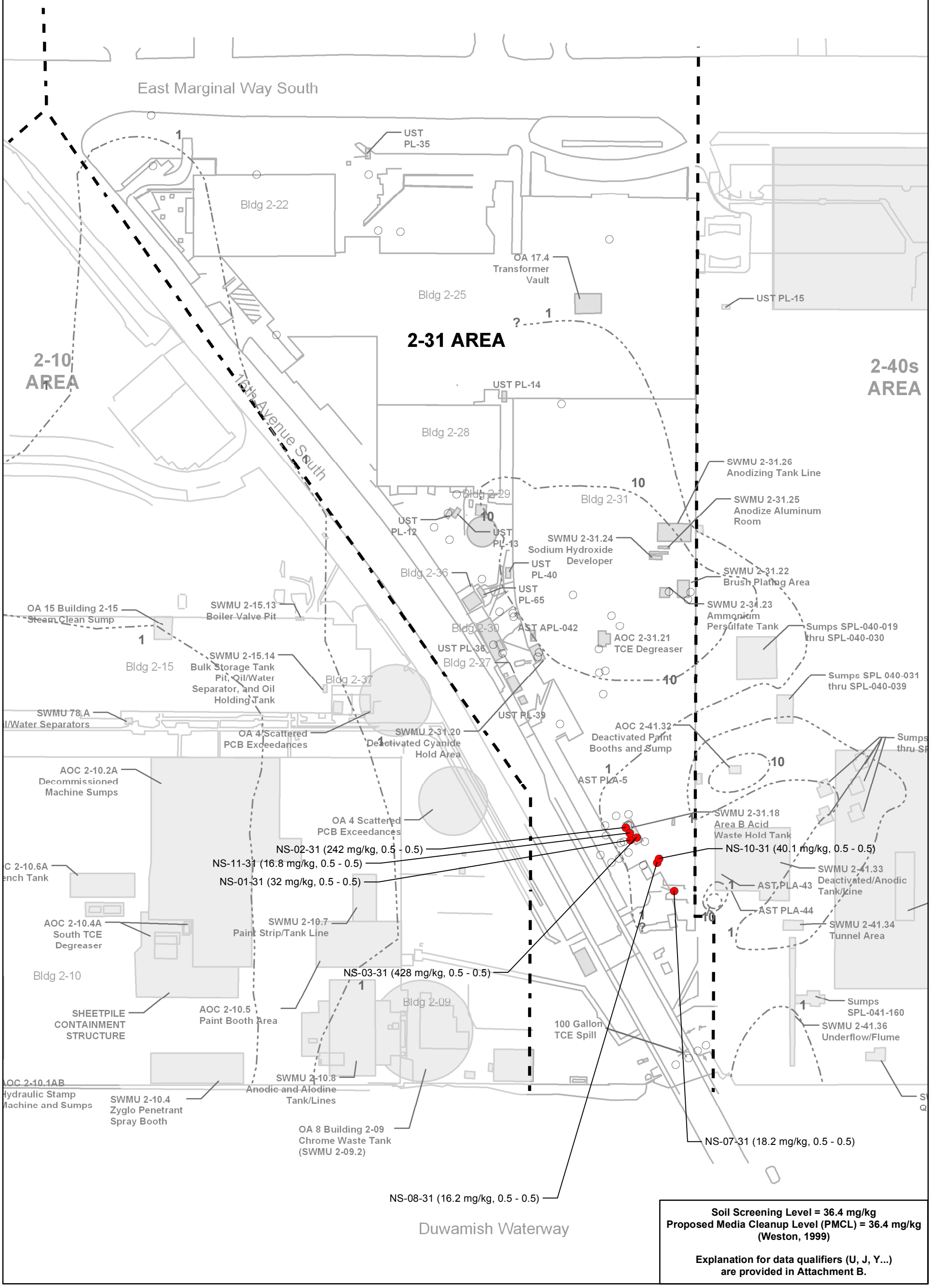
Source: Weston, Golder Associates

2-31 AREA
CADMIUM IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_CADMIUM2313.mxd

Golder Associates



Soil Screening Level = 36.4 mg/kg
Proposed Media Cleanup Level (PMCL) = 36.4 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

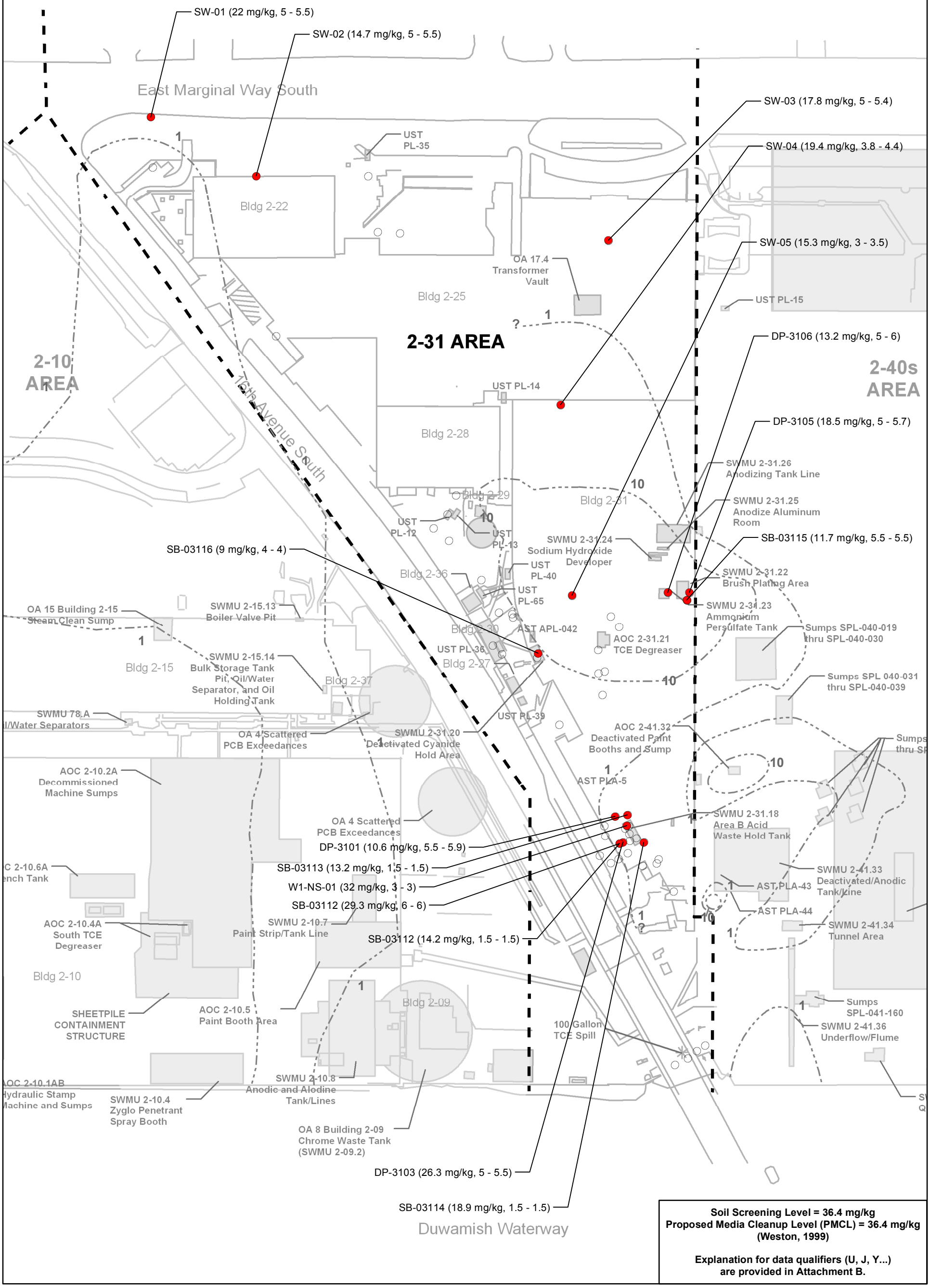
Source: Weston, Golder Associates

2-31 AREA
COPPER IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_COPPER2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

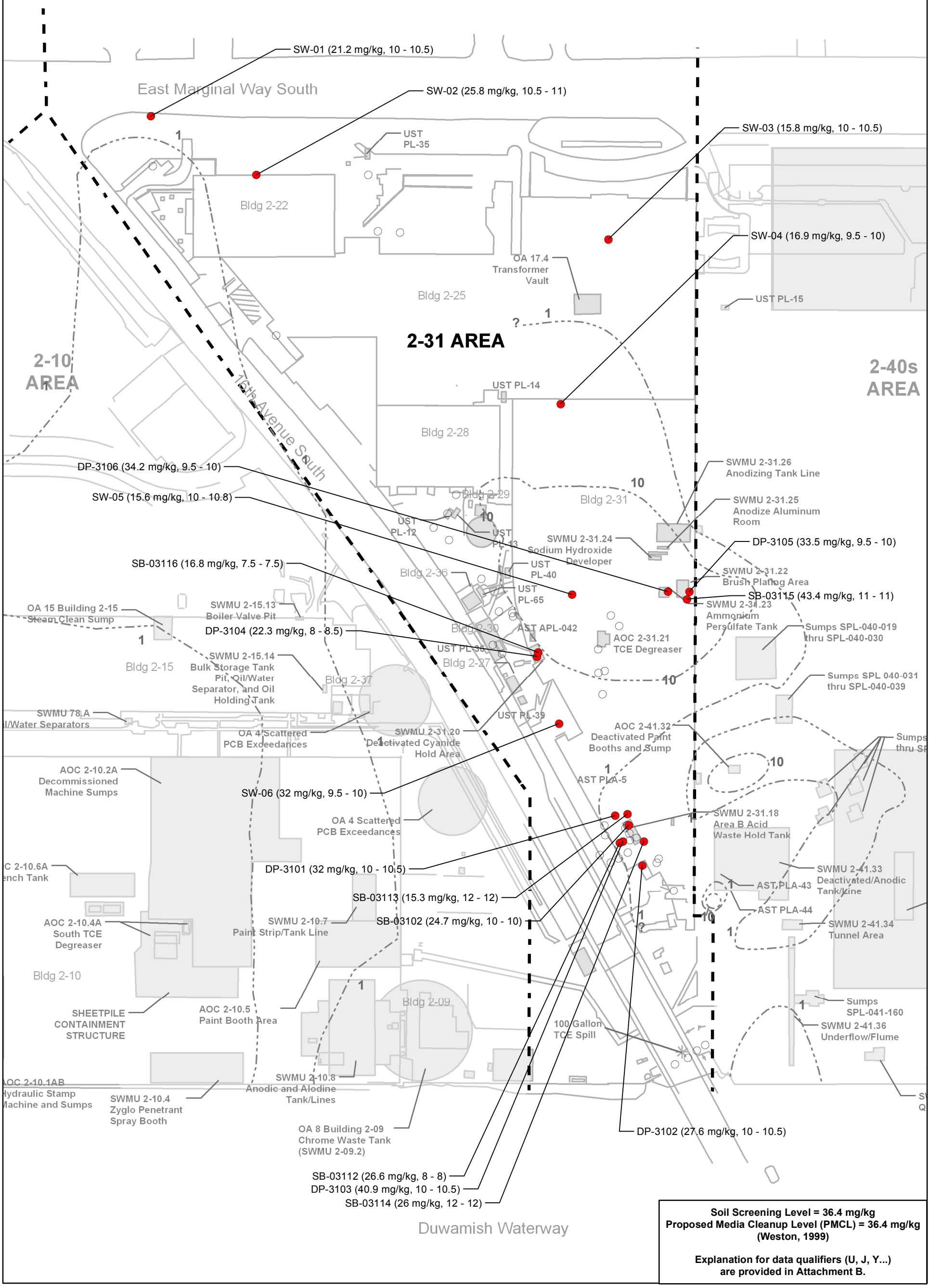
COPPER IN SOIL: DEPTH 1 - 6 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_COPPER2312.mxd

Golder Associates



Soil Screening Level = 36.4 mg/kg
Proposed Media Cleanup Level (PMCL) = 36.4 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
COPPER IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_COPPER2313.mxd

Golder Associates

East Marginal Way South

UST PL-35

Bldg 2-22

OA 17.4 Transformer Vault

Bldg 2-25

UST PL-15

2-31 AREA

2-10 AREA

2-40s AREA

16th Avenue South

UST PL-14

Bldg 2-28

0.01

Bldg 2-29

Bldg 2-31

SWMU 2-31.26 Anodizing Tank Line

SWMU 2-31.25 Anodize Aluminum Room

UST PL-12

UST PL-13

SWMU 2-31.24 Sodium Hydroxide Developer

UST PL-40

0.1

SWMU 2-31.22 Brush Plating Area

Bldg 2-36

UST PL-65

SWMU 2-31.23 Ammonium Persulfate Tank

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-30

AST APL-042

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

UST PL-36

Bldg 2-27

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

Sumps SPL 040-031 thru SPL-040-039

SWMU 78.A Oil/Water Separators

UST PL-39

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

Sumps thru SP

AOC 2-10.2A Decommissioned Machine Sumps

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

0.1

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

SWMU 2-41.34 Tunnel Area

Bldg 2-10

Bldg 2-09

Sumps SPL-041-160

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

100 Gallon TCE Spill

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.4 Zyglo Penetrant Spray Booth

SWMU 2-10.8 Anodic and Alodine Tank/Lines

0.001

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

Duwamish Waterway

Soil Screening Level = 0.07 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.07 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

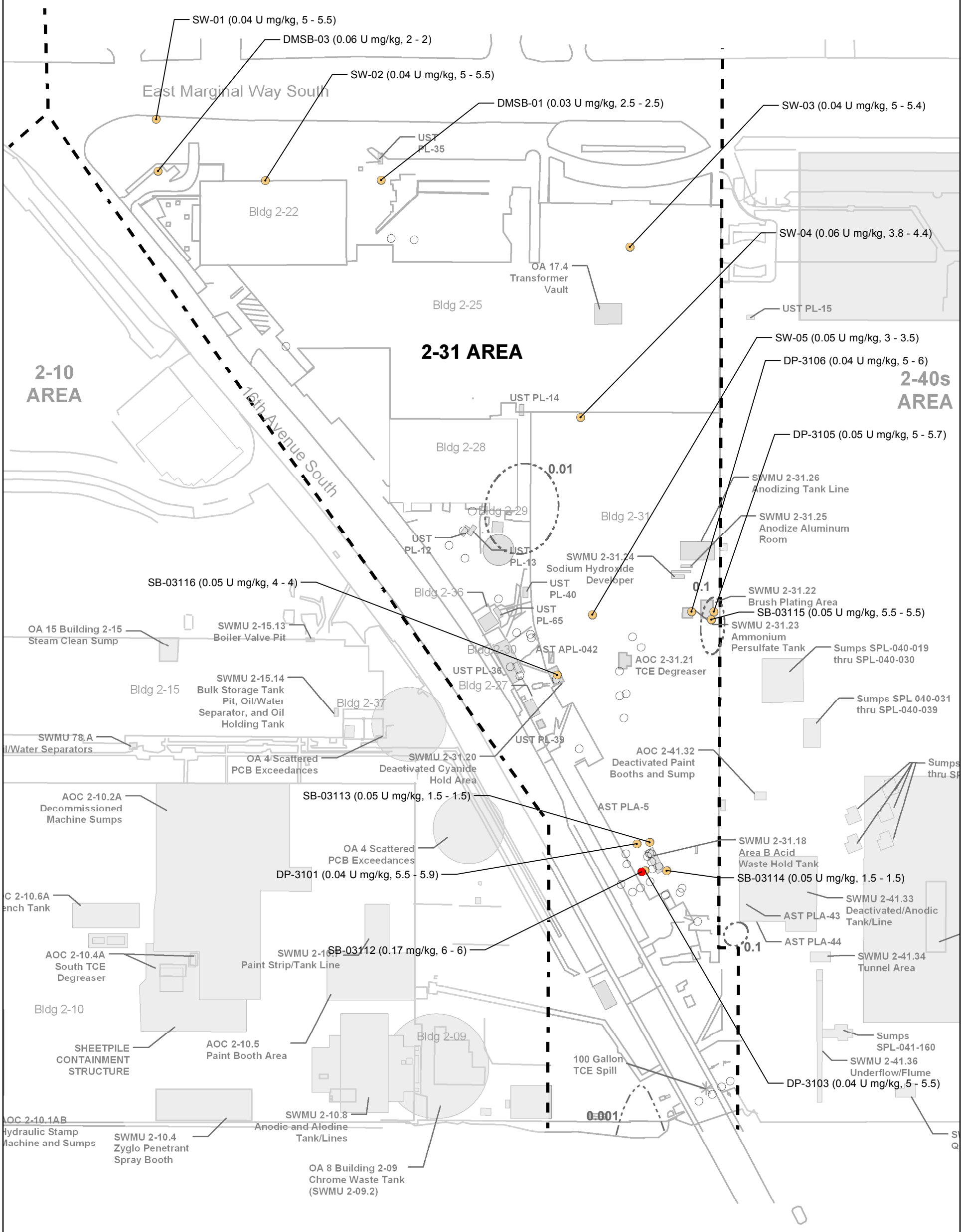
MERCURY IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_MERCURY2311.mxd

Golder Associates



Soil Screening Level = 0.07 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.07 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

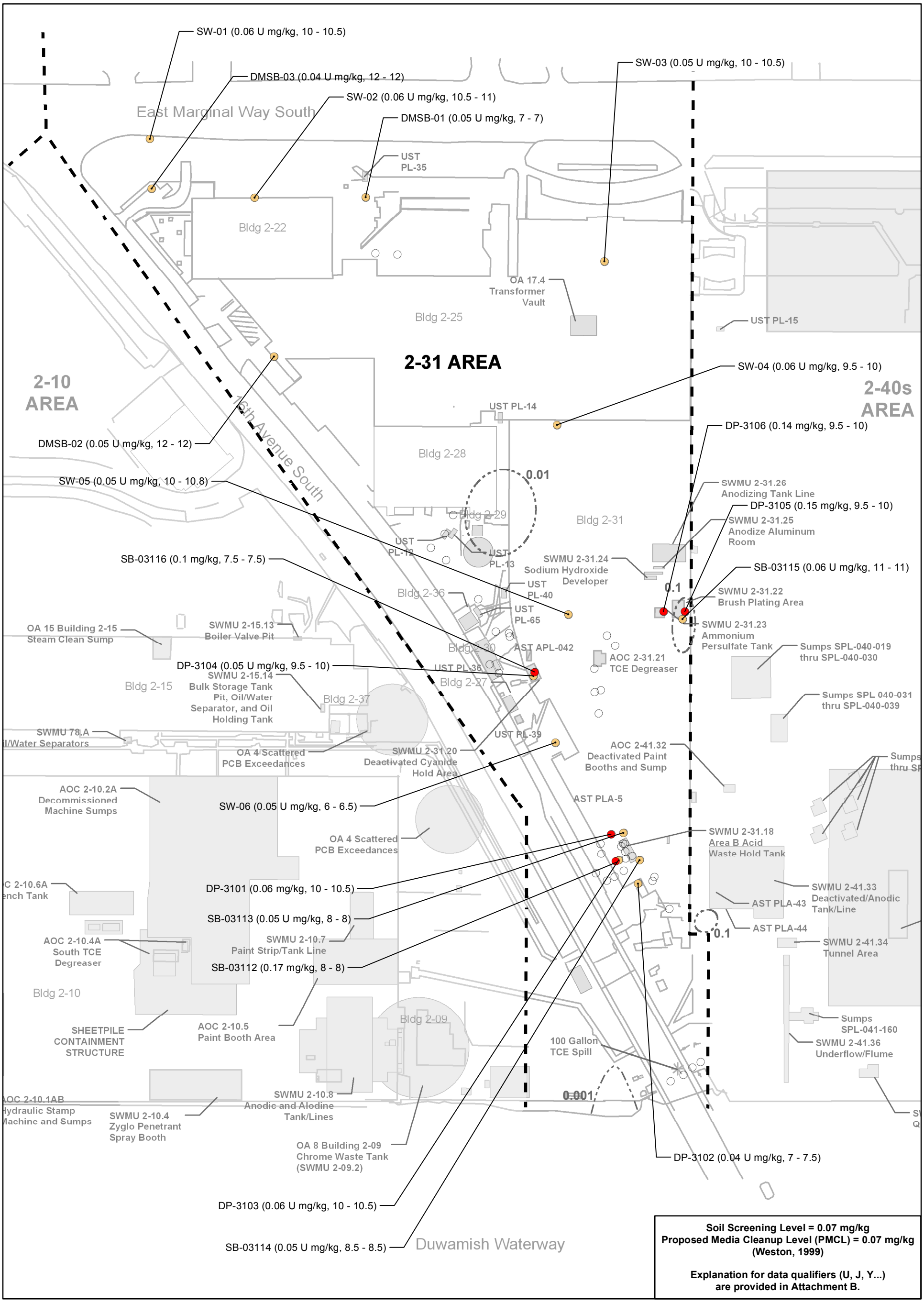
Source: Weston, Golder Associates

2-31 AREA
MERCURY IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_MERCURY2312.mxd

Golder Associates



Soil Screening Level = 0.07 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.07 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

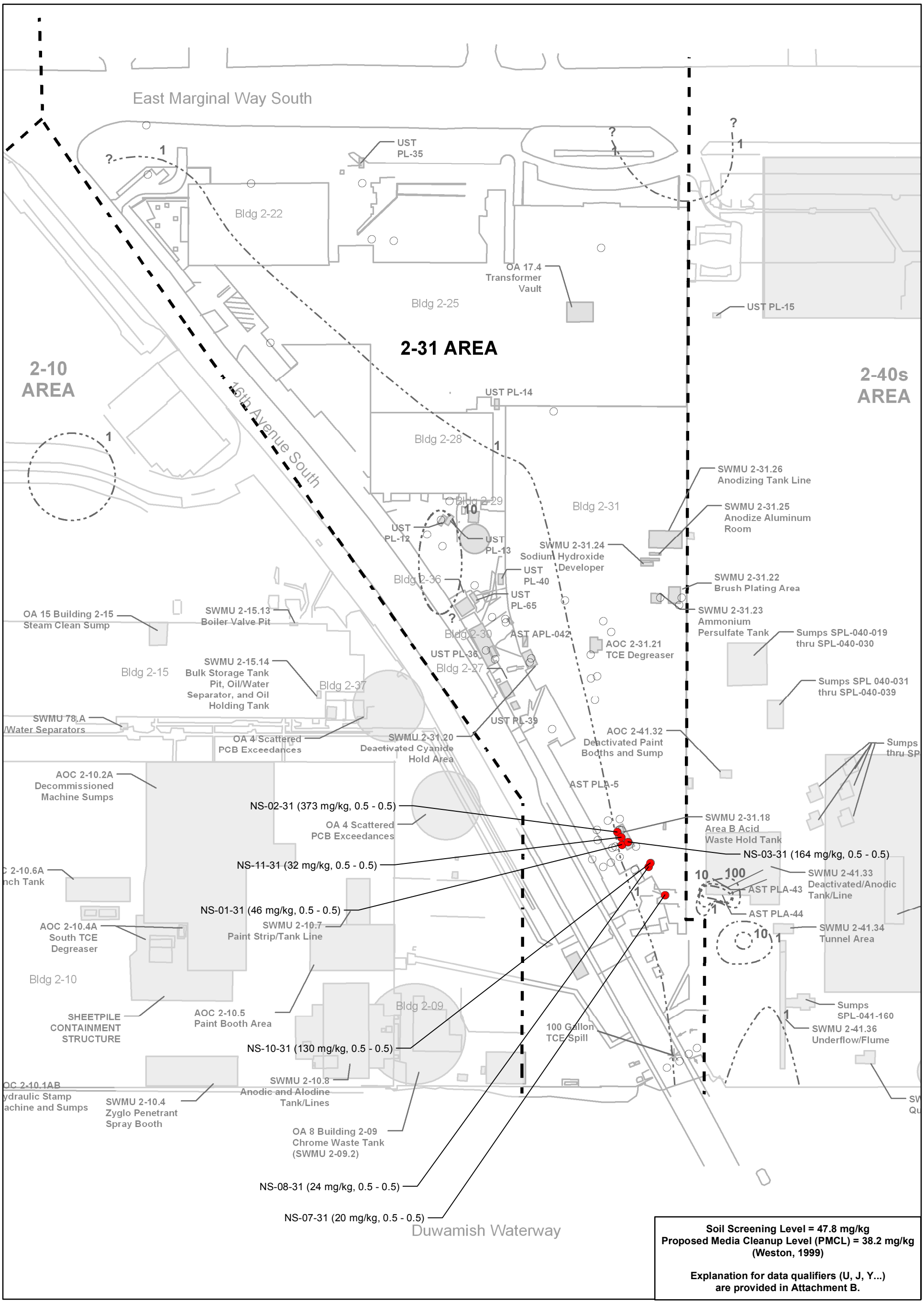
Source: Weston, Golder Associates

2-31 AREA
MERCURY IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_MERCURY2313.mxd

Golder Associates



Soil Screening Level = 47.8 mg/kg
Proposed Media Cleanup Level (PMCL) = 38.2 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

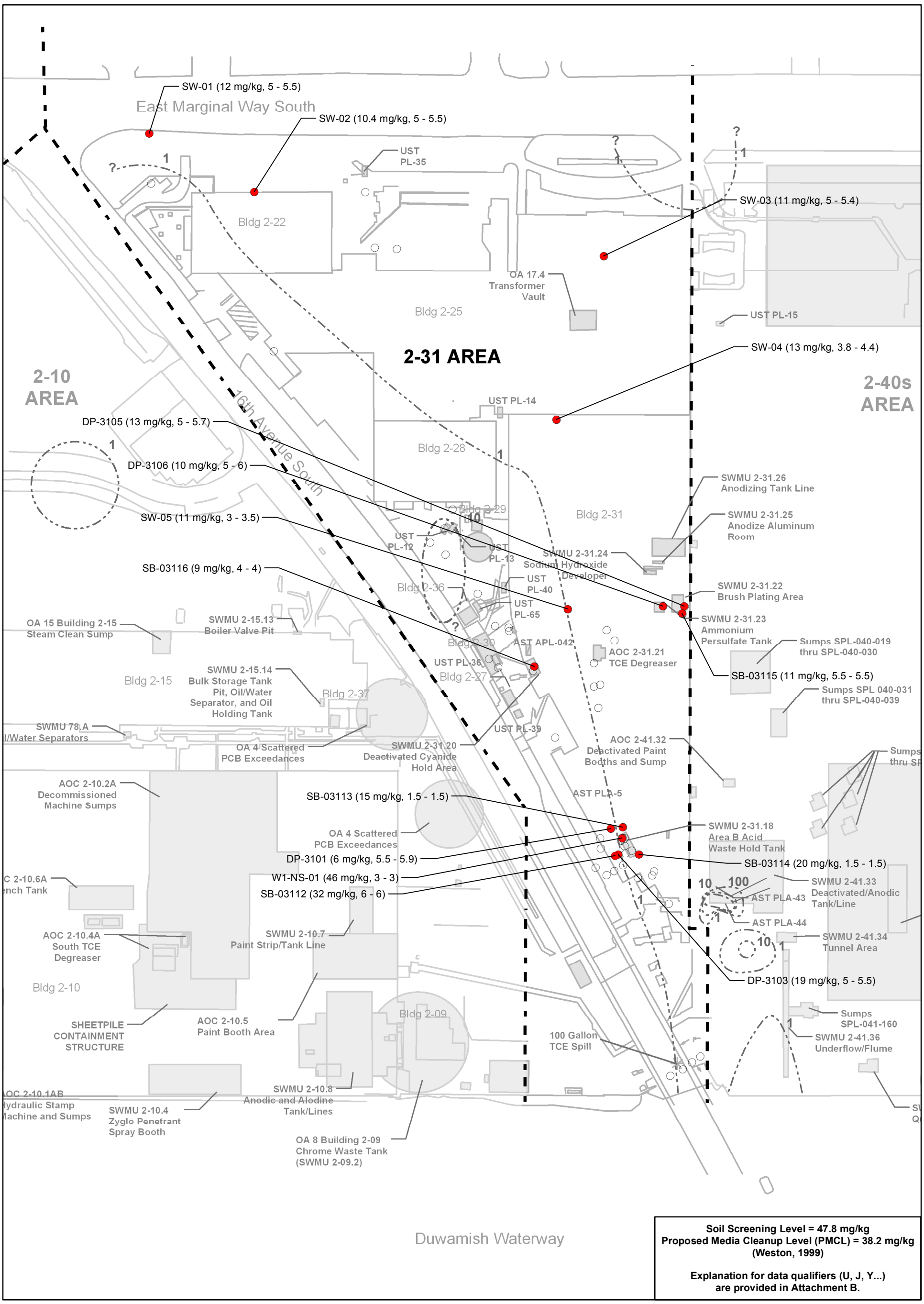
Source: Weston, Golder Associates

2-31 AREA
NICKEL IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_NICKEL2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection:
Washington State Plane
North Zone, NAD 83, Feet

