TERMINAL 108 – ENVIRONMENTAL CONDITIONS REPORT

FINAL

For submittal to:

Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008

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Acronyms

AGI	Applied Geotechnology, Inc.
APN	assessor's parcel number
AST	aboveground storage tank
BBP	butyl benzyl phthalate
BEHP	bis(2-ethylhexyl) phthalate
bgs	below ground surface
BMP	best management practice
Boeing	The Boeing Company
BTEX	benzene, toluene, ethyl benzene, and xylene
CB	catch basin
CCI	Container Care International
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
Chevron	Chevron USA Products Company
Chiyoda	Chiyoda Corporation International
City	City of Seattle
ConGlobal	ConGlobal Industries
County	King County
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
CSO	combined sewer overflow
cy	cubic yard
EAA	early action area
EBI	Elliott Bay Interceptor
Ecology	Washington State Department of Ecology
EOF	emergency overflow
EPA	US Environmental Protection Agency
ESA	environmental site assessment
FBI	Federal Bureau of Investigation
GSA	General Services Administration
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
ICR	independent cleanup report
Lafarge	Lafarge Canada, Inc.

LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
LUST	leaking underground storage tank
mgd	million gallons per day
mgy	million gallons per year
MLLW	mean lower low water
MTCA	Model Toxics Control Act
MT/yr	million tons per year
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PGG	Pacific Groundwater Group
Pioneer	Pioneer Construction Materials Company
Port	Port of Seattle
ppm	parts per million
RCB	right-of-way catch basin
RCRA	Resource Conservation and Recovery Act
ROW	right-of-way
SCAP	source control action plan
SCSP	source control strategy plan
SD	storm drain
SMS	Washington State Sediment Management Standards
SPCC	spill prevention control and countermeasure
SPU	Seattle Public Utilities
SQG	small-quantity generator
SQS	sediment quality standard
STP	sewage treatment plant
SWPPP	stormwater pollution prevention plan
T-108	Terminal 108
T-106	Terminal 106
TEQ	toxic equivalent
TPH	total petroleum hydrocarbons
TPH-D	diesel-range total petroleum hydrocarbons
TPH-O	oil-range total petroleum hydrocarbons

TSCA	Toxic Substances Control Act
TSS	total suspended solids
USACE	US Army Corps of Engineers
UST	underground storage tank
VCP	voluntary cleanup program
VOC	volatile organic compound
WAC	Washington Administrative Code
WSLCB	Washington State Liquor Control Board
WWTP	wastewater treatment plant

1 Introduction

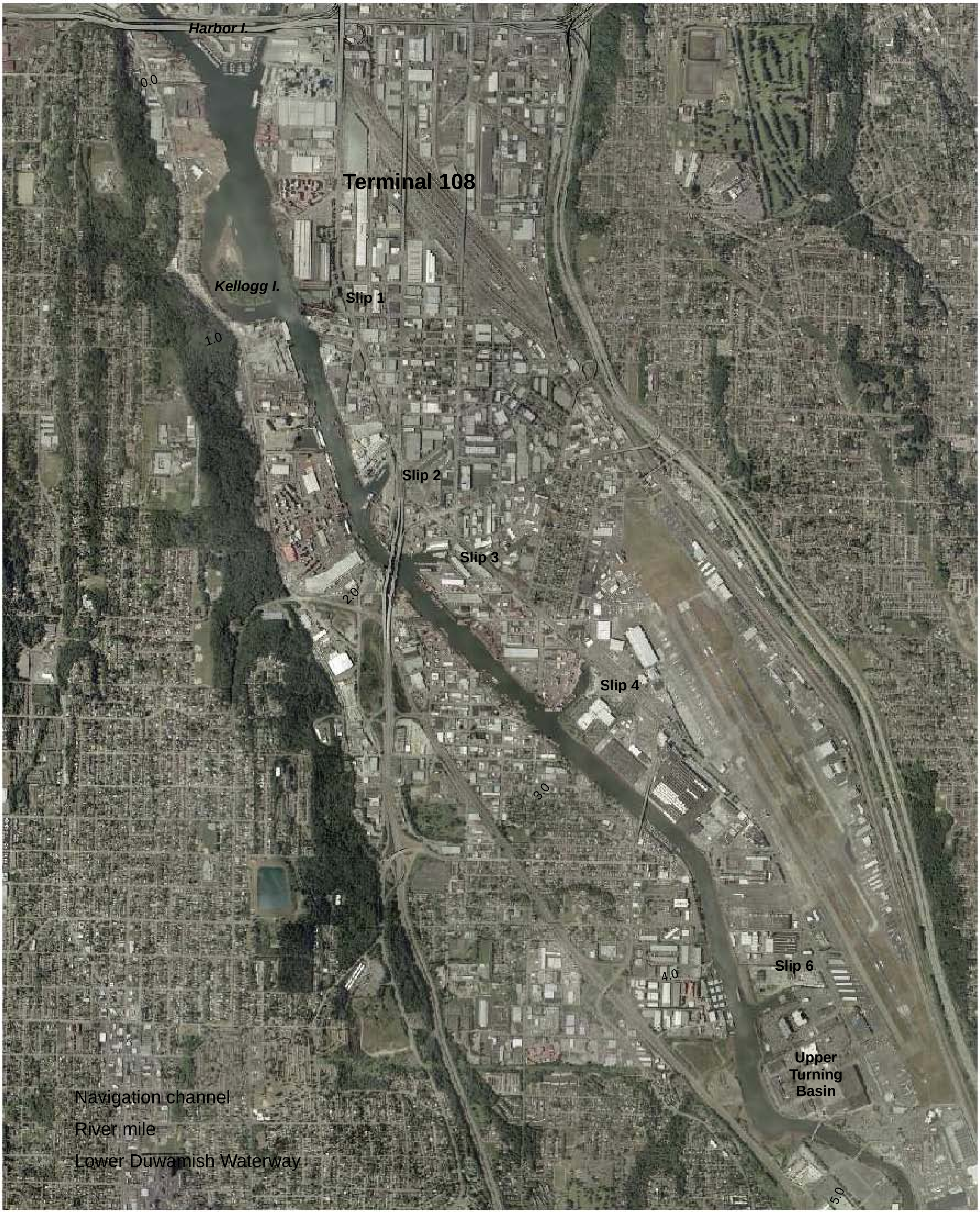
The Lower Duwamish Waterway (LDW) is an approximately 5.5-mile waterway located in Seattle, Washington. In 2001, the US Environmental Protection Agency (EPA) added the heavily used industrial waterway to the nation's Superfund list. Contaminants identified in the waterway's sediments that led to its listing include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), various metals, and phthalates. These identified contaminants may threaten both humans and wildlife.

The Port of Seattle's (Port) Terminal 108 property (T-108) is located on the eastern shore of the LDW, just upstream of Harbor Island (Map 1). T-108 has been owned by or leased to various entities during its history of industrial and commercial use. For the purposes of this report, T-108 will be referred to as the subject property. During the course of recent investigations on the waterway, the subject property, along with neighboring properties, has been identified as a property of potential interest for source control with respect to the LDW.

In support of these ongoing investigation efforts, the Port is developing independently a source control strategy for the terminal property. To help develop and focus the strategy on potential source control issues at the subject property, the Port is preparing this comprehensive Environmental Conditions Report detailing property-specific investigation information along with the operational history and development of the property over the course of the last hundred years. This report's conclusions and recommendations will assist in the development of a source control strategy for the subject property, to be discussed in future documentation.

1.1 Project Background

In December 2000, EPA and the Washington State Department of Ecology (Ecology) entered into an Agreed Order on Consent with King County (County), the Port, the City of Seattle (City), and The Boeing Company (Boeing). The purpose of the order was for the completion of a remedial investigation and feasibility study (RI/FS) to address the waterway's sediment contamination. Subsequent to signing of the agreement, the County, the City, the Port, and Boeing formed the Lower Duwamish Waterway Group (LDWG) to manage and coordinate the ongoing investigation and remediation strategy efforts.



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0 0.5 1 Kilometers

Map 1. Terminal 108 location

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Preventing recontamination to levels that exceed the Washington State Sediment Management Standards (SMS) (per Washington Administrative Code [WAC] 173-204) and the LDW sediment cleanup goals is the ultimate focus of Ecology's source control strategy. The LDW source control program, under Ecology's lead, is designed to identify and manage sources of contamination to LDW sediments in coordination with sediment remediation activities. This program provides the framework for identifying source control issues and implementing effective controls, potentially including various levels of remedial action. To support this effort, Ecology is preparing source control action plans and data gaps analysis reports to establish current environmental conditions and evaluate historical and ongoing sources of contamination.

In 2003, seven candidate sediment sites for early action (subsequently referred to as early action areas [EAAs]) were identified in the LDW. One of the recommended EAAs, EAA 1, includes the adjacent Duwamish/Diagonal combined sewer overflow (CSO) and storm drain (SD) area on the east side of the LDW at the end of the Oregon Street right-of-way (ROW). The subject property borders these outfall locations to the south and directly abuts EAA 1.

In December 2004, Ecology published a Source Control Action Plan (SCAP) for the Duwamish/Diagonal Way Early Action Cleanup Area (EAA 1) which strategized the approach to ongoing evaluation and control of sources of contamination to the sediment area. In that strategy document, the subject property was included as a property of potential concern relative to identified sediment contamination associated with EAA 1 (Ecology 2004). In June 2008, Ecology published several property reviews for individual properties of potential concern relative to EAA 1, including T-108, T-106 West (T-106W), T-106 Northwest (T-106NW), T-106 East (T-106E), and Federal Center South. Relevant information from Ecology's property reviews is included in the subsequent sections of this report.

Ecology has requested that the Port provide documentation of the subject property's environmental conditions and develop a long-term Source Control Strategy Plan (SCSP). The SCSP will be implemented and managed on a independent basis. Work to be performed at the site, including any potential remedial activities or engineered mitigation measures, will be managed as outlined under the Model Toxics Control Act (MTCA), the National Pollutant Discharge Elimination System (NPDES) requirements, and other established regulations.

This Environmental Conditions Report will help establish the basis for the development, implementation, and management of the SCSPs for the subject property. The SCSPs will take into consideration current operations and the recommendations of this report. The SCSPs will also consider remedial action alternatives, if appropriate, based on the conclusions of the environmental conditions documentation and the approaches deemed to be most effective for the potential issues at the subject property. Any remedial action at the subject property will be completed as an independent remedial action in accordance with Ecology's MTCA. However, the Port acknowledges that Ecology may consider an Agreed Order for the subject property in the future.

1.2 PURPOSE AND ORGANIZATION OF REPORT

The purpose of this report is to present and discuss the subject property's relevant operational and development history, evaluate existing environmental data, and identify potential source control issues, focusing on long-term source control strategy efforts at T-108.

This Environmental Conditions Report is organized as follows:

- Section 2.0, Site Description
- Section 3.0, Property Ownership and Operational History
- Section 4.0, Environmental Conditions and Source Information
- Section 5.0, Potential Pathways of Contamination and Source Control Management
- Section 6.0, Conclusions and Recommendations
- Section 7.0, References

2 Site Description

T-108 is located at 4525 Diagonal Avenue S in Seattle, Washington (Map 2). It is owned by the Port of Seattle and currently leased to ConGlobal Industries (ConGlobal), an international company that operates container and chassis depots. T-108 is located on the LDW which bounds the property to the west. It is bounded to the east by a King County pumping station and E Marginal Way S, to the west by the LDW, to the south by Diagonal Avenue S and the Federal Center South facility, and to the north by the Oregon Street ROW, Terminal 106 W (T-106W), and the Washington State Liquor Control Board (WSLCB) facility.

2.1 GENERAL PROPERTY DESCRIPTION

T-108 currently consists of two parcels totaling approximately 20 acres. The Western Parcel (Assessor's Parcel Number [APN] 7666700510) is approximately 9 acres in size, and the Eastern Parcel (APN 7666700515) is approximately 11 acres in size (King County 2008). Currently, ConGlobal leases both parcels of the subject property: the Eastern Parcel is used as a container storage facility and truck chassis storage and repair area, and the Western Parcel is used as a chassis lay-down area.

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0 0.05 0.1 Kilometers

Map 2. Terminal 108 vicinity and current site layout

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T-108 has been used by several parties for a variety of purposes since its development in the early 20th century. Detailed information on the subject property's ownership and operational history is discussed in Section 3.0. A timeline that provides a visual presentation of the property's ownership, operation, and environmental-related investigation history is also provided in Section 3.0.

Brief highlights of the ownership history of the T-108 property include:

- Diagonal Avenue S sewage treatment plant (STP) – Operated by the City of Seattle from 1938 to 1962 and then by King County Metro from 1962 to 1969 in the central portion of T-108 Eastern Parcel.
- Chiyoda Corporation International (Chiyoda) owned the property in the mid-1970s; EPA and the US Army Corps of Engineers (USACE) controlled the property for a portion of the Chiyoda ownership period.
- In the early 1980s, the T-108 property was subdivided for the first time when the Port acquired the property; the Port maintained ownership of the Western Parcel and sold the Eastern Parcel to Chevron in approximately 1984. The Port subsequently repurchased the Eastern Parcel in 1992.
- The Lafarge Cement Company leased the Western Parcel from 1989 to 1998; Lafarge constructed and operated a bulk cement terminal on the property.
- In the mid-1990s, the Eastern Parcel was redeveloped for use as a container storage and transfer yard by Container Care International (CCI). CCI is a predecessor to ConGlobal Industries.

Presently the majority of T-108 is operated as a container storage facility by ConGlobal Industries. The primary container storage area is located on the Eastern Parcel of the property, and portions of the Western Parcel are used for chassis lay-down and storage. A Port of Seattle public access and habitat mitigation area is located along the southern shoreline of the Western Parcel, adjacent to the LDW. The park area is one of approximately 12 habitat mitigation areas along the LDW shoreline, and public access to the site is provided in accordance with the Port's public access plan (Port of Seattle 1985a). Select photographs of the subject property used as reference for the following sections are included in Appendix A. Appendix B includes copies of historical aerial photographs of the immediate vicinity of the T-108 that were used as a resource for this discussion.

2.2 Physical and Ecological Features

T-108 is located in what was once a tidal marsh area associated with the Duwamish River delta. Much of this marsh area was filled in the early 1900s during engineering of the LDW. The present topography of the site is generally flat with gradual slopes downward to the east and northwest, away from the central part of the site (Port of

Seattle 1992a). The average ground surface elevation is approximately 19 feet mean lower low water (MLLW).

The majority of the container yard on the Eastern Parcel of T-108 is paved, however some portions are covered with gravel (Map 2). The southern half of the Western Parcel of T-108 is paved or covered with gravel. The paved and graveled areas on the Western Parcel were formerly used as part of the Lafarge bulk cement terminal and as a parking lot associated with the Diagonal Avenue S STP (discussed in Section 3.5). Currently, a thick layer of soil covers much of the paved/graveled portion of this parcel, and ConGlobal uses some of the area for chassis lay-down and storage (Appendix A, Photos 5, 7, and 8). The majority of the northern portion of the Western Parcel is unpaved and is covered with vegetation including grass, low lying shrubs (predominantly blackberries) and trees (Appendix A, Photo 6).

The T-108 shoreline is approximately 1,200 ft (or 0.23 mi) long. The bank elevation of the northern and central portions of the shoreline varies from 0 to 10 ft (Port of Seattle Datum) (Port of Seattle 1993). The bank elevation of the southern portion of the shoreline, which includes the mitigation area, varies from approximately 4 to 18 ft (Port of Seattle Datum). The northern and central portions of the T-108 shoreline are armored with riprap, gravel, and other materials (Appendix A, Photo 15). Along the south-central portion of the shoreline, to the north of the mitigation area, the shoreline is partially armored with riprap and a wooden bulkhead which runs parallel to the shoreline. The bulkhead is not well-anchored and is slanted away from the shoreline (Appendix A, Photos 12 and 13). Within the park and mitigation area, the T-108 shoreline is primarily unarmored, with the exception of gravel (habitat mix) scattered along the perimeter (Appendix A, Photo 10).

Two outfalls points are located along the T-108 shoreline boundary. One is an active storm drain outfall that drains the southern portion of the Western Parcel (Port of Seattle outfall 2225 on Map 2), located in the vicinity of the wooden bulkhead (Appendix A, Photo 13). The second is an abandoned outfall formerly associated with the Diagonal Avenue S STP, located to the north of the active outfall (former Diagonal Avenue S STP outfall 2002 on Map 2; Appendix A, Photo 14). In addition, a wooden box frame structure in an extreme state of disrepair was observed in approximately the middle of the shoreline. The former purpose of this structure is not known.

The intertidal portion of the shoreline (ranging between elevations 5 and -10 MLLW depending on location along the subject property's shoreline) is composed predominately of mudflats that gently incline toward the navigation channel. Debris including wood, metal, brick, plastic, glass, and wiring is visible in the shoreline banks and in the mudflat area.

The T-108 public access and habitat mitigation area was constructed in the late 1980s by excavating the bank shoreline. It is approximately 1 acre in size and includes approximately 420 ft of shoreline, at an elevation ranging from 8 to 18 ft. A vegetated buffer surrounds a U-shaped mudflat area that extends into the LDW (Appendix A, Photos 9 and 10). A buoy line is present along the mouth of the mitigation area to prevent debris from washing into the site. Vegetation within the public access and mitigation area is routinely maintained by Port maintenance crews and appears to be healthy, and the area provides fish and wildlife habitat. The public access area extends to a public parking area located at the end of Diagonal Avenue S which also includes a lawn area, picnic tables, a launch for hand-carried boats, and interpretive signage. Existing trees on the eastern perimeter of the public access area provide visual screening from the rest of T-108 and E Marginal Way S (Appendix A, Photo 9).

2.3 GEOLOGY AND HYDROGEOLOGY

The following section provides a brief overview of the subsurface conditions at the subject property and discusses the basics of the property's hydrogeological features. A more detailed discussion is available in the various site investigation reports cited as reference throughout the section.

2.3.1 Geology

T-108 is located within the Duwamish River valley which was formed approximately 15,000 years ago by the retreat of the glaciers that covered the Puget Sound region (Booth and Herman 1998). Sediment originating from the Osceola mudflow off Mt. Rainier as well as other sources from surrounding mountains and hills was carried into the valley by the ancestral White River over a period of several thousand years. Between 1913 and 1917, the LDW was created by dredging a channel for the waterway and filling adjacent floodplain areas. Fill was placed using both mechanical and hydraulic methods, and consisted primarily of dredge spoils produced during channelization of the LDW. Fill materials may have included soil and other geologic materials that were a by-product of other land development projects inland from the Duwamish River, such as re-grading projects, as well as other waste materials of the time including refuse. Glacial scouring, natural sedimentation, earthquakes, and human engineering projects have all influenced the geology of T-108 and surrounding areas. Numerous subsurface investigations have been completed which have identified the various hydrogeologic components that comprise the subject property.

A review of soil borings logged during development of monitoring wells on the property indicate that the shallow hydrostratigraphic units present at T-108 consist of fill materials underlain by tidal marsh deposits (Pacific Groundwater Group 2007a). The fill material was reported as a predominantly heterogeneous deposit extending from the ground surface approximately 10 to 15 feet to the top of the tidal marsh deposits (Pacific Groundwater Group 2007a; Dames & Moore 1988). The upland fill is described as brown to black, loose to medium dense, moist to wet, very fine to medium-grained sand and silty sand (AGI 1992a; Pacific Groundwater Group 2006c). The fill includes zones of significant organic content, localized cementation, and variations in percentage of silt and gravel content. During subsurface investigation at the property, the fill was usually identified by the presence of significant volumes of sand and anthropogenic materials, with a lack of peaty material. The fill potentially consists of hydraulic fill, dredge spoils from the former river channel, and potentially some volume of sewage sludge (Port of Seattle 1992a).

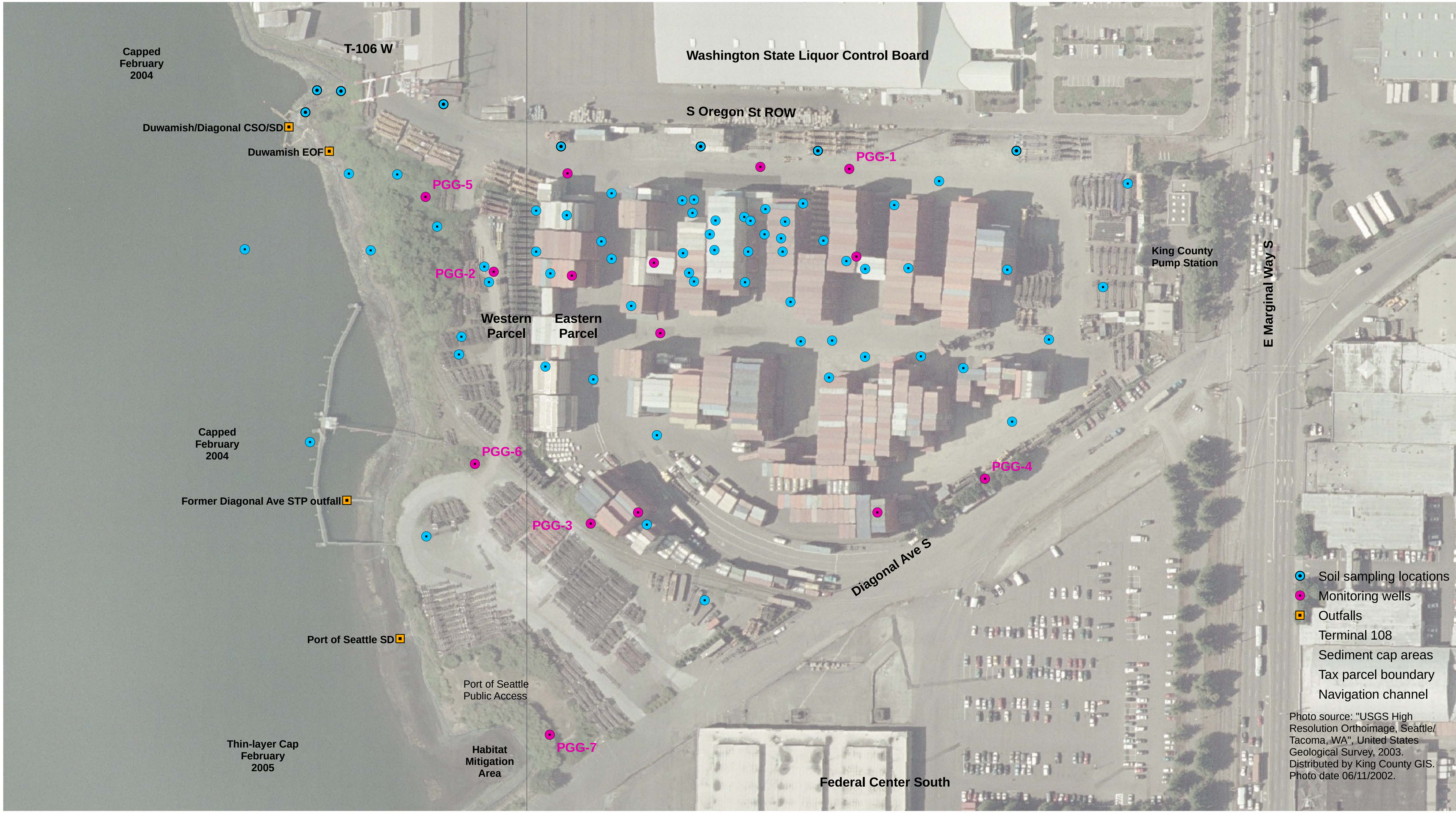
During advancement of monitoring wells on the property in 2006, tidal marsh deposits were distinctive and easily identified as compact silts intermixed with peaty grass and root materials (Pacific Groundwater Group 2006c). The tidal marsh deposits were described as compact sandy silt with peat (organic material). Outcrops of tidal marsh deposits are visible along the shoreline near mean sea level (Appendix A, Photo 14). In the observed outcroppings, the deposits consist of sandy silt with a high organic content (peat). The tidal marsh deposits underlie the fill material at T-108 from between 10 to 20 ft below ground surface (bgs). These deposits are brown to gray, very soft to soft, moist to wet, and composed of organic silts and clays.

Along the T-108 shoreline, various outcrops of fill that lacked peaty material was identified. The fill was described as silty sand predominantly gray in color containing significant amounts of sand and anthropogenic materials. Tidal marsh outcrops were also identified near mean sea level along the shoreline. These deposits are generally light brown in color and peat material is often visible. Boring logs from past subsurface investigations for the T-108 subject property are contained in Appendix C.

Several previous investigations have identified and described the alluvial deposits that underlie the marsh deposit layers. The alluvial deposits represent remnants of the former Duwamish River channel, of which the subject property was a part prior to development of the LDW. The alluvial materials range from black, loose, wet, fine grained sands to gray, medium stiff, wet, and very fine grained sandy silts (Pacific Groundwater Group 2006c).

2.3.2 Hydrogeology

The fill layer discussed in Section 2.3.1 is the uppermost water-bearing unit of the subject property. This unit is often referred to as the shallow aquifer in investigation documentation. Monitoring wells installed on T-108 have been completed in this shallow aquifer unit (Appendix A, Photo 6 is a representative groundwater well at T-108); groundwater is typically observed in this unit at approximately 10 ft bgs. Groundwater near the LDW within this shallow unit is tidally influenced. Groundwater flow patterns in the shallow aquifer have been observed over the course of several years of investigation; groundwater appears to flow radially from a relative high in the north-central portion of the subject property (roughly between groundwater monitoring wells PGG-1 and PGG-2 on Map 3).



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0 100 200 Meters

Map 3. Groundwater well and soil sampling locations

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Table 1 provides a summary of water level measurements over time for PGG wells 01 through 07 at the subject property. These seven wells are the most recently completed wells at the property and analytical information from these well locations is considered the most representative of current conditions at the subject property relative to source control. A groundwater contour map based on levels from these wells locations is provided as Map 4. Successive mapping of the groundwater contours at the subject property derived from years of investigations have indicated that groundwater in the shallow aquifer in the Western Parcel generally flows toward the LDW. However, in the Eastern Parcel, groundwater moves from a relative high in the center of the Eastern Parcel radially in all directions, but predominately to the north and east.

Table 1. T-108 groundwater and shoreline soil investigation monitoring well construction and water level summary

PARAMETER	PGG-1	PGG-2	PGG-3	PGG-4	PGG-5	PGG-6	PGG-7
General							
Ecology unique ID	APQ 005	APQ 002	APQ 004	APQ 006	APQ 007	APQ 003	APQ 001
Installation dates	6/6/2006	6/5/2006	6/5/2006	6/6/2006	6/6/2006	6/5/2006	6/5/2006
Development volume, gallons (approx.)	1.75	6.25	35	<0.5	15	25	20
Bailed dry at, gallons (approx.)	1	3.75	NA	<0.5	NA	NA	NA
Coordinates[a]							
Northing	209009.5	208857.2	208484.3	208550.9	208967.95	208572.9	208171.9
Easting	1267978	1267451	1267595	1268180	1267349.68	1267423	1267534
Elevations[b]							
Monument elevation (north rim)	15.4	19.25	13.68	15.59	23.45	15.53	12.59
Measuring point (PVC) elevation	15.04	18.82	13.26	15.21	22.81	15.03	12.24
Top of screen elevation	11.9	15.8	10.2	12.1	12.6	12	8.6
Bottom of screen elevation	5.4	8.8	2.7	5.6	2.6	3	2.1
Depths							
Top of screen, feet bgs	3.5	3.5	3.5	3.5	8	3.5	4
Bottom of screen, ft bgs	10	10.5	11	10	18	12.5	10.5
Depth of borehole, ft bgs	10.5	14	13.5	10.5	20	13	14
Round 3 Water Level Snapshot – 2/19/07							
Time of measurement	9:19 a.m.	10:12 a.m.	NA	9:33 a.m.	10:22 a.m.	10:04 a.m.	9:45 a.m.
Depth to water (ft bgs)	8.84	7.39	NM	8.34	17.9	9.17	5.99
Groundwater elevation [b]	6.2	11.43	NM	6.87	4.91	5.86	6.25
Time of tide observation[c]	9:18 a.m.	10:12 a.m.	NA	9:30 a.m.	10:24 a.m.	10:06 a.m.	9:42 a.m.
Tide elevation [b]2	8.29	6.19	NA	7.83	5.73	6.41	7.34

Round 4 Water Level Snapshot – 5/29/07

Time of measurement	8:54 a.m.	9:35 a.m.	NA	9:08 a.m.	9:25 a.m.	9:45 a.m.	10:01 a.m.
Depth to water (ft bgs)	9.13	9.22	NM	8.96	18.93	9.69	6.74
Groundwater elevation[b]	5.91	9.6	NM	6.25	3.88	5.34	5.5
Time of tide observation[c]	8:54 a.m.	9:36 a.m.	NA	9:06 a.m.	9:24 a.m.	9:42 a.m.	10:00 a.m.
Tide elevation[b]	0.33	-0.46	NA	0.04	-0.31	-0.54	-0.68

[a] Horizontal datum: NAD 83/(91), Washington Coordinate System, North Zone, based on the published coordinate values of WSDOT Monument No. 3295 and WSDOT No. 3294 as published on the WSDOT Website during September 2006.

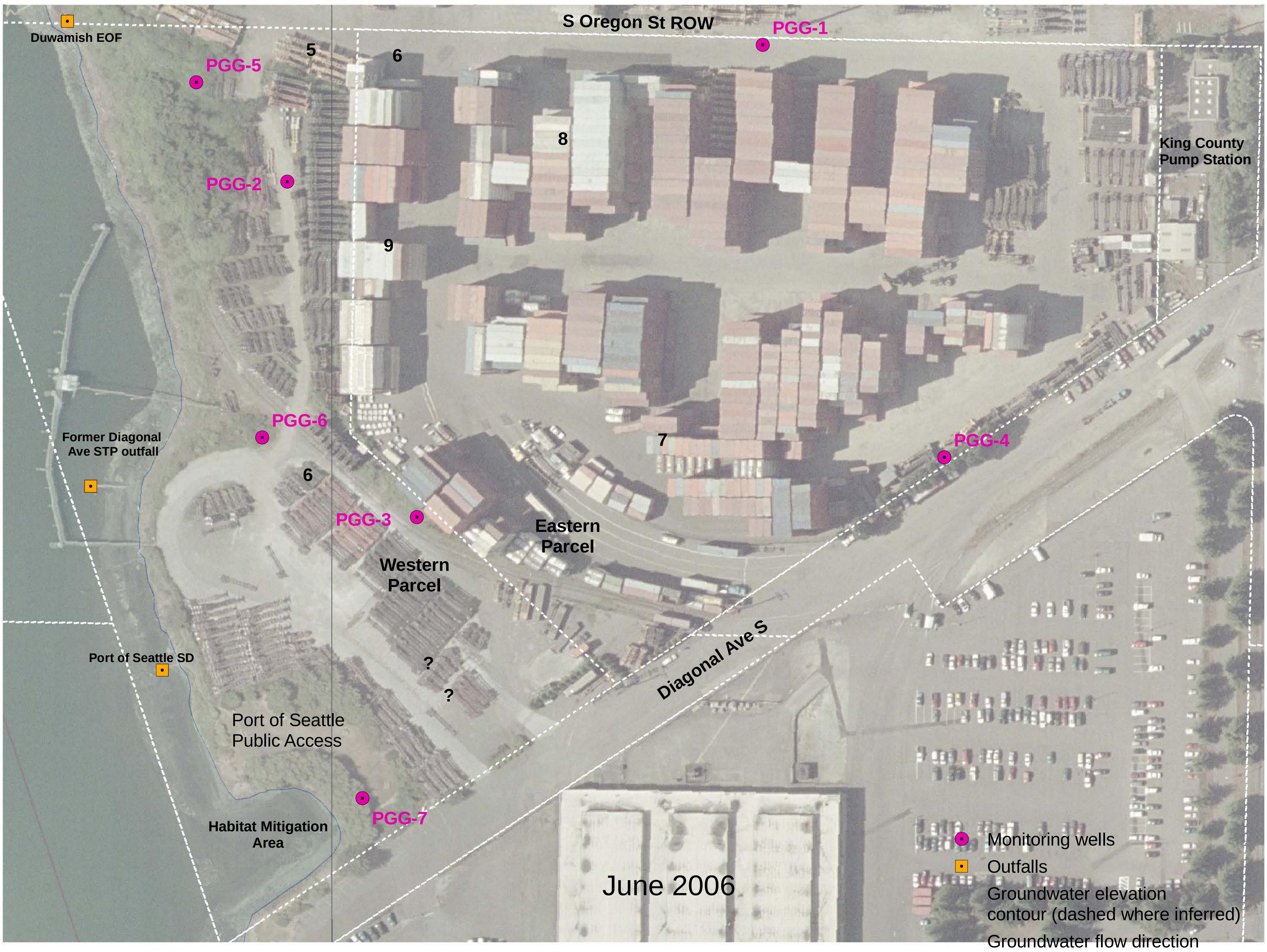
[b] Vertical Datum: MLLW. Elevations (monument, measuring point, top of screen, bottom of screen) presented in this table are correctly reported to MLLW and should replace elevations incorrectly presented in the Interim Report (PGG, 2006).

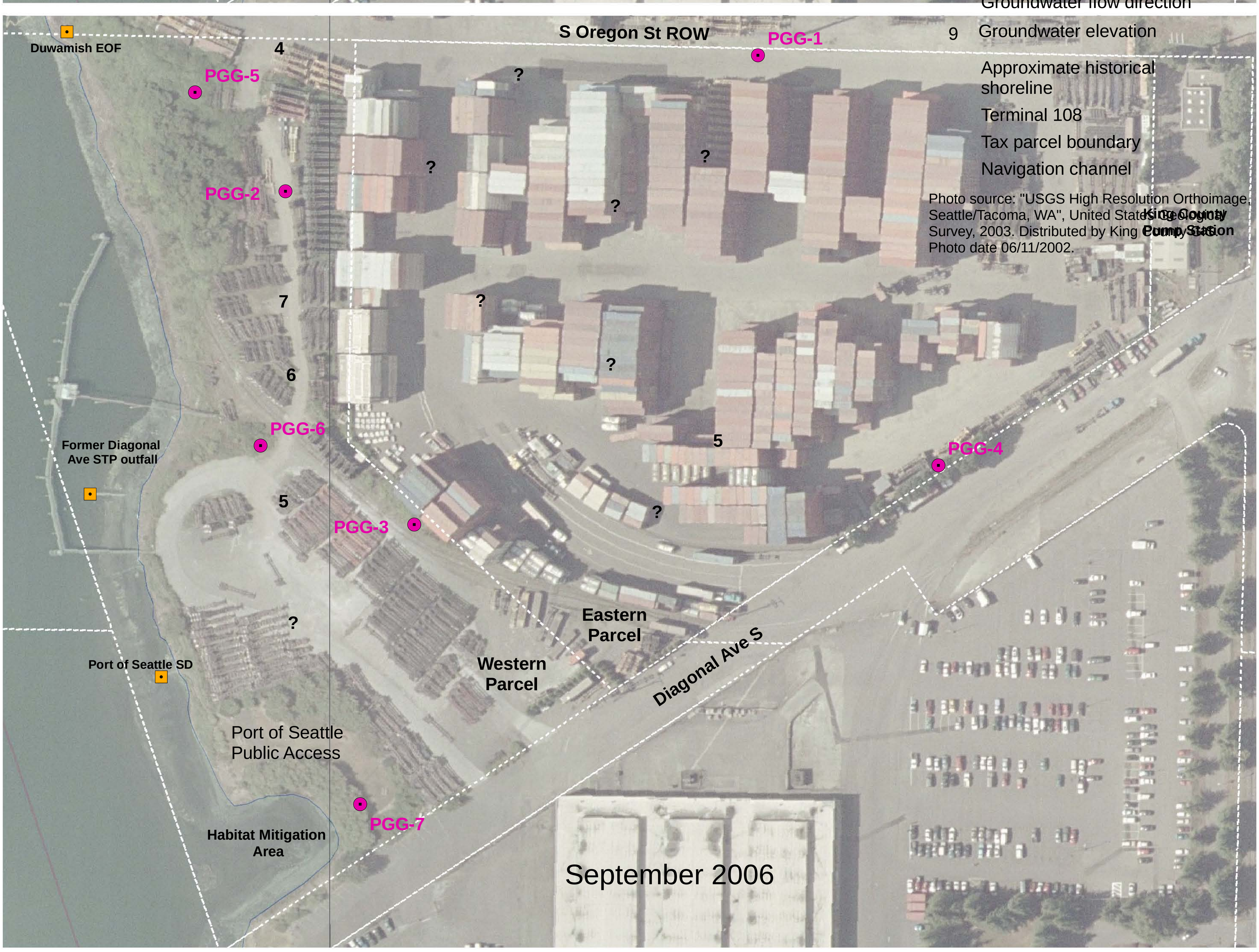
[c] Observed tide at Seattle Station ID 9447130 (ferry terminal) as reported by NOAA.

bgs – below ground surface; NM – not measured, PGG-3 wellhead damaged before Round 3

ID – identification

PVC – polyvinyl chloride





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0 20 40 Meters

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Scale is the same for each inset map

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Map 4. Groundwater contour maps, Pacific Groundwater Group wells (June and September 2006)

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Historical aerial photographs of the subject property (see Appendix B) identify a former tidal channel that extended from the LDW, along or adjacent to the north of the present day S Oregon Street ROW, and into the subject property (AGI 1992a). It is unclear where the channels exact terminus existed, but some of the aerial photographs indicate it may have extended to E Marginal Way S and potentially received runoff from the street and areas farther east. One source reported that the channel received untreated sewage discharge from small sewer system that was located to the northeast of T-108 (King County et al. 2005a). The aerial photograph from 1946 (Appendix B) shows a facility located to the northeast of T-108 along Diagonal Avenue S that may represent this reported sewer system; however, this could not be confirmed during the course of this investigation.

The tidal channel entered the subject property along the eastern boundary and extended through the northeast portion of the Eastern Parcel, passing outside of the property boundary near the center of the northern boundary of the parcel (near PGG-1; see map 3 for reference). Based on available information, the channel was likely filled between 1962 and 1976 (Pacific Groundwater Group 2006a); the channel was most likely backfilled when the Duwamish/Diagonal CSO/SD stormwater and sewer lines were installed in 1966 and 1967 (King County et al. 2005a).

Assuming that coarse-grained materials were used as backfill, the relic channel may be locally influencing groundwater flow in the shallow aquifer unit by providing a preferential pathway for flow. Ultimately the discharge point for this flow path is most likely the LDW, near the present day location of the Duwamish/Diagonal CSO/SD and the Duwamish emergency overflow (EOF).

2.4 INFRASTRUCTURE AND CONSTRUCTED SITE FEATURES

Current T-108 site features are associated with the existing container storage and maintenance facility on the Eastern Parcel and a former parking lot and bulk cement terminal on the Western Parcel, plus areas of chassis and miscellaneous material storage. The container storage and maintenance facility on the Eastern Parcel includes a paved and graveled container storage yard, a paved maintenance area, and access roadways and railway spurs for loading and unloading cargo. In total, approximately nine acres of paved area are used for cargo container storage operations and approximately five acres are graveled (the nine acres of paving includes areas in the S Oregon Street ROW and T-106W not included in the acreage of the subject property).

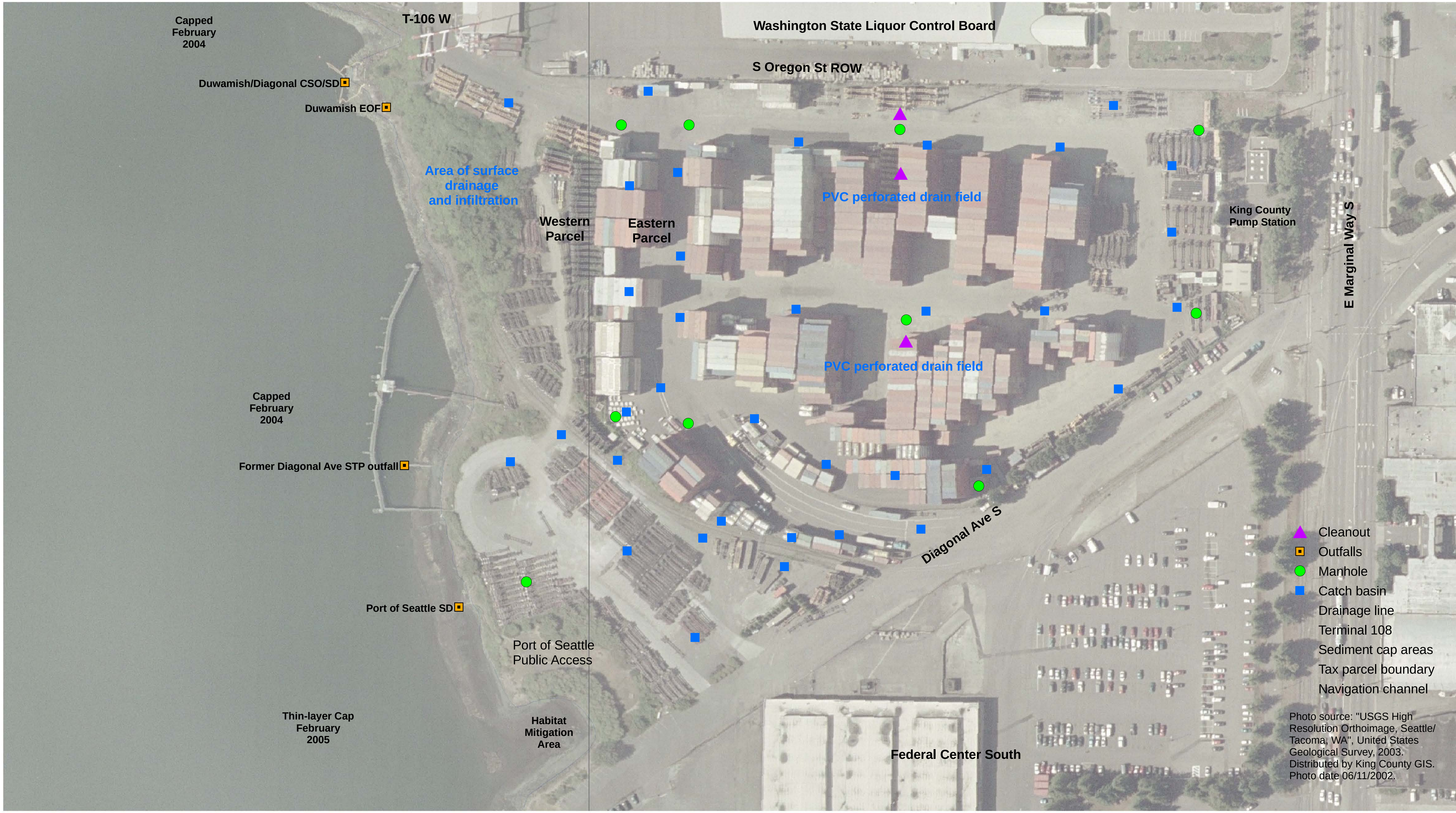
A four-lane entry extends from Diagonal Avenue S into the southern portion of the Eastern Parcel (Map 2). Access to the northern portion of the T-108 cargo yard can be gained from the Diagonal Avenue S ROW. The T-108 container storage and maintenance facility is linked to the adjoining T-106W, located to the north, by an access roadway extending the S Oregon Street ROW. An office trailer is located in the southeast corner of the maintenance yard in the Eastern Parcel but no permanent structures have been constructed on the Eastern Parcel. The Eastern Parcel is surrounded by chain-linked fencing and light posts are dispersed throughout the container yard.

A network of storm drainage lines, catch basins, manholes, and oil/water separators support drainage for the paved and graveled areas of the Eastern Parcel. The drainage system was installed in 1993 by the Port when the Port redeveloped the property for use as a container storage yard. The drainage system consists of City of Seattle-approved catch basins in a 100-ft by 150-ft grid pattern. Lines of highway grade perforated polyethylene pipe were installed beneath the areas of gravel during redevelopment of the property to collect stormwater that infiltrates in the areas where the cargo containers are stored. The perforated pipes are located approximately 2.5 ft bgs (note that the highest groundwater level measured at T-108 in 2007 was 5.99 ft bgs [Table 1]); therefore, groundwater is not expected to infiltrate the perforated piping). The perforated pipes interconnect with a combination of 18- and 24-inch-diameter pipes that collect stormwater runoff in the paved areas supported by the catch basins. All stormwater collected in the Eastern Parcel is routed through an approved oil/water separator prior to discharge into the Duwamish/Diagonal SD piping beneath the S Oregon Street ROW. This piping ultimately discharges into the LDW 100 ft northwest of the subject property. Surface runoff from the Eastern Parcel tends to collect in the eastern portion of the site (within the area of the maintenance yard) which is topographically lower than the remainder of the property (Pacific Groundwater Group 2006c).

ConGlobal maintains an industrial stormwater NPDES permit (No. SO3-010569) and has prepared a stormwater pollution prevention plan (SWPPP) to manage stormwater discharges to the Duwamish/Diagonal CSO/SD system. Additional information on the NPDES permit and SWPPP is included in Section 3.6.

Improvements on the Western Parcel of T-108 are primarily associated with its former uses. The southern portion of the Western Parcel was paved in the early 1960s for use as a parking lot (Port of Seattle 1988). A drainage system consisting of catch basins and a storm drain (Port outfall 2225) was also installed at this time to drain stormwater from the parking lot (Map 5).

In the early 1990s, Lafarge Canada, Inc. (Lafarge) installed a bulk cement terminal on the Western Parcel. The terminal was installed on existing paved areas (a former parking lot) which drained to an existing SD outfall. A catch basin was installed by Lafarge for the truck wash-down area; this catch basin was plumbed to the sanitary sewer (Port of Seattle 1988). The paved areas and catch basins, as well as remnants of the truck wash-down area, remain on the Western Parcel. In addition, Lafarge constructed a pier and pneumatic conveyor system offshore of T-108 in approximately the center of the shoreline. These features are still present although not currently in operation (Map 2).



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Map 5. Stormwater drainage networks

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A railroad spur, approximately 1,100 feet long, spans both the Eastern and Western Parcels of T-108. The spur extends from the southern property boundary and crosses Diagonal Avenue S before joining the existing Union Pacific Railroad track on the south side of Diagonal Avenue S. On T-108, the spur extends west and north to a loading platform in the northwest corner of the Western Parcel. On the Eastern Parcel, the rail spur runs along the boundary between the two parcels and terminates near the northern property border. The rail spur is not currently in use. Chain link fencing borders the majority of T-108 (both the Eastern and Western Parcels).

3 Property Ownership and Operational History

The area currently comprising T-108 was created from the flood plain of the Duwamish River between 1913 and 1917, at the time of construction of the LDW; however, based on historical aerial photographs, the site was otherwise undeveloped as of 1936 (Appendix B). The first documented development and use of the site occurred in 1938 when the property was developed as the Diagonal Avenue S STP.

Over the years the property has been used for various industrial purposes and has had several different owners and operators. Since 1980, ownership and operation of the property has been split between two parcels, an Eastern Parcel and a Western Parcel (Map 2). Both parcels are currently owned by the Port. The Eastern Parcel is approximately 11 acres in size and the Western Parcel is approximately 9 acres in size.

Information in this section is derived from documents on file at Ecology and the Port, as well as historical documentation of the Diagonal Avenue S STP (Brown and Caldwell 1958), documents prepared in association with the Duwamish/Diagonal CSO/SD sediment area cleanup, and documents prepared as part of the source control strategy for the LDW. Information from documentation on site use at T-108 prior to the Port's ownership period (beginning in 1980) is included when available. Several of the documents reviewed for information on property development and use were planning documents prepared for the purposes of acquiring permits. In some cases it is unknown whether all planned development activities were completed. Several historical sources provided conflicting or incomplete information. The property ownership and operational history presented for T-108 in this report are intended to be as complete and accurate as possible; however some inaccuracies and uncertainties may be present and are identified accordingly. Figure 1 provides a visual timeline of the subject property's ownership, operational, and environmental investigation history.

