Draft Cleanup Action Plan

Boeing Isaacson-Thompson Site
Tukwila, Washington

Toxics Cleanup Program

Washington State Department of Ecology

Northwest Regional Office

Shoreline, Washington

August 2024

DEPARTMENT OF ECOLOGY
State of Washington

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Department of Ecology’s Regional Offices

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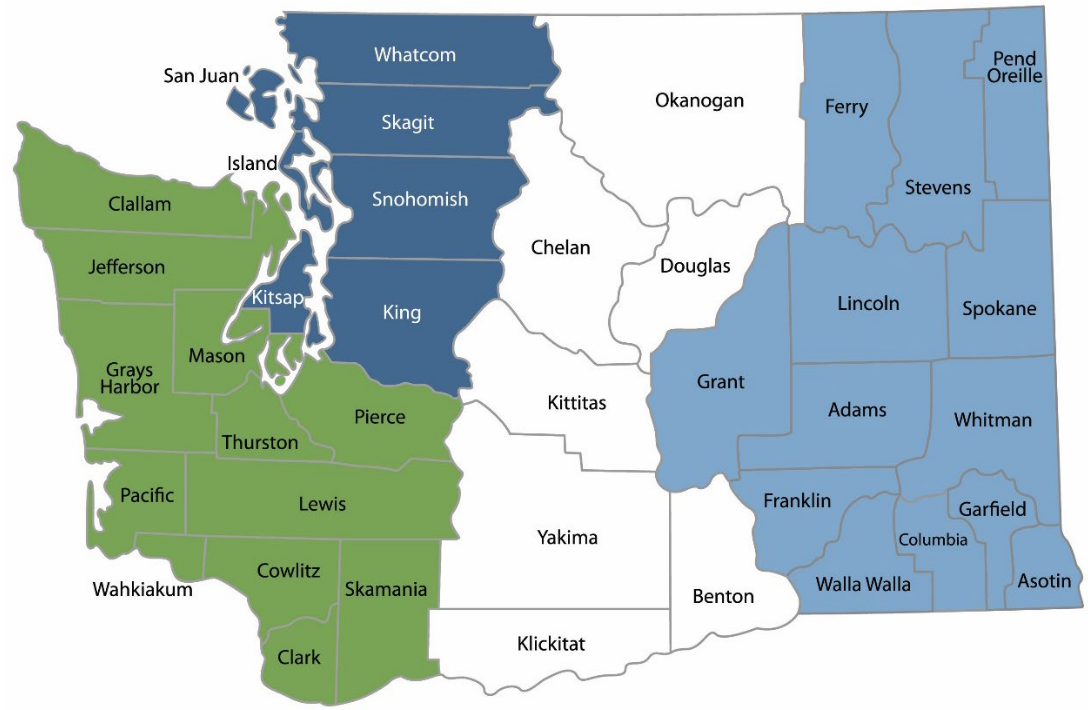

Southwest Region 360-407-6300

Northwest Region 206-594-0000

Central Region 509-575-2490

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Region	Counties served	Mailing Address	Phone
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LIST OF ABBREVIATIONS AND ACRONYMS

µg/L	micrograms per liter
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
Boeing	The Boeing Company
CAP	cleanup action plan
CB	catch basin
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPOC	conditional point of compliance
CSM	conceptual site model
CUL	cleanup levels
DAHP	Washington State Department of Archaeology and Historic Preservation
DCA	disproportionate cost analysis
dCAP	draft cleanup action plan
Ecology	Washington State Department of Ecology
EDR	engineering design report
EPA	US Environmental Protection Agency
FS	feasibility study
ft	feet, foot
ft^2	square feet
GAC	granular activated carbon
HASP	health and safety plan
IHS	indicator hazardous substances
ISGP	Industrial Stormwater General Permit
Landau	Landau Associates, Inc.
LDW	Lower Duwamish Waterway
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NAVD88	North American Vertical Datum of 1988
NHPA	National Historic Preservation Act of 1966
NPDES	National Pollutant Discharge Elimination System
Order	Agreed Order No. DE 7088
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCUL	preliminary cleanup level

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

POC .... point of compliance
Port .... Port of Seattle
PRB .... permeable reactive barrier
PRDI .... pre-remedial design investigation
QAPP .... quality assurance project plan
RAO .... remedial action objective
RCRA .... Resource Conservation and Recovery Act
RCW .... Revised Code of Washington
RI .... remedial investigation
SAP .... sampling and analysis plan
SEPA .... State Environmental Policy Act
Site .... Isaacson-Thompson Site
SMA .... Washington State Shoreline Management Act of 1971
SWPPP .... stormwater pollution prevention plan
TCLP .... Toxicity Characteristic Leachate Procedure
TEQ .... toxicity equivalency quotient
TPH .... total petroleum hydrocarbons
TSCA .... Toxic Substances Control Act
USACE .... US Army Corps of Engineers
USC .... United States Code
UST .... underground storage tank
WAC .... Washington Administrative Code
WDFW .... Washington Department of Fish & Wildlife
ZVI .... zero-valent iron

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1.0 INTRODUCTION

This draft cleanup action plan (dCAP) presents the cleanup actions for environmental releases from the Boeing Isaacson-Thompson Site (Site) located at 8701 East Marginal Way South in Tukwila, Washington (Figure 1-1); Facility Site Identification Number (FSID) 2218 and Cleanup Site Identification Number (CSID) 1944. The Site is composed of the three following industrial parcels of land surrounded by a security fence, with limited access, and bordered to the west by the Lower Duwamish Waterway (LDW):

1. The Isaacson property, located in the northern portion of the Site, purchased by The Boeing Company (Boeing) from the Isaacson Corporation in 1984;
2. The Thompson property, located in the southern portion of the Site, most of which was purchased by Boeing from Charles Thompson in 1956; and
3. The Port of Seattle (Port) property also known as the "Sliver Property;" located adjacent to the west of the Isaacson property.

Boeing has conducted investigations at the Isaacson-Thompson property to characterize soil and groundwater conditions as documented in the remedial investigation (RI) report (Landau Associates, Inc. [Landau] 2014). Investigation activities have been supplemented by the Washington State Department of Ecology (Ecology) investigation of the Port property, the results of which are documented in Appendix A1 and A2 of the feasibility study (FS; Landau 2023).

The RI report concluded that remedial action evaluation was warranted for impacted soil and groundwater at the Site. The FS developed and evaluated remedial action alternatives for the Site and identified a preferred remedial action that will address the contamination at the Site as required by Washington Administrative Code (WAC) 173-340-360, under the Model Toxics Control Act (MTCA). The FS also developed proposed soil and groundwater preliminary cleanup levels (pCULs) and identified proposed points of compliance (POCs). The cleanup process, including preparation of this dCAP, is currently being implemented under Agreed Order No. DE 7088 (Order) between Boeing and Ecology. The Final RI was submitted to Ecology on April 21, 2014. Ecology determined the RI to be sufficient to proceed with the FS in a letter dated May 11, 2017 (Ecology 2017). The Final FS was submitted on June 30, 2023 and approved by Ecology on July 5, 2023 (Ecology 2023).

1.1 Purpose

The purpose of this dCAP is to identify the proposed cleanup actions for the Site per WAC 173-340-380(1)(a)(i)-(ix) and to provide an explanatory document for public review. The following list summarizes the elements of this plan:

- Site description
- Summary of current Site conditions
- Summary of the cleanup action alternatives considered (in the FS)
- Description of the selected cleanup action for the Site and the rationale for selecting it

- Identification of Site-specific cleanup levels (CULs) and POCs for each hazardous substance in soil and groundwater for the proposed cleanup action
- Identification of applicable state and federal laws for the proposed cleanup action
- Identification of what residual contamination will remain after cleanup and a description of restrictions placed on the property to ensure continued protection of human health and the environment
- Discussion of compliance monitoring requirements
- Presentation of a preliminary schedule for implementing the Cleanup Action Plan (CAP).

Ecology has made a preliminary determination that a cleanup conducted in conformance with this dCAP will comply with the requirements for selection of a remedy under WAC 173-340-360.

2.0 SITE DESCRIPTION

This section presents a Site description, brief historical summary, remedial history, and current conditions.

The Site (Figure 2-1) is located in Tukwila, Washington on the east shore of the LDW, and is comprised of two Boeing-owned parcels and one Port-owned parcel of land surrounded by a security fence, with limited access. The northern Boeing parcel (King County Parcel No. 0001600014) is known as the Isaacson property and is a 9.84-acre parcel of land located near the east side of the LDW, at approximately river miles 3.7 to 3.8, as measured from the southern tip of Harbor Island. The southern Boeing parcel (King County Parcel No. 0007400033) is known as the Thompson property and is a 19.35-acre parcel of land located on the eastern bank of the LDW, directly south of the Isaacson property. Boeing occupies and operates on the Isaacson and Thompson properties only. The Port parcel (upland portion of an aquatic parcel identified as King County Parcel No. 332404HYDR; also known as the “Sliver property”),[1] is a 0.5-acre strip of land, approximately 60 feet (ft) wide and 400 ft long, located adjacent to the east of the LDW, to the west of the Isaacson property, and to the northwest of the Thompson property. For the purposes of this dCAP, these three parcels are referred to collectively as the Isaacson-Thompson Site. The total size of the Site is approximately 29.7 acres.

In addition to the upland parcels, the RI investigated the adjacent sediments within the LDW. The RI found Site related contamination in the adjacent sediments. Since MTCA defines a Site as "where contamination has come to be located”, the adjacent sediments are a part of the Boeing Isaacson-Thompson Site. However, these adjacent sediments (below the mean higher high-water level) will be addressed under the US Environmental Protection Agency (EPA)-led LDW Superfund Site cleanup and are not addressed under this draft Cleanup Action Plan.

Except for pavement and catch basins (CBs) that collect stormwater runoff, the Isaacson property is vacant of buildings and structures. This property is used by Boeing primarily for equipment and shipping container storage and parking.

The Thompson property is developed with several structures operated by Boeing to support the P-8 program that include a 316,000-square foot (ft^2) industrial building (Building 14-01) and several support structures including a boiler house (Building 14-02); two mechanical buildings (Buildings 14-03 and 14-14); a fire pump house (Building 14-13) and water tank; an electrical substation (Building 14-22); and a guard shack. A more detailed description of various infrastructure and equipment located on the Thompson property can be found in the FS.

The Port property consists of a flat area with deteriorating asphalt paving with vegetation growing through cracks and holes in the pavement. A chain-link fence separates the Port property from the Isaacson property. The Port property is not currently used.

[1] https://gismaps.kingcounty.gov/parcelviewer2/; https://www5.kingcounty.gov/kcgisreports/dd_report.aspx?PIN=332404HYDR

The shoreline of the Site is supported by three different bulkhead structures.

- A wooden shoreline bulkhead runs from the southern end of the Thompson property. Specific construction details of the Thompson wooden bulkhead are not known, but the bulkhead may have been present since at least 1936 based on historical photographs. The bulkhead is generally in fair condition and consists of large-diameter vertical timber pilings supporting horizontal lumber planks; however, some areas are in poor condition, showing varying levels of wood deterioration and visible gaps between planks and pilings. This bulkhead extends approximately 340 ft north from the south end of the Thompson property.
- The Thompson wooden bulkhead transitions to steel construction and runs an additional 160 ft to the southern end of the Port property (shown on Figure 2-1). The steel bulkhead was constructed in the 1960s and consists of a sheet pile wall that extends 60 ft below ground surface (bgs; Alpha Engineers 1989). The sheet pile is supported with tiebacks and timber fender piles spaced on 9-ft centers. The tieback anchor rods are located about 6 ft bgs, extend 41 ft east behind the wall, and are supported by timber pile groups connected by a continuous concrete pile cap. A timber pile-supported concrete apron extends behind the bulkhead approximately 20 ft.
- A dilapidated shoreline bulkhead runs along the southern and western sides of the Port property. Construction details for this bulkhead are not known, but it appears to have been constructed between the 1930s and 1960s during filling of the former Slip 5. The bulkhead consists of a mix of wood and steel pilings supporting wood and metal planks and concrete panels. Many of the planks have been dislodged, much of the concrete is cracked and deteriorating, and there are large void spaces along the bottom edge of the bulkhead.

Stormwater from the Site is collected in two Boeing-owned storm drain systems (Figure 2-2) that discharge to the LDW via two outfalls (Outfalls A and B). The Isaacson stormwater system includes two treatment vaults that treat stormwater prior to discharge to the LDW. Stormwater discharge from the facility is covered under Industrial Stormwater General Permit (ISGP) No. WAR000148. A 48-inch King County storm drain alignment runs through the Isaacson property and discharges to the LDW through the steel bulkhead, as shown on Figure 2-1. Stormwater from the Isaacson and Thompson properties does not enter the King County storm drain line.

2.1 Site History

A detailed description of the development and historical uses of the Site is provided in Section 2.0 of the RI. The following provides a brief summary of the Site history.

Historically, meanders of the Duwamish River were present in the area of the Site including a segment of the river that flowed west to east through the approximate center of the Site. Between 1910 and 1917, extensive dredge and fill operations were conducted in the lower Duwamish River valley, and the river was channelized through in its current location to the west of the Site. The river channel modifications resulted in the creation of an embayment known as Slip 5 within the Site. The approximate location of former Slip 5 is shown on Figure 2-1. The first known development of the Site began in 1917 and included a sawmill on the land south of former Slip 5 and, in 1920, another on the western portion of the Site. Slip 5 was filled with unknown sources of fill material in phases between 1936 and about 1966 to allow further development of the Site. A bulkhead, oriented east to west at the southern edge of former Slip 5, is visible in historical aerial photographs taken in 1956, 1961, and 1965; no other information regarding this bulkhead is available.

In 1943, the Isaacson property was purchased by the Isaacson Corporation and was developed between 1943 and 1966. The Isaacson property was used for various purposes associated with the Jorgensen Steel plant to the north, which included storage of scrap metal prior to it being melted down. Between 1943 and 1945, a galvanizing plant was constructed in the northeast corner of the Isaacson property; the plant was dismantled in 1967. The Mineralized Cell Wood Preserving Company operated on the northern side of former Slip 5 for an unknown period of time beginning prior to 1945. The operations of this company involved heating a solution of arsenic and sulfate salts of copper and zinc and applying the solution under pressure to the base of logs. Storage tanks associated with this operation were reportedly cleaned twice per day, and sludge and remaining chemicals in the tanks were reportedly drained directly to the ground surface.

Boeing purchased the Isaacson property from the Isaacson Corporation in 1984. Boeing proposed to redevelop the Isaacson property by demolishing the Isaacson building (former Building 14-05 outline shown on Figure 2-3) and constructing a new building; however, although the Isaacson building was dismantled prior to 1990, the planned new building was not constructed. Boeing purchased most of the Thompson property in 1956; the southern portion of the Thompson property was developed beginning in 1966. Until 2011, the layout of the Thompson property had remained relatively unchanged. In 2011, Boeing re-occupied Building 14-01 and building modifications were made, including removal of a loading dock and an inactive 5,000-gallon wastewater aboveground storage tank (AST; TSA-21) located west of Building 14-01, and removal of the aqueous degreaser formerly located in the western portion of Building 14-01. The sump associated with the aqueous degreaser was decommissioned in place when the aqueous degreaser was removed.

2.2 Site Geology and Hydrogeology

2.2.1 Geology

The geology of the lower Duwamish River valley is characterized by the historic riverine depositional environment from the river and the anthropogenic changes made to the river that resulted in the current configuration of the LDW. Naturally occurring soils in the vicinity generally consist of low to moderately permeable alluvial deposits of interbedded silt, clay, silty sand, and sand. The Duwamish River historically meandered across the river valley floor but was channelized in the 1900s for shipping and commerce. The constructed channel resulted in the human movement and deposition of dredge fill and other large quantities of sand, silt, gravel, and other fill sources.

Observations during the RI indicated that subsurface soil conditions at the Site consist of approximately 2 to 19.5 ft of fill overlying river deposits with the thickest layers of fill occurring in the former Slip 5 area. The fill generally consists of silty sand to sandy gravel. Fill materials within the former Slip 5 area include bricks, wood debris, and slag material from unknown sources. The native deposits typically consist of fine sand and silty fine sand with silt lenses. The native surficial deposits are characterized by the presence of small in-place roots, wood fragments, and peat, which are indicators of the original ground surface elevation prior to filling. Underlying the silt and silty fine sand is a series of interbedded alluvial sand and silt layers that were deposited within the floodplain of the lower Duwamish River. In the area of the mouth of former Slip 5, beneath the interbedded alluvial silt and fine sand is a layer of very dark to black silt. This naturally deposited silt is found throughout the lower Duwamish River valley and was likely deposited from flood waters.

2.2.2 Hydrogeologic Conditions

The near-surface groundwater regime within the lower Duwamish River valley is generally characterized as a shallow, single-aquifer system. The Site is located at and near the east bank of the LDW, at approximately 19 to 22 ft above mean lower low water (MLLW) or approximately 16.5 to 19.5 ft North American Vertical Datum of 1988 (NAVD88). Shallow groundwater is present throughout the area of the Site. River levels adjacent to the Site and groundwater elevations proximate to the shoreline at the Site are tidally influenced. Depth to water at the Site measured during the RI (all collected during an intermediate tide) typically ranged from 11 ft to 17 ft bgs and on average was 13.5 ft bgs.

Groundwater at the Site generally flows to the west toward the LDW, except at some locations along the shoreline where tidal influences may result in groundwater flows to the north or south prior to discharge to the LDW. Groundwater flow directions near the shoreline may be also affected by the presence of the various existing bulkheads described in Section 2.0.

The LDW is comprised of both marine and fresh surface water. Saltwater from Puget Sound extends back into the waterway, resulting in a saltwater wedge that is present in the LDW. The saltwater also intrudes from the LDW to groundwater at properties along its shoreline. The presence of brackish or saline water in the aquifer can affect groundwater flow because the less dense fresh groundwater tends to move above the higher density saline water. The density difference between the freshwater aquifer system and the saltwater of the LDW tends to concentrate the outflow of the surficial aquifer into the intertidal areas.

Tidal influences in upland groundwater monitoring wells are dependent on several factors including soil type, distance from the shoreline, and the presence of hydraulic barriers. These factors cause the magnitude of tidal influences in upland monitoring wells to be reduced, or altogether eliminated, in comparison to tidal fluctuations observed in water bodies like the LDW. In addition to attenuation of the magnitude of tidal influences, the timing of any observed tidal extremes (i.e., minimum or maximum groundwater elevation fluctuations caused by tidal influences) in upland monitoring wells typically lags behind the timing observed in the adjacent water body.

A tidal study during the RI showed that groundwater elevations at Site monitoring wells are influenced by tidal elevations by varying degrees. The amplitude of tidal fluctuations is dependent on the distance from the LDW (the amplitude decreases as distance increases) and the bulkhead material between the well and the LDW (the steel bulkhead appears to mute the amplitude more than the wooden bulkheads). The study indicated that tidal fluctuations generally do not occur more than 400 ft from the LDW. Lag times also generally increase with distance from the LDW.

2.3 Previous Studies

2.3.1 Previous Site Investigations

Environmental investigations at the Site to date have been conducted to characterize and evaluate the chemical quality and physical condition of soil, groundwater, sediment, and storm drain solids. Investigations have been conducted from 1983 to 2011, including formal RI investigation activities, at which point enough data had been collected to prepare the RI report. A full summary of previous investigations is provided in Section 3.0 of the RI report. Pre-RI soil and groundwater sampling locations are identified on Figures 2-3 and 2-4, respectively, and RI soil and groundwater sampling locations are shown on Figures 2-5 and 2-6, respectively. After completion of the RI, Ecology commissioned an investigation on the Port property, the results of which are included in a data summary report (Kennedy/Jenks 2015) that was attached to the FS (Landau 2023).

2.3.2 Previous Interim Actions/Remedial Actions

Several cleanup actions have previously been performed at the Site, the locations of which are shown on Figure 2-7. A full description of previous actions is provided in Section 3.0 of the RI report. The following sections provide a brief summary of these actions.

2.3.3 1984 Soil Excavation

In 1984, the Isaacson Corporation implemented a remedial action that consisted of excavating arsenic- and zinc-contaminated soil from three areas located in the northern portion of the Site. The extent of contamination identified, and excavation within each of these areas (identified as A, B, and C) are described below:

- The Area A excavation was located around well I-2(s) where elevated concentrations of arsenic were present in the soil and groundwater. Based on the analytical results for soil samples collected at this location, soil was excavated from an area about 13 ft by 25 ft, centered on this well. The excavation extended vertically to a depth of 11 ft bgs.
- The excavation at Area B occurred at the location of the former steam cleaning rack and a 5-ft-deep sand and gravel sump where the previous investigations had identified elevated concentrations of arsenic and zinc in the soil. The excavation removed the sump and some soil surrounding the sump to a depth of 4.7 ft bgs.
- The excavation in Area C was conducted to address arsenic-contaminated soil at I-1(s) and boring #11. The excavation was about 23 ft by 23 ft and extended to a depth of 12 ft bgs.

2.3.4 1988 Soil Excavation

In 1988, prior to Boeing's planned removal of the Isaacson building and paving of the Isaacson property, Ecology requested that soil containing elevated arsenic concentrations be removed from Bay 13 and the courtyard between Bays 11, 12, and 14 of the former Isaacson building. In each area, soil was excavated to the groundwater table (approximately 10–12 ft bgs). Excavations were backfilled with pea gravel, imported fill, and excavated soil.

2.3.5 1989/1990 Storm Drain Line Sampling/Excavation

In late 1989 and early 1990, the former Isaacson building was demolished, and the King County storm drain line that crossed the Isaacson property near its southern parcel boundary was rerouted along the northern parcel boundary (to its current alignment) as part of the planned development of the Site by Boeing. To evaluate proper disposition of soil removed from the linear excavation along the alignment of the new storm drain (vertical extent approximately 11–13 ft bgs, at which depth groundwater was encountered), soil from each 10- to 12-ft length of the storm drain alignment was stockpiled and sampled. The stockpile samples were analyzed for arsenic. Soil stockpiles containing arsenic concentrations less than 500 milligrams per kilogram (mg/kg) were used as backfill for the new storm drain line. Soil stockpiles containing arsenic concentrations greater than or equal to 500 mg/kg were disposed of offsite. Additionally, where trench sidewall samples contained arsenic concentrations at greater than 500 mg/kg, further excavation was conducted on both sides of the storm drain line in some areas (shown as “1990 excavation” on Figure 2-7).

2.3.6 1991 Soil Excavation/Stabilization

Due to elevated concentrations of arsenic in soil samples collected during 1989/1990 storm drain line sampling, an additional area was remediated. The selected remediation method consisted of excavation of soil within the area to the depth of the groundwater table (approximately 12 ft bgs) and chemical treatment and stabilization of the excavated soil using soluble silicate solutions and cementitious materials. Because previous sampling results indicated arsenic concentrations in shallow soil were below the remediation screening level of 200 mg/kg, most of the soil removed from the upper 2–3 ft of the excavation was not treated and was used as backfill. The remediation activities occurred between August and November 1991. Excavation continued until all sidewall sample arsenic concentrations were below 200 mg/kg, except along the northern boundary of the excavation. Additional excavation to the north was not feasible because of the King County storm drain line located approximately 15 ft north of the excavation. Following stabilization, the material was returned to the excavated area; however, the volume of treated material was greater than the volume of the excavation and a mound of treated soil was created. The stabilized material, including the mound, was covered with asphalt pavement.

2.3.7 1993–1995 Hydraulic Test Pad Area Excavations

In late 1993, approximately 10 ft of petroleum product was observed in a monitoring well near an oil/water separator located in the Former Hydraulic Test Pad Area east of Building 14-03. Based on this observation and subsequent drilling in this area at a nearby oil/water separator, an estimated 825 cubic yards of contaminated soil was excavated from this area. One report has been identified showing the proposed excavation area (GeoEngineers 1994), but documentation showing the final lateral and vertical extent of the excavation has not been identified.

In August 1995, the oil/water separator system was removed. According to an undated internal Boeing memorandum, approximately 900 tons of petroleum-contaminated soil was excavated from the area surrounding the oil/water separator and holding tank. The soil was transported to a treatment facility in

Oregon operated by TPS Technologies. Documentation showing the final lateral and vertical extent of the excavation has not been identified.

2.3.8 2004 20,000-Gallon Boiler Fuel Tank Closure/Excavation

In 2004, a 20,000-gallon boiler fuel underground storage tank (UST; TS-01) located on the west side of Building 14-02 was decommissioned in-place. A concrete pad (up to 4 ft thick) was situated on top of the UST as a counterweight to prevent the UST from floating in the shallow groundwater when not full. The bottom of the tank was estimated to be about 10 to 12 ft bgs. Due to the tank's location, it was abandoned in place rather than risking potential damage to a nearby 500-gallon diesel AST (TS-57) or Building 14-02. The overlying concrete slab and some of the soil surrounding the tank were removed prior to deciding to abandon the tank in place. The excavated soil was stockpiled nearby during abandonment of the tank. AST TS-57 was not excavated and is still actively used.

2.3.9 2006 Sump Removal

In November 2006, Boeing removed a sump located in the northeastern corner of the Site. The sump was a below-grade, open-to-the-surface 55-gallon drum that was discovered under a steel plate. The excavation associated with the sump removal extended about 2 ft beyond the exterior of the sump and to about 5 ft in depth. Results of excavation base and sidewall samples identified the presence of diesel-range and motor oil-range petroleum hydrocarbons, acetone, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate (BEHP), polychlorinated biphenyls (PCBs; specifically Aroclor 1260), and metals.

2.3.10 2008 Removal of Stabilized Soil Mound

In late 2008, an independent action was conducted to remove a portion of the mound within the Stabilized Soil Area in the northern portion of the Site (see Section 2.3.6 above). The independent action consisted of the removal and offsite disposal of the stabilized soil mound and non-stabilized surface soil surrounding the mound to reduce the grade, as necessary, to allow greater usability for driving and storage at the Isaacson property. After the mound of stabilized material and the surrounding non-stabilized surface soil were removed and graded for drainage, the area was recapped with asphalt. New stormwater treatment vaults and conveyance system improvements were also installed as part of this action.