Source: Weston,
Golder Associates

2-31 AREA

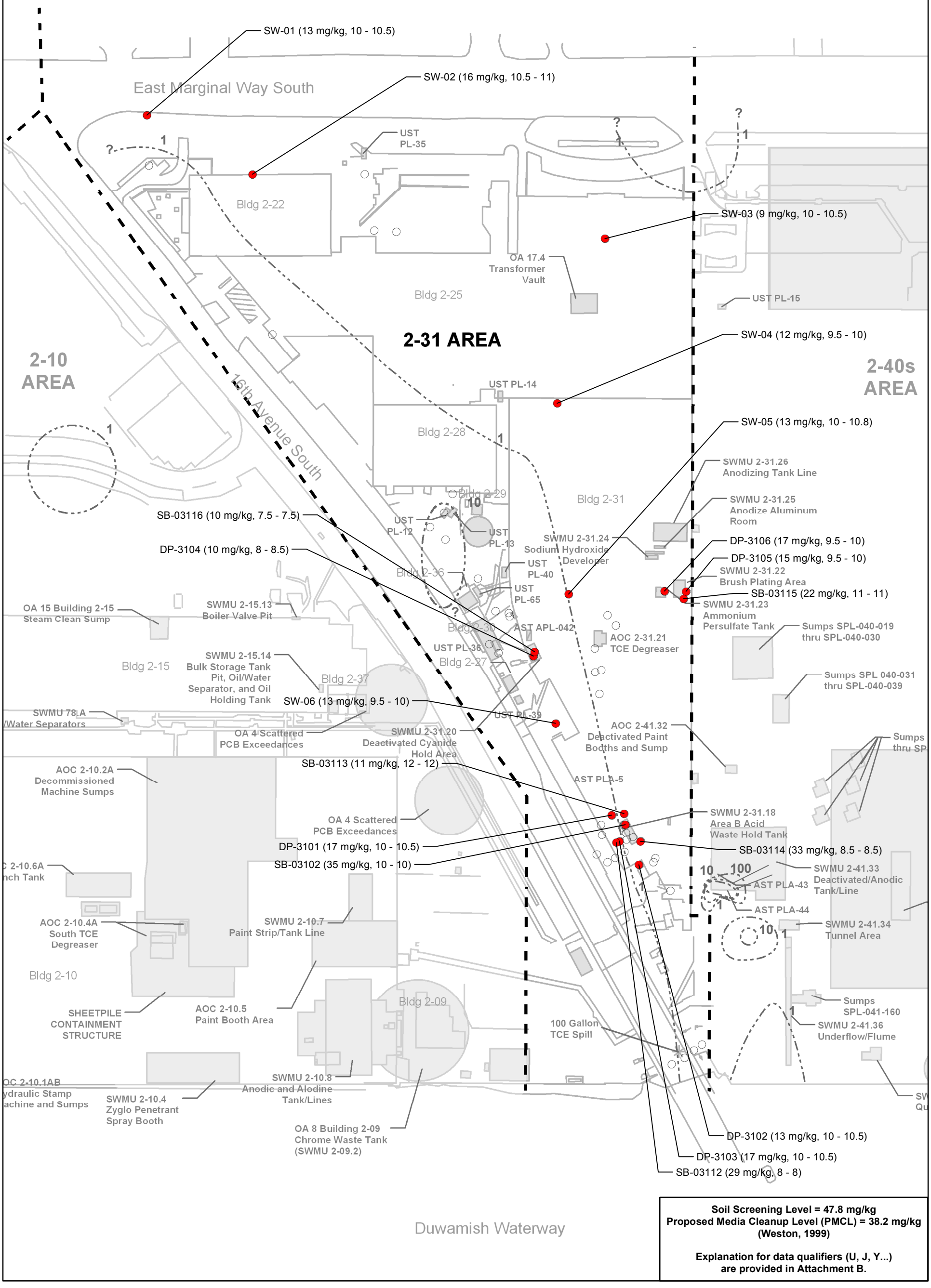
NICKEL IN SOIL: DEPTH 1 - 6 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_NICKEL2312.mxd

Golder Associates



Soil Screening Level = 47.8 mg/kg
Proposed Media Cleanup Level (PMCL) = 38.2 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection:
Washington State Plane
North Zone, NAD 83, Feet

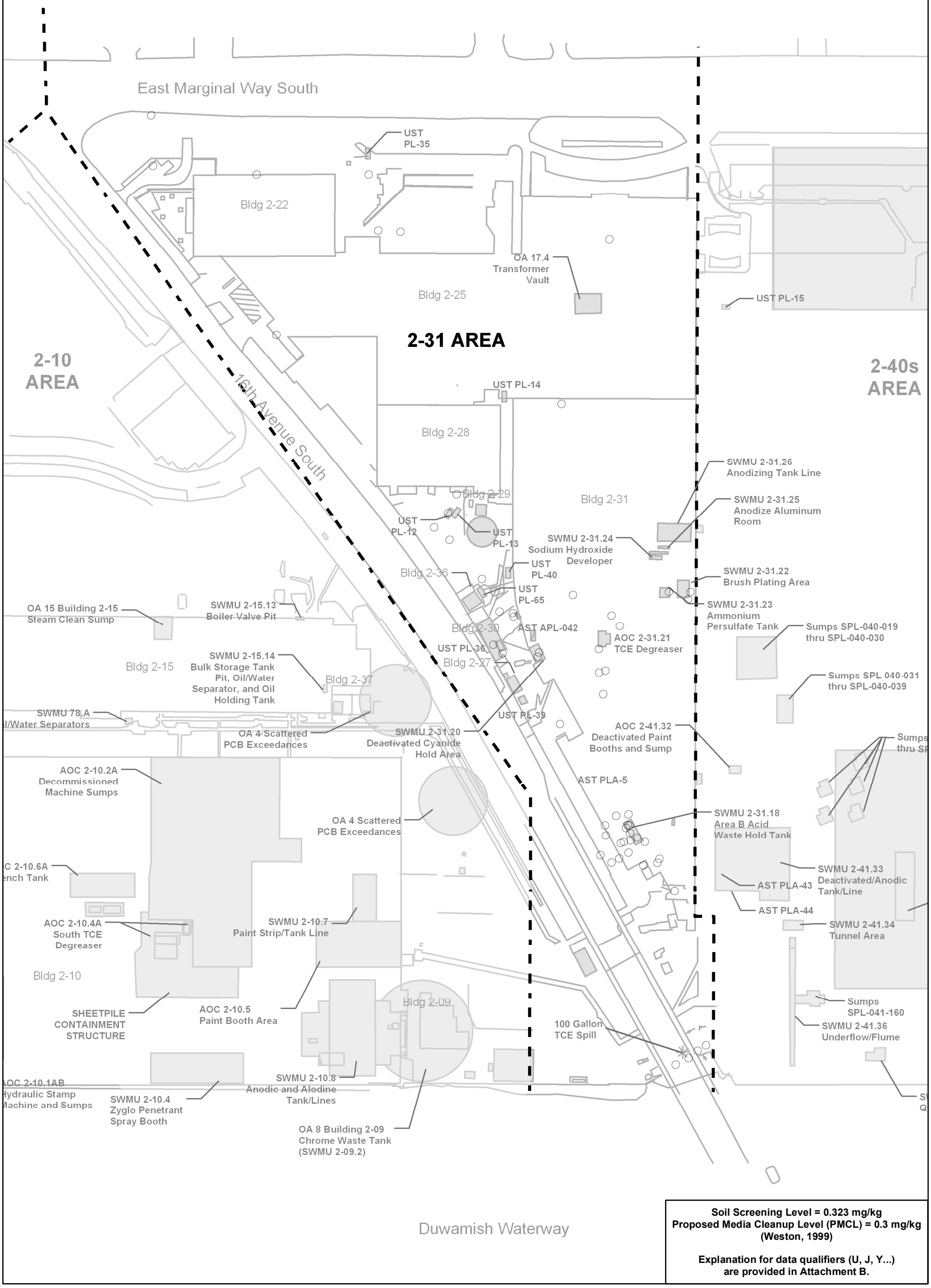
Source: Weston,
Golder Associates

2-31 AREA
NICKEL IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_NICKEL2313.mxd

Golder Associates



Soil Screening Level = 0.323 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.3 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

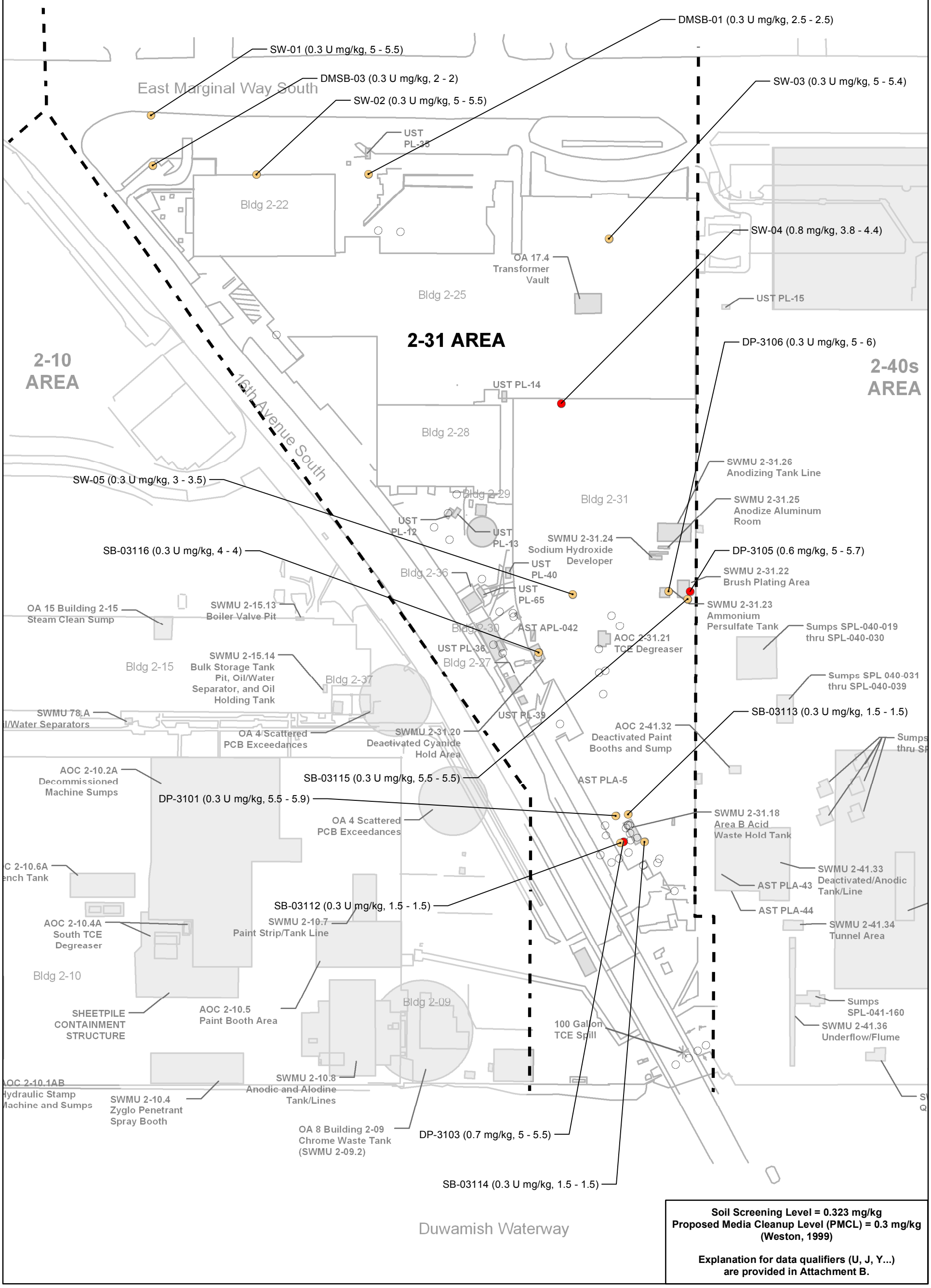
Source: Weston, Golder Associates

2-31 AREA
SILVER IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_SILVER2311.mxd

Golder Associates



Soil Screening Level = 0.323 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.3 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

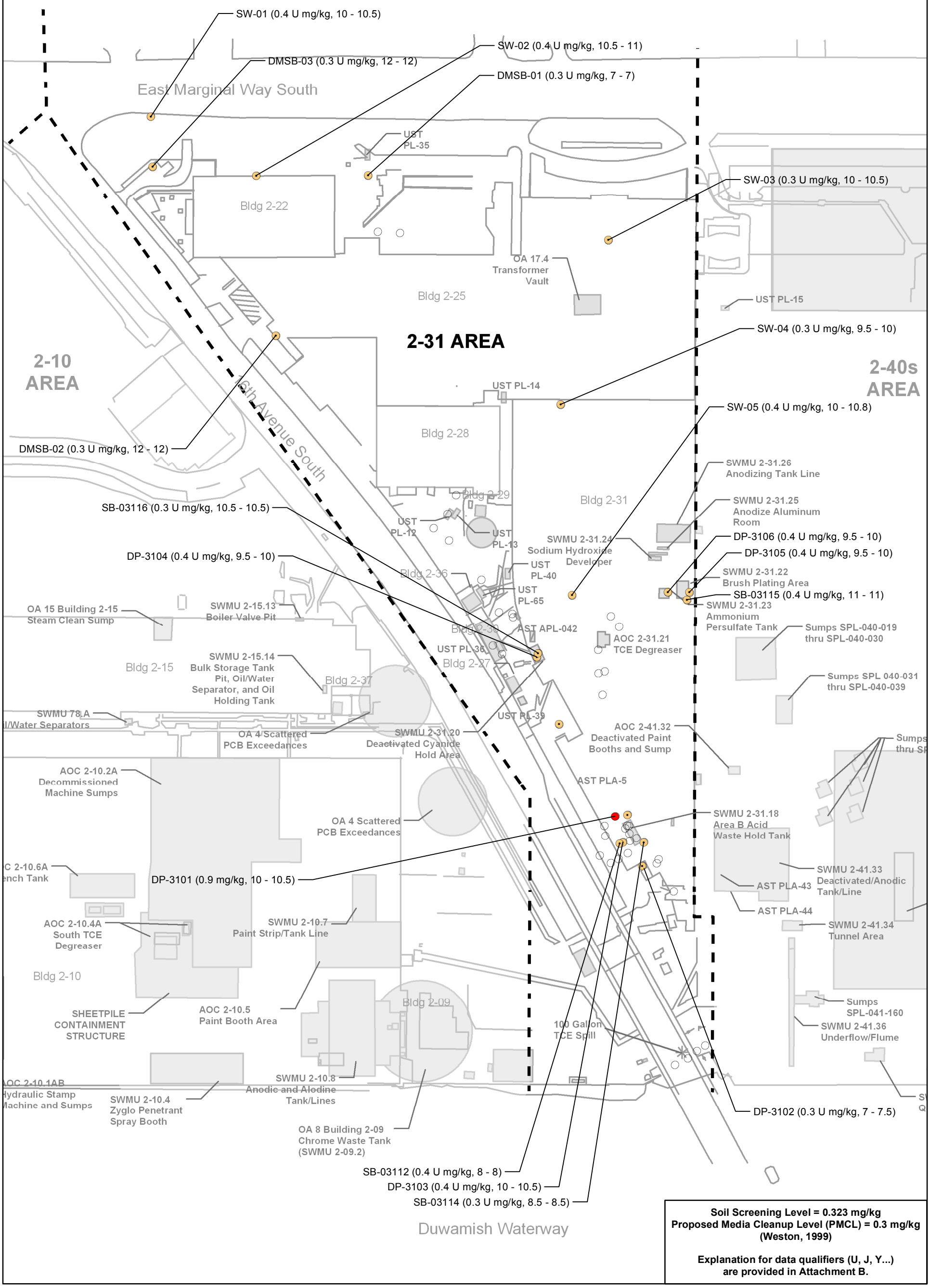
Source: Weston, Golder Associates

2-31 AREA
SILVER IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_SILVER2312.mxd

Golder Associates



Soil Screening Level = 0.323 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.3 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
SILVER IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_SILVER2314.mxd

Golder Associates

East Marginal Way South

UST PL-35

Bldg 2-22

OA 17.4 Transformer Vault

Bldg 2-25

UST PL-15

2-31 AREA

2-10 AREA

2-40s AREA

UST PL-14

16th Avenue South

Bldg 2-28

SWMU 2-31.26 Anodizing Tank Line

Bldg 2-29

Bldg 2-31

SWMU 2-31.25 Anodize Aluminum Room

UST PL-12

UST PL-13

SWMU 2-31.24 Sodium Hydroxide Developer

UST PL-40

Bldg 2-36

SWMU 2-31.22 Brush Plating Area

UST PL-65

SWMU 2-31.23 Ammonium Persulfate Tank

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-30

AST APL-042

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

UST PL-36

Bldg 2-27

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

Sumps SPL 040-031 thru SPL-040-039

SWMU 78.A Oil/Water Separators

UST PL-39

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

Sumps thru SP

AOC 2-10.2A Decommissioned Machine Sumps

NS-02-31 (218 mg/kg, 0.5 - 0.5)

NS-11-31 (110 mg/kg, 0.5 - 0.5)

NS-03-31 (428 mg/kg, 0.5 - 0.5)

NS-01-31 (93.8 mg/kg, 0.5 - 0.5)

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

SWMU 2-41.34 Tunnel Area

Bldg 2-10

Bldg 2-09

Sumps SPL-041-160

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

100 Gallon TCE Spill

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.4 Zyglo Penetrant Spray Booth

SWMU 2-10.8 Anodic and Alodine Tank/Lines

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

NS-07-31 (823 mg/kg, 0.5 - 0.5)

NS-10-31 (45.8 mg/kg, 0.5 - 0.5)

NS-08-31 (809 mg/kg, 0.5 - 0.5)

Duwamish Waterway

Soil Screening Level = 101 mg/kg
Proposed Media Cleanup Level (PMCL) = 107 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

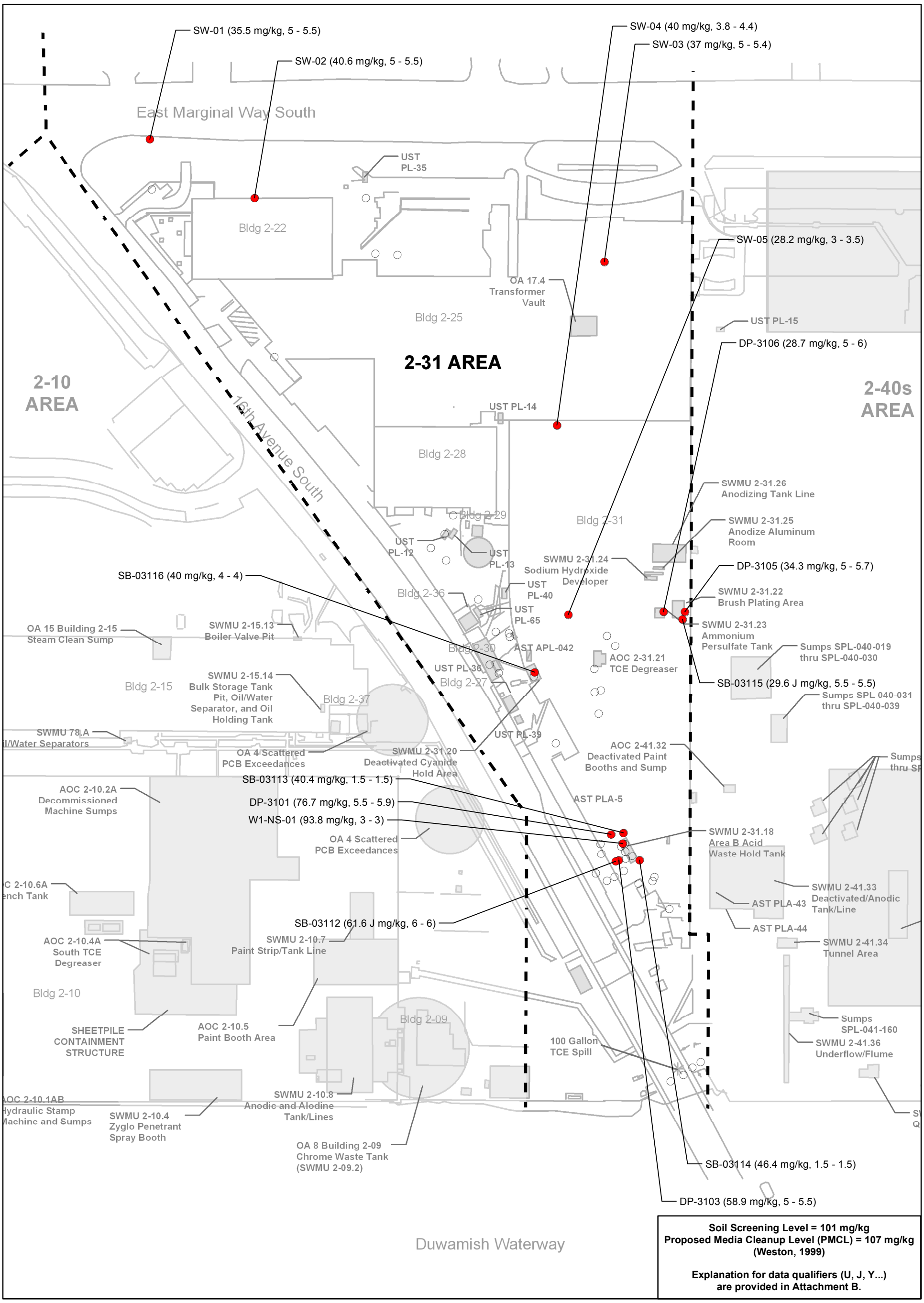
ZINC IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_ZINC2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection:
Washington State Plane
North Zone, NAD 83, Feet

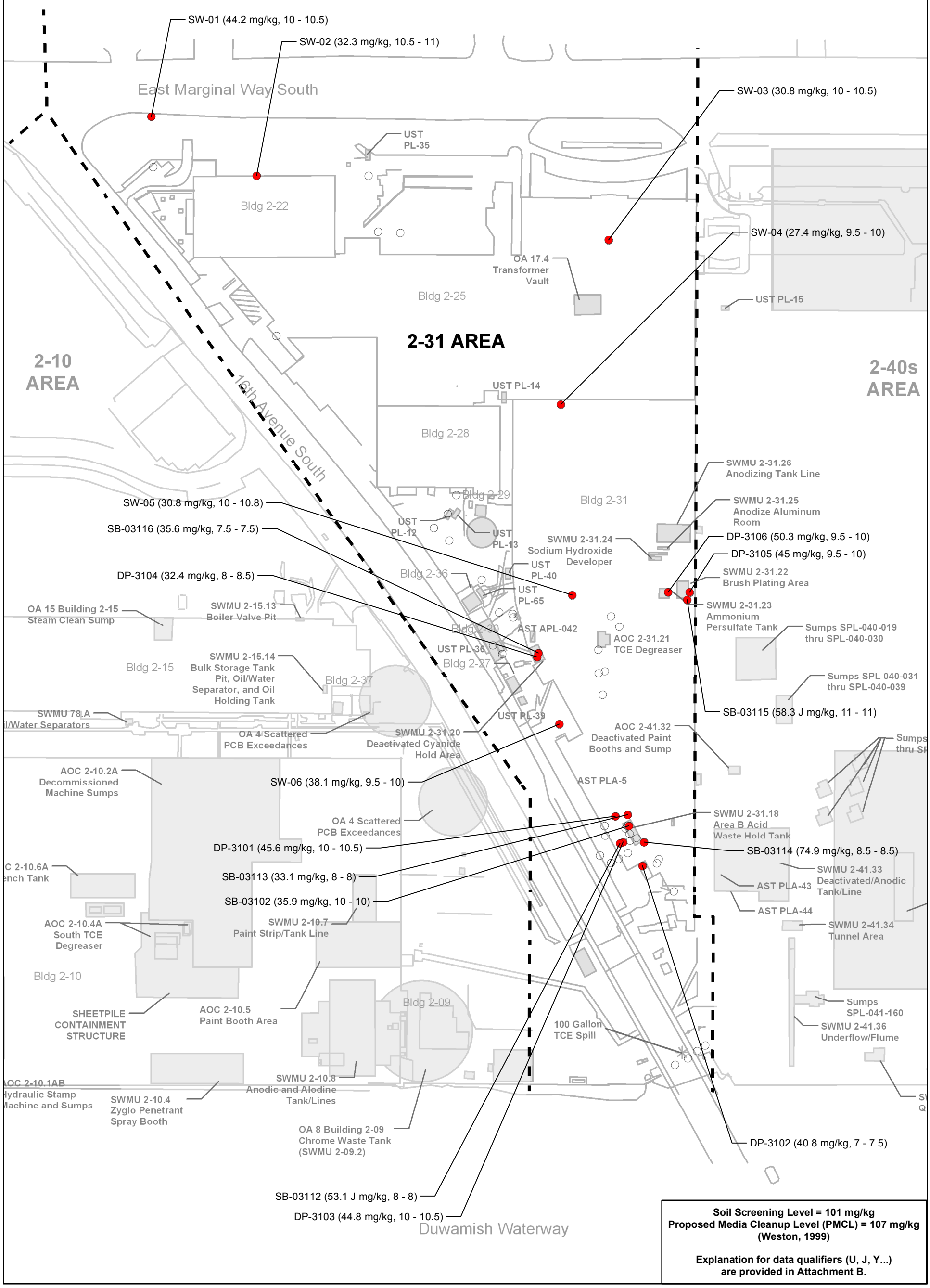
Source: Weston,
Golder Associates

2-31 AREA
ZINC IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date:Apr 2009	Figure: 2

0131646004100_ZINC2312.mxd

Golder Associates



Soil Screening Level = 101 mg/kg
Proposed Media Cleanup Level (PMCL) = 107 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
ZINC IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_ZINC2313.mxd

Golder Associates

East Marginal Way South

Bldg 2-22

UST PL-35

OA 17.4 Transformer Vault

Bldg 2-25

2-31 AREA

2-10 AREA

2-40s AREA

UST PL-15

UST PL-14

16th Avenue South

Bldg 2-28

Bldg 2-29

Bldg 2-31

UST PL-12

UST PL-13

UST PL-40

UST PL-65

Bldg 2-36

Bldg 2-30

AST APL-042

UST PL-36

Bldg 2-27

UST PL-39

SWMU 2-31.26 Anodizing Tank Line

SWMU 2-31.25 Anodize Aluminum Room

SWMU 2-31.24 Sodium Hydroxide Developer

SWMU 2-31.22 Brush Plating Area

SWMU 2-31.23 Ammonium Persulfate Tank

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

Sumps SPL 040-031 thru SPL-040-039

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

SWMU 78.A Oil/Water Separators

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

AOC 2-10.2A Decommissioned Machine Sumps

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

SWMU 2-41.34 Tunnel Area

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

Bldg 2-10

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

Bldg 2-09

100 Gallon TCE Spill

Sumps SPL-041-160

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.4 Zyglo Penetrant Spray Booth

SWMU 2-10.8 Anodic and Alodine Tank/Lines

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

Duwamish Waterway

Soil Screening Level = 0.202 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.2 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