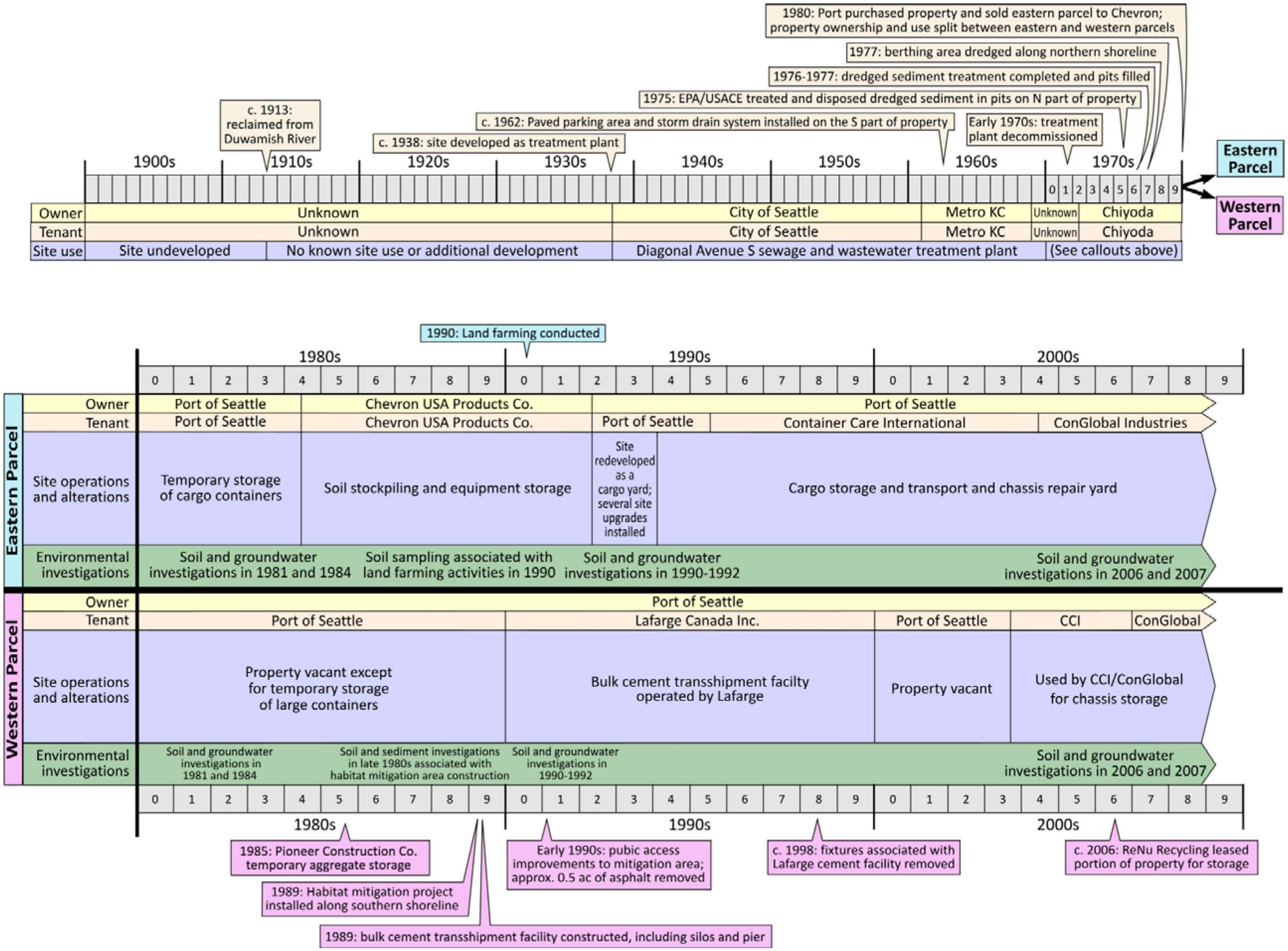


Figure 1. T-108 timeline: ownership, operations, and environmental investigations

3.1 PRE-INDUSTRIAL HISTORY

Until the 1850s, the Duwamish River and surrounding areas supported fishing, hunting, and trapping activities of various Native American Tribes. Historically, the Black, Green, and White Rivers all contributed to the flow of the Duwamish River, with the Black and Green Rivers being tributaries to the White River, which was tributary to the Duwamish. The original Duwamish drained an area of approximately 1,640 square miles as it meandered through grasslands, floodplains, wetlands, and tidal marshes prior to emptying into Elliott Bay.

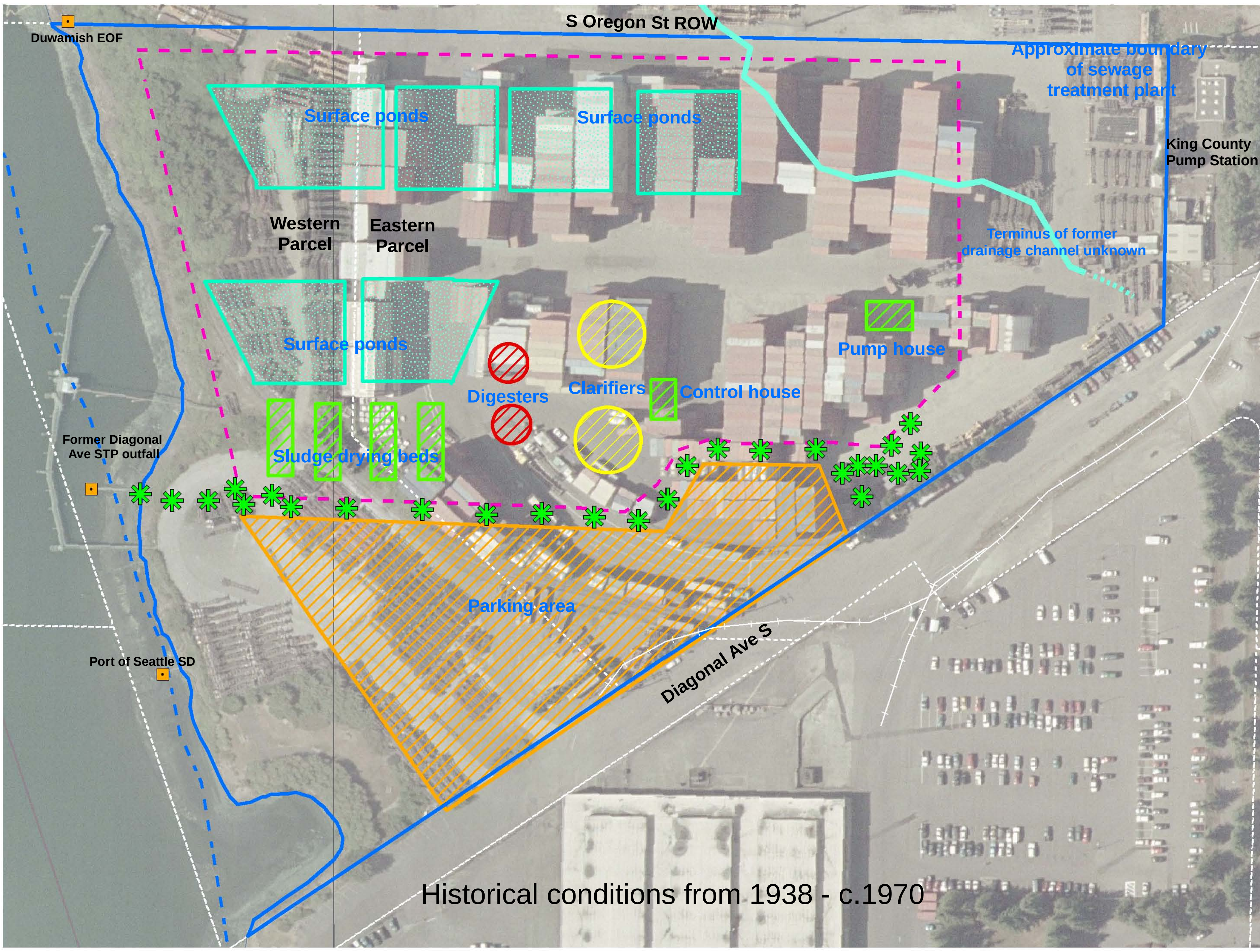
People of European descent arrived in the region in the 1850s and began clearing the shoreline and draining the adjacent freshwater and tidal marshes to facilitate farming activities. Logging emerged as a profitable venture, and docks and shipping infrastructure were built along the banks of the Duwamish. Because flooding in low-lying areas remained a concern in the early 1900s, levees and dams were installed to control water flow. Additional efforts to control river flooding led to several changes in the hydrology of the Duwamish River. The White River was diverted to the Puyallup River, the Cedar River was rerouted to flow into Lake Washington, and the Black River was reduced to a small stream with the construction of the Lake Washington Ship Canal and the resulting lowering of the water level in Lake Washington. The Green River remained as the only tributary to the Duwamish River.

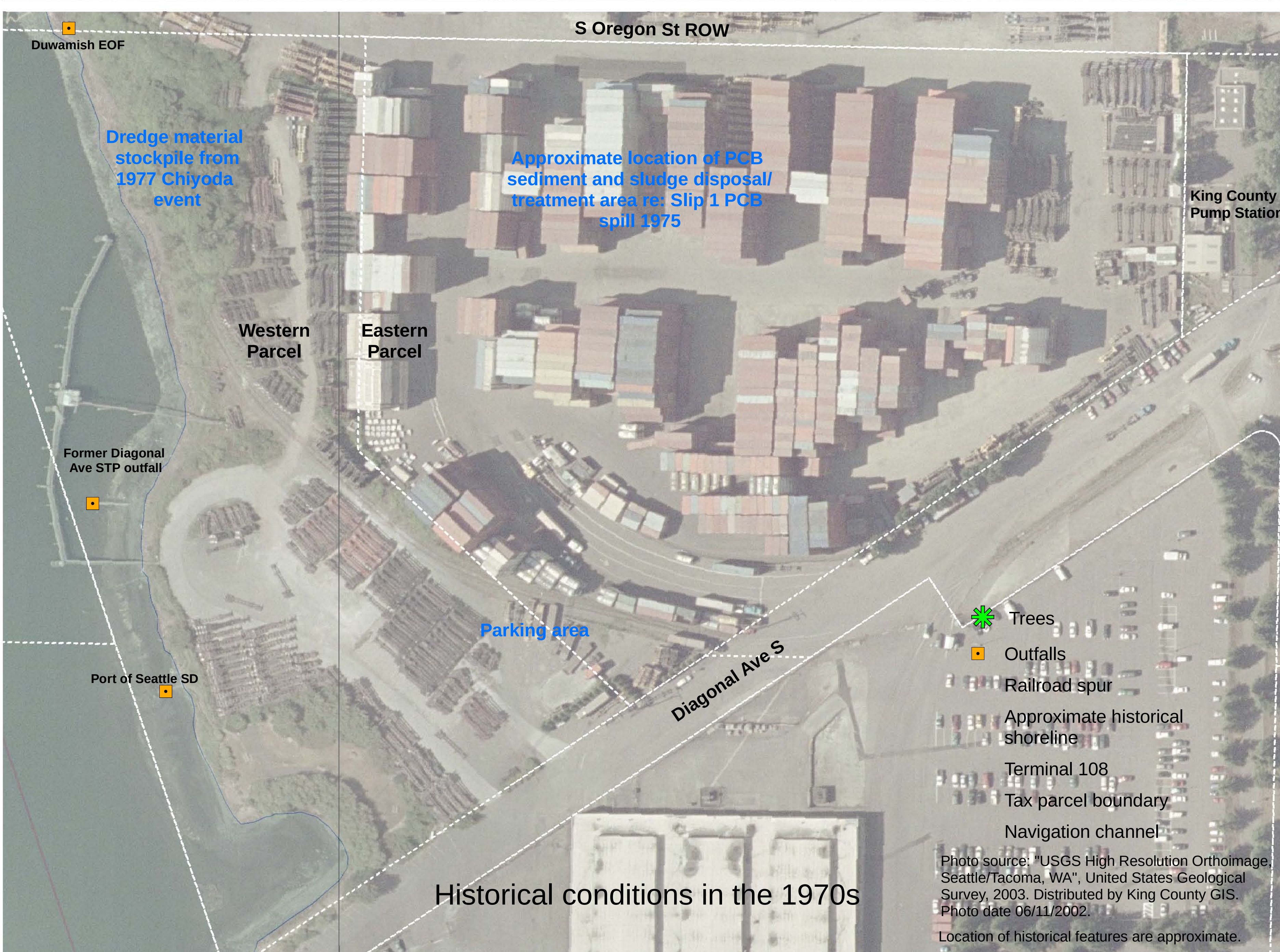
Between 1913 and 1917, the Duwamish River was channelized and dredged to form the LDW. The land on which T-108 now exists was once tidal marsh that was reclaimed through the placement of fill materials during this time period (AGI 1992b, citing Dames and Moore 1981). Channelization and dredging of the river increased the levels of industrialization of the area as berthing of large ocean-going vessels became possible. Commercial interest of the waterway's shoreline expanded, and residential areas sprung up in what had been farmland adjacent to the river.

The first known use of the T-108 property was as the Diagonal Avenue S STP, owned and operated by the City of Seattle until 1962. The plant began operations in 1938 (Ecology 2004a). Documentation regarding the use of the T-108 property prior to 1938 has not been identified.

3.2 DIAGONAL WAY SEWAGE TREATMENT PLANT

From 1938 to 1962, the City of Seattle operated the Diagonal Way STP on the current location of the T-108 subject property. Between 1962 and 1969, Metro assumed operation of the facility and made improvements to the plant (King County et al. 2005a). This facility had the capacity to receive eight million gallons of sewage and stormwater per day (mgd) and was the primary sewage treatment and discharge facility for the industrialized and downtown portions of the City of Seattle. The location of the treatment plant is shown on Map 6 (approximate locations of major facility features) and in aerial photos from 1946, 1953, 1961, and 1970 (Appendix B).





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Map 6. Historical site features 1938 – c. 1970, 1970s

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Treatment facilities comprising the treatment plant included two large clarifiers and two digesters located in approximately the center of the subject property, glass-covered sludge drying beds to the west of the clarifiers and digesters, a control house adjacent to the east of the clarifiers and digesters, and a pump house on the eastern portion of the property (TAMS 1992; Brown and Caldwell 1958) (Map 6; Appendix B – 1946 aerial). The pump house associated with the Diagonal Avenue S STP is different from the current King County pumping station located adjacent to and east of present day T-108.

As mentioned previously, historical aerial photographs identify a former tidal channel that extended from the LDW, along or adjacent to the north of the present day S Oregon Street ROW, and into the subject property (AGI 1992a). According to information on the construction and operations of the Diagonal Avenue S STP, this drainage channel was not used for water intake or effluent discharge from standard plant activities. The channel may have received untreated sewage from a small sewer system located to the northeast of T-108 (King County et al. 2005a), not associated with the Diagonal Avenue S STP.

Historically, a raw sewage trunk line extending west from E Marginal Way S carried wastewater to the former control house and clarifiers. Wastewater was treated in the clarifiers and digesters and the sludge was then pumped into open ponds and drying beds on the northern portion of the property (Dames & Moore 1988). The size, location, and configuration of the sludge ponds changed over the years as observed in aerial photographs (Appendix B). Primary-treated effluent was discharged into the LDW through a 30-inch steel outfall located approximately mid-way along the property shoreline (see former Diagonal Avenue STP outfall 2002 on Maps 2 and 6; Appendix A, Photo 14; and Appendix B). A parking lot area was constructed on the southern portion of the property around 1962 (Port of Seattle 1988). A drainage system was installed in association with the parking area, including an 18-inch concrete outfall (Port outfall 2225 on Map 2).

The Diagonal Way STP was closed by 1970 when construction of the West Point Wastewater Treatment Plant (WWTP) was completed and sewage and wastewater was re-routed to that facility. As part of the construction of the West Point facility, the Duwamish Pumping Station was constructed adjacent to and east of T-108 and the Diagonal Way CSO/SD and Duwamish EOF were installed beneath the S Oregon Street ROW. The structures and above-ground clarifiers were demolished and removed in the early-1970s. The digesters were reportedly filled and left in-place (Port of Seattle 1992a). Sludge up to five feet thick was left in the sludge ponds and drying beds on the northern portion of the property and subsequently covered with fill material (Dames & Moore 1988; AGI 1992b). The source of the fill material has not been identified during the review of historical documentation.

3.3 CHIYODA CORPORATION INTERNATIONAL OWNERSHIP (C. 1972-1980)

Chiyoda acquired the T-108 subject property in the mid-1970s and planned to construct a chemical manufacturing plant with a loading dock on the site. Although shoreline dredging was conducted by Chiyoda in anticipation of the manufacturing plant, it was never constructed because the company failed to acquire the necessary permits for the shore-based dock (King County 2002).

In 1974, approximately 265 gallons of PCB oil consisting of Aroclor 1242 were spilled into Slip 1 of the LDW (upstream of T-108) when an electrical transformer owned by the United States Air Force was damaged while being loaded onto a barge owned by the Alaska Puget United Transportation Company under contract to the Navy Military Sea Transportation Service (King County et al. 2005a; EPA 1975). Neither the US government nor the Puget United Transportation Company would claim responsibility for the spill, so EPA took control as the On-scene Coordinator for the spill cleanup. The majority of the spilled PCB material (approximately 250 gallons) was dredged from the bottom of the LDW and transferred to a trailer mounted portable treatment plant stationed on the southern portion of the Federal Center South facility.

Additional dredging was conducted by EPA and USACE between 1974 and 1976 to remove LDW sediments contaminated with the residual PCB material (approximately 20 gallons not removed during the initial cleanup effort). According to the interim groundwater and shoreline soil investigation final work plan report completed for T-108 by PGG, Chiyoda agreed to allow the EPA and USACE to store and treat approximately 10 million gallons of dredged sediment slurry on the subject property (Pacific Groundwater Group 2006c). A historical record of this agreement was not identified through the course of this investigation.

To accommodate treatment and disposal of the dredged sediment, USACE excavated two pits were excavated on the northern portion of the T-108 property near the location of a large former sludge pond (see Map 6 and Appendix B). The pits were reported by the Pacific Groundwater Group (PGG) to have been excavated to depths of 10 to 12 ft deep based on a review of a 1976 topographic map (2006c). PCB-contaminated sediment slurry was pumped into the southwest corner of the western pit where solids were allowed to settle out. The liquid portion of the slurry was then decanted into the eastern pit and pumped to a holding pond and treatment unit. From there it was pumped back into the LDW. PCB Aroclor 1242 concentrations in the dredged sediment within the western pit ranged from 146 mg/kg at the slurry intake point in the southwest corner of the pit, to 33 mg/kg in the pit interior (Pacific Groundwater Group 2006c). The location of the holding pond and treatment unit are not known.

The sediment treatment process was completed and USACE filled the pits by 1977. After treatment, water was pumped back into the LDW, however the solids that had settled out within the holding pits (primarily the western pit) were left in place and the pits were subsequently covered with fill material (Pacific Groundwater Group 2006c).

The fill consisted of the material excavated during pit construction and from other sources (see paragraph that follows). It has been estimated that between 7,000 and 8,000 cy of sediment dredged during the PCB spill cleanup were buried in the holding pits, and that in total, this included approximately 170 gallons of PCBs (Pacific Groundwater Group 2006c). In 1980, Chiyoda sold the T-108 property to the Port.

In 1977, Chiyoda cut back and dredged the northern portion of the T-108 shoreline to improve berthing (see Appendix B); the new shoreline was approximately 100 ft further inland from the extent of the shoreline before dredging (King County 2002). It is estimated that 80,000 cubic yards (cy) of material was dredged from the area (King County et al. 2005a). Based on a review of historical aerial photographs, it appears that the southern extent of the dredging likely ended in the vicinity of the former Diagonal Avenue S STP outfall (Maps 2 and 6). Dredged material was stockpiled on the northern portion of the Western Parcel (see Map 6 for approximate location), and was also used to fill the dredged sediment pits, fill nearshore areas, and level the site of the former Diagonal Way STP.

3.4 Ownership and Operational History (1980-2008) – Eastern Parcel

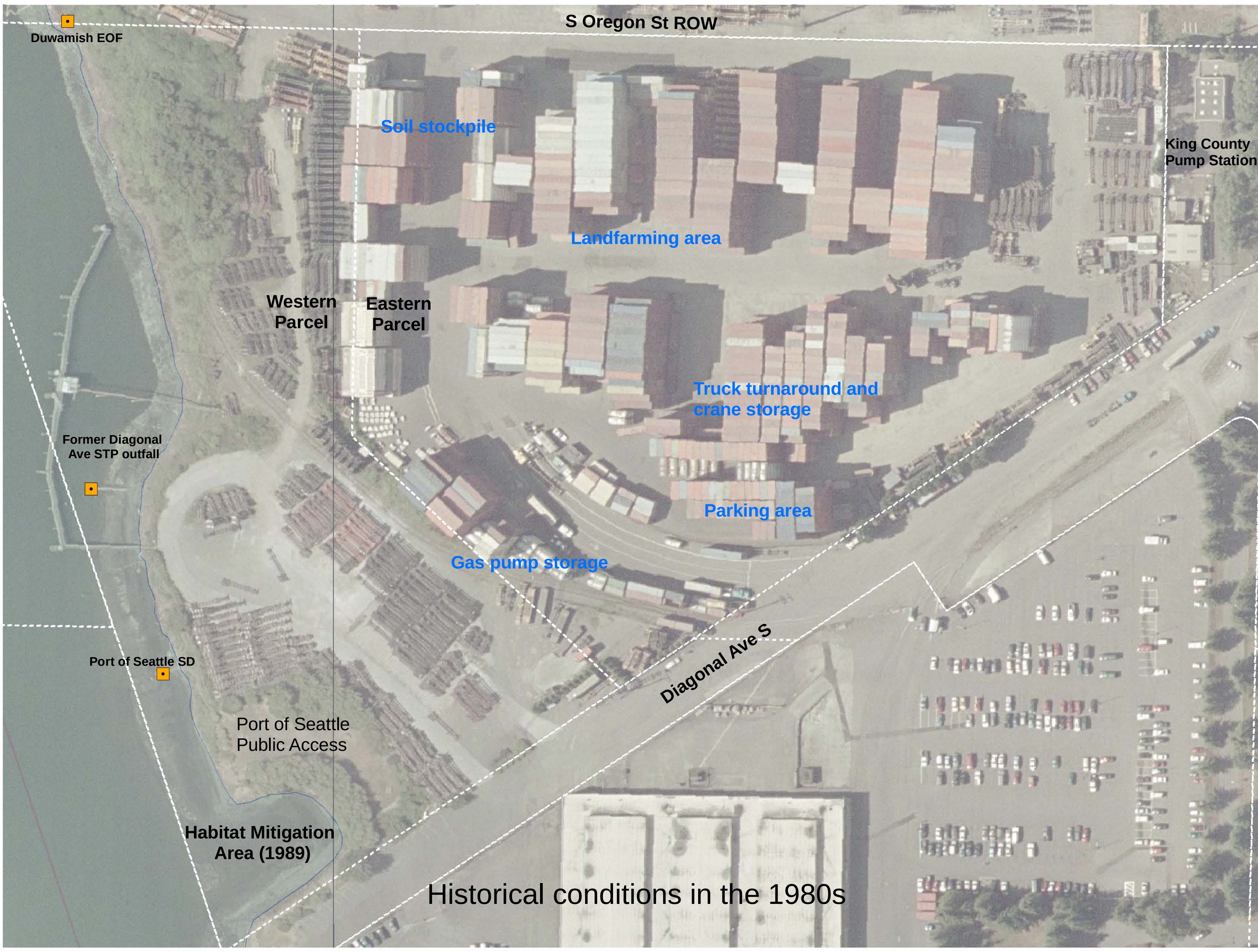
The subject property was first subdivided into the Eastern and Western Parcels in the early 1980s. Since that time, ownership of the Eastern Parcel traded between the Port and Chevron a few times in the 1980s and 1990s. Since 1992, the Eastern Parcel has been owned by the Port and leased as a container terminal.

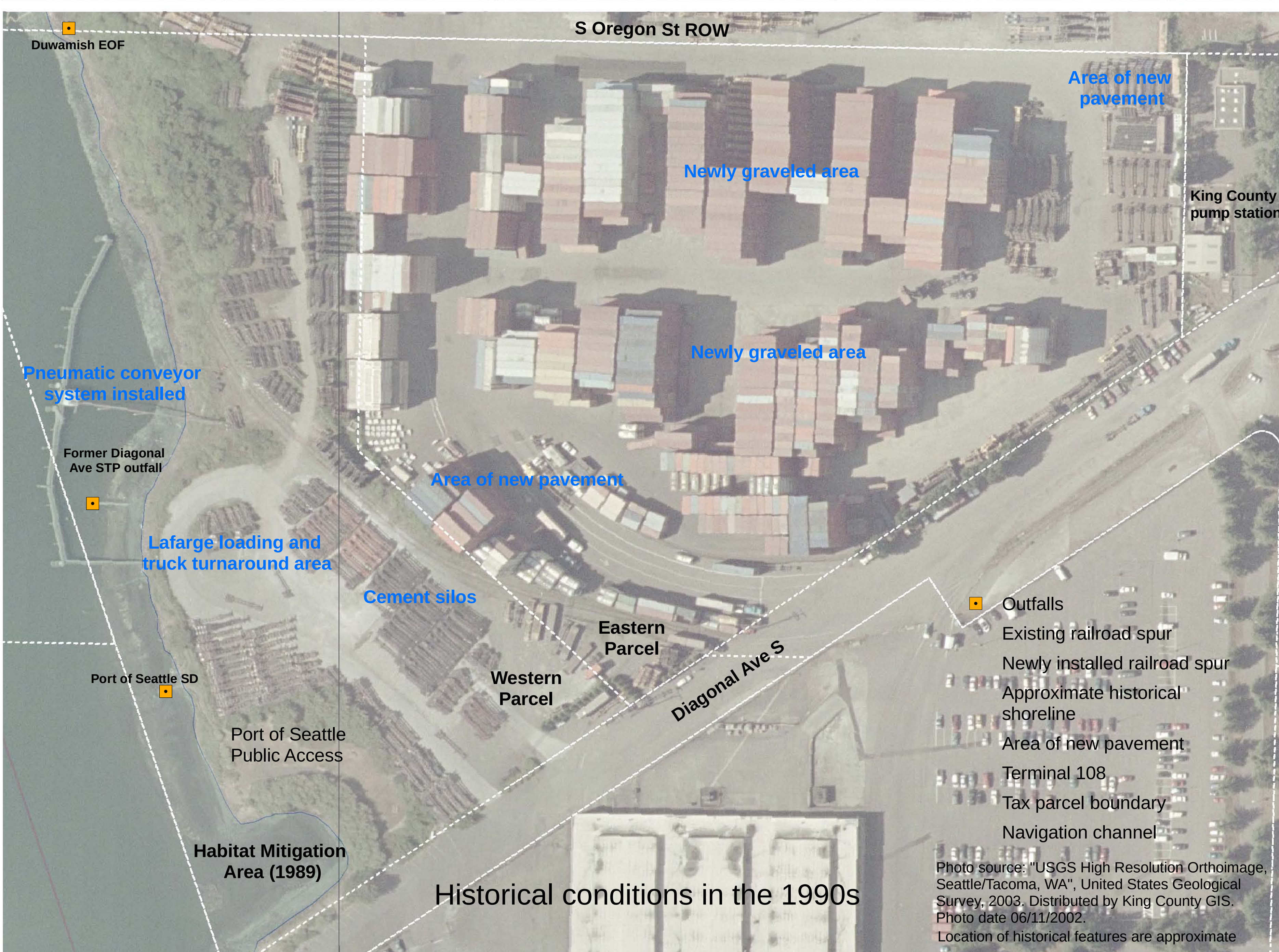
3.4.1 Port of Seattle Ownership (1980-1984)

The Port acquired the subject property from Chiyoda in 1980. Based on a historical aerial photo from 1981, the paved southern portion of the property and a small area in the central portion of the property were used for container storage (Appendix B). No additional information regarding the use of the Eastern Parcel during this time period was identified.

3.4.2 Chevron USA Products Company Ownership (1984-1992)

In 1984, Chevron USA Products Company (Chevron) acquired the Eastern Parcel of T-108 as part of a deal in which the Port acquired Pier 32 (formerly Terminal-30/Chevron). This is the first time that property ownership was split between the Eastern and Western Parcels. Chevron used the Eastern Parcel from 1984 to 1992 to stockpile soil and store equipment. Gasoline station equipment, including cranes and gasoline pumps, were stored on the southern portion of the parcel (Map 7) (Port of Seattle 1992a). The area was also used for automobile parking. One or two mobile office trailers were located on the Eastern Parcel during Chevron's ownership. Soil stockpiles and equipment storage areas are visible in aerial photographs from 1990 (Appendix B).





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Map 7. Historical site features 1980s, 1990s

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The northwestern portion of the parcel was used by Chevron to treat soil contaminated with petroleum hydrocarbons using a technique called land-farming for approximately six months in 1990. Approximately 1,400 cy of soil excavated from a local service station that had been contaminated by a leaking underground fuel storage tank was treated by land-farming (Thorne Environmental 1990); the approximate location where the land-farming activity occurred is presented on Map 7 and visible on the aerial photograph from 1990 (Appendix B).

Prior to the onset of land-farming activities, analytical samples were collected from the soil stockpile and the surface soil in the proposed land farming area. Total petroleum hydrocarbons (TPH) were detected above Ecology cleanup standards of 200 parts per million (ppm) in the soil stockpile (Thorne Environmental 1990) (Appendix C). Total xylenes, ethylbenzene, barium, and cadmium were also detected in the soil stockpile; PCBs, benzene, toluene, arsenic, chromium, lead, mercury, selenium, and silver were not detected (Thorne Environmental 1990). Gasoline and benzene, toluene, ethyl benzene, and xylene (BTEX) constituents were not detected in surface soil samples collected from the proposed land-farming location; however, PCBs were detected in five out of the six samples (with a maximum total PCB concentration of 6.90 ppm) (Pacific Environmental Group 1991).

The soil was placed in a 200-square ft area located at approximately the same location as the PCB dredge sediment disposal pits that were created to treat impacted sediment from the 1975 PCB spill at Slip 1. The aerial photo from 1990 shows the land farming area in the northern portion of the parcel (see Appendix B). Prior to placing the petroleum-contaminated soils onsite, a clay cap was installed in the designated land-farming area (Map 7) to prevent the possibility of contaminating the soils to be land-farmed with other contaminants that might have been present on the property (Dames & Moore 1988). The clay cap had a surface approximately two ft thick and varied from an elevation of approximately 15 to 17.5 ft (Dames & Moore 1992). The soil was land-farmed until petroleum hydrocarbon concentrations in the soil were below MTCA Method A cleanup screening levels. TPH concentrations of the land-farmed soil ranged from 42-190 mg/kg, TPH-gasoline concentrations ranged from non-detected to 28 mg/kg, and BTEX constituents were not detected (Pacific Environmental Group 1991) (Appendix C). The stockpiled soil was distributed on the Eastern Parcel of T-108 to a thickness of approximately 1 to 2 ft (Dames & Moore 1992).

After land-farming activities were completed, soil samples were also collected beneath the treatment area to determine whether native soil conditions had been affected by land-farming activities (Appendix C). TPH concentrations ranged from 15 to 100 mg/kg, TPH-gasoline was not detected, and BTEX constituents were not detected (Pacific Environmental Group 1991). PCB 1248 was detected at concentrations ranging from 106 to 9.3 mg/kg. These results suggest that native soil was contaminated with TPH because of land-farming activities but that the contamination was below Ecology cleanup levels.

In 1992, the Port purchased the Eastern Parcel of T-108 back from Chevron and redeveloped the property for use as a container terminal. Permitting documentation for development of the container terminal indicated that the land-farmed soils would be removed and disposed of at an approved off-site facility prior to redevelopment (Port of Seattle 1992a); therefore, it is assumed at this time that the land-farmed material is no longer present on the T-108 property.

3.4.3 Port of Seattle Ownership – Eastern Parcel (1992-1997)

In the early 1990s, the Port redeveloped the Eastern Parcel of T-108 for use as a container storage and chassis repair yard to accommodate CCI in expanding their operations from T-106W (located adjacent to the northwest of T-108). The redevelopment involved construction of a paved access road across the S Oregon Street ROW to connect the two Port properties, construction of a 4-lane truck access road extending from Diagonal Avenue S onto the southern portion of the Eastern Parcel, construction of a rail spur extending from the rail line along the south side of Diagonal Avenue S to the northwest corner of the container terminal, and re-surfacing much of the parcel with asphalt pavement and gravel for container storage and transport (Port of Seattle 1992a). These improvements are visible on aerial photographs from 1995 and subsequent years (Appendix B). Improvements were also made to the stormwater drainage system including installation of an oil-water separator, catch basins, and new subsurface piping; this drainage system is discussed in Section 2.4.

In order to ensure subsurface materials would be geotechnically suitable to support future land use as a cargo container storage and transport yard, approximately 5,000 cubic yards (cy) of soil and fill material, including the soil land-farmed during Chevron's ownership of the property, was removed from the property between 1992 and 1993 (as indicated by the permit for the effort), and replaced with newly-imported fill material (Port of Seattle 1992a).

Development of the container terminal was completed by 1995. CCI's operations included unloading cargo from barges and loading it onto trucks and railcars for transport. In addition, chassis repair and maintenance operations also occurred at the eastern portion of the Eastern Parcel during CCI's occupation of the property. Hazardous substances handled on the property in association with these activities included (but were not necessarily limited to) chlorofluorocarbon (CFC) 11/12, Freon 12, paint, paint thinner, oils, lubricants, and fuel products (Container Care International 1993).

In 2004, CCI merged with another depot operator called Global Intermodal Systems to form ConGlobal Industries (ConGlobal). ConGlobal assumed operation of both T-108 and T-106W at this time. For a brief period, ReNu recycling also leased approximately 2 acres of the southern portion of the Eastern Parcel of T-108 for use as temporary storage for trucks and roll-off bins (Pacific Groundwater Group 2007a). The ReNu lease was transferred to ConGlobal in August 2007.

3.5 OWNERSHIP AND OPERATIONAL HISTORY (1980-2008) – WESTERN PARCEL

The Port purchased the Western Parcel of T-108 from Chiyoda in 1980 and has maintained ownership of the property since that time. Between 1980 and 1985, the parcel remained vacant, with the exception of some container storage limited to the southern, paved portion of the parcel in the early 1980s. In 1985, the Pioneer Construction Materials Co. (Pioneer) was permitted to use the site as a temporary construction aggregate storage area for a period of approximately six months (Taylor 1985). The aggregate was unloaded from barges using a portable stacker/conveyer system and subsequently loaded onto trucks for transport to a construction site along I-90. The aggregate originated from Pioneer's gravel pit in Steilacoom, Washington and is assumed to have been free of contaminants when brought to the site.

In the late 1980s, a habitat project was constructed along the southern portion of the T-108 shoreline to mitigate for loss of habitat at another Port property (T-30). Approximately 12,400 cy of sediment and soil were cut out of the existing shoreline bank to create the 12,300 square foot (SF) intertidal shoreline habitat area located immediately north of Diagonal Avenue S (Port of Seattle 1985b) (Map 7). The majority of the soil and sediment removed during construction of the mitigation site was approved for open-water disposal in Elliott Bay. Approximately 200 cy of the excavated material was found to be contaminated and required disposal at an approved upland site (Ecology 1987). According to Port staff, contaminants in the soil were primarily metals and PAHs and were thought to be related trash (cans, broken glass, and other debris) dumped at the Diagonal Avenue S street end. Additional details (including the analytical results) of the sampling conducted in the mitigation area prior to its construction are not currently available. After the soil and sediment excavation was completed, approximately 1,500 cy of clean rock and structural fill were installed at the mitigation area to stabilize the bank.

Between 1989 and 1998, Lafarge leased the Western Parcel from the Port for use as a bulk cement transshipment facility. The facility was constructed in the early 1990s and was located on the southern half of the Western Parcel of T-108 (Map 7). Lafarge used the facility to transport bulk cement from barges to trucks and rail cars for distribution.

Several site improvements were made during development of the Lafarge facility. A barge moorage pier and pneumatic conveyor system were constructed offshore in the LDW, approximately in the center of the parcel shoreline (see Map 7 and Appendix B). A product transfer tower, four dry cement storage silos, a truck scale, and a truck wash-down area were all constructed according to permitting documentation (Port of Seattle 1988). The truck wash-down area was constructed on a concrete pad that drained to a catch basin and ultimately to the sanitary sewer. A prefabricated shed was placed on a paved area on the southwest portion of the parcel for use as an office building.

Public access improvements to the shoreline mitigation area and Diagonal Avenue S street end were also planned as part of the project. These improvements were in accordance with the Port's public access plan (Port of Seattle 1985a) and included a trail and hand-boat launch area. The wooden bulkhead observed along the property shoreline in March 2008 were associated with the public access trail (Blomberg 2008) (Appendix A, Photos 12 and 13).

Paved roadways, a rail spur, and associated loading areas were also constructed as part of the Lafarge facility improvements. According to Port staff, a covered loading area was located adjacent to the storage silos and was used to load trucks and railcars. The loading area was a shallow pit excavated beneath the rail line. Dry bulk cement that arrived to the facility by rail was unloaded into the pit and then loaded into the silos via an additional pneumatic conveyor system (Blomberg 2008). Plans for the terminal also called for construction of office and warehouse buildings, however according to Port staff and based on a review of historical aerial photographs, it does not appear that these buildings were ever constructed.

Grading and shoreline modifications were made as part of the Lafarge facility development. In order to stabilize eroding shoreline in the central and northern portions of the property, the bank was cut back above 11.5 ft MLLW and stabilized with riprap (Port of Seattle 1988, 1989). Excavated bank sediments, as well as dredge spoils along the northern portion of the shoreline (likely remaining from Chiyoda's 1977 dredging project) were graded across the northern portion of the parcel (Port of Seattle 1988). The area was then seeded/planted with vegetation to help control erosion.

Additional public access improvements were made to the mitigation area in the early-1990s. These improvements were made to compensate for public access restrictions to the S Oregon Street ROW implemented during development of the container storage facility on the Eastern Parcel of T-108 (Port of Seattle 1992a). Public access enhancements included removal of approximately a half acre of asphalt near the mitigation area, installation of additional native plantings, and installation of other human-use features such as picnic tables and interpretive signage (Port of Seattle 1992a).

In the late 1990s, Lafarge removed the bulk cement facility fixtures and transported them for use in Eastern Washington. The fixtures removed included the storage silos, office shed, truck scale and wash-down area, and rail car loading equipment (Port of Seattle 1999). Beginning around 2002 or 2003, CCI used a portion of the parcel as a chassis storage area.

3.6 Current Operations at T-108

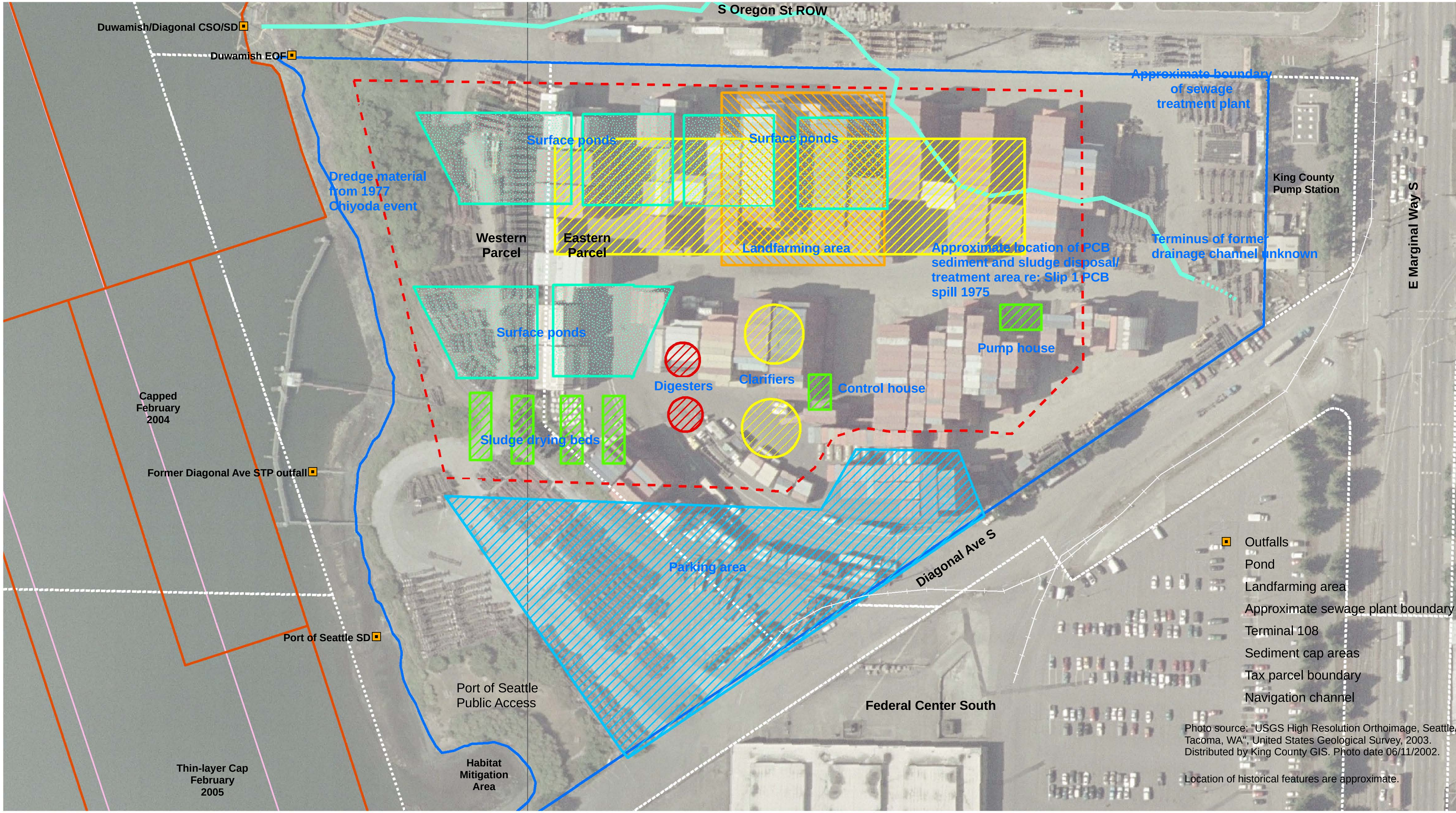
ConGlobal is currently the only tenant at T-108, and the company continues to operate a container terminal on the Eastern Parcel. Containers are stored throughout the Eastern Parcel and maintenance is conducted on the eastern end of the parcel (Appendix A, Photo 2). A fueling area, which includes two aboveground storage tanks (AST) containing diesel (one 300-gallons and one 600-gallons) is located on the southern portion of the Eastern Parcel. An additional 1,200-gallon AST is also located in this area.

ASTs are regulated based on the requirements outlined in the Code of Federal Regulations (CFR) (40 CFR 112 – Spill Prevention, Control, and Countermeasure Plans).

ConGlobal also leases the majority of the Western Parcel for use as a chassis storage and lay-down area (Appendix A, Photos 7 and 8). The public access park and mitigation area remain on the southern portion of the Western Parcel and are not included in the ConGlobal lease area (Appendix A, Photos 9 and 10). For reference purposes, Map 8 provides a comprehensive presentation of the historical site features (presented on Maps 6 and 7) overlying the current conditions of the T-108 subject property. Map 9 expands this comprehensive presentation to include the locations of previous soil and groundwater sample locations.

As of April 2008, ConGlobal maintains an industrial NPDES stormwater permit (No. SO3-010569) and a SWPPP for management of stormwater discharges from the container terminal to the Duwamish/Diagonal CSO/SD system has been prepared. ConGlobal also maintains an SPCC plan to be implemented in the case of a hazardous materials release. The purpose of the NPDES permit, SWPPP, and SPCC plan is to reduce the potential for stormwater contamination resulting from industrial activities conducted at the facility. Ecology conducted a stormwater compliance inspection at the facility on June 5, 2008. Several modifications to the SWPPP were required after the inspection.

Best management practices (BMPs) are implemented to reduce stormwater pollution, and inspections and stormwater sampling are conducted as required under the NPDES permit and associated SWPPP. Stormwater samples are analyzed for total zinc, oil and grease, turbidity, total suspended solids (TSS), and pH. In addition, total copper and total lead are analyzed if the benchmark for zinc is exceeded during two consecutive sampling events. The chassis repair area and equipment fueling areas on the Eastern Parcel are covered by the NPDES permit and SWPPP; the portions of T-108 used only for storage, office space, and parking are not covered.



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Map 8. Historical Site Features Overlay

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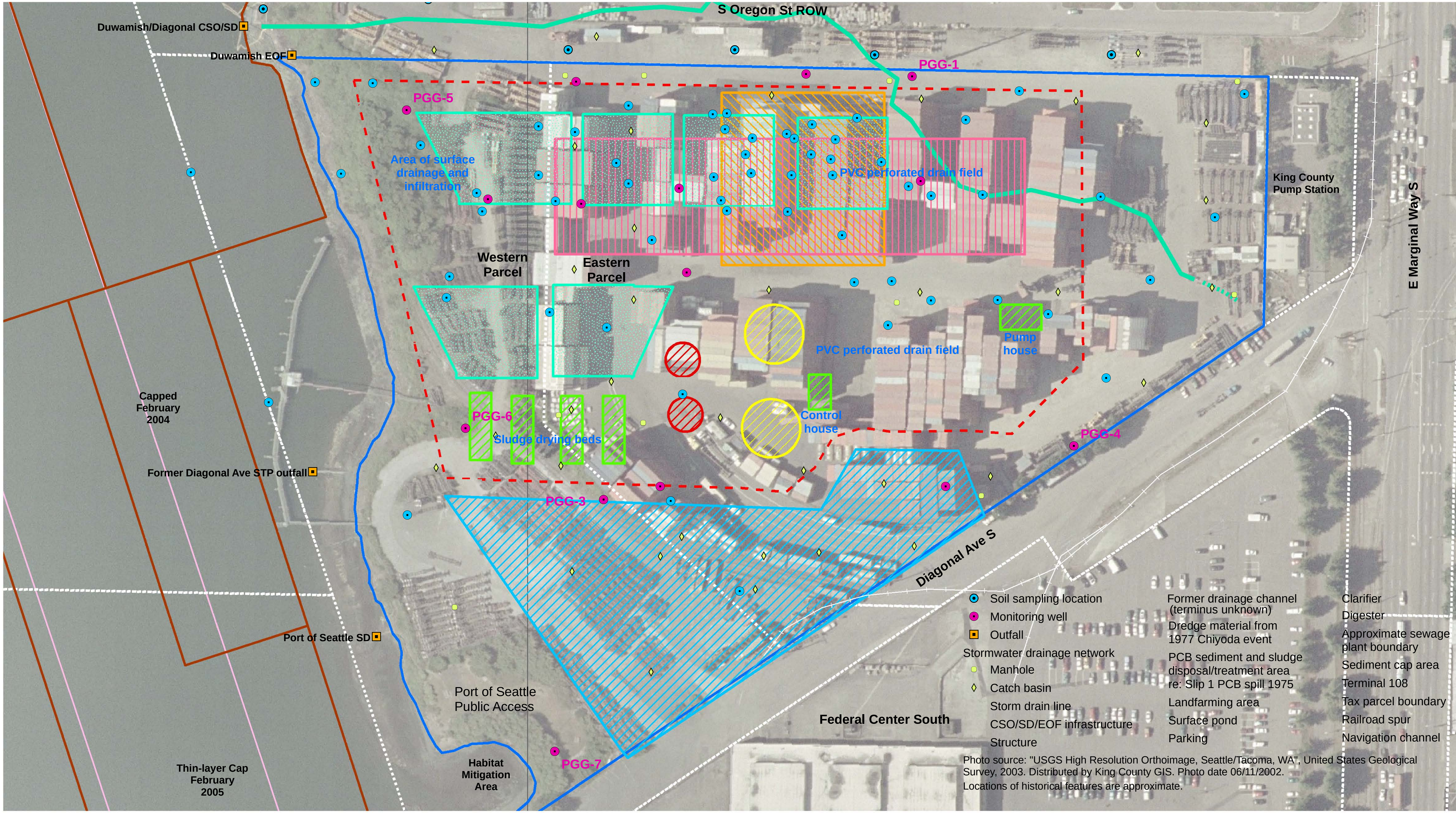

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Map 9. Historical site feature overlay, previous sample locations, and current drainage features

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Prepared by CEJ, 07/2009; MAP # 3357; W:\Projects\06-08-14-01 Marine Environmental Source Control\Data\GIS\T-108

4 T-108 Environmental Conditions and Investigation Information

Since the early 1980s, numerous environmental investigations have been completed at the subject property and at properties within its immediate vicinity. Environmental investigations have included sampling and analyses of soil, groundwater, seep water, bank soil, and nearshore sediment. Although samples have been collected over the majority of T-108, much of the investigation work has concentrated on the northern portion of the subject property, in the vicinity of the former landfarming and PCB sludge disposal and treatment areas.