To determine the appropriate disposal options for the stabilized soil designated for removal, samples of the stabilized soil were collected and analyzed for total Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc); Toxicity Characteristic Leachate Procedure (TCLP) RCRA metals; and gasoline-range, diesel-range, and oil-range petroleum hydrocarbons. Elevated concentrations of arsenic (up to 1,700 mg/kg) were detected in the samples, but the TCLP results were well below the hazardous waste designation threshold of 5 milligrams per liter). Barium, cadmium, chromium, and lead were also detected in the stabilized soil samples. Low concentrations (380 mg/kg or less) of diesel-range and motor oil-range petroleum hydrocarbons were also detected.

2.3.11 2011 Removal of Former Washdown System and Aqueous Degreaser

A large area of the western portion of Building 14-01 was formerly used for washing and painting of airplane sections. An aqueous degreaser was also located in the southwest portion of Building 14-01. Workers in this area washed various airplane sections with a solution containing methyl isobutyl ketone to prepare the sections for painting. Wastewater and overspray were washed into one of three concrete trenches, which ran north to south through the painting area. The trenches conveyed the solution to three sumps (TS-67, TS-68, and TS-69) located on the exterior of the south side of Building 14-01. The wastewater from the painting and washing operations was pumped from the sumps to two ASTs located in the west yard of Building 14-01 (TSA-14 and TSA-15) via underground piping. A third 5,000-gallon AST (TSA-21), located in the western yard of Building 14-01, was originally used to contain waste copper plating solution. This tank was later used for overflow containment for the aqueous degreaser.

In 2011, Boeing re-occupied Building 14-01 and building modifications were made, including removal of a loading dock and an inactive 5,000-gallon wastewater AST (TSA-21) located west of Building 14-01. The aqueous degreaser was also removed in 2011, and the sump associated with the aqueous degreaser (TS-26) was decommissioned in place. There were no indications of a release at any of the locations based on pre-RI soil sample results, RI soil and groundwater results, and construction-related soil sample results. The locations of the former ASTs and sumps are shown on Figure 4 of the RI Report (Landau 2014).

2.3.12 Former Paint Storage Area and Sumps

Two paint storage areas were previously located in the eastern portion of the Isaacson property, as shown on Figure 2-3. Three sumps were associated with the former paint storage area (identified as TS-09, TS-10, and TS-11 on Figure 4 of the RI Report). The sumps have since been removed. Analytical results for one soil sample collected in 1983 at 2.5 ft bgs indicated low concentrations of metals are present in the soil (e.g., arsenic and lead were detected at 8.7 mg/kg and 11 mg/kg, respectively).

Two monitoring wells (MW-15 and MW-16) were subsequently installed downgradient of the former paint storage areas and three soil borings were also drilled in the former paint storage area. Soil samples from the three locations in the former paint storage area contained carcinogenic PAHs (cPAHs), PCBs, arsenic, and copper at concentrations exceeding the RI screening levels. Except for arsenic and copper, the exceedances only occurred in the unsaturated soil zone and generally occurred in the upper 3.5 ft of soil. Only arsenic was detected in the groundwater at concentrations exceeding the screening level.

2.3.13 Former Diesel and Gasoline Tanks Area

Four diesel and gasoline USTs were located in the eastern portion of the Isaacson property, as shown on Figure 2-3. The USTs are identified as TS-05, TS-06, TS-07, and TS-08 on Figure 4 of the RI Report. Results for soil samples collected at a depth of 5.5 ft bgs in 1983 indicated that PCBs, total cyanide, mercury, and silver were not detected, and low concentrations of arsenic and lead were detected (at 3.4 mg/kg and 1.3 mg/kg, respectively). One test pit (TP-109) was subsequently excavated to determine if the tanks were still present and to collect soil samples for laboratory analysis. The test pit was approximately 6.5 ft by 10.5 ft and extended to a depth of 10 ft bgs. No visual signs of potential contamination were observed in the soil and no soil vapors were detected using the photoionization detector. No USTs were encountered. Based on the analytical results for the soil sample collected near the base of the test pit, no constituents were present at concentrations exceeding RI screening levels. Gasoline-range petroleum hydrocarbons (without associated benzene) were present but at a concentration well below the RI screening level of 100 mg/kg. Diesel-range and motor oil-range petroleum hydrocarbons were not detected. There was no indication of a release based on field screening and soil sample results at RI test pit TP-109.

2.4 Current Conditions and Potential Exposure Pathways

The following sections provide a summary of the current Site conditions and the general extent of contamination in soil and groundwater. Contaminants of concern (COCs) were identified in the FS by screening data against applicable pCULs. This section also identifies indicator hazardous substances (IHS) as determined under WAC 183-340-703; i.e., the primary subset of COCs used for characterizing the Site and/or establishing cleanup requirements for that Site (excludes COCS that only contribute a small percentage of the overall threat to human health and the environment). The nature and extent of contamination at the Site are based on the operational history of the Site and media.

The following sections describe the locations, extent, estimated quantities, and potential or actual exposure pathways for contaminants at the Site for each media of concern that contributes to the conceptual site model (CSM). Figure 2-8 presents a CSM diagram summarizing the site conditions, contaminant migration pathways, and exposure pathways.

2.4.1 Groundwater Quality

The following COCs have been identified for Site groundwater: vinyl chloride, PCBs, arsenic, copper, mercury, nickel, and zinc. However, compared to the minimal prevalence of other COCs, IHS for Site groundwater are limited to PCBs, arsenic, copper, nickel, and zinc. Areas of IHS exceedances are widespread and generally include areas where the non-IHS COCs are also found above pCULs. Therefore, the selected remedial action that addresses IHS will also address non-IHS COCs and will be protective of human health and the environment. The extent of metals and organic chemical groundwater contamination are summarized on Figures 2-9 and 2-10, respectively.

2.4.1.1 Upland Area Groundwater

IHS in the upland area of the Site (i.e., area of the Site excluding the shoreline area along the western boundary of the Site) are PCBs and dissolved metals (arsenic, copper, nickel, and zinc). Copper, nickel, and zinc exceed pCULs primarily at monitoring wells located in the area north of the former Slip 5 area (Figures 2-11, 2-12, and 2-13, respectively), where historical operations occurred such as the former sawmills, wood preserving facility, and steel forging and galvanizing plant. Dissolved arsenic exceedances occurred in groundwater throughout the Site (Figure 2-14), with the highest exceedances occurring north of the former Slip 5 area and mostly within and downgradient of the Stabilized Soil Area.

PCBs exceed the pCUL at a total of four upland monitoring well locations (MW-13, MW-17, MW-25, and I-205[s]), the majority of which are located within the former Slip 5 area (Figure 2-15).

2.4.1.2 Shoreline Area/Western Site Boundary Groundwater

The single seep, wells, and piezometers located in the shoreline area along the western Site boundary are the groundwater monitoring locations nearest the LDW, which provide the best information regarding what constituents may be discharging to the LDW surface water and sediment via groundwater. The only IHS with consistent pCUL exceedances in groundwater at these western-most monitoring locations is dissolved arsenic (Figure 2-14).

Dissolved arsenic exceedances occurred in around half of the samples collected from the near shoreline monitoring locations and primarily in those wells and piezometers located north of MW-9. The highest arsenic concentrations in the shoreline area occurred at wells MW-19, MW-20, and I-104(s), which are located downgradient of the Stabilized Soil Area. Dissolved arsenic concentrations range from 25.9 micrograms per liter (µg/L; well MW-19) to 2,460 µg/L (well I-104[s]). Although wells I-104(s) and MW-20 are located immediately adjacent to each other, dissolved arsenic concentrations are typically an order of magnitude higher at I-104(s), indicating the spatial variability of groundwater concentrations—i.e., monitoring well I-104(s) is screened at a deeper depth (15–25 ft bgs) than well MW-20 (screened at 8–18 ft bgs).

2.4.1.3 Groundwater Exposure Pathways

Exposure pathways for contaminants in groundwater are identified in the CSM (see Figure 2-8). Contaminants in groundwater can potentially migrate into the LDW because of groundwater flow into the LDW (above -5 ft MLLW), and LDW surface water may intrude and mix with groundwater contamination because of tidal influences that periodically reverse water gradients near the western Site boundary. However, it should be noted that based on the results of a tidal study performed during the RI (see RI Section 8.1.2.3), groundwater at most Site wells is typically higher than water elevations in the LDW, including during high tides. This is especially true east of the steel bulkhead running along the central portion of the western Site boundary where tidal influences are marginal. Tidal fluctuations are more evident at near-shoreline wells east of the wooden bulkheads on the north and south ends of the Site boundary. There are various potential receptors including humans, terrestrial ecological receptors, and aquatic species. These receptors have the potential for exposure through direct contact with surface water and/or sediment, direct or indirect uptake of surface water and/or sediment through consumption, or indirect uptake through consumption of aquatic organisms.

2.4.2 Soil Quality

The following COCs have been identified for Site soil at concentrations exceeding the pCULs: total petroleum hydrocarbons (TPH), PCBs, cPAHs, BEHP, arsenic, barium, cadmium, chromium (total), chromium VI, copper, lead, mercury, nickel, and zinc. IHS for Site soil are PCBs, cPAHs, arsenic, copper, lead, mercury, nickel, and zinc. Areas of IHS exceedances are widespread and generally include areas where the non-IHS COCs are also found above pCULs. Therefore, the selected remedial action that addresses IHS will also address non-IHS COCs and will be protective of human health and the environment. The extent of metals soil contamination is summarized on Figure 2-16.

2.4.2.1 North of Former Slip 5

IHS identified in soil north of the former Slip 5 area are arsenic, copper, mercury, nickel, zinc, and cPAHs. The vertical extent of the exceedances is generally limited to the unsaturated zone (above 11 ft bgs), but arsenic, copper, mercury, and zinc exceedances extend into the saturated soil zone (below the groundwater table) at several locations (Figures 2-17, 2-18, 2-19, and 2-20, respectively). Primarily, the highest concentrations of arsenic occur at depths between 5 and 11 ft bgs at locations west and north of the Stabilized Soil Area. Another area with elevated concentrations of arsenic at this depth is a small section of soil that was not stabilized adjacent to the east of the Stabilized Soil Area.

The observed tar-like substance area is generally characterized by TPH and cPAH exceedances and visual observations of a tar-like substance (Figure 2-21). Although petroleum hydrocarbons are non-IHS compounds, diesel-range, oil-range, and gasoline-range petroleum hydrocarbons exceedances also occurred in soil samples from this area. These exceedances, as well other exceedances in this area (cPAHs, arsenic, and copper), appear to be associated with the tar-like substance encountered at a depth interval between 1 and 2 ft bgs. No constituents were detected at concentrations exceeding the pCULs in samples collected below the tar-like substance (2–3 ft bgs). The tar-like substance did not appear to extend farther west than TP-107, because there was no observation of the substance on the west sidewall of TP-107. Although the extent of the tar-like substance was not specifically defined in the other directions, it is known to be contained within a relatively small and isolated area of the Site.

2.4.2.2 Former Slip 5

The IHS in soil in the former Slip 5 area and the Port property are arsenic, copper, mercury, zinc, lead, nickel, PCBs, and cPAHs (Figures 2-17, 2-18, 2-19, 2-20, 2-22, 2-23, 2-24 and 2-25, respectively). The majority of the pCULs exceedances occurred above and below the groundwater table in the fill materials in the central and northern portion of the former slip.

Arsenic, copper, nickel, and zinc exceeded pCULs in samples collected from depths above and below the water table in areas near MW-17 and I-202(s). Exceedances of copper, mercury, and nickel occurred above and below the groundwater table in the area of MW-12, MW-13, and MW-13B.

A total of 17 boring locations had exceedances of PCBs in the former Slip 5 area: MW-13B, IT-SB-3, ITSB-4, IT-SB-5, IT-SB-12, Boring 22, Boring 19, Boring 15, Boring 7-1, Boring 6-3, Boring 5, IT-MW-10, MW-17, I-202(s), I-203(i), MW-12, and MW-10. PCBs exceeded the pCUL in saturated soils (below 11 ft bgs) at MW-17, I-202(s), MW-12, and MW-10.

2.4.2.3 South of the Former Slip 5

The soil IHS in the area south of the former Slip 5 area are arsenic, copper, mercury, zinc, and lead (Figures 2-17, 2-18, 2-19, 2-20, and 2-22, respectively). The highest arsenic concentrations were detected in samples from the western portion of the Site at locations MW-7, HP-3, and I-206(s) and from intervals above and below the groundwater table. The majority of copper exceedances were detected above the groundwater table and in the vicinity of the former washdown area and near the eastern Site boundary. Lead exceedances occurred only in the unsaturated zone in a few locations south and west of the Thompson Building. While the highest concentrations of zinc occurred in soil north of the former Slip 5 area, zinc concentrations in shallow soils along the eastern Site boundary south of the former Slip 5 area exceed the pCUL. Elevated mercury concentrations in soil were also detected in the southeastern portion of the Site.

2.4.2.4 Soil Exposure Pathways

Exposure pathways for contaminants in soil are identified in the CSM (see Figure 2-8). Contaminants in soil have the potential to leach into groundwater and migrate to adjacent surface water, which is discussed in Section 3.1 of the FS. Another migration pathway to the LDW potentially occurs from soil erosion at gaps in the older bulkheads located at the southern portion of the Thompson property and along the Port property.

Other than potential leaching pathways and erosion, contaminants in soil are mostly contained at the Site by buildings and pavement. These structures also prevent plants or wildlife from being exposed to soil contamination. Only humans have been identified as potential receptors for Site contaminants in soil. Exposure for humans could occur during construction or maintenance activities that involve earthwork.

3.0 CLEANUP STANDARDS

Cleanup standards consist of three distinct components: 1) regulatory requirements that apply to the Site (applicable state and federal laws; WAC 173-340-700; relevant and appropriate requirements; WAC 173-340-710); 2) CULs for hazardous substances present at the Site; and 3) the location where the CULs must be met (POC) for each media of concern for the Site.

3.1 Regulatory Considerations

In accordance with MTCA, all cleanup actions must comply with applicable state and federal laws (WAC 173-340-710[1]) and any identified relevant and appropriate requirements (WAC 173-340-710(4). MTCA defines applicable state and federal laws to include applicable or relevant and appropriate requirements (ARARs). ARARs that are applicable to the cleanup action include the following:

- **Washington Hazardous Waste Management Act (Revised Code of Washington [RCW] 70.105) and its implementing regulations: Dangerous Waste Regulations (WAC 173-303).** These regulations establish a comprehensive statewide framework for the planning, regulation, control, and management of dangerous waste. The regulations designate those solid wastes that are dangerous or extremely hazardous to human health and the environment. The management of excavated contaminated soil from the Site would be conducted in accordance with these regulations to the extent that any dangerous wastes are discovered or generated during the cleanup action.
- **Washington Solid Waste Management Act (RCW 70.95) and its implementing regulation: Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC).** These regulations establish a comprehensive statewide program for solid waste management including proper handling and disposal. The management of any contaminated soil removed from the Site would be conducted in accordance with these regulations to the extent that this soil could be managed as solid waste instead of dangerous waste.
- **Hazardous Waste Operations (WAC 296-843).** Establishes safety requirements for workers conducting investigation and cleanup operations at sites containing hazardous materials. These requirements would be applicable to onsite cleanup activities and would be addressed in a site health and safety plan (HASP) prepared specifically for these activities.
- **Clean Water Act, Section 404—Dredge or Fill Requirements Regulations, 33 United States Code (USC) 1344(a)–(d); 33 CFR Parts 320–330; 40 CFR Part 230.** These requirements are applicable to cleanup action alternatives in or near navigable waters and establish requirements that limit the discharge of dredged or fill material to these waters. US Environmental Protection Agency (EPA) guidelines for discharge of dredged or fill materials in 40 CFR 230 specify consideration of alternatives that have less adverse impacts; prohibit discharges that would result in exceedance of surface water quality standards, exceedance of toxic effluent standards, and jeopardy of threatened or endangered species; and provide for evaluation and testing of fill materials before placement.
- **Federal Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permit and State Construction Stormwater General Permit.** Construction activities that disturb one or more acres of land typically need to obtain an NPDES Construction Stormwater General Permit from Ecology. A substantive requirement would be to prepare a stormwater pollution prevention plan

(SWPPP) prior to earthwork activities. The SWPPP would document planned procedures designed to prevent stormwater pollution by controlling erosion of exposed soil and by containing soil stockpiles and other materials that could contribute pollutants to stormwater.

- **Clean Water Act, Section 401, Water Quality Certification, 33 USC 1340; WAC 173-225-010.** Section 401 of the Federal Water Pollution Control Act provides that applicants for a license or permit from the federal government relating to any activity that may result in any discharge into the navigable waters shall obtain a certification from the state that the water quality standards will be met. Ecology's Water Quality Section would review any Nationwide Permit No. 38 issued by the US Army Corps of Engineers (USACE). Ecology would also review any associated draft and final design of the chosen cleanup action alternative to document substantive compliance with the Washington State Water Pollution Control Act requirements.
- **Toxic Substances Control Act (TSCA), 15 USC 2601.** The TSCA of 1976 provides EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to production, use, and disposal of certain chemical substances and/or mixtures such as PCBs. TSCA is the only ARAR used for development of soil pCULs; there are no other soil criteria for cleanup standards established under applicable federal laws. Disposal of remediation waste may require coordination with EPA under TSCA. Whether or not this is necessary will be determined no later than the design phase.
- **Washington Hydraulics Project Approval (RCW 75.20.100; WAC 220-110).** This regulation requires Washington Department of Fish & Wildlife (WDFW) approval for projects that will use, divert, obstruct, or change the natural flow or bed of waters of the state, such as the LDW. WDFW, in conjunction with the USACE, the National Marine Fisheries Service, and the US Fish & Wildlife Service, authorizes allowable periods for work in state and/or federal waters through this code.
- **Washington Minimum Standards for Construction and Decommissioning Wells (WAC 173-160-381).** Under WAC 173-160-381, Ecology or its delegated authority establishes requirements for the installation and decommissioning of monitoring wells.
- **Underground Injection Control Program (WAC 173-218).** Under WAC 173-160, underground injection control registration would be required for the injection of any materials below ground surface for the purposes of groundwater cleanup. This would include injection of reducing agents such as zero-valent iron (ZVI), electron donor substrates for bioremediation, oxidants for chemical oxidation, or other chemical activation agents or catalysts; or reinjection of treated groundwater.
- **National Historic Preservation Act of 1966 (NHPA); Indian Graves and Records (RCW 27.44); Archaeological Sites and Resources (RCW 27.53); Archaeological Excavation and Removal Permit (WAC 25-48).** In the event that archaeological artifacts or resources or human remains are encountered or disturbed by construction or excavation activities, or as otherwise determined through the SEPA review process, the requirements of the NHPA, RCW 27.44 and 27.53, and WAC 25-48 must be adhered to in order to ensure these resources are appropriately protected. When working in areas where archaeological resources may be present, as a best management practice, Contractors should consider preparing a Cultural Resources/Inadvertent Discovery Plan to follow when performing subgrade excavation and construction activities near historical native landforms. At a minimum, if archaeological resources are discovered during construction, work will be stopped immediately, and the Client and its respective contractors and agents, Ecology, the Washington State Department of Archaeology and Historic

Preservation (DAHP), and the cultural resources department or any applicable tribal government will be notified by the close of business on the day of discovery. A licensed archaeologist should also be retained to inspect the site and document the discovery, provide a professionally documented site form, and report to the aforementioned parties. In the event of an inadvertent discovery of human remains, work will be immediately halted in the discovery area, the remains will be covered and secured against further disturbance, and the Police Department and City or County Medical Examiner will be immediately contacted, along with the DAHP Physical Anthropologist and authorized tribal representatives. A treatment plan by a licensed archaeologist would then be developed in consultation with the above-listed parties consistent with RCW 27.44 and RCW 27.53 and implemented according to Chapter 25-48 WAC.

- **Washington State Shoreline Management Act of 1971 (SMA).** The SMA (RCW 90.58) considers the basic policy areas: shoreline use, environmental protection, and public access. It establishes the concept of preferred shoreline uses that are consistent with controlling pollution, preventing damage to the natural environment, and promoting water-dependent industrial and commercial developments, ports, developments that provide public access opportunities, recreational uses, and single-family residences. The SMA is intended to ensure the development of shorelines in a manner that will promote and enhance the public interest and that will protect shorelines of the state, including the land, vegetation, wildlife, and aquatic habitats, against adverse environmental effects. All allowed uses are required to minimize adverse environmental impacts as much as possible. The City of Tukwila complies with the SMA through its Shoreline Master Program (SMP), which establishes goals and policies consistent with the SMA that are implemented through use regulations set forth in the Tukwila Municipal Code. The final design of the selected remedy will comply with applicable substantive requirements of the City of Tukwila's SMP.

3.2 Contaminants of Concern

The following types of hazardous substance comprise the contaminants of concern (COCs) for the Site requiring cleanup as part of this dCAP:

- Soil: TPH, BEHP, total cPAHs (toxicity equivalency quotient [TEQ]), total PCBs, arsenic, barium, cadmium, chromium (III or total, VI), copper, lead, mercury, nickel, zinc
- Groundwater: vinyl chloride, total PCBs, arsenic, copper, mercury, nickel, zinc.

3.3 Cleanup Levels

CULs were developed for COCs identified in soil and groundwater. The pCULs were presented in the FS (Landau 2023) and are finalized in this report. The regulatory basis for the CULs for each media of concern are provided in Table 3-1 (groundwater) and Table 3-2 (soil).

3.4 Points of Compliance

The POCs under MTCA are the point or points at a site where the CULs must be attained to achieve cleanup standards.

- **Soil:** The POC for soil COCs with CULs based on protection of groundwater is throughout the Site under WAC 173-340-745(7); WAC 173-340-740(6)(b). The POC for soil COCs with CULs based on protection of human health via direct contact is from ground surface to 15 ft bgs in accordance with WAC 173-340-745(7); WAC 173-340(6)(d).

- **Groundwater:** An on-property conditional POC (CPOC) will be established per WAC 173-340-720(8)(c). The CPOC for groundwater at the Site will be between the LDW and as close as practicable to the contaminant source(s). The most practicable location(s) for the POC will be at monitoring wells near the LDW shoreline where the results of the groundwater cleanup action can be measured and shown to achieve the CULs prior to flow to surface water.

4.0 CLEANUP ACTION ALTERNATIVES AND ANALYSIS

Remedial action objectives (RAOs) define the goals of the cleanup that must be achieved to adequately protect human health and the environment. The RAOs identified for the Site consist of:

- RAO-1: Prevent direct human contact with soil containing contaminants from the Site at concentrations greater than the direct contact soil CULs. RAO-1 applies to soil contamination between 0 to 15 ft bgs.
- RAO-2: Prevent groundwater containing contaminants from the Site at concentrations greater than the groundwater CULs (protective of sediment and/or surface water beneficial uses) from migrating to surface water. RAO-2 is applicable at the CPOC.

Cleanup action alternatives were developed during the FS to support cleanup of contaminated soil and groundwater and achieve the RAOs. Evaluation of the following alternatives was presented in the FS; the findings of which are summarized below.

- Alternative 1: Containment and Hydraulic Capture via Capping and Groundwater Extraction
- Alternative 2: Containment and Hydraulic Control via Capping and Vertical Barrier
- Alternative 3: *In Situ* Groundwater Treatment, Shoreline Excavation, and Containment
- Alternative 4: Focused Excavation and Containment, and *In Situ* Groundwater Treatment
- Alternative 5: Site-Wide Excavation of Contaminated Soil.

Based on the FS, the preferred remedial action alternative for the Site is Alternative 3, which consists of excavation of contaminated soil from the northwestern portion of the Site (i.e., from the Port property and the area of the Isaacson property between the CPOC and the Port property line) and the observed tar-like substance area, *in situ* groundwater treatment upgradient of the shoreline CPOC using a permeable reactive barrier (PRB), maintaining a low-permeability cap over remaining soil contamination, institutional controls, and groundwater monitoring.

Alternative 3 physically removes some of the Site soil contamination; however, the majority of the contaminated soil (including the stabilized soil area and most of the former Slip 5 fill material) will remain in place. Alternative 3 relies on *in situ* treatment processes that will take place via groundwater flow through the PRB, that will protect the groundwater to surface water pathway, and maintain Site capping and institutional controls to protect humans from direct contact exposures.

Selection of this alternative over Alternatives 1, 2, 4, and 5 is primarily based on the following:

- Alternative 3 achieves each of the two RAOs and each of the threshold requirements, uses permanent solutions to the maximum extent practicable, and provides for a reasonable restoration time frame.
- Focused excavation of soil along the shoreline permanently removes contaminated soil along the Site's shoreline and protects sediments from migration of contaminated soil.

- Installation of a PRB containing a mix of ZVI and granular activated carbon (GAC) upgradient of the CPOC provides long-term groundwater treatment for Site COCs and reduces the risk of contaminant migration from Site groundwater to the LDW.
- Maintaining and repairing Site pavement will provide a cap over remaining contamination and prevent human contact with contaminated soil and groundwater. The cap will also limit surface water infiltration and, thereby, limit potential contaminant leaching and migration.
- As discussed in the FS disproportionate cost analysis (DCA), the costs of Alternatives 4 and 5 are disproportionate to their benefits, and the benefits of Alternatives 1 and 2 were disproportionately lower than for Alternative 3. Therefore, Alternative 3 uses permanent solutions to the maximum extent practicable.

5.0 DESCRIPTION OF SELECTED REMEDY

The following section describes the proposed cleanup action at the Site. Descriptions of technical and engineering design elements will be provided in an engineering design report (EDR) and a compliance monitoring plan in accordance with the schedule described in Section 7.0. Cleanup levels for the Site are provided in Tables 3-1 (groundwater) and 3-2 (soil).

An EDR will be prepared, including applicable engineering design and specifications, in accordance with WAC 173-340-400(4)(a) and (b). Compliance monitoring will be conducted as summarized below in adherence to an Ecology-approved compliance monitoring plan. The compliance monitoring plan will include the required elements of protection monitoring, performance monitoring, and confirmational monitoring as defined per WAC 173-340-410.