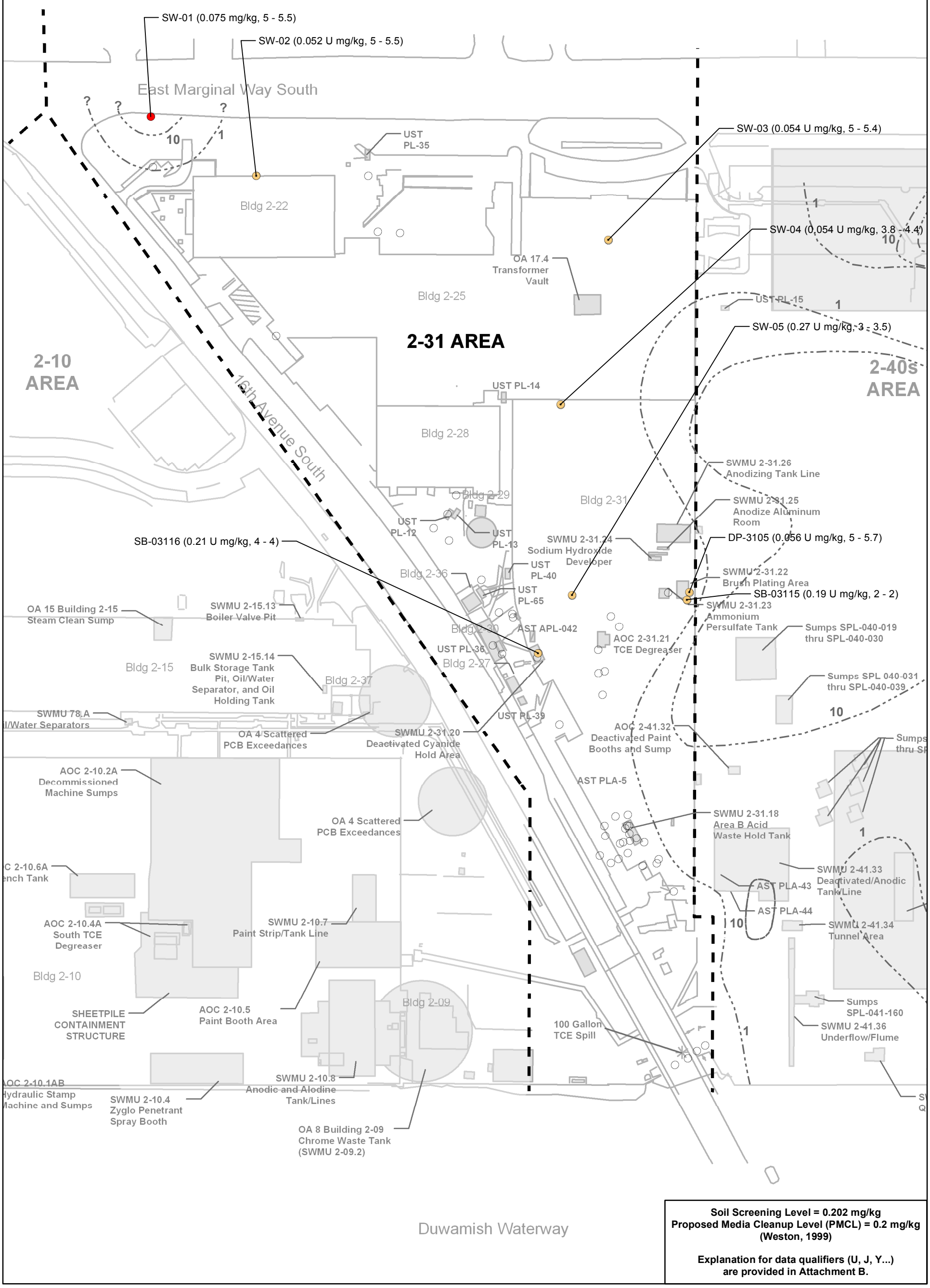
CYANIDE IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_CYANIDE2311.mxd

Golder Associates



Soil Screening Level = 0.202 mg/kg
Proposed Media Cleanup Level (PMCL) = 0.2 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

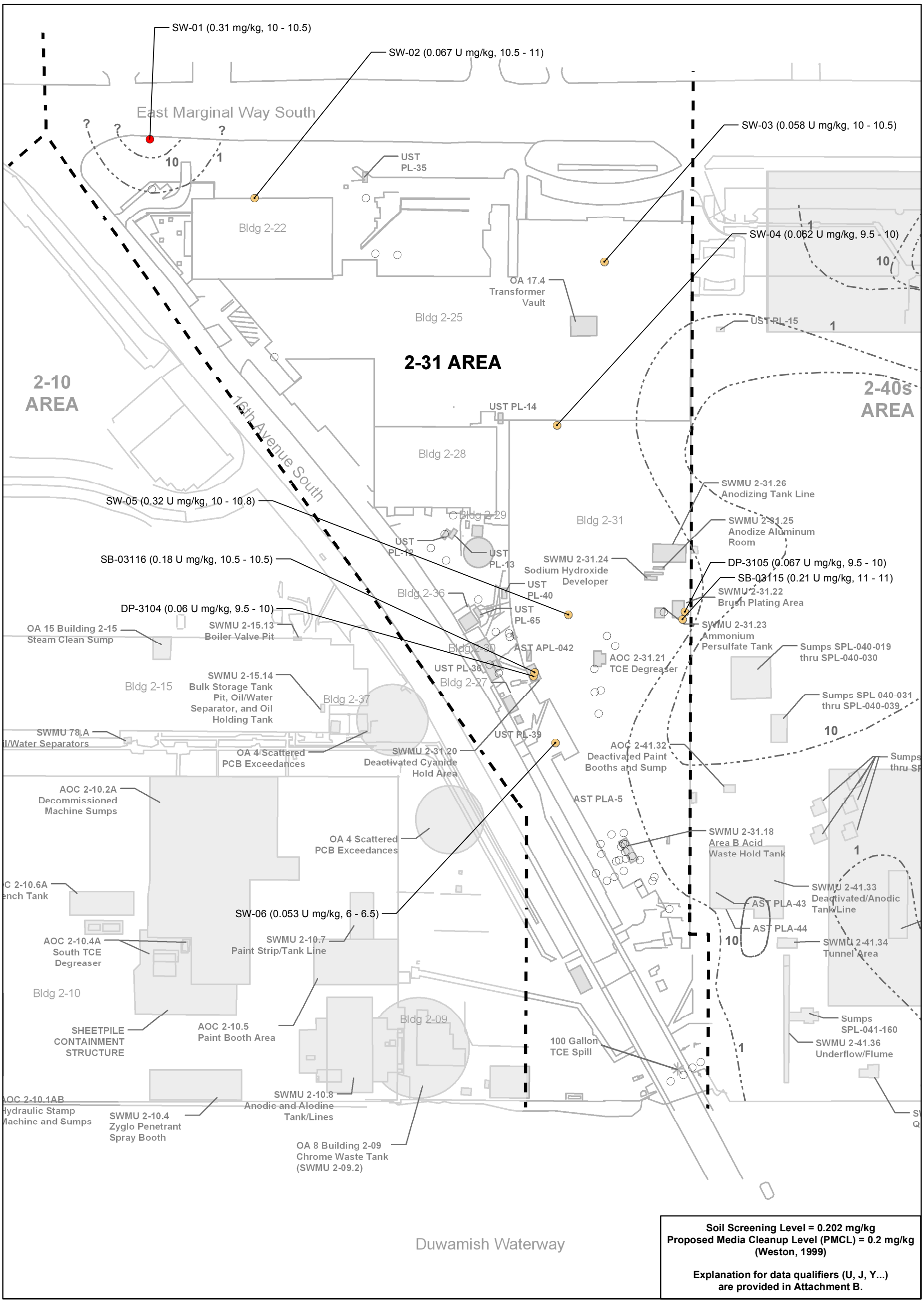
Source: Weston, Golder Associates

2-31 AREA
CYANIDE IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_CYANIDE2312.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

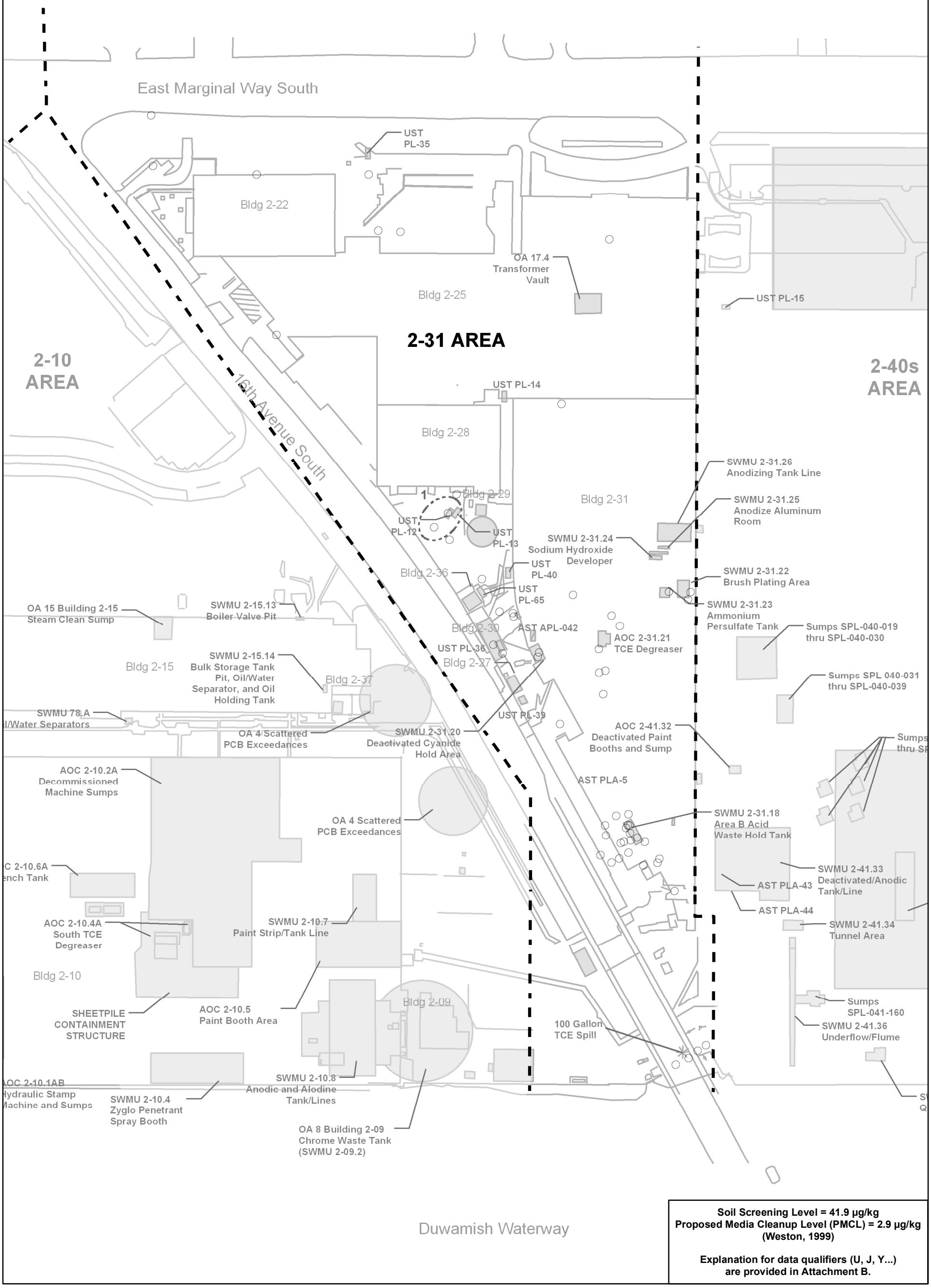
Source: Weston, Golder Associates

2-31 AREA
CYANIDE IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_CYANIDE2313.mxd

Golder Associates



Soil Screening Level = 41.9 µg/kg
Proposed Media Cleanup Level (PMCL) = 2.9 µg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

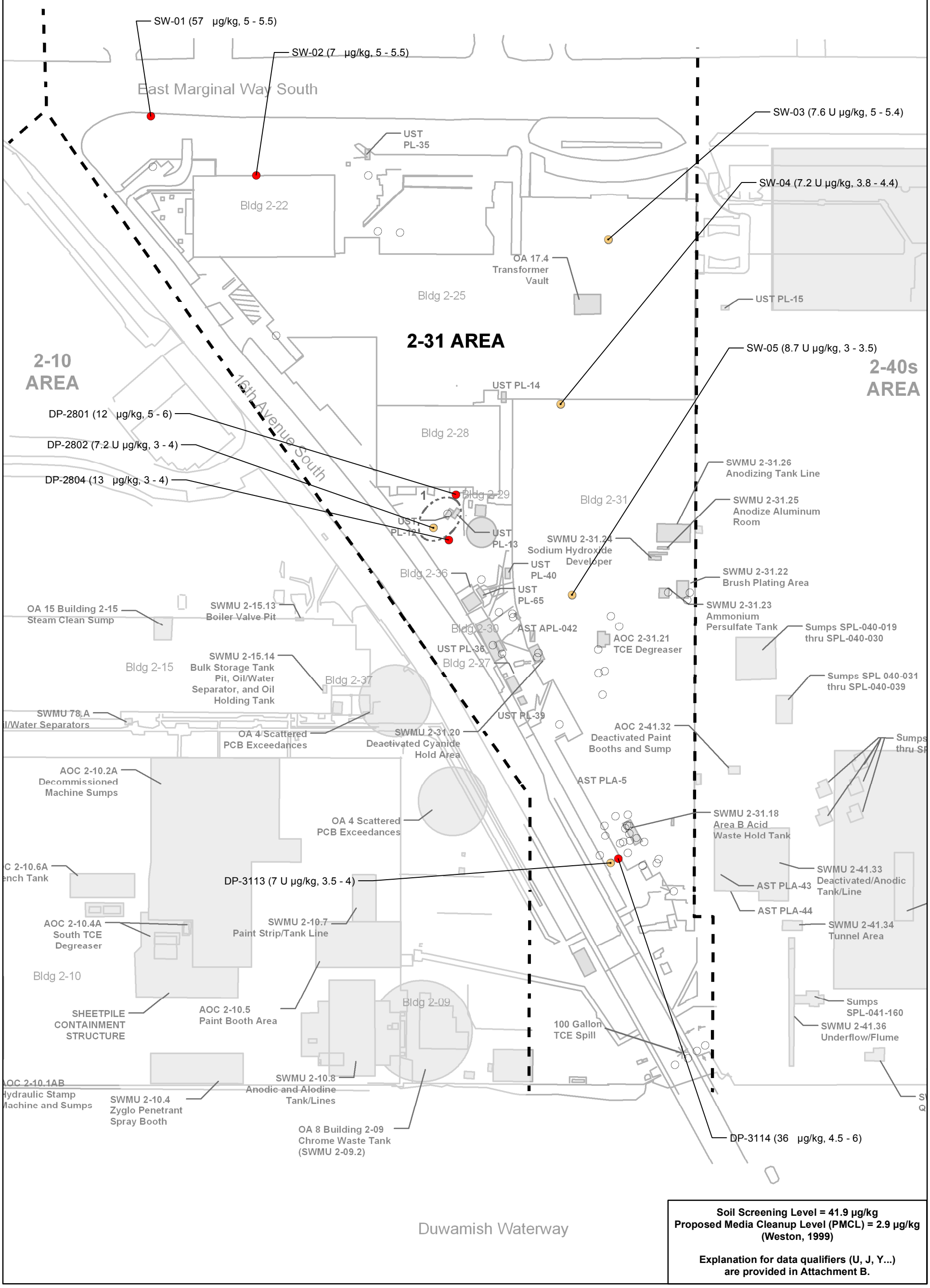
Source: Weston, Golder Associates

2-31 AREA
BENZO(A)ANTHRACENE IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_BENZOAANTHRACENE2311.mxd

Golder Associates



Soil Screening Level = 41.9 µg/kg
Proposed Media Cleanup Level (PMCL) = 2.9 µg/kg
(Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

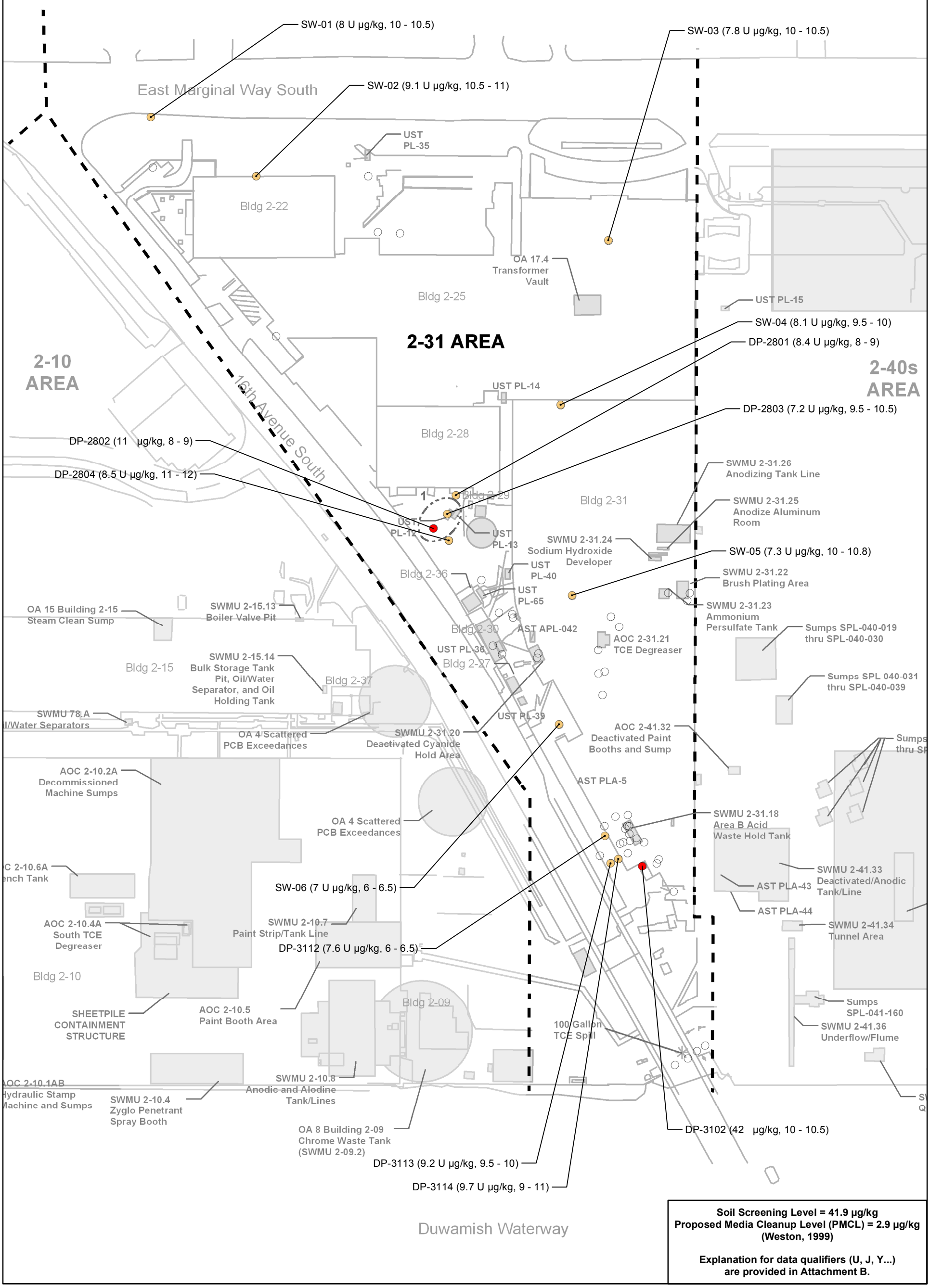
Source: Weston, Golder Associates

2-31 AREA
BENZO(A)ANTHRACENE IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_BENZOAANTHRACENE2312.mxd

Golder Associates



Soil Screening Level = 41.9 µg/kg
Proposed Media Cleanup Level (PMCL) = 2.9 µg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

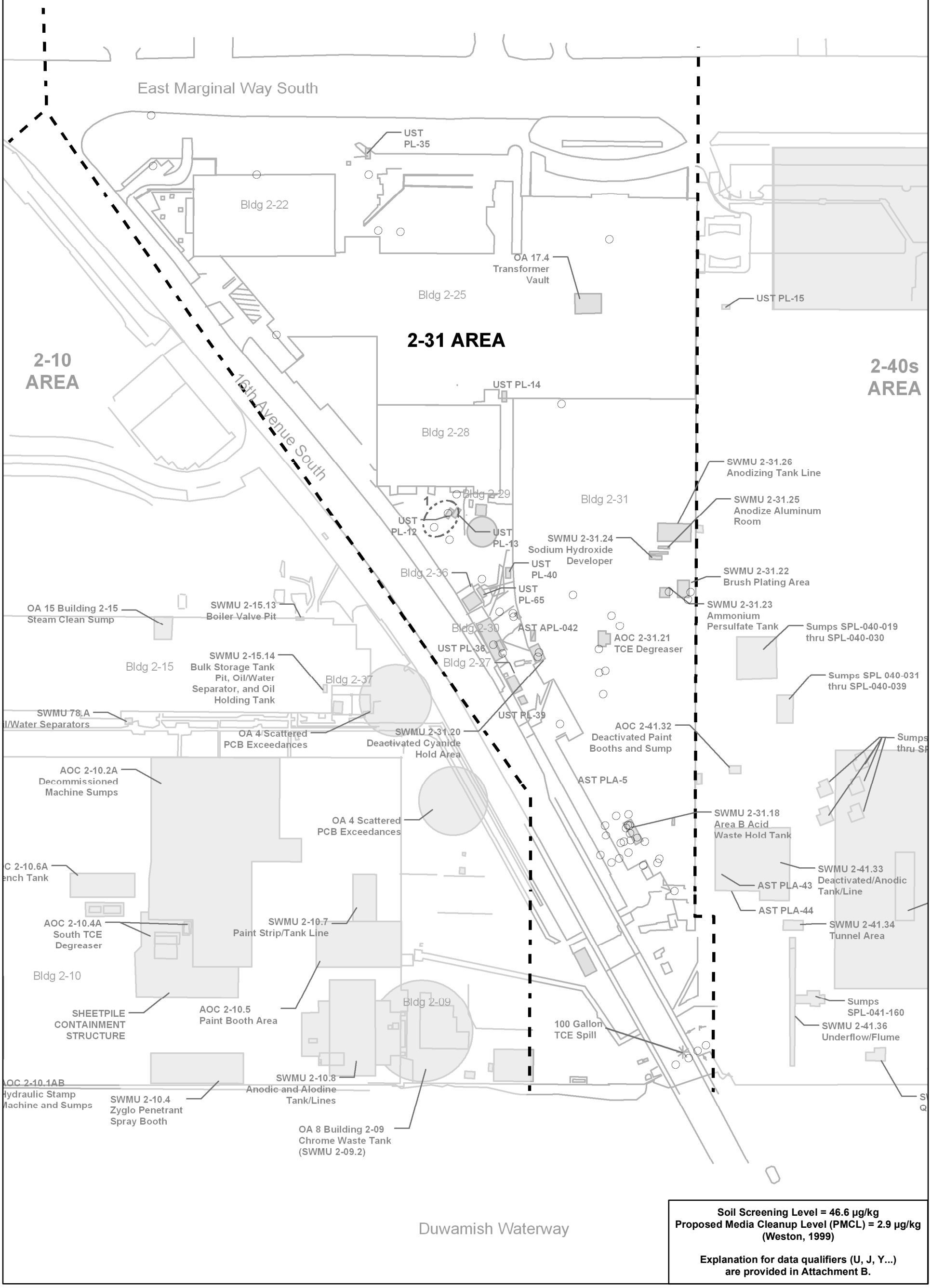
Source: Weston, Golder Associates

2-31 AREA
BENZO(A)ANTHRACENE IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_BENZOAANTHRACENE2313.mxd

Golder Associates



Soil Screening Level = 46.6 µg/kg
Proposed Media Cleanup Level (PMCL) = 2.9 µg/kg
(Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

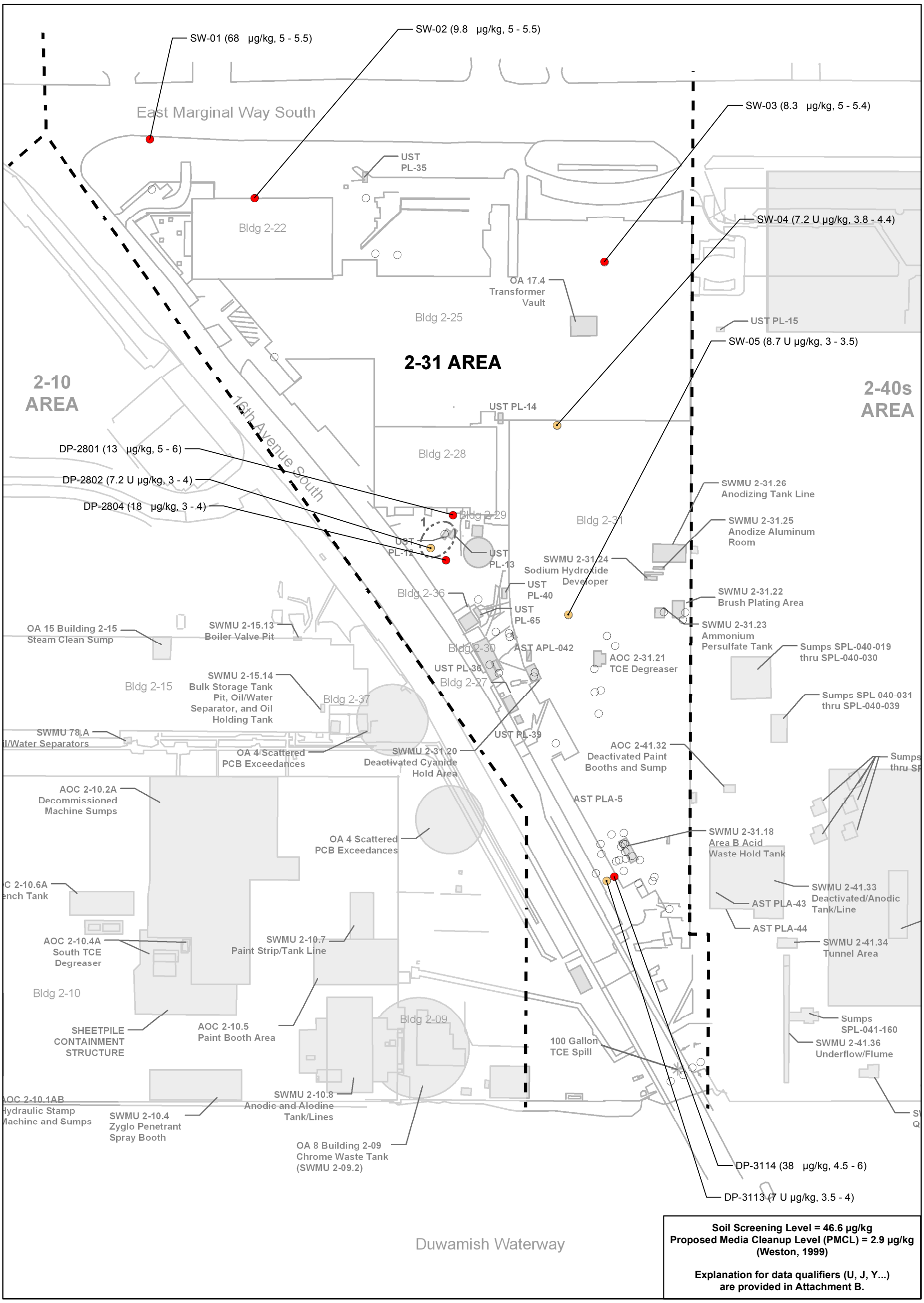
Source: Weston, Golder Associates

2-31 AREA
CHRYSENE IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Apr 2009	Figure: 1