The following sections provide an overview of previous sampling events completed at the subject and adjacent properties. The information in the section has been presented to assist with overall evaluation of the subject property, in order to develop an effective, long-term source control strategy. The particular data discussed in the follow sections are provided in more detail in Appendix D (T-108 related data) and Appendix E (relevant adjacent property data). This section and Appendix E also provide information on the rights-of-way surrounding the subject property and the stormwater outfalls within the vicinity of T-108.

4.1 Environmental Data Summary for T-108

In 2006, PGG completed a review and summary of historical soil and groundwater data for T-108 as part of their work plan for additional soil and groundwater sampling to be conducted on the property in 2006 and 2007 (Pacific Groundwater Group 2006c). The following soil and groundwater data summaries are based on the PGG work plan and the data reports summarizing PGG's recent environmental investigations at T-108 (Pacific Groundwater Group 2006b, 2007a).

4.1.1 T-108 soil

Several soil and groundwater investigations have been conducted on T-108 since the 1980s. Data are available from several historical investigations including Dames and Moore investigations from 1981 and 1984, PEG investigations from 1990, and an investigation by Applied Geotechnology, Inc. (AGI) in 1991 (Appendix D). PCBs, TPH (gasoline and diesel), toluene, ethylbenzene, and xylenes, thirteen individual PAHs, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, thallium, and zinc have historically been detected in soils at T-108. Of these chemicals, only cadmium was detected above MTCA industrial cleanup levels.

Soil conditions at T-108 were recently investigated by PGG (Pacific Groundwater Group 2006b). The locations sampled, PGG-2, PGG-5, PGG-6, and PGG-7, are shown on Map 3. PCBs (Aroclors 1248, 1254, and 1260), petroleum hydrocarbons (gasoline, diesel, and lube oil), 17 individual PAHs, arsenic, cadmium, chromium, copper, lead, nickel, and zinc were all detected. Of these, only diesel-range hydrocarbons, lube oil-range hydrocarbons, and cadmium were detected above MTCA Method A industrial soil cleanup levels. Sample location PGG-2, located adjacent to the west of the PCB sediment disposal area, exceeded MTCA Method A industrial cleanup levels for diesel-range hydrocarbons and cadmium in the 9-10.5 ft bgs interval. The other exceedance (for cadmium) occurred in the 0.5-2 ft bgs interval in sampling location PGG-7, located at the southern portion of the Western Parcel near the mitigation area (Map 3).

4.1.2 T-108 groundwater

Historical groundwater investigations were conducted on T-108 by Dames and Moore in 1981 and 1984 (Dames & Moore 1984) and by AGI in 1991 and 1992 (AGI 1992a, 1992b). Groundwater data from the Dames and Moore reports were not included in the PGG work plan, but data from the 1984 investigation are included along with other historical data in Appendix D of this report. Groundwater data from the 1981 Dames and Moore investigation were not identified during the course of this investigation; however, according to a site assessment summary report completed for Chevron in 1992, PCB Aroclor 1242 was detected at 0.9 µg/L in one of six groundwater monitoring wells sampled by Dames and Moore in 1981 (AGI 1992a). The well in which Aroclor 1242 was detected was located in the south-central portion of the approximate PCB sludge disposal area. Groundwater samples collected by Dames and Moore in 1984 did not contain PCBs at concentrations above the 1 µg/L detection limit (Dames & Moore 1984); the locations of these historical groundwater wells were not identified during the course of this investigation. PCBs were not detected in groundwater samples collected from T-108 by AGI in 1991 or 1992 (Appendix D).

Groundwater monitoring results from the AGI investigations in the early 1990s identified petroleum hydrocarbons (diesel and gasoline) in wells located on the northern portion of the property. Gasoline-range hydrocarbons did not exceed MTCA Method A cleanup levels; diesel-range hydrocarbons did exceed MTCA Method C cleanup levels in one well located approximately 100 ft south of the sediment disposal pit area. BTEX constituents were also detected in groundwater samples collected within or near the sediment disposal pits; however, concentrations were below MTCA Method C industrial cleanup levels.

PAHs were historically detected in groundwater samples collected from wells on the northern portion of T-108. Total carcinogenic PAH (cPAH) toxic equivalents (TEQs) exceeded the MTCA Method C cleanup level in three wells located to the east and south of the sediment disposal pit area, and one well within the disposal pit area in 1991. Total cPAH TEQs were below MTCA Method C in all wells when re-sampled in 1992 (Pacific Groundwater Group 2006c).

Arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc were detected in historical T-108 groundwater samples. Arsenic and cadmium were each detected above MTCA Method C cleanup levels; arsenic exceeded MTCA in a well near the northeast corner of the Eastern Parcel, and cadmium exceeded MTCA in two wells, one located approximately 100 ft south of the sediment disposal pit area, and one located along the northern boundary of the sediment disposal pit area. In addition, arsenic exceeded the MTCA Method C cleanup level in three historical wells sampled by Dames and Moore in 1984 (Dames & Moore 1984); the locations of these wells are not known. In their work plan, PGG stated that historical groundwater samples collected at T-108 were likely unfiltered and therefore biased high (Pacific Groundwater Group 2006c). In addition, historical samples were not collected with the low flow method and therefore likely contained entrained soils which could also biased analytical results.

In 2006 and 2007, PGG installed seven new monitoring wells and sampled groundwater during four monitoring rounds. The data from these sampling events are presented in Appendix D. PCBs were not detected in any of the wells during all four sampling rounds with the exception of Aroclor 1016, which was detected above MTCA Method A cleanup levels in one well in the second sampling round (PGG-2 on Map 3). This sample result was rejected due to poor sample quality (Pacific Groundwater Group 2006b). The sample was considered to be of poor quality because the well pumped dry several times during sampling, and it was concluded that soil particulates were likely introduced into the sample. In addition, due to a lab/chain-of-custody error, the sample was analyzed after its holding time had elapsed.

Petroleum hydrocarbons and BTEX constituents were not detected in any of the wells sampled during the four sampling rounds. Non-carcinogenic PAHs were detected in two wells in the first round of sampling but were not detected in the following three rounds. Carcinogenic PAHs were detected in two wells (PGG-2 and PGG-5) during the second round of sampling. The results from well PGG-2 were rejected due to poor sample quality for the reasons discussed above (Pacific Groundwater Group 2006b).

Total and dissolved arsenic, chromium, copper, nickel, and zinc were detected in multiple monitoring wells during all four sampling rounds. Within the first two rounds of sampling, total and dissolved arsenic were detected above MTCA Method A cleanup levels in wells PGG-1 and PGG-2 (Map 3). Total arsenic was also detected above MTCA Method A in well PGG-5 in the first sampling round. Total lead was detected above MTCA Method A in well PGG-1 in the first round of sampling. All detected metals concentrations in rounds three and four were below both MTCA Method A cleanup levels and the groundwater screening levels developed by Ecology for the protection of LDW sediments (Pacific Groundwater Group 2007a). Based on the 2006 and 2007 groundwater monitoring results, PGG recommended that groundwater monitoring be discontinued and that the groundwater pathway be considered closed as a source to LDW sediments (Pacific Groundwater Group 2007a). Ecology recently acknowledged that groundwater at the subject property was not considered a potential source of contamination to LDW sediments (Pacific Groundwater Group 2007a).

4.1.3 T-108 bank soil

In 2005, King County collected two bank soil samples (DUD-30C and DUD-31C) from the northern portion of the T-108 shoreline (Anchor 2007) (see Appendix D, Tables D-8 and D-9). No information was provided regarding the tidal elevation at the time of sampling, or the condition of the bank where samples were collected. PCBs (Aroclors 1248, 1254, and 1260) were detected in both samples; however, the dry weight (dw) concentrations were below the MTCA Method A cleanup level for unrestricted land use. The OC-normalized concentration of total PCBs was greater than the CSL in one of the samples. The total organic carbon content of this sample was 1.05%.

One individual low-molecular-weight PAH (LPAH) (i.e., phenanthrene) and all nine individual high-molecular-weight PAHs (HPAHs) analyzed for were detected; however, total LPAH and HPAH concentrations were below the SQS concentrations. Arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc were all detected in bank soil; however, only mercury was detected above the SQS (in one sample). Bis(2-ethylhexyl) phthalate (BEHP), butyl benzyl phthalate (BBP), and di-n-butylphthalate were detected but were below the SQS. Phenol and benzoic acid were both detected above the CSL, and 1,2-dichlorobenzene was detected in one of the two bank samples at a concentrations below the SQS.

4.1.4 T-108 seep data

Dames and Moore collected two seep samples from the T-108 shoreline in 1984 (Dames & Moore 1984). One of the maps was missing from this report; therefore, the sampling locations are not known. PCBs were not detected in either seep; however, the detection limit (1 µg/L) was above the MTCA Method A cleanup level of 0.1 µg/L. Cadmium, chromium, lead, mercury, and zinc were each detected in at least one of the seep samples. Arsenic was detected at 10 µg/L, which is above the MTCA Method C cleanup level. Lead was detected at 6 µg/L in one seep and at 5 µg/L in the other seep, and mercury was detected in one seep at 2 µg/L (no MTCA groundwater cleanup levels are available for lead for comparison). Cadmium, chromium and zinc were all detected below MTCA Method C cleanup levels. Details on how the seep samples were collected (e.g., filtered or unfiltered samples) were not available.

4.2 Relevant Information for Surrounding Properties, Roadways, and Outfall Systems

The following sections discuss relevant information pertaining to the adjacent properties, streets, and outfall networks in the immediate vicinity of the T-108 subject property. The surrounding area chosen for discussion in this section focus on those properties or facilities that may directly affect source control concerns at the subject property.

4.2.1 Adjacent properties

Environmental investigations have been conducted on several of the properties adjacent to T-108. Surrounding properties include T-106W and the WSLCB facility to the north, a King County pumping station and E Marginal Way S to the east, and the General Services Administration's (GSA's) Federal Center South facility to the south. The following section briefly discusses the operational and environmental investigation history of these adjacent properties.

4.2.1.1 Terminal 106 West – southern portion of property

Terminal 106 West (T-106W) is located across the S Oregon Street ROW to the north of T-108. It is approximately 31 acres in size. The southern portion of the property, currently operated as a container storage facility, is applicable to T-108 source control because of its proximity. T-106W includes a container repair and wash area, container lifts and stackers. The majority of the facility is covered with gravel (Port of Seattle 1992b). A portion of the northern end of the container terminal drains to the S Nevada Street storm drain system (Ecology 2004a). Available information for this property is summarized in Table 2.

4.2.1.2 Washington State Liquor Control Board

The WSLCB property is approximately 11 acres in size and is located across the S Oregon Street ROW to the north of T-108. There are two warehouse buildings on the property used for storage and distribution of alcoholic beverages and other unspecified items (King County 2008). Very little information was available regarding the past and current uses of the property, property ownership history, and environmental conditions on the property; however, according to a 1992 business letter from Barbara Hinkle, Port of Seattle Environmental Management Specialist to Barbara Ritchie, Ecology, past practices on the property, including steam cleaning of batteries and equipment may have caused contamination along S Oregon Street ROW (Port of Seattle 1992b). Available information for this property is summarized in Table 2.

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Table 2. Summary of relevant information for properties adjacent to T-108

Time Period	Ownership, Operational History, and Changes in Site Features	Environmental Investigations	Chemicals Identified in Sampled Environmental Media	Remedial Actions and Source Control Activities	References
Terminal 106 W (southern portion of property). Regulatory Listings: RCRA SQG, LUST/UST, ICR					
Late 1960s	property developed by reclaiming land from LDW; no ownership information available	unknown	na	unknown	Pinnacle Geosciences (2005)
1970	property purchased by Port of Seattle; much of site reclaimed from LDW when rock bulkhead installed and area backfilled to create approximately 900 linear ft of additional upland shoreline	unknown	na	unknown	Pinnacle Geosciences (2005), King County et al. (2005a)
1975 to 1990	Coastal Trailer Repair, Inc. leased the southern portion of the property for use as cargo container storage, repair and cleaning yard	RCRA compliance inspection by Ecology (1985) noted storage of waste oil drums and flammable solvents; generator reports dated between 1982-1990 identified wastes including lacquer thinner, oil, and waste solvent; waste handling practices at the facility were unclear	na	Coastal Trailer Repair received guidance from Ecology on cleanup of the waste oil and solvent storage areas	Pinnacle Geosciences (2005)
		soil and groundwater investigation of a compressor area and a steam-cleaning area (1990)	oil and PCBs identified in soil; lead, arsenic, PCBs, and oil identified in groundwater	soil removed from compressor area (1992)	Envirotech (1991) as cited in Pinnacle Geosciences (2005)

Time Period	Ownership, Operational History, and Changes in Site Features	Environmental Investigations	Chemicals Identified in Sampled Environmental Media	Remedial Actions and Source Control Activities	References
1990 to 2007	Container Care International (CCI) leased property for use as a container terminal; activities included storage, cleaning, repair, and transport of cargo containers and chassis	soil and groundwater investigation related to UST removal (1992)	petroleum identified in soil and groundwater	two USTs and associated petroleum-contaminated soil removed (1991)	Applied GeoTechnology (1992) as cited in Pinnacle Geosciences (2005)
		joint site inspection by the City of Seattle and Ecology (2001) noted poor housekeeping practices associated with used oil, antifreeze, and other waster materials	no sampling conducted	unknown	Ecology (2004a)
		facility inspection by Ecology (2002)	no sampling conducted	unknown	Ecology (2004a)
		catch basin solids sample collected along the boundary of T-106W and the WSCLB property by SPU (2003)[a]	copper (30 mg/kg dw), lead (10 mg/kg dw), zinc (55 mg/kg dw), TPH-D (15 mg/kg dw), TPH-O (52 mg/kg dw), BEHP (130 µg/kg dw), and BBP (20 µg/kg dw) detected in solids sample	unknown	Schmoyer (2008)
2007 to present	ConGlobal Industries leases property for use as a container storage and repair yard	none	na	established a SWPPP and acquired a general stormwater NPDES permit from Ecology	Pinnacle Geosciences (2005)
Washington State Liquor Control Board. Regulatory Listings: None					
Unknown to 2008	property owned by the SWLCB; warehouses used for storage and distribution	catch basin solids sample collected along the boundary of T-106W and the WSCLB property by SPU (2003)[a]	copper (30 mg/kg dw), lead (10 mg/kg dw), zinc (55 mg/kg dw), TPH-D (15 mg/kg dw), TPH-O (52 mg/kg dw), BEHP (130 µg/kg dw), and BBP (20 µg/kg dw) detected in solids sample	unknown	Pinnacle Geosciences (2005), King County Parcel Viewer (online)

Time Period	Ownership, Operational History, and Changes in Site Features	Environmental Investigations	Chemicals Identified in Sampled Environmental Media	Remedial Actions and Source Control Activities	References
1950s	warehouse building constructed	unknown	na	unknown	Pinnacle Geosciences (2005), King County Parcel Viewer (online)
1999	warehouse building demolished and reconstructed	unknown	na	unknown	Pinnacle Geosciences (2005), King County Parcel Viewer (online)
2007	second warehouse building constructed	unknown	na	unknown	Pinnacle Geosciences (2005), King County Parcel Viewer (online)
King County/METRO Duwamish Pump Station. Regulatory Listings: RCRA SQG					
1946 to late 1960s	site undeveloped, owner not known; southern boundary may have been used as a parking area	unknown	na	unknown	Aerial Photo Publishers (1946), Photographer unknown (1953), Pacific Aerial Surveys (1961),WDNR (1970)
Late 1960s to present	facility owned and operated by King County (formerly Metro) as a pumping station associated with the Elliott Bay Interceptor (part of the larger West Point WWTP system,) and the Duwamish Siphon	unknown	na	unknown	Pinnacle Geosciences (2005),King County et al. (2005a),Pacific Aerial Surveys (1961),WDNR (1970)
Federal Center South/US General Services Administration: Regulatory Listings: CSCSL, Spills, VCP, LUST/UST, ICR					
c. 1931 to c. 1941	property first developed and operated as a Ford automobile production plant	unknown	na	unknown	Herrera (2001)

Time Period	Ownership, Operational History, and Changes in Site Features	Environmental Investigations	Chemicals Identified in Sampled Environmental Media	Remedial Actions and Source Control Activities	References
c. 1937 to present	U. S. government acquired property and leased space in numerous buildings on the property for use as warehouse storage, office space, vehicle maintenance, and parking; materials were loaded onto barges and other vessels at Slip 1	na	na	na	Herrera (2001)
1974 to 1976	southern portion of property adjacent to Slip 1 and the LDW used as a treatment facility to remove spilled PCBs from Slip 1 and the LDW; treatment facility consisted of dredge pumps, a mobile treatment plant, dredged material receiving and holding tanks, and a clarifier; 215 barrels of contaminated sludge temporarily stored in the Air Force warehouse (Building 1202 on Map 2) during treatment operations	environmental investigations and cleanup related to a 265-gallon PCB spill into Slip 1 caused when a PCB-containing electrical transformer owned by the US Air Force was damaged while being loaded onto a private barge under contract to the Navy	PCBs (Aroclor 1242)	an initial spill cleanup was conducted by EPA in 1974; additional cleanup of PCB-contaminated sediments was conducted by EPA/USACE from 1974 and1976	EPA (1975)
1993	property owned by US government and leased to various tenants by GSA	hazardous waste inspection by Ecology noted boiler water was treated with algaecides, biocides, and fungicides and discharged into a drain (the discharge location of this drain was not specified); also chemically-treated coolant was discharged to a floor drain that discharged to the LDW and a drum storage area drained to the LDW	na	na	Ecology (2004a)

Time Period	Ownership, Operational History, and Changes in Site Features	Environmental Investigations	Chemicals Identified in Sampled Environmental Media	Remedial Actions and Source Control Activities	References
1997 to 1999	property owned by US government and managed by GSA	soil and groundwater investigations associated with the removal of USTs	diesel-range hydrocarbons (up to 4,700 mg/kg), heavy oil-range hydrocarbons (up to 960 mg/kg), gasoline-range hydrocarbons (up to 700 mg/kg), xylenes (up to 66 mg/kg), and metals (including lead) identified in soil; petroleum (gasoline plume and heavy hydrocarbons) and BTEX identified in groundwater; PCBs and VOCs not detected in soil samples[b]	USTs and associated contaminated soil removed	Herrera (2001); Glacier Environmental (1997), Herrera (1999), and Herrera (2003) as cited in Ecology (2004a)
2001	building on the western portion of property (Building 1203 on Map 2) used by the FBI as a maintenance area for motor pool vehicles	Phase I ESA conducted by Herrera; recognized environmental conditions identified included soil and groundwater contamination from removed USTs, the presence of five remaining USTs, and historical uses of the property	no sampling conducted in association with the Phase I ESA	unknown	Herrera (2001)
2008	GSA continues to manage the property; warehouse storage and office space is leased to various government agencies and other tenants, and the site is also used for vehicle maintenance and parking	unknown	na	unknown	Ecology (2004a; 2008)

[a] The same sample is discussed for both T-106W and the WSLCB property.

[b] The analytical data collected in association with UST removals was not available; however, maximum concentrations were reported in source documents.

BBP – butyl benzyl phthalate
BEHP – bis(2-ethylhexyl) phthalate
BTEX – benzene, toluene, ethylbenzene, xylene
CSL – cleanup screening level
PCB – polychlorinated biphenyls
RCRA – Resource Conservation and Recovery Act
SQG – small-quantity generator
SQS – sediment quality standard

Ecology – Washington State Department of Ecology
ESA – Environmental Site Assessment
FBI – Federal Bureau of Investigation
GSA – General Services Administration
ICR – Independent Cleanup Report
LDW – Lower Duwamish Waterway
LUST – leaking underground storage tank
mg/kg – milligrams per kilogram
na – not applicable
SWPPP – stormwater pollution prevention plan
TPH-D – diesel-range total petroleum hydrocarbons
TPH-O – oil-range total petroleum hydrocarbons
UST – underground storage tank
VCP – voluntary cleanup program
VOC – volatile organic compound
WSLCB – Washington State Liquor Control Board
WWTP – wastewater treatment plant
µg/kg – micrograms per kilogram

4.2.1.3 King County Pumping Station

King County operates a pumping station on the 0.7-acre parcel of land adjacent and to the east of T-108. The pumping station has been in operation as part of the Elliott Bay Interceptor (EBI) system since the late-1960s (Pinnacle Geosciences 2005; WDNR 1970). The EBI system carries sewage and wastewater from the LDW basin and parts of West Seattle to the West Point WWTP. No additional information was available for this property beyond what is summarized in Table 2.

4.2.1.4 GSA's Federal Center South – northern portion

The Federal Center South is located on a 33-ac parcel of land across Diagonal Avenue S to the south of T-108 (Map 2). The Federal Center South facility is owned by the US government and managed by the GSA which leases space within the center to various government agencies and other tenants. The property was operated as a Ford Motor plant from approximately 1931 to 1941 (Herrera 2001), and a significant historical PCB spill occurred directly offshore of the property in 1974. Additional a information available for this property is summarized in Table 2.

4.2.2 Adjacent streets

Two street ROWs are located adjacent to T-108. The S Oregon Street ROW is located adjacent and to the north and the Diagonal Avenue S ROW is adjacent and to the south. These ROWs are applicable to environmental conditions on T-108 because of their proximity to the property. If contamination were present within the ROWs, the possibility would exist for these contaminants to migrate to T-108 or the LDW. Information about these two ROWs is presented in the sections that follow and is summarized in Table 3.

4.2.2.1 S Oregon Street ROW

The S Oregon Street ROW extends westward from E Marginal Way S and terminates at the LDW. The ROW is owned by the City and is used for commercial operations by ConGlobal Industries and the WSLCB. The ROW has both paved and graveled portions. Power transmission lines are also located within the S Oregon Street ROW; public access to the roadway is restricted. The Duwamish/Diagonal CSO/SD and Duwamish EOF piping networks underlay the S Oregon Street ROW.

Table 3. Summary of relevant information for street rights-of-way adjacent to T-108

Time Period	Site Use	Environmental Investigations	Chemicals Identified in Environmental Media	Remedial Actions and Source Control Activities	Citations[a]	Available Analytical Data and Data Location[b]
S Oregon Street ROW						
Pre-1940 to late 1960s	area included tidal/drainage channel that likely received stormwater and wastewater discharges from surrounding industrial properties	unknown	na	unknown	Pacific Groundwater Group (2007a); Aerial Photo Publisher (1946); Photographer unknown (1953); Pacific Aerial Surveys (1961); WDNR (1970)	na
Late 1960s	underground piping associated with Metro's West Point sanitary sewer system and the Duwamish Siphon (the Duwamish/Diagonal CSO/SD, and the Duwamish EOF) laid adjacent to or within channel and channel filled	unknown	na	unknown	Pacific Groundwater Group (2007b); Pacific Aerial Surveys (1961); WDNR (1970)	na
1970s	high-power electrical transmission lines installed within ROW	unknown	na	unknown	cleanup study report	na
1970s to 1993	ROW; specific uses unknown	unknown	na	unknown	WDNR (1970); WDNR (1981); Metro Aerial (1991)	na

Time Period	Site Use	Environmental Investigations	Chemicals Identified in Environmental Media	Remedial Actions and Source Control Activities	Citations[a]	Available Analytical Data and Data Location[b]
1993 to 2008	portions of ROW used by the Port as an access roadway between T-108 and T-106W. Also used by WSLCB operations; public access restricted; the Duwamish/Diagonal CSO/SD and the Duwamish EOF discharge at end of ROW	Phase II ESA to investigate soil, groundwater, and adjacent intertidal sediment conditions (2007)	PAHs, diesel, and lube oil detected above MTCA Method A cleanup levels in soil, PCBs, cadmium, copper, lead, nickel, and zinc also detected in soil; gasoline, BTEX, and arsenic not detected in soil; cPAHs, lube oil, and dissolved arsenic detected above MTCA Method A in groundwater, PCBs also detected in groundwater; PAHs, diesel, lube oil, and metals detected in intertidal sediment	unknown	Pacific Groundwater Group (2007b)	soil, groundwater, and intertidal sediment data presented in Appendix E
Diagonal Avenue S ROW						
Pre-1944 to early 1960s	road ROW extending from E Marginal Way S to LDW with railroad spur crossing	unknown	na	unknown	Aerial Photo Publisher (1946); Photographer unknown (1953); Pacific Aerial Surveys (1961)	na
c. 1961 to mid-1980s	southwestern half of ROW incorporated into a large parking area for the Diagonal Avenue S STP and Federal Center South facility; street-end may have been used as an unofficial dump site	unknown	na	unknown	Pacific Aerial Surveys (1961); WDNR (1970); WDNR (1981); Metro Aerial (1991)	na
Mid-1980s to 2008	road ROW extending from E Marginal Way S to LDW with railroad spur crossing; Diagonal Avenue S storm drain line present beneath ROW	unknown	na	unknown	Ecology (2004a); Metro Aerial (1991); WDNR (1995)	na

[a] Historical aerial photographs cited are presented in Appendix B.

[b] Data associated with the drainage lines buried within these rights-of-way are presented in Table 4.

BTEX – benzene, toluene, ethylbenzene, xylene

MTCA – Model Toxics Control Act

cPAH – carcinogenic polycyclic aromatic hydrocarbon
CSO – combined sewer overflow
Ecology – Washington State Department of Ecology
EOF – emergency overflow
ESA – Environmental Site Assessment
na – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
ROW – right-of-way
SD – storm drain
STP – sewage treatment plant
WSLCB – Washington State Liquor Control Board

4.2.2.2 Diagonal Avenue S ROW

The Diagonal Avenue S ROW extends southeastward from E Marginal Way S and terminates at the LDW. It is owned by the City, and public access is allowed. The ROW has been present since at least the 1940s based on review of historical aerial photos (Appendix B). The exact date that the ROW was developed is not known. The street-end is currently used as a hand-boat launch area and park. The Diagonal Avenue S street end may have been used as a trash dumping area until the late 1980s according to Port staff. Cans, broken glass, and other debris were observed in the soil when the area was excavated during installation of the public access area and adjacent T-108 mitigation area. The Diagonal Avenue S SD line is located beneath the ROW, and discharges to the south of the ROW's terminus. This drainage line is discussed further in Section 4.2.3.3. Four source-tracing solids samples have been collected within the SD system; data for these samples are discussed in Table 4 and presented in Appendix E.

4.2.3 Public outfalls

Four public outfalls discharging to the LDW are located in the vicinity of T-108 (Map 2). The Diagonal Avenue S SD is located near the terminus of the Diagonal Avenue S ROW, and the S Nevada Street SD is located on the northern portion of T-106W. Two public outfalls discharge from the terminus of the S Oregon Street ROW: the Duwamish/Diagonal CSO/SD, (owned jointly by the City and the County), and the Duwamish EOF associated with the County-owned Duwamish siphon and pump station.

4.2.3.1 Duwamish/Diagonal CSO/SD and associated drainage basin

The Duwamish/Diagonal CSO/SD outfall discharges at the terminus of the S Oregon Street ROW at RM 0.45, approximately 50 ft from the northern portion of T-108. The system has a combined sewer service area of 4,900 ac and the storm drain basin encompasses about 2,620 acres (King County and SPU 2005). The drainage basin includes a 3.6-mi portion of I-5, parts of the Central District, the Duwamish industrial area, Rainier Valley, and Beacon Hill. The stormwater network in the Eastern Parcel of T-108 discharges to this drainage system. The estimated medium-range stormwater runoff from the Duwamish/Diagonal drainage basin is 1,045 million gallons per year (mgy) (King County 2002). Recent source control sampling efforts indicate that the average TSS values for the discharge is approximately 80 mg/L with the TSS loading range from 241 to 414 million tons per year (MT/yr).

Between 2002 and 2006, Seattle Public Utilities (SPU) collected in-line sediment from the Diagonal Avenue CSO/SD network in association with the Duwamish/Diagonal sediment remediation effort. During this timeframe, portions of the overall network were cleaned, including the Diagonal Avenue S CSO/SD mainline, the S Dakota Street lateral, and the downstream sections of the 1st Avenue S lateral and the Denver

Table 4. Summary of relevant information for outfalls adjacent to T-108

Ownership and Operational History	Drainage Basin Information	Discharge Information	Environmental Investigations	Chemicals Identified in Environmental Media	Source Control Activities	Citations	Available Analytical Data and Data Location
Duwamish/Diagonal CSO/SD							
System installed in the late 1960s in association with the West Point WWTP; the City owns and operates the storm drain system and the County owns and operates the CSO system	CSO service area is 4,900 ac in size and includes portions of the Diagonal and Hanford drainage basins, SD basin is 2,600 ac in size; SD basin includes a portion of I-5, and parts of the Central District of Seattle, the Duwamish industrial area; Rainier Valley, and Beacon Hill; outfall located at the S Oregon Street street-end	discharges to the LDW via a 144-in concrete outfall; average stormwater discharge of 1,100 mgy (King County 2002); average untreated CSO/EOF event frequency is 0.17 events/yr, with average an annual discharge volume of 0.67 mgy (Nairn 2007; King County 2006)	two source-tracing sediment samples collected (1985)	four individual PAHs detected above the CSL and seven detected above the SQS, total HPAHs and total LPAHs detected above the SQS, 1,2-dichlorobenzne, 1,4-dichlorobenzene, dimethyl phthalate, dibenzofuran, phenol, and 4-methylphenol detected above the CSL, and zinc detected above the SQS	unknown	Ecology (2004a)citing Tetra Tech (1988)	Appendix E
			whole-water stormwater effluent samples collected at two locations (1995)	arsenic, cadmium, chromium, copper, lead, mercury, zinc, fluoranthene, pyrene, and phthalates	unknown	Ecology (2004a)	stormwater effluent data presented in Appendix E
			multiple rounds of in-line sediment solids sampling (2002-2006)	PCBs, TPH, arsenic, lead, mercury, copper, zinc, BEHP, BBP, and PAHs	system drainage lines being cleaned periodically; business inspections in drainage basin (2000-present)s	King County and SPU (2005)	inline sediment solids data presented in Appendix E

Ownership and Operational History	Drainage Basin Information	Discharge Information	Environmental Investigations	Chemicals Identified in Environmental Media	Source Control Activities	Citations	Available Analytical Data and Data Location
			source-tracing sediment sampling was conducted within the CSO/SD basin by SPU; onsite catch basins, right-of-way catch basins, inline sediment trap, and inline sediment grab samples were collected (2002-2007)	arsenic, copper, lead, mercury, zinc, diesel-range hydrocarbons, oil-range hydrocarbons, BEHP, BBP, total PCBs, HPAHs, and LPAHs	source-tracing efforts within the CSO/SD drainage basin	Schmoyer (2008)	Appendix E
Duwamish EOF							
Installed in the late-1960s as part of the EBI system; owned and operated by the County; EOF is connected to the Duwamish Siphon and pump station	has the potential to discharge storm-water and combined sewage from the sanitary sewer system if flows from the Duwamish Siphon are too high; outfall located at the S Oregon Street street-end	overflows to the LDW only in emergency by-pass situations; has not overflowed since 1989; outfall is 36-in in diameter	unknown	na	unknown	Ecology (2004a)	na

Ownership and Operational History	Drainage Basin Information	Discharge Information	Environmental Investigations	Chemicals Identified in Environmental Media	Source Control Activities	Citations	Available Analytical Data and Data Location
S Nevada Street SD							
Owned and operated by the City; date of installation not identified	drains the northern portion of T-106W, including the northern end of the ConGlobal Industries container terminal	discharges to the LDW via a 24-in SD outfall located at the S Nevada Street street-end	source-tracing solids sampling within Nevada Street storm drain line (1985); SPU also attempted to sample manholes in the system but either solids were not present in the manholes or manholes were inaccessible	cadmium, chromium, and lead detected at concentrations above the CSL, and zinc detected above the SQS in storm drain solids	source-tracing solids sampling	Ecology (2004a) citing Tetra Tech (1988); Ecology (2004a); King County and SPU (2005)	storm drain solids data presented in Appendix E
Federal Center South Private Outfall (located on the northern portion of property)							
Owned and operated by USACE; date of installation not identified	drainage basin not identified; based on location, assumed to collect drainage from parking areas and roof drains on the northern portion of Federal Center South including parking areas and rooftops	discharges to the LDW via a 12-in metal outfall located to the west of Building 1203 (Map 2)	unknown	na	unknown	Herrera (2004)	na

Ownership and Operational History	Drainage Basin Information	Discharge Information	Environmental Investigations	Chemicals Identified in Environmental Media	Source Control Activities	Citations	Available Analytical Data and Data Location
Diagonal Avenue SD							
Owned and operated by City; date of installation not identified	system drains approximately 12 ac, including the Diagonal Avenue S roadway west of E Marginal Way S	discharges to the LDW via a 12-in. diameter steel outfall located on the northern portion of the Federal Center South property, adjacent to the south of the Diagonal Avenue S ROW	source-tracing solids sample collected (1985)	chromium detected above the CSL, zinc, di-n-octyl phthalate, and indeno(1,2,3-c,d)pyrene detected above SQS	unknown	Ecology (2004a) citing Tetra Tech (1988)	Appendix E
			sediment samples collected offshore of outfall location	BEHP and BBP exceeded the SQS	unknown	(King County 2002); Ecology (2004a)	Appendix E
			City attempted to collect manhole solids from system but manhole locations were inaccessible (2005)	na	unknown	King County and SPU (2005)	na

BBP – butyl benzyl phthalate
BEHP – bis(2-ethylhexyl) phthalate
CB – catch basin
CSL – cleanup screening level
CSO – combined sewer overflow
EBI – Elliott Bay Interceptor
Ecology – Washington State Department of Ecology
EOF – emergency overflow
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LDW – Lower Duwamish Waterway
LPAH- low-molecular-weight polycyclic aromatic hydrocarbon
mgy – million gallons per year
na – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
RCB – right-of-way catch basin
ROW – right-of-way
SD – storm drain
SPU – Seattle Public Utilities
STP – sewage treatment plant
SQS – sediment quality standard
USACE – United States Army Corps of Engineers
WSLCB – Washington State Liquor Control Board
WWTP – wastewater treatment plant

Avenue S lateral. A total of 168 samples were collected from the system's mainline and contributing lateral lines (as of December 2007), and several of the lines were cleaned out.

4.2.3.2 Duwamish EOF (pump station emergency bypass)

The Duwamish EOF is located at the terminus of S Oregon Street ROW approximately 100 ft upstream of the Diagonal Avenue S CSO/SD, and approximately at the northwest corner of T-108. It operates as the emergency overflow for the Duwamish siphon and pump station associated with the King County interceptor system. The Duwamish EOF has not overflowed since 1989, and therefore, Ecology does not consider it a significant source of recontamination to the LDW (Ecology 2004b).

4.2.3.3 Diagonal Avenue storm drain

The Diagonal Avenue SD is a 12-in-diameter steel outfall located adjacent to the south of the terminus of the Diagonal Avenue S ROW, approximately 100 ft from the southern end of T-108. The system drains stormwater from approximately 12 acres, including the Diagonal Avenue S roadway west of E Marginal Way S. Most of the area drained by this outfall is paved and used for general roadway access and miscellaneous storage by surrounding property tenants.

4.2.3.4 S Nevada Street storm drain

The S Nevada Street SD is a 24-in.-diameter outfall located at the S Nevada Street street end in approximately the center of the T-106W shoreline. The system is owned and operated by the City, and drains stormwater from the northern portion of T-106W, including the northern portion of the ConGlobal container yard. Most of the area drained by this outfall is paved or covered with buildings and is used for storage and transport of cargo and other goods.

5 Potential Pathways of Contamination and Source Control Management

The following section briefly highlights the various pathways through which contaminants can migrate and potentially enter the LDW; sources of contamination can often migrate through more than one potential pathway. This section also provides information on the source control measures and procedures that are either in place or can be incorporated at T-108 to aid in the management of these potential contaminant pathways. The section presents this data in a tabularized discussion with respect to the subject property's specific concerns relative to source control.

5.1 POTENTIAL PATHWAYS

Chemicals released to media such as air, soil, groundwater, or stormwater can migrate within the subject property and potentially to the LDW through various pathways. With respect to the subject property, the pathways of potential concern include atmospheric deposition; stormwater inputs (i.e., direct discharge); groundwater migration, and bank erosion. The following sections briefly discuss the potential pathways of concern at the subject property.

5.1.1 Atmospheric deposition

Chemicals have the potential to be emitted to the atmosphere from both point and non-point sources. Point sources include various industrial facilities and operations within the greater LDW basin (EPA 2001). T-108 is not currently regulated as a point-source of air emissions (Thomas 2008). Non-point sources include emissions from motor vehicles, marine vessels, and trains, as well as common materials (e.g., plastics) through off-gassing. Chemicals emitted to the air may be transported over long distances, generally in the direction of the area's prevailing winds.

Air pollutants can be deposited through either direct or indirect deposition. Direct deposition occurs when contaminated particulates are deposited directly onto the land surface or the surface of a water body. Indirect deposition to water bodies occurs when chemicals are first deposited on land or other water bodies and then transported to the receiving water body via stormwater runoff. Contaminants can adhere to solids on the ground or in stormwater runoff and potentially be transported to LDW sediment. The latter process is a major concern when considering source control within the greater Duwamish Valley; however, it is not expected to play a major role in environmental conditions at T-108.

5.1.2 Stormwater inputs (direct discharge)

Contaminants carried in stormwater have the potential to discharge directly into the LDW through public or private outfalls. Several outfalls serve the subject property, including connection with the City and County owned Duwamish/Diagonal CSO/SD network. Stormwater traversing across impervious surfaces can pick up chemicals originating from accidental spills (vehicle fueling, maintenance, etc.); leaking equipment or storage tanks; particulates deposited on the subject property through atmospheric deposition; and general commercial/industrial operations. Stormwater runoff in unpaved areas (surface runoff) can also collect materials (soil, debris, etc.) in the flow stream and transport them to other parts of the subject property and potentially into the LDW.

5.1.3 Groundwater migration

Groundwater flow in the greater Duwamish Basin is generally towards the LDW, although the direction varies locally depending on the nature of subsurface materials, hydrostratigraphy, local affects of tidal fluctuations, and relative proximity to the waterway. At the subject property, groundwater has been shown to flow radially from a relative high near the center of the site in all directions (pending time of year and tidal stage). Contaminants in groundwater have the potential to migrate directly into the LDW (seeps, shoreline discharge) or through other pathways (infiltration into underground stormwater piping). Leaking or spilled chemicals, as discussed above, can also infiltrate into groundwater in areas without pervious surfaces (western parcel). The determination of whether a chemical identified in groundwater will reach sediment and surface water is a complex process. In this case however, Ecology has acknowledged that recent monitoring has shown that groundwater at the subject property is not considered a potential source of contamination to LDW sediment.

5.1.4 Bank erosion

Soil in unprotected shoreline banks is susceptible to erosion by disturbances from human activities, wind, surface water runoff, tidal exchange, and groundwater discharge. Shoreline armoring and vegetation significantly reduce bank erosion, and steeper banks are particularly susceptible. Much of the subject property’s shoreline is armored and covered with vegetation; however, some areas remain susceptible to bank erosion. Contaminants in the subject property’s surficial and subsurface soil (originating from non-native fill or historical site operations, etc.) may exist at elevated concentrations in the shoreline bank. This contaminated material does have the potential to migrate to the waterway.

5.2 History of the Duwamish/Diagonal Source Control Area

As mentioned in the previous sections, T-108 has been identified as a property of potential concern for source control with respect to the greater Duwamish/Diagonal Source Control Area (SCA). The sediments near the Duwamish/Diagonal outfalls were originally identified as a priority cleanup area by the Elliott Bay/Duwamish Restoration Program in the mid-1990s because of contamination associated with the Duwamish EOF and Duwamish/Diagonal CSO/SD outfalls. The area was identified again through the

LDW Remedial Investigation as an early action area. Dredging and capping actions were implemented through the Elliott Bay/Duwamish Restoration Program beginning in November 2003. Ecology prepared a SCAP for the Duwamish/Diagonal SCA in December 2004. A sediment remediation project closure report was prepared in 2005 (King County et al. 2005b).

Studies conducted in 1994 and 1996 identified PCBs, mercury, BEHP, and BBP as the principal chemicals of concern for the Duwamish/Diagonal SCA area near the outfalls (Ecology 2004a; King County 1997). Table 5 presents the chemicals that have been identified in surface sediment within the Duwamish/Diagonal SCA in-water boundary during the LDW Remedial Investigation effort. The chemicals included on this table had at least one exceedance of its associated SMS criteria for surface sediment, as applicable, prior to sediment removal and capping activities.

Table 5. Chemicals of concern in Duwamish/Diagonal SCA surface sediment (exceeding associated SMS criteria)

Chemical	Chemical	Chemical
1,2,4-Trichlorobenzene	Bis(2-ethylhexyl)phthalate	Mercury
1,2-Dichlorobenzene	Butyl benzyl phthalate	Naphthalene
1,4-Dichlorobenzene	Cadmium	N-Nitrosodiphenylamine
2,4-Dimethylphenol	Chromium	PCBs (total calc'd)
2-Methylnaphthalene	Chrysene	Pentachlorophenol
2-Methylphenol	Dibenzo(a,h)anthracene	Phenanthrene
4-Methylphenol	Dibenzofuran	Phenol
Acenaphthene	Dimethyl phthalate	Pyrene
Benzo(a)anthracene	Fluoranthene	Silver
Benzo(a)pyrene	Fluorene	Total HPAH (calc'd)
Benzo(g,h,i)perylene	Hexachlorobenzene	Total LPAH (calc'd)
Benzofluoranthenes (total-calc'd)	Hexachlorobutadiene	Zinc
Benzoic acid	Indeno(1,2,3-cd)pyrene	
Benzyl alcohol	Lead	

Note: Exceedances of the chemicals listed in this table were detected before sediment removal and capping activities were conducted at the Duwamish/Diagonal cleanup area.

The Duwamish/Diagonal sediment cleanup project began in 1994; remedial actions occurred in late 2003 and early 2004. Sediment remediation included dredging contaminated sediments from a 7-ac area in the LDW and placing an engineered cap over the remaining sediment. The dredging was conducted between November 2003 and January 2004; the sediment cap was installed between January and March 2004 (see Map 2). A follow-up action was conducted in February 2005 involving the placement of a thin layer of sand around the dredged area in response to elevated chemical concentrations resulting from the previous dredging activity (Ecology 2004a) (Map 2).

Long-term sediment monitoring began in the summer of 2004 and is currently scheduled to continue until 2014. In samples collected as part of the monitoring program between June 2004 and April 2007, BEHP, BBP, fluoranthene, dimethyl phthalate, benzyl alcohol, benzoic acid, and total PCBs exceeded the SQS, and BEHP, total PCBs, benzyl alcohol, and benzoic acid also exceeded the CSL.

5.3 Source Control Management Tools

A wide variety of source control management tools are available for use at the subject property. These tools vary greatly in management and application, but all are aimed to help reduce or eliminate the potential impact from contaminant sources and their associated pathways on the subject property. In many instances, the components of these tools and source control measures overlap with one another in their intent or physical application. An effective long-term source control strategy will require incorporation of a mixture of these options, with specific focus on the operations at the subject property and types of contamination and pathways of concern. Some of these tools are already in place at the subject property; nevertheless, further consideration of additional application of these tools would continue to promote the goal of an effective, long-term source control strategy at the subject property. This strategy would include the compliance monitoring necessary to determine the effectiveness and performance of these tools.

Regulatory and compliance programs overseen by federal, state, and local jurisdictions offer numerous possible tools that could be implemented at the subject property under various circumstances. Table 6 presents a list of some of the available and relevant tools and source control measures that will be combined to establish and promote effective source control at the subject property. Many other source control tools exist and may be applicable to the site, especially with changes in operations or future development activities. For example, programs managed under the Toxic Substance Control Act (TSCA) could be applicable if hazardous waste associated with the former PCB disposal pits is encountered during site improvement work. Additionally, if future operations generated wastewater requiring off-site treatment, King County's Industrial Waste pre-treatment authorizations would represent an additional source control tool. Table 6 is not meant to be a comprehensive list of all tools available but those most appropriate for the current conditions and operations at the subject property.

Table 6. Potential source control management tools for the subject property

Source Control Tools	Tool Components	Additional Information on Potential Use or Application
Regulatory and Compliance Programs	NDPES Permit Programs	Municipal Permit - Port of Seattle. Includes Stormwater Management Planning, tenant education and oversight, and O&M programs. General Industrial Permit – ConGlobal. Includes requirements for preparation and management of a SWPPP and SPCC for operational areas.

SOURCE CONTROL TOOLS	TOOL COMPONENTS	ADDITIONAL INFORMATION ON POTENTIAL USE OR APPLICATION
	Port of Seattle Compliance Programs and Tenant Lease Arrangements	Port's internal compliance unit inspects for environmental compliance based on environmental regulations and lease agreements.
	LDW Source Control Work Group (SCWG) Coordination	Coordination with long-term strategy of SCWG and associated programs (Puget Sound Initiative, Urban Waters Initiative, etc.).
Environmental investigation	Multi-media characterization	Additional media information (subsurface, bank soil, etc.) to fulfill data gaps and focus effective environmental strategy.
Remediation Programs	Independent removal action (excavation, etc.)	Soil excavation with performance sampling in coordination with voluntary cleanup program
	Containment	Capping for in-place containment of impacted media
	In-situ treatments	In-situ treatment of areas of impacted subsurface soil
	Monitored natural attenuation	Monitoring of existing environmental conditions to satisfy cleanup goals
Operational/ Behavioral Best Management Practices (BMPs)	Public Involvement/Education	Education and communication of source control concerns with tenants and public users to support compliance and promote overall environmental stewardship.
	Good housekeeping practices	Promote environmentally-friendly operational and behavioral practices of those using the subject property.
Physical BMPs	Construction BMPs (permanent and temporary)	Erosion and runoff controls, sediment controls (vegetative buffer, drainage swales), grading improvements, hay bale buffers, catch basin filter socks, etc.
	Redevelopment BMPs	Habitat restoration, porous pavement, green roof technologies.
Capital Improvements	Utility upgrades and improvements	Upgrades to stormwater collection networks and other underground utility systems, upgrades to onsite pre-treatment, etc.
	Infrastructure improvements	Paving, grading, access concerns, bank/shoreline stabilization, etc.
	Tenant-driven improvements	Improvements in tenant areas (either operational or compliance driven)
	Restoration opportunities	Construction of restoration/mitigation areas along shoreline; with potential link to existing habitat area
Engineering Controls	Operation and Maintenance programs	Proper operation and maintenance of equipment used on property can greatly reduce the potential for accidently spills and leaks.
	Upgrades to newer "greener" equipment	Use of newer, "greener" equipment technologies could greatly reduce the potential impact from onsite operations.
Institutional Controls	Property deed restrictions	Restriction of long-term use of property to help ensure environmental stewardship.
	Tenant restrictions	Restrictions on operational use of tenant lease areas

Again, the tools highlighted in Table 6 are not inclusive of all of the options available for approaches to source control management, but are focused to a relative extent on measures that can be implemented at the subject property. Depending on the specific aspects of the contaminant and/or pathway of concern, different components of the tools mentioned may be more appropriate for evaluation and implementation. This evaluation process will be an important aspect of the SCSPs that will be prepared after finalization of this documentation.

One of the major tools available to help assess and manage stormwater concerns at the subject property is the NPDES permit program. As discussed in previous sections, stormwater discharges at T-108 are regulated under two NPDES permits: the Municipal Stormwater permit, under which the Port of Seattle is a secondary permittee, and the industrial stormwater general permit recently obtained by the tenant, ConGlobal Industries, in April 2008.