A compliance monitoring plan will be prepared including or in conjunction with:

- A Site-Specific HASP to address monitoring for protection of worker safety and health. The HASP will address protection monitoring, including potential physical and chemical hazards associated with Site cleanup activities consistent with the requirements of WAC 173-340-810,
- A sampling and analysis plan (SAP) that will be prepared in accordance with WAC 173-340-820, and
- A quality assurance project plan (QAPP) that will be prepared in adherence with the applicable provisions of WAC 173-340-820 and -830 and other applicable regulations.

The anticipated elements of the EDR and compliance monitoring are also described below.

5.1 Description of Cleanup Action

The selected remedial action consists of *in situ* treatment of contaminated groundwater with a PRB located upgradient of the shoreline monitoring wells likely to be used to demonstrate compliance at the groundwater CPOC, excavation of contaminated soil located downgradient of the CPOC and in the observed tar-like substance area, containment of contaminated soil through a surface cap, and institutional controls.

5.1.1 PRB for Groundwater Treatment

The final design for the PRB will be provided in the EDR. The PRB conceptual remedy design includes installation of a PRB extending from the northern Site boundary (and west of the stabilized soil area) parallel to the shoreline to near the southern edge of the former Slip 5 Area (Figure 5-1). The PRB will utilize reactive backfill containing ZVI and GAC for *in situ* treatment of contaminated groundwater flowing through the PRB.

The actual design parameters for the PRB (i.e., wall thickness, depth, and length, and reactant mix) will be determined during the design phase and will be based on the results of a pre-remedial design investigation (PRDI) and PRB pilot study. However, the conceptual remedy design assumed the PRB to be 5 ft thick, 25 ft deep, and 700 ft long, and use a mix of 30 percent ZVI,[2] 10 percent GAC,[3] and sand for the remainder (appropriately graded to provide necessary *in situ* hydraulic properties). The PRB will be set back from the shoreline/western Boeing property line approximately 50–100 ft to allow space to evaluate the performance of the PRB in treating groundwater contamination and confirming compliance with the CULs at the CPOC prior to groundwater flowing to the LDW. As part of the PRB design process, further evaluation and consideration of Site conditions will be needed for near-shoreline hydrogeology, aquifer chemistry/geochemistry, and geotechnical conditions. Data collection for these design considerations will be conducted through the PRDI. The PRDI will also address other data gaps identified during the FS (i.e., delineation of maximum vertical depth of soil and groundwater contamination; further evaluation of the lateral extent and hydraulic characteristics of the marine/river meander silty sediment layer; additional soil characterization near the southern Thompson property bulkhead; and developing a better understanding of the groundwater gradients and flow directions near the shoreline and bulkheads). Additional bench-scale and pilot study testing will be needed to determine PRB design specifications and evaluate performance and longevity. This pilot study testing may include column studies to evaluate treatment capacity/longevity of various PRB media (e.g., ZVI products) and installation of a short length of a PRB (e.g., 50–100 ft) to evaluate treatment effectiveness and design optimization in the area of the proposed PRB where groundwater pH and arsenic concentrations are highest (i.e., downgradient of the stabilized soil mass).

5.1.2 Remedial Excavations

The selected remedy will include two areas of remedial excavation, including (1) the “Shoreline Area” remedial excavation including contaminated soil on the Port property and contaminated soil on the Isaacson property east to the downgradient edge of the PRB (see above), and (2) the observed tar-like substance area in the upland area of the Isaacson-Property.

The extent of the observed tar-like substance area excavation will initially be determined in the field by visual observation of tar-like contamination but will be continued until confirmation sampling indicates that cPAH and TPH CULs are met at the excavation base and sidewalls (or further excavation becomes impracticable or infeasible to continue, e.g., due to the presence of utilities or other impediments/limitations). Based on RI sampling results, the excavation will likely extend to a depth of about 5 ft bgs. Approximately 370 cubic yards of soil (in-place) is assumed to be excavated for the purposes of estimating costs. Figure 5-1 shows the location of the observed tar-like substance area.

The Shoreline Area excavation will include soil removal between the proposed PRB location on the Isaacson property and the Port property shoreline. Because there is metals-contaminated soil (as well as relatively small discrete areas of PCB contamination) between the Port property and the proposed PRB location that may itself be impacting groundwater quality, the soil in this area (i.e., downgradient of the PRB) will be excavated to prevent recontamination of PRB-treated groundwater prior to flowing to the

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[2] Note that, although the treatability study indicated a 10 percent ZVI mix yielded adequate treatment results, it is assumed that a higher ratio of ZVI will be necessary to achieve hydraulic contact with the reactive ZVI particles and adequate longevity of the PRB (actual ratio will be determined during the design phase and pilot testing).

[3] Based on vendor recommendations, 1 percent should provide adequate treatment; however, up to 10 percent may be necessary to achieve adequate hydraulic contact (actual ratio will be determined during the design phase and pilot testing).

LDW. The extent of the Port property excavation is estimated to cover the entire area of the Port property to a depth of approximately 18 ft bgs (based on prior investigation results on this parcel) and will include the removal and disposal of 15,000 cubic yards of soil at an appropriately permitted disposal facility. An additional estimated 10,500 cubic yards of soil will be removed between the Port property and the PRB (excavation extending to approximately 15 ft bgs across a roughly 380-ft by 50-ft area immediately adjacent to the east of the Port property). Figure 5-2 presents a cross section through this area showing the estimated excavation limits with respect to the existing shoreline. This excavation does not include excavation of river sediments from the LDW waterway; however, direct coordination of the upland remedial action with the LDW sediment cleanup will be necessary because excavation of the Port sliver property will include in-water work directly adjacent to the LDW sediment cleanup.

Sufficient quantities of clean structural fill and other supporting materials will be placed, as necessary, to fill the excavated area to an elevation above the high-water line and to protect the exposed areas of shoreline from erosion. The dilapidated wooden bulkhead on the Port property will be removed in conjunction with the excavation activities and will either be replaced with a steel bulkhead or other engineered shoreline that will be stabilized and armored/protective against erosion.

Performance of the remedial excavation in the Shoreline Area may need to be coordinated with EPA with respect to EPA's planned Superfund Site cleanup in the middle-reach of the LDW.

5.1.3 Soil Capping

As evaluated in the FS, complete removal of all soil contamination is not practicable, so soil capping is an acceptable remedy under WAC 173-340-740(6)(f). Soil contamination will remain on Site in areas upgradient of the CPOC that are not included in planned remedial excavation areas (see Section 5.1.2 and Figure 5-2). This includes soil contamination in the former Slip 5 area, the stabilized soil material area, and other areas shown on Figure 2-16. A surface cap will be used to prevent human contact with contaminated soil in these areas and with groundwater at the Site. The cap would also limit infiltration of precipitation and, thereby, limit potential contaminant leaching and migration to groundwater from vadose zone soils.

Capping of the contaminated soil will primarily consist of the existing Site cover features including Site buildings and asphalt and concrete paving. Cracks or seams in the pavement will be sealed to minimize infiltration of stormwater. Areas where pavement is in disrepair will be repaired or repaved as possible. The Port property will be remediated and rehabilitated through removal of the existing damaged and dilapidated paving, excavation of contaminated soil, and removal and replacement of the dilapidated wooden bulkhead with a steel bulkhead and pavement, or other engineered shoreline protection. The replacement bulkhead, or other shoreline protection, will provide a competent barrier against soil erosion from the Port property and adjacent Isaacson property into the LDW, as well as provide additional control of shallow groundwater flow to the LDW.

5.1.4 Institutional Controls

In accordance with MTCA requirements (WAC 173-340-440), institutional controls will be implemented to limit or prohibit activities that may result in exposure to hazardous substances at the Site. Institutional controls prevent/control human contact with subsurface soil and prevent use of Site groundwater for drinking water or any other activity. Soil and groundwater institutional controls will only apply to the Boeing Isaacson and Thompson properties and the Port property. Institutional controls will include an environmental (restrictive) covenant on the three Site properties, deed recorded with King County, in accordance with the Uniform Environmental Covenants Act. This covenant will be binding on the owner’s successors and assignees. The environmental covenant will ensure only industrial land uses at the Site in the future, as required when using MTCA Method C soil CULs, place restrictions on any future excavation work within the capped Site (except as approved by Ecology), and prohibit the extraction and use of groundwater (except as required for compliance monitoring). An excavation procedures work plan will be prepared that will provide specific details about how any future utility installation or other subgrade work will need to be performed to ensure that the cap integrity is maintained and that any soil that is generated is handled and disposed of appropriately. The excavation procedures work plan will include a default HASP for contractors to adopt or modify for their work. Institutional controls will require that proper safety measures and soil management practices be implemented as part of any project involving disturbance of impacted soil at the Site (in accordance with WAC 173-340-440). The institutional controls will also include a requirement for periodic (e.g., annual) inspection of the cap and areas of shoreline protection (i.e., bulkheads or other engineered shoreline), with repair to be conducted, as necessary, if damage is sustained from Site activity or from natural events. Because the Site cap includes buildings and pavement, inspection and maintenance will be incorporated into the property maintenance plan(s). Even though the City of Seattle requires connection to the City water system, an institutional control to prohibit use of Site groundwater for potable water supply will also be included as part of the selected remedy. Long-term source monitoring is anticipated to be addressed under monitoring associated with periodic Site reviews.

The environmental restrictive covenants may be removed at the applicable property owner’s request (i.e., Boeing or the Port), once it is shown that the conditions at the Site requiring use of institutional controls no longer exists, Ecology holds a public notice and comment opportunity, and Ecology agrees that the restrictive covenants are no longer necessary.

Per WAC 173-340-420, because institutional controls are included as part of the cleanup action, Ecology will conduct periodic reviews “at least every 5 years after the initiation of a cleanup action” to “assure that human health and the environment are being protected.” If, as a result of the periodic review, Ecology determines that “substantial changes in the cleanup action are necessary to protect human health and the environment at the site,” Ecology can require a revised cleanup action plan to be prepared and conducted.

5.1.5 Contingency Actions

Based on the results of the PRDI and PRB pilot study testing and/or depending on the actual performance and longevity of the full-scale PRB (once installed), Ecology will determinate if the final remedy design must be augmented with contingent measures to optimize, supplement, or expand the PRB groundwater treatment portion of the remedial action. At Ecology's direction, Boeing will provide Ecology with a Contingency Action work plan and schedule, and will implement if approved by Ecology.

Ecology may require that a Contingency Action work plan be developed if performance monitoring data indicates that RAOs or cleanup standards are not being met or will not be met in a reasonable time frame or require maintenance to achieve RAOs/cleanup standards at a frequency or extent that is impracticable (e.g., PRB media changeouts over unreasonably short time frames).

The Contingency Action work plan may include optimization or supplemental measures such as:

- Increased width of portions of the PRB for greater groundwater contact time and/or treatment capacity and longevity.
- Addition of supplemental amendments to the PRB media mixture such as pH modifiers or other types of ZVI (e.g., sulfidated ZVI or ZVI with different grain sizes and structures).
- Injections of iron-based liquid amendments (e.g., ferrous sulfate, ferric chloride) within the PRB to increase or supplement performance or treatment capacity, or upgradient of the PRB for pre-treatment/pH adjustment.
- Placement of pre-treatment/pH adjustment media (emplaced or injected) upgradient of the PRB to create more optimal conditions for performance of the PRB or to augment the PRB if certain sections are experiencing premature breakthrough or decreased performance.

The Contingency Action work plan may also include limited soil excavation/upgradient soil removal if it is shown to be needed to meet CULs or significantly improve remedy effectiveness.

5.2 Restoration Timeline

The estimated restoration time frame for the remedial action is approximately 5 years for design and implementation of a PRDI and PRB pilot study; design, construction, and implementation of the PRB and remedial excavations; and demonstration that groundwater CULs are being met at the CPOC. The PRB is assumed to have a treatment duration of at least 10 years and will be replaced as needed based on compliance monitoring results. Institutional controls and long-term monitoring of groundwater and the cap will be implemented to confirm Site conditions are adequately protective until such time as groundwater CULs are met Site-wide (or otherwise directed by Ecology or allowed to be discontinued with Ecology's approval).

5.3 Compliance Monitoring

As specified under WAC 173-340-410, compliance monitoring consists of protection monitoring, performance monitoring, and confirmational monitoring. Compliance monitoring will be conducted prior to, during, and after cleanup action implementation activities.

5.3.1 Protection Monitoring

Protection monitoring will be performed in adherence with the Site-specific HASP to confirm human health and the environment are adequately protected during initial construction/implementation of the remedial excavations and pilot and full-scale PRBs, and during the operation and maintenance period of the cleanup action (e.g., during future replacement of the PRB media).

5.3.2 Performance Monitoring

Performance monitoring will include ongoing groundwater sampling for COCs until groundwater CULs are met at the groundwater CPOC. The specific locations and frequencies of performance monitoring will be provided in the compliance monitoring plan. Performance monitoring will include soil field monitoring to confirm that contaminated soil is removed to the extent practicable. Performance monitoring will be performed in accordance with the project SAP and QAPP.

PRB monitoring will include quarterly groundwater monitoring at monitoring wells upgradient and within the PRB, and at downgradient CPOC wells for 2 years after installation, then transitioning to annual events unless results indicate the need for more frequent monitoring. Prior to a change in monitoring frequency, the monitoring results and rationale for the change will be discussed with, and approved by, Ecology. Site-wide monitoring will be conducted every 5 years in conjunction with 5-year periodic reviews.

The specific locations used for performance monitoring and timing of monitoring will be identified in the compliance monitoring plan and/or EDR.

5.3.3 Confirmational Monitoring

Confirmational monitoring will include soil sampling at the final remedial excavation limits. Excavation soil samples will be collected from the bottom and sidewalls of the excavation to verify that soil CULs are met (where applicable; e.g., soil CULs are not anticipated to be met at the eastern edge of the shoreline remedial excavation where the PRB will be installed).

Site monitoring wells will be used to demonstrate compliance with groundwater CULs. Groundwater confirmational monitoring will include 4 to 8 quarters of monitoring at a representative monitoring well or wells after performance monitoring results indicate CULs are met in groundwater Site-wide unless otherwise approved by Ecology. The specific location(s) used for confirmational monitoring will be identified in the Ecology-approved compliance monitoring plan or a future final confirmational monitoring plan.

Groundwater conditional point of compliance CULs will be considered met when groundwater monitoring wells achieve cleanup standards for a duration specified in the Ecology-approved compliance monitoring plan or as applicable using statistical analysis evaluation of groundwater data in compliance with MTCA (WAC 173-340-720[9][d]). The specific location(s) used for confirmational monitoring and appropriate statistical analysis for CUL compliance will be identified in the Ecology-approved compliance monitoring plan.

6.0 PUBLIC PARTICIPATION

Members of the public will be invited to review and comment on this dCAP during a formal public comment period. Comments received during this period will be entered into the Site's formal record, considered by cleanup staff, and responded to in a responsiveness summary before the cleanup action plan is finalized.

Notice for this comment period will include mailings to nearby businesses and residents, email notification distributed to an email listserv, posting in Ecology's Site Register, website updates, and a newspaper legal advertisement. Contingent on public interest, Ecology may hold a public meeting where detailed information about the Site and the dCAP will be available. Boeing and the Port may be invited to be included in the public participation process for the Boeing Isaacson-Thompson Site.

7.0 SCHEDULE FOR IMPLEMENTATION

Following finalization of the CAP and execution of the implementing Agreed Order between Ecology and Boeing, the Site cleanup will be implemented in phases, including institutional controls and environmental covenants, PRDI and pilot study, engineering and design, and performance and compliance monitoring. As applicable, Boeing will coordinate with EPA and inform Ecology about remedial action activities that could impact the LDW sediment cleanup work. The planned implementation sequence is summarized as follows:

- A PRDI and PRB pilot study work plan will be prepared, reviewed and approved by Ecology, and implemented.
- A compliance monitoring plan for long-term monitoring will be prepared.
- Institutional controls will be implemented, and a restrictive environmental covenant will be filed.
- An EDR report will be prepared along with engineering designs, construction plans and specifications, and a compliance monitoring plan.
- Construction and implementation of the remedial excavations and PRB.
- Restoration time frames will be re-evaluated periodically during implementation of the PRB and associated compliance monitoring.

Boeing will adhere to the schedule below unless Ecology grants or approves of an extension for any specific activity as detailed in the Agreed Order. Additionally, the below schedule has been developed in consideration of, and to allow coordination with, EPA related to the LDW Superfund Cleanup; and is also subject to change for this reason. This is reflected in the below by a separation in the schedule for design documents and implementation of certain components of the remedial action. Boeing will coordinate the cleanup with EPA and inform Ecology of any necessary changes. Note that documents are considered to be Agency Review Drafts until Ecology has approved them as Final.

Activity	Approximate Anticipated Schedule
Quarterly Progress Reports	Quarterly on the 10th of the month beginning after the first full calendar quarter after the effective date of the Agreed Order
Financial Assurance Cost Estimate	Within 60 days of the effective date of the Consent Decree
Proof of Financial Assurance	Within 60 days of Ecology approval of the Financial Assurance Cost Estimate
Financial Assurance Documentation Updated for Inflation	Annually, as per Section 7.4 in the Agreed Order
Submit Agency Review PRDI and PRB Pilot Study Work Plan to Ecology	120 days after the effective date of the Agreed Order

Activity	Approximate Anticipated Schedule
Submit Final PRDI and PRB Pilot Study Work Plan to Ecology	60 days after receipt of Ecology review comments for Agency Review PRDI and PRB Pilot Study Plan
Submit Agency Review EDR for Shoreline and Observed Tar-Like Substance Area Remedial Excavation	120 days after the effective date of the Agreed Order
Submit Final EDR for Shoreline and Observed Tar-Like Substance Area Remedial Excavation	60 days after receipt of Ecology review comments for EDR for Shoreline Remedial Excavation
Complete PRDI and Construction/Implementation of PRB Pilot Study and Groundwater Monitoring and Submit Draft Completion Report to Ecology	18 months after Ecology approval of Final PRDI and PRB Pilot Study Plan
Submit Final PRDI/PRB Pilot Study Completion Report to Ecology	30 days after receipt of Ecology review comments on Completion Report
Submit Agency Review EDR for Full Scale PRB and Compliance Monitoring Plan (for long-term monitoring) to Ecology	6 months after Ecology approval of PRDI and PRB Pilot Study Completion Report
Submit Final EDR for Full Scale PRB and Compliance Monitoring Plan to Ecology	90 days after Ecology review comments for Agency Review Engineering Design Report and Compliance Monitoring Plan
Submit Agency Review Environmental Covenants to Ecology for Boeing Isaacson-Thompson Properties and Port Property	6 months after Ecology approval of the Final EDR for Full Scale PRB and Compliance Monitoring Plan
Environmental Covenants for Boeing Isaacson-Thompson Properties Filed with King County	60 days following Boeing and Ecology signing of Environmental Covenants
Environmental Covenants for Port Property Filed with King County	60 days following Port and Ecology signing of Environmental Covenants
Complete Remedial Excavation at Shoreline and Observed Tar-Like Substance Area	Within the next fish window for in-water work (October 1 – February 15), following Ecology-approval of the final EDR for Shoreline Remedial Excavation
Complete Full Scale PRB Construction and Initiate Compliance Monitoring	6 months after Ecology approval of Final EDR for Full Scale PRB
Submit Long-Term Compliance Monitoring Reports	60 days after analytical data reports are received and validation is complete

8.0 REFERENCES

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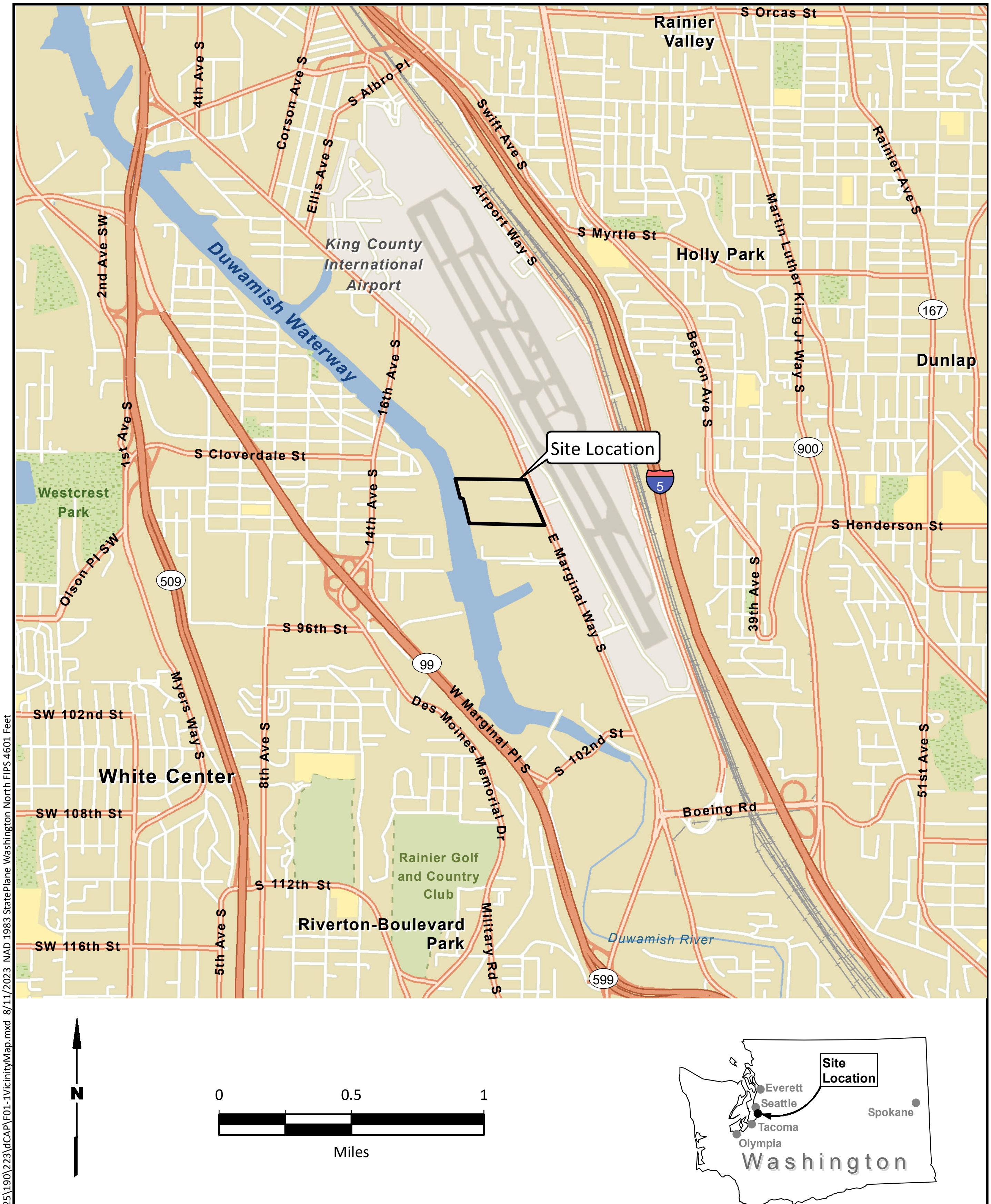
Landau. 2023. Feasibility Study Report, Final—For Public Review (Revision 1), Isaacson-Thompson Site, Tukwila, Washington. Landau Associates, Inc. July 5.



Data Source: Esri.

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Boeing Isaacson-Thompson Site Tukwila, Washington	**Vicinity Map**	Figure 1-1

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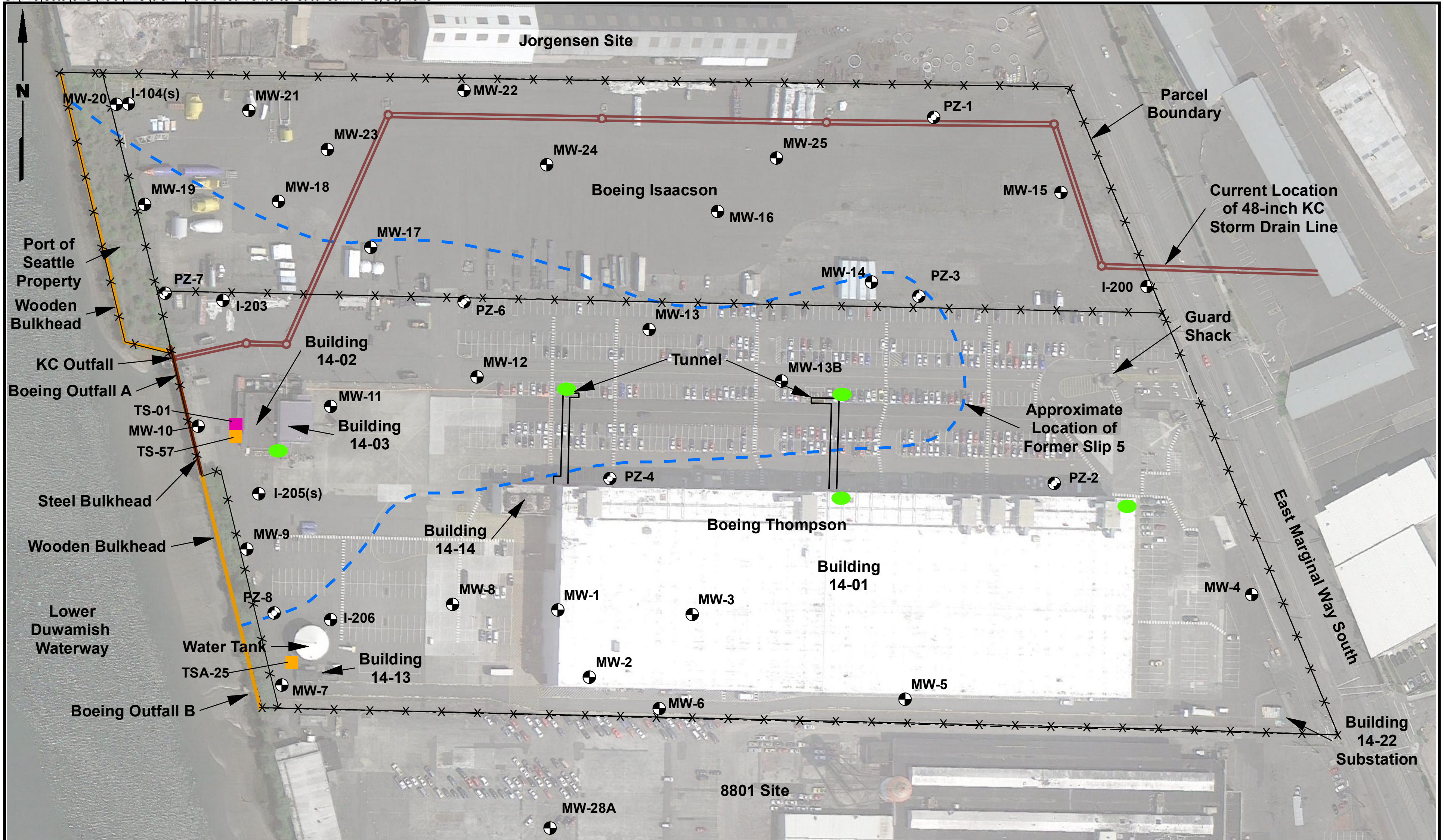

Legend

- Monitoring Well
- Piezometer
- Approximate Location of Former Slip 5
- Fence
- Aboveground Storage Tank
- Underground Storage Tank
- Sump

0 200 400

Scale in Feet

Note

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

Data Sources: Google Earth Pro 2012; King County Parcel Data.