0131646004100_CHRYSENE2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

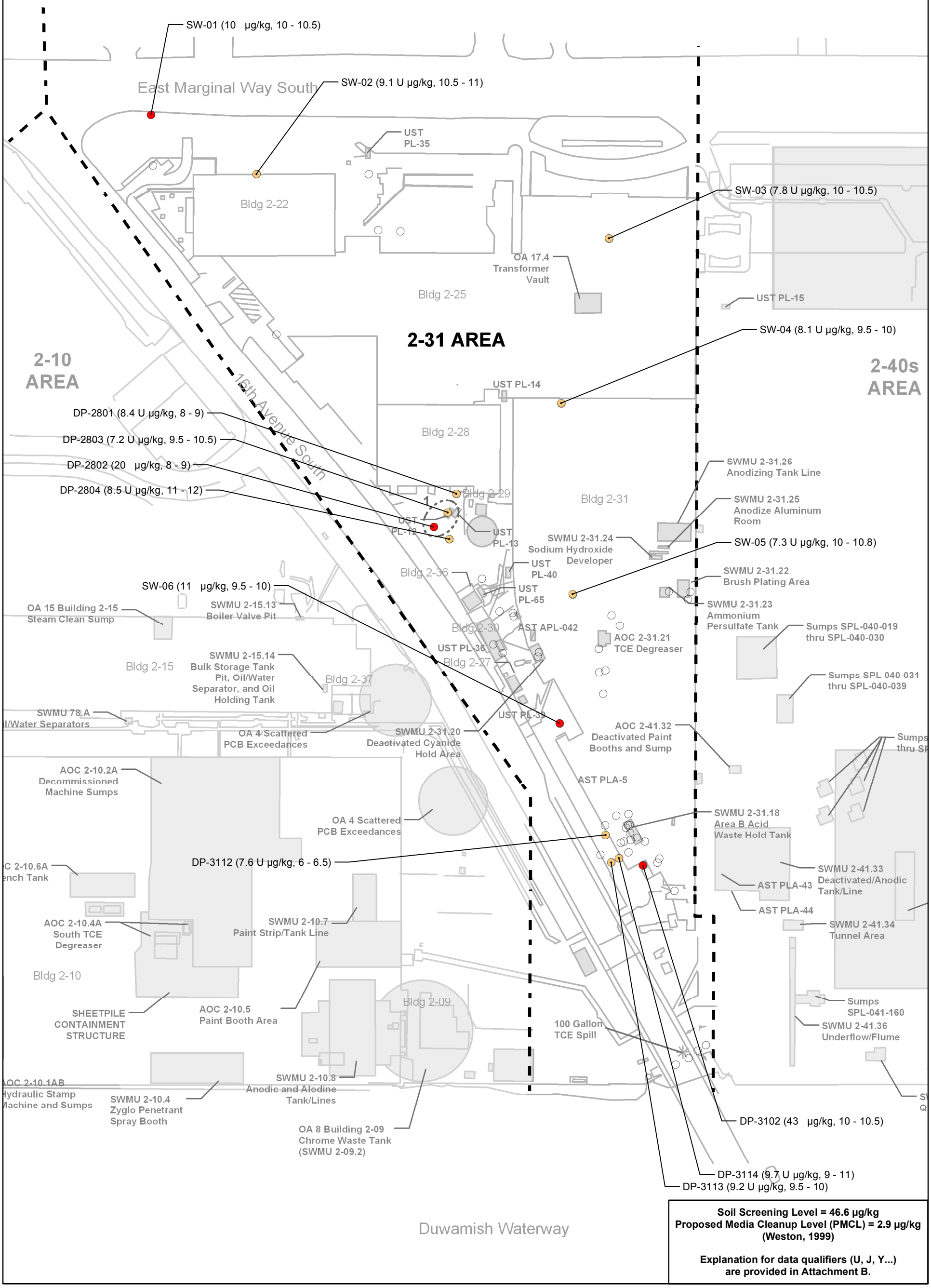
Source: Weston, Golder Associates

2-31 AREA
CHRYSENE IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_CHRYSENE2312.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
CHRYSENE IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_CHRYSENE2313.mxd

Golder Associates

East Marginal Way South

UST PL-35

Bldg 2-22

OA 17.4 Transformer Vault

Bldg 2-25

UST PL-15

2-31 AREA

2-10 AREA

2-40s AREA

UST PL-14

16th Avenue South

Bldg 2-28

SWMU 2-31.26 Anodizing Tank Line

Bldg 2-29

Bldg 2-31

SWMU 2-31.25 Anodize Aluminum Room

UST PL-12

UST PL-13

SWMU 2-31.24 Sodium Hydroxide Developer

UST PL-40

Bldg 2-36

SWMU 2-31.22 Brush Plating Area

UST PL-65

SWMU 2-31.23 Ammonium Persulfate Tank

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-30

AST APL-042

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

UST PL-36

Bldg 2-27

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

Sumps SPL 040-031 thru SPL-040-039

SWMU 78.A Oil/Water Separators

UST PL-39

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

Sumps thru SP

AOC 2-10.2A Decommissioned Machine Sumps

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

SWMU 2-41.34 Tunnel Area

Bldg 2-10

Bldg 2-09

Sumps SPL-041-160

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

100 Gallon TCE Spill

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.8 Anodic and Alodine Tank/Lines

SWMU 2-10.4 Zyglo Penetrant Spray Booth

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

Duwamish Waterway

Soil Screening Level = 33 µg/kg
Proposed Media Cleanup Level (PMCL) = 33 µg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

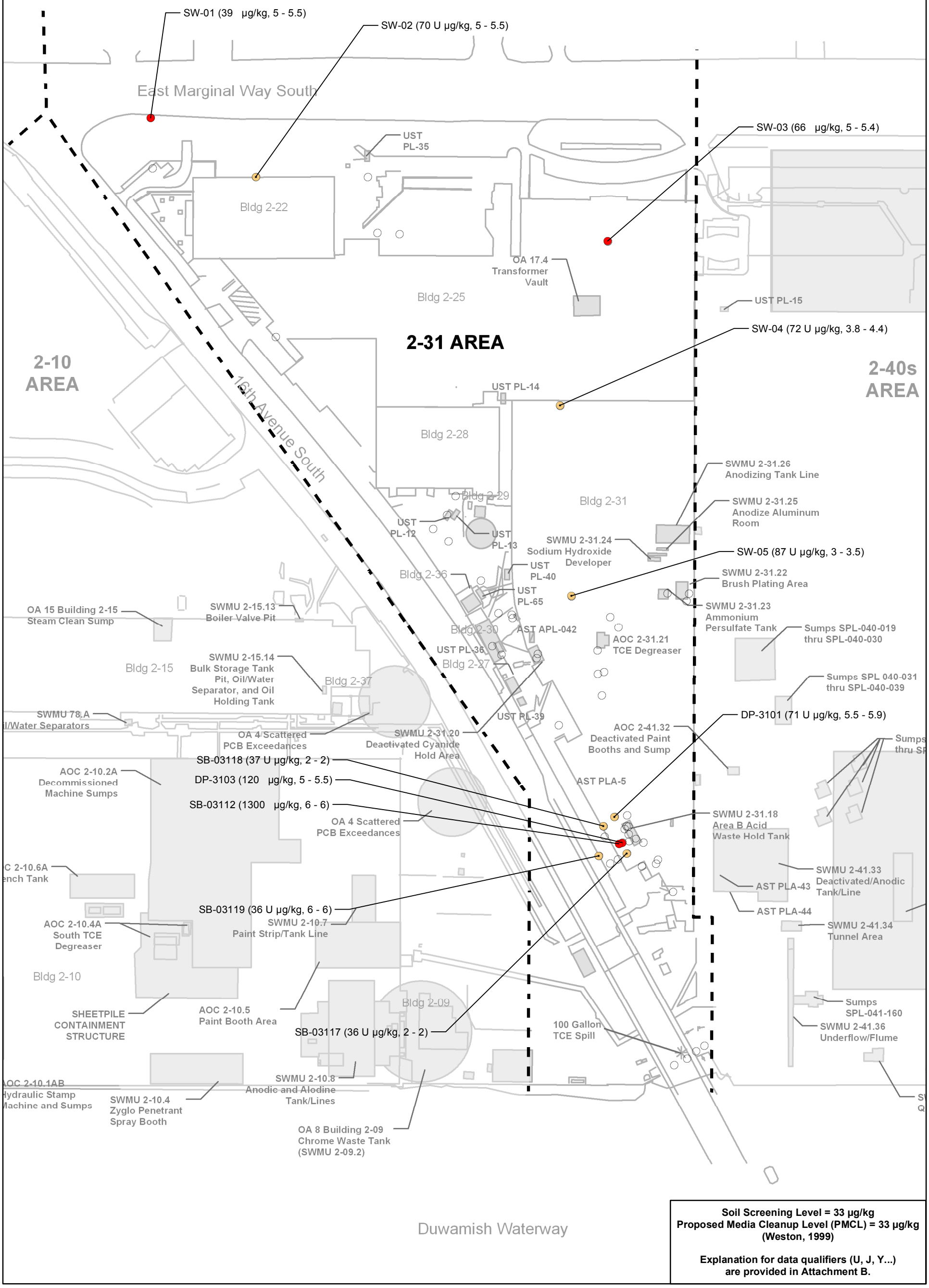
TOTAL PCB IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_TOTALPCB2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

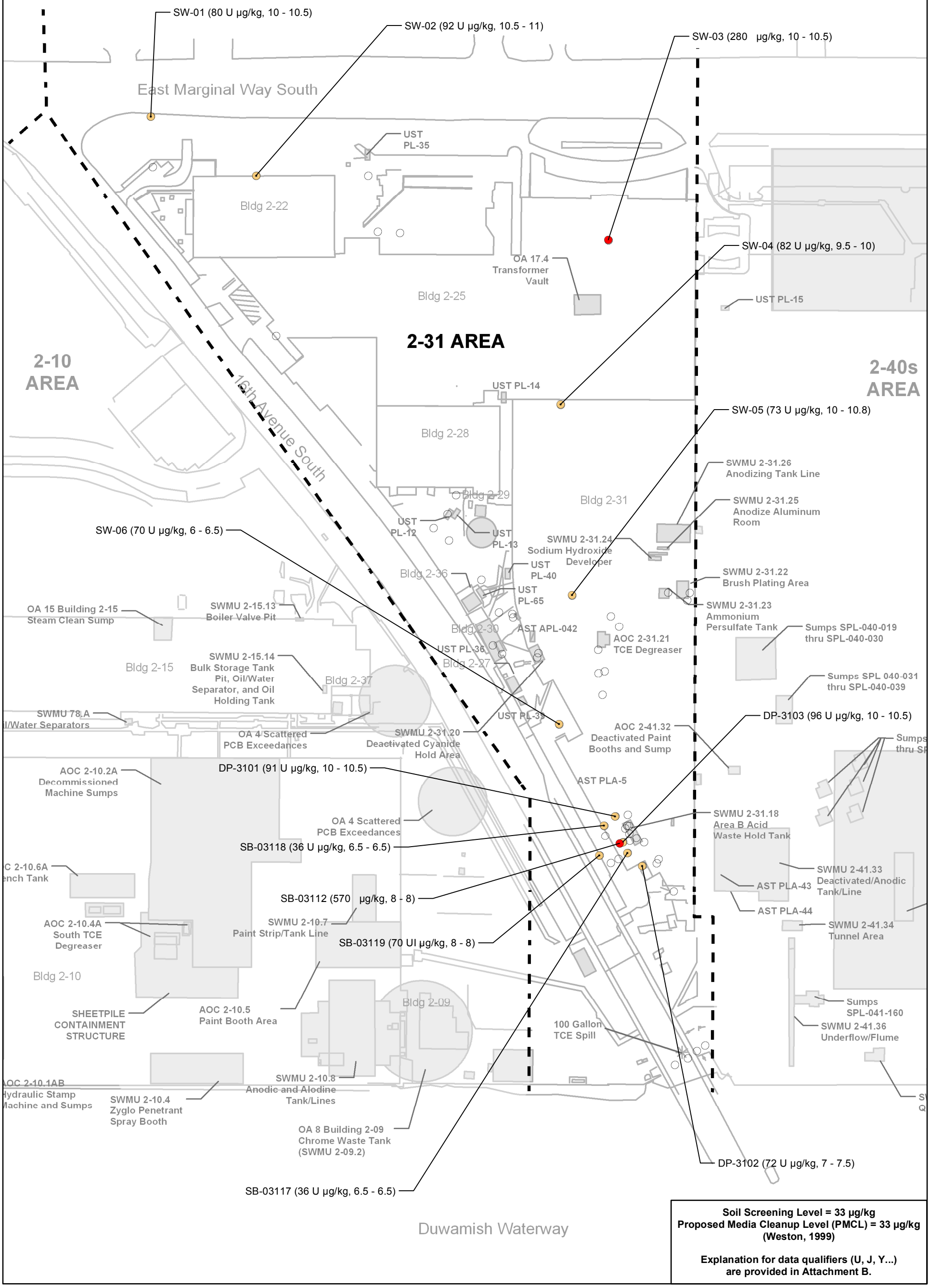
Source: Weston, Golder Associates

2-31 AREA
TOTAL PCB IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_TOTALPCB2312.mxd

Golder Associates



Soil Screening Level = 33 µg/kg
Proposed Media Cleanup Level (PMCL) = 33 µg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA
TOTAL PCB IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_TOTALPCB2313.mxd

Golder Associates

East Marginal Way South

UST PL-35

Bldg 2-22

OA 17.4 Transformer Vault

Bldg 2-25

UST PL-15

2-31 AREA

2-10 AREA

2-40s AREA

16th Avenue South

UST PL-14

Bldg 2-28

Bldg 2-29

Bldg 2-31

SWMU 2-31.26 Anodizing Tank Line

SWMU 2-31.25 Anodize Aluminum Room

UST PL-12

UST PL-13

SWMU 2-31.24 Sodium Hydroxide Developer

UST PL-40

Bldg 2-36

UST PL-65

SWMU 2-31.22 Brush Plating Area

SWMU 2-31.23 Ammonium Persulfate Tank

OA 15 Building 2-15 Steam Clean Sump

SWMU 2-15.13 Boiler Valve Pit

Bldg 2-30

AST APL-042

AOC 2-31.21 TCE Degreaser

Sumps SPL-040-019 thru SPL-040-030

UST PL-36

Bldg 2-27

Bldg 2-15

SWMU 2-15.14 Bulk Storage Tank Pit, Oil/Water Separator, and Oil Holding Tank

Bldg 2-37

Sumps SPL 040-031 thru SPL-040-039

SWMU 78.A Oil/Water Separators

UST PL-39

OA 4 Scattered PCB Exceedances

SWMU 2-31.20 Deactivated Cyanide Hold Area

AOC 2-41.32 Deactivated Paint Booths and Sump

Sumps thru SP

AOC 2-10.2A Decommissioned Machine Sumps

AST PLA-5

OA 4 Scattered PCB Exceedances

SWMU 2-31.18 Area B Acid Waste Hold Tank

AOC 2-10.6A Trench Tank

SWMU 2-41.33 Deactivated/Anodic Tank/Line

AST PLA-43

AST PLA-44

AOC 2-10.4A South TCE Degreaser

SWMU 2-10.7 Paint Strip/Tank Line

SWMU 2-41.34 Tunnel Area

Bldg 2-10

Bldg 2-09

Sumps SPL-041-160

SHEETPILE CONTAINMENT STRUCTURE

AOC 2-10.5 Paint Booth Area

100 Gallon TCE Spill

SWMU 2-41.36 Underflow/Flume

AOC 2-10.1AB Hydraulic Stamp Machine and Sumps

SWMU 2-10.4 Zyglo Penetrant Spray Booth

SWMU 2-10.8 Anodic and Alodine Tank/Lines

OA 8 Building 2-09 Chrome Waste Tank (SWMU 2-09.2)

Duwamish Waterway

Soil Screening Level = 2.0 µg /kg
Proposed Media Cleanup Level (PMCL) = 5,500 µg /kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg /L).
- Plant 2 Sub-Area Boundary.

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

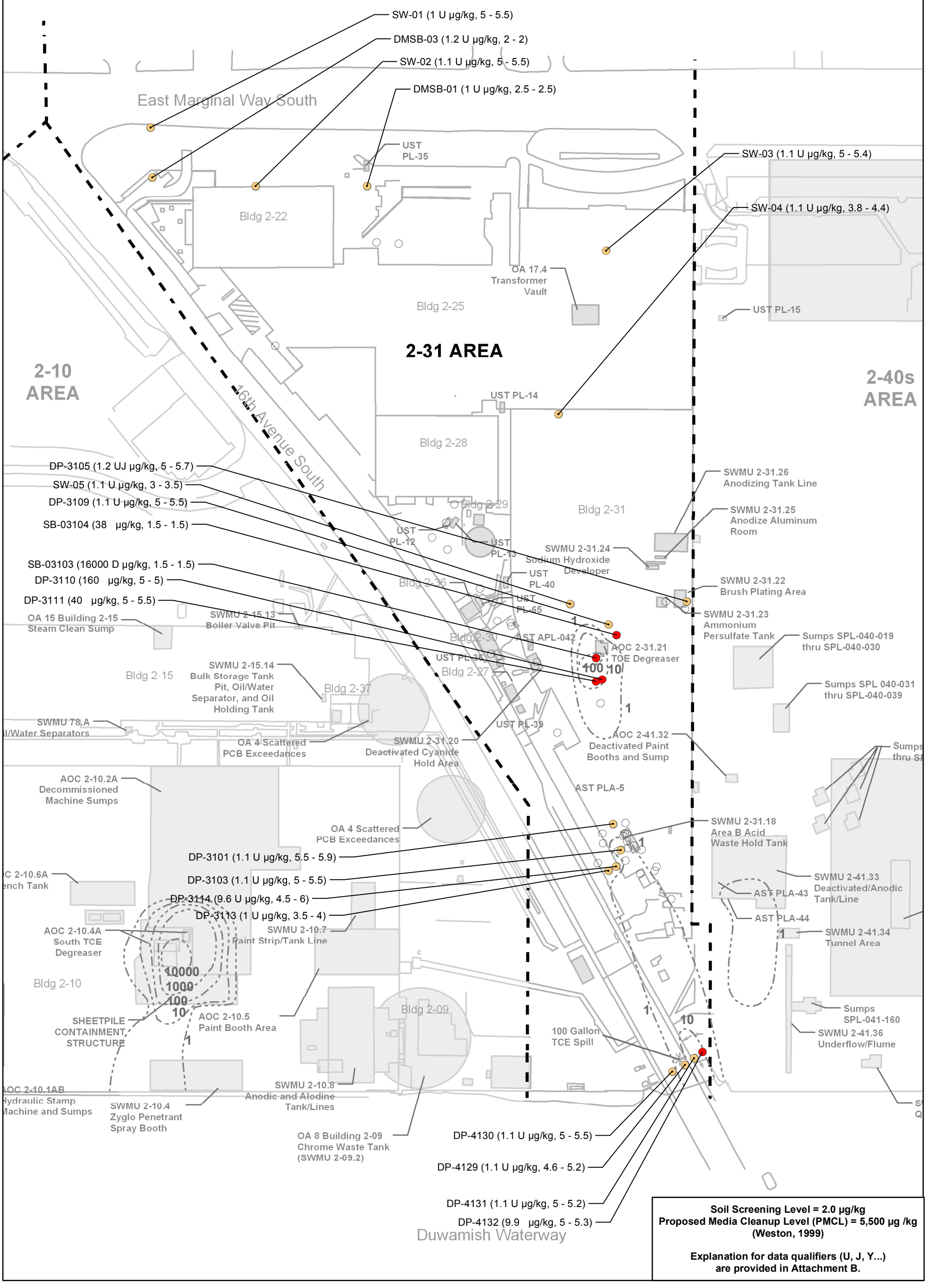
TRICHLOROETHENE IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_TCE2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 150
Scale 1" = 150 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 AREA

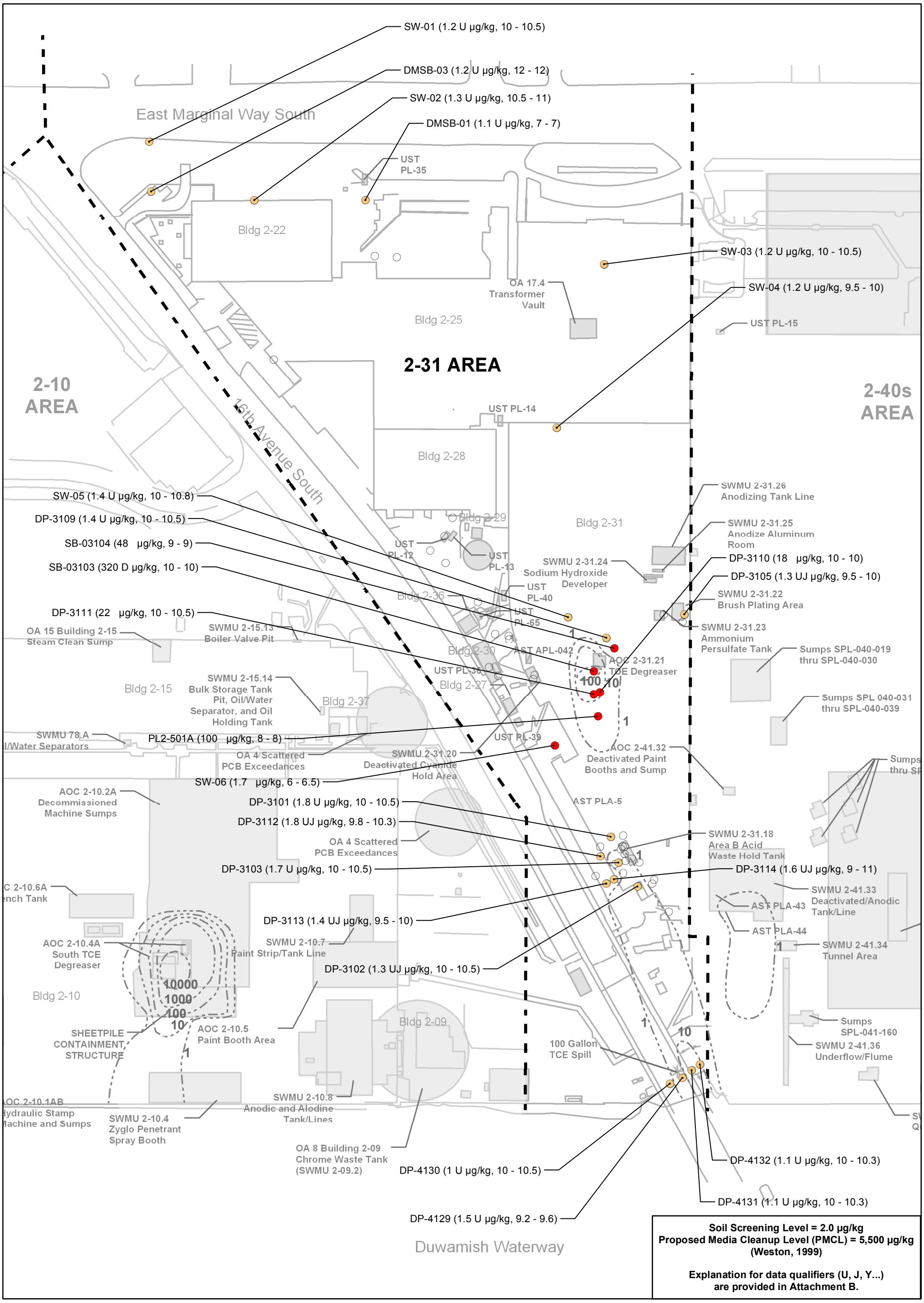
TRICHLOROETHENE IN SOIL: DEPTH 1 - 6 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_TCE2312a.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection:
Washington State Plane
North Zone, NAD 83, Feet

Source: Weston,
Golder Associates

2-31 AREA

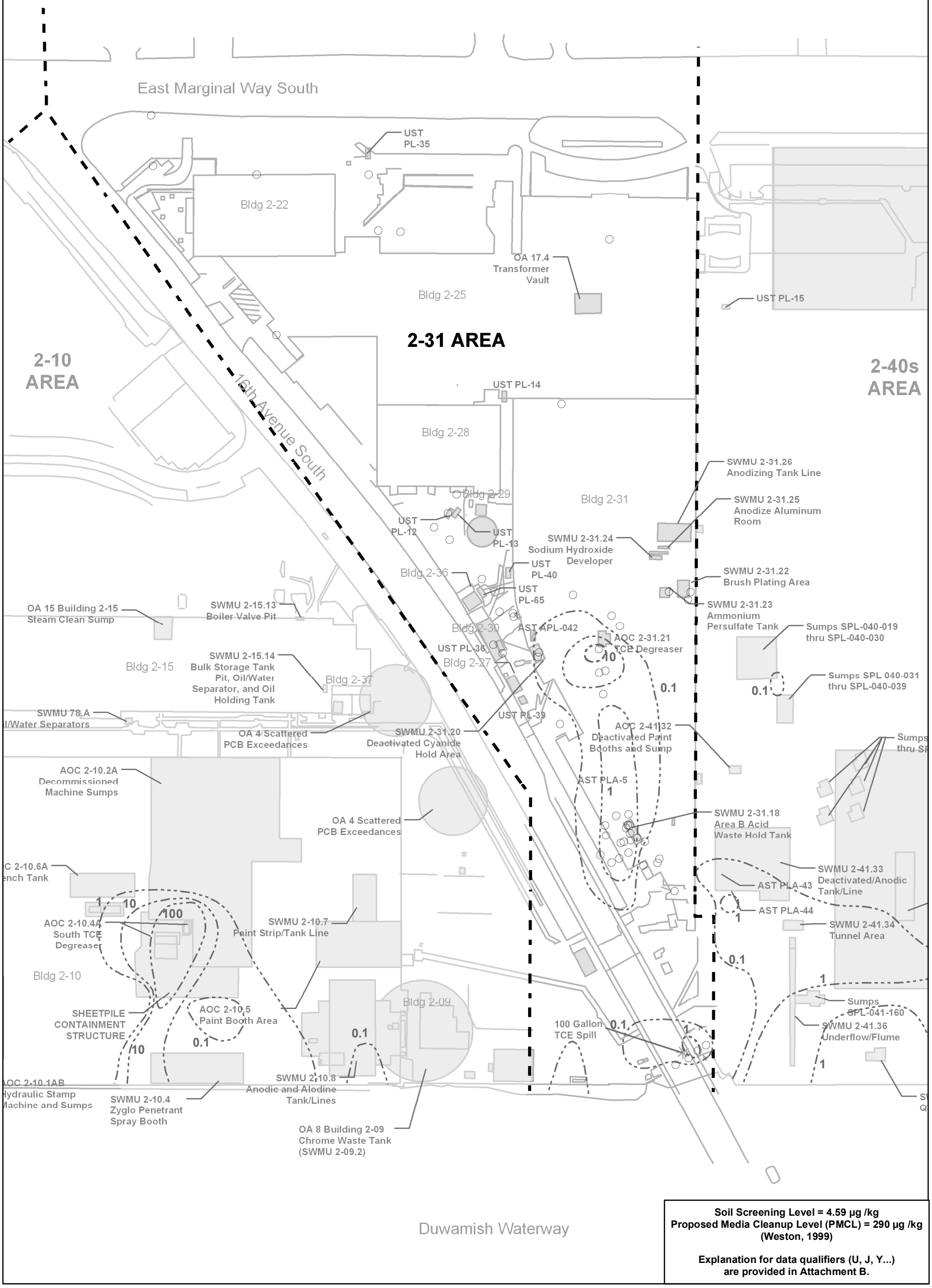
TRICHLOROETHENE IN SOIL: DEPTH 6 - 12 FT

BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_TCE2313.mxd

Golder Associates



Soil Screening Level = 4.59 µg /kg
Proposed Media Cleanup Level (PMCL) = 290 µg /kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg /L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