As required under the permit, the Port of Seattle has implemented a Stormwater Management Program (SWMP) that includes:

- an education program, including training on Best Management Practices (BMPs), for tenants and Port employees aimed at reducing behaviors and practices that can adversely affect stormwater quality
- a program to identify, eliminate, and prevent illicit discharges and spills to the stormwater system
- a program of information gathering that allows for adequate stormwater management planning, priority setting, and program evaluation including maps of properties, drainage basins, stormwater conveyance lines, and outfalls
- a program for documenting operation and maintenance activities for stormwater facilities
- field inspections to inspect for illicit discharges at all known outfalls covered under the permit; at least one third of all outfalls should be inspected each year
- procedures for removing illicit discharges and documenting activities associated with monitoring these discharges
- a spill response plan
- a program for management of construction site stormwater runoff and post-construction stormwater management for new development and redevelopment
- an operation and maintenance program for all catch basins, stormwater treatment, and flow control facilities
- a long-term monitoring program to characterize stormwater runoff at a limited number of locations[1], evaluate stormwater management practices, and evaluate BMPs

[1] The facility selected for monitoring under the Port's SWMP is used for different operational purposes than T-108 and is not located in the LDW; monitoring data from this facility will most likely not be directly applicable to conditions at T-108.

These elements of the Port's SWMP are aimed to help in the protection of stormwater quality at all Port terminals and facilities, including T-108.

As of April 2008, ConGlobal has maintained a general industrial NPDES stormwater permit (No. SO3-010569) and a SWPPP for management of stormwater discharges from the container terminal to the Duwamish/Diagonal CSO/SD system. The chassis repair area and equipment fueling areas on the Eastern Parcel are covered by the NPDES permit and SWPPP; the portions of T-108 used only for storage, office space, and parking are not covered.

As part of the general industrial stormwater permit, ConGlobal:

- maintains an SPCC plan to be implemented in the case of a hazardous materials release
- implements BMPs to reduce stormwater pollution
- inspects the stormwater system infrastructure
- samples stormwater and analyzes samples for total zinc, oil and grease, turbidity, total suspended solids (TSS), and pH, as well as total copper and total lead if the benchmark for zinc is exceeded during two consecutive sampling events
- provides discharge monitoring reports to Ecology to report the results of the inspection and sampling program

As with the Port's program, ConGlobal's NPDES permit, SWPPP, and SPCC plan are in place to reduce the potential for stormwater contamination resulting from industrial activities conducted at the facility. While the permit and plans limit and control the discharge of a number of pollutants, they do not necessarily control contaminants that pose a threat to LDW sediments, such as PCBs, phthalates, arsenic, mercury, and PAHs (Thomas 2008). The combinations of these established regulatory and compliance requirements with the other "grab bag" of tools presented in Table 6 (BMPs, remediation programs, capital improvements, institutional controls, etc.) will be further evaluated in the following sections with respect to their potential application and use at the subject property to lessen or potentially eliminate the threat from the potential pathways of contamination.

5.4 T-108 Onsite Potential Pathways of Contamination and Source Control

Several potential onsite contaminant migration pathways were identified at the subject property through the completion of the environmental conditions review effort. Controlling these potential pathways and sources can decrease the potential for them to impact other media on the property or ultimately the LDW. Many of these identified pathways and their associated contaminant sources can be either eliminated entirely or controlled to some degree through implementation of various source control tools and procedures and adherence to the requirements of regulatory programs currently governing operations at the subject property.

Table 7 provides information on the potential pathways and sources of contamination identified on the T-108 property, and briefly identifies the various source control tools (with reference to those discussed in Table 6) that are either in place or that can be implemented to help control each pathway. Not all pathways and corresponding chemical sources have the same relative potential for impact to area media and the LDW. The table provides general information on chemicals that can be potentially associated with each source type.

Information on the table takes into consideration both historical source areas and potential ongoing sources based on the current conditions of the property, and expected long-term tenant operations (cargo container storage, chassis storage and repair, miscellaneous maintenance). The table also provides general information on data gaps related to these potential pathways and sources. Fulfilling these data gaps may require further study or characterization to more fully understand their potential for contributing contaminants to the LDW, as well as options for controlling them.

Table 7. Potential onsite pathways of contamination and general source control information at T-108

Potential Pathway	Potential Sources	Potential Contaminants	Details	Data Gap	General Options and Tools for Additional Pathway Characterization or Source Control (Refer to table 6)	
					Western Parcel	Eastern Parcel
Air	Emissions from operational equipment	Metals, phthalates, dioxins/furans, particulates	Equipment and machinery used by the current tenants are of similar use as most commercial operations in the greater Duwamish Valley (trucks, etc.).	Data on air emissions in the greater Duwamish Valley are very limited; additional data would be helpful in further assessing pathway but difficult to associate directly with T-108 concerns.	• **Regulatory and Compliance Programs** – Stormwater monitoring results can help assess impact from atmospheric deposition. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help limit impact from air emissions. • **Engineering Controls** – Newer "greener" machinery can help reduce onsite emissions.	• **Regulatory and Compliance Programs** – Stormwater monitoring results can help assess impact from atmospheric deposition. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help limit impact from air emissions. • **Engineering Controls** – Newer "greener" machinery can help reduce onsite emissions; effective operation and maintenance of equipment can also reduce emissions. • **Institutional Controls** – Deed and tenant restrictions can limit operations that produce harmful emissions.
Stormwater	Spills, leaks, and accidental discharges; onsite dust and debris	Metals, PAHs, PCBs, TPH, VOCs, SVOCs	Operations include chassis and miscellaneous maintenance; chemicals have the potential to enter stormwater system and discharge to LDW via the Duwamish/Diagonal CSO/SD (Eastern Parcel) and Port private storm drains (Western Parcel).	Current information on stormwater quality limited. ConGlobal's NDPES sampling requirements will provide some additional information to assist in ongoing assessment of this potential contaminant pathway.	• **Regulatory and Compliance Programs** – Stormwater monitoring results, although limited for this area, can help assess impact from stormwater runoff. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help reduce introduction of contaminants to stormwater. • **Physical BMPs** – Erosion and runoff control, and vegetative barriers can help limit transport of contaminants in stormwater. • **Capital Improvements** – Paving and utility upgrades (installation of stormwater infrastructure) would help management stormwater issues in this area.	• **Regulatory and Compliance Programs** – Adherence to requirements of the Port's and ConGlobal's permit (proper materials storage/handling, inspection and oversight, etc.) will help manage stormwater concerns in this area. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help reduce introduction of contaminants to stormwater. • **Physical BMPs** – Hay bale buffers, catch basin filter socks, etc., can help prevent accidental spills from affecting stormwater. • **Institutional Controls** – Deed and tenant restrictions can limit potential operations in this area.

Table 7, cont. Potential onsite pathways of contamination and general source control information at T-108

Potential Pathway	Potential Sources	Potential Contaminants	Details	Data Gap	General Options and Tools for Additional Pathway Characterization or Source Control (Refer to Table 6) — Western Parcel	Eastern Parcel
Stormwater	Contaminants in fill material	Miscellaneous	Large portions of the subject property have been filled over time, using both native and non-native materials. These fill materials can infiltrate into underground piping.	Soil data available for site; additional soil data would provide little new information relevant to the tools used to manage this potential contaminant pathway.	• **Regulatory and Compliance Programs** – Stormwater monitoring results, although limited for this area, can help assess impact from impacted fill material. • **Environmental Investigation** – Additional characterization could assess volume and potential impact from contaminated fill in this area. • **Remediation Programs** – Soil excavation, containment, or in-situ treatment could help manage contaminants in fill material. • **Physical BMPs** – Erosion and runoff controls, sediment controls, and vegetative buffers would aid in management of this pathway. • **Capital Improvements** – Paving and utility upgrades (installation of stormwater infrastructure) would help management potential impact to stormwater in this area.	• **Regulatory and Compliance Programs** – Stormwater monitoring results could help assess impact from contaminated fill materials in this area; however, upgraded stormwater network at higher elevation than areas of suspected fill; potential impact from this pathway is unlikely. • **Environmental Investigation** – Additional characterization in this area could assess volume and potential impact from contaminated fill in this area; however, investigation would greatly affect ongoing operations and would not likely provide information useful for practical management of this potential pathway.
Stormwater	Sludges and general STP-related materials and PCB-contaminated materials from the 1974 spill remain in place	TPH, PCBs, metals, household/ industrial chemicals	Much of the area comprising the former treatment plant and PCB-material treatment/disposal area is covered by pavement. Areas in the western parcel that overlay former STP units are unpaved.	Additional soil data would provide further understanding of where STP-or PCB spill-related materials remain on site; however, this additional information will add little to support the tools available for managing these lingering materials.	• **Regulatory and Compliance Programs** – Stormwater monitoring results, although limited for this area, could help assess impact from remaining impacted materials. • **Environmental Investigation** – Additional characterization could assess volume and potential impact from remaining contaminated materials in this area. • **Remediation Programs** – Soil excavation, containment, or in-situ treatment could help manage remaining contaminants in these materials. • **Physical BMPs** – Erosion and runoff controls, sediment controls, and vegetative buffers would aid in management of this pathway. • **Capital Improvements** – Paving and utility upgrades (installation of stormwater infrastructure) would help management potential impact to stormwater in this area.	• **Regulatory and Compliance Programs** – Stormwater monitoring results could help assess impact from remaining contaminated materials in this area; however, upgraded stormwater structure at higher elevation than suspected materials; potential impact from this pathway is unlikely. • **Environmental Investigation** – Additional characterization in this area could assess volume and potential impact from STP/PCB-treatment related contamination in this area; however, investigation would greatly affect ongoing operations and would not likely provide information useful for practical management of this potential source concern.

Table 7, cont. Potential onsite pathways of contamination and general source control information at T-108

Potential Pathway	Potential Sources	Potential Contaminants	Details	Data Gap	General Options and Tools for Additional Pathway Characterization or Source Control (Refer to Table 6)	
					Western Parcel	Eastern Parcel
Groundwater migration	Contaminants in groundwater on the subject property have the potential to migrate directly to the LDW or via underground piping/infiltration.	TPH compounds, metals	Sampling results indicated that TPH, metals, PCBs, and PAHs were present at some level in onsite groundwater, however at levels below MTCA standards.	Recent groundwater sampling has been conducted; available data establishes that pathway is not of impact concern at the subject property; additional data not required.	Recent groundwater investigations have allowed Ecology to determine that groundwater at the subject property is not a pathway for recontamination of LDW sediment. Nevertheless, capital improvements to address other potential pathways (i.e., stormwater) will greatly reduce infiltration and migration potential.	Recent groundwater investigations have allowed Ecology to determine that groundwater at the subject property is not currently a pathway for recontamination of LDW sediment.
Groundwater migration	Chemicals spilled or leaked on impervious areas have the potential to infiltrate into migrating groundwater	TPH compounds, metals, PCBs, PAHs, and SVOCs	Operations being completed in areas currently unpaved (storage) do not indicate a major threat for accidental spills and leaked chemicals that could enter groundwater.	Given conditions of areas of operation, impact from these sources would likely affect stormwater prior to any influence over area groundwater; additional groundwater data not required.	• **Operational BMPs** – Good housekeeping and environmental stewardship education could help reduce the potential future introduction of contaminants to groundwater. • **Capital Improvements** –Paving, grading, and utility improvements (stormwater network installation) would greatly limit future infiltration of stormwater into subsurface groundwater and prevent these spilled materials from being transported via groundwater.	• **Regulatory and Compliance Programs** – Adherence to requirements of the Port's and ConGlobal's permit (proper materials storage/handling, inspection and oversight, etc.) will help limit potential future impact to groundwater; although the majority of this area is paved and managed by an updated stormwater network installed above the water table. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help reduce the potential for future introduction of contaminants from spills and leaks. • **Engineering Controls** – Proper operation and maintenance of machinery can limit accidental spills and leaks. • **Institutional Controls** – Deed and tenant restrictions can limit potential operations in this area.
Groundwater migration	Contaminated fill material beneath subject property or in former tidal drainage channel	Miscellaneous sewage and industrial wastes	Large portions of the subject property have been filled over time including the former drainage channel, using both native and non-native materials. These fill materials can infiltrate into migrating groundwater	Additional soil information gathered to ascertain location and quality of fill materials would be helpful; however, the information would add little to implementation of the tools most effective to address potential lingering contamination.	• **Remediation Programs** –Containment or in-situ treatment could help manage potential future impact to groundwater from contaminants in fill material. • **Capital Improvements** – Paving and utility upgrades (installation of stormwater infrastructure) would help prevent future infiltration of stormwater into impacted fill material which may mobilize contaminants to groundwater.	• **Environmental Investigation** – Additional characterization in this area could assess volume and potential future impact to groundwater from contaminated fill in this area; however, investigation would greatly affect ongoing operations and provide little information for a pathway previously determined to be of minimal concern.

Table 7, cont. Potential onsite pathways of contamination and general source control information at T-108

Potential Pathway	Potential Sources	Potential Contaminants	Details	Data Gap	General Options and Tools for Additional Pathway Characterization or Source Control (Refer to Table 6): Western Parcel	Eastern Parcel
Groundwater migration	Sludge materials remaining in place from historical STP or PCB spill treatment operations	TPH, PCBs, metals, household/ industrial chemicals	Much of the area comprising the former STP and PCB-spill treatment areas is covered by pavement. Areas in the Western Parcel that overly former STP units are unpaved.	Additional groundwater data would provide further understanding of STP- and PCB treatment-related materials; however, groundwater determined not to be a potential source at the subject property and additional data would not benefit application of practical tools to address lingering contamination.	• **Environmental Investigation** – Additional characterization in this area could assess volume and potential future impact to groundwater from contaminated materials in this area. • **Remediation Programs** –Containment or in-situ treatment could help prevent future stormwater infiltration that may mobilize contaminants remaining in these materials into groundwater. • **Capital Improvements** – Paving and utility upgrades (installation of stormwater infrastructure) would help prevent future infiltration of stormwater that may mobilize contaminants in these materials into local groundwater.	• **Environmental Investigation** – Additional characterization in this area could assess volume and potential future impact to groundwater from STP/PCB spill treatment related contamination in this area; however, investigation would greatly affect ongoing operations and would not likely provide information useful for practical management of this pathway already determined to be of minimal concern.
Bank erosion	Contaminated bank sediment can erode directly into the LDW (surface water runoff, tidal exchanges, etc.)	PCBs, metals, TPH compounds, PAHs, phthalates, phenol, benzoic acid, 1,2-dichlorobenzene	Areas of the subject property shoreline are unarmored, or existing armoring/vegetation are not providing stability as designed.	Little shoreline bank data are available; further sampling of the bank would provide useful information and help focus long-term environmental strategy.	• **Environmental Investigation** – Additional characterization of bank soil is necessary to provide information to formulate an effective strategy for this area. • **Remediation Programs** – Soil removal and/or containment would greatly reduce the potential impact from this pathway. • **Physical BMPs** – Erosion and runoff controls and vegetative buffers would help reduce potential impact from this pathway to LDW sediment. • **Capital Improvements** – Infrastructure improvements (paving, grading, containment, and shoreline stabilization, etc.) would greatly reduce potential impact from this pathway. Restoration opportunities along the shoreline would promote long-term environmental stewardship.	Not applicable

BMP – best management practice
CSO – combined sewer overflow
LDW – Lower Duwamish Waterway
NPDES – National Pollutant Discharge Elimination System
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SD – storm drain
STP – sewage treatment plant
SWPPP – stormwater pollution prevention plan
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

The potential pathways and associated source information in Table 7 provide a general overview of the contaminant dynamics currently of potential issue at the subject property. Planning and management of ongoing and future source control programs at the subject property will be discussed in greater length in the subsequent SCSP documentation to be completed upon finalization of this Environmental Conditions Report.

5.5 OFFSITE POTENTIAL PATHWAYS OF CONTAMINATION

Contamination documented at adjacent properties also has the potential to migrate into and through the subject property. Some of this documented environmental contamination was discussed in Section 4.2; data summaries for many of these facilities are provided in Appendix E.

Since these pathways are outside of the T-108 property boundary, options for control or elimination of these sources and pathways are highly limited. However, source control management practices, standard operating procedures, and existing permit monitoring requirements can be utilized to greatly reduce the potential impact from these offsite sources.

Table 8 highlights some of the potential offsite sources and the routes of migration onto the subject property. As with the information included in Table 7, the information in this table will be used to assist in the planning and management of ongoing and future source control programs at the subject property to be discussed in the upcoming SCSP documentation.

Table 8. Potential offsite sources of contamination and pathway information relative to T-108

Potential Pathway	Potential Sources	Potential Contaminants	Details	Data Gap	General Options and Tools for Additional Pathway Characterization or Source Control (Refer to Table 6)
Air	Emission from neighboring industrial facilities depositing on site	Metals, phthalates, dioxins/furans, particulates	Subject property located in large industrial area; neighboring facilities (e.g., Ash Grove Cement) have documented releases to the atmosphere above regulatory standards; emissions can migrate through stormwater and groundwater pathways.	Data on air emissions in the greater Duwamish Valley are very limited; additional data would be helpful in further assessing pathway but difficult to associate directly with T-108 concerns.	• **Regulatory and Compliance Programs** – Review and consideration of greater Duwamish Valley stormwater monitoring results can provide insight as to the level of impact from atmospheric deposition. Ongoing coordination with the SCWG can provide valuable information on strategies within the greater Duwamish Valley to assess and manage impacts from atmospheric deposition. • **Operational BMPs** – Good housekeeping and environmental stewardship education can aid in the identification by subject property workers of potential offsite air emissions issues.
Stormwater	Spills, leaks, and accidental discharges from neighboring facilities	Metals, PAHs, PCBs, TPH, VOCs, miscellaneous chemicals	Contaminants from operations at adjacent terminal properties, truck traffic, and general ROW activities have the potential to migrate through stormwater runoff or sheet flow and into the drainage networks serving the subject property.	Monitoring information from adjacent Port properties (as applicable to their permit) and other potential monitoring data from local property owners (as available) can be assessed for potential impacts to the subject property; however, available data will likely be very limited.	• **Regulatory and Compliance Programs** – Coordination with other NPDES permittees and with the efforts of the SCWG can provide useful information on assessing potential for impact to the subject property from contaminated stormwater originating offsite. • **Operational BMPs** – Good housekeeping and environmental stewardship education can help subject property workers identify concerns in advance of potential impact to the site. • **Physical BMPs** – Hay bale buffers, catch basin filter socks, silt screens, etc., can help limit the introduction of contaminants transported to the site from offsite stormwater. Regular cleaning of the catch basin and the stormwater networks can prevent impacted materials from entering the LDW through the stormwater pathway.
Stormwater	Contaminants from indirect atmospheric deposition, dust and particulates	Metals, phthalates, dioxins/furans, particulates	As mentioned above, contaminants deposited via indirect atmospheric deposition onto the subject property can be transported to the LDW through the stormwater pathway.	Data on air emissions in the greater Duwamish Valley are very limited; additional data would be helpful in further assessing pathway but difficult to associate directly with T-108 concerns.	• **Regulatory and Compliance Programs** – Review and consideration of greater Duwamish Valley stormwater monitoring results can provide insight as to the level of impact from atmospheric deposition. Ongoing coordination with the SCWG can provide valuable information on strategies within the greater Duwamish Valley to assess and manage impacts from atmospheric deposition. • **Operational BMPs** – Good housekeeping practices (pavement sweeping, catch basin cleanout, etc.) can help prevent contaminants in atmospheric materials from entering the stormwater network.

POTENTIAL PATHWAY	POTENTIAL SOURCES	POTENTIAL CONTAMINANTS	DETAILS	DATA GAP	GENERAL OPTIONS AND TOOLS FOR ADDITIONAL PATHWAY CHARACTERIZATION OR SOURCE CONTROL (REFER TO TABLE 6)
Stormwater	Contaminants carried to the subject property from offsite by trucks, miscellaneous equipment, and in cargo containers, etc.	Metals, PAHs, PCBs, TPH, miscellaneous chemicals	Tenant operations involve management of trucks, chassis, and cargo containers that could potentially introduce contaminants to the subject property from other locations.	Information on potential contaminants that can be brought to the site via truck traffic, etc. is very limited. Additional data would be helpful but would be difficult to assign specifically to potential T-108 concerns.	• **Regulatory and Compliance Programs** – Permit required monitoring could be used to assess potential impact from offsite materials deposited on the subject property and transported into the stormwater pathway. However, differentiation between onsite contributions and those introduced by offsite equipment would be very difficult to ascertain. • **Operational BMPs** – Good housekeeping practices (pavement sweeping, catch basin cleanout, etc.) and an established equipment/truck washing program in a dedicated area at the subject property (with appropriate wash-water collection systems) would be the most practical way of addressing this potential contaminant pathway at the subject property.
Groundwater migration	Contaminants in groundwater in properties outside the T-108 subject property (i.e., S Oregon Street ROW) have the potential to migrate onto the subject property	TPH compounds, metals, miscellaneous chemicals	Results of sampling in the S Oregon Street ROW indicated soil and/or groundwater impacted with PCBs, metals, TPH compounds, and PAHs	Additional coordination and assessment of neighboring groundwater monitoring programs will provide necessary, if likely limited, information on overall groundwater quality in the area of the subject property.	• **Environmental Investigation** – Additional characterization of groundwater conditions around the perimeter of the subject property would provide useful information on the quality of groundwater potentially entering the property; however, groundwater flow patterns in many areas of the subject property have been shown to be existing the subject property toward neighboring facilities. • **Remediation Programs** – In-situ treatment of groundwater at the property boundary, or potential containment pumping of impacted groundwater would limit its influence on subsurface groundwater conditions at the site; however, given the level of contamination identified to date, this is an expensive and relatively impractical approach to address this potential pathway of concern.

BMP – best management practice

LDW – Lower Duwamish Waterway

NPDES – National Pollutant Discharge Elimination System

PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl

ROW – right-of-way

SWPPP – stormwater pollution prevention plan

TPH – total petroleum hydrocarbons

VOC – volatile organic compound

6 Conclusions and Recommendations

Terminal 108 has had numerous owners and operators over the course of the last hundred years. Operations have included wastewater/stormwater treatment, materials storage and transfer, PCB-contaminated sediment treatment and disposal, and most recently container and chassis storage and miscellaneous maintenance efforts. Upgrades and improvements to subject property infrastructure have occurred with each change of operation at the site and have greatly influenced the overall shape and layout of the subject property.

This diverse operational history has created a complex list of potential environmental concerns that must be considered in the formulation and implementation of an effective long-term source control strategy. Numerous source control tools and management procedures are available for consideration and incorporation into an effective strategy for the subject property. Requirements of a variety of regulatory and compliance programs, many already applicable to operations at the subject property (NPDES permits, etc.), can be utilized to reduce and potentially eliminate contaminants from impacting the subject property while at the same time assessing potential impacts from other onsite and offsite sources. Focused characterization efforts and remediation programs can potentially remove or contain impacted media at the subject property while operational and physical BMPs (good housekeeping practices, worker education, erosion control, etc.) can be incorporated as standard operating procedure at the subject property. Most importantly capital improvement initiatives (utility upgrades, paving, infrastructure improvements, etc.) can greatly reduce the potential for impact from upland sources to LDW sediment.

Environmental media at the subject property (i.e., surface and subsurface soil, groundwater) have been sampled and analyzed for the last three decades. Impacted soil at the subject property may have originated from past onsite operations (wastewater treatment, PCB-impacted sediment treatment and disposal) or may have been brought to the site during filling and grading historically associated with the construction of the LDW. Although the continued characterization and potential remediation (i.e., excavation) of these impacted materials should be considered for the site (especially in consideration of bank soil in the Western Parcel), current and long-term operational use at the subject property makes this approach practical for only small portions of the site. With these considerations, ongoing infrastructure improvements and applicable engineering controls (paving, containment, etc.) are a more practical and effective strategy for the subject property.

Recent groundwater investigation reports for the subject property (Pacific Groundwater Group 2006b, 2007a) have indicated that low concentrations of contaminants have been identified in samples, but at reporting levels below relevant regulatory cleanup standards. Subsequent to this reporting, Ecology acknowledged that groundwater at T-

108 is not currently considered as a potential source for impact to neighboring LDW sediment. Nevertheless, groundwater migration potential (from onsite and offsite) must be considered if a long-term source control strategy implemented at the site is to be effective.

The stormwater pathway's potential to transport contaminants across the subject property and to the LDW will need to be a chief focus during development and implementation of an effective source control strategy. Stormwater has the potential to transport a wide array of contaminants whose origins are from both onsite (spills, leaks, accidental discharges, etc.) and offsite (atmospheric deposition, runoff from adjacent properties, etc.). Numerous options are available to help reduce this pathway's potential of impact including the aspects of the existing NPDES programs (education, spill prevention, proper materials handling and storage, and inspection and oversight). Adherence to the requirements of the Port's and tenant's NPDES permits will reduce the potential for chemicals to leave the property and impact the LDW.

Nevertheless, source control programs will only be effective if they consider the "big picture," including understanding potential future uses of the property (both by its tenants and owner), and the potential for outside sources and pathways to impact the subject property. The understanding of the current conditions of the subject property provided in this documentation, including (but not limited to) the property's geology, hydrogeology, historical operations and practices, environmental investigation history, and future development plans (as applicable) will have to be considered in order to develop an effective strategy for the site.

The SCSPs that will now be completed will expand upon the information included in this documentation (particularly concerning potential pathways and selected source control measures/tools) and provide an overall strategy for continued source control management at the subject property. The plans will take into consideration the regulatory requirements already established as well as other measures and techniques that can be used to ensure that the strategies are proactive and can adjust to the potential changing operational and environmental conditions of the subject property.

7 References

Aerial Photo Publishers. 1946. Aerial survey of T4N, R3E and 4E: T-108 and vicinity. Publisher: Aerial Photo Publishers, Seattle, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

AGI. 1992a. Site assessment summary, site 64534097, 4525 Diagonal Avenue South, Seattle, Washington. Prepared for Chevron USA Products Company. Applied Geotechnology, Inc., Bellevue, WA.

AGI. 1992b. Supplemental site investigation, Chevron USA Site 64534097, 4525 Diagonal Avenue South, Seattle, Washington. Prepared for Chevron USA Inc. Applied Geotechnology, Inc., Bellevue, WA.

Anchor. 2007. Duwamish/Diagonal sediment remediation project 2005 monitoring report: Elliott Bay/Duwamish restoration program panel. Panel publication 40. Prepared for King County Department of Natural Resources and Parks Elliot Bay/Duwamish restoration program. Anchor Environmental, L.L.C., Seattle, WA.

Blomberg G. 2008. Personal communication (telephone conversation with Jenny Buening, Windward Environmental, regarding former Lafarge facilities on T-108 property). Port of Seattle, Seattle, WA. June 4, 2008.

Booth D, Herman L. 1998. Duwamish industrial area hydrogeologic pathways project: Duwamish basin groundwater pathways conceptual model report. Prepared for City of Seattle Office of Economic Development and King County Office of Budget and Strategic Planning. Produced by Hart Crowser, Inc., Seattle, WA.

Brown and Caldwell. 1958. Metropolitan Seattle sewerage and drainage survey: A report for the City of Seattle, King County and the State of Washington on the collection, treatment and disposal of sewage and the collection and disposal of storm water in the metropolitan Seattle area. Brown and Caldwell Consulting Engineers, Seattle, WA.

Container Care International. 1993. Letter dated December 9, 1993 from Bob Bunch to J. Sizemore, Port of Seattle, regarding pollution prevention plan and contingency plan. Container-Care International, Inc., Seattle, WA.

Dames & Moore. 1984. Progress report, consultation, soil and water test results, Duwamish Waterway property, Seattle, Washington, for Chiyoda International Corporation. June 25, 1984. Dames & Moore, Seattle, WA.

Dames & Moore. 1988. Report of geotechnical investigation, Port of Seattle-Terminal 108 site, Seattle, Washington. Prepared for LaFarge Canada, Inc. Dames & Moore, Seattle, WA.

Dames & Moore. 1992. Preliminary design and cost estimate, proposed develoment for container care, Terminal 108/Chiyoda, Seattle, Washington. Prepared for the Port of Seattle. Dames & Moore, Seattle, WA.

Ecology. 1987. Water quality certification, Public Notice no. 071-OYB-2-010439-R. Letter to Port of Seattle from M.F. Palco, Environmental Review, dated February 19, 1987. Washington Department of Ecology, Olympia, WA.

Ecology. 2004a. Lower Duwamish Waterway source control action plan for the Duwamish/Diagonal Way early action cleanup. No. 04-09-003. Washington Department of Ecology, Northwest Regional Office, Toxics Cleanup Program, Bellevue, WA.

Ecology. 2004b. Lower Duwamish Waterway source control strategy. No. 04-09-043. Washington Department of Ecology, Northwest Regional Office, Toxics Cleanup Program, Bellevue, WA.

Ecology. 2008. Property review: Federal Center South. Early Action Area 1, Duwamish/Diagonal combined sewer overflow/storm drain Washington Department of Ecology, Olympia, WA.

EPA. 1975. Region 10 On-Scene Coordinator's report on the Duwamish Waterway PCB spill on September 13, 1974. US Environmental Protection Agency, Region 10, Seattle, WA.

EPA. 2001. Frequently asked questions about atmospheric deposition. EPA-453/R-01/009. Office of Wetlands, Oceans, and Watersheds and Office of Air Quality Planning and Standards, US Environmental Protection Agency, Washington, DC.

Herrera. 2001. Phase I environmental site assessment, Federal Center South, Seattle, Washington. Herrera Environmental Consultants, Inc., Seattle, WA.

Herrera. 2004. Summary report, Lower Duwamish Waterway outfall survey. Prepared for Seattle Public Utilities. Herrera Environmental Consultants, Inc., Seattle, WA.

King County. 1997. Duwamish/Diagonal site assessment report. Prepared for Elliott Bay Duwamish Restoration Program. King County Department of Natural Resources, Seattle, WA.

King County. 2002. Source control summary for the Duwamish Diagonal cleanup project addendum. Prepared for the Elliott Bay/Duwamish Restoration Panel. King County Department of Natural Resources and Parks, Seattle, WA.

King County, Anchor, EcoChem. 2005a. Duwamish/Diagonal CSO/SD cleanup study report. Final. Prepared for Elliott Bay/Duwamish Restoration Program panel. King County Department of Natural Resources, Anchor Environmental, L.L.C., and EcoChem, Inc., Seattle, WA.

King County. 2006. Combined sewer overflow control program 2005-2006 annual report. Wastewater Treatment Division, King County Department of Natural Resources and Parks, Seattle, WA.

King County. 2008. King County Parcel Viewer web page [online]. King County GIS Center, Seattle, WA. Available from: http://www.metrokc.gov/gis/index.htm.

King County, SPU. 2005. King County and Seattle Public Utilities source control program for the Lower Duwamish Waterway: June 2005 progress report. King County Department of Natural Resources and Parks and Seattle Public Utilities, Seattle, WA.

King County, Anchor, EcoChem. 2005b. Duwamish/Diagonal CSO/SD sediment remediation project closure report. Prepared for the Elliott Bay Duwamish Restoration Program Panel. King County Department of Natural Resources, Anchor Environmental LLC, and EcoChem, Inc., Seattle, WA.

Metro Aerial. 1991. Seattle/Metro aerial survey: aerial photo of T-108 and vicinity. Survey by Metro Aerial. Publisher: Metro Aerial, Roseville, CA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Nairn B. 2007. Personal communication (memorandum to Jeff Stern titled "CSO data provided to LDWG," distributed at October 24, 2007 meeting). Comprehensive Planning & Technical Resources Group, King County Department of Natural Resources and Parks, Seattle, WA. Undated.

Pacific Aerial Surveys. 1961. Mylar enlargements: aerial photo of T-108 and vicinity. Publisher: Pacific Aerial Surveys. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Pacific Environmental Group. 1991. Letter dated January 3, 1991 to S. Bruce, Chevron USA, Inc., from E. Larsen and W. Crell, PEG, regarding soil landfarming at Chevron Site 4097. Pacific Environmental Group, Inc., Redmond, WA.

Pacific Groundwater Group. 2006a. Draft South Oregon Street 2006 environmental data review and summary. Prepared for Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2006b. Port of Seattle T-108 interim groundwater and soil investigation. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2006c. T-108 interim groundwater and shoreline soil investigation final work plan. Prepared for Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2007a. Port of Seattle T-108 groundwater investigation final report. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2007b. Soil and groundwater data report, Oregon Street right-of-way, Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Photographer unknown. 1953. S53 survey: Aerial photo of T-108 and vicinity. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Pinnacle Geosciences. 2005. Phase I environmental site assessment, Terminal 106 West, Building 1, 44 South Nevada Street, Seattle, Washington. Prepared for Port of Seattle. Pinnacle Geosciences, Inc., Bellevue, WA.

Port of Seattle. 1985a. Comprehensive public access plan for the Duwamish Waterway. Port of Seattle, Seattle, WA.

Port of Seattle. 1985b. State Environmental Policy Act (SEPA) environmental checklist determination of non-significance (DNS). POS SEPA 85-31. Port of Seattle, Seattle, WA.

Port of Seattle. 1988. SEPA determination of nonsignificance (DNS) of proposed action, Terminal 108, bulk cement transshipment facility. Port of Seattle, Seattle, WA.

Port of Seattle. 1989. Terminal 108 shore stabilization, water main and public access plot plan. Marine facilities drawing no. 108-8901-C1. Port of Seattle, Seattle, WA.

Port of Seattle. 1992a. Environmental checklist, Port of Seattle Terminal 108 improvements. #9203345. Port of Seattle, Seattle, WA.

Port of Seattle. 1992b. Letter from Barbara Hinkle, Environmental Management Specialist, to Barbara Ritchie, Department of Ecology, regarding Terminal 108 Improvements Environmental Checklist POS SEPA File Number (92-14). Port of Seattle, Seattle, WA.

Port of Seattle. 1993. Marine facilities, Terminal 108 yard development, contract two: Existing conditions phasing and demo plan. Port of Seattle no. 108-93-1 C-3. Port of Seattle, Seattle, WA.

Port of Seattle. 1999. Letters dated 8/10/99 and 9/24/99 to M. Jensen and T. Hudson, Puget Sound Clean Air Agency, regarding notice of intent and close-out of existing dust control equipment, Terminal 108, case no. 9901092. Port of Seattle, Seattle, WA.

Schmoyer B. 2008. Personal communication (e-mail to Jeffrey Fellows, Windward Environmental, regarding source data through December 2007, with Excel attachment: source_chemistry_thru_12-07b.xls). Seattle Public Utilities, Seattle, WA. June 3, 2008.

TAMS. 1992. Port of Seattle Chevron Property development: order of magnitude cost estimate and report. TAMS Consultants, Inc., Seattle, WA.

Taylor L. 1985. Letter to W. Justin, Department of Construction and Land Use, City of Seattle, regarding Determination of Non-significance. May 2, 1985. Director of Planning and Research, Port of Seattle, Seattle, WA.

Tetra Tech. 1988. Elliott Bay action program: evaluation of potential contaminant sources. Prepared for Puget Sound Estuary Program, US Environmental Protection Agency, Region 10. Tetra Tech, Inc., Bellevue, WA.

Thomas R. 2008. Personal communication (comments provided to Jeffrey Fellows, Windward Environmental, on Sections 5 and 6 of T108 Environmental Conditions Report, as attachment to e-mail). Northwest Regional Office, Washington State Department of Ecology, Bellevue, WA. December 11, 2008.

Thorne Environmental. 1990. Quantitative chemistry results for soils stockpiled at the Chevron U.S.A. Inc. Chiyoda site, Seattle, Washington. Prepared for Chevron U.S.A. Inc. Thorne Environmental, Inc.

WDNR. 1970. Seattle 1970 photomaps: aerial photo of T-108 and vicinity. . Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

WDNR. 1981. SP-81: aerial photo of T-108 and vicinity. Photo by Washington State Department of Natural Resources. Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

WDNR. 1995. NW-95 enlargements: aerial photo of T-108 and vicinity. Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

APPENDIX A

Terminal-108 and Adjacent Property Photographic Log

Appendix B

Historical Aerial Photograph Review

APPENDIX C

Groundwater Monitoring Well and Boring Logs

APPENDIX D

Terminal-108 Analytical Information

APPENDIX E

Adjacent Property Analytical Information

APPENDIX F

Terminal-108 Reference Documentation

Appendix A Terminal-108 and Adjacent Property Photographic Log

Photo 1: ConGlobal Industries container terminal operations on the eastern parcel of T-108.

Photo 2: View (looking north) of the maintenance area located on the eastern portion of the ConGlobal Industries container terminal.

Photo 3: A catch basin on the northern portion of the ConGlobal Industries container terminal located near the maintenance area (eastern parcel).

Photo 4: View (looking northwest from Diagonal Ave S) of the railway crossing the southern portion of the eastern parcel onto the eastern and central portions of the western parcel of T-108.

Photo 5: View (looking south) of the northern portion of the western parcel of T-108. Container chassis are stored on portions of this parcel. The containers in the background are located on the eastern parcel.

Photo 6: Vegetation, chassis parts storage, and a groundwater monitoring well (PGG-5) located on the northern portion of the western parcel of T-108.

Photo 7: View (looking west) of the chassis storage area located on the paved, central portion of the western parcel of T-108.

Photo 8: View (looking north) from the interior of the western parcel of T-108. High-power transmission lines located along the S Oregon St ROW are visible in the background.

Photo 9: View (looking north from the Diagonal Ave S street-end) of the T-108 mitigation area and shoreline; protective buoy line visible at center of image.

Photo 10: Close-up view (looking north) of the T-108 mitigation area.

Photo 11: View (looking south toward the mitigation area) of the southern portion of the T-108 shoreline.

Photo 12: A portion of the wooden bulkhead located on the south-central portion of the T-108 shoreline.

Photo 13: Wooden bulkhead and the Port storm drain outfall (2225) located on the south-central portion of the T-108 shoreline.

Photo 14: View (looking northwest) of the abandoned Diagonal Ave STP outfall and the pipeline dock (installed by Lafarge) located on the north-central portion of the T-108 shoreline. Note the native intertidal substrate.

Photo 15: View (looking north) of the north-central and northern portions of the T-108 shoreline; the bank in this area is armored with rip-rap.

Photo 16: View (looking south from the S Oregon St ROW end) of the northern portion of the T-108 shoreline. The Duwamish/Diagonal CSO/SD and EOF outfalls are nearby, and the location of the Duwamish Siphon is indicated by the sign.

Photo 17: View (looking east) of the S Oregon St ROW. T-108 is on the right-hand side of the photograph, and the WSLCB property is to the left.

Photo 18: View (looking northeast from Diagonal Ave S) of the King County pumping station located adjacent and to the east of T-108.

Photo 19: View (looking northeast) of Diagonal Ave S. T-108 is located to the left (north) of the roadway, and the GSA's Federal Center South is visible to the right (south).

Photo 20: View (looking southeast from Diagonal Ave S) of the northern portion of the Federal Center South property.

Appendix B. Historical Aerial Photograph Review

A historical aerial photo review was conducted to document changes in site use and layout at T-108 over time. Photos from 1936 (King County 2008), 1946 (Aerial Photo Publishers), 1953 (Photographer unknown), 1961 (Pacific Aerial Surveys), 1970 (WDNR), 1981 (WDNR), 1990 (Metro Aerial 1991), and 1995 (WDNR) were available. The parcel boundaries for both the Eastern and Western Parcels of T-108 and the outline of the present-day shoreline are overlaid on the aerial photographs for reference. In addition to the aerial photos collected for this investigation, photos from 1976 and 1977 showing the central and western portions of the property were also available from an existing report by King County (King County et al. 2005).

The 1936 aerial photograph shows the property undeveloped with a tidal channel located on the eastern and northern portions of the Eastern Parcel. The shoreline extends further into the LDW than the present-day shoreline. By 1946, the Diagonal Way STP had been developed. Two large, round clarifiers are visible in the photograph, with two smaller round digesters to the west, and three or four rectangular-shaped sludge-drying beds to the west of the digesters. A control house is located to the east of the clarifiers. The STP outfall is visible approximately midway along the property shoreline, and lumber is being stored offshore within the LDW.

A report by King County indicated that the tidal channel on the north end of the property received untreated sewage from a small sewer system located to the northeast of the Diagonal Way STP (King County et al. 2005). What appears to be a small structure is visible along the eastern boundary of the Eastern Parcel in the aerial photograph from 1946. This may represent the small sewer system, however this could not be confirmed during the course of this investigation.

The site layout observed in the 1953 photograph appears similar to the 1946 layout. In the 1961 photo, a large sludge pond is visible to the west of the clarifiers and digesters; additional sludge ponds may be present to the north of the treatment plant. A large parking lot has been installed on the southern portion of the property.

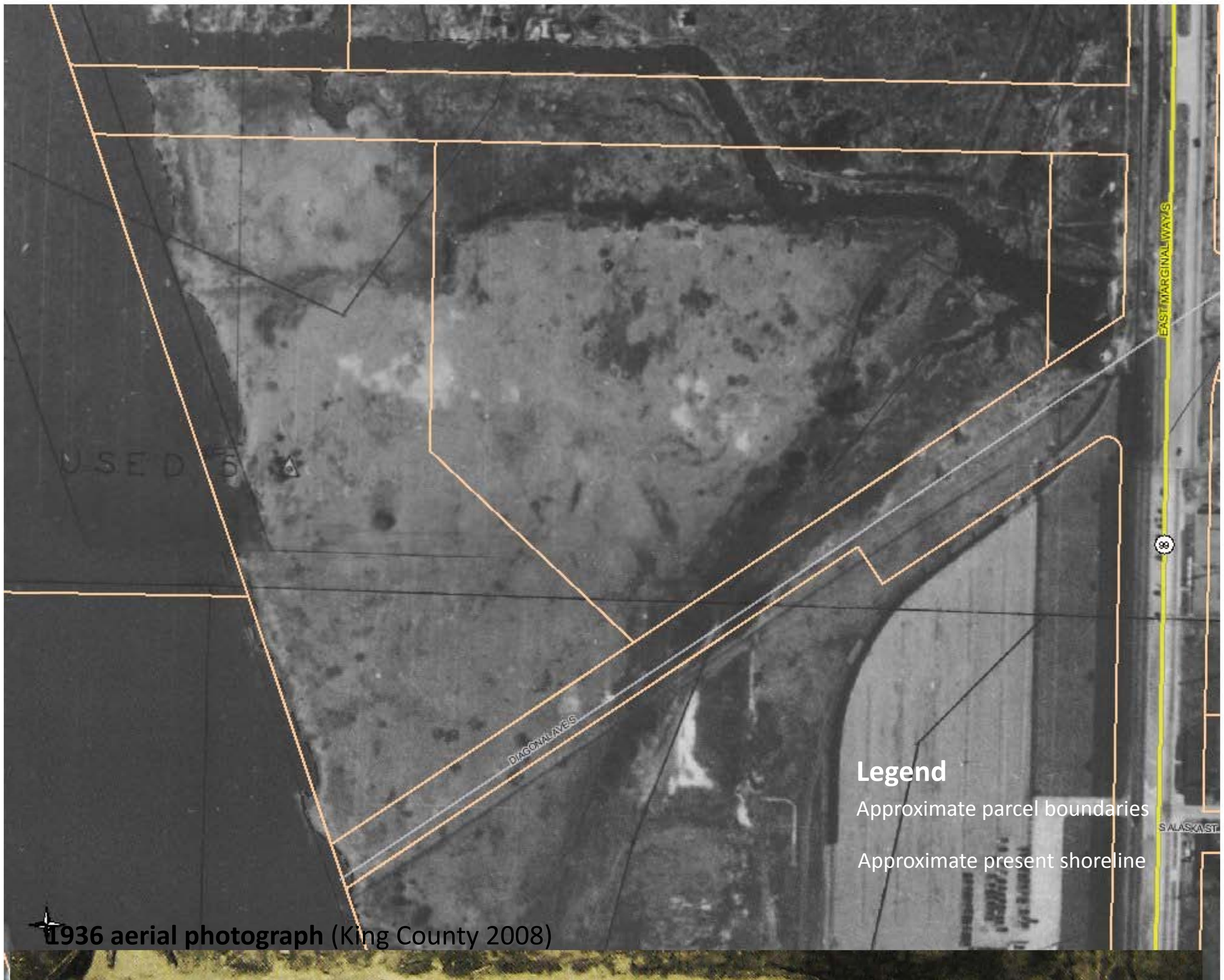
In the aerial photograph from 1970, an additional structure has been added to the northeast corner of the Eastern Parcel. According to a historical map by the Kroll Map Co. contained in a historical report of site conditions conducted for Chevron by TAMS (1992), this may have been a pump house. Other changes from 1961 apparent on the 1970 photograph include filling of the tidal channel, clearing and grading on the northern and eastern portions of the site, and a reduction in the size of the open sludge pond located to the west of the clarifiers and digesters.

In the 1981 aerial photograph, the STP has been removed and the shoreline along the northern portion of the property has been dredged. It appears that the paved parking area on the southern portion of the property and an area in the center of the Eastern Parcel are being used to store shipping containers or similar large objects.

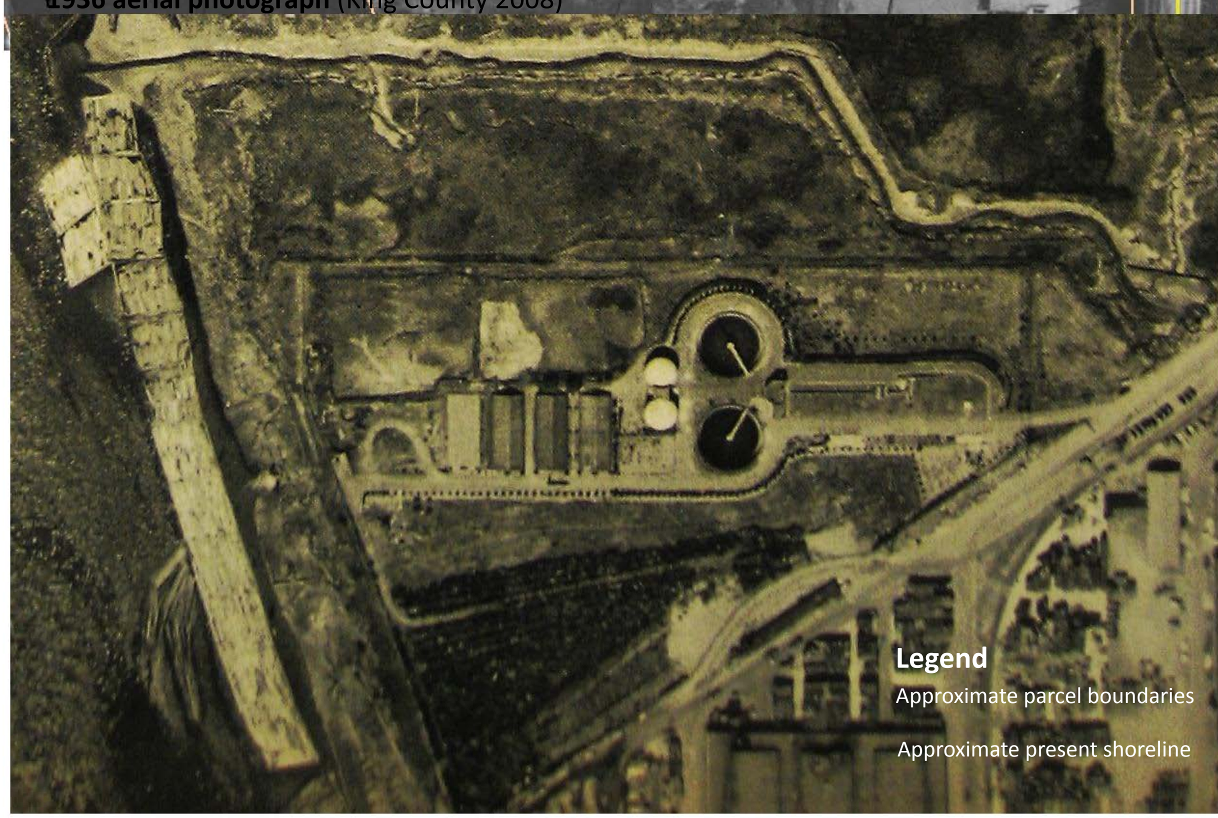
The Lafarge facility is apparent on the Western Parcel of the property in the aerial photograph from 1990. The pipeline dock, cement silos, and truck turn-around area are all distinguishable. The Eastern Parcel appears to be primarily vacant except for a few equipment storage areas visible on the central and southern portions of the parcel. The shape of the mitigation area on the southern portion of the shoreline is also apparent, and lumber is no longer being stored offshore of the property.