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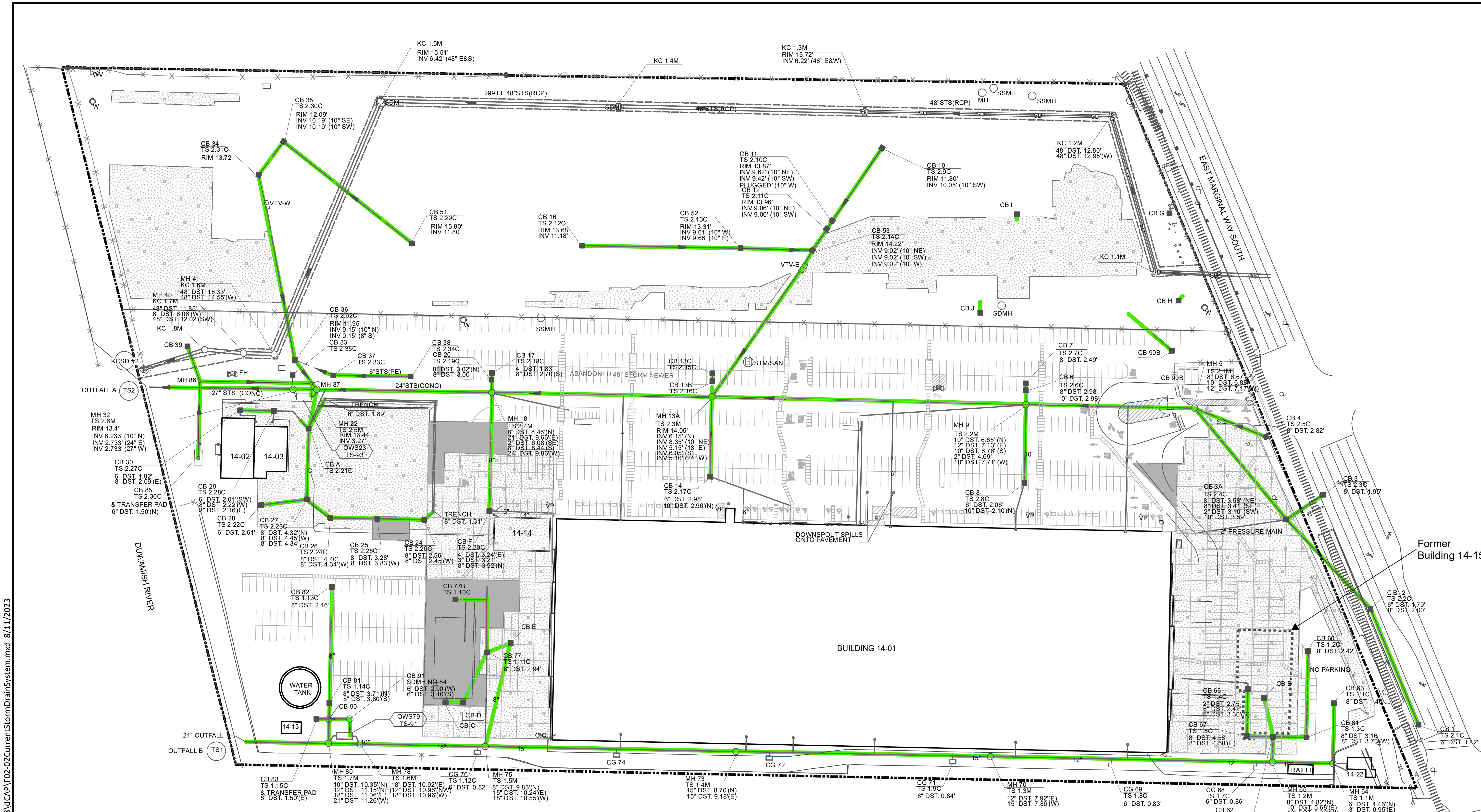
Boeing Isaacson-Thompson Site Tukwila, Washington	**Current Site Features**	Figure 2-1



Legend

- Existing Catch Basin
- Existing Storm Drain Line
- Boeing Property Boundary
- New Concrete (Replaced 2011)
- Concrete Area
- Former Building

Notes

1. See Figure 2-1 for fence locations.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Boeing 2012

0 120 240

Scale in Feet

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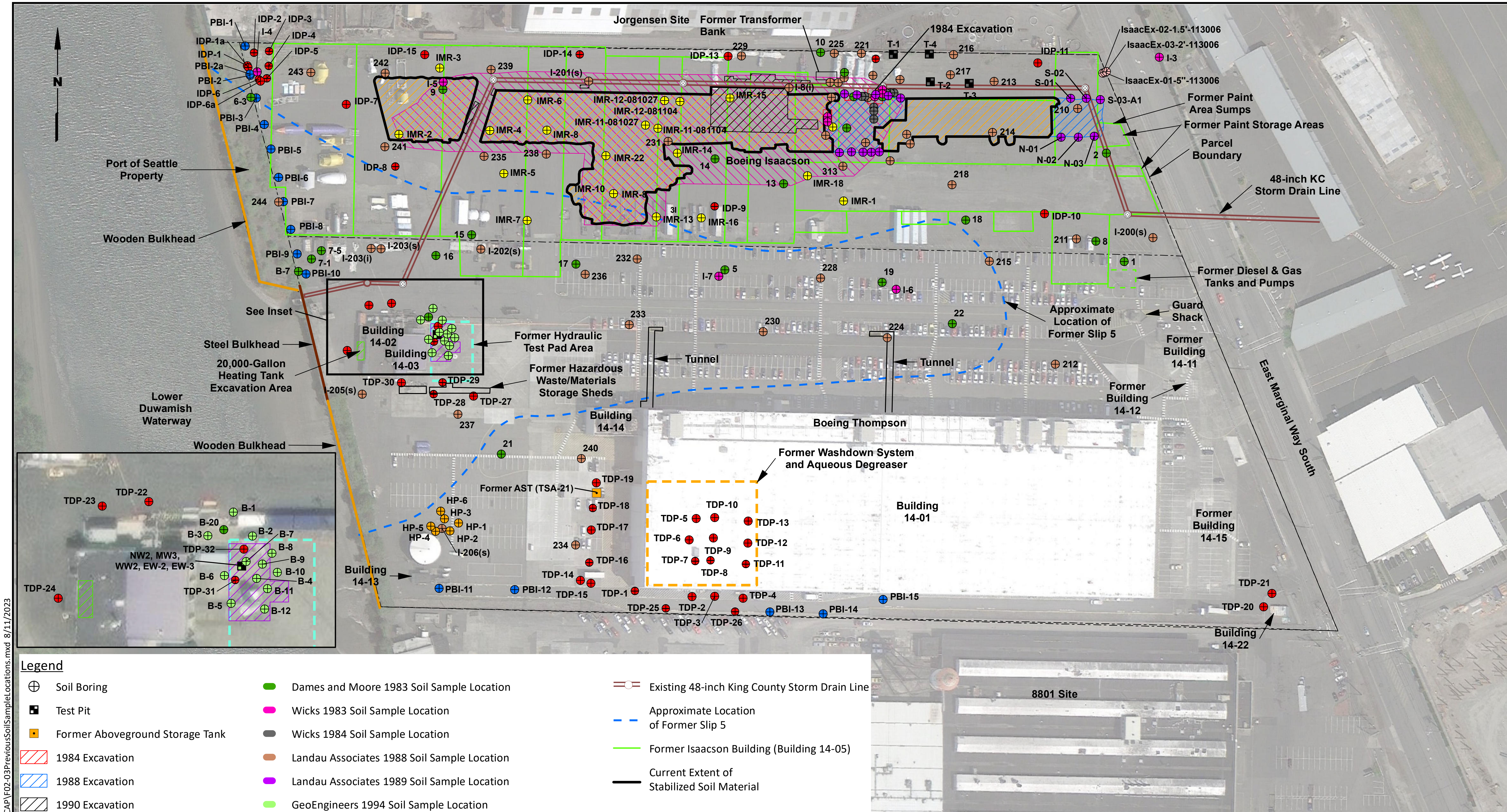
Boeing Isaacson-Thompson Site
Tukwila, Washington

Current Storm Drain System

Figure 2-2



Legend

- Soil Boring
- Test Pit
- Former Aboveground Storage Tank
- 1984 Excavation
- 1988 Excavation
- 1990 Excavation
- 1991 Excavation
- 1993-1995 Excavation
- 2004 Excavation
- 2008 Removal of Stabilized Soil Mound
- Dames and Moore 1983 Soil Sample Location
- Wicks 1983 Soil Sample Location
- Wicks 1984 Soil Sample Location
- Landau Associates 1988 Soil Sample Location
- Landau Associates 1989 Soil Sample Location
- GeoEngineers 1994 Soil Sample Location
- GeoEngineers 1996 Soil Sample Location
- Landau Associates 2006 Soil Sample Location
- Landau Associates 2009 Post-Excavation Soil Sample Location
- Landau Associates 2008/2009 Phase II ESA Soil Sample Location
- Landau Associates 2009 Property Boundary Soil Sample Location
- Existing 48-inch King County Storm Drain Line
- Approximate Location of Former Slip 5
- Former Isaacson Building (Building 14-05)
- Current Extent of Stabilized Soil Material

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

Data Sources: Google Earth Pro, 2012; King County Parcel Data

0 150 300
Scale in Feet

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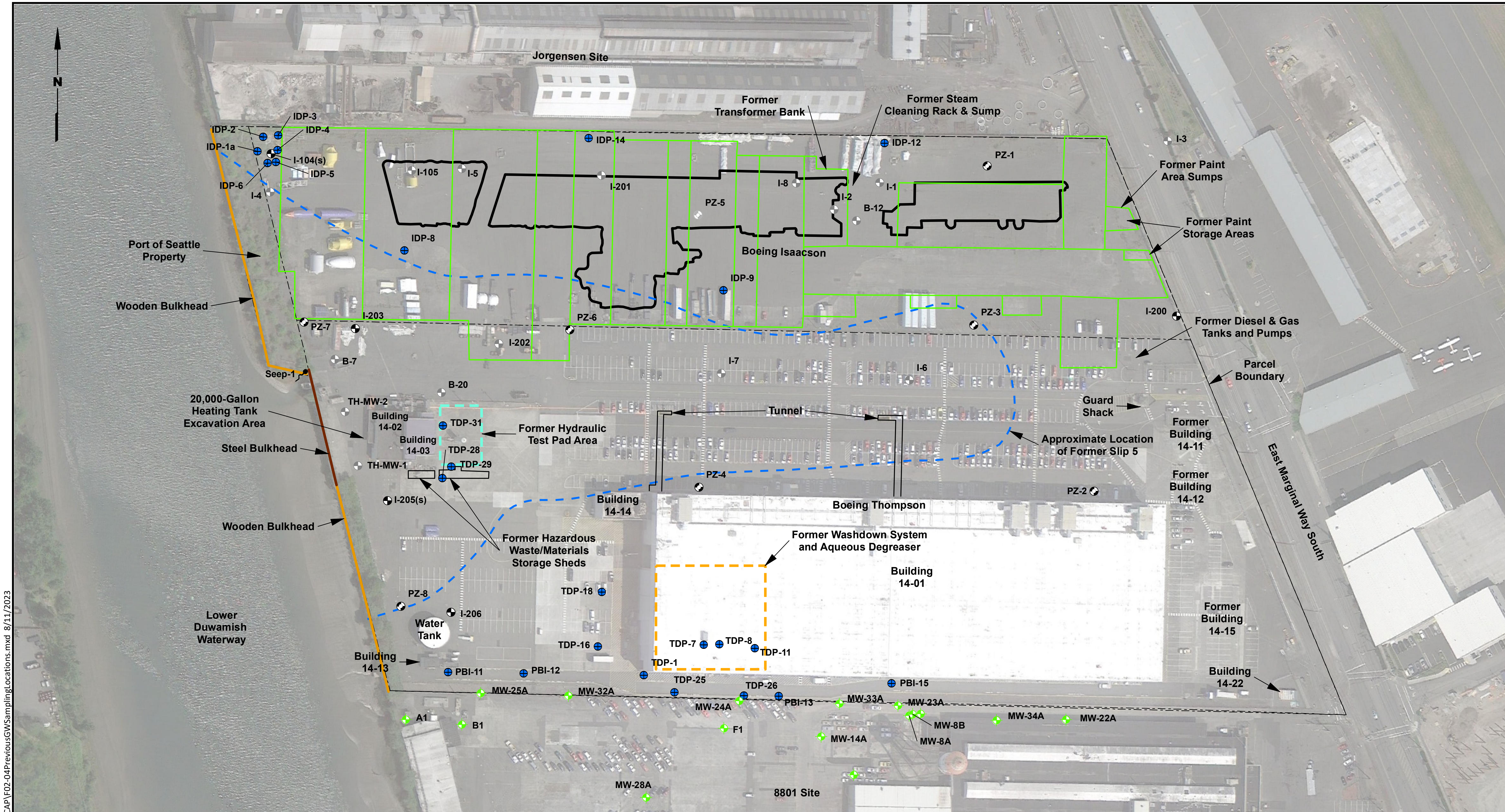
Boeing Isaacson-Thompson Site
Tukwila, Washington

Pre-Remedial Investigation
Soil Sampling Locations

Figure
2-3



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Legend

- Direct-Push Groundwater Sample Location
- Existing Monitoring Well Location
- Existing Piezometer Location
- Decommissioned or Destroyed Monitoring Well
- 8801 Site Groundwater Sampling Locations
- Seep
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material
- Former Isaacson Building/Building 14-05

0 150 300
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

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

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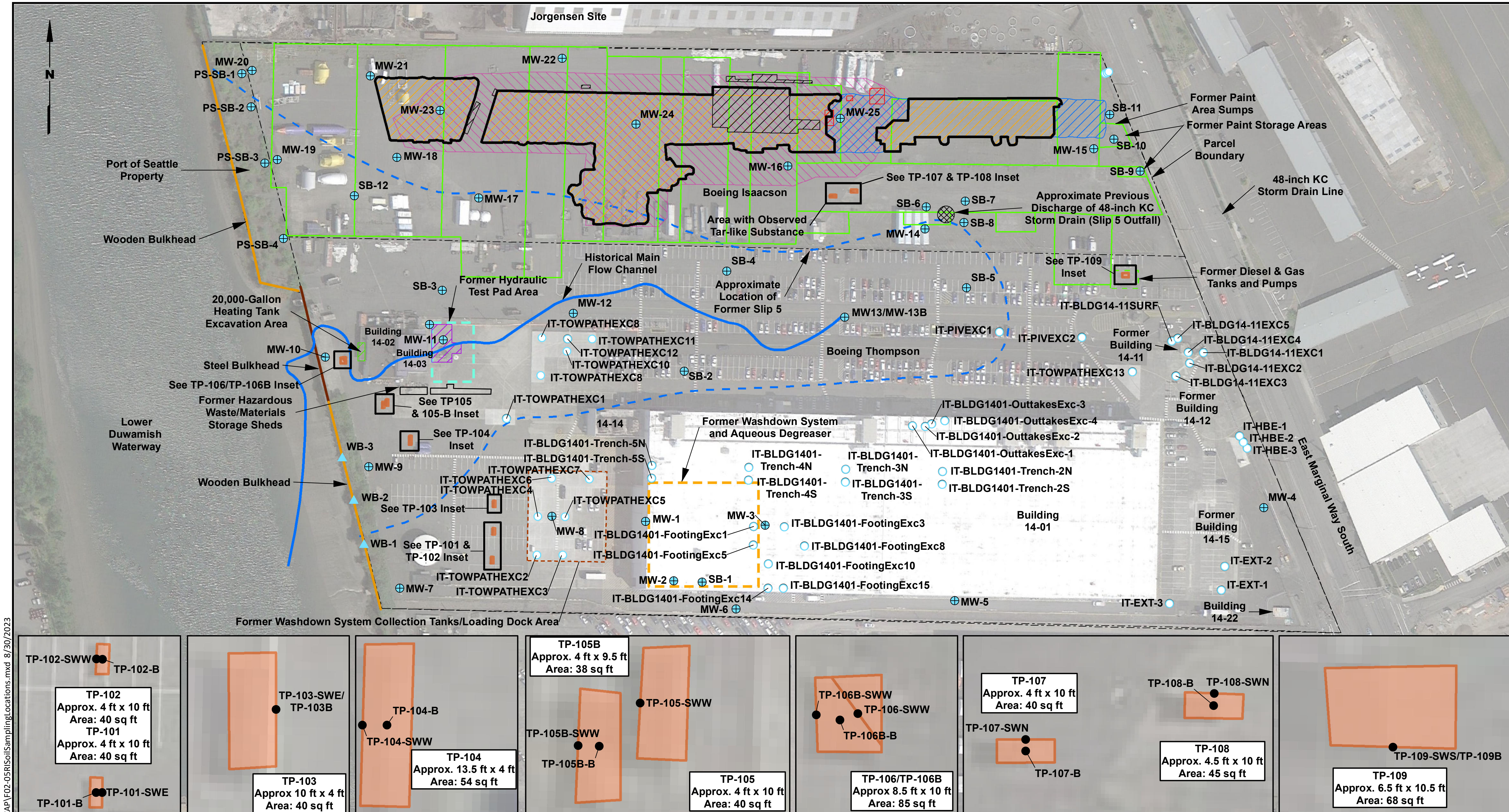
Boeing Isaacson-Thompson Site
Tukwila, Washington

Pre-Remedial Investigation Groundwater Monitoring Locations

Figure
2-4



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Legend

- RI Soil Boring Sample Location
- RI Test Pit Soil Sampling Location
- RI Construction-Related Soil Sample Location
- RI Wooden Bulkhead Sample Location
- 1984 Excavation
- 1988 Excavation
- 1990 Excavation
- 1991 Excavation
- 1993-1995 Excavation
- 2004 Excavation
- 2008 Removal of Stabilized Soil Mound
- Former Isaacson Building/ Building 14-05
- Current Extent of Stabilized Soil Material
- Historical Main Flow Channel
- Approximate Location of Former Slip 5

0 150 300

Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

Notes

1. MW-13/MW-13B borings were advanced, but no wells were installed at these locations because of an obstruction. The actual monitoring well MW-13 was installed near boring location SB-4.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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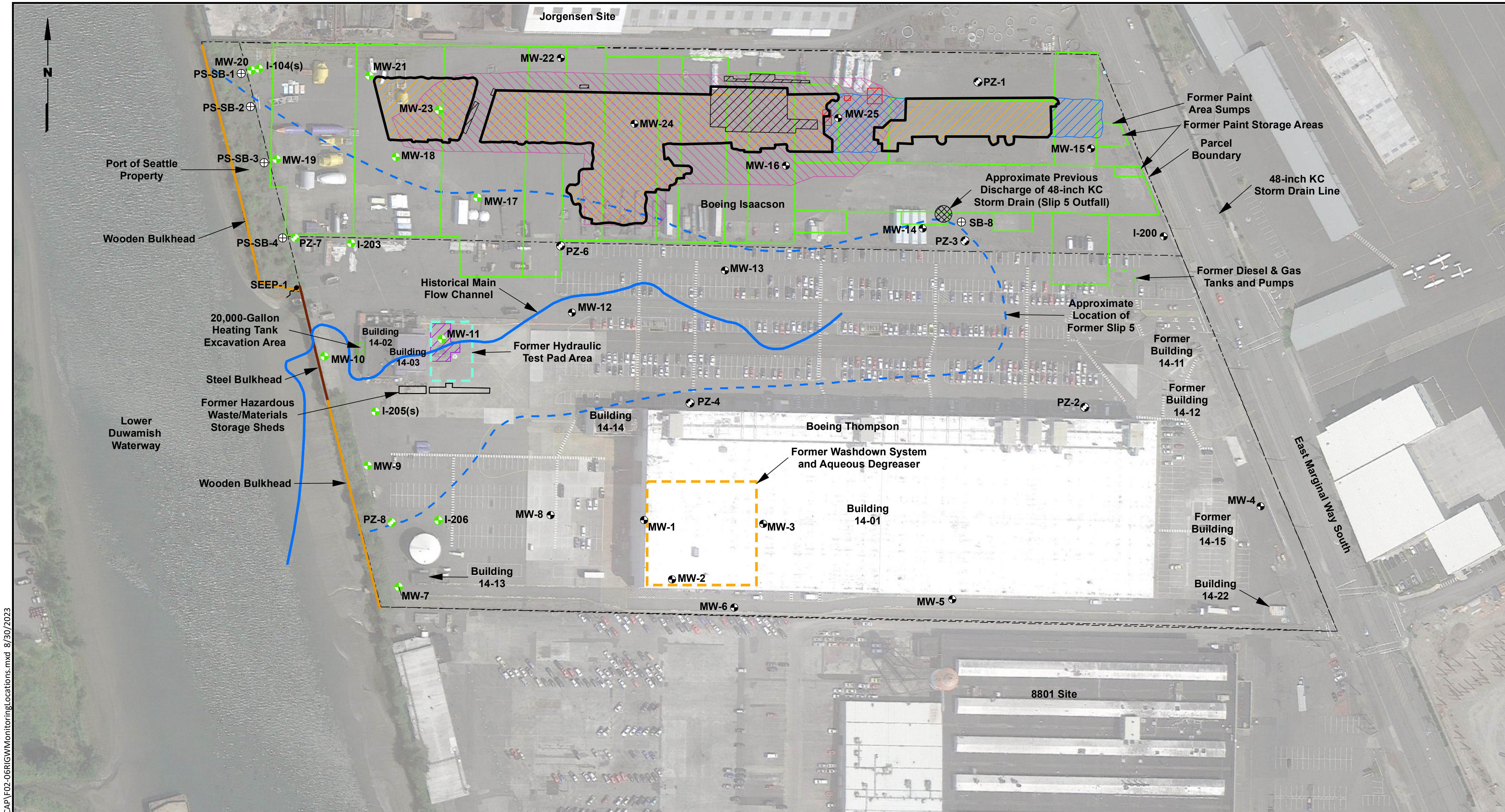
Boeing Isaacson-Thompson Site
Tukwila, Washington

RI Soil Sampling Locations

Figure
2-5



Legend

- MW-22 Monitoring Well Location
- MW-10 Monitoring Well Location Where Groundwater Sampling Occured 1 Hour Before Low Tide and 1 Hour After a 0.0 Tide
- PZ-1 Piezometer Location
- PZ-7 Piezometer Location Where Groundwater Sampling Occured 1 Hour Before Low Tide and 1 Hour After a 0.0 Tide
- SB-8 Direct-Push Boring Groundwater Sample Location
- SEEP-1 Seep
- 1984 Excavation
- 1988 Excavation
- 1990 Excavation
- 1991 Excavation
- 1993-1995 Excavation
- 2004 Excavation
- 2008 Removal of Stabilized Soil Mound
- Current Extent of Stabilized Soil Material
- Former Isaacson Building (Building 14-05)
- Approximate Location of Former Slip 5
- Historical Main Flow Channel