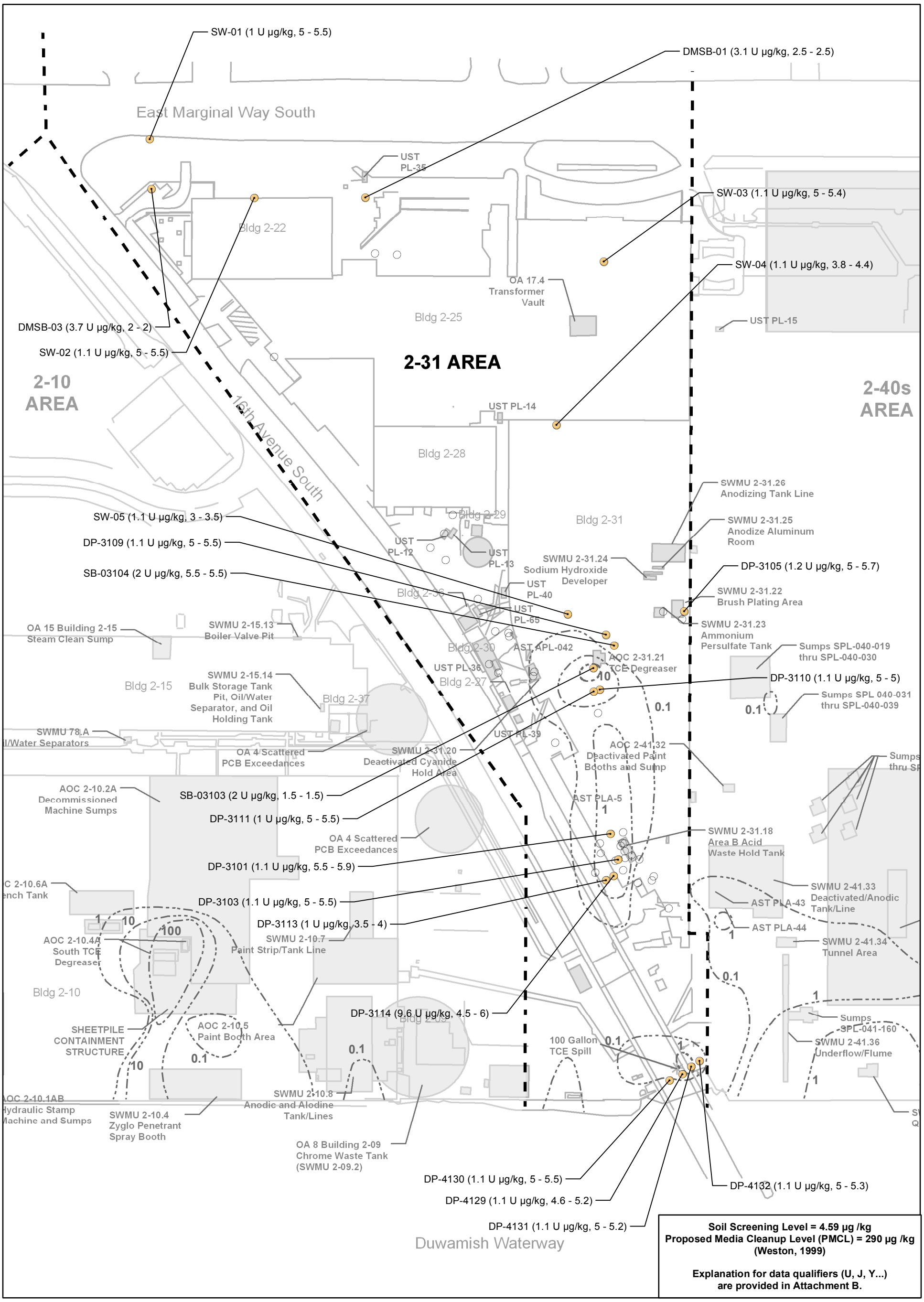
Source: Weston, Golder Associates

2-31 AREA
VINYL CHLORIDE IN SOIL: DEPTH 0 - 1 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_VINYLCHLORIDE2311.mxd

Golder Associates



Soil Screening Level = 4.59 µg /kg
Proposed Media Cleanup Level (PMCL) = 290 µg /kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg /kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg /L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

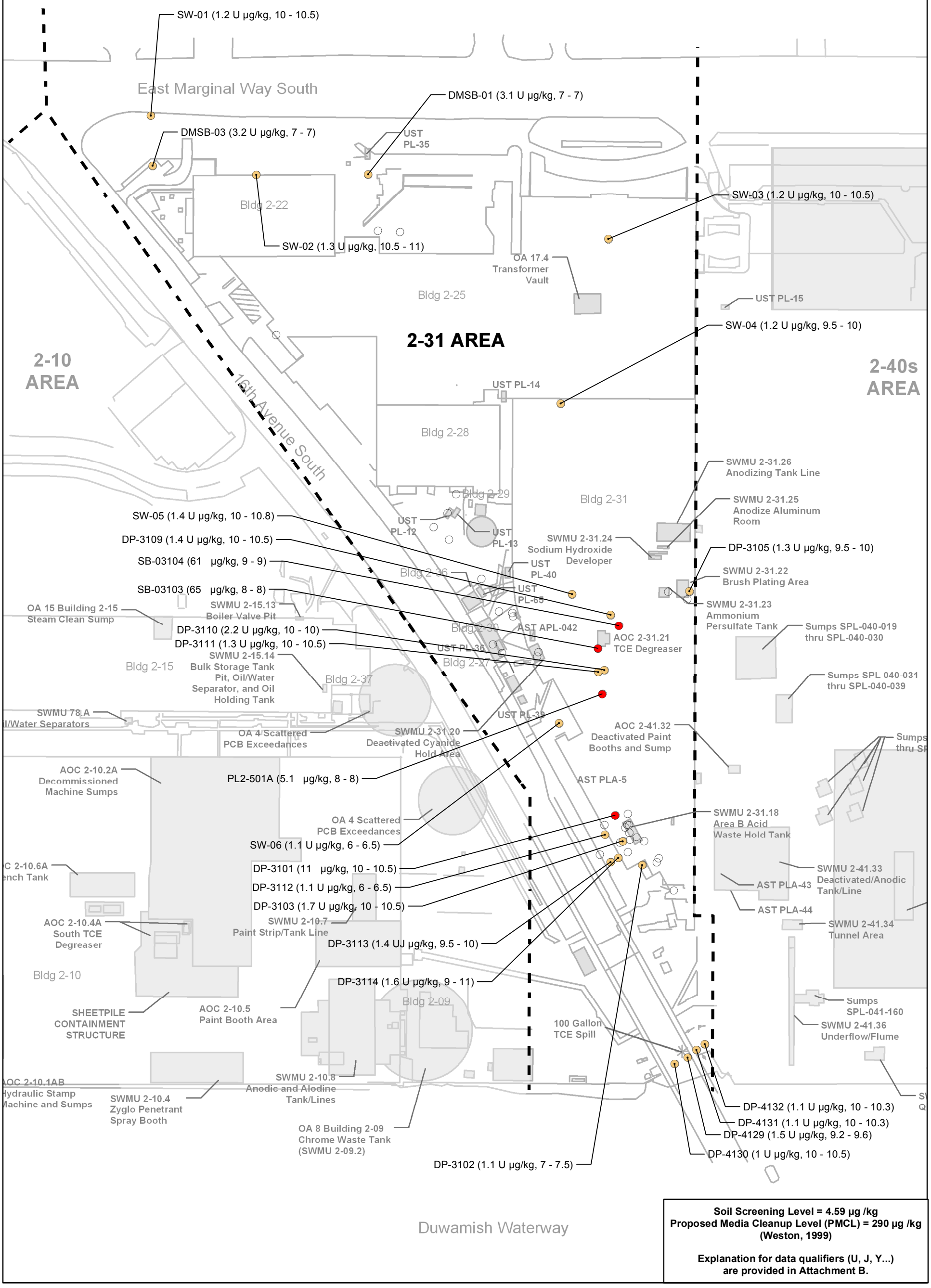
Source: Weston, Golder Associates

2-31 AREA
VINYL CHLORIDE IN SOIL: DEPTH 1 - 6 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_VINYLCHLORIDE2312.mxd

Golder Associates



Soil Screening Level = 4.59 µg /kg
Proposed Media Cleanup Level (PMCL) = 290 µg /kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; µg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-zone Aquifer (µg /L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

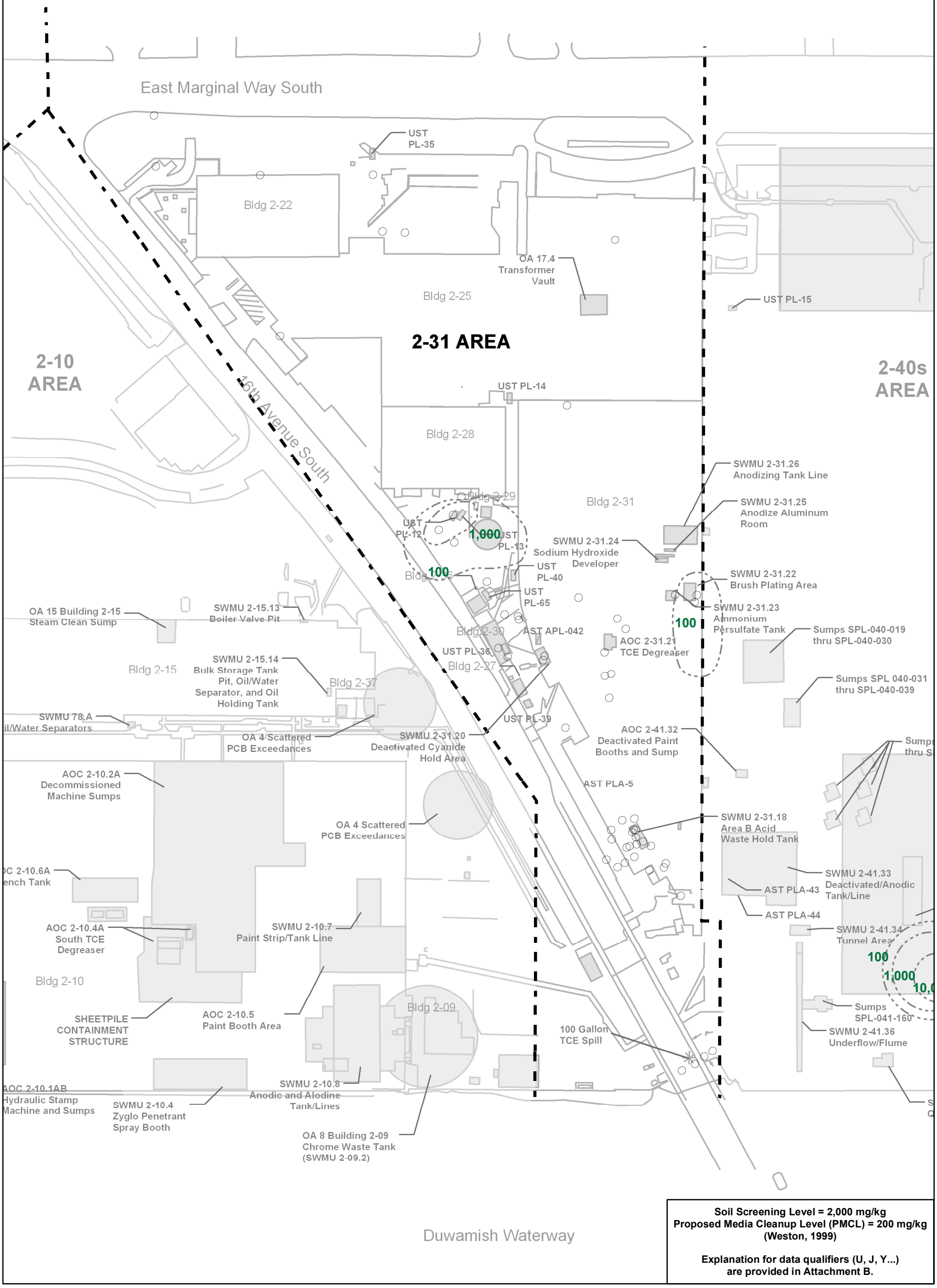
Source: Weston, Golder Associates

2-31 AREA
VINYL CHLORIDE IN SOIL: DEPTH 6 - 12 FT
BOEING PLANT 2

Drawn: TH	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_VINYLCHLORIDE2313.mxd

Golder Associates



Soil Screening Level = 2,000 mg/kg
Proposed Media Cleanup Level (PMCL) = 200 mg/kg (Weston, 1999)

Explanation for data qualifiers (U, J, Y...) are provided in Attachment B.

LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-Zone Aquifer (µg /L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

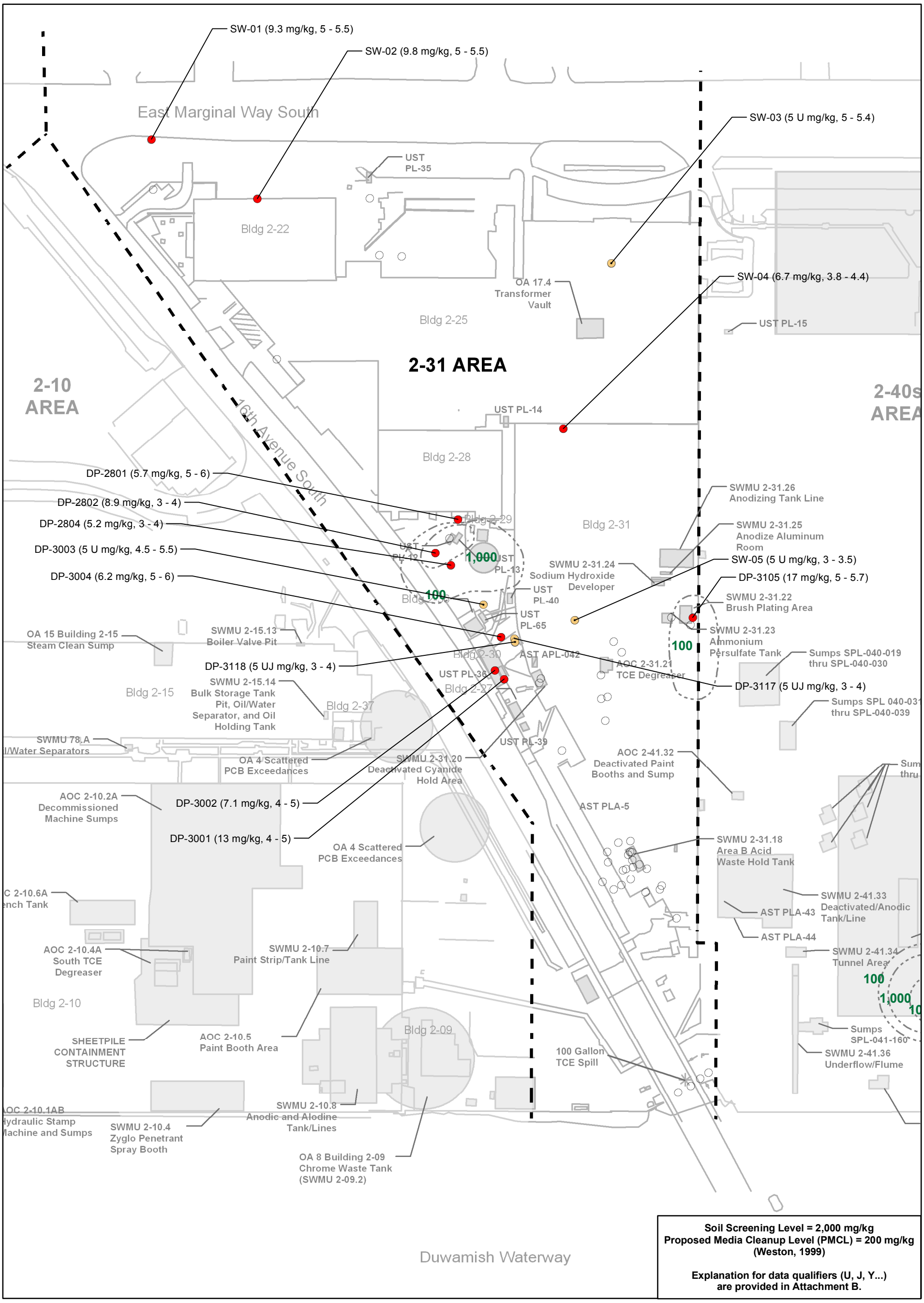
2-31 AREA DIESEL RANGE PETROLEUM HYDROCARBONS IN SOIL: DEPTH 0 - 1 FT

BOEING PLANT 2

Drawn: GPB	Revision: 1	Date: Apr 2009	Figure: 1

0131646004100_DIESEL2311.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-Zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

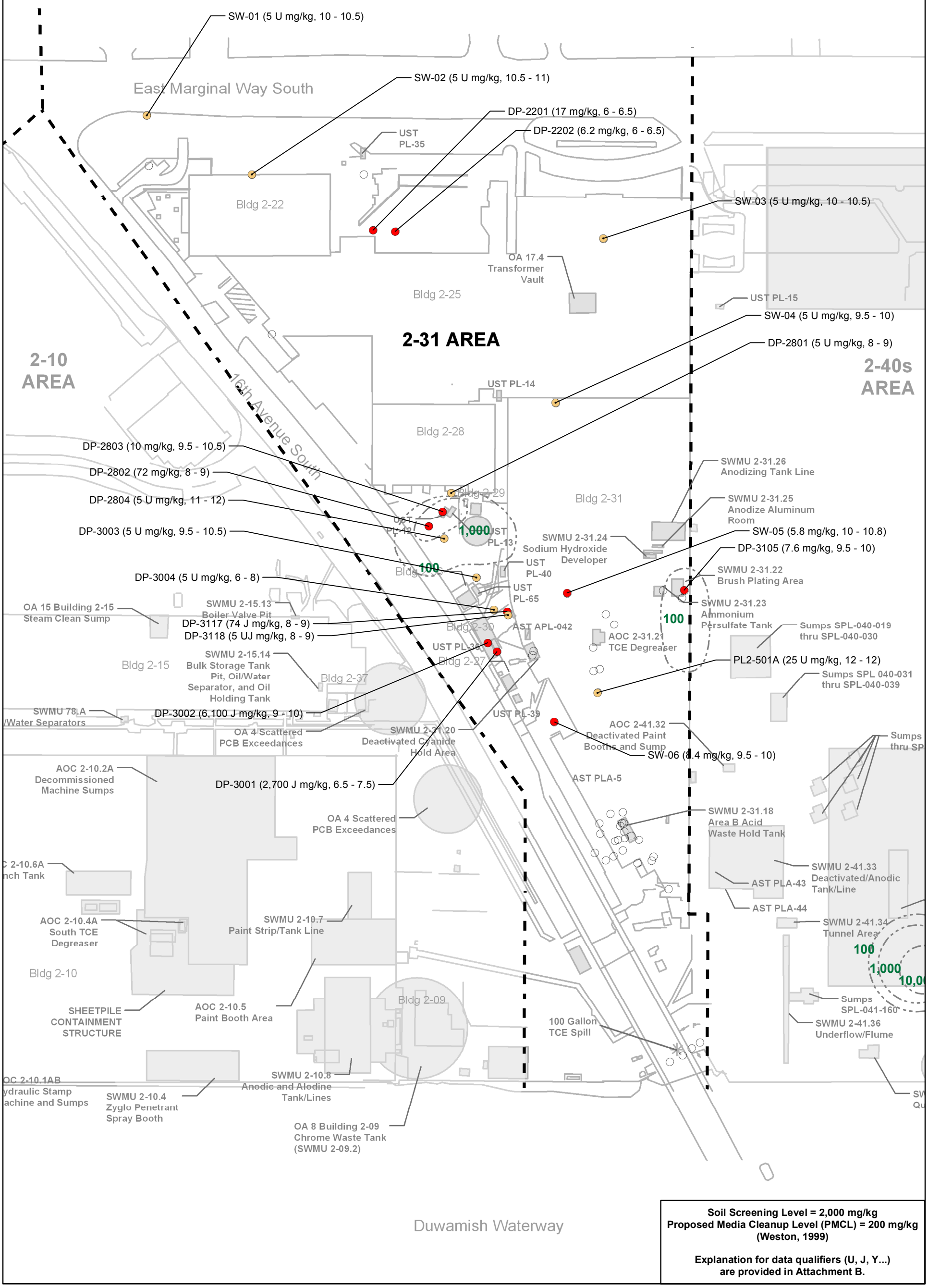
2-31 AREA DIESEL RANGE PETROLEUM HYDROCARBONS IN SOIL: DEPTH 1 - 6 FT

BOEING PLANT 2

Drawn: GPB	Revision: 1	Date: Apr 2009	Figure: 2

0131646004100_DIESEL2312.mxd

Golder Associates



LEGEND

- Sample location where constituent was detected. (Concentration; mg/kg, Depth; feet bgs).
- Sample location where constituent was not detected.
- Sample location where constituent was not analyzed.
- Groundwater isoconcentration line within the A-Zone Aquifer (µg/L).
- Plant 2 Sub-Area Boundary.

0 120
Scale 1" = 120 Feet

Map Projection:
Washington State Plane
North Zone, NAD 83, Feet

Source: Weston,
Golder Associates

2-31 AREA DIESEL RANGE PETROLEUM HYDROCARBONS IN SOIL: DEPTH 6 - 12 FT

BOEING PLANT 2

Drawn: GPB	Revision: 1	Date: Apr 2009	Figure: 3

0131646004100_DIESEL2313.mxd

Golder Associates

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment B
Data Tables

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2-31 Area COC Results
Arsenic Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Arsenic (mg/kg) - 2004 Soil Screening Level = 5.0 mg/kg; PMCL = 7.3 mg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	9	
DMSB-01	7 - 7	1/30/1991	10	
DMSB-02	7 - 7	1/29/1991	12	
DMSB-02	12 - 12	1/29/1991	7	
DMSB-03	2 - 2	1/30/1991	11	
DMSB-03	7 - 7	1/30/1991	7	
DMSB-03	12 - 12	1/30/1991	6	
DMSB-03	12 - 12	1/30/1991	8	
DP-3101	5.5 - 5.9	9/26/2002	2.1	
DP-3101	10 - 10.5	9/26/2002	4.1	
DP-3102	7 - 7.5	9/13/2002	1.8	
DP-3102	10 - 10.5	9/13/2002	3.6	
DP-3103	5 - 5.5	9/18/2002	2.4	
DP-3103	10 - 10.5	9/25/2002	4.6	
DP-3104	8 - 8.5	9/12/2002	2.8	
DP-3104	9.5 - 10	9/12/2002	1.4	
DP-3105	5 - 5.7	9/17/2002	4.3	
DP-3105	9.5 - 10	9/17/2002	5.4	
DP-3106	5 - 6	9/17/2002	2.2	
DP-3106	9.5 - 10	9/17/2002	6.2	
NS-01-31	0.5 - 0.5	1/27/1994	8	
NS-02-31	0.5 - 0.5	2/23/1994	12	
NS-03-31	0.5 - 0.5	3/1/1994	10	
NS-07-31	0.5 - 0.5	1/5/1994	5	U
NS-08-31	0.5 - 0.5	1/5/1994	5	U
NS-10-31	0.5 - 0.5	1/7/1994	5	U
NS-11-31	0.5 - 0.5	3/1/1994	7	U
SB-03102	10 - 10	2/24/1994	6	U
SB-03112	1.5 - 1.5	8/31/1994	5	U
SB-03112	6 - 6	8/31/1994	6	U
SB-03112	8 - 8	8/31/1994	6	U
SB-03113	1.5 - 1.5	8/29/1994	5	U
SB-03113	8 - 8	8/29/1994	6	U
SB-03113	12 - 12	8/29/1994	7	U
SB-03114	1.5 - 1.5	8/29/1994	5	U
SB-03114	8.5 - 8.5	8/29/1994	5	U
SB-03114	12 - 12	8/29/1994	7	U
SB-03115	2 - 2	1/26/1995	5	U
SB-03115	5.5 - 5.5	1/26/1995	5	U
SB-03115	11 - 11	1/26/1995	7	U
SB-03115	11 - 11	1/26/1995	7	U
SB-03116	4 - 4	8/15/1994	5	U
SB-03116	7.5 - 7.5	8/15/1994	6	U
SB-03116	10.5 - 10.5	8/15/1994	6	U
SW-01	5 - 5.5	9/25/2002	2.7	
SW-01	10 - 10.5	9/25/2002	5.4	
SW-02	5 - 5.5	9/27/2002	2.1	
SW-02	10.5 - 11	9/27/2002	2.8	
SW-03	5 - 5.4	9/25/2002	3.2	
SW-03	10 - 10.5	9/25/2002	2.8	
SW-04	3.8 - 4.4	9/30/2002	2.6	
SW-04	9.5 - 10	9/30/2002	1.9	
SW-05	3 - 3.5	9/19/2002	2.9	
SW-05	10 - 10.8	9/19/2002	2.9	
SW-06	6 - 6.5	9/13/2002	1.8	

2-31 Area COC Results
Arsenic Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Arsenic (mg/kg) - 2004 Soil Screening Level = 5.0 mg/kg; PMCL = 7.3 mg/kg[3]				
SW-06	9.5 - 10	9/13/2002	5.9	
W1-NS-01	3 - 3	7/20/1999	8	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Cadmium (mg/kg) - 2004 Soil Screening Level = 1.01 mg/kg; PMCL = 1.28 mg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	0.2	U
DMSB-01	7 - 7	1/30/1991	0.2	U
DMSB-02	7 - 7	1/29/1991	0.2	U
DMSB-02	12 - 12	1/29/1991	0.2	U
DMSB-03	2 - 2	1/30/1991	0.2	U
DMSB-03	7 - 7	1/30/1991	0.2	U
DMSB-03	12 - 12	1/30/1991	0.2	U
DMSB-03	12 - 12	1/30/1991	0.2	U
DP-3101	5.5 - 5.9	9/26/2002	0.2	U
DP-3101	10 - 10.5	9/26/2002	0.3	
DP-3102	7 - 7.5	9/13/2002	0.7	
DP-3102	10 - 10.5	9/13/2002	0.3	U
DP-3103	5 - 5.5	9/18/2002	3.4	
DP-3103	10 - 10.5	9/25/2002	0.3	U
DP-3104	8 - 8.5	9/12/2002	0.2	U
DP-3104	9.5 - 10	9/12/2002	0.2	U
DP-3105	5 - 5.7	9/17/2002	0.2	
DP-3105	9.5 - 10	9/17/2002	0.3	U
DP-3106	5 - 6	9/17/2002	0.2	U
DP-3106	9.5 - 10	9/17/2002	0.3	U
NS-01-31	0.5 - 0.5	1/27/1994	14.2	
NS-02-31	0.5 - 0.5	2/23/1994	83.3	
NS-03-31	0.5 - 0.5	3/1/1994	60.4	
NS-07-31	0.5 - 0.5	1/5/1994	3	
NS-08-31	0.5 - 0.5	1/5/1994	1.3	
NS-10-31	0.5 - 0.5	1/7/1994	2.7	
NS-11-31	0.5 - 0.5	3/1/1994	1.6	
SB-03102	10 - 10	2/24/1994	2.4	
SB-03112	1.5 - 1.5	8/31/1994	0.2	U
SB-03112	6 - 6	8/31/1994	1.2	
SB-03112	8 - 8	8/31/1994	1.2	
SB-03113	1.5 - 1.5	8/29/1994	2.9	
SB-03113	8 - 8	8/29/1994	8.1	
SB-03113	12 - 12	8/29/1994	0.3	
SB-03114	1.5 - 1.5	8/29/1994	0.3	
SB-03114	8.5 - 8.5	8/29/1994	16.9	
SB-03114	12 - 12	8/29/1994	0.3	U
SB-03115	2 - 2	1/26/1995	0.2	U
SB-03115	5.5 - 5.5	1/26/1995	0.2	U
SB-03115	11 - 11	1/26/1995	0.3	U
SB-03115	11 - 11	1/26/1995	0.3	U
SB-03116	4 - 4	8/15/1994	0.2	U
SB-03116	7.5 - 7.5	8/15/1994	0.2	U
SB-03116	10.5 - 10.5	8/15/1994	0.2	U
SW-01	5 - 5.5	9/25/2002	0.2	U
SW-01	10 - 10.5	9/25/2002	0.2	U
SW-02	5 - 5.5	9/27/2002	0.2	U
SW-02	10.5 - 11	9/27/2002	0.3	U
SW-03	5 - 5.4	9/25/2002	0.2	U
SW-03	10 - 10.5	9/25/2002	0.2	U
SW-04	3.8 - 4.4	9/30/2002	0.2	U
SW-04	9.5 - 10	9/30/2002	0.2	U
SW-05	3 - 3.5	9/19/2002	0.2	U

2-31 Area COC Results
Cadmium Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Cadmium (mg/kg) - 2004 Soil Screening Level = 1.01 mg/kg; PMCL = 1.28 mg/kg[3]				
SW-05	10 - 10.8	9/19/2002	0.2	U
SW-06	6 - 6.5	9/13/2002	0.2	U
SW-06	9.5 - 10	9/13/2002	0.4	
W1-NS-01	3 - 3	7/20/1999	14.2	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