In the 1995 aerial photograph, the T-108 container terminal is visible on the Eastern Parcel of the property, while the Lafarge facility remains on the Western Parcel. The mitigation area appears to be more fully developed than in the 1990 photo as vegetation is now visible.

The aerial photographs with coverage of the western portion of the property acquired from the Duwamish/Diagonal CSO/SD Cleanup Study Report (King County et al. 2005) provides information on site conditions at T-108 in the mid-1970s. It was during this time period that the Diagonal Way STP was decommissioned, and also that two pits were excavated on the property to store and treat PCB-contaminated sediment dredged from the LDW. Based on these photographs, it is known that the sediment pits were present on the property in 1976 but had been filled by 1977. The Diagonal Way STP appears to have been decommissioned either in the latter half of 1976 of in 1977. The newly-dredged shoreline along the northern portion of the property is also clearly visible in the 1977 photograph. Overall, the historical aerial photographs reviewed during this investigation support the accounts of the property history reviewed in other reports and records.

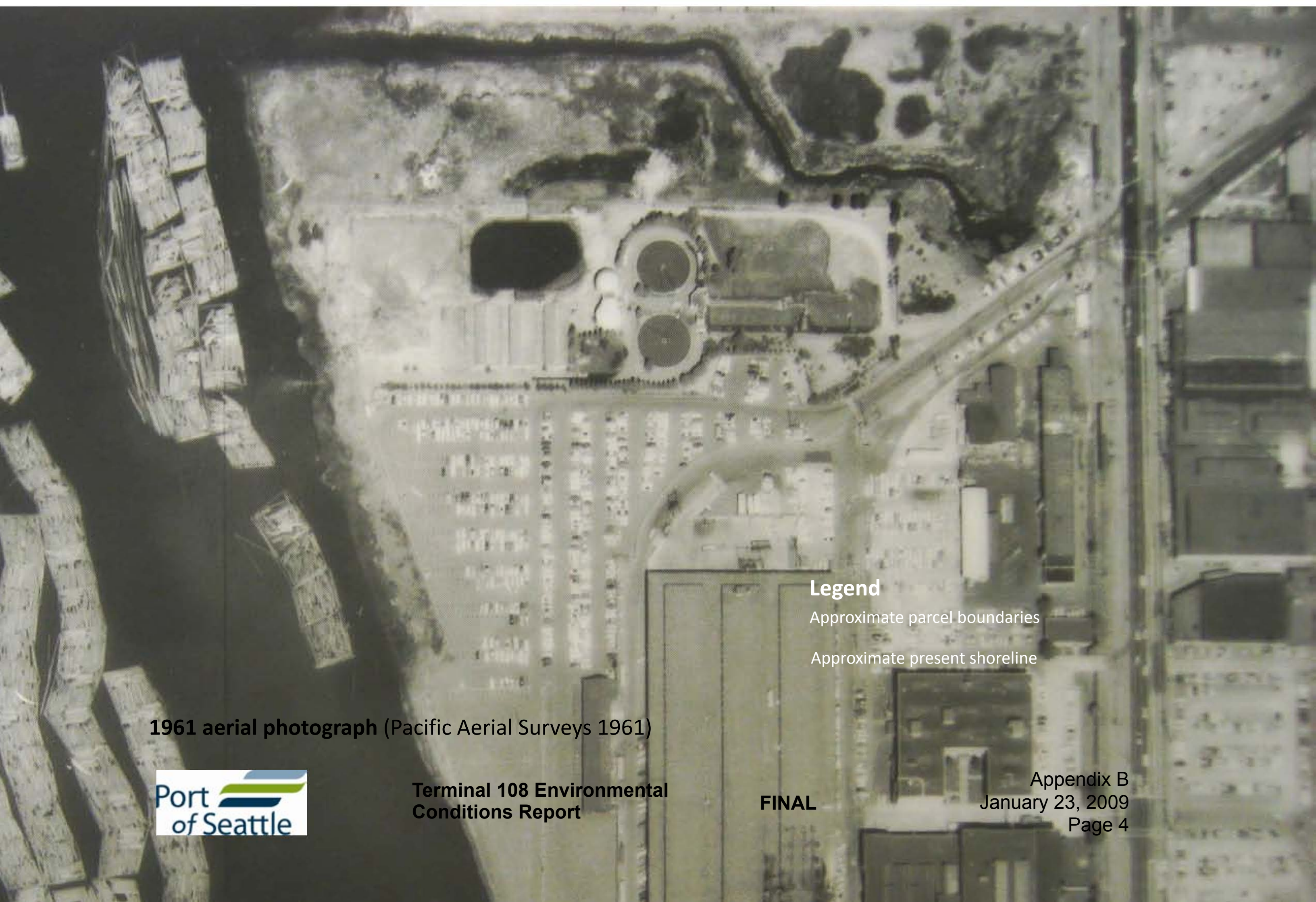


1936 aerial photograph (King County 2008)

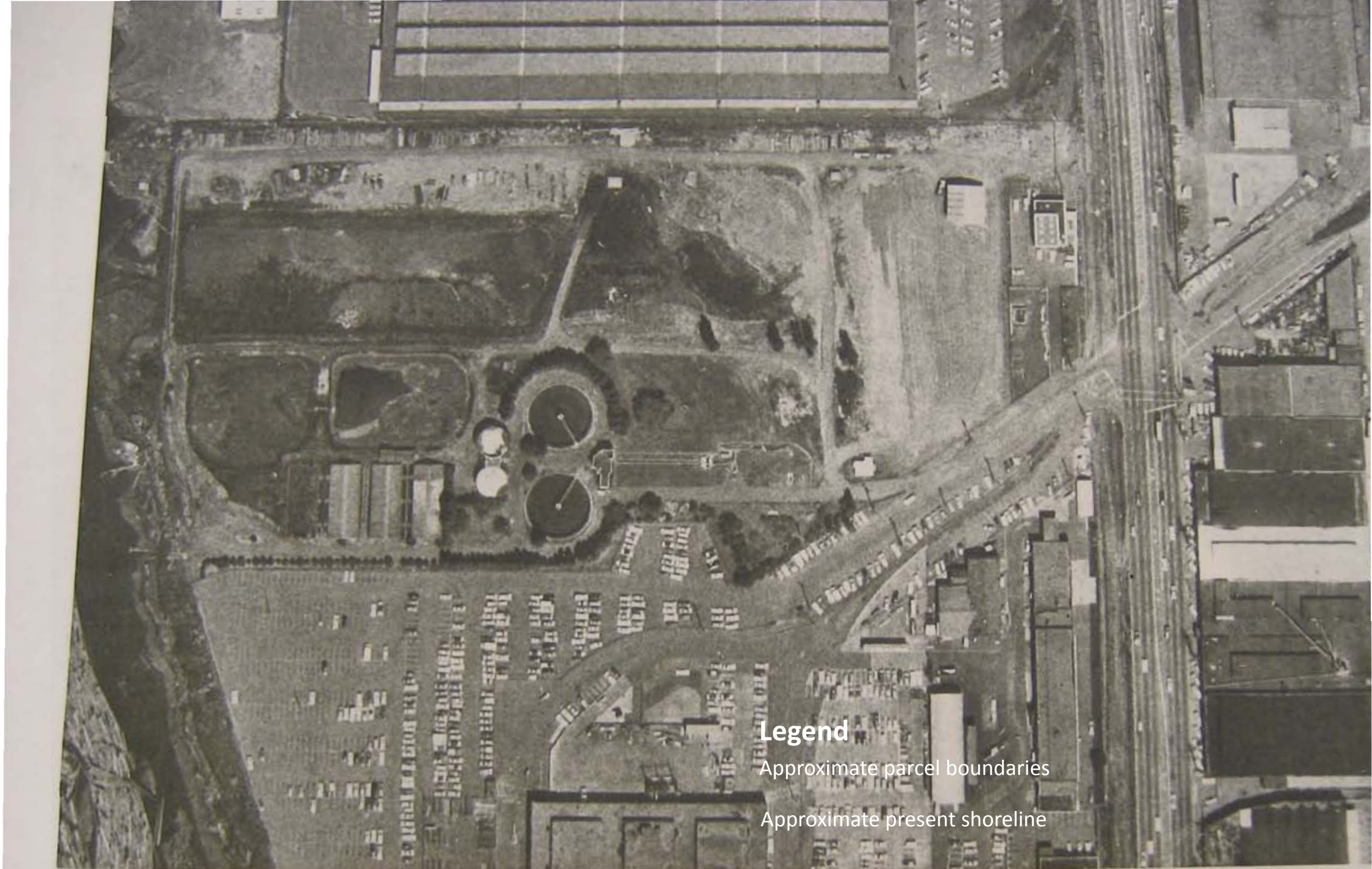


1946 aerial photograph (Aerial Photo Publishers 1946)

1953 aerial photograph (Source not reported)



1961 aerial photograph (Pacific Aerial Surveys 1961)



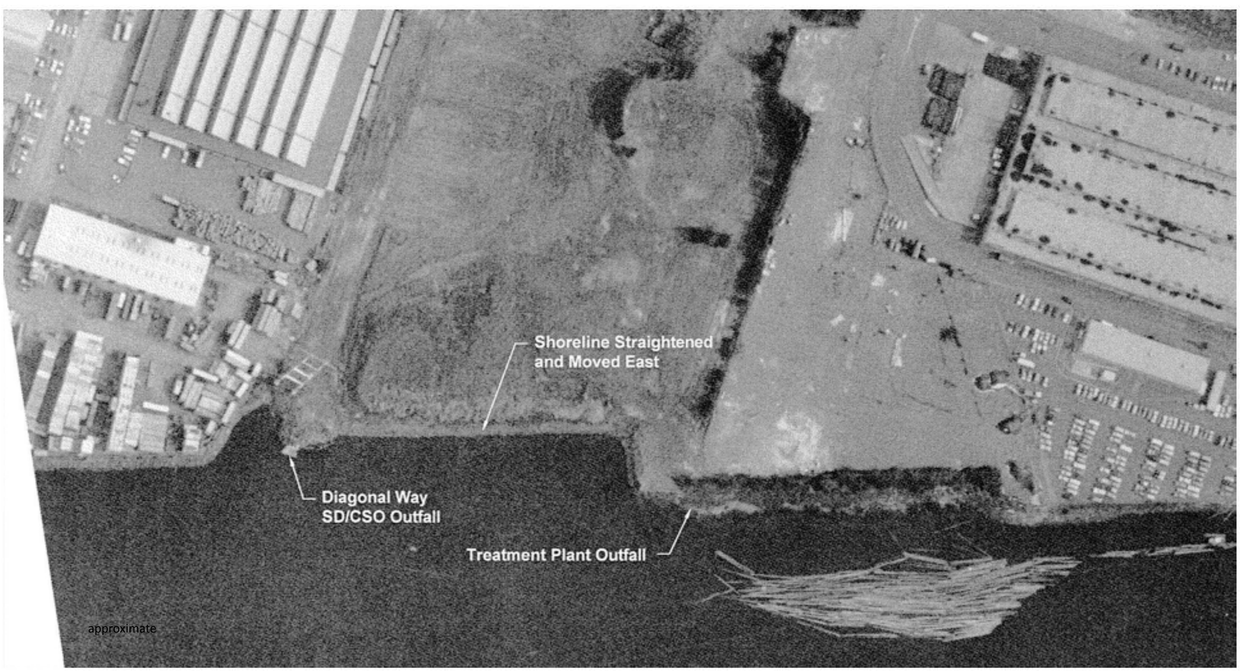
1970 aerial photograph (Washington Department of Natural Resources 1970)

1981 aerial photograph (Washington Department of Natural Resources 1981)

1990 aerial photograph (Metro Aerial 1991)

1995 aerial photograph (Washington Department of Natural Resources 1995)

1976 aerial photograph showing settling holding pits (KCDNR et al. 2005; photograph provided by US Army Corps of Engineers, Seattle District, dated July 28, 1976)



1977 aerial photograph showing settling holding pits filled (KCDNR et al. 2005; photograph provided by US Army Corps of Engineers, Seattle District, dated October 4, 1977)

References

Aerial Photo Publishers. 1946. Aerial survey of T4N, R3E and 4E: T-108 and vicinity. Publisher: Aerial Photo Publishers, Seattle, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

King County, Anchor, EcoChem. 2005. Duwamish/Diagonal CSO/SD cleanup study report. Final. Prepared for Elliott Bay/Duwamish Restoration Program panel. King County Department of Natural Resources, Anchor Environmental, L.L.C., and EcoChem, Inc., Seattle, WA.

King County. 2008. iMap. King County spatial information interactive mapping [online]. King County, Seattle, WA. Updated July 7, 2008. Available from: (http://www.metrokc.gov/gis/mapportal/iMAP_main.htm.

Metro Aerial. 1991. Seattle/Metro aerial survey: aerial photo of T-108 and vicinity. Survey by Metro Aerial. Publisher: Metro Aerial, Roseville, CA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Pacific Aerial Surveys. 1961. Mylar enlargements: aerial photo of T-108 and vicinity. Publisher: Pacific Aerial Surveys. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Photographer unknown. 1953. S53 survey: Aerial photo of T-108 and vicinity. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

TAMS. 1992. Port of Seattle Chevron Property development: order of magnitude cost estimate and report. TAMS Consultants, Inc., Seattle, WA.

WDNR. 1970. Seattle 1970 photomaps: aerial photo of T-108 and vicinity. . Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

WDNR. 1981. SP-81: aerial photo of T-108 and vicinity. Photo by Washington State Department of Natural Resources. Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

WDNR. 1995. NW-95 enlargements: aerial photo of T-108 and vicinity. Publisher: Washington State Department of Natural Resources, Olympia, WA. Accessed at the Map Collection and Cartographic Information Services Unit, University of Washington Libraries, Seattle, WA.

Appendix C Groundwater Monitoring Well and Boring Logs

Boring and Well Log Information

Boring Core ID	Completed as a Well?	Obtained Log?	Endnote Citation	Notes
C-1	Y	Y	AGI (1992)	
C-2	Y	Y	AGI (1992)	
C-3	Y	Y	AGI (1992)	
C-4	Y	Y	AGI (1992)	
C-5	Y	Y	AGI (1992)	
C-6	Y	Y	AGI (1992)	
MW-7	Y	Y	AGI (1992)	
MW-8	Y	Y	AGI (1992)	
MW-9	Y	Y	AGI (1992)	
MW-10	Y	Y	AGI (1992)	
MW-11	Y	Y	AGI (1992)	
MW-12	Y	Y	AGI (1992)	
MW-13	Y	Y	AGI (1992)	
MW-14	Y	Y	AGI (1992)	
PGG-1	Y	Y	Pacific Groundwater Group (2007)	
PGG-2	Y	Y	Pacific Groundwater Group (2007)	
PGG-3	Y	Y	Pacific Groundwater Group (2007)	
PGG-4	Y	Y	Pacific Groundwater Group (2007)	
PGG-5	Y	Y	Pacific Groundwater Group (2007)	
PGG-6	Y	Y	Pacific Groundwater Group (2007)	
PGG-7	Y	Y	Pacific Groundwater Group (2007)	
A	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
B	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
C	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
D	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
E	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
F	N	Y	AGI (AGI 1992)	D&M - diff locations from PEG A-F
B88-1	N	Y	Dames & Moore (1989)	
B88-2	N	Y	Dames & Moore (1989)	
B88-3	N	Y	Dames & Moore (1989)	
B81-1	N	Y	Dames & Moore (1981)	Boring log label is 1
B81-2	N	Y	Dames & Moore (1981)	Boring log label is 2
B81-3	N	Y	Dames & Moore (1981)	Boring log label is 3
B81-4	N	Y	Dames & Moore (1981)	Boring log label is 4
B81-5	N	Y	Dames & Moore (1981)	Boring log label is 5

Boring Core ID	Completed as a Well?	Obtained Log?	Endnote Citation	Notes
B81-6	N	Y	Dames & Moore (1981)	Boring log label is 6
B81-7	N	Y	Dames & Moore (1981)	Boring log label is 7
B81-8	N	Y	Dames & Moore (1981)	Boring log label is 8
B81-9	N	Y	Dames & Moore (1981)	Boring log label is 9
B81-10	N	Y	Dames & Moore (1981)	Boring log label is 10
B81-11	N	Y	Dames & Moore (1981)	Boring log label is 11
B81-12	N	Y	Dames & Moore (1981)	Boring log label is 12
B81-13	N	Y	Dames & Moore (1981)	Boring log label is 13
A	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
B	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
C	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
D	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
E	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
F	N	N	Pacific Environmental Group (1991)*	PEG - diff locations from D&M A-F
NAT-1	N	N	Pacific Groundwater Group (2006)*	
NAT-2	N	N	Pacific Groundwater Group (2006)*	
NAT-3	N	N	Pacific Groundwater Group (2006)*	
NAT-4	N	N	Pacific Groundwater Group (2006)*	
NAT-5	N	N	Pacific Groundwater Group (2006)*	
NAT-6	N	N	Pacific Groundwater Group (2006)*	
EP-1	N	N	Pacific Groundwater Group (2006)*	Should be in PEG 1991 Environmental Investigation but boring logs are missing from Appendix
EP-2	N	N	Pacific Groundwater Group (2006)*	
EP-3	N	N	Pacific Groundwater Group (2006)*	
EP-4	N	N	Pacific Groundwater Group (2006)*	
EP-5	N	N	Pacific Groundwater Group (2006)*	
EP-6	N	N	Pacific Groundwater Group (2006)*	
EP-7	N	N	Pacific Groundwater Group (2006)*	
EP-8	N	N	Pacific Groundwater Group (2006)*	
EP-9	N	N	Pacific Groundwater Group (2006)*	
EP-10	N	N	Pacific Groundwater Group (2006)*	
EP-11	N	N	Pacific Groundwater Group (2006)*	
DUD_30C	N	N	Anchor (2007)*	
DUD_31C	N	N	Anchor (2007)*	

* – Could not find boring log, but found analytical data associated with the location

REFERENCES

AGI. 1992. Site assessment summary, site 64534097, 4525 Diagonal Avenue South, Seattle, Washington. Prepared for Chevron USA Products Company. Applied Geotechnology, Inc., Bellevue, WA.

Anchor. 2007. Duwamish/Diagonal sediment remediation project 2005 monitoring report: Elliott Bay/Duwamish restoration program panel. Panel publication 40. Prepared for King County Department of Natural Resources and Parks Elliot Bay/Duwamish restoration program. Anchor Environmental, L.L.C., Seattle, WA.

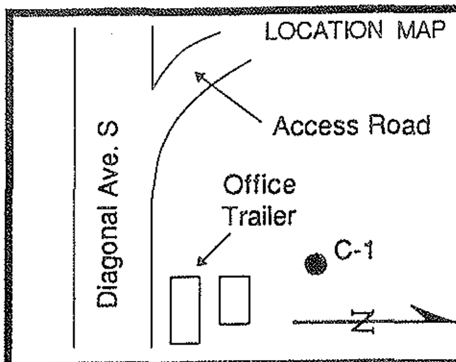
Dames & Moore. 1981. Report of site contamination, Chiyoda property. Prepared for Port of Seattle. Dames & Moore, Seattle, WA.

Dames & Moore. 1989. Report of geotechnical services, proposed cement terminal, Seattle, Washington. Prepared for LaFarge Canada, Inc. Dames & Moore, Seattle, WA.

Pacific Environmental Group. 1991. Letter dated January 3, 1991 to S. Bruce, Chevron USA, Inc., from E. Larsen and W. Crell, PEG, regarding soil landfarming at Chevron Site 4097. Pacific Environmental Group, Inc., Redmond, WA.

Pacific Groundwater Group. 2006. T-108 interim groundwater and shoreline soil investigation final work plan. Prepared for Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2007. Port of Seattle T-108 groundwater investigation final report. Pacific Groundwater Group, Seattle, WA.



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-1
BORING NO.
PAGE 1 OF 1

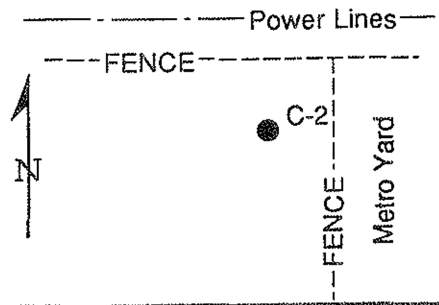
PROJECT NO. 520-02.02	CLIENT: Chevron USA
LOGGED BY: EL	DATE DRILLED: 8-16-90
DRILLING METHOD: HSA	LOCATION: 4525 Diagonal Ave.
SAMPLING METHOD: Split Spoon	HOLE DIAMETER: 8"
CASING TYPE: Sch 40 PVC	HOLE DEPTH: 19'
SLOT SIZE: 0.010"	WELL DEPTH: 17'
GRAVEL PACK: 10 X 20 SAND	WELL DIAMETER: 2"

WELL COMPLETION	MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CEMENT	Dp	0	9	2–4	■		CL	CLAY; dark grayish brown; silty; 10-20% fine gravel; stiff; no hydrocarbon-like odor.
BENTONITE	Dp ▼	4.6	10	8	■			@7.5': gray; wood fragments; soft; hydrocarbon-like odor.
SAND	▽ Mst	0	5	12–14	■		OL	ORGANIC CLAY; dark gray; silty; 20% peat; soft; no hydrocarbon-like odor.
	Wt	0	1	18	■			@17.5': silt interbeds; very soft; no hydrocarbon-like odor.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44

BOTTOM OF BORING 19'
LIP OF BOX STICKUP: 2.4'

LOCATION MAP



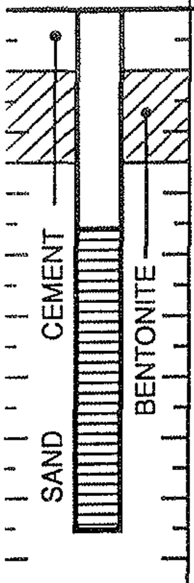
PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-2
BORING NO.
PAGE 1 OF 1

PROJECT NO. 520-02.02
LOGGED BY: EL
DRILLING METHOD: HSA
SAMPLING METHOD: Split Spoon
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.010"
GRAVEL PACK: 10 X 20 SAND

CLIENT: Chevron USA
DATE DRILLED: 8-16-90
LOCATION: 4525 Diagonal Ave.
HOLE DIAMETER: 8"
HOLE DEPTH: 19'
WELL DEPTH: 17'
WELL DIAMETER: 2"

WELL COMPLETION

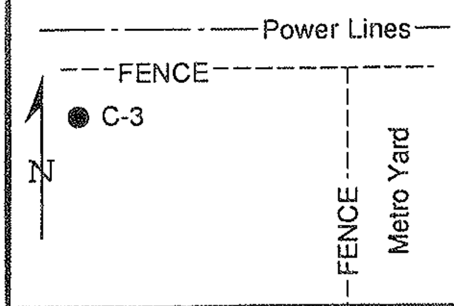


MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SOIL TYPE	LITHOLOGY / REMARKS
			0	SM	SILTY SAND; black; 20-30% fines; fine grained; medium dense; hydrocarbon-like odor.
Dp	0.7	10	3		
Mst	0	6	8		@7.5': loose; hydrocarbon-like odor.
Wt	0	4	13	ML	SILT; dark gray; 20-30% fine sand; firm; hydrocarbon-like odor.
Wt	0	2	18	CL	CLAY; dark gray; silty; soft; no hydrocarbon-like odor.

Depth scale (feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44

BOTTOM OF BORING 19'
LIP OF BOX STICKUP: 2.54'

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-3
BORING NO.

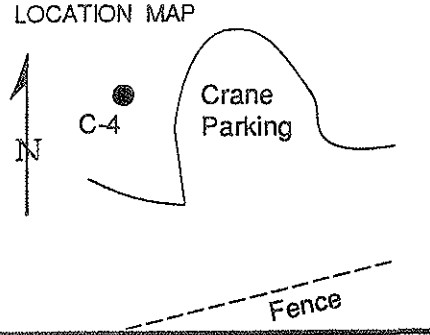
PROJECT NO. 520-02.02
LOGGED BY: EL
DRILLING METHOD: HSA
SAMPLING METHOD: Split Spoon
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.010"
GRAVEL PACK: 10 X 20 SAND

CLIENT: Chevron USA
DATE DRILLED: 8-16-90
LOCATION: 4525 Diagonal Ave.
HOLE DIAMETER: 8"
HOLE DEPTH: 19'
WELL DEPTH: 17'
WELL DIAMETER: 2"

WELL COMPLETION	MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CEMENT							SM	SILTY SAND; dark gray; 30-40% fines; fine grained; trace gravel; medium dense; hydrocarbon-like odor.
BENTONITE	Dp	0	10	2–4	■			
	Dp	10.5	2	8	■			@7.5': wood fragments; loose; hydrocarbon-like odor.
SAND	Mst	0	1	12–14	■			@12.5': abundant wood fragments; loose; hydrocarbon-like odor.
							CL	CLAY; gray; silty; peaty; very soft; no hydrocarbon-like odor.
	Wt	0	1	18	■			@17.5': no hydrocarbon-like odor.

BOTTOM OF BORING 19'
LIP OF BOX STICKUP: 1.63'

LOCATION MAP



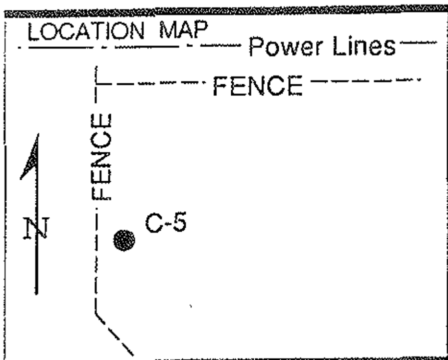
PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-4
BORING NO.
PAGE 1 OF 1

PROJECT NO. 520-02.02
LOGGED BY: EL
DRILLING METHOD: HSA
SAMPLING METHOD: Split Spoon
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.010"
GRAVEL PACK: 10 X 20 SAND

CLIENT: Chevron USA
DATE DRILLED: 8-16-90
LOCATION: 4525 Diagonal Ave.
HOLE DIAMETER: 8"
HOLE DEPTH: 15'
WELL DEPTH: 15'
WELL DIAMETER: 2"

WELL COMPLETION	MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
CEMENT				0			SM	SILTY SAND; grayish brown; 15% fines; fine grained; loose; no hydrocarbon-like odor.
BENTONITE	Dp	0	3	3.5	■			
	Wt	0	6	8	■			@7.5': fine to coarse grained; no hydrocarbon-like odor.
SAND	Wt	0	2	13.5	■		Pt	PEAT; brown; very soft; no hydrocarbon-like odor.
				15				BOTTOM OF BORING 15' LIP OF BOX STICKUP: 0.83'

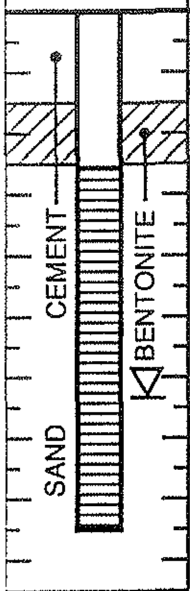


PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / BORING NO. C-5
PAGE 1 OF 1

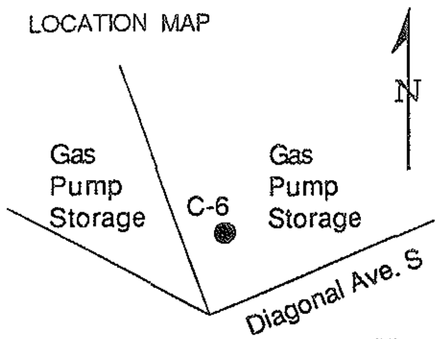
PROJECT NO. 520-02.02
LOGGED BY: EL
DRILLING METHOD: HSA
SAMPLING METHOD: Split Spoon
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.010"
GRAVEL PACK: 10 X 20 SAND

CLIENT: Chevron USA
DATE DRILLED: 8-16-90
LOCATION: 4525 Diagonal Ave.
HOLE DIAMETER: 8"
HOLE DEPTH: 19'
WELL DEPTH: 17'
WELL DIAMETER: 2"



WELL COMPLETION	MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SOIL TYPE	LITHOLOGY / REMARKS
				0–2	SM	SILTY SAND; black; 20-30% fines; fine to medium grained; loose; hydrocarbon-like odor.
	Dp	11.4	9	3–4		
	Dp	28	2	7.5–8.5		@7.5': very loose; hydrocarbon-like odor.
	Wt	2.1	8	12.5–14		
				17	CL	CLAY; gray; trace silt; peaty; very soft; hydrogen sulfide odor; no hydrocarbon-like odor.
	Wt	0	2	17.5–19		

BOTTOM OF BORING 19'
LIP OF BOX STICKUP: 2.75'

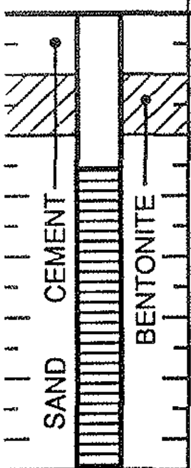


PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-6
BORING NO.

PROJECT NO. 520-02.02	CLIENT: Chevron USA
LOGGED BY: EL	DATE DRILLED: 8-16-90
DRILLING METHOD: HSA	LOCATION: 4525 Diagonal Ave.
SAMPLING METHOD: Split Spoon	HOLE DIAMETER: 8"
CASING TYPE: Sch 40 PVC	HOLE DEPTH: 15'
SLOT SIZE: 0.010"	WELL DEPTH: 15'
GRAVEL PACK: 10 X 20 SAND	WELL DIAMETER: 2"

WELL COMPLETION



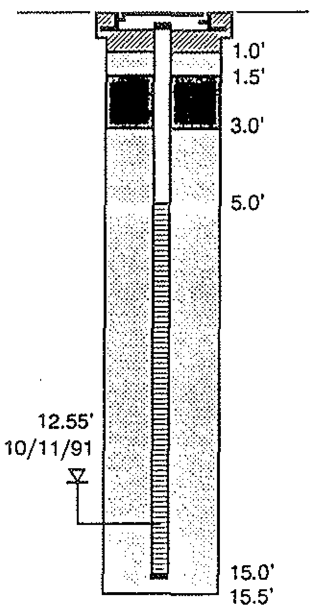
MOISTURE CONTENT	PID READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SOIL TYPE	LITHOLOGY / REMARKS
			0–2	SM	SILTY SAND; black; 20-30% fines; fine to medium grained; loose; no hydrocarbon-like odor.
Dp	0	4	3		
Wt	0	1	8		@7.5': very loose; no hydrocarbon-like odor.
Wt	0	2	13	OL	ORGANIC CLAY; dark gray; trace silt; abundant peat; very soft; hydrogen sulfide odor; no hydrocarbon-like odor.
			15		BOTTOM OF BORING 15'

Depth scale (feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44

Equipment Mobile B-61

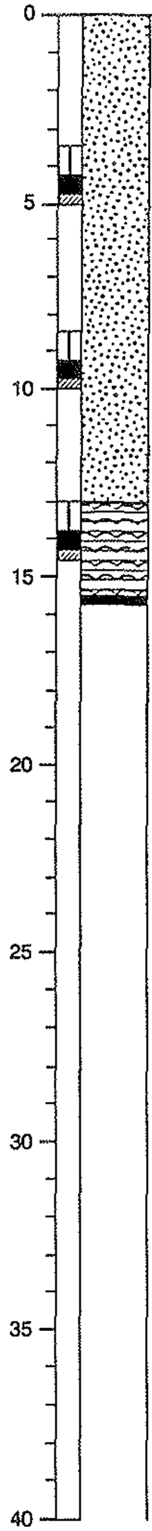
Land Surface Elevation ~ 8.8 feet * Date 10/8/91

Well Construction Summary



OVM (ppm)	Blows per Foot
0.4	10
0.4	8
0.0	4

Depth / Sample



BROWN SAND (SP) loose, moist; fine grained.

Becomes black, wet at 9 feet.

GRAY CLAY (OL) soft, wet; with a trace of organic debris.

Groundwater not encountered during drilling.

*Temporary Benchmark = 8.35 feet

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Monitoring Well 7

Chevron/Site 64534097
Seattle, Washington

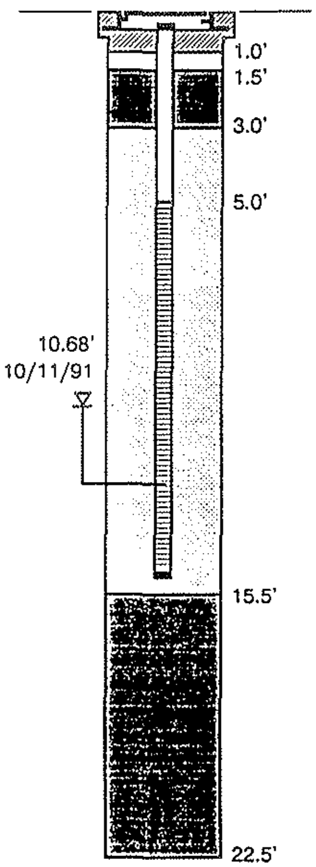
PLATE **B3**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

Equipment Mobile B-61

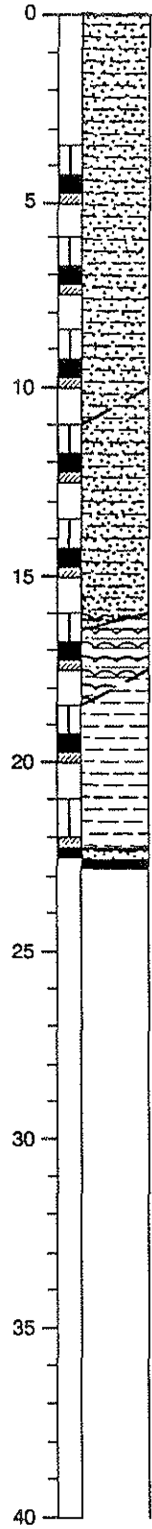
Land Surface Elevation ~ 9.3 feet * Date 10/9/91

Well Construction Summary



OVM (ppm)	Blows per Foot
2.4	14
1.9	7
1.4	2
0.9	10
0.4	4
0.4	2
0.0	2
0.0	5

Depth / Sample



DARK GRAY BROWN SILTY SAND (SM) medium dense, moist; fine to medium grained, with a trace of organic debris.

Becomes loose at 6 feet.

Becomes dark gray, very loose at 9 feet.

BROWN SILTY SAND (SM) loose, wet; medium grained.

Becomes dark gray at 14 feet.

DARK BROWN ORGANIC SILT (OL) soft, wet; with fibrous organics.

GRAY SANDY SILT (ML) soft, wet; very fine sand, with a trace of organic debris.

BLACK SILTY SAND (SM) loose, wet; fine grained.

Groundwater not encountered during drilling.

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Log of Monitoring Well 8

Chevron/Site 64534097
Seattle, Washington

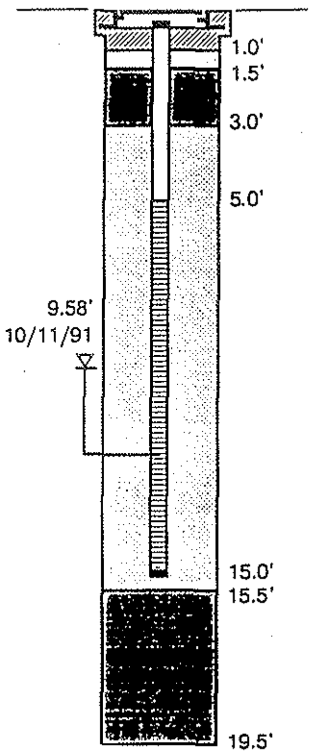
PLATE **B4**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

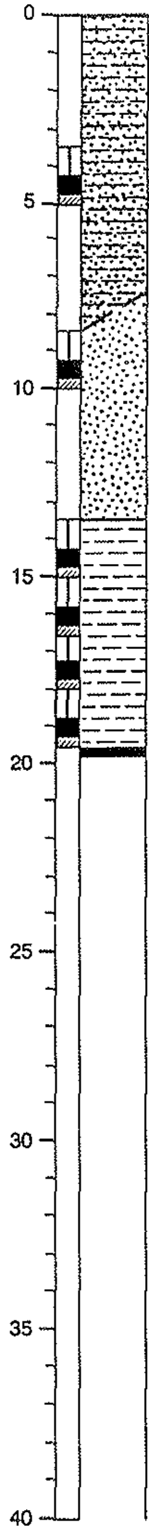
Equipment Mobile B-61

Land Surface Elevation ~7.3 feet * Date 10/8/91

Well Construction Summary



OVM (ppm)	Blows per Foot	Depth	Description
		0	BROWN SILTY SAND (SM) loose, moist; fine to medium grained.
0.4	5	5	
			BROWN SAND (SP) loose, moist; medium grained.
0.4	9	10	
0.4	4	15	GRAY BROWN SILT (ML) soft, moist; with a trace of root and wood debris.
2.2	2		
0.4	2		
0.0	2		Becomes wet at 19 feet.
		20	Groundwater not encountered during drilling.



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Log of Monitoring Well 9

Chevron/Site 64534097
Seattle, Washington

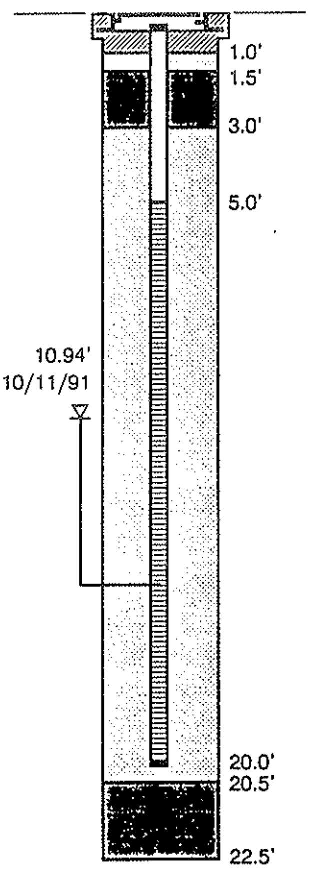
PLATE **B5**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

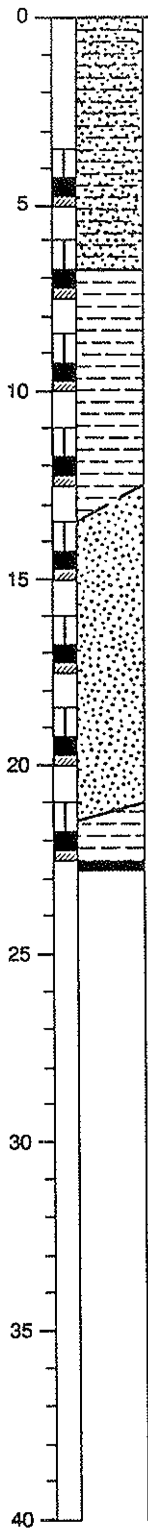
Equipment Mobile B-61

Land Surface Elevation ~10.1 feet * Date 10/9/91

Well Construction Summary



OVM (ppm)	Blows per Foot
0.0	8
1.4	4
0.9	5
0.4	5
0.4	2
0.4	3
0.4	2
0.0	5



BROWN SILTY SAND (SM) loose, moist; fine to medium grained.

DARK GRAY SANDY SILT (ML) medium stiff, moist.

Becomes black, with a trace of organics at 9.5 feet.

Becomes wet at 12 feet.

DARK BROWN BLACK SAND (SP) very loose, wet; medium grained, with some silt.

GRAY SANDY SILT (ML) medium stiff, wet; very fine sand.

Groundwater not encountered during drilling.

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Log of Monitoring Well 10

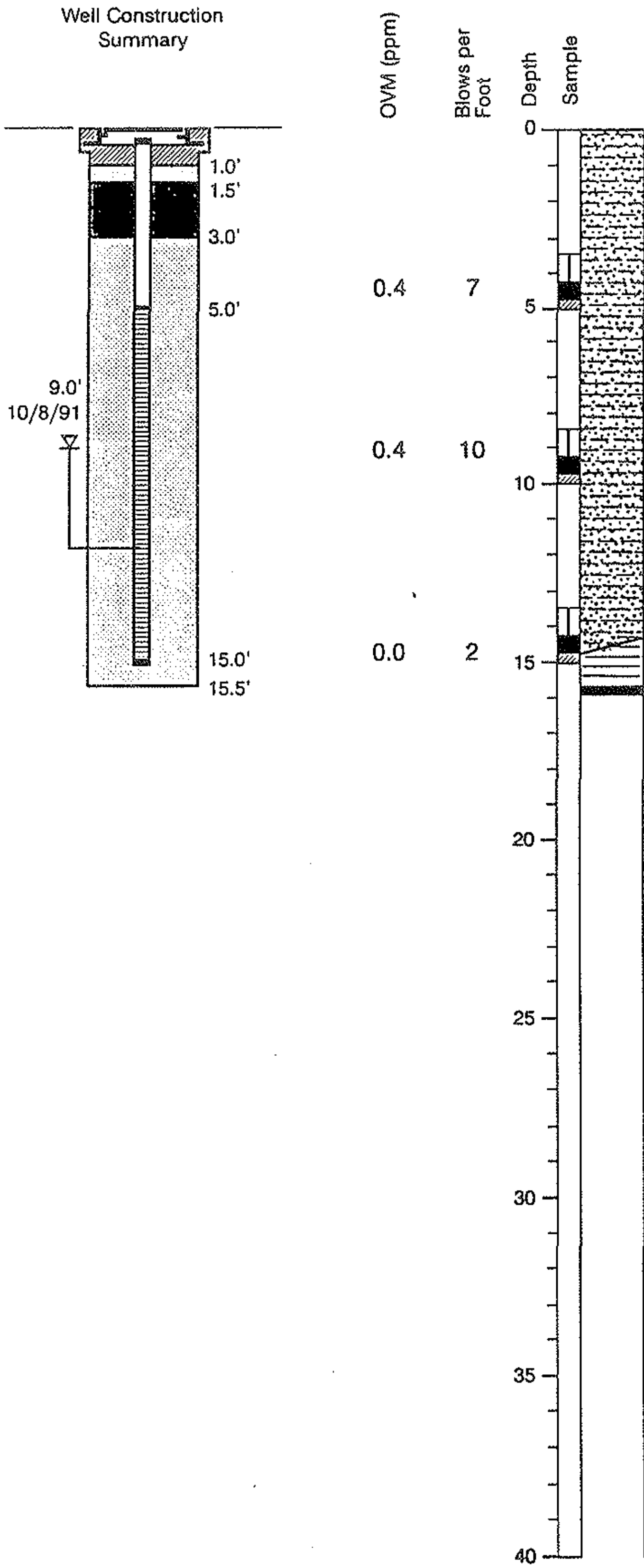
Chevron/Site 64534097
Seattle, Washington

PLATE **B6**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		Appendix C

Equipment Mobile B-61

Land Surface Elevation ~7.5 feet * Date 10/8/91



BROWN SILTY SAND (SM) loose, moist; fine to medium grained.

Becomes black, saturated at 9.5 feet.

GRAY CLAY (CL) very soft, saturated; with a trace of organics.

Groundwater encountered at 9 feet during drilling.

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Log of Monitoring Well 11

Chevron/Site 64534097
Seattle, Washington

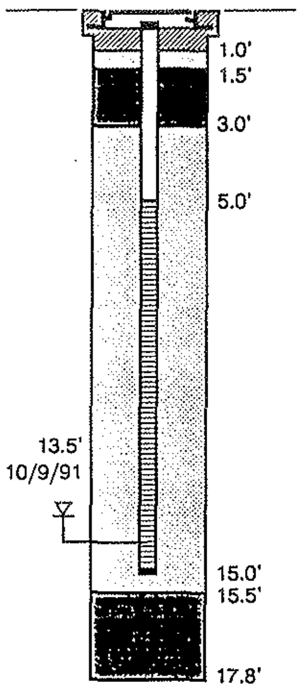
PLATE **B7**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

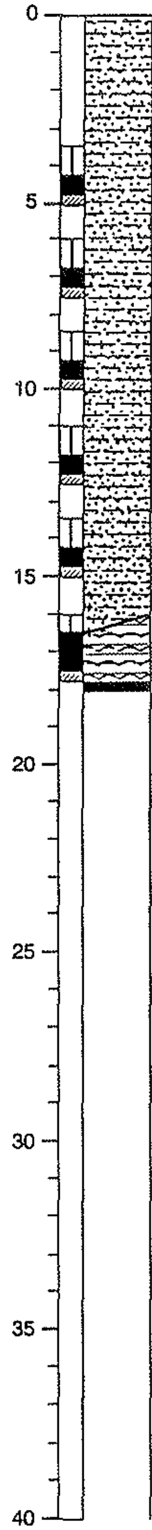
Equipment Mobile B-61

Land Surface Elevation ~9.8 feet * Date 10/9/91

Well Construction Summary



OVM (ppm)	Blows per Foot
0.4	7
0.9	7
0.4	2
1.4	2
0.9	2
0.4	3



BROWN SILTY SAND (SM) loose, moist; fine to medium grained.

Becomes gray at 7 feet.

Becomes very loose, wet at 9.5 feet.

Becomes gray brown, moist at 12 feet.

Becomes saturated, with a trace of organics at 14.5 feet.

BROWN ORGANIC SILT (OL) soft, wet; fibrous organics.

Groundwater encountered at 13.5 feet during drilling.

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Log of Monitoring Well 12

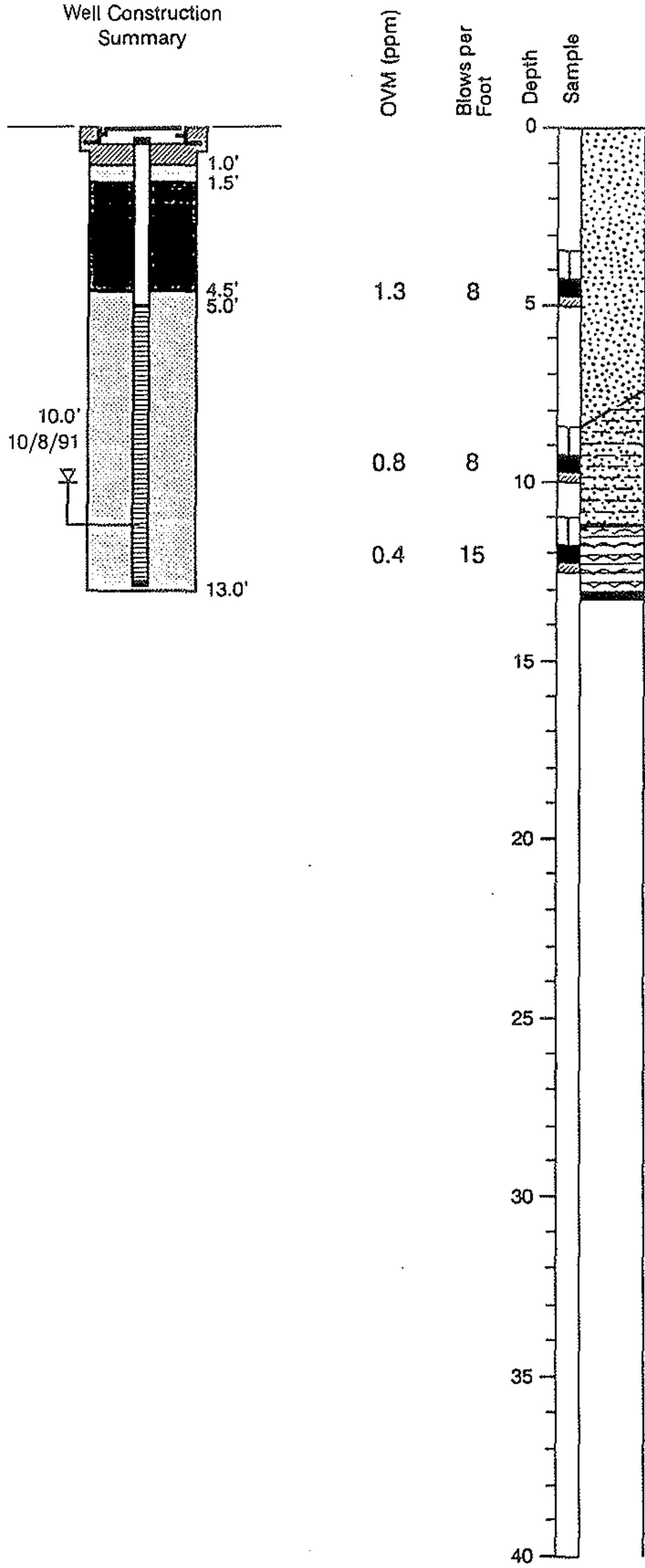
Chevron/Site 64534097
Seattle, Washington

PLATE **B8**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

Equipment Mobile B-61

Land Surface Elevation ~6.0 feet * Date 10/8/91



DARK BROWN SAND (SP) loose, moist; fine grained, with a trace of fine gravel and silt.