0 150 300

Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

Note

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

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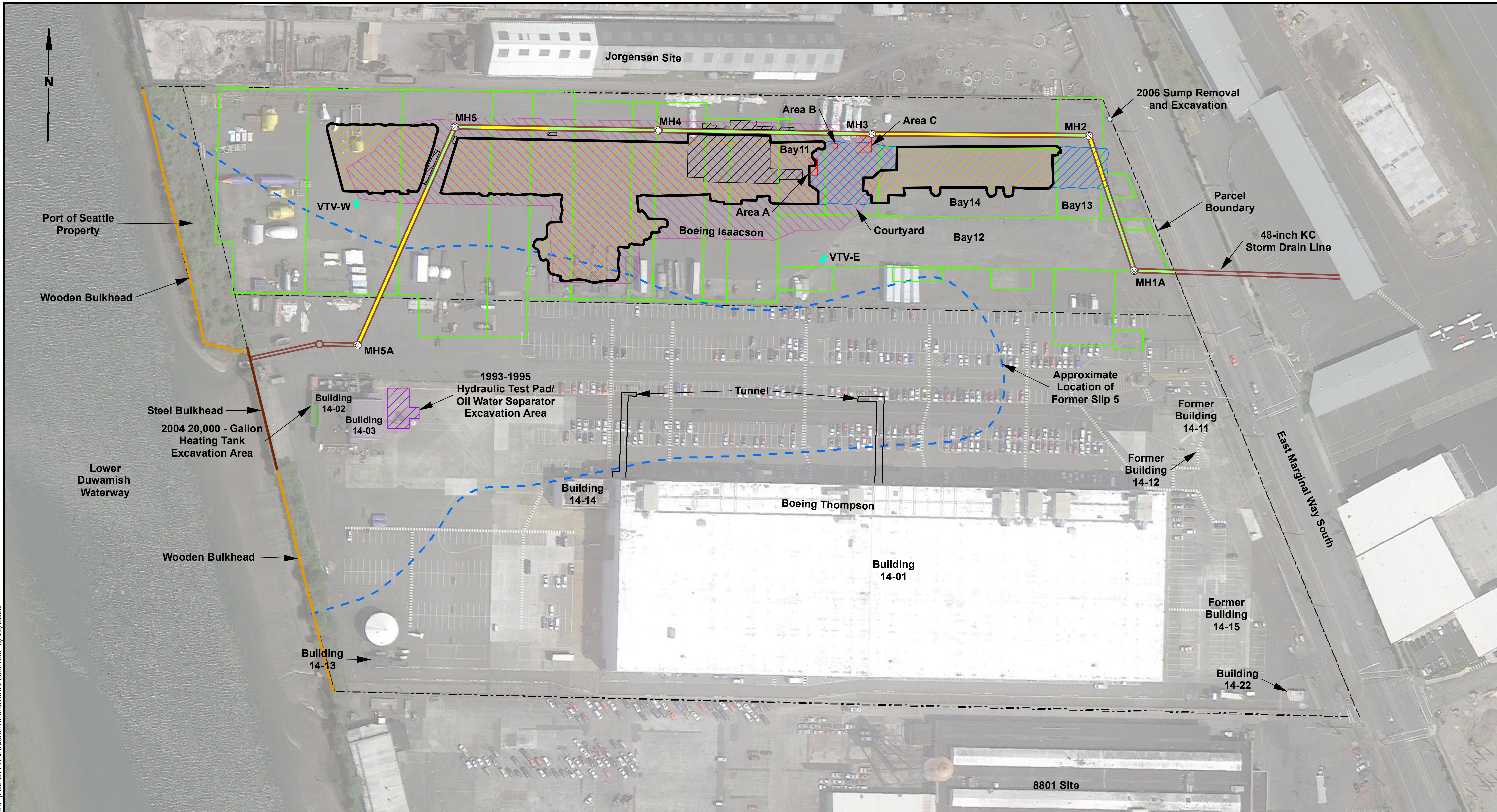
Boeing Isaacson-Thompson Site Tukwila, Washington	**RI Groundwater Monitoring Locations**	Figure 2-6



Legend

- 1984 Excavation
- 1988 Excavation
- 1990 Excavation
- 1991 Excavation
- 1993-1995 Excavation
- 2004 Excavation
- 2008 Removal of Stabilized Soil Mound
- Vortechs Treatment System Vaults
- Approximate Location of Former Slip 5
- Former Isaacson Building/ Building 14-05
- Backfilled with Imported Soil
- Backfilled with Site Excavated Soil < 500 ppm Arsenic
- Current Extent of Stabilized Soil Material

0 130 260

Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

Note

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

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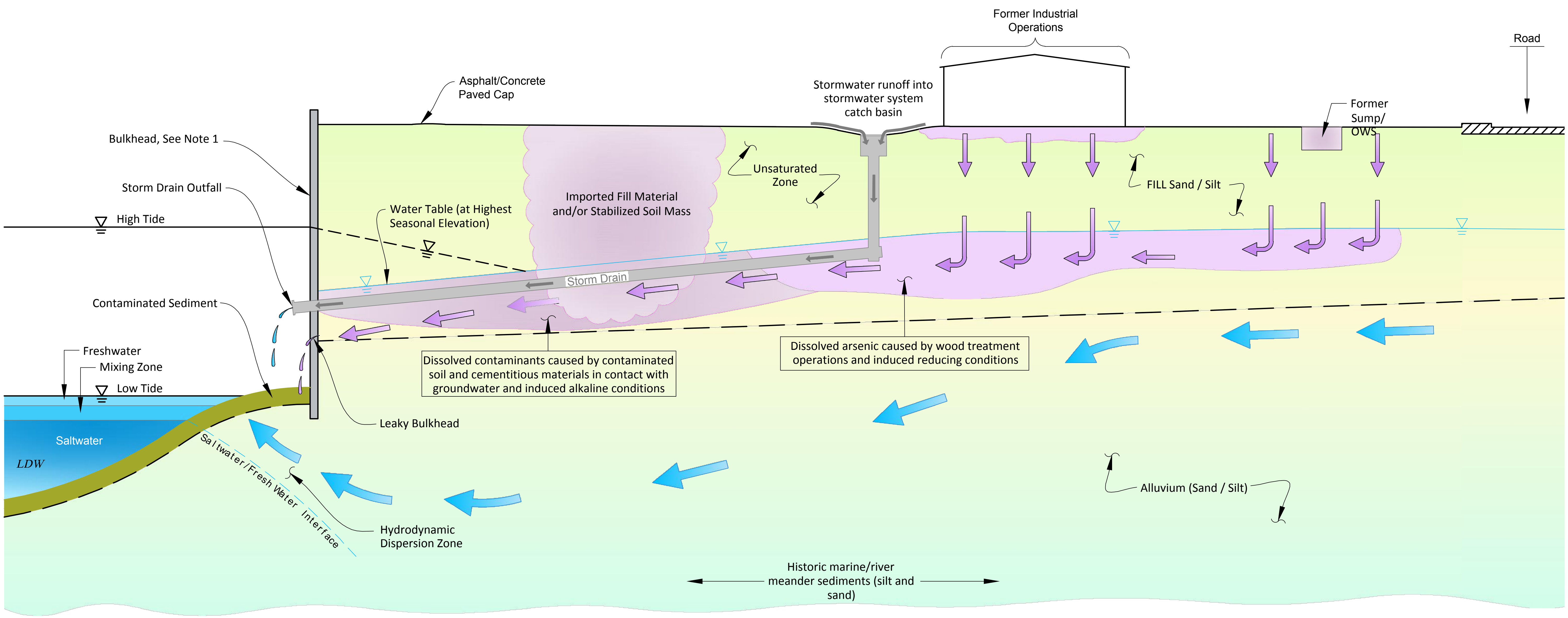
Boeing Isaacson-Thompson Site Tukwila, Washington	**Previous Remediation Areas**	Figure 2-7



Legend

- Water Table
- Tidally Influenced Water Level
- Conceptual Boundary Between Stratigraphic Units
- Potential Transport of Dissolved Contaminants
- Potential Transport of Dissolved Contaminants

Notes

1. Gaps in portions of the wooden bulkhead (which is not a solid structure) that may allow groundwater seepage through holes.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Summary of Potential Receptors and Exposure Pathways

Contaminated Media	Potential Receptors			Potential Exposure Pathways		
	Human	Terrestrial Ecological	Aquatic Ecological	Direct Contact	Ingestion	Inhalation
Soil	✓			✓(a)		
Ground Water	✓			✓(b)	O	
Surface Water	✓	✓	✓	✓	✓(d)	
Sediment (c)	✓	✓	✓	✓	✓(d)	
Soil Gas/Air	✓					O

Notes

(a) Site soil covered with asphalt/concrete cap or buildings, exposure risk only for utility workers during intrusive activities.

(b) Shallow groundwater exposure risk for construction workers is present during intrusive activities

(c) Note that while stormwater/stormwater solids from the onsite stormwater management system and sediments adjacent to the Site were investigated during the remedial investigation (RI), any necessary source control and/or cleanup thereof will be addressed under the requirements of the site Industrial Stormwater General Permit (ISGP) or Lower Duwamish Waterway (LDW) sediment cleanup.

(d) Direct uptake or consumption of aquatic organisms.

Abbreviations and Acronyms

√ = potential receptor / complete exposure pathway
O = incomplete exposure pathway
Blank = no applicable receptors or exposure pathways

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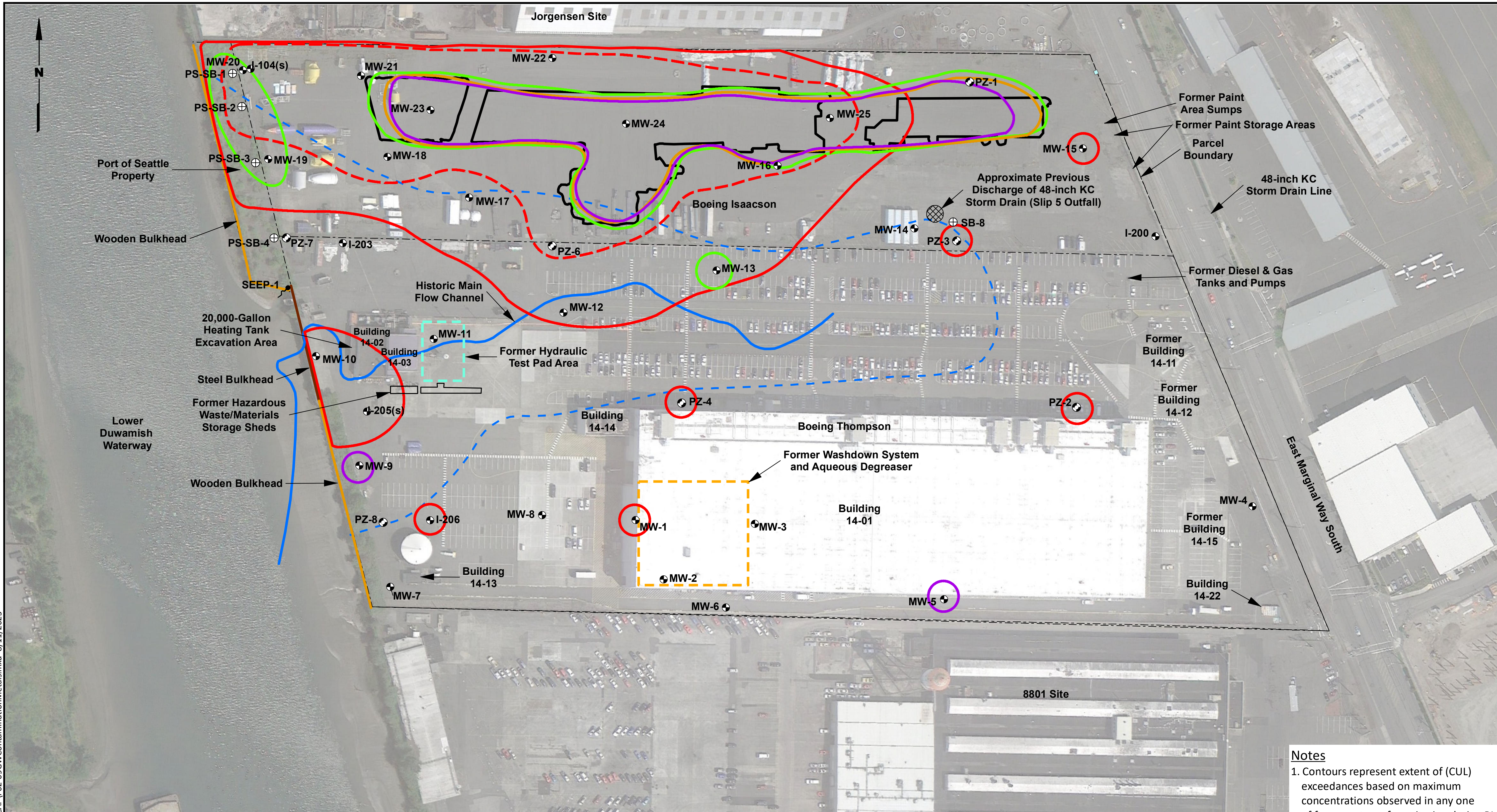
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Conceptual Site Model

Figure 2-8



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Legend

SB-8	Direct-Push Boring Groundwater Sample Location		Current Extent of Stabilized Soil Material
MW-22	Monitoring Well Location		
PZ-1	Piezometer Location		
SEEP-1	Seep Location		

Groundwater Contamination

- As > 100X CUL (800 µg/L)
- As > CUL (8 µg/L)
- Cu > CUL (3.1 µg/L)
- Ni > CUL (8.2 µg/L)
- Zn > CUL (81 µg/L)

0 150 300
Scale in Feet

Notes
1. Contours represent extent of (CUL) exceedances based on maximum concentrations observed in any one of four quarters of monitoring during RI (December 2011 - September 2012).
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data

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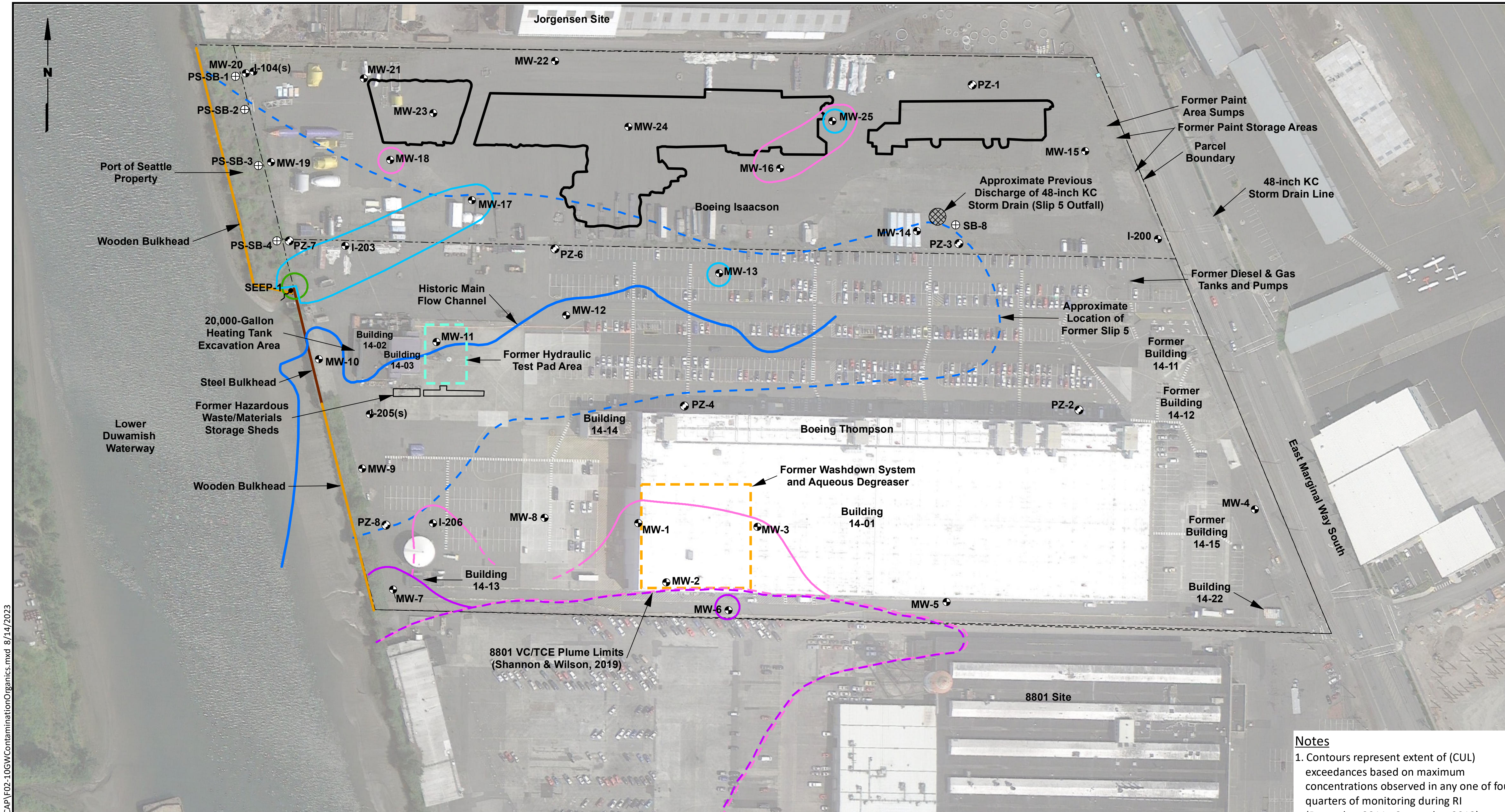
Boeing Isaacson-Thompson Site
Tukwila, Washington

Extent of Metals Contamination in Groundwater

Figure 2-9



Notes
1. Contours represent extent of (CUL) exceedances based on maximum concentrations observed in any one of four quarters of monitoring during RI (December 2011 - September 2012).
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

⊕ MW-22	Monitoring Well Location	
PZ-1	Piezometer Location	
⊕ SB-8	Direct-Push Boring Groundwater Sample Location	
SEEP-1	Seep Location	

Current Extent of Stabilized Soil Material

Approximate Location of Former Slip 5

Groundwater Contamination

- PCBs > CUL (0.01 µg/L)
- cPAH (TEQ) > CUL (0.048 µg/L)
- TCE > CUL (0.7 µg/L)
- VC > CUL (0.18 µg/L)

0 150 300
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Shannon & Wilson, 2019

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Boeing Isaacson-Thompson Site Tukwila, Washington	**Extent of Organic Chemical Contamination in Groundwater**	Figure 2-10

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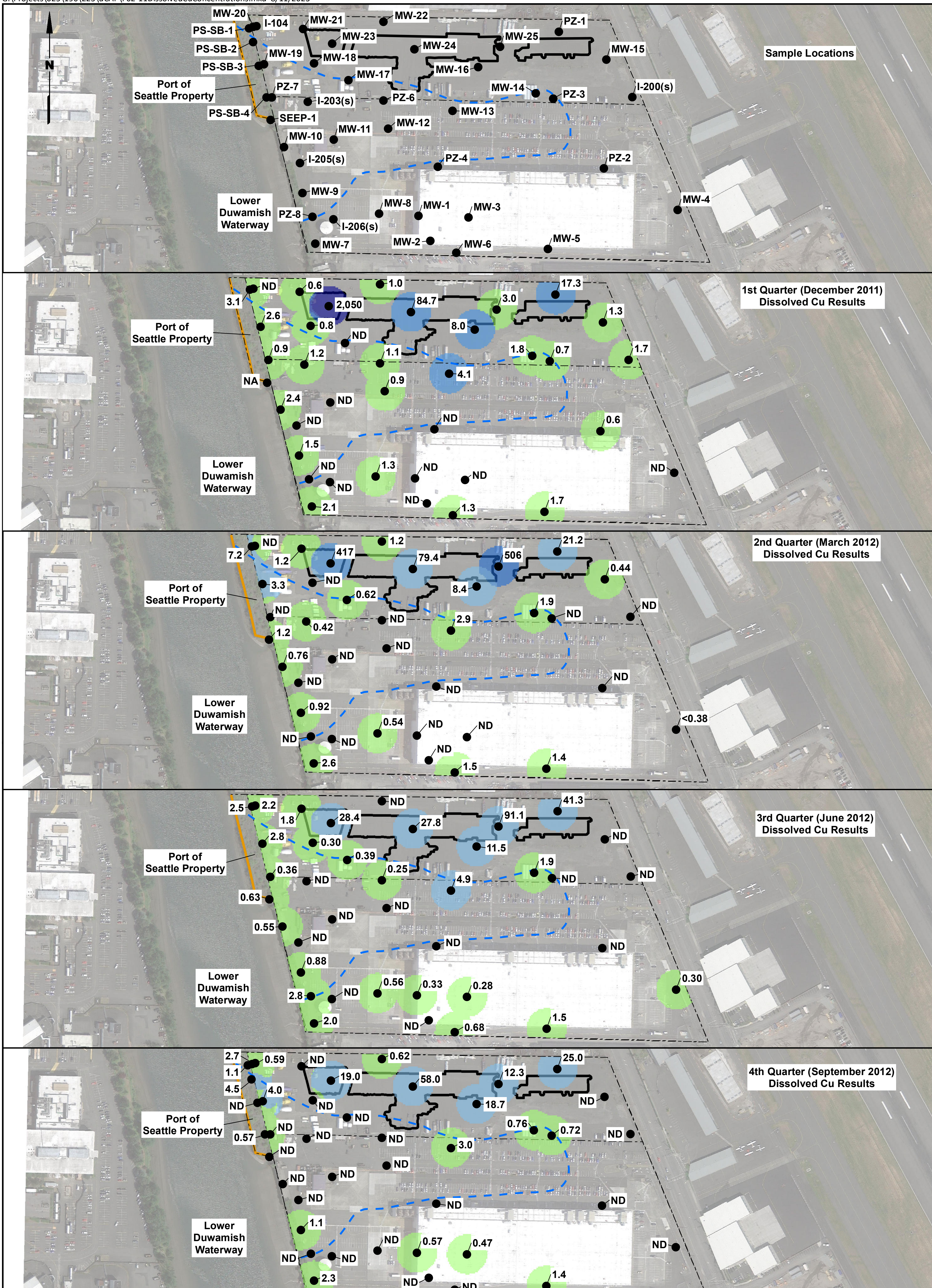


Legend

- ● Groundwater Sampling Locations
- - - Approximate Location of Former Slip 5
- ── Current Extent of Stabilized Soil Material

Detected Concentrations (µg/L)

- ≤3.1 (CUL)
- 3.1-100
- 100-500
- 500-1,000
- 1,000+

Notes

1. All results shown are reported in µg/L.
2. The cleanup level for copper in groundwater is 3.1 µg/L.
3. Groundwater samples from direct push borings were collected on the Port Property on 8/27/2013.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 350 700
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

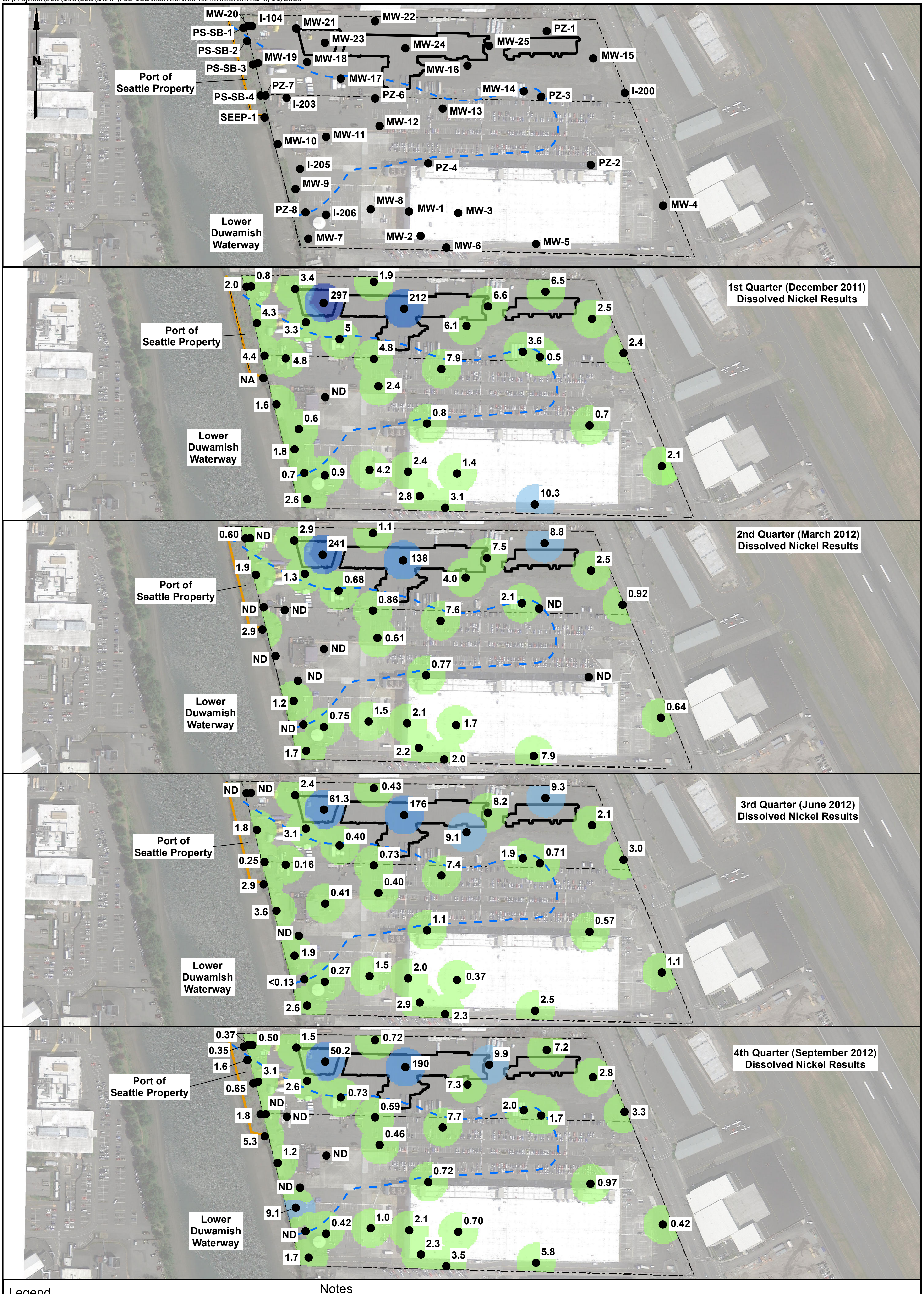
LANDAU ASSOCIATES

Boeing
Isaacson-Thompson Site
Tukwila, Washington

Dissolved Copper Concentrations in Groundwater

Figure
2-11

G:\Projects\025\190\223\dCAP\F02-12DissolvedNiConcentrations.mxd 8/11/2023



Legend

- Groundwater Sampling Locations
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Detected Concentrations (µg/L)