2-31 Area COC Results
Copper Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Copper (mg/kg) - 2004 Soil Screening Level = 1.38 mg/kg; PMCL = 36.4 mg/kg[3]				
DP-3101	5.5 - 5.9	9/26/2002	10.6	
DP-3101	10 - 10.5	9/26/2002	32	
DP-3102	7 - 7.5	9/13/2002	13.5	
DP-3102	10 - 10.5	9/13/2002	27.6	
DP-3103	5 - 5.5	9/18/2002	26.3	
DP-3103	10 - 10.5	9/25/2002	40.9	
DP-3104	8 - 8.5	9/12/2002	22.3	
DP-3104	9.5 - 10	9/12/2002	14.8	
DP-3105	5 - 5.7	9/17/2002	18.5	
DP-3105	9.5 - 10	9/17/2002	33.5	
DP-3106	5 - 6	9/17/2002	13.2	
DP-3106	9.5 - 10	9/17/2002	34.2	
NS-01-31	0.5 - 0.5	1/27/1994	32	
NS-02-31	0.5 - 0.5	2/23/1994	242	
NS-03-31	0.5 - 0.5	3/1/1994	428	
NS-07-31	0.5 - 0.5	1/5/1994	18.2	
NS-08-31	0.5 - 0.5	1/5/1994	16.2	
NS-10-31	0.5 - 0.5	1/7/1994	40.1	
NS-11-31	0.5 - 0.5	3/1/1994	16.8	
SB-03102	10 - 10	2/24/1994	24.7	
SB-03112	1.5 - 1.5	8/31/1994	14.2	
SB-03112	6 - 6	8/31/1994	29.3	
SB-03112	8 - 8	8/31/1994	26.6	
SB-03113	1.5 - 1.5	8/29/1994	13.2	
SB-03113	8 - 8	8/29/1994	8.3	
SB-03113	12 - 12	8/29/1994	15.3	
SB-03114	1.5 - 1.5	8/29/1994	18.9	
SB-03114	8.5 - 8.5	8/29/1994	16.5	
SB-03114	12 - 12	8/29/1994	26	
SB-03115	2 - 2	1/26/1995	10.3	
SB-03115	5.5 - 5.5	1/26/1995	11.7	
SB-03115	11 - 11	1/26/1995	31.2	
SB-03115	11 - 11	1/26/1995	43.4	
SB-03116	4 - 4	8/15/1994	9	
SB-03116	7.5 - 7.5	8/15/1994	16.8	
SB-03116	10.5 - 10.5	8/15/1994	8	
SW-01	5 - 5.5	9/25/2002	22	
SW-01	10 - 10.5	9/25/2002	21.2	
SW-02	5 - 5.5	9/27/2002	14.7	
SW-02	10.5 - 11	9/27/2002	25.8	
SW-03	5 - 5.4	9/25/2002	17.8	
SW-03	10 - 10.5	9/25/2002	15.8	
SW-04	3.8 - 4.4	9/30/2002	19.4	
SW-04	9.5 - 10	9/30/2002	16.9	
SW-05	3 - 3.5	9/19/2002	15.3	
SW-05	10 - 10.8	9/19/2002	15.6	
SW-06	6 - 6.5	9/13/2002	9.1	
SW-06	9.5 - 10	9/13/2002	32	
W1-NS-01	3 - 3	7/20/1999	32	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Mercury (mg/kg) - 2004 Soil Screening Level = 0.05 mg/kg; PMCL = 0.07 mg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	0.03	U
DMSB-01	7 - 7	1/30/1991	0.05	U
DMSB-02	7 - 7	1/29/1991	0.05	U
DMSB-02	12 - 12	1/29/1991	0.05	U
DMSB-03	2 - 2	1/30/1991	0.06	U
DMSB-03	7 - 7	1/30/1991	0.04	U
DMSB-03	12 - 12	1/30/1991	0.04	U
DMSB-03	12 - 12	1/30/1991	0.04	U
DP-3101	5.5 - 5.9	9/26/2002	0.04	U
DP-3101	10 - 10.5	9/26/2002	0.06	
DP-3102	7 - 7.5	9/13/2002	0.04	U
DP-3102	10 - 10.5	9/13/2002	0.05	U
DP-3103	5 - 5.5	9/18/2002	0.04	U
DP-3103	10 - 10.5	9/25/2002	0.06	U
DP-3104	8 - 8.5	9/12/2002	0.06	U
DP-3104	9.5 - 10	9/12/2002	0.05	U
DP-3105	5 - 5.7	9/17/2002	0.05	U
DP-3105	9.5 - 10	9/17/2002	0.15	
DP-3106	5 - 6	9/17/2002	0.04	U
DP-3106	9.5 - 10	9/17/2002	0.14	
SB-03112	1.5 - 1.5	8/31/1994	0.05	U
SB-03112	6 - 6	8/31/1994	0.17	
SB-03112	8 - 8	8/31/1994	0.17	
SB-03113	1.5 - 1.5	8/29/1994	0.05	U
SB-03113	8 - 8	8/29/1994	0.05	U
SB-03113	12 - 12	8/29/1994	0.07	U
SB-03114	1.5 - 1.5	8/29/1994	0.05	U
SB-03114	8.5 - 8.5	8/29/1994	0.05	U
SB-03114	12 - 12	8/29/1994	0.06	U
SB-03115	2 - 2	1/26/1995	0.05	U
SB-03115	5.5 - 5.5	1/26/1995	0.05	U
SB-03115	11 - 11	1/26/1995	0.06	U
SB-03115	11 - 11	1/26/1995	0.07	U
SB-03116	4 - 4	8/15/1994	0.05	U
SB-03116	7.5 - 7.5	8/15/1994	0.1	
SB-03116	10.5 - 10.5	8/15/1994	0.06	U
SW-01	5 - 5.5	9/25/2002	0.04	U
SW-01	10 - 10.5	9/25/2002	0.06	U
SW-02	5 - 5.5	9/27/2002	0.04	U
SW-02	10.5 - 11	9/27/2002	0.06	U
SW-03	5 - 5.4	9/25/2002	0.04	U
SW-03	10 - 10.5	9/25/2002	0.05	U
SW-04	3.8 - 4.4	9/30/2002	0.06	U
SW-04	9.5 - 10	9/30/2002	0.06	U
SW-05	3 - 3.5	9/19/2002	0.05	U
SW-05	10 - 10.8	9/19/2002	0.05	U
SW-06	6 - 6.5	9/13/2002	0.05	U
SW-06	9.5 - 10	9/13/2002	0.06	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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2-31 Area COC Results
Nickel Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Nickel (mg/kg) - 2004 Soil Screening Level = 10.7 mg/kg; PMCL = 38.2 mg/kg[3]				
DP-3101	5.5 - 5.9	9/26/2002	6	
DP-3101	10 - 10.5	9/26/2002	17	
DP-3102	7 - 7.5	9/13/2002	8	
DP-3102	10 - 10.5	9/13/2002	13	
DP-3103	5 - 5.5	9/18/2002	19	
DP-3103	10 - 10.5	9/25/2002	17	
DP-3104	8 - 8.5	9/12/2002	10	
DP-3104	9.5 - 10	9/12/2002	7	
DP-3105	5 - 5.7	9/17/2002	13	
DP-3105	9.5 - 10	9/17/2002	15	
DP-3106	5 - 6	9/17/2002	10	
DP-3106	9.5 - 10	9/17/2002	17	
NS-01-31	0.5 - 0.5	1/27/1994	46	
NS-02-31	0.5 - 0.5	2/23/1994	373	
NS-03-31	0.5 - 0.5	3/1/1994	164	
NS-07-31	0.5 - 0.5	1/5/1994	20	
NS-08-31	0.5 - 0.5	1/5/1994	24	
NS-10-31	0.5 - 0.5	1/7/1994	130	
NS-11-31	0.5 - 0.5	3/1/1994	32	
SB-03102	10 - 10	2/24/1994	35	
SB-03112	1.5 - 1.5	8/31/1994	29	
SB-03112	6 - 6	8/31/1994	32	
SB-03112	8 - 8	8/31/1994	29	
SB-03113	1.5 - 1.5	8/29/1994	15	
SB-03113	8 - 8	8/29/1994	11	
SB-03113	12 - 12	8/29/1994	11	
SB-03114	1.5 - 1.5	8/29/1994	20	
SB-03114	8.5 - 8.5	8/29/1994	33	
SB-03114	12 - 12	8/29/1994	15	
SB-03115	2 - 2	1/26/1995	10	
SB-03115	5.5 - 5.5	1/26/1995	11	
SB-03115	11 - 11	1/26/1995	21	
SB-03115	11 - 11	1/26/1995	22	
SB-03116	4 - 4	8/15/1994	9	
SB-03116	7.5 - 7.5	8/15/1994	10	
SB-03116	10.5 - 10.5	8/15/1994	7	
SW-01	5 - 5.5	9/25/2002	12	
SW-01	10 - 10.5	9/25/2002	13	
SW-02	5 - 5.5	9/27/2002	10.4	
SW-02	10.5 - 11	9/27/2002	16	
SW-03	5 - 5.4	9/25/2002	11	
SW-03	10 - 10.5	9/25/2002	9	
SW-04	3.8 - 4.4	9/30/2002	13	
SW-04	9.5 - 10	9/30/2002	12	
SW-05	3 - 3.5	9/19/2002	11	
SW-05	10 - 10.8	9/19/2002	13	
SW-06	6 - 6.5	9/13/2002	6.3	
SW-06	9.5 - 10	9/13/2002	13	
W1-NS-01	3 - 3	7/20/1999	46	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Silver (mg/kg) - 2004 Soil Screening Level = 0.32 mg/kg; PMCL = 0.3 mg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	0.3	U
DMSB-01	7 - 7	1/30/1991	0.3	U
DMSB-02	7 - 7	1/29/1991	0.3	U
DMSB-02	12 - 12	1/29/1991	0.3	U
DMSB-03	2 - 2	1/30/1991	0.3	U
DMSB-03	7 - 7	1/30/1991	0.3	U
DMSB-03	12 - 12	1/30/1991	0.3	U
DMSB-03	12 - 12	1/30/1991	0.3	U
DP-3101	5.5 - 5.9	9/26/2002	0.3	U
DP-3101	10 - 10.5	9/26/2002	0.9	
DP-3102	7 - 7.5	9/13/2002	0.3	U
DP-3102	10 - 10.5	9/13/2002	0.4	U
DP-3103	5 - 5.5	9/18/2002	0.7	
DP-3103	10 - 10.5	9/25/2002	0.4	U
DP-3104	8 - 8.5	9/12/2002	0.4	U
DP-3104	9.5 - 10	9/12/2002	0.4	U
DP-3105	5 - 5.7	9/17/2002	0.6	
DP-3105	9.5 - 10	9/17/2002	0.4	U
DP-3106	5 - 6	9/17/2002	0.3	U
DP-3106	9.5 - 10	9/17/2002	0.4	U
SB-03112	1.5 - 1.5	8/31/1994	0.3	U
SB-03112	6 - 6	8/31/1994	0.4	U
SB-03112	8 - 8	8/31/1994	0.4	U
SB-03113	1.5 - 1.5	8/29/1994	0.3	U
SB-03113	8 - 8	8/29/1994	0.3	U
SB-03113	12 - 12	8/29/1994	0.4	U
SB-03114	1.5 - 1.5	8/29/1994	0.3	U
SB-03114	8.5 - 8.5	8/29/1994	0.3	U
SB-03114	12 - 12	8/29/1994	0.4	U
SB-03115	2 - 2	1/26/1995	0.3	U
SB-03115	5.5 - 5.5	1/26/1995	0.3	U
SB-03115	11 - 11	1/26/1995	0.4	U
SB-03115	11 - 11	1/26/1995	0.4	U
SB-03116	4 - 4	8/15/1994	0.3	U
SB-03116	7.5 - 7.5	8/15/1994	0.3	U
SB-03116	10.5 - 10.5	8/15/1994	0.3	U
SW-01	5 - 5.5	9/25/2002	0.3	U
SW-01	10 - 10.5	9/25/2002	0.4	U
SW-02	5 - 5.5	9/27/2002	0.3	U
SW-02	10.5 - 11	9/27/2002	0.4	U
SW-03	5 - 5.4	9/25/2002	0.3	U
SW-03	10 - 10.5	9/25/2002	0.3	U
SW-04	3.8 - 4.4	9/30/2002	0.8	
SW-04	9.5 - 10	9/30/2002	0.3	U
SW-05	3 - 3.5	9/19/2002	0.3	U
SW-05	10 - 10.8	9/19/2002	0.4	U
SW-06	6 - 6.5	9/13/2002	0.3	U
SW-06	9.5 - 10	9/13/2002	0.4	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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2-31 Area COC Results
Zinc Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Zinc (mg/kg) - 2004 Soil Screening Level = 101 mg/kg; PMCL = 107 mg/kg[3]				
DP-3101	5.5 - 5.9	26-Sep-02	76.7	
DP-3101	10 - 10.5	26-Sep-02	45.6	
DP-3102	7 - 7.5	13-Sep-02	40.8	
DP-3102	10 - 10.5	13-Sep-02	29.9	
DP-3103	5 - 5.5	18-Sep-02	58.9	
DP-3103	10 - 10.5	25-Sep-02	44.8	
DP-3104	8 - 8.5	12-Sep-02	32.4	
DP-3104	9.5 - 10	12-Sep-02	21.5	
DP-3105	5 - 5.7	17-Sep-02	34.3	
DP-3105	9.5 - 10	17-Sep-02	45	
DP-3106	5 - 6	17-Sep-02	28.7	
DP-3106	9.5 - 10	17-Sep-02	50.3	
NS-01-31	0.5 - 0.5	27-Jan-94	93.8	
NS-02-31	0.5 - 0.5	23-Feb-94	218	
NS-03-31	0.5 - 0.5	01-Mar-94	428	
NS-07-31	0.5 - 0.5	05-Jan-94	823	
NS-08-31	0.5 - 0.5	05-Jan-94	809	
NS-10-31	0.5 - 0.5	07-Jan-94	45.8	
NS-11-31	0.5 - 0.5	01-Mar-94	110	
SB-03102	10 - 10	24-Feb-94	35.9	
SB-03112	1.5 - 1.5	31-Aug-94	30.3	J
SB-03112	6 - 6	31-Aug-94	61.6	J
SB-03112	8 - 8	31-Aug-94	53.1	J
SB-03113	1.5 - 1.5	29-Aug-94	40.4	
SB-03113	8 - 8	29-Aug-94	33.1	
SB-03113	12 - 12	29-Aug-94	28.6	
SB-03114	1.5 - 1.5	29-Aug-94	46.4	
SB-03114	8.5 - 8.5	29-Aug-94	74.9	
SB-03114	12 - 12	29-Aug-94	33.3	
SB-03115	2 - 2	26-Jan-95	29.6	J
SB-03115	5.5 - 5.5	26-Jan-95	29.6	J
SB-03115	11 - 11	26-Jan-95	42.7	J
SB-03115	11 - 11	26-Jan-95	58.3	J
SB-03116	4 - 4	15-Aug-94	40	
SB-03116	7.5 - 7.5	15-Aug-94	35.6	
SB-03116	10.5 - 10.5	15-Aug-94	22.8	
SW-01	5 - 5.5	25-Sep-02	35.5	
SW-01	10 - 10.5	25-Sep-02	44.2	
SW-02	5 - 5.5	27-Sep-02	40.6	
SW-02	10.5 - 11	27-Sep-02	32.3	
SW-03	5 - 5.4	25-Sep-02	37	
SW-03	10 - 10.5	25-Sep-02	30.8	
SW-04	3.8 - 4.4	30-Sep-02	40	
SW-04	9.5 - 10	30-Sep-02	27.4	
SW-05	3 - 3.5	19-Sep-02	28.2	
SW-05	10 - 10.8	19-Sep-02	30.8	
SW-06	6 - 6.5	13-Sep-02	19.5	
SW-06	9.5 - 10	13-Sep-02	38.1	
W1-NS-01	3 - 3	20-Jul-99	93.8	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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2-31 Area COC Results
Cyanide Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
Cyanide (mg/kg) - 2004 Soil Screening Level = 0.2 mg/kg; PMCL = 0.2 mg/kg[3]				
DP-3104	8 - 8.5	9/12/2002	0.065	U
DP-3104	9.5 - 10	9/12/2002	0.06	U
DP-3105	5 - 5.7	9/17/2002	0.056	U
DP-3105	9.5 - 10	9/17/2002	0.067	U
SB-03115	2 - 2	1/26/1995	0.19	U
SB-03115	5.5 - 5.5	1/26/1995	0.2	U
SB-03115	11 - 11	1/26/1995	0.21	U
SB-03115	11 - 11	1/26/1995	0.26	U
SB-03116	4 - 4	8/15/1994	0.21	U
SB-03116	7.5 - 7.5	8/15/1994	0.22	U
SB-03116	10.5 - 10.5	8/15/1994	0.18	U
SW-01	5 - 5.5	9/25/2002	0.075	
SW-01	10 - 10.5	9/25/2002	0.31	
SW-02	5 - 5.5	9/27/2002	0.052	U
SW-02	10.5 - 11	9/27/2002	0.067	U
SW-03	5 - 5.4	9/25/2002	0.054	U
SW-03	10 - 10.5	9/25/2002	0.058	U
SW-04	3.8 - 4.4	9/30/2002	0.054	U
SW-04	9.5 - 10	9/30/2002	0.062	U
SW-05	3 - 3.5	9/19/2002	0.27	U
SW-05	10 - 10.8	9/19/2002	0.32	U
SW-06	6 - 6.5	9/13/2002	0.053	U
SW-06	9.5 - 10	9/13/2002	0.099	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Benzo(a)anthracene (µg/kg) - 2004 Soil Screening Level = 41.9 µg/kg; PMCL = 2.9 µg/kg[3]				
DP-2801	5 - 6	8/26/2002	12	
DP-2801	5 - 6	8/26/2002	73	U
DP-2801	8 - 9	8/26/2002	84	U
DP-2801	8 - 9	8/26/2002	8.4	U
DP-2802	3 - 4	8/26/2002	72	U
DP-2802	3 - 4	8/26/2002	7.2	U
DP-2802	8 - 9	8/26/2002	76	U
DP-2802	8 - 9	8/26/2002	11	
DP-2803	9.5 - 10.5	8/26/2002	72	U
DP-2803	9.5 - 10.5	8/26/2002	7.2	U
DP-2804	3 - 4	8/26/2002	71	U
DP-2804	3 - 4	8/26/2002	13	
DP-2804	11 - 12	8/26/2002	85	U
DP-2804	11 - 12	8/26/2002	8.5	U
DP-3102	7 - 7.5	9/13/2002	30	
DP-3102	7 - 7.5	9/13/2002	72	U
DP-3102	10 - 10.5	9/13/2002	88	U
DP-3102	10 - 10.5	9/13/2002	42	
DP-3112	6 - 6.5	9/13/2002	76	U
DP-3112	6 - 6.5	9/13/2002	7.6	U
DP-3112	9.8 - 10.3	9/13/2002	110	U
DP-3112	9.8 - 10.3	9/13/2002	11	U
DP-3113	3.5 - 4	9/9/2002	70	U
DP-3113	3.5 - 4	9/9/2002	7	U
DP-3113	9.5 - 10	9/9/2002	92	U
DP-3113	9.5 - 10	9/9/2002	9.2	U
DP-3114	4.5 - 6	9/13/2002	36	
DP-3114	4.5 - 6	9/13/2002	71	U
DP-3114	9 - 11	9/13/2002	97	U
DP-3114	9 - 11	9/13/2002	9.7	U
SW-01	5 - 5.5	9/25/2002	71	U
SW-01	5 - 5.5	9/25/2002	57	
SW-01	10 - 10.5	9/25/2002	80	U
SW-01	10 - 10.5	9/25/2002	8	U
SW-02	5 - 5.5	9/27/2002	70	U
SW-02	5 - 5.5	9/27/2002	7	
SW-02	10.5 - 11	9/27/2002	91	U
SW-02	10.5 - 11	9/27/2002	9.1	U
SW-03	5 - 5.4	9/25/2002	7.6	U
SW-03	5 - 5.4	9/25/2002	76	U
SW-03	10 - 10.5	9/25/2002	78	U
SW-03	10 - 10.5	9/25/2002	7.8	U
SW-04	3.8 - 4.4	9/30/2002	72	U
SW-04	3.8 - 4.4	9/30/2002	7.2	U
SW-04	9.5 - 10	9/30/2002	81	U
SW-04	9.5 - 10	9/30/2002	8.1	U
SW-05	3 - 3.5	9/19/2002	87	U
SW-05	3 - 3.5	9/19/2002	8.7	U
SW-05	10 - 10.8	9/19/2002	73	U
SW-05	10 - 10.8	9/19/2002	7.3	U
SW-06	6 - 6.5	9/13/2002	70	U
SW-06	6 - 6.5	9/13/2002	7	U

2-31 Area COC Results

Benzo(a)anthracene Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Benzo(a)anthracene (µg/kg) - 2004 Soil Screening Level = 41.9 µg/kg; PMCL = 2.9 µg/kg[3]				
SW-06	9.5 - 10	9/13/2002	9.6	U
SW-06	9.5 - 10	9/13/2002	96	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Chrysene (µg/kg) - 2004 Soil Screening Level = 46.6 µg/kg; PMCL = 2.9 µg/kg[3]				
DP-2801	5 - 6	8/26/2002	13	
DP-2801	5 - 6	8/26/2002	73	U
DP-2801	8 - 9	8/26/2002	84	U
DP-2801	8 - 9	8/26/2002	8.4	U
DP-2802	3 - 4	8/26/2002	72	U
DP-2802	3 - 4	8/26/2002	7.2	U
DP-2802	8 - 9	8/26/2002	76	U
DP-2802	8 - 9	8/26/2002	20	
DP-2803	9.5 - 10.5	8/26/2002	72	U
DP-2803	9.5 - 10.5	8/26/2002	7.2	U
DP-2804	3 - 4	8/26/2002	71	U
DP-2804	3 - 4	8/26/2002	18	
DP-2804	11 - 12	8/26/2002	85	U
DP-2804	11 - 12	8/26/2002	8.5	U
DP-3102	7 - 7.5	9/13/2002	33	
DP-3102	7 - 7.5	9/13/2002	72	U
DP-3102	10 - 10.5	9/13/2002	88	U
DP-3102	10 - 10.5	9/13/2002	43	
DP-3112	6 - 6.5	9/13/2002	76	U
DP-3112	6 - 6.5	9/13/2002	7.6	U
DP-3112	9.8 - 10.3	9/13/2002	110	U
DP-3112	9.8 - 10.3	9/13/2002	11	U
DP-3113	3.5 - 4	9/9/2002	70	U
DP-3113	3.5 - 4	9/9/2002	7	U
DP-3113	9.5 - 10	9/9/2002	92	U
DP-3113	9.5 - 10	9/9/2002	9.2	U
DP-3114	4.5 - 6	9/13/2002	38	
DP-3114	4.5 - 6	9/13/2002	71	U
DP-3114	9 - 11	9/13/2002	97	U
DP-3114	9 - 11	9/13/2002	9.7	U
SW-01	5 - 5.5	9/25/2002	71	U
SW-01	5 - 5.5	9/25/2002	68	
SW-01	10 - 10.5	9/25/2002	80	U
SW-01	10 - 10.5	9/25/2002	10	
SW-02	5 - 5.5	9/27/2002	70	U
SW-02	5 - 5.5	9/27/2002	9.8	
SW-02	10.5 - 11	9/27/2002	91	U
SW-02	10.5 - 11	9/27/2002	9.1	U
SW-03	5 - 5.4	9/25/2002	8.3	
SW-03	5 - 5.4	9/25/2002	76	U
SW-03	10 - 10.5	9/25/2002	78	U
SW-03	10 - 10.5	9/25/2002	7.8	U
SW-04	3.8 - 4.4	9/30/2002	72	U
SW-04	3.8 - 4.4	9/30/2002	7.2	U
SW-04	9.5 - 10	9/30/2002	81	U
SW-04	9.5 - 10	9/30/2002	8.1	U
SW-05	3 - 3.5	9/19/2002	87	U
SW-05	3 - 3.5	9/19/2002	8.7	U
SW-05	10 - 10.8	9/19/2002	73	U
SW-05	10 - 10.8	9/19/2002	7.3	U
SW-06	6 - 6.5	9/13/2002	70	U
SW-06	6 - 6.5	9/13/2002	7	U

2-31 Area COC Results
Chrysene Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Chrysene (µg/kg) - 2004 Soil Screening Level = 46.6 µg/kg; PMCL = 2.9 µg/kg[3]				
SW-06	9.5 - 10	9/13/2002	11	
SW-06	9.5 - 10	9/13/2002	96	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

2-31 Area COC Results
Aroclor 1254 Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Aroclor 1254 (µg/kg) - 2004 Screening Level = 33 µg/kg; PMCL = 33 µg/kg[3]				
DP-3101	5.5 - 5.9	9/26/2002	35	U
DP-3101	10 - 10.5	9/26/2002	46	U
DP-3102	7 - 7.5	9/13/2002	36	U
DP-3102	10 - 10.5	9/13/2002	44	U
DP-3103	5 - 5.5	9/18/2002	36	U
DP-3103	10 - 10.5	9/25/2002	48	U
SB-03112	1.5 - 1.5	8/31/1994	69	U
SB-03112	6 - 6	8/31/1994	78	U
SB-03112	8 - 8	8/31/1994	81	U
SB-03117	2 - 2	2/22/1995	36	U
SB-03117	6.5 - 6.5	2/28/1995	36	U
SB-03117	8 - 8	2/28/1995	43	U
SB-03118	2 - 2	2/22/1995	37	U
SB-03118	6.5 - 6.5	2/28/1995	36	U
SB-03118	8 - 8	2/28/1995	44	U
SB-03119	2 - 2	2/22/1995	39	U
SB-03119	6 - 6	2/28/1995	37	U
SB-03119	6 - 6	2/28/1995	36	U
SB-03119	8 - 8	2/28/1995	45	U
SW-01	5 - 5.5	9/25/2002	39	
SW-01	10 - 10.5	9/25/2002	40	U
SW-02	5 - 5.5	9/27/2002	35	U
SW-02	10.5 - 11	9/27/2002	46	U
SW-03	5 - 5.4	9/25/2002	38	U
SW-03	10 - 10.5	9/25/2002	120	U
SW-04	3.8 - 4.4	9/30/2002	36	U
SW-04	9.5 - 10	9/30/2002	41	U
SW-05	3 - 3.5	9/19/2002	44	U
SW-05	10 - 10.8	9/19/2002	36	U
SW-06	6 - 6.5	9/13/2002	35	U
SW-06	9.5 - 10	9/13/2002	48	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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2-31 Area COC Results
Aroclor 1260 Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Aroclor 1260 (µg/kg) - 2004 Screening Level = 33 µg/kg; PMCL = 33 µg/kg[3]				
DP-3101	5.5 - 5.9	9/26/2002	35	U
DP-3101	10 - 10.5	9/26/2002	46	U
DP-3102	7 - 7.5	9/13/2002	36	U
DP-3102	10 - 10.5	9/13/2002	44	U
DP-3103	5 - 5.5	9/18/2002	120	
DP-3103	10 - 10.5	9/25/2002	48	U
SB-03112	1.5 - 1.5	8/31/1994	69	U
SB-03112	6 - 6	8/31/1994	1300	
SB-03112	8 - 8	8/31/1994	570	
SB-03117	2 - 2	2/22/1995	36	U
SB-03117	6.5 - 6.5	2/28/1995	36	U
SB-03117	8 - 8	2/28/1995	43	U
SB-03118	2 - 2	2/22/1995	37	U
SB-03118	6.5 - 6.5	2/28/1995	36	U
SB-03118	8 - 8	2/28/1995	44	U
SB-03119	2 - 2	2/22/1995	39	U
SB-03119	6 - 6	2/28/1995	37	U
SB-03119	6 - 6	2/28/1995	36	U
SB-03119	8 - 8	2/28/1995	45	U
SW-01	5 - 5.5	9/25/2002	36	U
SW-01	10 - 10.5	9/25/2002	40	U
SW-02	5 - 5.5	9/27/2002	35	U
SW-02	10.5 - 11	9/27/2002	46	U
SW-03	5 - 5.4	9/25/2002	66	
SW-03	10 - 10.5	9/25/2002	280	
SW-04	3.8 - 4.4	9/30/2002	36	U
SW-04	9.5 - 10	9/30/2002	41	U
SW-05	3 - 3.5	9/19/2002	44	U
SW-05	10 - 10.8	9/19/2002	36	U
SW-06	6 - 6.5	9/13/2002	35	U
SW-06	9.5 - 10	9/13/2002	48	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999)