BLACK SILTY SAND (SM) loose, saturated; fine grained, with some fine gravel.

DARK BROWN ORGANIC SILT (OL) stiff, saturated; with a trace of very fine sand.

Groundwater encountered at 10 feet during drilling.

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Log of Monitoring Well 13

Chevron/Site 64534097
Seattle, Washington

PLATE **B9**

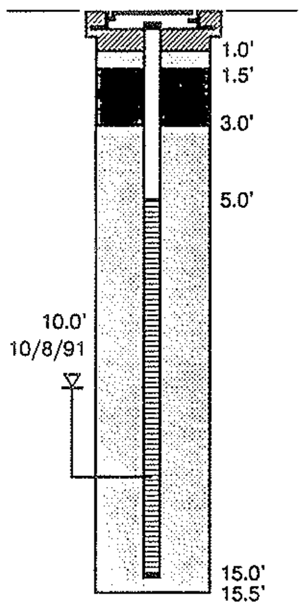
JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

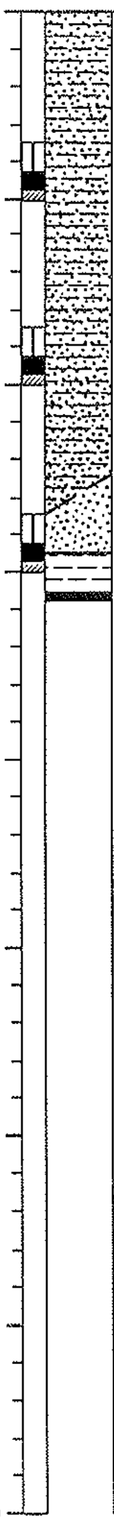
Equipment: Mobile B-61

Land Surface Elevation: ~9.8 feet

Date: 10/8/91

Well Construction Summary





OVM (ppm)	Blows per Foot	Depth	Description
		0	BROWN SILTY SAND (SM) medium dense, moist; fine to medium grained, with a trace of fine gravel.
2.3	27	5	
0.4	9	10	Becomes dark gray, very fine to fine grained at 9.5 feet.
0.0	2		BLACK SAND (SP) loose, saturated; medium grained.
		15	DARK GRAY SANDY SILT (ML) soft, saturated; fine sand, with a trace of organics.
			Groundwater encountered at 10 feet during drilling.
		20	
		25	
		30	
		35	
		40	

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Log of Monitoring Well 14

Chevron/Site 64534097
Seattle, Washington

PLATE **B10**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,582.022	SES	GCC	10 Aug 92		

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0		GRAVEL			ASPHALT road surface Damp angular GRAVEL	Flush-mount, high-traffic, heavy-duty monument High strength concrete
1					Damp, brown, gravelly SAND (SP) with trace silt and organics	
				8,9,15		
2						2-inch PVC riser Hydrated bentonite
3						
4					Damp, brown, gravelly SAND (SP); poor recovery; diesel odor in sampler	
				5,6,14		8-inch borehole
5		SAND				
6					Wet, brown, silty SAND (SM); light hydrocarbon odor in sampler; trace gravel, shell fragements and broken glass	
			PGG-1A	4,5,9		
7						2-inch 10-slot PVC screen (3.5 to 10 feet) Sand pack Lapis Lustre Monterey sand blend #39
8					Wet, gray, fine-medium SAND (SP)	Water level 8.65 feet on 6/9/2006
9				4,2,1		
10		SILT			Wet, brown, sandy SILT with trace organics (ML-OL)	

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-1
Ecology ID: APQ005
MP Elevation:15.04
Datum: MLLW
Installed: 6/6/2006

Figure A-1
GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-1
Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PGG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0					Damp, brown, medium SAND (SP); trace silt and gravel; poorly graded/sorted	Flush-mount monument
1						Concrete
2				6,6,5		Hydrated bentonite 2-inch PVC riser
3						
4		SAND			Damp, light gray, silty SAND (SM/SP); silt occurs as thin, irregular layers with oxidation at contact with sand	
5				3,3,3		2-inch 10-slot PVC screen (3.5 to 10.5 feet)
6					Moist, dark gray, fine silty SAND (SP) with isolated fragments of tan silt; trace gravel	
7				3,3,3		Water level 7.22 ft on 6/8/2006 Sand pack Lapis Lustre Monterey Sand blend #39
8						
9				PGG-2A 3,3,3	Moist, dark gray sandy SILT (SM) with trace organics, trace shell fragments; light diesel odor in sampler	
10						8-inch borehole
11		SILT			Wet, dark gray, sandy SILT (OL/CL) with trace organics and mixed peaty layers; light diesel odor in sampler	
12				PGG-2B 6,5,5		
13						Bentonite
14						

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-2
Ecology ID: APQ002
MP Elevation:18.82
Datum: MLLW
Installed: 6/5/2006

Figure A-2

GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-2

Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PGG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0					Moist, brown-gray, fine SAND (SP); poorly sorted, poorly graded	Flush-mount monument
1						Concrete
2		SAND		5,6,5		2-inch PVC riser Hydrated bentonite
3						
4						
5		SILT		4,4,4	Wet, tan, SILT (CL) Wet, brown, fine SAND (SP); faint paleosol at silt contact	
6					Moist, gray, fine-medium SAND (SP)	2-inch 10-slot PVC screen (3.5 to 11 feet)
7				4,5,6		Water level 6.92 feet 6/8/2006
8		SAND				Sand pack Lapis Lustre Monterey Sand blend #39
9					Wet, gray, fine-medium SAND (SP); poorly sorted, poorly graded	
10				1,2,3		8-inch borehole
11						
12		SILT		1,1,2	Wet, brown SILT (OL); trace sand at top of sample; trace organics increase downwards	
13						Bentonite

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-3
Ecology ID: APQ004
MP Elevation: 13.26
Datum: MLLW
Installed: 6/5/2006

Figure A-3

GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-3

Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PGG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0		AS.			ASPHALT	Flush-mount monument
		GRVL.			GRAVEL	
						Concrete
1					Damp, brown to dark brown, gravelly SAND (SP); trace organic material; no odor	2-inch PVC riser
				10,18,11		
2						Hydrated bentonite
3						
					Damp, grayish brown, med-fine SAND (SP); trace silt; homogeneous	
4				4,4,4		
5		SAND				Sand pack Lapis Lustre Monterey Sand blend #39
6					Damp, gray, fine SAND (SP); trace silt	
				4,5,4		
7						10-slot PVC screen (3.5 to 10 feet)
8						8-inch borehole
					Wet, gray,fine SAND (SP)	
9						
				nr		Water level 9.47 feet on 6/8/2006
10		SILT			Wet, dark gray, SILT (MM); trace organics	

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-4
Ecology ID: APQ006
MP Elevation: 15.21
Datum: MLLW
Installed: 6/6/2006

Figure A-4

GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-4

CORRECTION

Port of Seattle T-108, Seattle, WA

JK0410, 6/6/2006

PgG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
-3						
-2						Yellow steel Stickup monument with 3 bollards.
-1						
0						
1					Damp, brown silty SAND (SP); trace organics	Concrete
2						
3				9,10,12 PGG-5A		
4		SAND				2-inch PVC riser
5						Hydrated bentonite
6				2,2,2 PGG-5B	Damp, gray, silty SAND; trace organics	
7						
8					Moist, gray med-fine SAND (SP)	
9				1,1,1 PGG-5C	Moist, tan SILT	8-inch borehole
10		SILT			Moist interbedded tan SILT and and moist to wet gray fine SAND; trace organics	
11				nr PGG-5D		
12						
13		SAND		nr PGG-5E	Moist, gray,fine-medium SAND	Sand pack Lapis Lustre Monterey Sand blend #39
14						2-inch 10-Slot PVC Screen (8 to 18 feet)
15					Moist, gray sandy SILT; trace gravel	
16		SILT		nr PGG-5F		
17						
18		SAND			Wet, gray, fine-medium SAND (SP)	
19		SILT		5,3,2 PGG-5G	Wet, tan SILT with organics	Water level 18.82 feet on 6/8/2006 Bentonite
20						

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-5
Ecology ID: APQ007
MP Elevation: 22.81
Datum: MLLW
Installed: 6/6/2006
nr = not recorded

Figure A-5
GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-5
Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PGG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0					Damp, brown, gravelly, medium-fine SAND (SP); poorly sorted, poorly graded	Flush-mount monument
1						Concrete
						2-inch PVC riser
2						Hydrated bentonite
				16,30, 50.5 PGG-6A		
3		SAND				
					Damp, gray, fine SAND (SP)	
4						
5				8,9,10 PGG-6B		8-inch borehole
6						
					Moist, brown, SILT (OL); trace organics	
7		SILT				2-inch 10-Slot PVC Screen (3.5 to 12.5 feet)
				7,6,4 PGG-6C		
8					Moist, gray SAND (SP)	
						Sand pack Lapis Lustre Monterey Sand blend #39
9					Moist to wet, gray fine-medium SAND (SP) with trace silt; poorly graded, poorly sorted	
						Water level 9.63 feet on 6/8/2006
10		SAND		3,3,4 PGG-6D		
11					Moist, gray,fine-medium SAND	
12						
				1,2,3 PGG-6E		
13		S			Wet, tan SILT with organics in sampler shoe	

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

Well Name: PGG-6
Ecology ID: APQ003
MP Elevation: 15.03
Datum: MLLW
Installed: 6/5/2006

Figure A-6

GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-6

Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PgG

Depth (ft)	Geology	Unit	Soil Sample	Blow Counts	Log	Well Construction
0		LT+C			ASPHALT	Flush-mount monument
1					Dry, angular GRAVEL.	Concrete
					Damp, brown, fine-medium SAND (SP); trace silt	
2						2-inch PVC riser
				13,8,14 PGG-7A		Hydrated bentonite
3						
4					Damp, gray, medium SAND (SP)	
5		SAND		4,4,4 PGG-7B		
6						Water level estimated at 6 feet ATD
						Water level 6.56 feet on 6/9/2006
7				3,3,4 PGG-7C	Wet, dark gray, medium SAND (SP)	2-inch 10-slot PVC screen (4 to 10.5 feet)
8						
9						Sand pack Lapis Lustre Monterey Sand blend #39
10				3,3,4 PGG-7D	Wet, light brown, SILT (ML/OL); trace organics	
11		SILT				8-inch borehole
12				nr PGG-7E		
13		SAND			Wet, dark gray SAND (SP, SM); trace silt	Hydrated bentonite
14						

Project Name: T-108
Drilling Method: Hollow Stem Auger
Driller: Andy Flanagan
Firm: Cascade Drilling
Consulting Firm: PGG
Logged by: Glen Wallace
Location: Terminal 108, Seattle, Washington

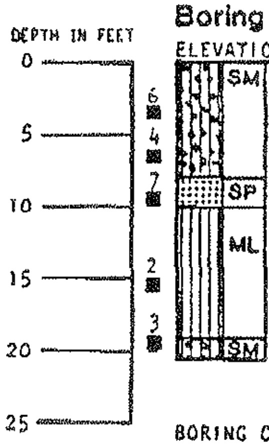
Well Name: PGG-7
Ecology ID: APQ001
MP Elevation: 12.24
Datum: MLLW
Installed: 6/5/2006
nr = not recorded

Figure A-7
GEOLOGIC LOG AND AS-BUILT FOR WELL PGG-7
Port of Seattle T-108
Seattle, Washington
JK0410, 6/6/2006

PGG

Boring A

ELEVATION 19 ±



BROWN AND GRAY SILTY FINE TO MEDIUM SAND (LOOSE) (FILL)

BROWN AND GRAY FINE TO MEDIUM SAND (LOOSE) (FILL)

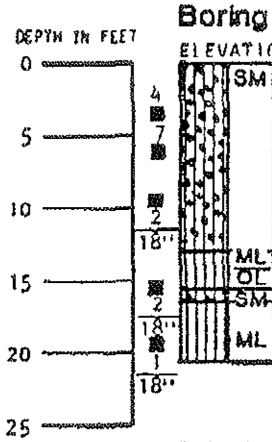
GRAY SILT WITH A TRACE OF ORGANIC MATERIAL (MEDIUM STIFF)

DARK GRAY SILTY FINE TO MEDIUM SAND (VERY LOOSE)

BORING COMPLETED 10-26-81
GROUND WATER ENCOUNTERED AT DEPTH OF 10.7' ON 10-26-81
2" DIAMETER PVC WELL CASING INSTALLED TO DEPTH OF 19', SCREENED IN LOWER 5'

Boring B

ELEVATION 20 ±



DARK BROWN AND BLACK SILTY FINE TO MEDIUM SAND WITH OCCASIONAL LUMPS OF GRAY, CLAYEY SILT (LOOSE) (FILL)

GRADES WITH GRAVEL AND DECAYED ORGANIC MATERIAL

DARK GRAY AND BLACK SILT WITH ORGANIC MATERIAL (VERY SOFT)

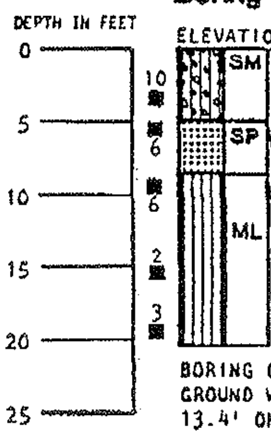
DARK GRAY TO BROWN SILTY FINE TO MEDIUM SAND WITH ORGANIC MATERIAL (VERY LOOSE)

GRAY SILT WITH A TRACE OF ORGANIC MATERIAL (VERY SOFT)

BORING COMPLETED 10-26-81
GROUND WATER ENCOUNTERED AT DEPTH OF 11.2' ON 10-26-81
2" DIAMETER PVC WELL CASING INSTALLED TO DEPTH OF 19', SCREENED IN LOWER 5'

Boring C

ELEVATION 19 ±



BROWN AND BLACK SILTY FINE TO MEDIUM SAND WITH A TRACE OF GRAVEL AND ORGANIC (LOOSE) (FILL) MATERIAL

DARK GRAY AND BROWN FINE TO MEDIUM SAND (LOOSE) (FILL)

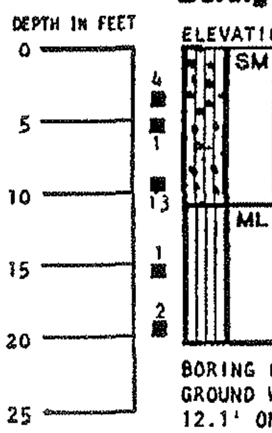
GRAY SANDY SILT WITH A TRACE OF ORGANIC MATERIAL (MEDIUM STIFF)

GRADES WITH A TRACE OF CLAY AND TO VERY SOFT

BORING COMPLETED 10-26-81
GROUND WATER ENCOUNTERED AT DEPTH OF 13.4' ON 10-26-81
2" DIAMETER PVC WELL CASING INSTALLED TO DEPTH OF 20', SCREENED IN LOWER 5'

Boring D

ELEVATION 16 ±



BROWN AND DARK GRAY SILTY FINE TO MEDIUM SAND (VERY LOOSE) (FILL)

GRADES TO BLACK WITH LUMPS OF GRAY SILT AND ORGANIC MATERIAL

GRADES TO MEDIUM DENSE

GRAY SANDY SILT (VERY SOFT)

BORING COMPLETED 10-26-81
GROUND WATER ENCOUNTERED AT DEPTH OF 12.1' ON 10-27-81
2" DIAMETER PVC WELL CASING INSTALLED TO DEPTH OF 19', SCREENED IN LOWER 5'

Key:

6 — BLOWS REQUIRED TO DRIVE DAMES & MOORE SAMPLER ONE FOOT WITH A HAMMER WEIGHT OF 325 LBS. AND A STROKE OF 30 INCHES.

■ INDICATES DEPTH AT WHICH UNDISTURBED DAMES & MOORE SAMPLE WAS EXTRACTED.

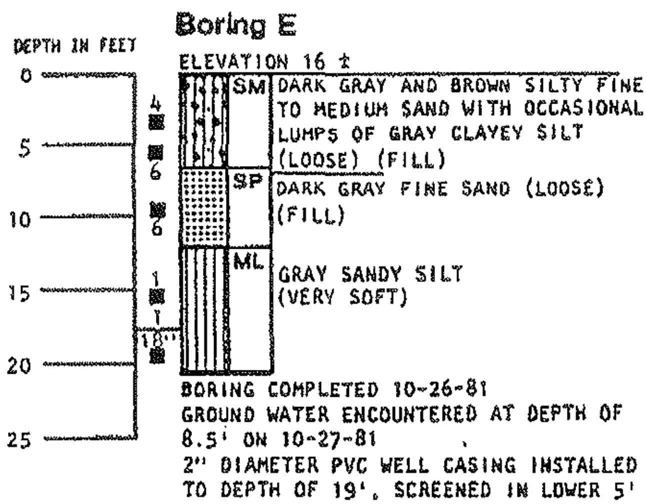
▣ INDICATES DEPTH AT WHICH DISTURBED DAMES & MOORE SAMPLE WAS EXTRACTED.

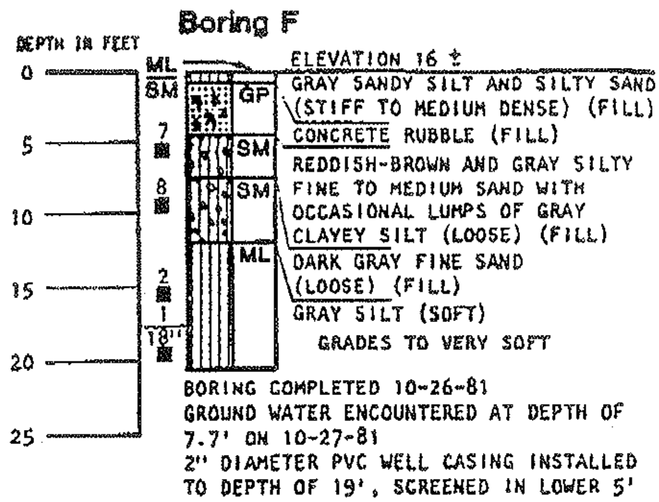
Notes:

1. THE DISCUSSION IN THE TEXT OF THIS REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIAL.
2. THE ELEVATIONS SHOWN HAVE BEEN ESTIMATED FROM MAPS AND SHOULD BE CONSIDERED APPROXIMATE; DATUM IS MLLW.

LOG OF BORINGS

Dames & Moore

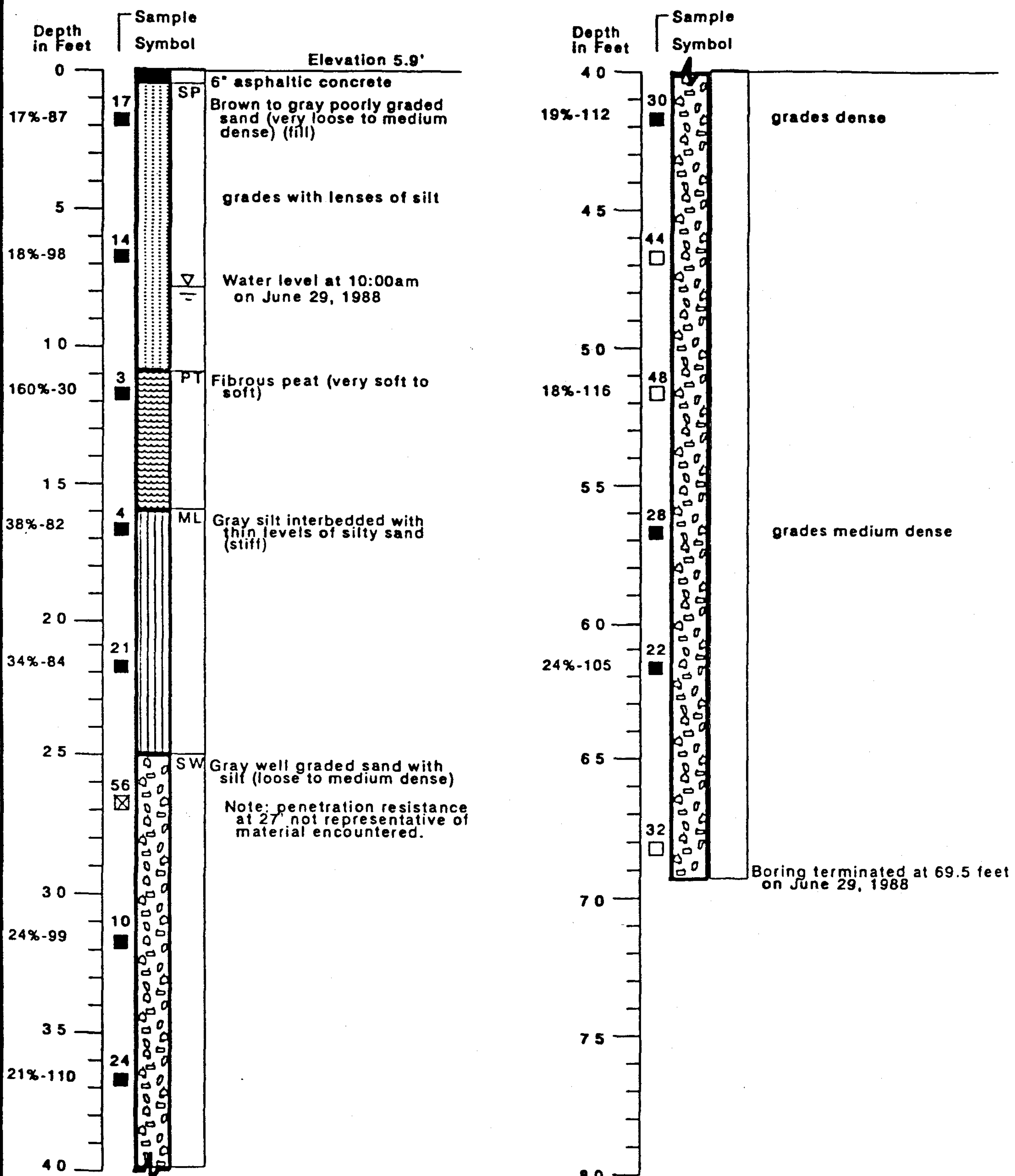




LOG OF BORINGS

Dames & Moore

Boring 88-1



Log of Borings

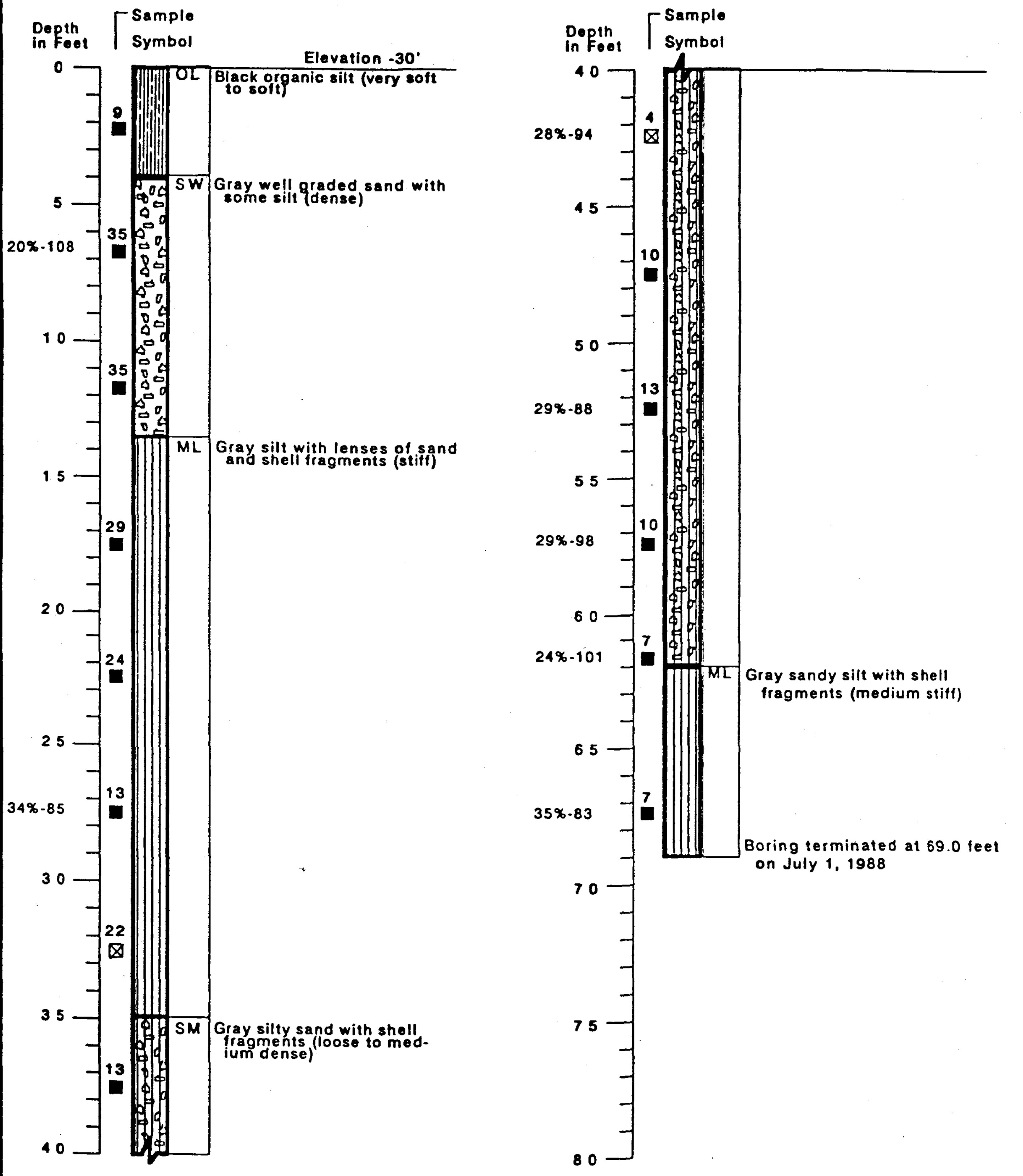
Dames & Moore

Appendix C

Job No. 17405-001-016

Plate A-1

Boring 88-2



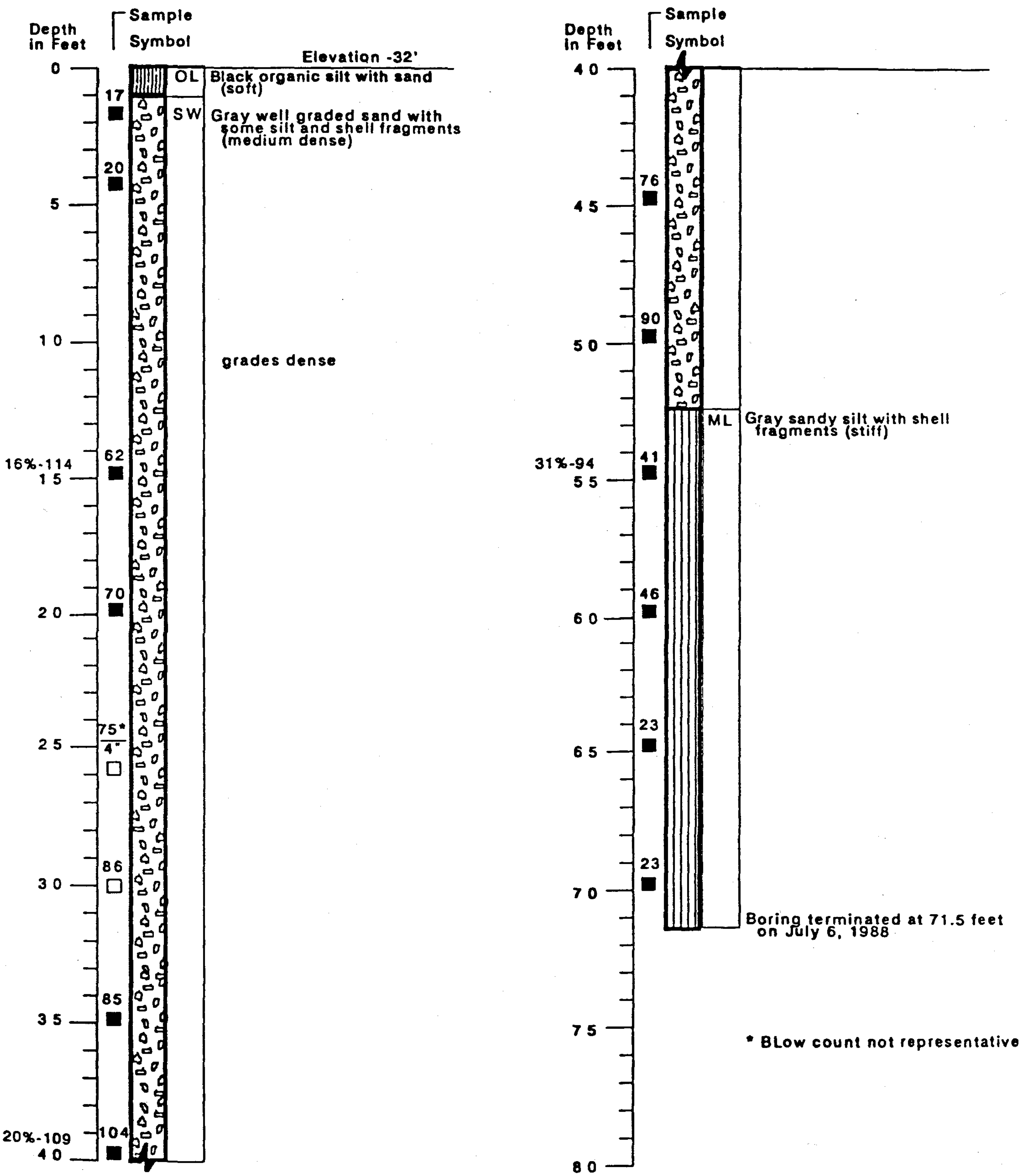
Log of Borings

Dames & Moore

Job No. 17405-001-016

Plate A-2

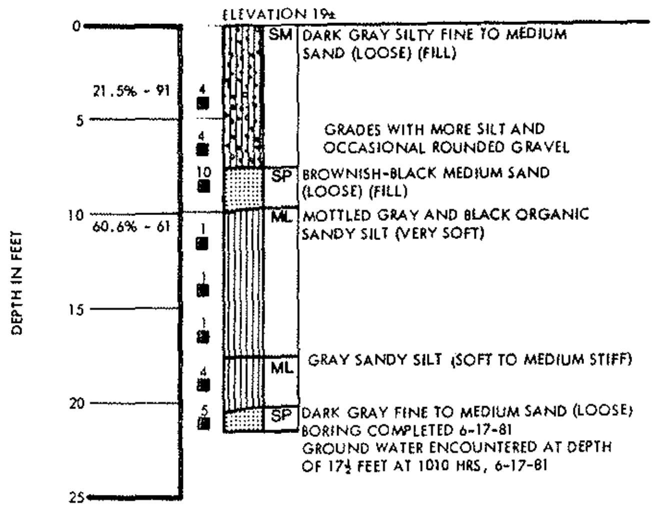
Boring 88-3



Log of Borings

Dames & Moore

BORING 1



KEY:

MOISTURE CONTENT 21.5%-91 DRY DENSITY IN PCF

4 — BLOWS REQUIRED TO DRIVE DAMES AND MOORE SAMPLER ONE FOOT WITH A HAMMER WEIGHT OF 325 LBS., AND A STROKE OF 18 INCHES.

■ INDICATES DEPTH AT WHICH UNDISTURBED SAMPLE WAS EXTRACTED.

⊠ INDICATES DEPTH AT WHICH DISTURBED SAMPLE WAS EXTRACTED.

□ INDICATES SAMPLING ATTEMPT WITH NO RECOVERY.

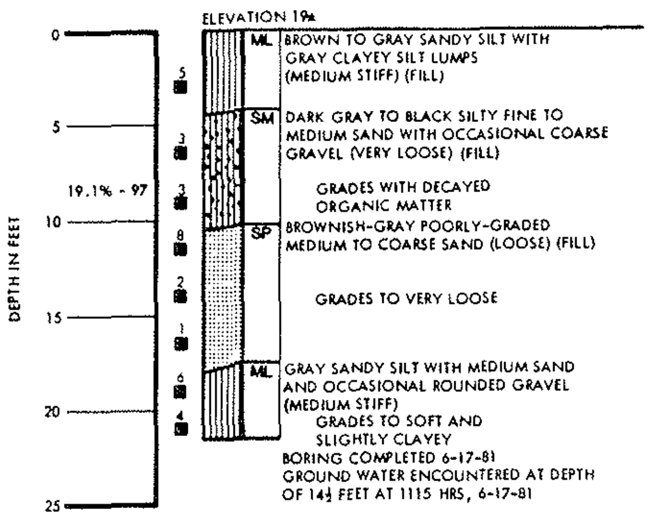
NOTES:
1. THE DISCUSSION IN THE TEXT OF THIS REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.
2. THE ELEVATIONS SHOWN HAVE BEEN ESTIMATED FROM MAPS AND SHOULD BE CONSIDERED APPROXIMATE; DATUM IS MLLW.

LOG OF BORINGS

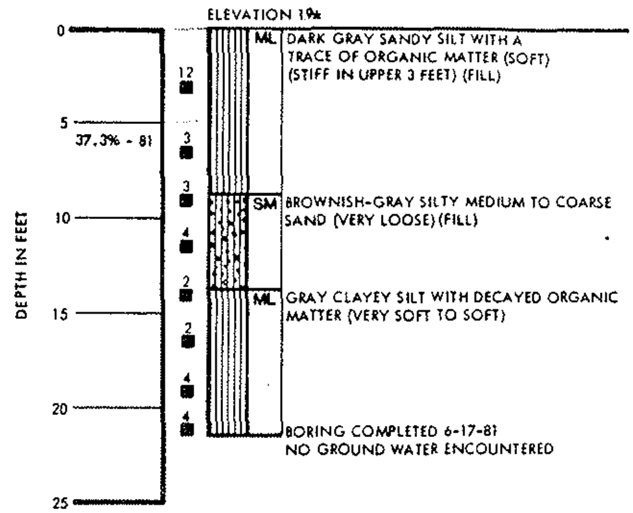
Dames & Moore

Plate A1

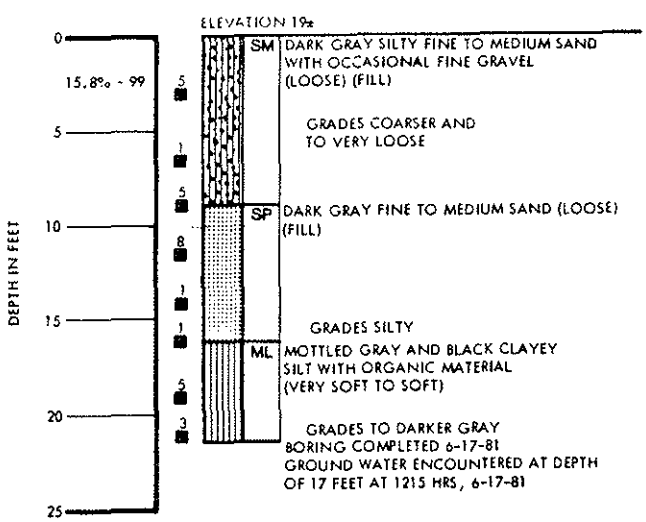
BORING 2



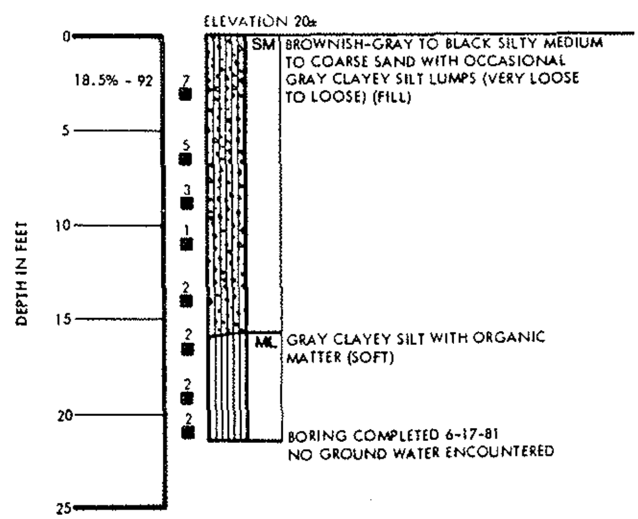
BORING 4



BORING 3

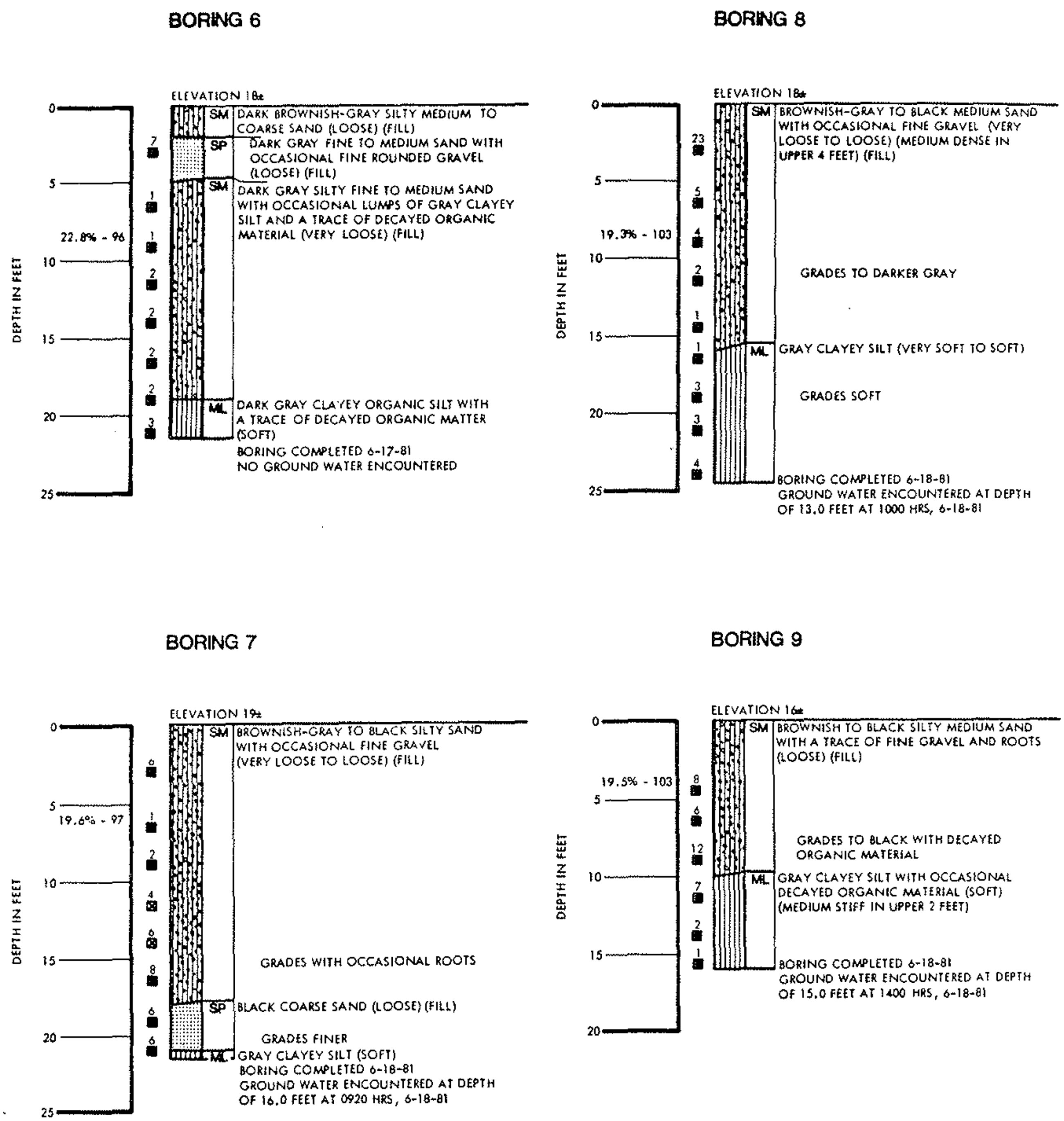


BORING 5



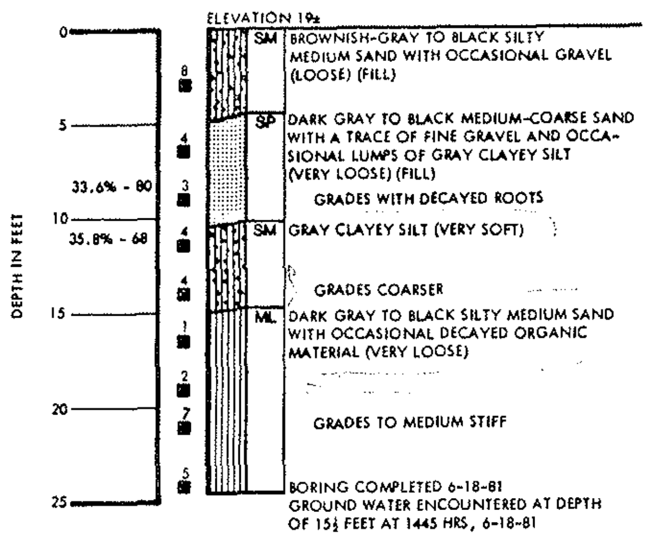
LOG OF BORINGS

Dames & Moore

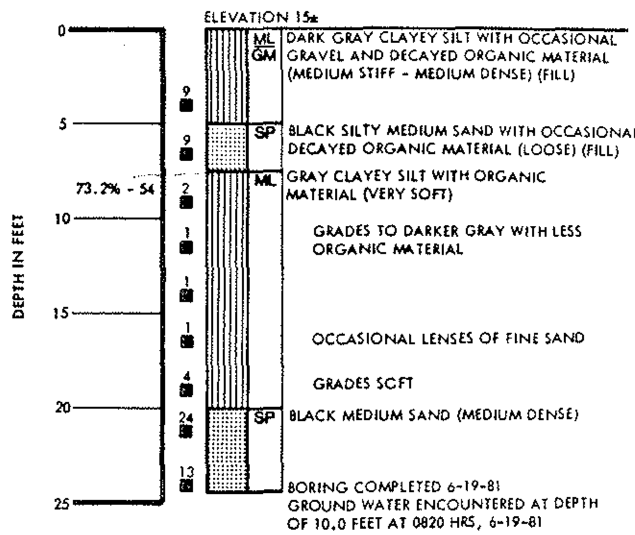


LOG OF BORINGS

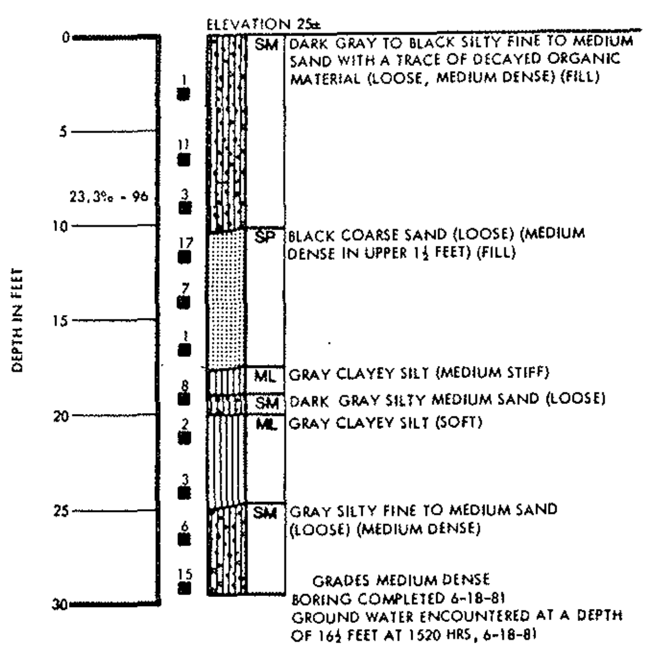
BORING 10



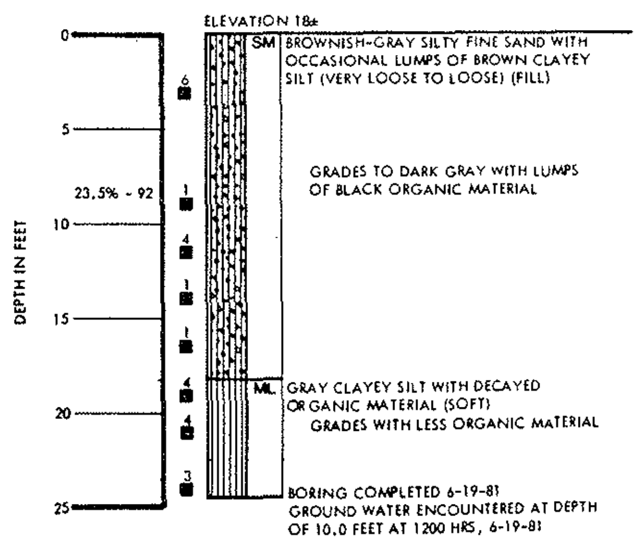
BORING 12



BORING 11



BORING 13



LOG OF BORINGS

Appendix D T-108 Analytical Information

Summary Table

TABLE	MEDIA	CHEMICALS ANALYZED	LOCATION SAMPLED
Table D-1. Analytical Summary of Soil Sampling conducted June 5 and 6th 2006.	Soil	Petroleum hydrocarbons, total metals, PCBs, PAH, toxicity equivalent concentrations	PGG-1 to 7
Table D-2. Historical Soil Sample Results for PCBs conducted July 20, 1981, June 13, August 16 and September 28, 1990, and October 1991	Soil	PCBs	B81-1 to 13, EP-1 to 11, A-F, C-1 to 6, NAT-1 to 6, MW-7 to 14
Table D-3. Historical Soil Sample Results for TPH samples conducted June 13, July 19, and August 16, 1990 and September 28, October 8, 9, and 10, 1991	Soil	TPH	EP-1 to 11, A-F, C-1 to 6, NAT-1 to 6, MW-7 to 14
Table D-4. Historical Soil Sample Results for PAH conducted October 1992	Soil	PAH	MW-7 to 14
Table D-5. Historical Soil Sample Results for Metals conducted July 20, 1981 and October 1991	Soil	Metals	B81-1 to 13, MW-7 to 14
Table D-6. Historical Soil Sample Results PCB and Metals conducted June 12, 1984	Soil	PCB, metals	B81-1 to 13
Table D-7. Historical Soil Sample Results for Metals conducted June 12, 1984	Soil	metals	B84-1 to 11
Table D-8. Summary of Analytical Chemistry (dry weight) - AET Screening conducted on August 17, 2005	Soil	Metals, PCBs, LPAH, HPAH, chlorinated hydrocarbons, phthalates, phenols, misc extractables	DUD_30C and DUD_31C
Table D-9. Summary of Analytical Chemistry (organic carbon normalized) – SMS Screening conducted on August 17, 2005	Soil	Metals, PCBs, .LPAH, HPAH, chlorinated hydrocarbons, phthalates, phenols, misc extractables	DUD_30C and DUD_31C
Table D-10. Historical test pit soil sample results conducted on July 20, 1981	Soil (Test Pit)	PCB, metals	TP81-1 to 6
Table D-11. Historical soil sample results prior to land-farming, conducted July 19, 1990	Soil	TPH, BTEX compounds	A-F
Table D-12. Historical stockpile soil sample results after land-farming, conducted September 28, 1990	Soil (stockpile)	TPH, BTEX compounds	SP-1 to SP-3
Table D-13.Historical stockpile soil sample results after land-farming, conducted November 6, 1990	Soil (stockpile)	TPH, BTEX compounds	SP-1 to SP-12