- ≤8.2 (CUL)
- 8.2-15
- 15-200
- 200-275
- 275+

Notes

1. All results shown are reported in µg/L.
2. The cleanup level for nickel in groundwater is 8.2 µg/L.
3. Groundwater samples from direct push borings were collected on the Port Property on 8/27/2013.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 350 700
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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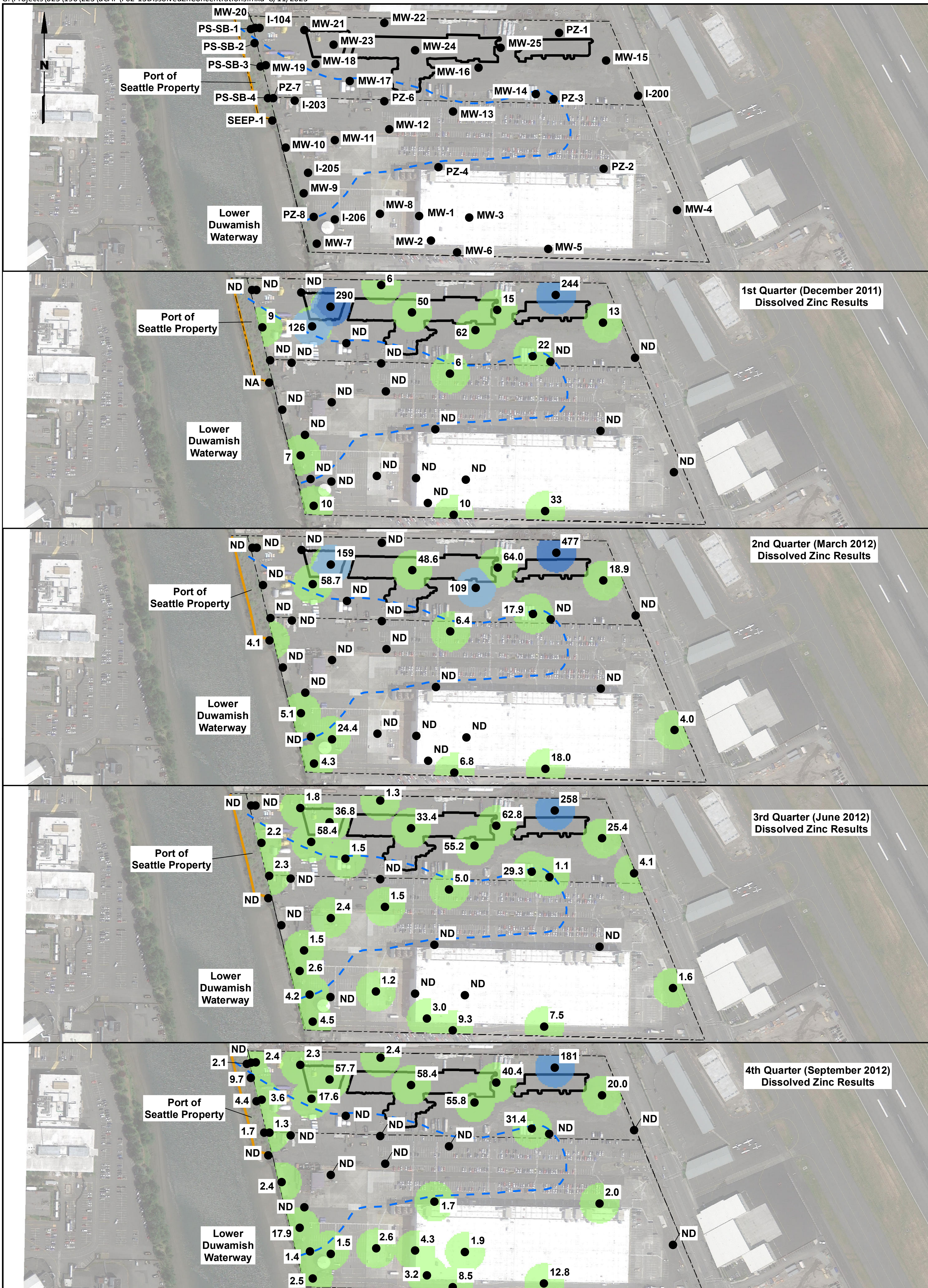
Boeing Isaacson-Thompson Site Tukwila, Washington	**Dissolved Nickel Concentrations in Groundwater**	Figure 2-12

G:\Projects\025\190\223\dCAP\F02-13DissolvedZnConcentrations.mxd 8/11/2023



Legend

- Groundwater Sampling Locations
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Detected Concentrations (µg/L)

- ≤81 (CUL)
- 81-165
- 165-265
- 265-365
- 365+

Notes

1. All results shown are reported in µg/L.
2. The cleanup level for zinc in groundwater is 81 µg/L.
3. Groundwater samples from direct push borings were collected on the Port Property on 8/27/2013.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 350 700

Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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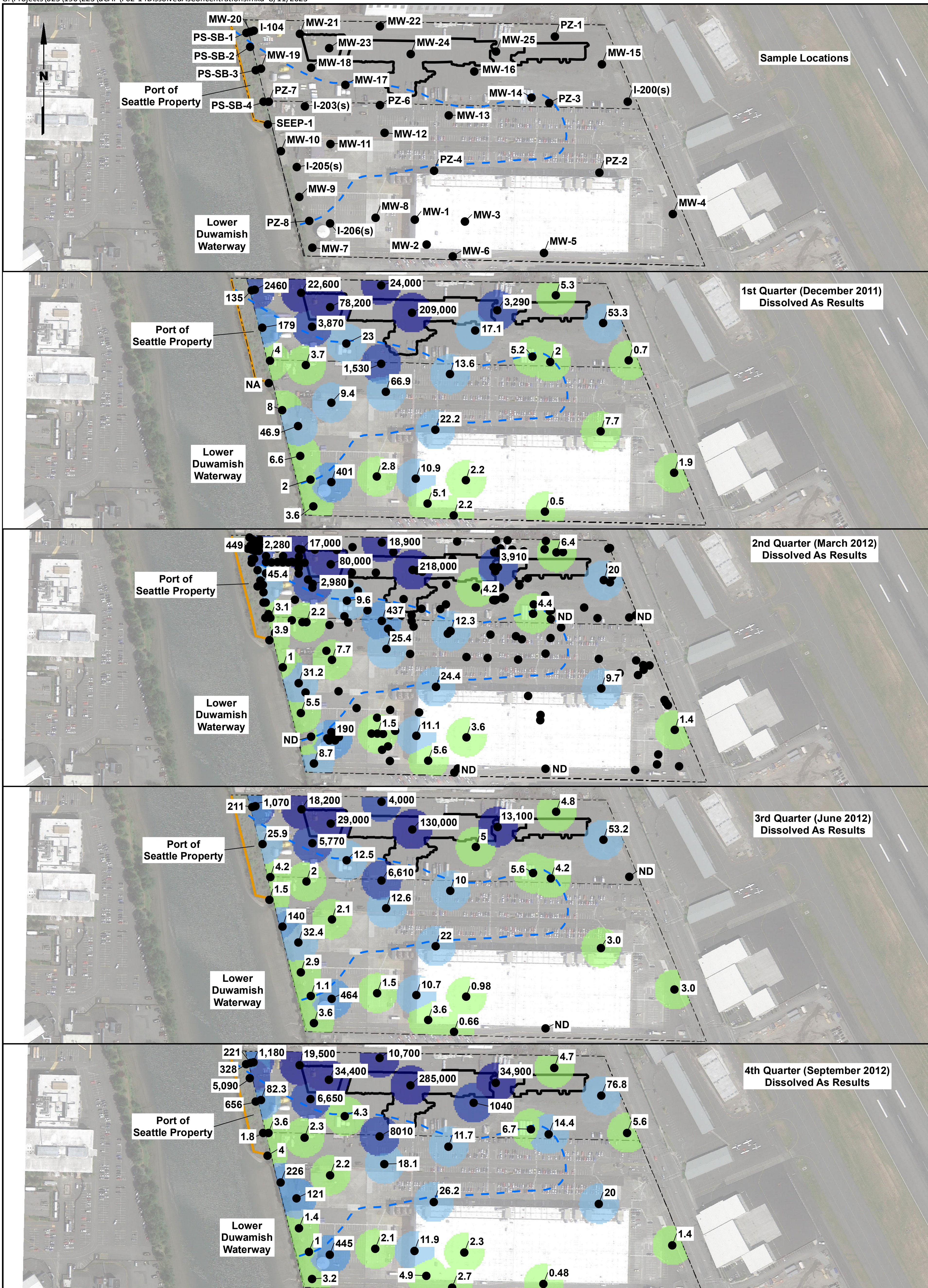
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Dissolved Zinc Concentrations in Groundwater

Figure 2-13

G:\Projects\025\190\223\dCAP\F02-14DissolvedAsConcentrations.mxd 8/11/2023



Legend

- ● Groundwater Sampling Locations
- Approximate Location of Former Slip 5 (dashed blue line)
- Current Extent of Stabilized Soil Material (solid black line)

Detected Concentrations (µg/L)

- ≤8 µg/L (CUL)
- 8-100 µg/L
- 100-500 µg/L
- 500-1,000 µg/L
- 1000-10,000 µg/L
- 10,000+ µg/L

Notes

1. All results shown are reported in µg/L.
2. The cleanup level for arsenic in groundwater is 8 µg/L.
3. Groundwater samples from direct push borings were collected on the Port Property on 8/27/2013.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 350 700

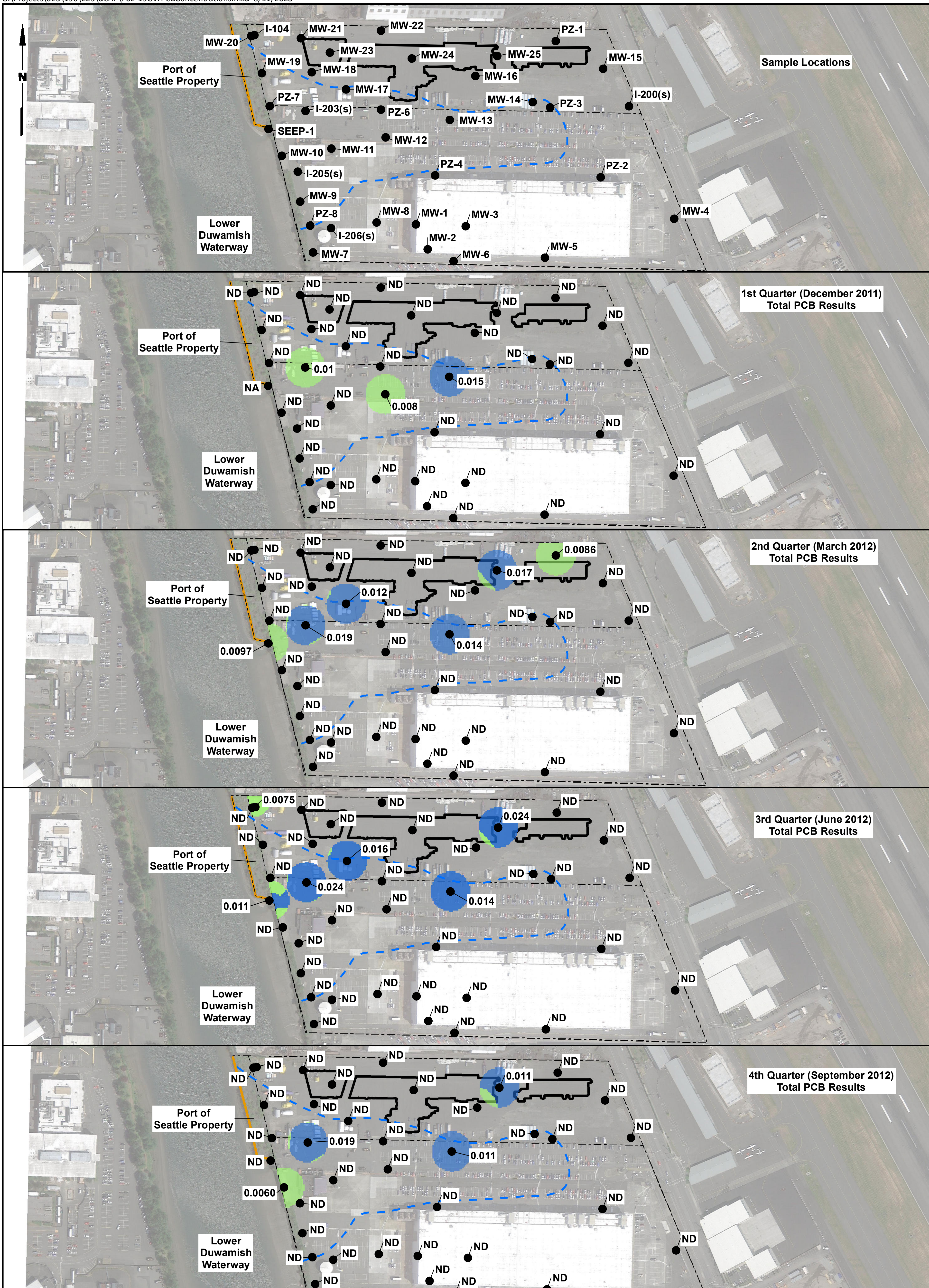
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

LANDAU ASSOCIATES

Boeing Isaacson-Thompson Site Tukwila, Washington	**Dissolved Arsenic Concentrations in Groundwater**	Figure 2-14

G:\Projects\025\190\223\dCAP\F02-15GWPCBConcentrations.mxd 8/11/2023



Legend

- Groundwater Sampling Locations
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Detected Concentrations (µg/L)

- ≤0.01 µg/L (CUL)
- 0.01+

Notes

1. All results shown are reported in µg/L.
2. The cleanup level for total PCBs in groundwater is 0.01 µg/L.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

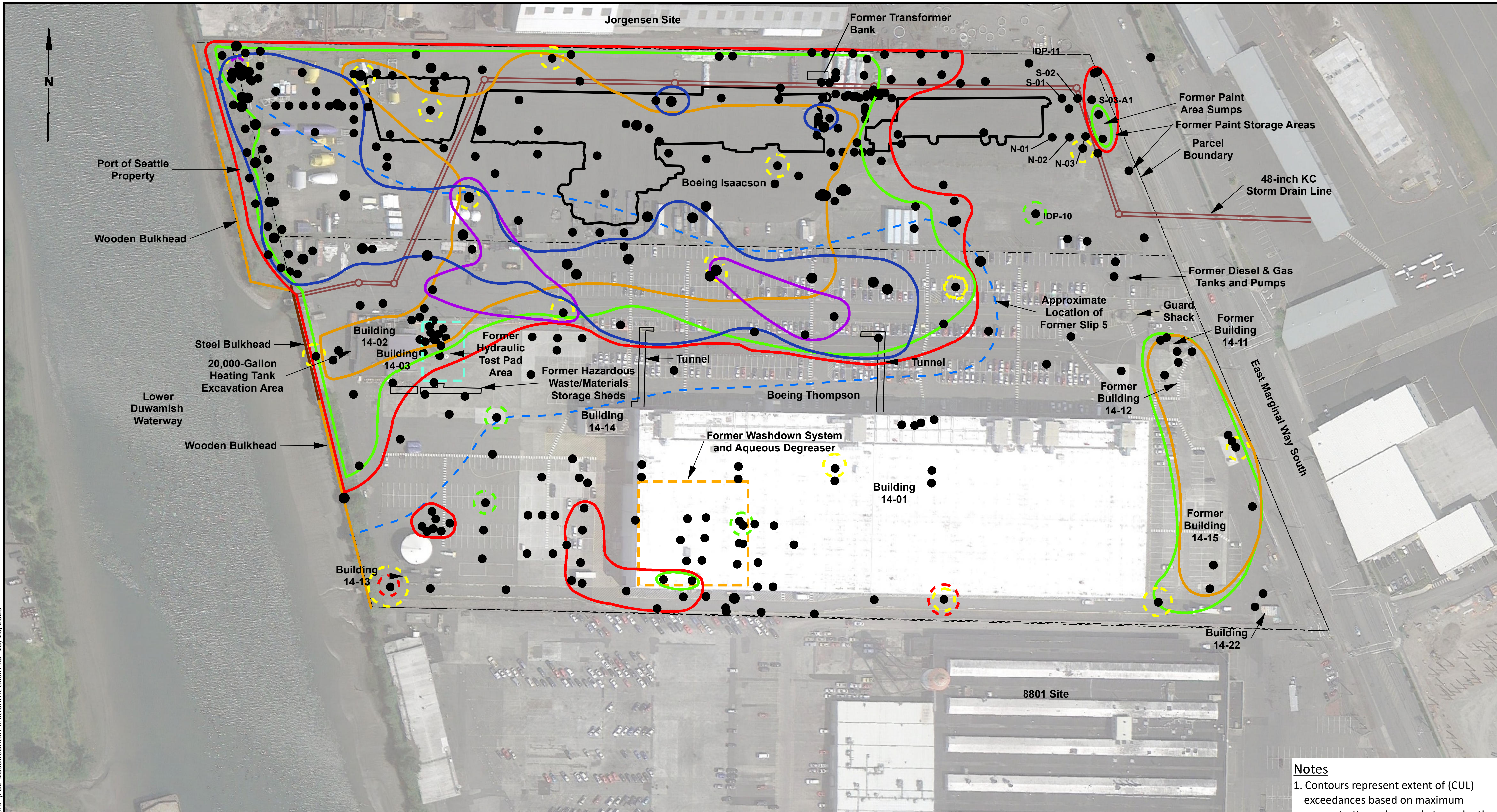
0 350 700
Scale in Feet

LANDAU ASSOCIATES

Boeing
Isaacson-Thompson Site
Tukwila, Washington

Total PCB Concentrations in Groundwater

Figure 2-15



Notes

1. Contours represent extent of (CUL) exceedances based on maximum concentrations observed at any depth interval at the tiven exploration location.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Soil Boring
- Existing 48" King County Storm Drain Line
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Soil Contamination

- As > CUL (7.3 mg/kg)
- Cu > CUL (36 mg/kg)
- Hg > CUL (0.07 mg/kg)
- Ni > CUL (48 mg/kg)
- Pb > CUL (250 mg/kg)
- Zn > CUL (85 mg/kg)

*Dashed Lines = Isolated Sampling Results, Extent not Defined

0 150 300
Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

G:\Projects\025\190\223\dCAP\F02-16SoilContaminationMetals.mxd 10/10/2023

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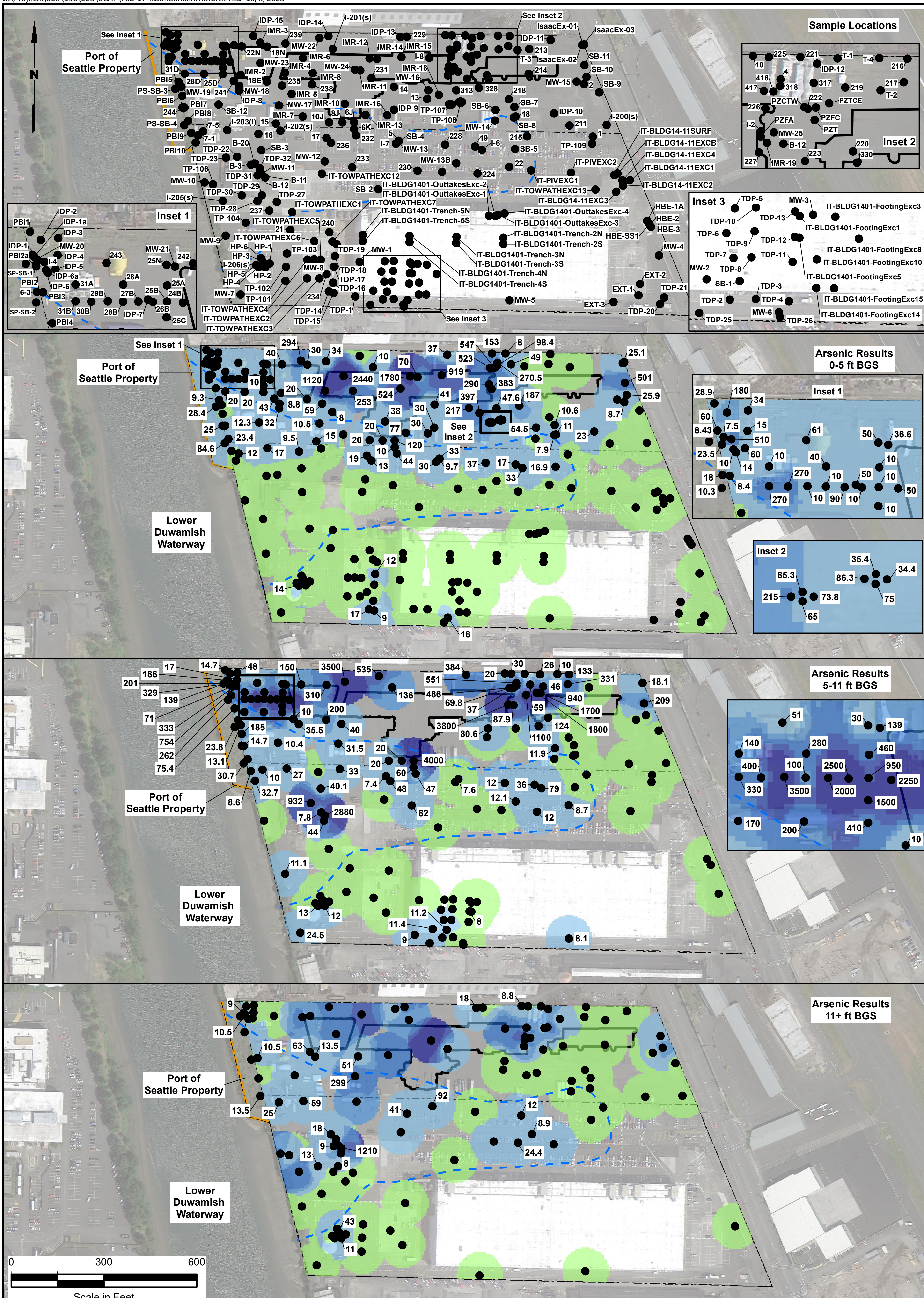
Boeing Isaacson-Thompson Site
Tukwila, Washington

Extent of Metals Contamination in Soil

Figure 2-16



Legend

- ● Soil Sampling Locations
- - - Approximate Location of Former Slip 5
- ― Current Extent of Stabilized Soil Material

Detected Concentrations (mg/kg)

- ≤7.3 (CUL)
- 7.3-100
- 100-200
- 200-500
- 500-1,000
- 1,000+

LANDAU ASSOCIATES

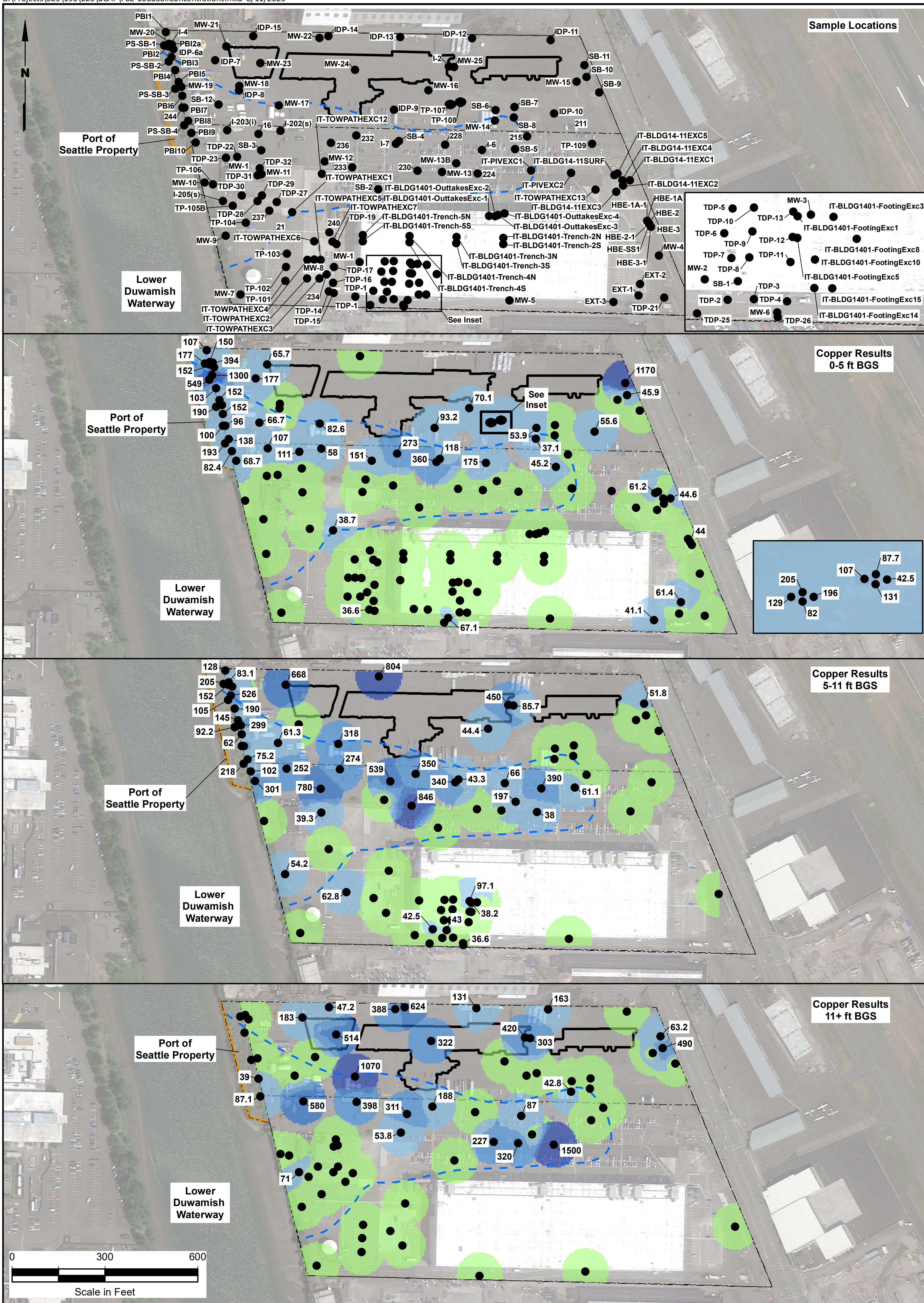
Notes

1. All results shown are reported in mg/kg.
2. Concentration values less than or equal to the cleanup level (7.3 mg/kg) are not presented.
3. The cleanup level for arsenic in soil is 7 mg/kg.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

Boeing Isaacson-Thompson Site Tukwila, Washington	Arsenic Concentrations in Soil	Figure 2-17

G:\Projects\025\190\223\dCAP\F02-18CuSoilConcentrations.mxd 8/11/2023



Legend

- ● Soil Sampling Locations
- - - Approximate Location of Former Slip 5
- — Current Extent of Stabilized Soil Material