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Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Trichloroethene (µg/kg) - 2004 Soil Screening Level = 2.0 µg/kg; PMCL = 5,500 µg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	1	U
DMSB-01	7 - 7	1/30/1991	1.1	U
DMSB-03	2 - 2	1/30/1991	1.2	U
DMSB-03	7 - 7	1/30/1991	1.1	U
DMSB-03	12 - 12	1/30/1991	1.2	U
DMSB-03	12 - 12	1/30/1991	1.2	U
DP-3101	5.5 - 5.9	9/26/2002	1.1	U
DP-3101	10 - 10.5	9/26/2002	1.8	U
DP-3102	7 - 7.5	9/13/2002	1.1	U
DP-3102	10 - 10.5	9/13/2002	1.3	UJ
DP-3103	5 - 5.5	9/18/2002	1.1	U
DP-3103	10 - 10.5	9/25/2002	1.7	U
DP-3105	5 - 5.7	9/17/2002	1.2	UJ
DP-3105	9.5 - 10	9/17/2002	1.3	UJ
DP-3109	5 - 5.5	9/26/2002	1.1	U
DP-3109	10 - 10.5	9/26/2002	1.4	U
DP-3110	5 - 5	9/12/2002	160	
DP-3110	10 - 10	9/12/2002	18	
DP-3111	5 - 5.5	9/12/2002	40	
DP-3111	10 - 10.5	9/12/2002	22	
DP-3112	6 - 6.5	9/13/2002	1.1	U
DP-3112	9.8 - 10.3	9/13/2002	1.8	UJ
DP-3113	3.5 - 4	9/9/2002	1	U
DP-3113	9.5 - 10	9/9/2002	1.4	UJ
DP-3114	4.5 - 6	9/13/2002	9.6	U
DP-3114	9 - 11	9/13/2002	1.6	UJ
DP-4129	4.6 - 5.2	9/9/2002	1.1	U
DP-4129	9.2 - 9.6	9/9/2002	1.5	U
DP-4130	5 - 5.5	9/25/2002	1.1	U
DP-4130	10 - 10.5	9/25/2002	1	U
DP-4131	5 - 5.2	9/25/2002	1.1	U
DP-4131	10 - 10.3	9/25/2002	1.1	U
DP-4132	5 - 5.3	9/25/2002	9.9	
DP-4132	10 - 10.3	9/25/2002	1.1	U
PL2-501A	8 - 8	12/3/1993	100	
PL2-501A	12 - 12	12/3/1993	1.5	U
SB-03103	1.5 - 1.5	8/25/1994	16000	D
SB-03103	8 - 8	8/25/1994	110	
SB-03103	10 - 10	8/25/1994	320	D
SB-03104	1.5 - 1.5	8/15/1994	38	
SB-03104	5.5 - 5.5	8/15/1994	7.6	
SB-03104	9 - 9	8/15/1994	48	
SW-01	5 - 5.5	9/25/2002	1	U
SW-01	10 - 10.5	9/25/2002	1.2	U
SW-02	5 - 5.5	9/27/2002	1.1	U
SW-02	10.5 - 11	9/27/2002	1.3	U
SW-03	5 - 5.4	9/25/2002	1.1	U
SW-03	10 - 10.5	9/25/2002	1.2	U
SW-04	3.8 - 4.4	9/30/2002	1.1	U
SW-04	9.5 - 10	9/30/2002	1.2	U
SW-05	3 - 3.5	9/19/2002	1.1	U
SW-05	10 - 10.8	9/19/2002	1.4	U

2-31 Area COC Results
Trichloroethene Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Trichloroethene (µg/kg) - 2004 Soil Screening Level = 2.0 µg/kg; PMCL = 5,500 µg/kg[3]				
SW-06	6 - 6.5	9/13/2002	1.7	
SW-06	9.5 - 10	9/13/2002	1.5	UJ

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999).

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Vinyl Chloride (µg/kg) - 2004 Soil Screening Level = 4.59 µg/kg; PMCL = 290 µg/kg[3]				
DMSB-01	2.5 - 2.5	1/30/1991	3.1	U
DMSB-01	7 - 7	1/30/1991	3.1	U
DMSB-03	2 - 2	1/30/1991	3.7	U
DMSB-03	7 - 7	1/30/1991	3.2	U
DMSB-03	12 - 12	1/30/1991	3.6	U
DMSB-03	12 - 12	1/30/1991	3.6	U
DP-3101	5.5 - 5.9	9/26/2002	1.1	U
DP-3101	10 - 10.5	9/26/2002	11	
DP-3102	7 - 7.5	9/13/2002	1.1	U
DP-3102	10 - 10.5	9/13/2002	1.3	U
DP-3103	5 - 5.5	9/18/2002	1.1	U
DP-3103	10 - 10.5	9/25/2002	1.7	U
DP-3105	5 - 5.7	9/17/2002	1.2	U
DP-3105	9.5 - 10	9/17/2002	1.3	U
DP-3109	5 - 5.5	9/26/2002	1.1	U
DP-3109	10 - 10.5	9/26/2002	1.4	U
DP-3110	5 - 5	9/12/2002	1.1	U
DP-3110	10 - 10	9/12/2002	2.2	U
DP-3111	5 - 5.5	9/12/2002	1	U
DP-3111	10 - 10.5	9/12/2002	1.3	U
DP-3112	6 - 6.5	9/13/2002	1.1	U
DP-3112	9.8 - 10.3	9/13/2002	1.8	U
DP-3113	3.5 - 4	9/9/2002	1	U
DP-3113	9.5 - 10	9/9/2002	1.4	UJ
DP-3114	4.5 - 6	9/13/2002	9.6	U
DP-3114	9 - 11	9/13/2002	1.6	U
DP-4129	4.6 - 5.2	9/9/2002	1.1	U
DP-4129	9.2 - 9.6	9/9/2002	1.5	U
DP-4130	5 - 5.5	9/25/2002	1.1	U
DP-4130	10 - 10.5	9/25/2002	1	U
DP-4131	5 - 5.2	9/25/2002	1.1	U
DP-4131	10 - 10.3	9/25/2002	1.1	U
DP-4132	5 - 5.3	9/25/2002	1.1	U
DP-4132	10 - 10.3	9/25/2002	1.1	U
PL2-501A	8 - 8	12/3/1993	5.1	
PL2-501A	12 - 12	12/3/1993	2.9	U
SB-03103	1.5 - 1.5	8/25/1994	2	U
SB-03103	8 - 8	8/25/1994	65	
SB-03103	10 - 10	8/25/1994	18	
SB-03104	1.5 - 1.5	8/15/1994	2.1	U
SB-03104	5.5 - 5.5	8/15/1994	2	U
SB-03104	9 - 9	8/15/1994	61	
SW-01	5 - 5.5	9/25/2002	1	U
SW-01	10 - 10.5	9/25/2002	1.2	U
SW-02	5 - 5.5	9/27/2002	1.1	U
SW-02	10.5 - 11	9/27/2002	1.3	U
SW-03	5 - 5.4	9/25/2002	1.1	U
SW-03	10 - 10.5	9/25/2002	1.2	U
SW-04	3.8 - 4.4	9/30/2002	1.1	U
SW-04	9.5 - 10	9/30/2002	1.2	U
SW-05	3 - 3.5	9/19/2002	1.1	U
SW-05	10 - 10.8	9/19/2002	1.4	U

2-31 Area COC Results
Vinyl Chloride Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (µg/kg)	Data Qualifier[2]
Vinyl Chloride (µg/kg) - 2004 Soil Screening Level = 4.59 µg/kg; PMCL = 290 µg/kg[3]				
SW-06	6 - 6.5	9/13/2002	1.1	U
SW-06	9.5 - 10	9/13/2002	1.5	U

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999).

2-31 Area COC Results

TPH - Diesel Range Concentrations in Soil

Sample Location	Sample Interval[1] (ft. bgs)	Sample Date	Concentration (mg/kg)	Data Qualifier[2]
TPH - Diesel Range (mg/kg) - 2004 Soil Screening Level = 2,000 mg/kg; PMCL = 200 mg/kg[3]				
DP-2201	6 - 6.5	9/13/2002	17	
DP-2201	9.8 - 10.4	9/13/2002	5	U
DP-2202	6 - 6.5	9/13/2002	6.2	
DP-2202	9.5 - 10	9/13/2002	5.3	
DP-2801	5 - 6	8/26/2002	5.7	
DP-2801	8 - 9	8/26/2002	5	U
DP-2802	3 - 4	8/26/2002	8.9	
DP-2802	8 - 9	8/26/2002	72	
DP-2803	9.5 - 10.5	8/26/2002	10	
DP-2804	3 - 4	8/26/2002	5.2	
DP-2804	11 - 12	8/26/2002	5	U
DP-3001	4 - 5	8/29/2002	13	
DP-3001	6.5 - 7.5	8/29/2002	2700	J
DP-3001	6.5 - 7.5	8/29/2002	550	
DP-3001	10 - 10.8	8/29/2002	5	U
DP-3002	4 - 5	8/29/2002	7.1	
DP-3002	9 - 10	8/29/2002	6100	J
DP-3003	4.5 - 5.5	8/29/2002	5	U
DP-3003	9.5 - 10.5	8/29/2002	5	U
DP-3004	5 - 6	9/13/2002	6.2	
DP-3004	6 - 8	9/13/2002	5	U
DP-3105	5 - 5.7	9/17/2002	17	
DP-3105	9.5 - 10	9/17/2002	7.6	
DP-3117	3 - 4	8/27/2002	5	UJ
DP-3117	8 - 9	8/27/2002	74	J
DP-3118	3 - 4	8/27/2002	5	UJ
DP-3118	8 - 9	8/27/2002	5	UJ
PL2-501A	8 - 8	12/3/1993	25	U
PL2-501A	12 - 12	12/3/1993	25	U
SW-01	5 - 5.5	9/25/2002	9.3	
SW-01	10 - 10.5	9/25/2002	5	U
SW-02	5 - 5.5	9/27/2002	9.8	
SW-02	10.5 - 11	9/27/2002	5	U
SW-03	5 - 5.4	9/25/2002	5	U
SW-03	10 - 10.5	9/25/2002	5	U
SW-04	3.8 - 4.4	9/30/2002	6.7	
SW-04	9.5 - 10	9/30/2002	5	U
SW-05	3 - 3.5	9/19/2002	5	U
SW-05	10 - 10.8	9/19/2002	5.8	
SW-06	6 - 6.5	9/13/2002	5	U
SW-06	9.5 - 10	9/13/2002	8.4	

Note: (1) - Data restricted from surface to 12ft bgs.
(2) - Definitions for data qualifiers are provided on Table B-3.
(3) - PMCL - Preliminary Media Cleanup Level (Weston, 1999).

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Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment C
Health & Safety Plan

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ENVIRONMENTAL PARTNERS INC

Attachment C: Health and Safety Plan for 2-31 Area Data Gap Investigation

Boeing Plant 2
Seattle/Tukwila, Washington

Prepared For:

The Boeing Company
P.O. Box 3707
M/C 1W-12
Seattle/Tukwila, WA 98124

April 2009

Prepared By:

Environmental Partners, Inc.
295 NE Gilman Blvd. Suite 201
Issaquah, WA 98027
(425) 395-0010

Douglas C. Kunkel L.G., L.H.G.
Principal Hydrogeologist

BOEING CONTACTS

Jennifer Parsons: ..... **(206) 715-7981 (cell)**
Will Ernst: ..... **(425) 891-7724 (cell)**
Mike Gleason: ..... **(206) 290-6576**

EPI CONTACTS

Josh Bernthal: ..... **(425) 241-5400 (cell) (425) 395-0024 (office)**
Doug Kunkel: ..... **(425) 241-8170 (cell) (425) 395-0016 (office)**

GOLDER CONTACT

Ted Norton ..... **(206) 755-4970 (cell) (425) 885-7648 (office)**

EMERGENCY CONTACTS AND EMERGENCY INFORMATION

****Boeing Emergency Number:..... 206-655-2222 Call First****
POLICE: **911**
FIRE: **911**
FIRST AID: **911**

In the event of an emergency, be prepared to give the following information:

- Location of Emergency

  Site Location: ..... **The Boeing Company**
  7755 East Marginal Way South
  Seattle, Washington 98108
  Landmarks: ..... **West of Boeing Field and East of the Duwamish Waterway**
  Nearest Cross Street: ..... **South of 16th Ave South**

- Phone Number That You Are Calling From: ..... **LOOK ON PHONE**

- What Happened?
  * Type of Accident
  * Type(s) of Injuries
- How Many People Need Help?

Additional Emergency Information:

- **Boeing Emergency Number:..... 206-655-2222**

- Hospital Name: ..... **Harborview Medical Center**
  Address: ..... **325 9th Avenue (Map in Figures Section)**
  City, State, Zip Code: ..... **Seattle, Washington 98104**
  Phone Number: ..... **(206) 731-3000**

- Contact a Principal at Environmental Partners, Inc. after Emergency Services have been called.
  Environmental Partners, Inc. ..... **(425) 395-0010 (office)**
  Thom Morin (Principal) ..... **(206) 342-6957 (cell)**
  Doug Kunkel (Principal) ..... **(425) 241-8170 (cell)**

1.0 PLAN OBJECTIVES AND APPLICABILITY

This Health and Safety Plan has been written to comply with the standards prescribed by the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act (WISHA).

The purpose of this health and safety plan is to establish protection standards and mandatory safe practices and procedures for all personnel involved with field activities associated with the 2-31 Area Data Gap Investigation at the Boeing Plant 2. This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may occur during field activities. The plan consists of site and facility descriptions, a summary of work activities, an identification and evaluation of chemical and physical hazards, monitoring procedures, personnel responsibilities, a description of site zones, decontamination and disposal practices, emergency procedures, and administrative requirements.

Mr. Josh Bernthal, of Environmental Partners, Inc. (EPI) is the designated Site Health and Safety Officer. Mr. Doug Kunkel and Mr. Ted Norton are designated as alternate Site Health and Safety Officers. As Site Health and Safety Officer, Mr. Bernthal has total responsibility for ensuring that the provisions outlined herein adequately protect worker health and safety and that the procedures outlined by this Health and Safety Plan are properly implemented. In this capacity, Mr. Bernthal will conduct ongoing oversight and site inspections to ensure that this Health and Safety Plan remains current with potentially changing site conditions. Mr. Bernthal has the authority to make health and safety decisions that may not be specifically outlined in this plan, should site conditions warrant such actions. In the event that Mr. Bernthal leaves the site while work is in progress, an alternate Site Health and Safety Officer will be designated.

The provisions and procedures outlined by this Health and Safety Plan apply to all contractors, subcontractors, owner's representatives, oversight personnel, and any other persons involved with the field activities described herein. All such persons are required to read this Health and Safety Plan and indicate that they understand its contents by signing the Site Health and Safety Officer's copy of the Plan. In addition, all such persons are required to provide documentation of their current certification under Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation, 29 CFR 1910.120. Copies of this Health and Safety Plan have been distributed to a designated representative of the following companies and/or organizations:

- The Boeing Company

It should be noted that this Health and Safety Plan is based on information that was available as of the date indicated on the Title Page. It is possible that additional hazards that are not specifically addressed by this Health and Safety Plan may exist at the work-site, or may be created as a result of on-site activities. It is EPI's firm belief that active participation in health and safety procedures and acute awareness of on-site conditions by all site workers is crucial to the health and safety of everyone involved. If you identify a site condition that is not addressed by this Health and Safety Plan, or if you have any questions or concerns about site conditions or this Plan, immediately notify the Site Health and Safety Officer.

2.0 BACKGROUND INFORMATION

The work site is located at: The Boeing Company, Plant 2
7755 East Marginal Way South
Seattle, Washington 98108

2.1 Site History

This Health and Safety Plan relates specifically to data gap investigation work that will be performed at in the 2-31 Area of the Facility. Figure 2-1 shows the boundaries of the 2-31 Area and locations and outlines of various RCRA units present within the 2-31 Area. The area contains nine RCRA Units,six of which have been granted No Further Action status from the United States Environmental Protection Agency. The remaining three RCRA Units have not. The interior portion of the 2-31 Area is almost entirely paved or covered by buildings limiting the potential for incidental exposure to contaminated soil and groundwater. Portions of the 2-31 Area bordering the Duwamish Waterway are unpaved and there is the opportunity to access potentially contaminated soil, groundwater, sediment, and surface water in those areas near the 16th Ave South Bridge.

2.2 Scope of Work

Following is a brief summary of the on-site work activities that are covered by this Health and Safety Plan:

Task 1 – Monitoring well installation and development
Task 2 – Soil and groundwater sampling using direct-push probes
Task 3 – Groundwater sampling in monitoring wells
Task 4 – Surveying well and probe locations

3.0 HAZARD EVALUATION AND RISK ANALYSIS

In general, there are three broad hazard categories that may be encountered during site work; Chemical Exposure Hazards, Fire/Explosion Hazards, and Physical Hazards. Subsections 3.1 through 3.3 deal with specific hazards falling within each of these broad categories.

3.1 Chemical Exposure Hazards

Table 1 presents chemical-specific data regarding permissible exposure levels (PELs), likely pathways of exposure, target organs that will likely be affected by exposure, and likely symptoms of exposure for hazardous substances that are potentially present at the site. Table 1 data were compiled from the NIOSH Pocket Guide to Chemical Hazards, September 2007 edition. It should be noted that the PELs are the regulated limits; Recommended Exposure Limits (RELs) by NIOSH are guidance but are listed as a reference.

Table 1: Chemical-Specific Exposure Data

Chemical Name	REL*	PEL*	IDLH*	Exposure Route	Target Organs	Symptoms
Aroclor (1242) [CAS 53469-21-9]	NE	NE	NE	See Total PCB	See Total PCB	See Total PCB
Aroclor (1248) [CAS 12672-29-6]	NE	NE	NE	See Total PCB	See Total PCB	See Total PCB
Aroclor (1254] [CAS 11097-69-1]]	NE	NE	NE	See Total PCB	See Total PCB	See Total PCB
Arsenic (elemental) [CAS 7440-38-2]	0.002 mg/m^3	0.010 mg/m^3	5 mg/m^3	Inhalation; ingestion; skin/eye contact	Skin; respiratory system; kidneys; central nervous system; liver; GI tract; respiratory system	Irritation of skin; dermatitis; respiratory distress; diarrhea; kidney damage; muscle tremor; convulsions; GI tract; reproductive effects; lover damage
Benzo(a)anthracene [CAS 56-55-3]	NE	NE	NE			
Benzo(a)pyrene (coal tar pitch volatiles) [CAS 50-32-8]	0.1 mg/m^3	0.2 mg/m^3	80 mg/m^3	Inhalation; skin/eye contact	Skin; respiratory system; bladder, kidneys.	Dermatitis; bronchitis.
Benzo(b)fluoranthene (coal tar pitch volatiles) [CAS 205-99-2)]	0.1 mg/m^3	0.2 mg/m^3	80 mg/m^3	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)
Benzo(k)fluoranthene (coal tar pitch volatiles) [CAS 207-08-9]	NE	NE	NE	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)
Cadmium (dust) [CAS 7440-43-9]	Lowest possible exposure	0.005 mg/m^3	9 mg/m^3	Inhalation; ingestion	Respiratory system, kidneys, prostate, blood	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscular aches, nausea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia
Chrysene [CAS 218-01-9] (1,2-benzphenanthracene)	NE	NE	NE	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)
Copper (dust) [CAS 7440-5-8]	1 mg/m^3	1 mg/m^3	100 mg/m^3	Inhalation; ingestion; skin/eye contact	Eyes, skin, respiratory system, liver, kidneys	Irritation of eyes, nose and pharynx, nasal septum perforation, metallic taste, dermatitis.

Table 1: Chemical-Specific Exposure Data (continued)

Chemical Name	REL*	PEL*	IDLH*	Exposure Route	Target Organs	Symptoms
Indeno(1,2,3-cd)pyrene [CAS 193-39-5]	NE	NE	NE	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)	See Benzo(a)pyrene (coal tar pitch volatiles)
Mercury Compounds	Ceiling 0.1 mg/m^3 (skin)	0.1 mg/m^3	10 mg/m^3	Inhalation; absorption; ingestion; skin/eye contact	Eyes; skin; respiratory system; central nervous system; kidneys.	Irritation of eyes and skin, cough, chest pain, dyspnea, bronchitis, Pneumonia, tremor, insomnia, irritability, indecision, headaches, lassitude, stomatitis, salvation, GI disturbance, anorexia, , low weight, proteinuria
PCB (Total)	NE	TWA 0.5 mg/m^3		Ingestion, inhalation, skin absorption.	Skin, liver, reproductive system	Irritation eyes; chloracne; liver damage; reproductive effects
Trichloroethene	25 ppm	100 ppm	1000 ppm	Inhalation; ingestion; absorption; skin/eye contact	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Irritation eyes, skin; headache, visual disturbance, lassitude, dizziness, tremor, drowsiness, nausea, vomiting; dermatitis, cardiac arrhythmias, paresthesia, liver injury
Vinyl Chloride	Lowest possible exposure	0.5 ppm (29 CFR 1910.1017)	Not determined	Inhalation; skin/eye contact	Liver, central nervous system, blood, respiratory system, lymphatic system	Lassitude; abdominal pain; GI bleeding; enlarged liver; pallor or cyanosis of extremities; liquid; frostbite
Zinc (dust)	5 mg/m^3 Ceiling 15 mg/m^3 (skin)	15 mg/m^3	500 mg/m^3	Inhalation	Respiratory system	Metal fume fever: chills, muscle ache, nausea, fever, dry throat and cough; lassitude; metallic taste; headache; blurred vision; lower back pain; vomiting; malaise; chest tightness; dyspnea; rales; decreased pulmonary function.

REL – Recommended Exposure Limit (NIOSH) Pocked Guide to Chemical Hazards, September 2007
PEL – Permissible Exposure Limit (OSHA) Table Z-1 in 29 CFR 1910.1000
IDLH – Immediately Dangerous to Life or Health
NE – None established

3.2 Fire and Explosion Hazards

It is highly unlikely that vapors from the contaminated soils will be present at levels sufficient to create an explosion and/or fire hazard. It should be noted, however, that the 1996 Emergency Response Guidebook, published by the United States Department of Transportation, identifies the following explosion and/or fire hazards associated with fuel vapors.

- Flammable/combustible material
- May be ignited by heat, sparks or flames
- Vapors may travel to a source of ignition and flash back
- Containers may explode in heat or fire
- Vapor explosion hazards indoors, outdoors or in sewers
- Run-off to sewers may cause a fire or explosion hazard

3.3 Physical Hazards

Following is a summary of a variety of physical hazards that may be encountered on the job-site. For convenience, these hazards have been categorized into several general groupings and suggested preventative measures are also included.

Category	Cause	Prevention
Head Hazards	Falling and/or sharp objects, bumping hazards.	Hard hats will be worn by all personnel at all times when overhead hazards are present.
Foot/Ankle Hazards	Sharp objects, dropped objects, uneven and/or slippery surfaces, chemical exposure	Chemical resistant, steel-toed boots must be worn at all times on-site.
Eye Hazards	Sharp objects, poor lighting, bright lights (welding equipment), exposure due to splashes	Safety glasses/face shields will be worn when appropriate. Shaded welding protection will be worn when appropriate.
Electrical Hazards	Underground utilities, overhead utilities	Locator service mark-outs, visual inspection of work area prior to starting work.
Mechanical Hazards	Heavy equipment such as drill rigs, service trucks, excavation equipment, saws, drills, etc.	Competent operators, backup alarms, regular maintenance, daily mechanical checks, proper guards.
Noise Hazards	Machinery creating >85 decibels TWA, >115 decibels continuous noise, or peak at >140 decibels	Wear earplugs or protective ear muffs when appropriate.
Fall Hazards	Elevated and/or slippery or uneven surfaces. Trips caused by poor "housekeeping" practices	Care should be used to avoid such accidents and to maintain good “housekeeping". Fall protection devices must be used when work proceeds on elevated surfaces.
Lifting Hazards	Injury due to improper lifting techniques, overreaching/overextending, heavy objects	Use proper lifting techniques, mechanical devices where appropriate.
Lighting Accidents	due to improper illumination	Work will proceed during daylight hours only, or under sufficient artificial illumination.

4.0 AIR/SITE MONITORING

The following section describes monitoring techniques and equipment that are to be used during site work. The Site Health and Safety Officer, or a designated alternate, is responsible for performing all monitoring activities. Air and site monitoring will be used to determine the level of protection that is required for work to proceed safely.

4.1 Air Monitoring

Air monitoring will be performed to ensure that personnel are not exposed to harmful vapor concentrations in excess of PELs. This monitoring will also be used to identify any increases in airborne contaminant concentrations during work activities.

4.1.1 Air Monitoring Equipment

All monitoring equipment used during this project will be inspected and calibrated at least daily to ensure that it is in proper working condition. If any piece of required monitoring equipment does not work properly, work in the monitored area will stop and will not continue until the monitoring equipment is repaired.

PID: Because exposure to airborne contaminants is expected to be limited to volatile organic compounds (VOCs), air monitoring will be performed with a Photoionization Detector (PID). The range of contaminants expected to be present require that the PID be equipped with a 10.2 eV detector lamp. The most likely airborne constituents include TCE and vinyl chloride. Because the site action level for VOCs is set and 5 ppm and the PEL for vinyl chloride is 1.0 ppm it will be important to determine if the total VOCs detected in the air contain greater than 1.0 ppm vinyl chloride. This determination will be made using colorimetric tubes specifically designed to detect and quantify vinyl chloride concentrations in the air. If total VOC concentrations are greater than 1.0 ppm over background (sustained for >15 minutes) EPI or Golder field personnel will use colorimetric tubes to evaluate the vinyl chloride concentration. If vinyl chloride is detected at concentrations greater than 1.0 ppm in the breathing zone engineering controls will be implemented and the breathing zone will be re-tested. Work will not be resumed until vinyl chloride concentrations are below 1.0 ppm in the breathing zone.

The PID must be "zeroed" and calibrated according to manufacturer instructions at least daily. Initial monitoring will be performed every 5 minutes, unless odors, tastes, or a PID response indicate the presence of airborne contaminants above background levels. If airborne contaminants are detected, air monitoring will be performed continuously. If airborne contaminants are not detected in the first 30 minutes of monitoring then monitoring intervals can be increased to every 15 minutes.

4.1.2 Action Levels

Photoionization Detector (PID)

Response	Length of Time	Protective Measure
< 5 ppm	15 minute average	Level D PPE
>1 ppm over background	15 minute average	Evaluate vinyl chloride concentrations relative to total VOCs using colorimetric tubes
5-25 ppm	15 minute average	Allow work area to vent. If persistent: Level C
25-50 ppm	Sustained over 15 minutes	Level C PPE, High-efficiency organic vapor cartridges in respirator
> 50 ppm	One (1) minute average	Vacate work area, notify Site Health and Safety Officer or designated alternate immediately

It should be noted that these action levels are based on the presence of benzene and vinyl chloride which have the lowest PELs and STELs of the compounds listed in Table 1.

4.2 Site Monitoring

The Site Health and Safety Officer will visually inspect the work-site at least daily to identify whether any new potential hazards have arisen. If and whenever possible, immediate measures will be taken to eliminate, or reduce the risks associated with these hazards.