Table	Media	Chemicals Analyzed	Location Sampled
Table D-14. Historical stockpile soil sample results at former Chiyoda site conducted June 21, 1989 and March 19, 1990	Soil (stockpile)	TPH, BTEX compounds, barium, cadmium, fuel hydrocarbons	WS-1, ES-1, SP-N1 to SP-N4, SP-S1 to SP-S4
Table D-15. Analytical Summary of Groundwater Sampling Round 1 Conducted June 13 and 14, 2006	Groundwater	Petroleum hydrocarbons, total metals, dissolved metals, PCBs, PAH	PGG-1 to 7
Table D-16. Analytical Summary of Groundwater Sampling Round 2 Conducted September 19 and 20, 2006	Groundwater	Petroleum hydrocarbons, total metals, dissolved metals, PCBs, PAH	PGG-1 to 7
Table D-17. Analytical Summary of Groundwater Sampling Round 3 Conducted February 19 and 20 2007	Groundwater	Petroleum hydrocarbons, total metals, dissolved metals, PCBs, polycyclic aromatic compounds	PGG-5 to 7
Table D-18. Analytical Summary of Groundwater Sampling Round 4 Conducted May 29 and 30th 2007	Groundwater	Petroleum hydrocarbons, total metals, dissolved metals, PCBs, polycyclic aromatic compounds	PGG-5 to 7
Table D-19. Historical Groundwater Sample Results for PCB Conducted October 11, 1991 and January 18, 1992	Groundwater	PCBs	C-1 to 6, MW-7 to 14
Table D-20. Historical Groundwater Sample Results for PAH Conducted October 11 and 12, 1991	Groundwater	PAH	C-1 to 6, MW-7 to 14
Table D-21. Historical Groundwater Sample Results for PAH Conducted January 17 and 18, 1992	Groundwater	PAH	C-1 to 6, MW-7 to 14
Table D-22. Historical Groundwater Sample Results for TPH Conducted October 11, 1991 and January 18, 1992	Groundwater	TPH	C-1 to 6, MW-7 to 14
Table D-23. Historical Groundwater Sample Results for Metals Conducted October 11, 1991 and January 17, 1992	Groundwater	Metals	C-1 to 6, MW-7 to 14
Table D-24. Historical groundwater sample results for metals and PCBs conducted June 5, 1984	Groundwater	Metals and PCBs	Well 84-1 to 84-2, Well A
Table D-25. Historical seep sample results for metals and PCBs conducted June 5, 1984	Groundwater (Seep)	Metals and PCBs	Seep N and Seep S

Table D-1a. Analytical summary of soil sampling conducted June 5 and 6, 2006: PGG-2A through PGG-6A

Chemical/Sample Information	Analytical Method	Unit	MTCA Method A	PGG-2A	PGG-2B	PGG-5A	PGG-5B	PGG-5C	PGG-5D	PGG-5E	PGG-5F	PGG-5G	PGG-6A
Depth		feet bgs		9-10.5	11.5-13	1.5-3	5-6.5	7.5-9	10-11.5	12.5-14	15-16.5	17.5-19	1.5-3
Total Organic Carbon	EPA 9060 mod	mg/kg		140000	14000	11500	9170	13400	11400	1950	24700	2350	4700
Dry Weight	BSOPSPL003R08	%		64.9	77.7	85.4	80.7	71.4	86.5	82.1	66.9	83.8	95.8
Petroleum Hydrocarbons													
Gasoline Range HC	NWTPH-Gx/8021B	mg/kg	100*	17	5.69 U	5.87 U	5.04 U	12.8	4.88 U	6.53 U	8.4 U	6.4 U	5.12 U
Benzene	NWTPH-Gx/8021B	mg/kg	0.03	0.036 U	0.0342 U	0.0352 U	0.0302 U	0.0461 U	0.0293 U	0.0392 U	0.0504 U	0.0384 U	0.0307 U
Toluene	NWTPH-Gx/8021B	mg/kg	7	0.06 U	0.0569 U	0.0587 U	0.0504 U	0.0768 U	0.0488 U	0.0653 U	0.084 U	0.064 U	0.0512 U
Ethylbenzene	NWTPH-Gx/8021B	mg/kg	6	0.06 U	0.0569 U	0.0587 U	0.0504 U	0.0768 U	0.0488 U	0.0653 U	0.084 U	0.064 U	0.0512 U
Xylenes (total)	NWTPH-Gx/8021B	mg/kg	9	0.12 U	0.114 U	0.117 U	0.101 U	0.154 U	0.0976 U	0.131 U	0.168 U	0.128 U	0.102 U
Diesel Range HC	NWTPH-Dx	mg/kg	2,000	4120 T	53.4 T	105 T	72.5 T	136 T	64.7 T	12.7 T	203 T	11.9 U	10.5 U
Lube Oil Range HC	NWTPH-Dx	mg/kg	2,000	4910	57.5	179	153	173	106	30.5 U	510	29.7 U	26.4 U
Total Metals													
Arsenic	EPA 6020	mg/kg	20	15.1	3.69	5.36	3.76	9.92	2.85	2.21	11.4	2.05	2.73
Cadmium	EPA 6020	mg/kg	2	13.9	0.644	0.585	0.632	1.15	0.545	0.648	0.951	1.7	0.522
Chromium	EPA 6020	mg/kg	2,000	1260	27.1	32.4	30	84	16.9	13.9	200	12.8	20.7
Copper	EPA 6020	mg/kg		594	18.3	22.9	21.9	68.4	23.1	32	74.7	10.5	14.9
Lead	EPA 6020	mg/kg	1,000	625	14.9	31.6	30	24.3	74.7	8.49	202	3.01	2.83
Nickel	EPA 6020	mg/kg		84.5	9.82	7.51	6.53	29.3	11	10	21.7	7.43	25.9
Zinc	EPA 6020	mg/kg		1460	39.6	35.8	34.7	163	51.8	62.1	149	64.7	46.3
PCBs													
Aroclor 1016	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1221	EPA 8082	µg/kg	10,000	7680 U	65.2 U	593 U	315 U	71.2 U	57.4 U	61.7 U	371 U	59.9 U	52.5 U
Aroclor 1232	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1242	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1248	EPA 8082	µg/kg	10,000	56200 P	325 Q	737	464	1090	89	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1254	EPA 8082	µg/kg	10,000	44600 P	248 Q	655	406	864	73.6	30.9 U	876	29.9 U	26.3 U
Aroclor 1260	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1262	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Aroclor 1268	EPA 8082	µg/kg	10,000	3840 U	32.6 U	297 U	158 U	35.6 U	28.7 U	30.9 U	186 U	29.9 U	26.3 U
Total PCB (U as O)	EPA 8082	µg/kg	10,000	100,800	573	1,392	870	1,954	163	0	876	0	0
PAHs													
1-Methylnaphthalene	EPA 8270-SIM	mg/kg	2	0.118	0.013 U	0.0118 U	0.0125 U	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U

Chemical/Sample Information	Analytical Method	Unit	MTCA Method A	PGG-2A	PGG-2B	PGG-5A	PGG-5B	PGG-5C	PGG-5D	PGG-5E	PGG-5F	PGG-5G	PGG-6A
2-Methylnaphthalene	EPA 8270-SIM	mg/kg	2	0.169	0.013 U	0.0118 U	0.0125 U	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U
Acenaphthene	EPA 8270-SIM	mg/kg	2	0.0768 U	0.013 U	0.0118 U	0.0235	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U
Acenaphthylene	EPA 8270-SIM	mg/kg	2	0.0768 U	0.013 U	0.0118 U	0.0125 U	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U
Anthracene	EPA 8270-SIM	mg/kg	2	0.0768 U	0.0136	0.0118 U	0.0487	0.0185	0.0117 U	0.012 U	0.016	0.0119 U	0.0106 U
Benzo(ghi)perylene	EPA 8270-SIM	mg/kg	2	0.0768 U	0.013 U	0.0118 U	0.115	0.0142 U	0.0208	0.012 U	0.0196	0.0119 U	0.0106 U
Fluoranthene	EPA 8270-SIM	mg/kg	2	0.49	0.0225	0.0386	0.493	0.0818	0.037	0.012 U	0.0817	0.0119 U	0.0106 U
Fluorene	EPA 8270-SIM	mg/kg	2	0.134	0.013 U	0.0118 U	0.0186	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U
Naphthalene	EPA 8270-SIM	mg/kg	2	0.0788	0.013 U	0.0118 U	0.0125 U	0.0142 U	0.0117 U	0.012 U	0.0155	0.0119 U	0.0106 U
Phenanthrene	EPA 8270-SIM	mg/kg	2	0.195	0.013 U	0.0259	0.28	0.027	0.0138	0.012 U	0.0475	0.0119 U	0.0106 U
Pyrene	EPA 8270-SIM	mg/kg	2	1.06	0.025	0.0466	0.467	0.128	0.05	0.012 U	0.109	0.0119 U	0.0106 U
Benzo(a)anthracene	EPA 8270-SIM	mg/kg	2	0.202	0.013 U	0.0165	0.184	0.0255	0.0184	0.012 U	0.0354	0.0119 U	0.0106 U
Benzo(a)pyrene	EPA 8270-SIM	mg/kg	2	0.4	0.0339	0.0181	0.219	0.0256	0.0364	0.012 U	0.0524	0.0119 U	0.0106 U
Benzo(b)fluoranthene	EPA 8270-SIM	mg/kg	2	0.305	0.013 U	0.0281	0.226	0.0344	0.0339	0.012 U	0.0515	0.0119 U	0.0106 U
Benzo(k)fluoranthene	EPA 8270-SIM	mg/kg	2	0.25	0.013 U	0.0236	0.233	0.027	0.0396	0.012 U	0.0576	0.0119 U	0.0106 U
Chrysene	EPA 8270-SIM	mg/kg	2	0.478	0.013 U	0.0334	0.28	0.0409	0.0277	0.012 U	0.058	0.0119 U	0.0106 U
Dibenz(a,h)anthracene	EPA 8270-SIM	mg/kg	2	0.0768 U	0.013 U	0.0118 U	0.0517	0.0142 U	0.0117 U	0.012 U	0.0151 U	0.0119 U	0.0106 U
Indeno(1,2,3-cd)pyrene	EPA 8270-SIM	mg/kg	2	0.162	0.0222	0.0118 U	0.117	0.0142 U	0.0197	0.012 U	0.0153	0.0119 U	0.0106 U
Toxicity Equivalent Concentrations	**TEF**												
Benzo(a)anthracene	0.1	mg/kg	2	0.0202	0	0.00165	0.0184	0.00255	0.00184	0	0.00354	0	0
Benzo(a)pyrene	1	mg/kg	2	0.4	0.0339	0.0181	0.219	0.0256	0.0364	0	0.0524	0	0
Benzo(b)fluoranthene	0.1	mg/kg	2	0.0305	0	0.00281	0.0226	0.00344	0.00339	0	0.00515	0	0
Benzo(k)fluoranthene	0.1	mg/kg	2	0.025	0	0.00236	0.0233	0.0027	0.00396	0	0.00576	0	0
Chrysene	0.01	mg/kg	2	0.00478	0	0.000334	0.0028	0.000409	0.000277	0	0.00058	0	0
Dibenzo(a,h)anthracene	0.4	mg/kg	2	0	0	0	0.02068	0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	0.1	mg/kg	2	0.0162	0.00222	0	0.0117	0	0.00197	0	0.00153	0	0
Sum of TEF			2	0.5	0.04	0.03	0.32	0.03	0.05	0	0.07	0	0

Source: (Pacific Groundwater Group 2007)

Green highlight – concentration exceeds MTCA Method A for soil (for Industrial Properties)

Yellow highlight – parameter detected

bgs – below ground surface

EPA – US Environmental Protection Agency

HC - hydrocarbons

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

µg/kg – micrograms per kilogram
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
P – Results for 500x dilution
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PGG – Pacific Groundwater Group
Q – results for 5x dilution
R – analytical result rejected based on unrepresentative sample quality and poor data quality, as the sample did not meet Standard Operating Procedures.
S – lab analyst note: results reported for the gas range are primarily due to overlap from diesel range hydrocarbons
SIM – Simultaneous Ion Monitoring
T – lab analyst note: results reported for the gas range are primarily due to overlap from heavy oil range product
TEF – Toxic Equivalency Factor
U – parameter not detected, associated # is the lab reporting limit
UJ – parameter not detected at the associated reporting limit; analysis performed 44 days outside holding time

Table D-1b. Analytical summary of soil sampling conducted June 5 and 6, 2006: PGG-6B through PGG-7E

Chemical/Sample Information	Analytical Method	Unit	MTCA Method A	PGG-6B	PGG-6C	PGG-6D	PGG-6E	PGG-7A	PGG-7B	PGG-7C	PGG-7D	PGG-7E
Depth		feet bgs		4-5.5	6.5-8	9-10.5	11.5-13	0.5-2	4-5.5	6.5-8	9-10.5	11.5-13
Total Organic Carbon	EPA 9060 mod	mg/kg		839	18000	785	14400	52300	2050	645	10200	46000
Dry Weight	BSOPSPL003R08	%		95.4	64.2	80	66.9	85	93.6	78.8	74.1	59.1
Petroleum Hydrocarbons												
Gasoline Range HC	NWTPH-Gx/8021B	mg/kg	100*	5.6 U	6.74 U	5.47 U	6.31 U	6.7 U	9.34 U	5.41 U	6 U	8.55 U
Benzene	NWTPH-Gx/8021B	mg/kg	0.03	0.0336 U	0.0405 U	0.0328 U	0.0378 U	0.0402 U	0.056 U	0.0325 U	0.036 U	0.0513 U
Toluene	NWTPH-Gx/8021B	mg/kg	7	0.056 U	0.0674 U	0.0547 U	0.0631 U	0.067 U	0.0934 U	0.0541 U	0.06 U	0.0855 U
Ethylbenzene	NWTPH-Gx/8021B	mg/kg	6	0.056 U	0.0674 U	0.0547 U	0.0631 U	0.067 U	0.0934 U	0.0541 U	0.06 U	0.0855 U
Xylenes (total)	NWTPH-Gx/8021B	mg/kg	9	0.112 U	0.135 U	0.109 U	0.126 U	0.134 U	0.187 U	0.108 U	0.12 U	0.171 U
Diesel Range HC	NWTPH-Dx	mg/kg	2,000	10.3 U	15.8 U	12.5 U	15 U	285 T	10.6 U	12.6 U	13.5 U	16.7 U
Lube Oil Range HC	NWTPH-Dx	mg/kg	2,000	25.8 U	39.6 U	31.2 U	37.6 U	670	26.4 U	31.4 U	33.7 U	41.7 U
Total Metals												
Arsenic	EPA 6020	mg/kg	20	1.11	7.67	1.68	4.93	12.2	1.13	0.641	3.41	7.72
Cadmium	EPA 6020	mg/kg	2	0.524	0.779	0.625	0.747	6.12	0.534	1.2	0.675	0.846
Chromium	EPA 6020	mg/kg	2,000	9.45	26	6.98	17.8	91.6	8	10.3	12.6	18.1
Copper	EPA 6020	mg/kg		10.1	47.3	6.59	26.5	71.8	7.48	14.3	16.4	26.9
Lead	EPA 6020	mg/kg	1,000	2.05	7.8	0.8	4.54	130	1.08	1.26	6.15	4.82
Nickel	EPA 6020	mg/kg		4.6	24.3	4.89	12.8	37.4	4.16	8.36	8.8	12.4
Zinc	EPA 6020	mg/kg		26.8	66.3	18.5	36.1	460	35.8	99	33	31.3
PCBs												
Aroclor 1016	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1221	EPA 8082	µg/kg	10,000	52.6 U	78.4 U	62.9 U	74.5 U	59.8 U	53.6 U	64.3 U	67.5 U	85.7 U
Aroclor 1232	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1242	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1248	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1254	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1260	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	2190	26.8 U	32.2 U	42.2	42.9 U
Aroclor 1262	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Aroclor 1268	EPA 8082	µg/kg	10,000	26.3 U	39.2 U	31.5 U	37.2 U	29.9 U	26.8 U	32.2 U	33.7 U	42.9 U
Total PCB (U as O)	EPA 8082	µg/kg	10,000	0	0	0	0	2,190	0	0	42	0
PAHs												
1-Methylnaphthalene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U

Chemical/Sample Information	Analytical Method	Unit	MTCA Method A	PGG-6B	PGG-6C	PGG-6D	PGG-6E	PGG-7A	PGG-7B	PGG-7C	PGG-7D	PGG-7E
2-Methylnaphthalene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Acenaphthene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Acenaphthylene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Anthracene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Benzo(ghi)perylene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Fluoranthene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0438	0.0124 U	0.0148 U	0.205	0.0105 U	0.0125 U	0.0133 U	0.017 U
Fluorene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Naphthalene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Phenanthrene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0304	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Pyrene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.067	0.0124 U	0.0148 U	0.252	0.0105 U	0.0125 U	0.0133 U	0.017 U
Benzo(a)anthracene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.019	0.0124 U	0.0148 U	0.116	0.0105 U	0.0125 U	0.0133 U	0.017 U
Benzo(a)pyrene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0199	0.0124 U	0.0148 U	0.178	0.0105 U	0.0125 U	0.0133 U	0.017 U
Benzo(b)fluoranthene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.202	0.0105 U	0.0125 U	0.0133 U	0.017 U
Benzo(k)fluoranthene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.024	0.0124 U	0.0148 U	0.182	0.0105 U	0.0125 U	0.0133 U	0.017 U
Chrysene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0284	0.0124 U	0.0148 U	0.215	0.0105 U	0.0125 U	0.0133 U	0.017 U
Dibenz(a,h)anthracene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Indeno(1,2,3-cd)pyrene	EPA 8270-SIM	mg/kg	2	0.0106 U	0.0155 U	0.0124 U	0.0148 U	0.116 U	0.0105 U	0.0125 U	0.0133 U	0.017 U
Toxicity Equivalent Concentrations (TEF)												
Benzo(a)anthracene	0.1	mg/kg	2	0	0.0019	0	0	0.0116	0	0	0	0
Benzo(a)pyrene	1	mg/kg	2	0	0.0199	0	0	0.178	0	0	0	0
Benzo(b)fluoranthene	0.1	mg/kg	2	0	0	0	0	0.0202	0	0	0	0
Benzo(k)fluoranthene	0.1	mg/kg	2	0	0.0024	0	0	0.0182	0	0	0	0
Chrysene	0.01	mg/kg	2	0	0.000284	0	0	0.00215	0	0	0	0
Dibenzo(a,h)anthracene	0.4	mg/kg	2	0	0	0	0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	0.1	mg/kg	2	0	0	0	0	0	0	0	0	0
Sum of TEF			2	0	0.02	0	0	0.23	0	0	0	0

Source: (Pacific Groundwater Group 2007)

Green highlight – concentration exceeds MTCA Method A for soil (for Industrial Properties)

Yellow highlight – parameter detected

bgs – below ground surface

EPA – US Environmental Protection Agency

HC - hydrocarbons

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

µg/kg – micrograms per kilogram

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

P – Results for 500x dilution

PAH – Polycyclic Aromatic Hydrocarbon

PCB – Polychlorinated Biphenyls

PGG – Pacific Groundwater Group

Q – Results for 5x dilution

R – analytical result rejected based on unrepresentative sample quality and poor data quality, as the sample did not meet Standard Operating Procedures.

S – lab analyst note: results reported for the gas range are primarily due to overlap from diesel range hydrocarbons

SIM – Simultaneous Ion Monitoring

T – lab analyst note: results reported for the gas range are primarily due to overlap from heavy oil range product

TEF – Toxic Equivalency Factor

U – parameter not detected, associated # is the lab reporting limit

UJ – parameter not detected at the associated reporting limit; analysis performed 44 days outside holding time

Table D-2. Historical soil sample results for PCBs conducted July 20, 1981, June 13, August 16 and September 28, 1990, and October 1991

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	Aroclor 8080 (mg/kg)	Aroclor 1016/1242 8080 (mg/kg)	Aroclor 1016 8080 (mg/kg)	Aroclor 1221 8080 (mg/kg)	Aroclor 1232 8080 (mg/kg)	Aroclor 1242 8080 (mg/kg)	Aroclor 1248 8080 (mg/kg)	Aroclor 1254 8080 (mg/kg)	Aroclor 1260 8080 (mg/kg)
B81-1	D&M	7/20/1981	6	Yes	2.06								
B81-1	D&M	7/20/1981	11	Yes	4.89								
B81-1	D&M	7/20/1981	21	Yes	0.013								
B81-10	D&M	7/20/1981	9	No	5.91								
B81-10	D&M	7/20/1981	16	No	0.443								
B81-10	D&M	7/20/1981	24	No	0.01 U								
B81-11	D&M	7/20/1981	19	No	0.661								
B81-11	D&M	7/20/1981	26.5	No	0.01 U								
B81-12	D&M	7/20/1981	15.5	No	0.01 U								
B81-13	D&M	7/20/1981	24	No	0.01 U								
B81-2	D&M	7/20/1981	2.5	Yes	2.73								
B81-2	D&M	7/20/1981	16	Yes	0.169								
B81-3	D&M	7/20/1981	6	Yes	2.29								
B81-3	D&M	7/20/1981	19	Yes	0.171								
B81-4	D&M	7/20/1981	9	Yes	0.512								
B81-4	D&M	7/20/1981	21	Yes	0.01 U								
B81-5	D&M	7/20/1981	6	Yes	2.6								
B81-5	D&M	7/20/1981	16	Yes	4.27								
B81-6	D&M	7/20/1981	19	Yes	1.71								
B81-7	D&M	7/20/1981	2.5	Yes	0.709								
B81-7	D&M	7/20/1981	14	Yes	1.21								
B81-8	D&M	7/20/1981	14.5	Yes	1.13								
B81-8	D&M	7/20/1981	24	Yes	0.01 U								
B81-9	D&M	7/20/1981	15.5	No	0.102								

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	Aroclor 8080 (mg/kg)	Aroclor 1016/1242 8080 (mg/kg)	Aroclor 1016 8080 (mg/kg)	Aroclor 1221 8080 (mg/kg)	Aroclor 1232 8080 (mg/kg)	Aroclor 1242 8080 (mg/kg)	Aroclor 1248 8080 (mg/kg)	Aroclor 1254 8080 (mg/kg)	Aroclor 1260 8080 (mg/kg)
EP-1	PEG	6/13/1990	3	No		0.05 U					0.05 U	0.021	0.05 U
EP-1	PEG	6/13/1990	8	No		0.05 U					0.05 U	0.05 U	0.05 U
EP-10	PEG	6/13/1990	6	No		0.05 U					0.05 U	0.05 U	0.05 U
EP-11	PEG	6/13/1990	6	No		0.05 U					0.05 U	0.14	0.035
EP-2	PEG	6/13/1990	4	No		0.05 U					0.05 U	0.05 U	4.5
EP-2	PEG	6/13/1990	8	No		0.05 U					0.05 U	0.05 U	0.05 U
EP-3	PEG	6/13/1990	4	No		0.4					0.05 U	2.1	2.3
EP-3	PEG	6/13/1990	8	No		0.031					0.05 U	0.19	0.19
EP-4	PEG	6/13/1990	4	Yes		0.05 U					0.05 U	0.093	0.06
EP-4	PEG	6/13/1990	10	Yes		0.54					0.05 U	0.22	0.05 U
EP-5	PEG	6/13/1990	6	No		0.26					0.05 U	0.97	0.6
EP-5	PEG	6/13/1990	11	No		0.17					0.05 U	0.42	0.26
EP-6	PEG	6/13/1990	4	No		0.05 U					0.05 U	0.05 U	0.05 U
EP-6	PEG	6/13/1990	8	No		0.05 U					0.05 U	0.05 U	0.05 U
EP-7	PEG	6/13/1990	4	No		0.05 U					0.05 U	0.05 U	0.42
EP-8	PEG	6/13/1990	6	Yes		0.42					0.05 U	0.29	0.11
EP-9	PEG	6/13/1990	4	No		0.05 U					0.05 U	0.05 U	0.05 U
A	PEG	8/16/1990	1	Yes		0.05 U					1.4	0.66	0.61
B	PEG	8/16/1990	1	Yes		<0.500					6.9	<0.500	<0.500
C	PEG	8/16/1990	1	Yes		0.05 U					0.05 U	0.05 U	0.05 U
D	PEG	8/16/1990	1	Yes		0.05 U					0.05 U	0.081	0.05 U
E	PEG	8/16/1990	1	Yes		0.05 U					0.36	0.1	0.063
F	PEG	8/16/1990	1	Yes		0.05 U					0.297	0.21	0.08
C-1	PEG	8/16/1990	7.5-9	No		0.05 U					0.05 U	0.14	0.12
C-2	PEG	8/16/1990	7.5-9	No		0.05 U					0.05 U	0.025	0.05 U
C-3	PEG	8/16/1990	7.5-9	No		0.12					0.05 U	0.18	0.13
C-4	PEG	8/16/1990	2.5-4	No		0.05 U					0.05 U	0.05 U	0.05 U

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	Aroclor 8080 (mg/kg)	Aroclor 1016/1242 8080 (mg/kg)	Aroclor 1016 8080 (mg/kg)	Aroclor 1221 8080 (mg/kg)	Aroclor 1232 8080 (mg/kg)	Aroclor 1242 8080 (mg/kg)	Aroclor 1248 8080 (mg/kg)	Aroclor 1254 8080 (mg/kg)	Aroclor 1260 8080 (mg/kg)
C-4	PEG	8/16/1990	7.5-9	No		0.05 U					0.05 U	0.05 U	0.05 U
C-5	PEG	8/16/1990	7.5-9	No		1.1					0.05 U	2.6	0.87
C-6	PEG	8/16/1990	2.5-4	No		0.05 U					0.05 U	0.05 U	0.05 U
C-6	PEG	8/16/1990	7.5-9	No		0.05 U					0.05 U	0.05 U	0.05 U
NAT-1	PEG	9/28/1990	1	Yes			0.05 U	0.05 U	0.05 U	0.05 U	9.3	0.05 U	0.05 U
NAT-2	PEG	9/28/1990	1	No			0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
NAT-3	PEG	9/28/1990	1	Yes			0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
NAT-4	PEG	9/28/1990	1	Yes			0.05 U	0.05 U	0.05 U	0.05 U	1.6	0.05 U	0.05 U
NAT-5	PEG	9/28/1990	1	Yes			0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
NAT-6	PEG	9/28/1990	1	Yes			0.05 U	0.05 U	0.05 U	0.05 U	2.9	0.05 U	0.05 U
MW-10	AGI	October 1991	6	Yes			0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
MW-10	AGI	October 1991	8.5	Yes			1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
MW-11	AGI	October 1991	3.5	No			0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
MW-11	AGI	October 1991	8.5	No			0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
MW-12	AGI	October 1991	6	Yes			0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
MW-12	AGI	October 1991	8.5	Yes			0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
MW-13	AGI	October 1991	3.5	No			0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-14	AGI	October 1991	3.5	No			0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
MW-14	AGI	October 1991	8.5	No			0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
MW-7	AGI	October 1991	8.5	Yes			0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
MW-7	AGI	October 1991	13	Yes			0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
MW-8	AGI	October 1991	6	Yes			0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
MW-8	AGI	October 1991	11	Yes			0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
MW-9	AGI	October 1991	8.5	No			0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U

Source: (Pacific Groundwater Group 2006)
Green highlight – concentration exceeds MTCA Method A for soil
Yellow highlight – parameter detected
AGI – Applied Geotechnology Inc.
bgs – below ground surface
D&M – Dames and Moore
mg/kg – milligram per kilogram
PCB – Polychlorinated Biphenyls
PEG –Pacific Environmental Group
U – parameter not detected; associated number is laboratory detection limit

Table D-3. Historical soil sample results for TPH samples conducted June 13, July 19, and August 16, 1990 and September 28, October 8, 9, and 10, 1991

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	TPH 418.1 (mg/kg)	Gasoline 8015 (mg/kg)	Mineral Spirits (mg/kg)	Kerosene (mg/kg)	Jet Fuel (mg/kg)	Diesel 8015 (mg/kg)	Benzene 8020 (mg/kg)	Ethyl-benzene GC-FID (mg/kg)	Toluene GC-FID (mg/kg)	Total Xylenes GC-FID (mg/kg)
EP-1	PEG	6/13/1990	3	No	10 U									
EP-1	PEG	6/13/1990	8	No	10 U									
EP-2	PEG	6/13/1990	4	No	130									
EP-2	PEG	6/13/1990	8	No	10 U									
EP-3	PEG	6/13/1990	4	No	210	88				80				
EP-3	PEG	6/13/1990	8	No	240	94				25 U				
EP-4	PEG	6/13/1990	4	Yes	20									
EP-4	PEG	6/13/1990	10	Yes	67									
EP-5	PEG	6/13/1990	6	No	140									
EP-5	PEG	6/13/1990	11	No	59									
EP-6	PEG	6/13/1990	4	No	10 U									
EP-6	PEG	6/13/1990	8	No	10 U									
EP-7	PEG	6/13/1990	4	No	10 U									
EP-8	PEG	6/13/1990	6	Yes	75									
EP-9	PEG	6/13/1990	4	No	26									
EP-10	PEG	6/13/1990	6	No	93									
EP-11	PEG	6/13/1990	6	No	10 U									
A	PEG	7/19/1990	1	Yes	25 U									
B	PEG	7/19/1990	1	Yes	25 U									
C	PEG	7/19/1990	1	Yes	25 U									
D	PEG	7/19/1990	1	Yes	25 U									
E	PEG	7/19/1990	1	Yes	25 U									

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	TPH 418.1 (mg/kg)	Gasoline 8015 (mg/kg)	Mineral Spirits (mg/kg)	Kerosene (mg/kg)	Jet Fuel (mg/kg)	Diesel 8015 (mg/kg)	Benzene 8020 (mg/kg)	Ethyl-benzene GC-FID (mg/kg)	Toluene GC-FID (mg/kg)	Total Xylenes GC-FID (mg/kg)
F	PEG	7/19/1990	1	Yes	25 U									
NAT-1	PEG	9/28/1991	1	Yes	68	1 U								
NAT-2	PEG	9/28/1991	1	No	44	1 U								
NAT-3	PEG	9/28/1991	1	Yes	15	1 U								
NAT-4	PEG	9/28/1991	1	Yes	33	1 U								
NAT-5	PEG	9/28/1991	1	Yes	31	1 U								
NAT-6	PEG	9/28/1991	1	Yes	100	1 U								
C-1	PEG	8/16/1990	7.5-9	No	88									
C-2	PEG	8/16/1990	7.5-9	No	16									
C-3	PEG	8/16/1990	7.5-9	No	530									
C-4	PEG	8/16/1990	2.5-4	No	10 U									
C-4	PEG	8/16/1990	7.5-9	No	10 U									
C-5	PEG	8/16/1990	7.5-9	No	260									
C-6	PEG	8/16/1990	2.5-4	No	10 U									
C-6	PEG	8/16/1990	7.5-9	No	10 U									
MW-7	AGI	10/8/1991	8.5	Yes		13 U	13 U	13 U	13 U	13 U	0.006 U	0.013	0.006 U	0.052
MW-7	AGI	10/8/1991	13	Yes		17 U	17 U	17 U	17 U	17 U	0.008 U	0.008 U	0.008 U	0.026 U
MW-8	AGI	10/9/1991	6	Yes		12 U	12 U	12 U	12 U	18	0.006 U	0.024	0.006 U	0.026 U
MW-8 Dup[a]	AGI	10/10/1991	6	Yes		12 U	12 U	12 U	12 U	68	0.006 U	0.048	0.006 U	0.11
MW-8	AGI	10/9/1991	11	Yes		12 U	12 U	12 U	12 U	12 U	0.006 U	0.006 U	0.006	0.018 U
MW-9	AGI	10/9/1991	8.5	No		12 U	12 U	12 U	12 U	12 U	0.006 U	0.006 U	0.006 U	0.018 U
MW-10	AGI	10/9/1991	6	Yes		13 U	13 U	13 U	13 U	14	0.006 U	0.006 U	0.006 U	0.02 U
MW-10 Dup[b]	AGI	10/10/1991	6	Yes		19 U	19 U	19 U	19 U	170	0.01 U	0.01 U	0.01 U	0.028 U
MW-10	AGI	10/9/1991	8.5	Yes		15 U	15 U	15 U	15 U	24	0.008 U	0.008 U	0.01	0.022 U
MW-11	AGI	10/9/1991	3.5	No		11 U	11 U	11 U	11 U	11 U	0.006 U	0.006 U	0.006 U	0.016 U

Sample ID	Investigation	Date	Depth (feet bgs)	Within Sludge Footprint	TPH 418.1 (mg/kg)	Gasoline 8015 (mg/kg)	Mineral Spirits (mg/kg)	Kerosene (mg/kg)	Jet Fuel (mg/kg)	Diesel 8015 (mg/kg)	Benzene 8020 (mg/kg)	Ethyl-benzene GC-FID (mg/kg)	Toluene GC-FID (mg/kg)	Total Xylenes GC-FID (mg/kg)
MW-11	AGI	10/9/1991	8.5	No		14 U	14 U	14 U	14 U	14 U	0.007 U	0.007 U	0.007 U	0.021 U
MW-12	AGI	10/9/1991	6	Yes		12 U	12 U	12 U	12 U	12 U	0.006 U	0.006 U	0.007	0.018 U
MW-12	AGI	10/9/1991	8.5	Yes		13 U	13 U	13 U	13 U	13 U	0.006 U	0.006	0.006 U	0.021
MW-13	AGI	10/8/1991	3.5	No		11 U	11 U	11 U	11 U	11 U	0.005 U	0.005 U	0.005 U	0.02
MW-14	AGI	10/8/1991	3.5	No		11 U	11 U	11 U	11 U	11 U	0.006 U	0.006 U	0.006 U	0.016 U
MW-14	AGI	10/8/1991	8.5	No		15 U	15 U	15 U	15 U	15 U	0.008 U	0.008 U	0.008 U	0.022 U
	MTCA Method A - Industrial					100				2000	0.03	6	7	9

Source: (Pacific Groundwater Group 2006)

[a]MW-8 Dup is sample MW-15

[b]MW-10 Dup is Sample MW-1

yellow highlight – parameter detected

Green highlight – concentration exceeds MTCA Method A for soil

AGI – Applied Geotechnology Inc.

bgs – below ground surface

D&M – Dames and Moore

Dupl. – Duplicate

GC-FID – Gas Chromatograph – Flame Ionization Detector

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

PEG – Pacific Environmental Group

TPH – Total Petroleum Hydrocarbons

U – parameter not detected; associated # is laboratory detection limit

Table D-4. Historical soil sample results for PAH conducted October 1992

Chemical/Sample Information	Analytical Method	MW-7 (mg/kg)	MW-7 (mg/kg)	MW-8 (mg/kg)	MW-8 (mg/kg)	MW-9 (mg/kg)	MW-10 (mg/kg)	MW-10 (mg/kg)	MW-11 (mg/kg)	MW-11 (mg/kg)	MW-12 (mg/kg)	MW-12 (mg/kg)	MW-13 (mg/kg)	MW-14 (mg/kg)	MW-14 (mg/kg)
Depth (feet bgs):		8.5	13	6	11	8.5	6	8.5	3.5	8.5	6	8.5	3.5	3.5	8.5
Within Sludge Footprint:		Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	No	No
Naphthalene[a]	8310	0.18 U	0.24 U	0.17 U	0.17 U	0.17 U	0.18 U	0.21 U	0.15 U	0.2 U	0.17 U	0.17 U	0.14 U	0.15 U	0.21 U
Acenaphthylene	8310	0.09 U	0.12 U	0.083 U	0.083 U	0.083 U	0.09 U	0.1 U	0.076 U	0.097 U	0.83 U	0.083 U	0.069 U	0.76 U	0.1 U
Acenaphthene	8310	0.026 U	0.064	0.054	0.024 U	0.024 U	0.026 U	0.03 U	0.022 U	0.28 U	0.24 U	0.024 U	0.02 U	0.022 U	0.03 U
Fluorene	8310	0.021	0.039	0.038	0.016 U	0.016 U	0.022	0.02 U	0.014 U	0.08 U	0.016 U	0.013 U	0.013 U	0.014 U	0.02 U
Phenanthrene	8310	0.19	0.15	0.13	0.055	0.023 U	0.025 U	0.028 U	0.021 U	0.027 U	0.026	0.059	0.019 U	0.11	0.028 U
Anthracene	8310	0.045	0.034	0.026	0.017 U	0.017 U	0.018 U	0.021 U	0.015 U	0.02 U	0.017 U	0.029	0.014 U	0.015 U	0.021 U
Fluoranthene	8310	0.17	0.14	0.094	0.03 U	0.03 U	0.032 U	0.038 U	0.028 U	0.035 U	0.03 U	0.051	0.025 U	0.071	0.038 U
Pyrene	8310	0.21	0.11	0.077	0.042	0.018	0.11	0.17	0.015 U	0.02 U	0.049	0.1	0.014 U	0.094	0.021 U
Benzo(a)anthracene	8310	0.095	0.022	0.023	0.015	0.013 U	0.039	0.081	0.012 U	0.015 U	0.026	0.058	0.011 U	0.042	0.016 U
Chrysene	8310	0.01	0.046	0.055	0.081	0.018	0.049	0.11	0.014 U	0.018 U	0.028	0.069	0.013 U	0.067	0.012 U
Benzo(b)fluoranthene	8310	0.087	0.052	0.05	0.026	0.037	0.072	0.17	0.014 U	0.018 U	0.038	0.073	0.013 U	0.064	0.032
Benzo(k)fluoranthene	8310	0.014	0.019 U	0.018	0.013 U	0.013 U	0.022	0.033	0.012 U	0.015 U	0.013 U	0.03	0.011 U	0.018	0.021
Benzo(a)pyrene	8310	0.091	0.024	0.014 U	0.014 U	0.014 U	0.029	0.079	0.013 U	0.017 U	0.022	0.051	0.012 U	0.026	0.018 U
Dibenzo(a,h)anthracene	8310	0.014 U	0.019 U	0.013 U	0.013 U	0.013 U	0.014 U	0.016 U	0.012 U	0.015 U	0.013 U	0.013 U	0.011 U	0.011 U	0.016 U
Benzo(g,h,i)perylene	8310	0.049	0.051 U	0.036 U	0.036 U	0.036 U	0.039 U	0.045 U	0.033 U	0.042 U	0.036 U	0.036 U	0.03 U	0.03 U	0.045 U
Indeno(1,2,3-cd)pyrene	8310	0.029	0.02 U	0.014 U	0.014 U	0.014 U	0.016 U	0.025	0.013 U	0.017 U	0.014 U	0.014 U	0.012 U	0.012 U	0.018 U
Toxicity Equivalent Concentrations	**TEF**														
Benzo(a)anthracene	0.1	0.0095	0.0022	0.0023	0.0015	0.0013	0.0039	0.0081	0.0006	0.00075	0.0026	0.0058	0.00055	0.0042	0.0016
Benzo(a)pyrene	1	0.091	0.024	0.007	0.007	0.007	0.029	0.079	0.0065	0.0085	0.022	0.051	0.006	0.026	0.009
Benzo(b)fluoranthene	0.1	0.0087	0.0052	0.005	0.0026	0.0037	0.0072	0.017	0.0007	0.0009	0.0038	0.0073	0.00065	0.0064	0.0032
Benzo(k)fluoranthene	0.1	0.0014	0.00095	0.0018	0.00065	0.00065	0.0022	0.0033	0.0006	0.00075	0.00065	0.003	0.00055	0.0018	0.00105
Chrysene	0.01	0.0001	0.00046	0.00055	0.00081	0.00018	0.00049	0.0011	0.00007	0.00009	0.00028	0.00069	0.000065	0.00067	0.00006
Dibenzo(a,h)anthracene	0.4	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0024	0.003	0.0028	0.0028	0.0022	0.0028	0.0028
Indeno(1,2,3-cd)pyrene	0.1	0.0029	0.001	0.0007	0.0007	0.0007	0.0008	0.0025	0.00065	0.00085	0.0007	0.0007	0.0006	0.0006	0.0009
Total cPAH Toxicity Equivalent Concentrations		0.116	0.037	0.02	0.016	0.016	0.046	0.114	0.012	0.015	0.033	0.071	0.011	0.042	0.019

Source: (Pacific Groundwater Group 2006)

[a] MTCA Method A - Industrial cleanup level for naphthalene – 5 mg/kg. Individual cleanup levels for remaining PAHs not established under MTCA Method A - Industrial

Green highlight – concentration exceeds MTCA Method A for soil

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

bgs – below ground surface

cPAH – carcinogenic Polycyclic Aromatic Hydrocarbon

EPA – US Environmental Protection Agency

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

MW – Monitoring Well

Non-detect cPAH results considered 50% of the reporting limit in the TEF calculations

TEF – toxic equivalency factor

U – parameter not detected; associated # is laboratory detection limit

Table D-5. Historical soil sample results for metals conducted July 20, 1981 and October 1991

Sample ID	Date	Depth (ft bgs)	Antimony 6010/7000 (mg/kg)	Arsenic 6010/ 7000 (mg/kg)	Beryllium 6010/7000 (mg/kg)	Cadmium 6010/7000 (mg/kg)	Chromium 6010/7000 (mg/kg)	Copper 6010/7000 (mg/kg)	Lead 7240 (mg/kg)	Mercury 6010/ 7000 (mg/kg)	Nickel 6010/ 7000 (mg/kg)	Selenium 6010/ 7000 (mg/kg)	Silver 6010/ 7000 (mg/kg)	Thallium 6010/ 7000 (mg/kg)	Zinc 6010/ 7000 (mg/kg)
B81-1-2	7/20/1981	6	na	8	na	1.4	39	na	41	0.24	na	na	na	na	86
B81-1-4	7/20/1981	11	na	19	na	15	64	na	240	0.17	na	na	na	na	2500
B81-1-8	7/20/1981	21	na	7	na	0.31	10	na	4	0.02 U	na	na	na	na	22
B81-2-1	7/20/1981	2.5	na	6	na	1.4	39	na	72	0.13	na	na	na	na	91
B81-2-6	7/20/1981	16	na	1.5	na	0.22	3.9	na	4	0.06	na	na	na	na	19
B81-3-2	7/20/1981	6	na	5.2	na	1.4	42	na	88	0.15	na	na	na	na	110
B81-3-7	7/20/1981	19	na	4.7	na	0.32	11	na	6	0.15	na	na	na	na	24
B81-4-3	7/20/1981	9	na	9	na	0.85	24	na	39	0.07	na	na	na	na	88
B81-4-8	7/20/1981	21	na	4.1	na	0.37	11	na	4	0.04	na	na	na	na	24
B81-5-2	7/20/1981	6	na	7	na	2	85	na	45	0.23	na	na	na	na	140
B81-5-6	7/20/1981	16	na	10	na	3.1	150	na	130	0.32	na	na	na	na	320
B81-6-7	7/20/1981	19	na	4.9	na	2	62	na	140	0.13	na	na	na	na	140
B81-7-1	7/20/1981	2.5	na	4.8	na	1.4	13	na	14	0.02 U	na	na	na	na	43
B81-7-5	7/20/1981	14	na	9	na	1.7	25	na	350	0.11	na	na	na	na	130
B81-8-5	7/20/1981	14.5	na	5.5	na	0.85	19	na	57	0.1	na	na	na	na	54
B81-8-9	7/20/1981	24	na	6.1	na	0.32	11	na	6	0.02 U	na	na	na	na	25
B81-9-6	7/20/1981	15.5	na	8.2	na	0.47	11	na	6	0.05	na	na	na	na	28
B81-10-3	7/20/1981	9	na	17	na	3.3	380	na	240	0.4	na	na	na	na	280
B81-10-6	7/20/1981	16	na	7.2	na	0.46	11	na	6	0.02 U	na	na	na	na	25
B81-10-9	7/20/1981	24	na	6	na	0.35	10	na	6	0.02 U	na	na	na	na	23
B81-11-7	7/20/1981	19	na	8	na	0.53	12	na	11	0.03	na	na	na	na	35
B81-11-20	7/20/1981	26.5	na	3.4	na	0.27	7.5	na	3	0.05	na	na	na	na	21
B81-12-9	7/20/1981	15.5	na	1.7	na	0.19	5.9	na	2	0.04	na	na	na	na	14

Sample ID	Date	Depth (ft bgs)	Antimony 6010/7000 (mg/kg)	Arsenic 6010/ 7000 (mg/kg)	Beryllium 6010/7000 (mg/kg)	Cadmium 6010/7000 (mg/kg)	Chromium 6010/7000 (mg/kg)	Copper 6010/7000 (mg/kg)	Lead 7240 (mg/kg)	Mercury 6010/ 7000 (mg/kg)	Nickel 6010/ 7000 (mg/kg)	Selenium 6010/ 7000 (mg/kg)	Silver 6010/ 7000 (mg/kg)	Thallium 6010/ 7000 (mg/kg)	Zinc 6010/ 7000 (mg/kg)
B81-13-8	7/20/1981	24	na	7.2	na	0.39	12	na	7	0.05	na	na	na	na	28
MW-7	Oct-91	8.5	6.5 U	6.5 U	1.3 U	1.3 U	56	21	18	0.06 U	70	6.5 U	3.4 U	10	75
MW-7	Oct-91	13	8.5 U	8.5 U	1.7 U	1.7 U	46	48	34	0.24	48	8.5 U	4.2 U	20	88
MW-8	Oct-91	6	6 U	6 U	1.2 U	1.9	65	40	44	0.97	12	6 U	7.1	13	120
MW-8	Oct-91	11	6 U	6 U	1.2 U	1.2 U	17	19	8.5	0.06 U	16	6 U	3 U	18	62
MW-9	Oct-91	8.5	6 U	6 U	1.2 U	1.2 U	13	13	<6	0.06 U	7.1	6 U	3 U	24	25
MW-10	Oct-91	6	6.5 U	6.5 U	1.3 U	1.3 U	23	26	20	0.1	10	6.5 U	4.7	10	51
MW-10	Oct-91	8.5	7.5 U	7.5 U	1.5 U	3	180	100	150	1.1	16	7.5 U	11	22	340
MW-11	Oct-91	3.5	5.5 U	5.5 U	1.1 U	1.1 U	9.2	11	5.5 U	0.06 U	5.5 U	5.5 U	2.8 U	19	20
MW-11	Oct-91	8.5	6 U	6 U	1.2 U	1.2 U	8.3	10	6 U	0.06 U	7.4	6 U	3 U	14	16
MW-12	Oct-91	6	6 U	6 U	1.2 U	1.2 U	14	22	7.6	0.06 U	7.8	6 U	3 U	11	31
MW-12	Oct-91	8.5	6.5 U	6.5 U	1.3 U	1.3 U	34	22	21	0.13	9.8	6.5 U	3.4 U	18	66
MW-13	Oct-91	3.5	5 U	5 U	1 U	1 U	5.8	3.3	5 U	0.05 U	5 U	5 U	2.5 U	10	21
MW-14	Oct-91	3.5	5.5 U	5.5 U	1.1 U	1.1 U	32	20	31	0.37	8.2	5.5 U	2.8 U	15	42
MW-14	Oct-91	8.5	7.5 U	7.5 U	1.5 U	1.5 U	12	22	10	0.08 U	9.4	7.5 U	3.8 U	26	54
MTCA Method A - Industrial				20		2	2000		1000	2					

Source: (Pacific Groundwater Group 2006)

Green highlight – concentration exceeds MTCA Method A for soil

Yellow highlight – parameter detected

Investigation – D&M

bgs – below ground surface

D&M – Dames and Moore

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

na – not applicable

U – parameter not detected; associated # is laboratory detection limit

Table D-6. Historical soil sample results for PCBs and metals conducted June 12, 1984

Sample ID	Depth (ft bgs)	Aroclor (1242 & 1254) (mg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)	Total Solids (mg/kg)
B1-2	6	2.06	8	1.4	39	41	0.24	86	71.4
B1-4	11	4.89	19	15	64	240	0.17	2500	59.1
B1-8	21	0.013	7	0.31	10	4	< 0.02	22	72.6
B2-1	2.5	2.73	6	1.4	39	72	0.13	91	80.1
B2-6	16	0.169	1.5	0.22	3.9	4	0.06	19	7
B3-2	6	2.29	5.2	1.4	42	88	0.15	110	73.9
B3-7	19	0.171	4.7	0.32	11	6	0.15	24	58.9
B4-3	9	0.512	9	0.85	24	0.9	0.07	88	73.7
B4-8	21	< 0.01	4.1	0.37	11	4	0.04	24	73.4
B5-2	6	2.6	7	2	85	45	0.23	140	69.7
B5-6	16	4.27	10	3.1	150	130	0.32	320	50.5
B6-7	19	1.71	4.9	2	62	140	0.13	140	55.3
B7-1	2.5	0.709	4.8	1.4	13	14	< 0.02	43	88.8
B7-5	14	1.21	9	1.7	25	350	0.11	130	79.3
B8-5	14.5	1.13	5.5	0.85	19	57	0.1	54	77.9
B8-9	24	< 0.01	6.1	0.32	11	6	< 0.02	25	73.5
B9-6	15.5	0.102	8.2	0.47	11	6	0.05	28	69.5
B10-3	9	5.91	17	3.3	360	240	0.4	280	69.7
B10-6	16	0.443	7.2	0.46	11	6	< 0.02	25	67.4
B10-9	24	< 0.01	6	0.35	10	6	< 0.02	23	73.6
B11-7	19	0.661	8	0.53	12	11	0.03	35	73.5
B11-10	26.5	< 0.01	3.4	0.27	7.5	3	0.05	21	81.9
B12-9	15.5	< 0.01	1.7	0.19	5.9	2	0.04	14	81.7
B13-8	24	< 0.01	7.2	0.39	12	7	0.05	28	71.9

Source: (Dames & Moore 1984)
bgs – below ground surface
mg/kg – milligram per kilogram
PCB – polychlorinated biphenyl

Table D-7. Historical soil sample results for metals conducted June 12, 1984

Sample ID	Depth (ft bgs)	Aroclor 1242 (µg/g)	Aroclor 1254 (µg/g)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)	% Solids
84-1	1.5-3	--	--	8.5	0.25	19	7.8	0.12	53	86
84-1	4-6	--	--	15	4.6	50	170	0.25	280	76
84-2	1.5-3	7.2	--	7.5	0.6	100	11	0.55	83	73
84-2	1.5-3	9.9	4.1 [a]	7.8	0.55	120	140	0.81	58	72
84-3	4.5-7	--	--	6	0.55	43	29	0.2	75	85
84-3	9-10.5	--	--	6.8	0.32	19	17	0.2	71	83
84-3	12-14	6.7	--	8.4	0.52	34	22	0.14	100	69
84-4	1-3		3.2	6	0.081	21	18	0.14	27	80
84-5	1-2.5	--	--	5.2	0.35	17	9.3	<0.1	52	86
84-6	4-5.5	--	--	6.5	0.38	9.8	2.9	<0.1	25	78
84-7	1.5-3	--	--	4.1	0.1	11	9.7	<0.1	19	91
84-8	1-2.5	--	--	4.8	0.31	13	5.5	<0.1	31	85
84-9	1.5-3	--	--	5	0.4	17	5	0.12	39	88
84-10	1.5-3	--	--	4.5	0.074	6.1	1.3	<0.1	17	7
84-10	4-6	--	--	4.2	3.1	28	41	0.28	110	87
84-11	1-2	--	--	3.8	0.11	6.2	3.8	<0.1	16	82
84-11	3.5-5	--	--	3.9	0.07	7.3	1.9	<0.1	24	78

Source: (Dames & Moore 1984)

[a] Duplicate samples were tested for quality control check.