Detected Concentrations (mg/kg)

- ≤36 (CUL)
- 36-200
- 200-500
- 500-800
- 800-3,200
- 3,200+

Notes

1. All results shown are reported in mg/kg.
2. Concentration values less than or equal to the cleanup level (36 mg/kg) are not presented.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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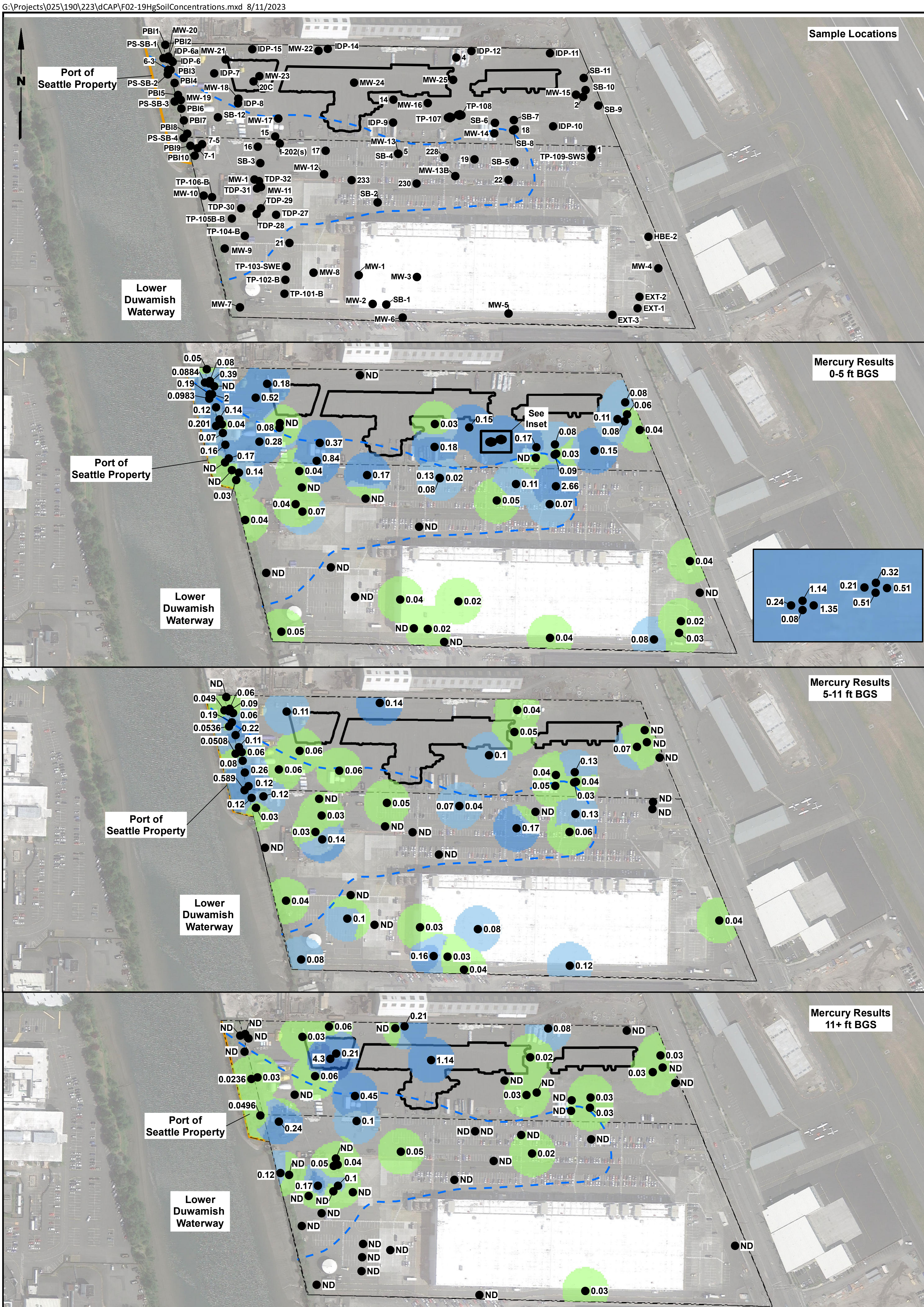
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Copper Concentrations in Soil

Figure 2-18

G:\Projects\025\190\223\dCAP\F02-19HgSoilConcentrations.mxd 8/11/2023



Legend

- ● Soil Sampling Locations
- Approximate Location of Former Slip 5 (blue dashed line)
- Current Extent of Stabilized Soil Material (black line)

Detected Concentrations (mg/kg)

- ≤0.07 (CUL)
- 0.07-0.14
- 0.14-24
- 24+

Notes

1. All results shown are reported in mg/kg.
2. The cleanup level for Mercury in soil is 0.07 mg/kg.
3. Inverse Distance Weighting calculated using the following inputs: Power = 4, Search Radius = Variable, Number of Points = 8, Maximum Distance = 75
4. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data

0 300 600
Scale in Feet

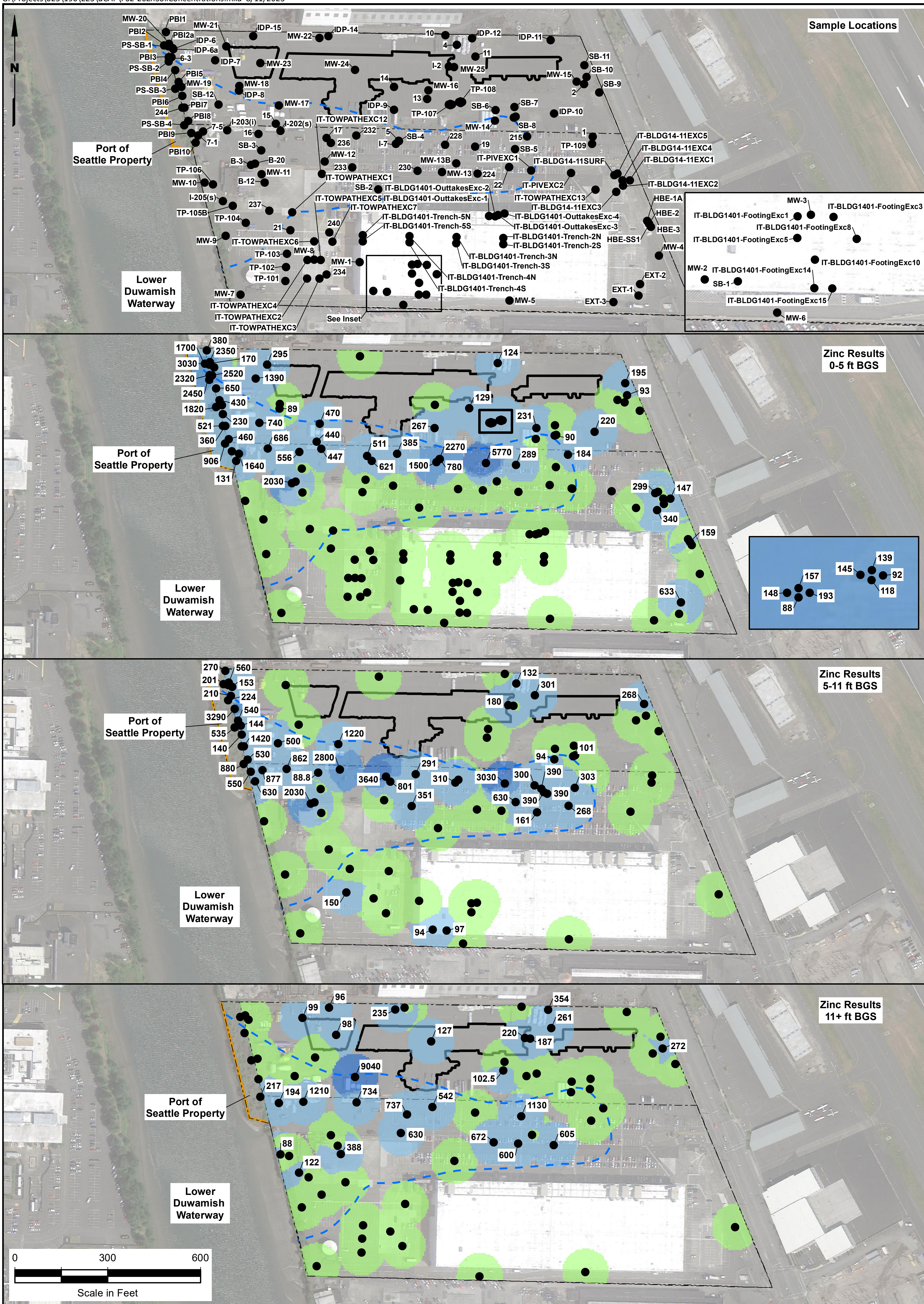
LANDAU ASSOCIATES

Boeing
Isaacson-Thompson Site
Tukwila, Washington

Mercury Concentrations in Soil

Figure 2-19

G:\Projects\025\190\223\dCAP\F02-20ZnSoilConcentrations.mxd 8/11/2023



Legend

- ● Soil Sampling Locations
- Approximate Location of Former Slip 5 (dashed blue line)
- Current Extent of Stabilized Soil Material (solid black line)

Detected Concentrations (mg/kg)

- ≤85 (CUL)
- 85-1,400
- 1,400-3,000
- 3,000-24,000
- 24,000+

LANDAU ASSOCIATES

Notes

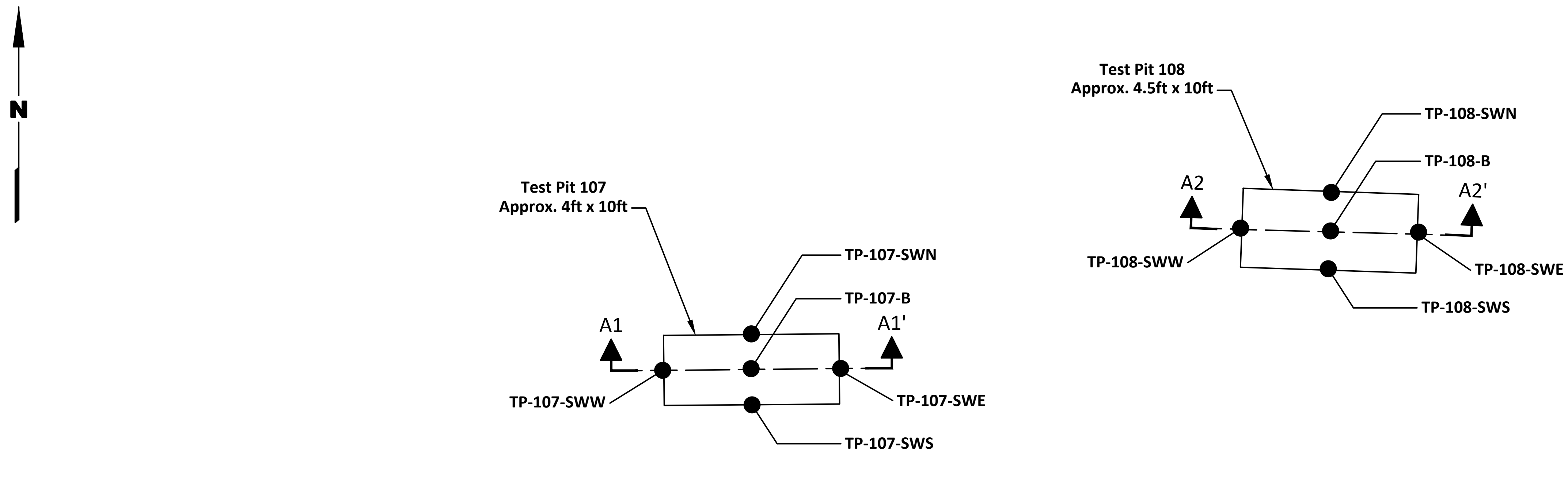
1. All results shown are reported in mg/kg.
2. Concentration values less than or equal to the cleanup level (85 mg/kg) are not presented.
3. Soil samples from direct push borings were collected on the Port Property on 8/27/2013.
4. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
5. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final Boeing I-T (April 2014).

Boeing Isaacson-Thompson Site Tukwila, Washington	**Zinc Concentrations in Soil**	Figure 2-20

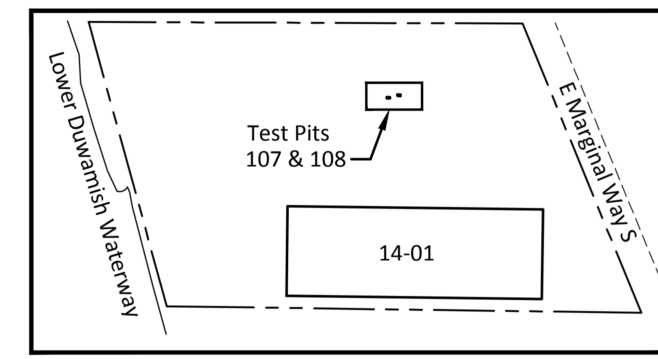
Legend

TP-107 ● Test Pit Sample Location and Designation

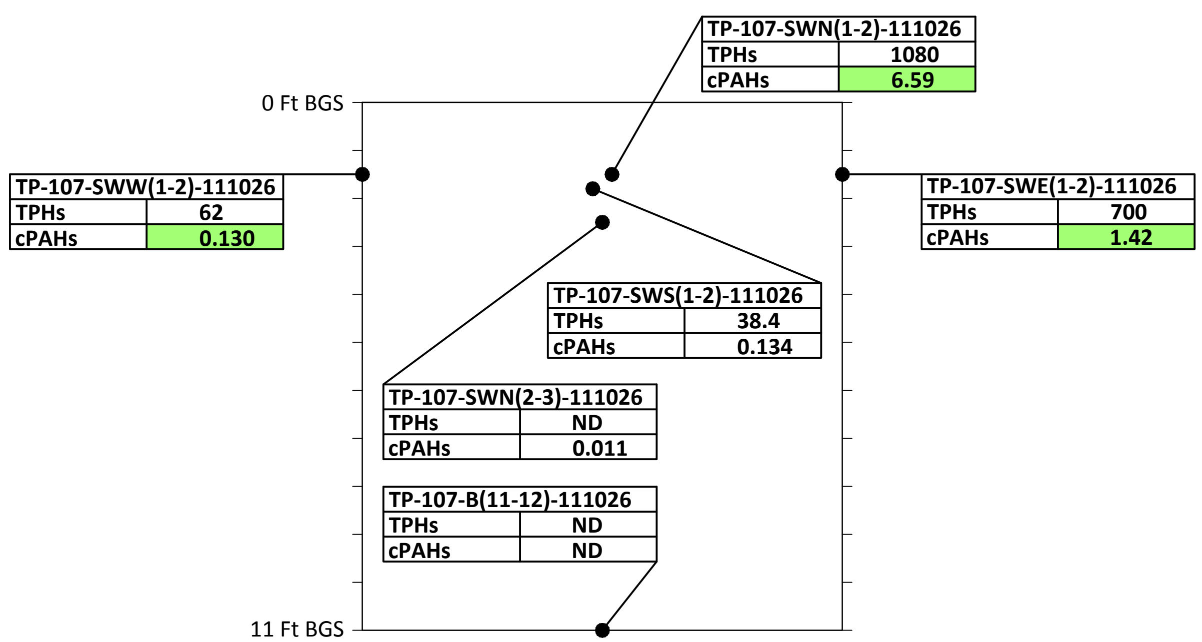


Plan: Observed Tar-like Area

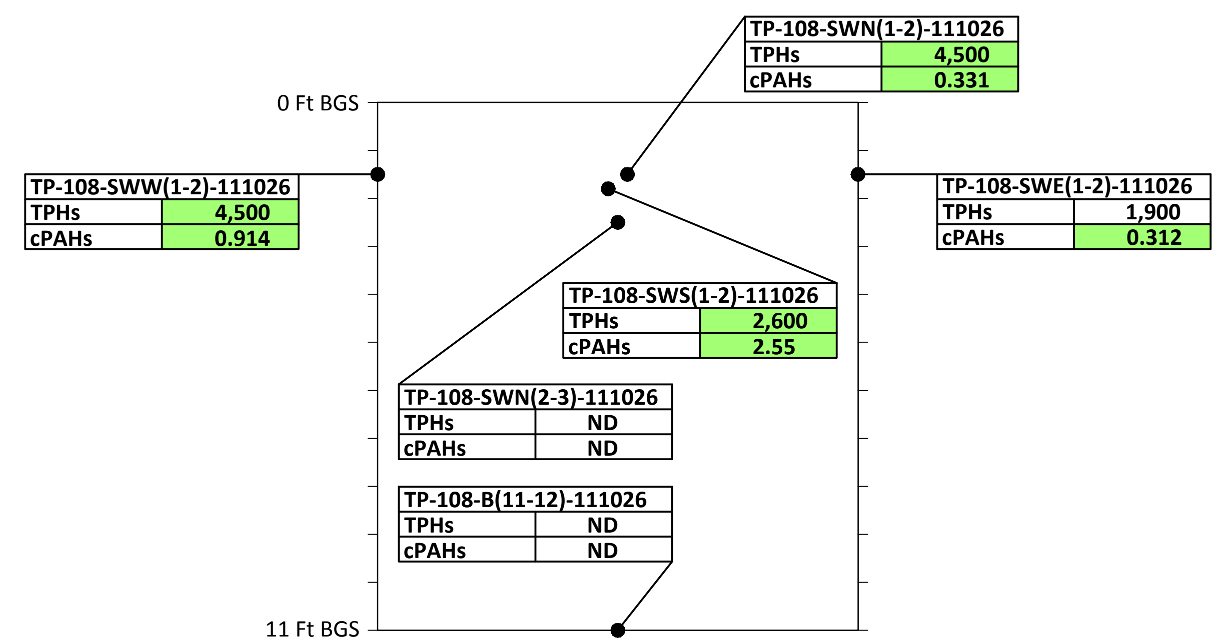
0 8 16
Scale in Feet



Site-wide Plan 1"=600'



Cross-Section A1-A1'



Cross-Section A2-A2'

0 4 8
Scale in Feet
1x Vertical Exaggeration

Notes

1. Concentrations of TPHs include the sum of diesel range organics (DRO) and oil range organics (ORO) in mg/kg.
2. Concentrations of cPAHs are total cPAH TEQs in mg/kg.
3. Detected concentrations exceeding cleanup levels (CULs) are highlighted green.
4. The CUL is 2,000 mg/kg for the sum of DRO and ORO; the CUL is 0.0076 mg/kg for total cPAH TEQs.
5. ND = Non-detect; concentrations were not detected above laboratory reporting limits.
6. All samples collected on October 26, 2011 during Remedial Investigation.
7. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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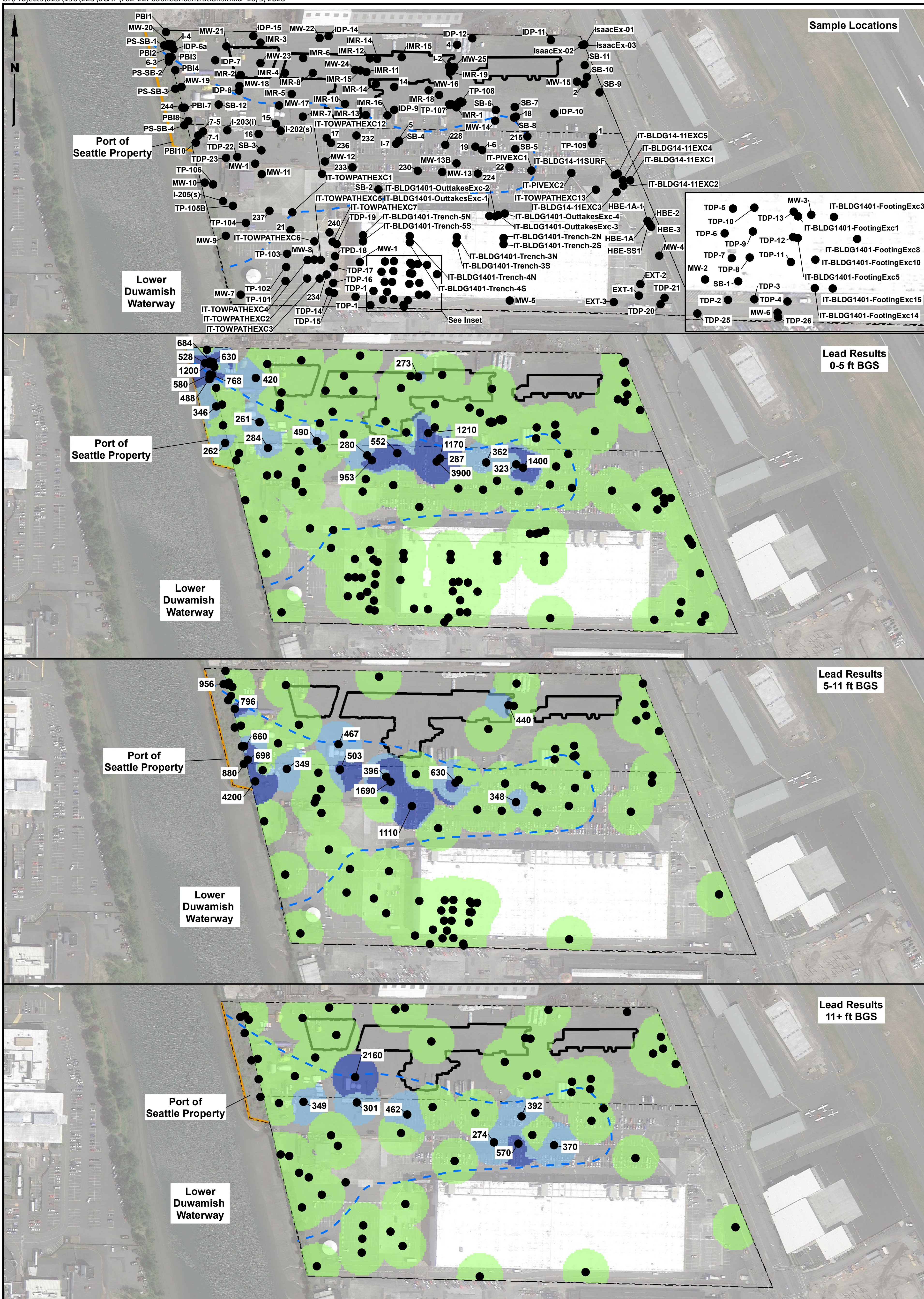
Boeing Isaacson-Thompson Site
Tukwila, Washington

Extent of TPHs and cPAHs in Observed Tar-Like Substance Area Soil

Figure 2-21

G:\Projects\025\190\223\dCAP\F02-22PbSoilConcentrations.mxd 10/9/2023



Legend

- ● Soil Sampling Locations
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Detected Concentrations (mg/kg)

- ≤250 (CUL)
- 250-500
- 500+

0 300 600

Scale in Feet

Notes

1. All results shown are reported in mg/kg.
2. Concentration values less than or equal to the cleanup level (250 mg/kg) are not presented.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Groundwater samples from direct push borings were collected on the Port Property on 8/27/2013.
5. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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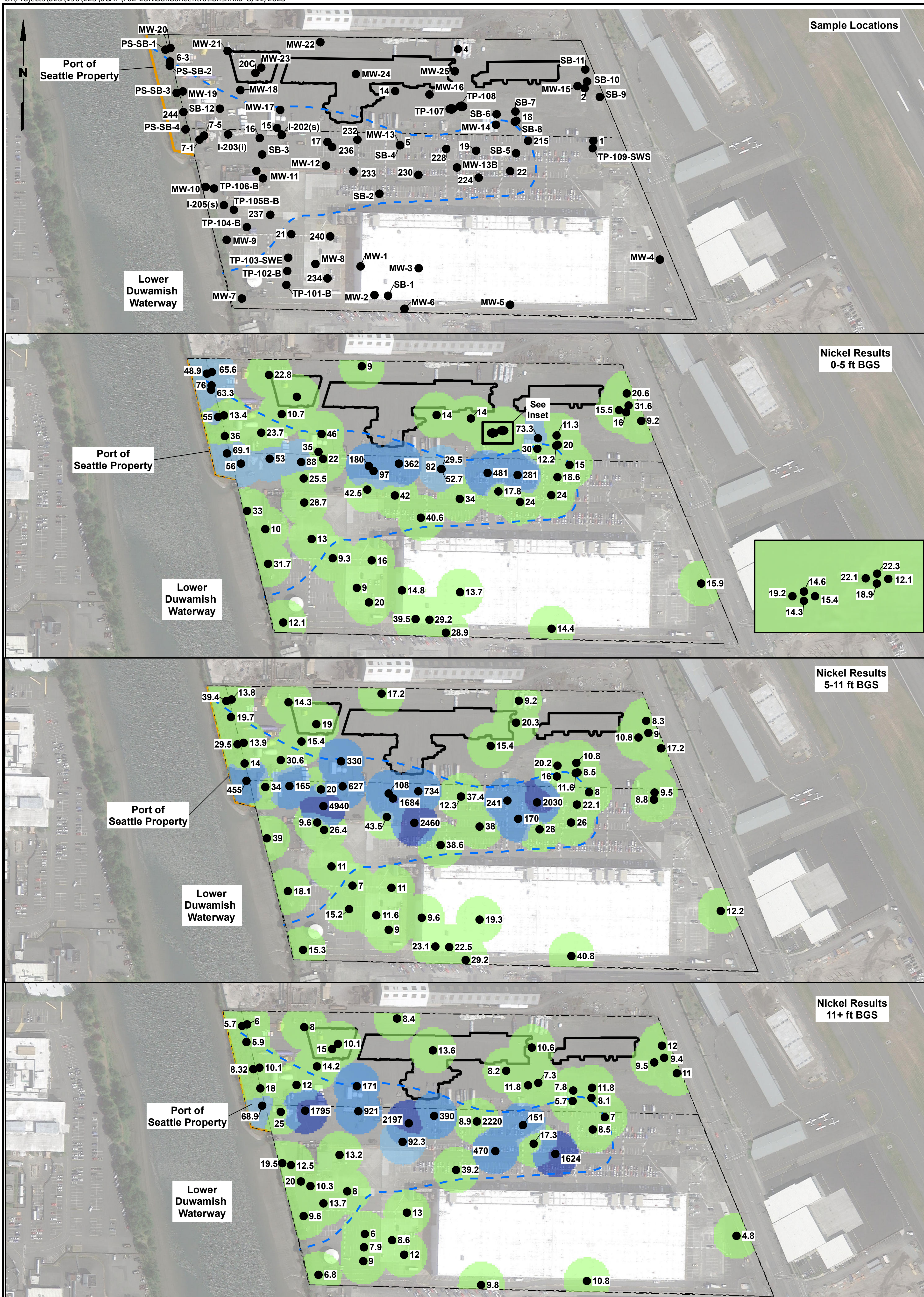
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Lead Concentrations in Soil