4.3 Personal Protective Equipment (PPE)

It is anticipated that all field tasks will be performed in Level D PPE unless additional PPE is required because of task or site-specific upgrades. Level D PPE includes the following items:

- Nitrile inner and outer gloves
- Steel toe, steel shank work boots. Neoprene steel-toe, steel shank boots for ground water sampling and for drilling below the water table
- Hearing protection during drilling activities
- Hard hat during drilling activities and excavation work
- Safety glasses
- Cotton or Tyvek coveralls required

Level C PPE includes all Level D items plus the following:

- Full-face respirator equipped with organic vapor/HEPA combination cartridges (full face respirator replaces safety glasses for eye protection),
- Tyvek or Saranex coveralls
- Neoprene steel-toe, steel shank boots

5.0 HAZARD ANALYSIS BY TASK

The following section identifies potential hazards associated with each task listed in Section 2.2 of this Health and Safety Plan. Unless otherwise noted, work will begin and proceed in Level D personal protective equipment. The level of protection will be upgraded accordingly by the Site Health and Safety Officer whenever warranted by conditions present in the work area.

Task 1 – Monitoring Well Installation and Development: Exposure to volatile organic compounds in soil, air and groundwater; head, foot/ankle, and eye hazards; electrical and mechanical hazards; noise, fall, lifting, and overhead hazards.

Task 2 – Direct-Push Probe Groundwater and Soil Sampling: Exposure to volatile organic compounds in soil, air and groundwater; head, foot/ankle, and eye hazards; electrical and mechanical hazards; noise, fall, lifting, and overhead hazards.

Task 3 – Groundwater Sampling: Exposure to volatile organic compounds; head, foot/ankle, and eye hazards; electrical and mechanical hazards; noise, fall, and lifting hazards.

Task 4 - Surveying Well and Probe Locations: Limited potential for exposure to volatile organic compounds in air, potential slip, trip and fall hazards.

Personnel: EPI – Josh Bernthal, Doug Kunkel, Mary Holder, Monica Mogg, Tom Sparley
Golder - Ted Norton, Liz, Shea, Ian Young, Daniel Gorman, Jill Lamberts

Contractor Names: Cascade Drilling or other drilling company for drilling and probing
Dwayne Hartman and Associates for surveying tasks
APS or other utility locating company for subsurface utility locating
Cascade Concrete Sawing or other company for concrete coring

6.0 SITE CONTROL

The following section identifies several activity zones located on the work-site. It should be noted that access to some of these activity zones (i.e. the exclusion zone) will be restricted to designated personnel.

The work site is secured. Pedestrians and other unauthorized personnel will not be allowed within the exclusion zone.

6.1 Contamination Reduction Zone

A specified area will be established for the decontamination of sampling equipment and personnel. Because the location of this zone will change during the course of the investigation the site safety office will discuss the contaminant reduction zone location during each daily safety briefing.

6.1.1 Decontamination Procedures - Equipment

Split-spoon samplers and other down-hole equipment will be decontaminated with a solution of Liquinox™ or equivalent soap and potable water and rinsed with distilled or deionized water prior to collecting soil samples for analysis as noted in Section 3.8.2 of the work plan. An alternative method of decontamination is to hot water pressure wash all down-hole sampling and drilling equipment. All decontamination wastes will be containerized, properly marked, and left in a designated on-site location for disposition by Boeing.

6.1.2 Decontamination Procedures - Personnel

All personal protective clothing (i.e. nitrile gloves) and other miscellaneous waste will be bagged in opaque garbage bags and will be discarded in the trash. All on-site personnel must, at a minimum, wash their face and hands before eating, before break periods, and prior to leaving the site as noted in Section 3.8.3 of the work plan.

7.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

The purpose of this section is to define procedures and specific responsibilities that are to be followed in the event that a chemical spill or release, a fire or explosion, or an accident involving injuries occurs. The Site Health and Safety Officer, or a designated alternate, will determine when emergency and/or regulatory agencies should be contacted and which agencies are appropriate to contact. It should be noted that if injuries have occurred, all site workers have the responsibility to secure medical help for the affected worker(s). Medical emergency help can be contacted at the appropriate phone numbers listed on the pink pages of this Plan. A route map to the nearest hospital (Harborview Medical Center) is included with the attached figures.

In all emergency situations, the rule is SAFETY FIRST! Do not, under any circumstances, endanger yourself or others to rescue a fallen co-worker. It is far better to rescue one person after proper safety measures for the rescue have been carefully considered, than to have to rescue additional people whose haste to help out got them in trouble.

In case of injury: call 206-655-2222 first, then 911 if necessary.

8.0 ADMINISTRATIVE

8.1 Medical Surveillance

Personnel involved with field activities must be covered under their employer's medical surveillance program that includes annual physical examinations and certification to wear respiratory protective equipment. These medical monitoring programs must be in compliance with all applicable worker health and safety regulations.

8.2 Record Keeping

The Site Health and Safety Officer, or a designated alternate, will be responsible for keeping daily logs of workers and visitors present at the work site, attendance lists of personnel present at site health and safety meetings, accident reports, air monitoring results, and signatures of all personnel who have read this Health and Safety Plan.

SIGNATURE PAGE

I have read this Health and Safety Plan and understand its contents. I agree to abide by its provisions and will immediately notify the Site Health and Safety Officer (Josh Bernthal, (425) 241-5400), or designated alternate if site conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date	Company/Affiliation

Figures

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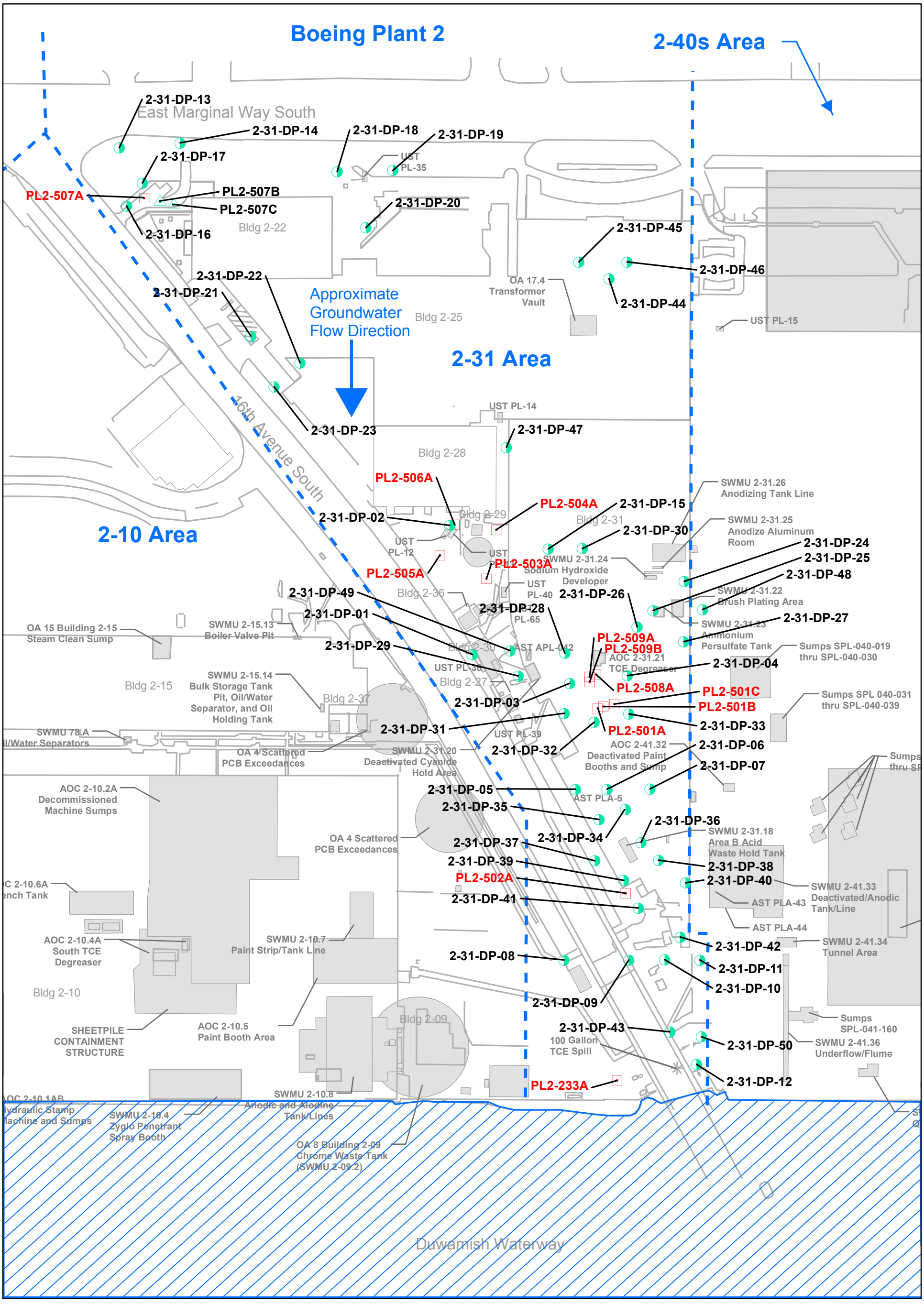

LEGEND

- New Probe Location
- Wells Sampled for Data Gaps
- New Well Location
- Plant 2 Sub-Area Boundary

0 120

Scale 1" = 120 Feet

Map Projection: Washington State Plane North Zone, NAD 83, Feet

Source: Weston, Golder Associates

2-31 Area
Groundwater and Soil Data Gap
Sampling Locations

Drawn: TH	Revision: 5	Date: Apr 2009	Figure: 2-1

0131646008100_MXDs_Area_2_31_RO5.mxd

Golder Associates

Directions from Boeing Plant 2 to **Harborview Medical Center**
325 9th Avenue, Seattle, Wa, 98104

Driving Directions:

1 From Boeing Plant 2, turn left onto East Marginal Way S and drive northwest 1.1 miles to Corson Avenue.
2 Turn right onto Corson Avenue S and proceed north 0.4 miles to S Bailey Street.
3 Turn right on S Bailey Street and proceed east 0.2 miles to the I-5 freeway entrance.
4 Turn left to the I-5 freeway ramp, get in the left hand lane, and proceed to northbound I-5
5 Continue on I-5 northbound 2.8 miles to exit 164A
6 Turn right onto the ramp for exit 164 A and proceed north 0.1 miles
7 Get in the left hand lane to stay on the exit ramp, and proceed north 0.2 miles
8 Get in the left hand lane to stay on the exit ramp, and proceed north 0.5 miles
9 Get in the right hand lane to stay on the exit ramp and proceed 0.2 miles to the James Street exit.
10 Turn right onto James Street and proceed 0.1 miles east to 9th Street
11 Turn right on 9th Street and proceed 0.1 miles south to Harborview Medical Center

Boeing Plant 2
Seattle/Tukwila, Washington

Uplands Corrective Measures
Volume VIIIa: 2-31 Area

Data Gap Investigation Work Plan

Attachment D
Quality Assurance Project Plan

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Distribution List

This Quality Assurance Project Plan (QAPP) distribution list identifies all individuals who will receive a copy of the approved QAPP, either in hard copy or electronic form. Individuals on this distribution list will also receive subsequent revisions to this QAPP.

- Mr. William Ernst/Boeing Company Project Manager
  P.O. Box 3707
  M/C 1W-12
  Seattle, WA 98124
  (425) 891-7724
  (206) 544-7297

- Ms. Christy Brown/USEPA Region X Project Manager
  1200 Sixth Avenue
  Seattle, WA 98101
  (206) 553-1200

- Mr. Doug Kunkel/EPI Project Manager
  295 NE Gilman Blvd, Suite 201
  Issaquah, WA 98027
  (425) 395-0010 (office)
  (425) 395-0011 (fax)

- Mr. Ted Norton/Golder Project Manager
  18300 NE Union Hill Rd, Suite 200
  Redmond, WA 98052
  (425) 883-0777 (office)
  (425) 882-5498 (fax)

- Mr. Josh Bernthal/EPI Field Team Leader/Site Health and Safety Officer
  295 NE Gilman Blvd., Suite 201
  Issaquah, WA 98027
  (425) 395-0010 (office)
  (425) 395-0011 (fax)

- Ms. Jill Lamberts/Golder Sampling/QA Officer
  18300 NE Union Hill Rd, Suite 200
  Redmond, WA 98052
  (425) 883-0777 (office)
  (425) 882-5498 (fax)

- Ms. Elizabeth Shea/Golder Associates, Data Manager
  220 Sixth Avenue, Suite 600
  Seattle, WA 98121
  (206) 267-1166

- Ms. Kelly Bottem /Analytical Resources Inc. Project Manager
  Mr. David Mitchell/Analytical Resources Inc. QA Manager
  4611 South 134th Place, Suite 100
  Tukwila, WA 98168
  (206) 695-6200 (office)
  (206) 695-6201 (fax)

ACRONYMS

ARI	Analytical Resources, Inc.
CD	Compact disc, read only memory (CD ROM)
DOT	Department of Transportation
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
EPI	Environmental Partners, Incorporated
Golder	Golder Associates Inc.
HASP	Health and Safety Plan
IM	Interim Measure
MSDS	material safety data sheet
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan

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FIGURE

Figure 1. Project Organization

1.0 PROJECT DESCRIPTION

1.1 Introduction

Refer to the work plan section 1.0 for a description of the work covered under this project. This QAPP presents specific requirements for the conduct of the work. Where appropriate, references to existing sampling and QA project plans are provided. Copies of all referenced sampling and QA plans are provided in electronic format on the enclosed CD in a document titled "Compendium of Sampling and Analysis Plans and Quality Assurance Project Plans for Boeing Plant 2", updated September 2008 (Golder, 2008), hereinafter referred to as the "Compendium".

1.2 Background

See work plan section 1.0.

1.3 Project Objectives

1.3.1 Specific Objectives and Associated Tasks

See work plan section 2.0.

1.3.2 Project Target Parameters and Intended Data Usage

See work plan section 2.0.

1.3.3 Data Quality Objectives

Data must be of sufficient quality to meet the work plan objectives noted above. Two levels of data quality and analysis are applicable for this project:

- Screening level data.
- Definitive data.

1.3.3.1 Screening level data

Screening level data is generated via field measurements performed using portable instruments. Field measurement results are used to evaluate achievement of stable groundwater conditions prior to sample collection. Field parameter measurement methods are summarized in section 3 of the work plan.

1.3.3.2 Definitive data

Fixed laboratory data meets a higher level of stringency and is used for soil and groundwater analytical measurements. Analytical procedures are discussed in section 7 of this plan. To generate data of sufficient quality, the following approach for analytical laboratory data for soil and groundwater samples is followed:

- The laboratory is accredited by Washington State Department of Ecology.
- Applicable analytical test methods (e.g., Washington State and EPA SW-846 methods) will be used.
- QC samples and procedures are used by the laboratory for analysis.
- Data summary packages generated and documentation provided are sufficient to perform a Level I (or higher) data quality review.

Data quality review will be performed on the analytical data packages according to the procedures specified in section 9 of this plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The Boeing Company has overall responsibility for the work described in this plan. Project management, quality assurance, laboratory, and field responsibilities of essential project personnel are defined below.

2.1 Project Organization Chart

Main contact names and addresses are show in the Distribution List. Project management organization is depicted in Figure 1.

2.2 Management, Quality Assurance, Field, and Laboratory Responsibilities

Ms. Christy Brown is the EPA Project Manager. Mr. William Ernst is the Boeing Project Manager. Mr. Doug Kunkel is the EPI Project Manager and Mr. Ted Norton is the Golder Project Manager.

Analytical Resources, Inc. (ARI) of Tukwila, Washington has been selected to perform all laboratory analysis. Ms. Kelly Bottem is ARI's Project Manager for this project. Mr. David Mitchell is the laboratory Quality Assurance Officer.

As shown on Figure 1, project responsibilities are divided into three categories specific to the work plan (field monitoring, sampling and data management). The following paragraphs describe individual responsibilities for key team members.

The Project Managers, Mr. Doug Kunkel of EPI and Mr. Ted Norton of Golder, are responsible for overseeing project performance to ensure contract compliance and for implementing all necessary actions and adjustments to accomplish program objectives. The project managers also act as liaison between agencies, the client, the laboratory, and contract personnel.

The project Health and Safety Manager, Josh Bernthal of EPI, is responsible for evaluating risks associated with the work plan and preparing a site-specific HASP conforming to the requirements listed in the Order.

The Sampling/QA Officer, Ms. Jill Lamberts of Golder, is responsible for overall implementation of this QAPP. Duties include overseeing all field sampling and sample identification activities to ensure compliance with the QAPP, including field and laboratory activities, and project work products. The QA Officer will work closely with the other QA Managers, be immediately notified if problems occur, and approve changes to the work plan if such changes are warranted. In the event that changes are needed, the QA Officer will immediately notify the Project Manager, who will discuss the proposed changes with the Boeing Project Manager prior to implementing those changes.

The Project Data Manager, Ms. Elizabeth Shea of Golder, is responsible receipt tracking and data entry of all electronic data packages into the Boeing Plant 2 site wide database. Data will be received from the laboratory for all sample analyses, checked and uploaded in to the database. Following completion of validation of laboratory data reports by the Project Chemist, data qualifiers will be updated in the database so that data summary tables and reports can be produced.

The Project Chemist, Ms. Jessie Compeau of Informa LLC, who will remain independent of direct project involvement and day-to-day operations, is responsible for coordinating with the laboratory to obtain required analyses, sample tracking, and chain of custody. She is also responsible for review and validation of laboratory analysis reports and resolving any analytical data quality issues.

The Field Team will consist of, Mr. Josh Bernthal of EPI and Mr. Dan Gorman of Golder. The Field Team will support the Project Managers and is responsible for

day-to-day coordination with the Project Managers on technical issues, coordinating and managing field staff, implementing QC procedures for field measurements, and for monitoring and documenting all work performed for this project.

The Laboratory Project Manager, Ms. Kelly Bottem of ARI, will serve as the primary ARI contact for EPI and will be responsible for sample tracking and analysis at the analytical laboratory.

The Laboratory QA Officer, Mr. David Mitchell of ARI, is responsible for monitoring and documenting the quality of all work produced by the laboratory for this project, and for implementing corrective action should the need arise.

2.3 Special Training Requirements and Certifications

No special training or certification is required other than all field personnel will be trained as required by the Occupational Safety and Health Administration's Hazardous Waste and Emergency Response (OSHA-HAZWOPER) regulations.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The DQOs for this work plan are designed to ensure that the accuracy and precision of the data is sufficient and that the data are useful for baseline and performance monitoring of the contaminants of concern (COCs) at the site. QA and QC are important elements in all facets of a project. They are mechanisms whereby the proponent can monitor the performance and results of staff or contractors, and they permit the regulatory agency to determine the quality of data submitted as part of a project review. The complexity of environmental data and the need for comparability has led to requirements for QA and QC in the analytical laboratory without necessarily recognizing that QA and QC must be applied throughout the program.

The data quality indicators presented in this section are precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity. Table 2-2 of the work plan summarizes the samples and procedures that will be analyzed or used to evaluate data quality. Table 3-1 summarizes the number of samples that will be analyzed to evaluate data quality. Project-specific control limits for all groundwater and soil parameters as well as current laboratory QA requirements are summarized in the Compendium.

3.1 Precision

See section 19 of the Compendium for definition and use of the precision term. Precision goals for this project are presented in section 14 of the Compendium.

3.2 Accuracy

See section 19 of the Compendium for definition and use of the precision term. Precision goals for this project are presented in section 14 of the Compendium.

3.3 Representativeness

Standard procedures for sample collection and handling have been developed to provide data that are representative of each sampling event. Field sampling procedures are discussed in detail in the section 3 of the work plan.

3.4 Comparability

Data comparability expresses the confidence with which each sampling event can be compared to another. Comparability will be maintained by use of consistent sampling procedures, approved analytical methods, consistent detection limits, and consistent units.

3.5 Completeness

Completeness for usable data is defined as the percentage of usable data out of the total amount of data generated. Specifically, the basis is the total number of scoped samples collected relative to the total number of valid results generated. When feasible, the amount of sample collected will be sufficient to reanalyze the sample should the initial results not meet QC requirements. The target goal for completeness will be 90% for laboratory analytical methods shown in Table 3-2 of the work plan.

3.6 Sensitivity

Analytical method sensitivity, both method detection and method reporting limits is evaluated against screening levels to ensure the methods selected will achieve the required limits. Method detection limits (MDLs) and method reporting limits (RL) for all constituents are summarized in Table 3-2 of the work plan and in the laboratory SOPs provided in section 22 of the Compendium.

4.0 SAMPLING PROCEDURES

Sampling procedures to be used for the project are summarized in section 4.0 of the work plan.

5.0 SAMPLE CUSTODY PROCEDURES

Chain of custody procedures to be used for the project are provided in section 21 of the Compendium. Sample identification, labeling and sample documentation requirements are provided in section 4 of the work plan.

6.0 INSTRUMENT CALIBRATION AND MAINTENANCE

Analytical instrument calibration and maintenance requirements are detailed in the individual laboratory SOPs provided in section 22 of the Compendium.

6.1 Field Measurement Instrument Calibration Procedures

The calibration and general maintenance of field instruments is the responsibility of the field team. All calibration procedures and measurements are made in accordance with manufacturers' specifications. Field instruments are checked and calibrated before their use on-site, and batteries are charged and checked daily where applicable. Field instrument calibration will be documented in the field logbook.

7.0 ANALYTICAL PROCEDURES

Laboratory analytical procedures to be used for the project are listed in Table 3.1 of the work plan and are further detailed in the laboratory MDL and SOP documents provided in section 22 of the Compendium.

8.0 INTERNAL QUALITY CONTROL SAMPLES

8.1 Field Quality Control Check

Field quality control checks to be conducted for the project are outlined in section 3.5 of the work plan.

8.2 Laboratory Quality Control Checks

Laboratory quality control checks are summarized in the laboratory QA plan and in the individual MDL and SOP documents provided in section 22 of the Compendium.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

The process of data reduction, review, and reporting is applicable to all aspects of the project (e.g., field activities, laboratory analyses, and analytical data review) and is required for all collected data. All data generated through field activities or by the laboratory operation shall be reduced and validated prior to reporting.

Field data requirement analysis and reduction is maintained by the field team, summarized and checked by the project manager prior to inclusion in any reports.

Laboratory data is received by the Sampling/QA Officer, logged and forwarded to the Data Quality Review person for validation. Laboratory reporting requirements are summarized in

section 19 of the Compendium. Data review requirements consist of a Level I QC review of the laboratory deliverables for compliance with QAPP requirements. Typical data review requirements are summarized in Section 19 of the Compendium.

Electronic data is received by the data manager, checked and incorporated into the database. Following receipt of the data quality reports, the electronic database records are updated as appropriate.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits may be conducted during the project to determine:

- Compliance with requirements outlined in the work plan, QAPP and procedures referenced in this QAPP in the Compendium.
- Deviations from the work plan, QAPP and referenced procedures and that corrective action has been taken and documented.

The project QA Officer is responsible for initiating audits and overseeing their completion and documentation.

10.1 Data Quality Audits (Independent Data Validation)

Data generated by the laboratory undergoes a Level I verification and validation by the QA Officer or Data Quality Review consultant. Laboratory data will be evaluated for compliance with DQOs, and with procedural requirements contained and referenced in this QAPP. The detailed scope of this validation is presented in section 9 of this plan.

10.2 Laboratory Audits

ARI Laboratory is certified by the State of Washington Department of Ecology and State of Washington Department of Health to perform the methods listed or referenced in this QAPP. ARI also participates in the EPA Contract Laboratory Program (CLP), multiple performance evaluation programs, and is subject to the QC requirements and audits of these programs. Therefore, no laboratory audit will be conducted as part of this project. If problems are identified during data quality audits, a suitable audit of the laboratory will be conducted in order to identify and correct any specific problems identified.

10.3 Field Audits

Field audits will be conducted if the Project QA Officer determines the need for such.

11.0 PREVENTATIVE MAINTENANCE

Field instruments will be utilized in accordance with section 3.3.1 and 3.3.2 of the work plan. Laboratory instruments will be maintained in accordance with the laboratory QAP provided in section 22 of the Compendium.

12.0 CORRECTIVE ACTIONS

Corrective actions may be identified during sampling, sample handling, sample preparation, laboratory analysis, and data quality review. These will be corrected, documented and reported to the Project Manager and summarized in the data gap investigation report.

13.0 QUALITY CONTROL REPORTS

As data quality review is completed and documented, a summary report will be prepared in included with the data gap investigation report.

14.0 REFERENCES

Golder, 2008. Golder Associates Inc. Compendium of Sampling and Analysis Plans and Quality Assurance Plans for Boeing Plant 2, Seattle/Tukwila, Washington. The Boeing Company, Seattle/Tukwila, Washington. September 2008.

FIGURE

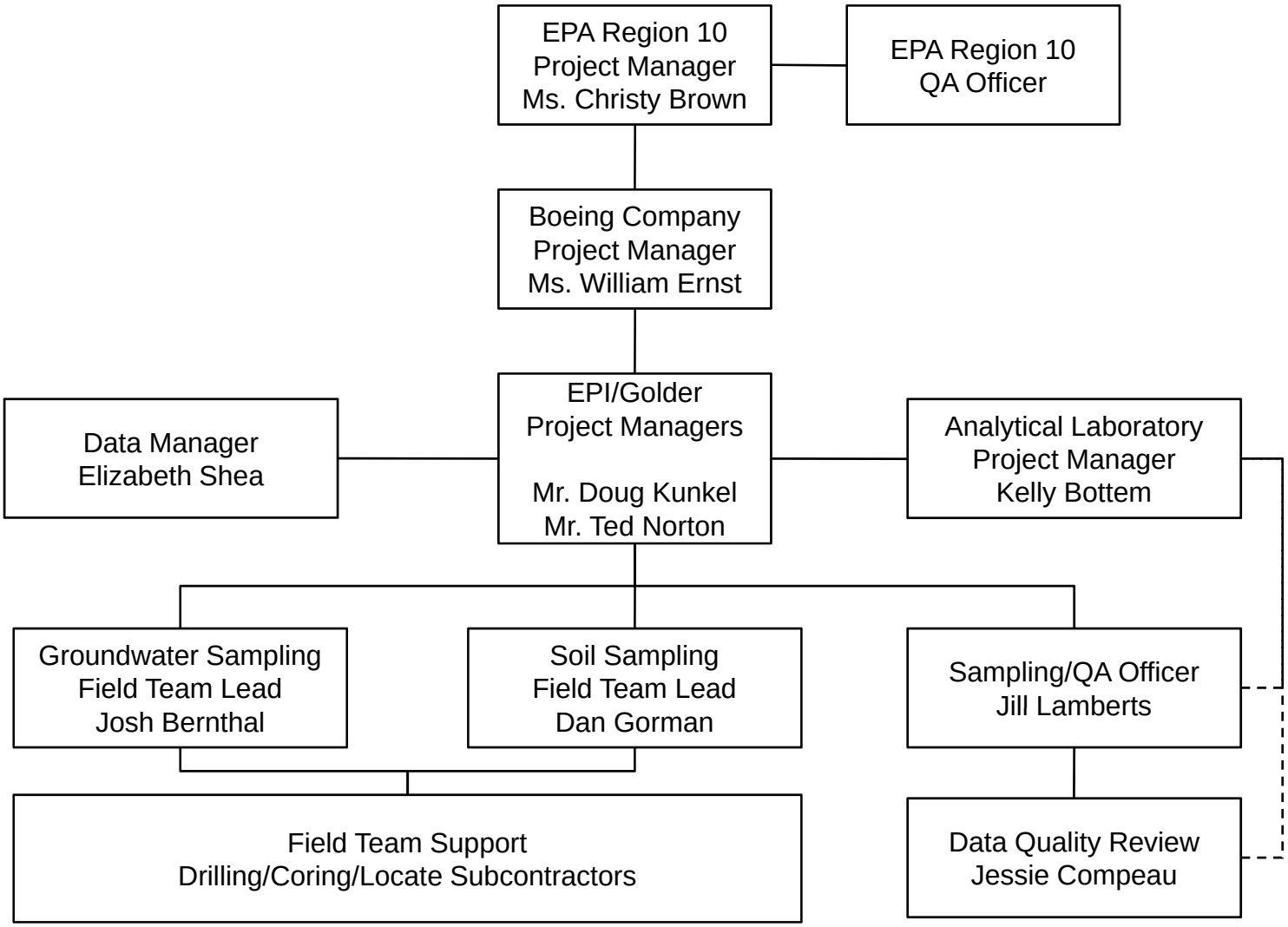

Figure 1 – Project Organization