Figure 2-22

G:\Projects\025\190\223\dCAP\F02-23NiSoilConcentrations.mxd 8/11/2023



Legend

- ● Soil Sampling Locations
- Approximate Location of Former Slip 5 (blue dashed line)
- Current Extent of Stabilized Soil Material (black line)

Detected Concentrations (mg/kg)

- ≤48 (CUL)
- 48-96
- 96-1,600
- 1,600+

Notes

1. All results shown are reported in mg/kg.
2. The cleanup level for Nickel in soil is 48 mg/kg.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

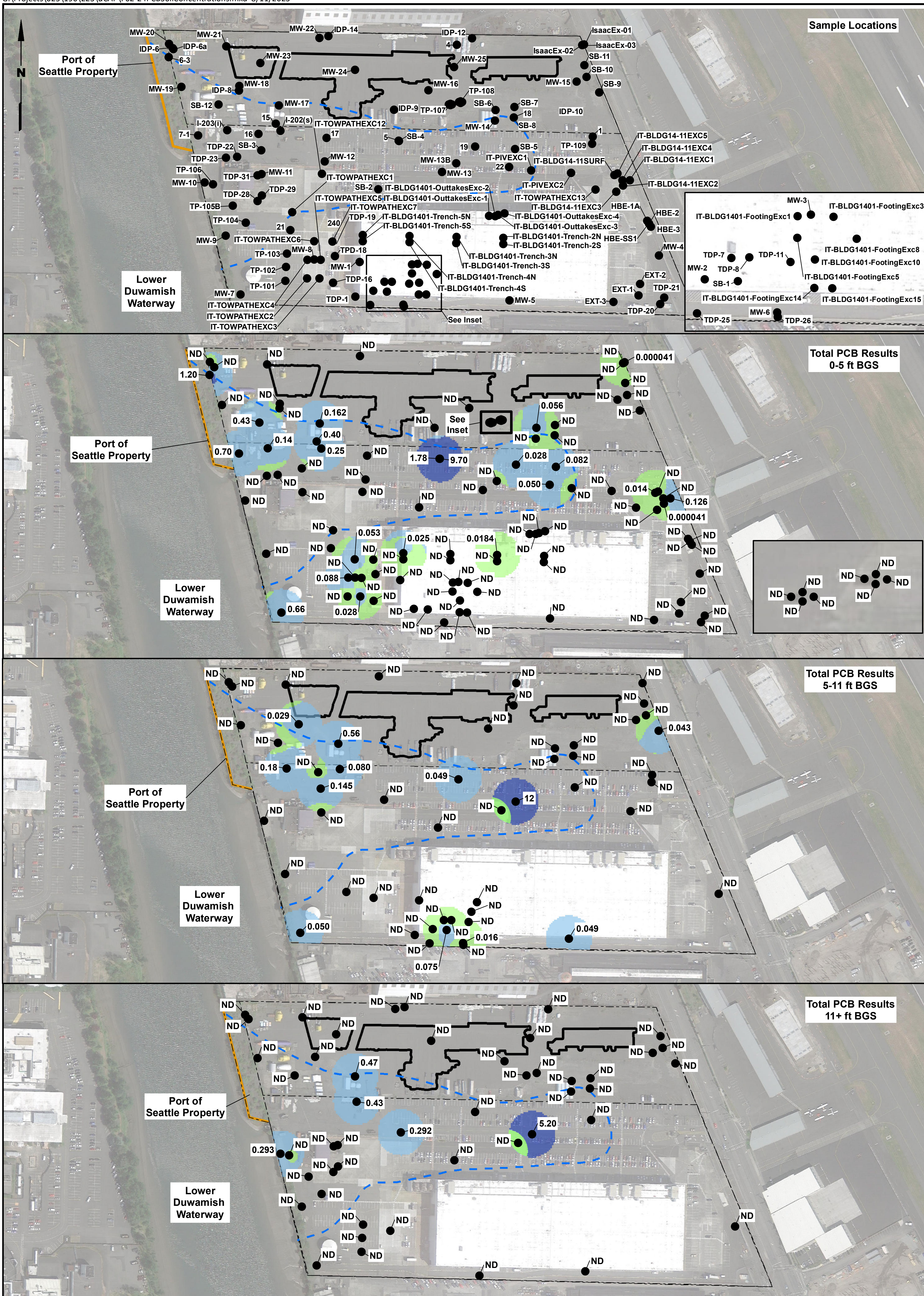
0 300 600

Scale in Feet

Data Sources: Google Earth Pro, 2012; King County Parcel Data

LANDAU ASSOCIATES

Boeing Isaacson-Thompson Site Tukwila, Washington	Nickel Concentrations in Soil	Figure 2-23



Legend

- Soil Sampling Locations
- Approximate Location of Former Slip 5
- Current Extent of Stabilized Soil Material

Detected Concentrations (mg/kg)

- ≤0.02 (CUL)
- 0.02-1.00
- 1.00+

0 300 600

Scale in Feet

Notes

1. All results shown are reported in mg/kg.
2. The cleanup level for Total PCBs is 0.02 mg/kg.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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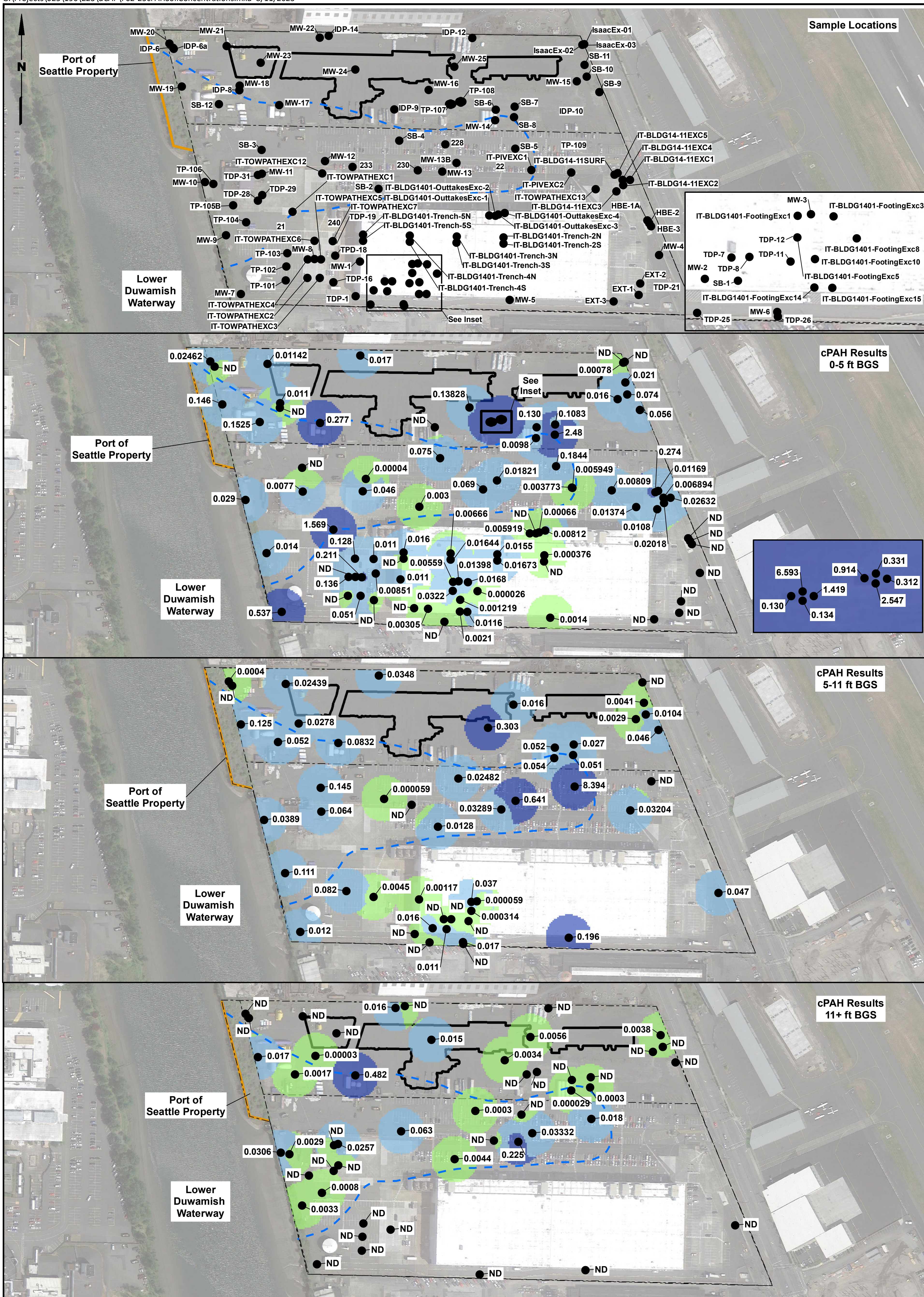
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Total PCB Concentrations in Soil

Figure 2-24



Legend

- ● Soil Sampling Locations
- Approximate Location of Former Slip 5 (dashed blue line)
- Current Extent of Stabilized Soil Material (solid black line)

Detected Concentration (mg/kg)

- ≤ 0.0076 (CUL)
- 0.0076 - 0.19
- 0.19+

Scale in Feet: 0, 300, 600

Notes

1. All results shown are reported in mg/kg.
2. The cleanup level for total cPAHs in soil is 0.0076 mg/kg.
3. Inverse Distance Weighting calculated using the following inputs:
   Power = 4
   Search Radius = Variable
   Number of Points = 8
   Maximum Distance = 75
4. Post-RI samples that were collected from the Port Sliver Property are not shown on this figure, but are included in Appendix A of the FS Report.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Google Earth Pro, 2012; King County Parcel Data; Final RI Boeing I-T (April 2014)

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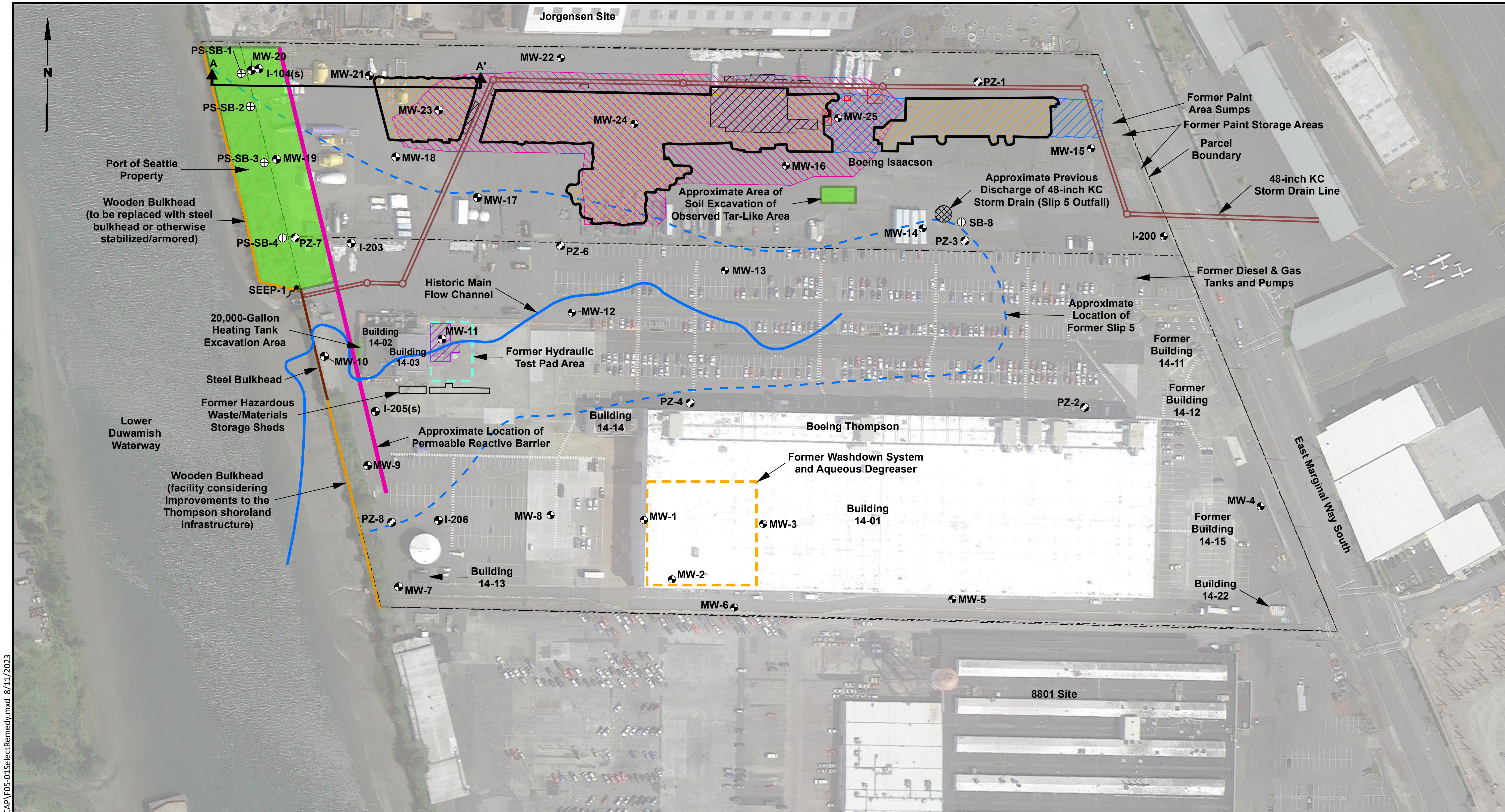
Boeing
Isaacson-Thompson Site
Tukwila, Washington

Total cPAH Concentrations in Soil

Figure 2-25



Legend

- MW-22 Monitoring Well Location
- PZ-1 Piezometer Location
- SB-8 Direct-Push Boring Groundwater Sample Location
- SEEP-1 Seep
- 1984 Excavation
- 1988 Excavation
- 1990 Excavation
- 1991 Excavation
- 1993-1995 Excavation
- 2004 Excavation
- 2008 Removal of Stabilized Soil Mound
- Current Extent of Stabilized Soil Material
- Approximate Location of Former Slip 5
- Approximate Location of Permeable Reactive Barrier
- Approximate Area of Soil Excavation
- Cross Section Location

Note

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

Data Sources: Google Earth Pro, 2012; King County Parcel Data

0 150 300
Scale in Feet

G:\Projects\025\190\223\dCAP\F05-01SelectRemedy.mxd 8/11/2023

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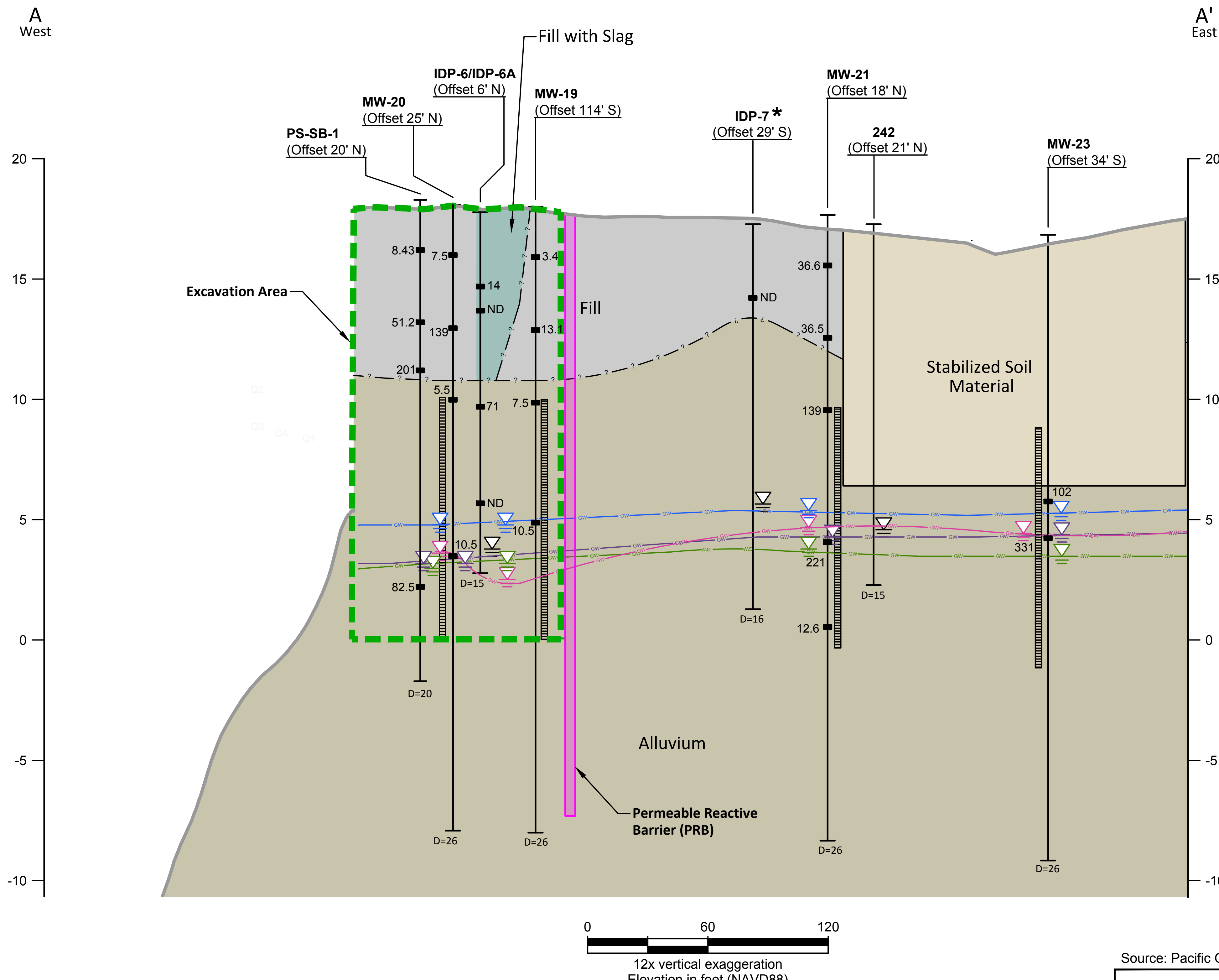
Boeing Isaacson-Thompson Site Tukwila, Washington	**Selected Remedy (Conceptual)** **In Situ Groundwater Treatment, Shoreline Excavation, and Containment**	Figure 5-1



Legend

- XX — Project Exploration Designation
- (Offset 16' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Soil Sample Location
- ND — Arsenic not detected above laboratory reporting limits
- 36.3 — Arsenic concentration in mg/kg
- Groundwater Level (at time of drilling)
- Inferred Geologic Contact
- Well Screen Interval (if installed)
- Bottom of Exploration
- D=14 — Depth of Exploration (BGS)

- Groundwater Elevation (12/05/12; Q1)
- Groundwater Elevation (03/06/12; Q2)
- Groundwater Elevation (06/13/12; Q3)
- Groundwater Elevation (09/10/12; Q4)

- Fill: Brown to light gray fine to coarse sand, silty sand, sandy gravel, and debris (brick, concrete, glass, crushed rock)
- Fill with Slag: Brown to light gray fine to coarse sand, silty sand, sandy gravel, and debris with slag, brick, and wood debris
- Stabilized Soil Material: Soil mixed with cementitious material
- Alluvium: Brown to dark gray silty fine to medium sand, sandy silt, with occasional gravel and organic material

Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For cross-section profile location, see Figure 5-1.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

* 2010 ground surface elevation used as top of boring locations where elevation was missing or could not be resolved.

Source: Pacific Geomatic Services, Inc. 2008, Puget Sound Lidar Consortium 2005

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Boeing Isaacson-Thompson Site Tukwila, Washington	**Cross-Section A-A' Selected Remedy (Conceptual) Shoreline Excavation and PRB**	Figure 5-2

DRAFT

Table 3-1
Cleanup Levels: Groundwater
Draft Cleanup Action Plan
Boeing Isaacson-Thompson
Tukwila, Washington

GROUNDWATER	Groundwater CUL (µg/L)	COC?	IHS?	Basis
VOLATILES				
Vinyl Chloride	0.18	Yes	--	MTCA Method B - Protection of Surface Water, 40 CFR 131.45
PCBs				
Total PCBs	0.01	Yes	Yes	MTCA Method B - PQL - EPA Method 8082 PQL = 0.01 µg/L (Total Aroclors) (PQL from Analytical Resources, Inc. Laboratory in Tukwila, Washington. Used for PCBs to get low-level reporting limits)
METALS				
Arsenic	8	Yes	Yes	MTCA Method B - Natural Background (Ecology 2022)
Copper	3.1	Yes	Yes	MTCA Method B - Protection of Surface Water (Aquatic Life, Chronic), Chapter 173-201A WAC
Mercury	0.025	Yes	--	MTCA Method B - Protection of Surface Water (Aquatic Life, Chronic), Chapter 173-201A WAC
Nickel	8.2	Yes	Yes	MTCA Method B - Protection of Surface Water (Aquatic Life, Chronic), Chapter 173-201A WAC
Zinc	81	Yes	Yes	MTCA Method B - Protection of Surface Water (Aquatic Life, Chronic), Chapter 173-201A WAC

Abbreviations and Acronyms:

µg/L = micrograms per liter
ARI = Analytical Resources, Inc.
CFR = Code of Federal Regulations
COC = contaminant of concern
CUL = cleanup level
Ecology = Washington State Department of Ecology
EPA = US Environmental Protection Agency
IHS = indicator hazardous substance
MTCA = Model Toxics Control Act
PCBs = polychlorinated biphenyls
PQL = practical quantitation limit
WAC = Washington Administrative Code

Sources:

Ecology. 2022. Natural Background Groundwater Arsenic Concentrations in Washington State. Study Results. Publication No. 14-09-044. Washington State Department of Ecology. January.

DRAFT

Table 3-2
Cleanup Levels: Soil
Draft Cleanup Action Plan
Boeing Isaacson-Thompson
Tukwila, Washington

SOIL	Soil CUL (mg/kg)	COC?	IHS?	Basis
SEMIVOLATILES				
bis(2-ethylhexyl)phthalate	0.12	Yes	--	Method B - PQL - EPA Method 8270E PQL based on Ecology's recommended PQL from comment letter December 29, 2021.
Total cPAH TEQ	0.0076	Yes	Yes	Method B - PQL - EPA Method 8270E SIM PQL
PCBs				
Total PCBs	0.020	Yes	Yes	Method B - PQL - Method 8082A PQL (Total Aroclors)
TOTAL PETROLEUM HYDROCARBONS				
Diesel-Range Organics Oil-Range Organics	2,000	Yes	--	Method A - CUL is sum of DRO and ORO if from unknown source and/or no distinct product releases have been identified. Other than three detections in test pit TP-108 (tar-like substance area), only one detection total DRO + ORO above 2,000 mg/kg in MW-17 boring (15.5-17 feet; 2,700 mg/kg).
Gasoline-Range Organics	30	Yes	--	Method A - lower value of 30 mg/kg because benzene is present
METALS				
Arsenic	7.3	Yes	Yes	Method B - Natural background (Ecology 1994, Table 7, 90th percentile value for the Puget Sound Region)
Barium	160	Yes	--	Method B - Protection of Surface Water (through the groundwater leaching pathway) for saturated soils is not applicable for barium at this site, because barium is not impacting groundwater, even though all of the samples collected in saturated zone soil exceeded the protection of surface water for saturated soils value (8.3 mg/kg). Therefore, only the Protection of Surface Water for vadose zone soils is applicable.
Cadmium	0.77	Yes	--	Method B - Natural background (Ecology 1994)
Chromium (III or total)	550	Yes	--	Method B - Protection of Surface Water (through the groundwater leaching pathway) for saturated soils is not applicable for Chromium III at this site, because Chromium III is not impacting groundwater. Therefore, only the Protection of Surface Water for vadose zone soils is be applicable.
Chromium (VI)	0.40	Yes	--	Method B - PQL - Method 6020/7196 Modified PQL
Copper	36	Yes	Yes	Method B - Natural background (Ecology 1994)
Lead	250	Yes	Yes	Method A - Unrestricted land uses
Mercury	0.07	Yes	Yes	Method B - Natural background (Ecology 1994)
Nickel	48	Yes	Yes	Method B - Natural background (Ecology 1994)
Zinc	85	Yes	Yes	Method B - Natural background (Ecology 1994)

Abbreviations and Acronyms:

cPAH = carcinogenic polycyclic aromatic hydrocarbon
COC = contaminant of concern
CUL = cleanup level
DRO = diesel-range organics
Ecology = Washington State Department of Ecology
EPA = US Environmental Protection Agency
GRO = gasoline-range organics
IHS = indicator hazardous substance
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
ORO = oil-range organics
PCBs = polychlorinated biphenyls
PQL = practical quantitation limit
SIM = selected ion monitoring
TEQ = toxicity equivalency quotient

Sources:

Ecology. 2021. Letter: Ecology Comments on Agency Review Draft Final (Revision 1), Feasibility Study Report, Isaacson-Thompson Site, Tukwila, Washington, dated December 21, 2020, for Boeing Isaacson Thompson, 8701 E Marginal Way, Tukwila WA, 98108, Facility/Site No.: 2218, Cleanup Site ID No.: 1944, Agreed Order No.: 7088. From Sam Wang, Washington State Department of Ecology, to Lindsey Erickson, The Boeing Company. December 29.

Ecology. 1994. Natural Background Soil Metals Concentrations in Washington State. Publication No. 94-115. Washington State Department of Ecology. October.