-- PCB concentration is less than the detection limit of 1 ppm (mg/kg)

bgs – below ground surface

Dupl. – Duplicate

µg/g – micrograms per gram

mg/kg – milligram per kilogram

PCB – polychlorinated biphenyl

Table D-8. Summary of bank soil analytical chemistry (dry weight)—AET screening[a] conducted on August 17, 2005

Chemical / Sample Information	SQS-AET	CSL-AET	DUD_30C	DUD_31C
Sample ID			L36565-1	L36565-2
Depth Interval			0-3 cm	0-3 cm
Conventionals (%)				
Total solids	--	--	83.2	*95.3*
Total Organic Carbon	--	--	1.05	*0.377*
Metals (mg/kg)				
Arsenic	57	93	6 JL	*2.6 U*
Cadmium	5.1	6.7	0.18 U	*0.28*
Chromium	260	270	55.9	*31*
Copper	390	530	61.8	*158*
Lead	450	530	94.4	*7.8*
Mercury	0.41	0.59	0.468*	*0.031*
Zinc	410	960	61.9 J	*85.8*
PCBs (µg/kg)				
Aroclor 1016	--	--	170U	*1.4U*
Aroclor 1221	--	--	30U	*2.6U*
Aroclor 1232	--	--	470U	*2.6U*
Aroclor 1242	--	--	400U	*1.4U*
Aroclor 1248	--	--	315	*2*
Aroclor 1254	--	--	303	*5.22*
Aroclor 1260	--	--	197	*9.32*
Total PCBs (SMS)	130	1000	815*	*16.5*
LPAH (µg/kg)				
Naphthalene	2100	2400	16U	*2.8U*
Acenaphthylene	1300	1300	16U	*2.8U*
Acenaphthene	500	730	16U	*2.8U*
Fluorene	540	1000	16U	*2.8U*
Phenanthrene	1500	5400	43.8	*8.84*
Anthracene	960	4400	16U	*2.8U*
2-Methylnaphthalene	670	1400	16U	*2.8U*
Total LPAH (SMS)	5200	13000	43.8	*8.84*
HPAH (µg/kg)				
Fluoranthene	1700	2500	112	*22.6*
Pyrene	2600	3300	98.8	*19.5*

Chemical / Sample Information	SQS-AET	CSL-AET	DUD_30C	DUD_31C
Benzo(a)anthracene	1300	1600	41	*8.36*
Chrysene	1400	2800	55	*14.8*
Benzo(b)fluoranthene	--	--	53	*13.6*
Benzo(k)fluoranthene	--	--	54.9	*15.5*
Benzo(a)pyrene	1600	3000	47.4	*13.7*
Indeno(1,2,3-cd)pyrene	600	690	38.9	*10.9*
Dibenzo(a,h)anthracene	230	540	16U	*3.3*
Benzo(g,h,i)perylene	670	720	45.8	*13.2*
Total benzofluoranthenes (SMS)	3200	3600	107.9	*29.1*
Total HPAH (SMS)	12000	17000	546.8	*135.46*
Chlorinated Hydrocarbons (µg/kg)				
1,3-Dichlorobenzene	--	--	1.6U	*0.28U*
1,4-Dichlorobenzene	110	120	1.6U	*0.28U*
1,2-Dichlorobenzene	35	50	7.21	*0.28U*
1,2,4-Trichlorobenzene	31	51	1.6U	*0.28U*
Hexachlorobenzene	22	70	3.2U	*0.56U*
Phthalates (µg/kg)				
Dimethylphthalate	71	160	32U	*5.6U*
Diethylphthalate	200	1200	32U	*5.6U*
Di-n-butylphthalate	1400	5100	38J	*9.1*
Butylbenzylphthalate	63	900	32U	*61.1*
bis(2-Ethylhexyl)phthalate	1300	1900	138	*39.3*
Di-n-octylphthalate	6200	--	32U	*5.6U*
Phenols (µg/kg)				
Phenol	420	1200	1300J*#	*14.7*
2-Methylphenol	63	72	32U	*5.6U*
4-Methylphenol	670	1800	32U	*5.6U*
2,4-Dimethylphenol	29	72	16U	*2.8U*
Pentachlorophenol	360	690	81U	*14U*
Misc Extractables (µg/kg)				
Benzyl alcohol	57	73	32U	*5.6U*
Benzoic acid	650	650	846J*	*116*
Dibenzofuran	540	700	16U	*2.8U*
Hexachlorobutadiene	11	120	8.1U	*1.4U*
n-Nitrosodiphenylamine	28	40	32U	*5.6U*

Source: (Anchor 2007)

a. Note chemicals are compared to dry weight AETs when TOC is <0.5% or >3% (except for metals, phenols and some miscellaneous extractable organics which are always compared to dry weight AETs).

Yellow Highlight – parameter detected

Italics – TOC <0.5% or >3%.

* – Exceeds SQS-AET dry weight criteria.

– Exceeds CSL-AET dry weigh criteria

AET – apparent effects threshold

CSL – cleanup screening level

HPAH – high-molecular-weight Polycyclic Aromatic Hydrocarbon

µg/kg – micrograms per kilogram

mg/kg – milligram per kilogram

PAH – Polycyclic Aromatic Hydrocarbon

PCB – Polychlorinated Biphenyls

SQS – sediment quality standard

SMS – Washington State Sediment Management Standards

Table D-9. Summary of bank soil analytical chemistry (organic carbon normalized) – SMS screening conducted on August 17, 2005

Chemical / Sample Information			DUD_30C	DUD_31C
Sample ID			L36565-1	L36565-2
Depth Interval			0-3 cm	0-3 cm
	SMS SQS	**SMS CSL**		
Conventionals (%)				
Total solids	--	--	83.2	95.3
Total Organic Carbon	--	--	1.05	0.377
Metals (mg/kg)				
Arsenic	57	93	6 JL	*2.6 U*
Cadmium	5.1	6.7	0.18 U	0.28
Chromium	260	270	55.9	31
Copper	390	390	61.8	158
Lead	450	530	94.4	7.8
Mercury	0.41	0.59	0.468*	0.031
Silver	6.1	6.1	2.62JG	0.79
Zinc	410	960	61.9J	85.8
PCBs (mg/kg-OC)				
Total PCBs (SMS)	12	65	77.6*#	4.39
LPAH (mg/kg-OC)				
Naphthalene	99	170	1.52U	*0.743U*
Acenaphthylene	66	66	1.52U	*0.743U*
Acenaphthene	16	57	1.52U	*0.743U*
Fluorene	23	79	1.52U	*0.743U*
Phenanthrene	100	480	4.17	*2.34*
Anthracene	220	1200	1.52U	*0.743U*
2-Methylnaphthalene	38	64	1.52U	*0.743U*
Total LPAH (SMS)	370	780	4.17	*2.34*
HPAH (mg/kg-OC)				
Fluoranthene	160	1200	10.7	*5.99*
Pyrene	1000	1400	9.41	*5.17*
Benzo(a)anthracene	110	270	3.9	*2.22*
Chrysene	110	460	5.24	*3.93*
Benzo(a)pyrene	99	210	4.51	*3.63*
Indeno(1,2,3-cd)pyrene	34	88	3.7	*2.89*
Dibenzo(a,h)anthracene	12	33	1.52U	*0.875*
Benzo(g,h,i)perylene	31	78	4.36	*3.5*

Chemical / Sample Information			DUD_30C	DUD_31C
Total benzofluoranthenes (SMS)	230	450	10.3	*7.72*
Total HPAH (SMS)	960	5300	52.1	*35.9*
Chlorinated Hydrocarbons (mg/kg-OC)				
1,4-Dichlorobenzene	3.1	9	0.152U	*0.0743U*
1,2-Dichlorobenzene	2.3	2.3	0.687	*0.0743U*
1,2,4-Trichlorobenzene	0.81	1.8	0.152U	*0.0743U*
Hexachlorobenzene	0.38	2.3	0.305U	*0.149U*
Phthalates (mg/kg-OC)				
Dimethylphthalate	53	53	3.05U	*1.49U*
Diethylphthalate	61	110	3.05U	*1.49U*
Di-n-butylphthalate	220	1700	3.62J	*2.41*
Butylbenzylphthalate	4.9	64	3.05U	*16.2**
bis(2-Ethylhexyl)phthalate	47	78	13.1	*10.4*
Di-n-octylphthalate	58	4500	3.05U	*1.49U*
Phenols (µg/kg)				
Phenol	420	1200	1300J*#	*14.7*
2-Methylphenol	63	63	32U	*5.6U*
4-Methylphenol	670	670	32U	*5.6U*
2,4-Dimethylphenol	29	29	16U	*2.8U*
Pentachlorophenol	360	690	81U	*14U*
Misc Extractables (mg/kg-OC)				
Dibenzofuran	15	58	1.52U	*0.743U*
Hexachloroethane	3.9	6.2	0.771U	*0.371U*
n-Nitrosodiphenylamine	11	11	3.05U	*1.49U*
Misc Extractables (µg/kg)				
Benzyl alcohol	57	73	32U	*5.6U*
Benzoic acid	650	650	846J*#	*116*

Source: (Anchor 2007)

Note: metals, phenols and some miscellaneous extractable organics are not compared to organic carbon normalized values but only to dry weight AETs regardless of the organic carbon value.

Green Highlight – Exceeds TOC applicable criteria.

Yellow Highlight – parameter detected

* – Exceeds SQS-AET dry weight criteria.

– Exceeds CSL-AET dry weigh criteria.

Italics – TOC <0.5% or >3%.

-- TOC undetected; not normalized

AET – apparent effects threshold

cm – centimeters

CSL – cleanup screening level

µg/kg – micrograms per kilogram

mg/kg – milligrams per kilogram OC – organic carbon

PCB – Polychlorinated Biphenyls

PAH – Polycyclic Aromatic Hydrocarbon

SQS – sediment quality standard

SMS – Washington State Sediment Management Standards

Table D-10. Historical test pit soil sample results conducted on July 20, 1981

Chemical	Analytical Method	TP81-1 (mg/kg)	TP81-2 (mg/kg)	TP81-3 (mg/kg)	TP81-4 (mg/kg)	TP81-5 (mg/kg)	TP81-6 (mg/kg)
Depth (feet bgs)		9.5	10	10	9	8	5.5
Aroclors (1242 & 1254)		0.432	1.19	0.803	1.72	0.225	2.11
Arsenic	6010/7000	6.3	12	9	5.2	4.4	4.2
Cadmium	6010/7000	0.63	0.54	0.54	0.64	0.58	0.69
Chromium	6010/7000	17	13	16	27	14	16
Lead	7240	16	14	17	33	16	18
Mercury	6010/7000	0.02 U	0.02 U	0.04	0.19	0.02 U	0.02 U
Zinc	6010/7000	49	50	46	63	34	36
Total Solids		82.6	86.5	84.1	81.2	83	83.9

Source: (Pacific Groundwater Group 2006)
Green Highlight – Exceeds TOC applicable criteria.
Yellow Highlight – parameter detected
Investigation – Dames and Moore
bgs – below ground surface
mg/kg – milligram per kilogram
PCB – Polychlorinated Biphenyls
TP – test pit

Table D-11. Historical soil sample results prior to land-farming, conducted July 19, 1990

Chemical	Analytical Method	A (mg/kg)	B (mg/kg)	C (mg/kg)	D (mg/kg)	E (mg/kg)	F (mg/kg)	Detection Limit
TPH-Gasoline	EPA 8015	nd	nd	nd	nd	nd	nd	25
Benzene	EPA 8020	nd	nd	nd	nd	nd	nd	0.05 – 0.062
Toluene	EPA 8020	nd	nd	nd	nd	nd	nd	0.05 – 0.062
Ethyl-Benzene	EPA 8020	nd	nd	nd	nd	nd	nd	0.05 – 0.062
Total Xylenes	EPA 8020	nd	nd	nd	nd	nd	nd	0.05 – 0.062

Source: (Pacific Environmental Group 1991)
Yellow Highlight – parameter detected
EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
nd – not detected
TPH – total petroleum hydrocarbons

Table D-12. Historical stockpile soil sample results after land-farming, conducted September 28, 1990

Chemical	Analytical Method	SP-1 (composite) (mg/kg)	SP-2 (composite) (mg/kg)	SP-3 (composite) (mg/kg)	Detection Limit
TPH-EPA 418.1	EPA 418.1	110	110	130	5
TPH-Gasoline	EPA 8015	28	nd	10	1
Benzene	EPA 8020	nd	nd	nd	0.05
Toluene	EPA 8020	nd	nd	nd	0.1
Ethyl-Benzene	EPA 8020	nd	nd	nd	0.1
Total Xylenes	EPA 8020	nd	nd	nd	0.1

Source: (Pacific Environmental Group 1991)

Note: This soil has reportedly been removed

Yellow Highlight – parameter detected

EPA – US Environmental Protection Agency

mg/kg – milligram per kilogram

nd – not detected

TPH – Total Petroleum Hydrocarbons

Table D-13. Historical stockpile soil sample results after land-farming, conducted November 6, 1990

Sample ID	TPH-EPA 418.1 (mg/kg)	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-Benzene (mg/kg)	Total Xylenes (mg/kg)
Analytical Method	EPA 418.1	EPA 8015	EPA 8020	EPA 8020	EPA 8020	EPA 8020
SP-1	110	nd	nd	nd	nd	nd
SP-2	130	nd	nd	nd	nd	nd
SP-3	150	nd	nd	nd	nd	nd
SP-3A	150	nd	nd	nd	nd	nd
SP-4	96	nd	nd	nd	nd	nd
SP-5	73	nd	nd	nd	nd	nd
SP-6	160	nd	nd	nd	nd	nd
SP-7	120	nd	nd	nd	nd	nd
SP-8	170	nd	nd	nd	nd	nd
SP-9	79	nd	nd	nd	nd	nd
SP-10	83	nd	nd	nd	nd	nd
SP-11	42	nd	nd	nd	nd	nd
SP-12	190	nd	nd	nd	nd	nd
Detection Limit	5	1	0.05	0.1	0.1	0.1

Source: (Pacific Environmental Group 1991)
Note: This soil has reportedly been removed
Yellow Highlight – parameter detected
EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
nd – not detected
TPH – Total Petroleum Hydrocarbons

Table D-14. Historical stockpile soil sample results at the former Chiyoda site conducted June 21, 1989 and March 19, 1990

Sample ID	Date Sampled	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)	TPH (mg/kg)	Barium (mg/L)	Cadmium (mg/L)	Fuel Hydrocarbons (mg/kg)	Fuel Type[a]
WS-1[b]	6/21/1989	nd	nd	nd	0.011[c]	212	nd	nd	63 / 110	Diesel #2/turpentine
ES-1[b]	6/21/1989	nd	nd	0.017	0.107[c]	344	nd	nd	53 / 670	Diesel #2/turpentine
SP-N1	3/19/1990	nd	nd	nd	0.27	200	0.032	0.002	60	Gasoline
SP-N2	3/19/1990	nd	nd	nd	0.14	180	0.077	0.003	nd	
SP-N3	3/19/1990	nd	nd	nd	1.2	230	0.046	nd	48	Gasoline
SP-N4	3/19/1990	nd	nd	nd	nd	260	0.061	nd	nd	
SP-S1	3/19/1990	nd	nd	nd	0.056	410	0.061	nd	200	Gasoline
SP-S1[d]	3/19/1990	nd	nd	nd	0.57	na	na	na	na	
SP-S2	3/19/1990	nd	nd	nd	0.49	360	0.071	nd	150	Gasoline
SP-S2[d]	3/19/1990	nd	nd	nd	0.51	na	na	na	na	
SP-S3	3/19/1990	nd	nd	nd	0.18	810	0.044	nd	84	Gasoline
SP-S4	3/19/1990	nd	nd	nd	0.14	200	0.049	nd	nd	
SP-4A[e]	3/19/1990	nd	nd	nd	0.15	230	0.062	nd	nd	

Source: (Thorne Environmental 1990)

[a] Identified only if analyte detected

[b] Samples taken from stockpile at service station site prior to being exported to the Chiyoda site

[c] Individual isomers have been combined into a total xylene result

[d] Sample analyzed twice by laboratory

[e] Duplicate of sample S4

Yellow Highlight – parameter detected

Analytical Method – EPA 8015

EPA – US Environmental Protection Agency

mg/kg – milligram per kilogram

na – not analyzed

nd – not detected at the analytical detection limit of 25 mg/kg

Table D-15a. Analytical summary of groundwater sampling, round 1, conducted June 13 and 14, 2006, PGG-1 through PGG-5

Chemical/Sample Information	Analytical Method	Unit	PGG-1[a] (6/13/06)	PGG-1[a] (6/14/06)	PGG-2	PGG-3	PGG-4	PGG-5	MTCA Method A
Coordinates			N: 209009.53 E: 1267978.45	N: 209009.53 E: 1267978.45	N: 208857.20 E: 1267450.88	N: 208484.34 E: 1267594.69	N: 208550.85 E: 1268179.67	N: 208967.95 E: 1267349.68	
pH				6.88	5.92	6.03	6.36	7.10	
Temp		°C		16.83	15.2	13.44	15.36	13.48	
Dissolved Oxygen		mg/L		0.5	1.74	1.36	2.32	0.47	
Electrical Conductivity		mS/cm		4.96	1.357	0.591	1.172	1.868	
Oxidation Reduction Potential		mV		-290.2	84.5	-338.3	-210.4	-295.2	
Petroleum Hydrocarbons									
Gasoline Range HC	NWTPH-Gx/8021B	µg/L	50.0 U		50.0 U	50.0 U	50.0 U	50.0 U	1000
Benzene	NWTPH-Gx/8021B	µg/L	0.500 U		0.500 U	0.500 U	0.500 U	0.500 U	5
Toluene	NWTPH-Gx/8021B	µg/L	0.500 U		0.500 U	0.500 U	0.500 U	0.500 U	1000
Ethylbenzene	NWTPH-Gx/8021B	µg/L	0.500 U		0.500 U	0.500 U	0.500 U	0.500 U	700
Xylenes (total)	NWTPH-Gx/8021B	µg/L	1.000 U		1.000 U	1.000 U	1.000 U	1.000 U	1000
Diesel Range HC	NWTPH-Dx	mg/L	0.255 U	0.272 U	0.250 U	0.250 U	0.253 U	0.250 U	500
Lube Oil Range HC	NWTPH-Dx	mg/L	0.51 U	0.543 U	0.500 U	0.500 U	0.505 U	0.500 U	500
Total Metals									
Arsenic	EPA 6020	mg/L	na	0.00628	0.00381	0.001 U	0.005	0.0107	0.005
Cadmium	EPA 6020	mg/L	na	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005
Chromium	EPA 6020	mg/L	na	0.0078	0.00622	0.001 U	0.00538	0.00985	0.05
Copper	EPA 6020	mg/L	na	0.011	0.00316	0.00198	0.00791	0.00205	na

Chemical/Sample Information	Analytical Method	Unit	PGG-1[a] (6/13/06)	PGG-1[a] (6/14/06)	PGG-2	PGG-3	PGG-4	PGG-5	MTCA Method A
Lead	EPA 6020	mg/L	na	0.0168	0.00249	0.001 U	0.00324	0.001 U	0.015
Nickel	EPA 6020	mg/L	na	0.00598	0.0381	0.0134	0.00816	0.00247	na
Zinc	EPA 6020	mg/L	na	0.0747	0.36	0.0446	0.049	0.001 U	na
Dissolved Metals									
Arsenic	EPA 6020-Diss	mg/L	na	0.00577	0.00378	0.00103	0.0104	0.0104	0.005
Cadmium	EPA 6020-Diss	mg/L	na	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005
Chromium	EPA 6020-Diss	mg/L	na	0.00246	0.00455	0.00108	0.00892	0.00892	0.05
Copper	EPA 6020-Diss	mg/L	na	0.001 U	0.00173	0.00155	0.00138	0.00138	
Lead	EPA 6020-Diss	mg/L	na	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.015
Nickel	EPA 6020-Diss	mg/L	na	0.0031	0.0347	0.0111	0.0029	0.0029	na
Zinc	EPA 6020-Diss	mg/L	na	0.0249	0.435	0.0436	0.069	0.001 U	na
Polychlorinated Biphenyls									
Aroclor 1016	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1221	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1232	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1242	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1248	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1254	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1260	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1262	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Aroclor 1268	EPA 8082 Mod	µg/L	na	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	na
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.286	0.0943 U	0.0952 U	0.0943 U	na
2-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Acenaphthene	EPA 8270C-HVI	µg/L	0.115	0.138	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na

Chemical/Sample Information	Analytical Method	Unit	PGG-1[a] (6/13/06)	PGG-1[a] (6/14/06)	PGG-2	PGG-3	PGG-4	PGG-5	MTCA Method A
Acenaphthylene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Anthracene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Benzo(ghi)perylene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Fluoranthene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Fluorene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.111	0.0943 U	0.0952 U	0.0943 U	na
Naphthalene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.136	0.0943 U	0.0952 U	0.0943 U	na
Phenanthrene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Pyrene	EPA 8270C-HVI	µg/L	0.105 U	0.0952 U	0.0943 U	0.0943 U	0.0952 U	0.0943 U	na
Benzo(a)anthracene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Benzo(a)pyrene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Benzo(b)fluoranthene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Benzo(k)fluoranthene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Chrysene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Dibenz(a,h)anthracene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na
Indeno(1,2,3-cd)pyrene	EPA 8270C-HVI	µg/L	0.0105 U	0.00952 U	0.00943 U	0.00943 U	0.00952 U	0.00943 U	na

Source: (Pacific Groundwater Group 2007)

[a] PGG-1 sampled on 6/13 and 6/14 to collect volume requested by laboratory.

Green highlight – concentration exceeds MTCA Method A for groundwater

Yellow highlight – parameter detected

CSL – cleanup screening level

EPA – US Environmental Protection Agency

HC – hydrocarbons

HVI – high volume injection

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

µg/L – micrograms per liter

mg/L – milligram per liter

na – not applicable

NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable

NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
SQS – sediment quality standard
SAIC – Science Applications International Corporation
U – parameter not detected, associated number is the lab reporting limit

Table D-15b. Analytical summary of groundwater sampling, round 1, conducted June 13 and 14, 2006, PGG-6 through PGG-7

Chemical/Sample Information	Analytical Method	Unit	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Coordinates			N: 208572.89 E: 1267423.01	N: 208171.87 E: 1267534.03			
pH			6.87	6.44			
Temp		°C	13.21	14.34			
Dissolved Oxygen		mg/L	0.36	1.56			
Electrical Conductivity		mS/cm	0.496	0.457			
Oxidation Reduction Potential		mV	-117.6	-432.1			
Petroleum Hydrocarbons							
Gasoline Range HC	NWTPH-Gx/8021B	µg/L	50.0 U	50.0 U	na	na	1000
Benzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	na	na	5
Toluene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	na	na	1000
Ethylbenzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	na	na	700
Xylenes (total)	NWTPH-Gx/8021B	µg/L	1.000 U	1.000 U	na	na	1000
Diesel Range HC	NWTPH-Dx	mg/L	0.253 U	0.250 U	na	na	500
Lube Oil Range HC	NWTPH-Dx	mg/L	0.505 U	0.500 U	na	na	500
Total Metals							
Arsenic	EPA 6020	mg/L	0.00166	0.00206	0.37	0.227	0.005
Cadmium	EPA 6020	mg/L	0.001 U	0.001 U	0.0034	0.0026	0.005
Chromium	EPA 6020	mg/L	0.001 U	0.00127	0.318	0.306	0.05

Chemical/Sample Information	Analytical Method	Unit	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Copper	EPA 6020	mg/L	0.00112	0.00104	0.123	0.123	
Lead	EPA 6020	mg/L	0.001 U	0.001 U	0.013	0.011	0.015
Nickel	EPA 6020	mg/L	0.00255	0.00242	na	na	na
Zinc	EPA 6020	mg/L	0.001 U	0.001 U	0.076	0.033	na
Dissolved Metals							
Arsenic	EPA 6020-Diss	mg/L	0.00207	0.00234	0.37	0.227	0.005
Cadmium	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.0034	0.0026	0.005
Chromium	EPA 6020-Diss	mg/L	0.00149	0.00156	0.318	0.306	0.05
Copper	EPA 6020-Diss	mg/L	0.001	0.001 U	0.123	0.123	na
Lead	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.013	0.011	0.015
Nickel	EPA 6020-Diss	mg/L	0.00268	0.00213	na	na	na
Zinc	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.076	0.033	na
Polychlorinated Biphenyls							
Aroclor 1016	EPA 8082 Mod	µg/L	0.100 U	0.100 U	2.4	0.44	na
Aroclor 1221	EPA 8082 Mod	µg/L	0.100 U	0.100 U	na	na	na
Aroclor 1232	EPA 8082 Mod	µg/L	0.100 U	0.100 U	na	na	na
Aroclor 1242	EPA 8082 Mod	µg/L	0.100 U	0.100 U	na	na	na
Aroclor 1248	EPA 8082 Mod	µg/L	0.100 U	0.100 U	1.5	0.27	na
Aroclor 1254	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.86	0.16	na
Aroclor 1260	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.31	0.058	na
Aroclor 1262	EPA 8082 Mod	µg/L	0.100 U	0.100 U	na	na	na

Chemical/Sample Information	Analytical Method	Unit	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Aroclor 1268	EPA 8082 Mod	µg/L	0.100 U	0.100 U	na	na	na
PAHs							
1-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	na	na	na
2-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	7.1	7.1	na
Acenaphthene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	9.3	2.6	na
Acenaphthylene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	11	11	na
Anthracene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	59	11	na
Benzo(ghi)perylene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	0.029	0.012	na
Fluoranthene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	17	2.3	na
Fluorene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	7	2	na
Naphthalene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	92	54	na
Phenanthrene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	23	4.8	na
Pyrene	EPA 8270C-HVI	µg/L	0.0943 U	0.0943 U	20	14	na
Benzo(a)anthracene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.63	0.26	na
Benzo(a)pyrene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.27	0.13	na
Benzo(b)fluoranthene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.56	0.29	na
Benzo(k)fluoranthene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.57	0.29	na
Chrysene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	1.9	0.47	na
Dibenz(a,h)anthracene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.013	0.0046	na
Indeno(1,2,3-cd)pyrene	EPA 8270C-HVI	µg/L	0.00943 U	0.00943 U	0.033	0.013	na

Source: (Pacific Groundwater Group 2007)

Green highlight – concentration exceeds MTCA Method A for groundwater

Yellow highlight – parameter detected

CSL – cleanup screening level
EPA – US Environmental Protection Agency
HC – hydrocarbons
HVI – high volume injection
J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results
µg/L – micrograms per liter
mg/L – milligram per liter
MTCA – Model Toxics Control Act
na – not applicable
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
PAH – Polycyclic Aromatic Hydrocarbon
SQS – sediment quality standard
SAIC – Science Applications International Corporation
U – parameter not detected, associated number is the lab reporting limit

Table D-16. Analytical summary of groundwater sampling, round 2, conducted September 19 and 20, 2006

Chemical/Sample Information	Analytical Method	Unit	PGG-2	PGG-3	PGG-5	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Coordinates			N: 208857.20 E: 1267450.88	N: 208484.34 E: 1267594.69	N: 208967.95 E: 1267349.68	N: 208572.89 E: 1267423.01	N: 08171.87 E:1267534.03			
pH			6.33	6.34	6.70	6.48	6.56			
Temp		°C	16.63	16.57	12.83	15.79	16.17			
Dissolved Oxygen		mg/L	0.9	0.53	0.56	0.92	0.47			
Electrical Conductivity		mS/cm	1.682	1.697	1.841	1.714	1.717			
Oxidation Reduction Potential		mV	-72.8	47.2	-154.5	19.3	-47.9			
Petroleum Hydrocarbons										
Gasoline Range HC	NWTPH-Gx/8021B	µg/L	80.0 U	80.0 U	80.0 U	80.0 U	80.0 U	na	na	1000
Benzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	na	na	5
Toluene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	na	na	1000
Ethylbenzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	na	na	700
Xylenes (total)	NWTPH-Gx/8021B	µg/L	1.000 U	1.000 U	1.000 U	1.000 U	1.000 U	na	na	1000
Diesel Range HC	NWTPH-Dx	mg/L	0.284 U	0.269 U	0.240 U	0.243 U	0.269 U	na	na	500
Lube Oil Range HC	NWTPH-Dx	mg/L	0.568 U	0.472 U	0.481 U	0.485 U	0.472 U	na	na	500
Total Metals										
Arsenic	EPA 6020	mg/L	0.00538	0.00156	0.00205	0.00228	0.00168	0.37	0.227	0.005
Cadmium	EPA 6020	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0034	0.0026	0.005

Chemical/Sample Information	Analytical Method	Unit	PGG-2	PGG-3	PGG-5	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Chromium	EPA 6020	mg/L	0.0135	0.001 U	0.0135	0.001 U	0.001 U	0.318	0.306	0.05
Copper	EPA 6020	mg/L	0.00533	0.001 U	0.00204	0.001 U	0.001 U	0.123	0.123	
Lead	EPA 6020	mg/L	0.0073	0.001 U	0.001 U	0.001 U	0.001 U	0.013	0.011	0.015
Nickel	EPA 6020	mg/L	0.00948	0.00698	0.00637	0.00237	0.00144	na	na	
Zinc	EPA 6020	mg/L	0.0692	0.0101	0.0155	0.001 U	0.001 U	0.076	0.033	
Dissolved Metals										
Arsenic	EPA 6020-Diss	mg/L	0.00611	0.00188	0.00194	0.00208	0.00149	0.37	0.227	0.005
Cadmium	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0034	0.0026	0.005
Chromium	EPA 6020-Diss	mg/L	0.0111	0.00166	0.0143	0.001 U	0.001 U	0.318	0.306	0.05
Copper	EPA 6020-Diss	mg/L	0.00136	0.001 U	0.00149	0.001 U	0.001 U	0.123	0.123	
Lead	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013	0.011	0.015
Nickel	EPA 6020-Diss	mg/L	0.0062	0.0059	0.0043	0.00221	0.001 U	na	na	
Zinc	EPA 6020-Diss	mg/L	0.0129	0.001 U	0.001 U	0.001 U	0.001 U	0.076	0.033	
Polychlorinated Biphenyls										
Aroclor 1016	EPA 8082 Mod	µg/L	0.638 R	0.100 U	0.100 U	0.100 U	0.100 U	2.4	0.44	0.1
Aroclor 1221	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	na	na	0.1
Aroclor 1232	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	na	na	0.1

Chemical/Sample Information	Analytical Method	Unit	PGG-2	PGG-3	PGG-5	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Aroclor 1242	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	na	na	0.1
Aroclor 1248	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	1.5	0.27	0.1
Aroclor 1254	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	0.86	0.16	0.1
Aroclor 1260	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	0.31	0.058	0.1
Aroclor 1262	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	na	na	0.1
Aroclor 1268	EPA 8082 Mod	µg/L	0.100 UJ	0.100 U	0.100 U	0.100 U	0.100 U	na	na	0.1
PAHs										
1-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	na	na	
2-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	7.1	7.1	
Acenaphthene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	9.3	2.6	
Acenaphthylene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	11	11	
Anthracene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	59	11	
Benzo(ghi)perylene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	0.029	0.012	
Fluoranthene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	17	2.3	
Fluorene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	7	2	

Chemical/Sample Information	Analytical Method	Unit	PGG-2	PGG-3	PGG-5	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Naphthalene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	92	54	
Phenanthrene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	23	4.8	
Pyrene	EPA 8270C-HVI	µg/L	0.204 U	0.0943 U	0.0943 U	0.0943 U	0.0943 U	20	14	
Benzo(a)anthracene	EPA 8270C-HVI	µg/L	0.0204 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.63	0.26	
Benzo(a)pyrene	EPA 8270C-HVI	µg/L	0.0204 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.27	0.13	
Benzo(b)fluoranthene	EPA 8270C-HVI	µg/L	0.171 R	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.56	0.29	
Benzo(k)fluoranthene	EPA 8270C-HVI	µg/L	0.129 R	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.57	0.29	
Chrysene	EPA 8270C-HVI	µg/L	0.0204 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	1.9	0.47	
Dibenz(a,h)anthracene	EPA 8270C-HVI	µg/L	0.177 R	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.013	0.0046	
Indeno(1,2,3-cd)pyrene	EPA 8270C-HVI	µg/L	0.16 R	0.00943 U	0.00943 U	0.00943 U	0.00943 U	0.033	0.013	
Toxicity Equivalency Calculations	**Factor**									
Benzo(a)anthracene	0.1	µg/L	0.00	0.00	0.00	0.00	0.00	na	na	
Benzo(a)pyrene	1	µg/L	0.00	0.00	0.00	0.00	0.00	na	na	
Benzo(b)fluoranthene	0.1	µg/L	0.017 R	0.00	0.00	0.00	0.00	na	na	
Benzo(k)fluoranthene	0.1	µg/L	0.0129 R	0.00	0.00	0.00	0.00	na	na	
Chrysene	0.01	µg/L	0.00	0.00	0.00	0.00	0.00	na	na	
Dibenz(a,h)anthracene	0.4	µg/L	0.0708 R	0.00	0.0620	0.00	0.00	na	na	

Chemical/Sample Information	Analytical Method	Unit	PGG-2	PGG-3	PGG-5	PGG-6	PGG-7	SAIC Ground-water Based on CSL	Screening Levels Based on SQS	MTCA Method A
Indeno(1,2,3-cd)pyrene	0.1	µg/L	0.016 R	0.00	0.0132	0.00	0.00	na	na	
Total Toxicity Equivalency Concentrations (µg/L)			0.1167 R	0.00	0.0756	0.00	0.00	na	na	

Source: (Pacific Groundwater Group 2007)

PGG-1: coordinates N: 209009.53 E: 1267978.45, sample was dry, sampled on 6/13 and 6/14 to collect volume requested by lab.

PGG-4: coordinates N: 208550.85 E: 1268179.67, sample was dry

Green highlight – concentration exceeds MTCA Method A for groundwater

Yellow highlight – parameter detected

CSL – cleanup screening level

EPA – US Environmental Protection Agency

HC – hydrocarbons

HVI – high volume injection

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

µg/L – micrograms per liter

mg/L – milligram per liter

mS/cm – milliSiemens per centimeter

MTCA – Model Toxics Control Act

mV – millivolts

PGG – Pacific Groundwater Group

R – analytical result rejected based on unrepresentative sample quality and poor data quality, as the sample did not meet Standard Operating Procedures.

SAIC – Science Applications International Corporation

SQS – sediment quality standard

NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable

NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable

U – parameter not detected, associated # is the lab reporting limit

UJ – parameter not detected at the associated reporting limit; analysis performed 44 days outside holding time

Table D-17. Analytical summary of groundwater sampling, round 3, conducted February 19 and 20, 2007

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Coordinates			N: 208967.95 E:1267349.68	N: 208572.89 E:1267423.01	N: 208171.87 E: 1267534.03		
pH			6.44	6.43	6.24		
Temp		°C	12.33	11.76	10.78		
Dissolved Oxygen		mg/L	0.55	0.66	0.56		
Electrical Conductivity		mS/cm	3.486	1.505	0.646		
Oxidation Reduction Potential		mV	-130.6	-177	-90.6		
Petroleum Hydrocarbons							
Gasoline Range	NWTPH-Gx/8021B	µg/L	50.0 U	50.0 U	50.0 U	na	na
Benzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Toluene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Ethylbenzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Xylenes (total)	NWTPH-Gx/8021B	µg/L	1.000 U	1.000 U	1.000 U	na	na
Diesel Range	NWTPH-Dx	mg/L	0.236 U	0.248 U	0.243 U	na	na
Lube Oil Range	NWTPH-Dx	mg/L	0.472 U	0.495 U	0.485 U	na	na
Total Metals							
Arsenic	EPA 6020	mg/L	0.00172	0.00100 U	0.00115	0.37	0.227
Barium	EPA 6020	mg/L	0.04900	0.01000 U	0.01000 U	na	na
Cadmium	EPA 6020	mg/L	0.00100 U	0.00100 U	0.00100 U	0.0034	0.0026
Chromium	EPA 6020	mg/L	0.00884	0.00100 U	0.00149	0.318	0.306
Copper	EPA 6020	mg/L	0.00158	0.00322	0.00100 U	0.123	0.123
Iron	EPA 6010B	mg/L	105.0 J	9.37000 J	10.6 J	na	na
Lead	EPA 6020	mg/L	0.00100 U	0.00100 U	0.00100 U	0.013	0.011

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Manganese	EPA 6020	mg/L	4.21 J	0.40800 J	0.291 J	na	na
Nickel	EPA 6020	mg/L	0.00100 U	0.00324	0.00133	na	na
Zinc	EPA 6020	mg/L	0.01000 U	0.01110	0.01000 U	0.076	0.033
Mercury	EPA 7470A	mg/L	0.00020 U	0.00020 U	0.00020 U	0.0000074	0.0000052
Dissolved Metals							
Arsenic	EPA 6020-Diss	mg/L	0.00157	0.00100	0.00118	0.37	0.227
Barium	EPA 6020-Diss	mg/L	0.0400	0.01000 U	0.01000 U	na	na
Cadmium	EPA 6020-Diss	mg/L	0.00100 U	0.00100 U	0.00100 U	0.0034	0.0026
Chromium	EPA 6020-Diss	mg/L	0.0105	0.00215	0.00177	0.318	0.306
Copper	EPA 6020-Diss	mg/L	0.00100 U	0.00209	0.00100 U	0.123	0.123
Iron	EPA 6010B-Diss	mg/L	37.8 J	9.07 J	11.8 J	na	na
Lead	EPA 6020-Diss	mg/L	0.00100 U	0.00100 U	0.00100 U	0.013	0.011
Manganese	EPA 6020-Diss	mg/L	4.01 J	0.43000	0.272	na	na
Nickel	EPA 6020-Diss	mg/L	0.00100 U	0.00304	0.00119	na	na
Zinc	EPA 6020-Diss	mg/L	0.01000 U	0.01000 U	0.01000 U	0.076	0.033
Mercury	EPA 7470A-Diss	mg/L	0.00020 U	0.00020 U	0.00020 U	0.0000074	0.0000052
Polychlorinated Biphenyls							
Aroclor 1016	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	2.4	0.44
Aroclor 1221	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1232	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1242	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1248	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	1.5	0.27
Aroclor 1254	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.86	0.16
Aroclor 1260	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.31	0.058
Aroclor 1262	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Aroclor 1268	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Polycyclic Aromatic Compounds							
Acenaphthene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	9.3	2.6
Acenaphthylene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	11	11
Anthracene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	59	11
Benzo(a)anthracene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	0.63	0.26
Benzo(a)pyrene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	0.27	0.13
Benzo(b)fluoranthene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	0.56	0.29
Benzo(k)fluoranthene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	0.57	0.29
Benzo(ghi)perylene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	0.029	0.012
Chrysene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	1.9	0.47
Dibenz(a,h)anthracene	EPA 8270C-HVI	µg/L	0.0099 U	0.0098 U	0.0099 U	0.013	0.0046
Fluoranthene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	17	2.3
Fluorene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	7	2
Indeno(1,2,3-cd)pyrene	EPA 8270C-HVI	µg/L	0.0099 U	0.0980 U	0.0099 U	0.033	0.013
1-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	na	na
2-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	31	18
Naphthalene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	92	54
Phenanthrene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	23	4.8
Pyrene	EPA 8270C-HVI	µg/L	0.0990 U	0.0980 U	0.0990 U	20	14

Source: (Pacific Groundwater Group 2007)

Green highlight – concentration exceeds MTCA Method A for groundwater

Yellow highlight – parameter detected

CSL – cleanup screening level

EPA – US Environmental Protection Agency

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

µg/L – micrograms per liter
mg/L – milligram per liter
mS/cm – milliSiemens per centimeter
MTCA – Model Toxics Control Act
mV – millivolts
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
PGG – Pacific Groundwater Group
SQS – sediment quality standard
SAIC – Science Applications International Corporation
U – parameter not detected, associated # is the lab reporting limit

Table D-18. Analytical summary of groundwater sampling, round 4, conducted May 29 and 30, 2007

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Coordinates			N: 208967.95 E: 1267349.68	N: 208572.89 E: 1267423.01	N: 208171.87 E: 1267534.03	na	na
pH			6.14	6.13	6.00	na	na
Temp		°C	12.94	13.33	14.15	na	na
Dissolved Oxygen		mg/L	1.73	1.22	1.13	na	na
Electrical Conductivity		mS/cm	2.352	0.7	0.318	na	na
Oxidation Reduction Potential		mV	-151.9	-52.2	-77.6	na	na
Petroleum Hydrocarbons						na	na
Gasoline Range	NWTPH-Gx/8021B	µg/L	50.0 U	50.0 U	50.0 U	na	na
Benzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Toluene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Ethylbenzene	NWTPH-Gx/8021B	µg/L	0.500 U	0.500 U	0.500 U	na	na
Xylenes (total)	NWTPH-Gx/8021B	µg/L	1.000 U	1.000 U	1.000 U	na	na
Diesel Range	NWTPH-Dx	mg/L	0.236 U	0.236 U	0.236 U	na	na
Lube Oil Range	NWTPH-Dx	mg/L	0.472 U	0.472 U	0.472 U	na	na
Total Metals						na	na
Arsenic	EPA 6020	mg/L	0.00164	0.0012	0.0015	0.37	0.227
Cadmium	EPA 6020	mg/L	0.001 U	0.001 U	0.001 U	0.0034	0.0026
Chromium	EPA 6020	mg/L	0.012	0.001 U	0.001 U	0.318	0.306
Copper	EPA 6020	mg/L	0.00136	0.00122	0.001 U	0.123	0.123
Lead	EPA 6020	mg/L	0.001 U	0.001 U	0.001 U	0.013	0.011
Nickel	EPA 6020	mg/L	0.00119	0.00159	0.001 U	na	na
Zinc	EPA 6020	mg/L	0.01 U	0.01 U	0.01 U	0.076	0.033

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Mercury	EPA 7470A	mg/L	0.005 U	0.005 U	0.005 U	0.0074	0.0052
Dissolved Metals							
Arsenic	EPA 6020-Diss	mg/L	0.00161	0.00132	0.00107	0.37	0.227
Cadmium	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.001 U	0.0034	0.0026
Chromium	EPA 6020-Diss	mg/L	0.0118	0.00161	0.00138	0.318	0.306
Copper	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.001 U	0.123	0.123
Lead	EPA 6020-Diss	mg/L	0.001 U	0.001 U	0.001 U	0.013	0.011
Nickel	EPA 6020-Diss	mg/L	0.001 U	0.00136	0.001 U	na	na
Zinc	EPA 6020-Diss	mg/L	0.01 U	0.01 U	0.01 U	0.076	0.033
Mercury	EPA 7470A-Diss	mg/L	0.005 U	0.005 U	0.005 U	0.0074	0.0052
Polychlorinated Biphenyls							
Aroclor 1016	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	2.4	0.44
Aroclor 1221	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1232	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1242	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1248	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	1.5	0.27
Aroclor 1254	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.86	0.16
Aroclor 1260	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	0.31	0.058
Aroclor 1262	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Aroclor 1268	EPA 8082 Mod	µg/L	0.100 U	0.100 U	0.100 U	na	na
Polynuclear Aromatic Compounds							
Acenaphthene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	9.3	2.6
Acenaphthylene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	11	11
Anthracene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	59	11

Chemical/Sample Information	Analytical Method	Unit	PGG-5	PGG-6	PGG-7	SAIC Groundwater Based on CSL	Screening Levels Based on SQS
Benzo(a)anthracene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.63	0.26
Benzo(a)pyrene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.27	0.13
Benzo(b)fluoranthene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.56	0.29
Benzo(k)fluoranthene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.57	0.29
Benzo(ghi)perylene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	0.029	0.012
Chrysene	EPA 8270C-HVI	µg/L	0.472 U	0.00943 U	0.00943 U	1.9	0.47
Dibenz(a,h)anthracene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.013	0.0046
Fluoranthene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	17	2.3
Fluorene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	7	2
Indeno(1,2,3-cd)pyrene	EPA 8270C-HVI	µg/L	0.0472 U	0.00943 U	0.00943 U	0.033	0.013
1-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.472 U	0.0943	0.0943	na	na
2-Methylnaphthalene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	31	18
Naphthalene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	92	54
Phenanthrene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	23	4.8
Pyrene	EPA 8270C-HVI	µg/L	0.472 U	0.0943 U	0.0943 U	20	14

Source: (Pacific Groundwater Group 2007)

Green highlight – concentration exceeds MTCA Method A for groundwater

Yellow highlight – parameter detected

CSL – cleanup screening level

EPA – US Environmental Protection Agency

J – parameter detected at the reported concentration; result qualifies as "estimated" due to unacceptable QA results

HVI – high volume injected

µg/L – micrograms per liter

mg/L – milligrams per liter

mS/cm – milliSiemens per centimeter

MTCA – Model Toxics Control Act

mV – millivolts

na – not applicable

NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable

NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable

PGG – Pacific Groundwater Group

SAIC – Science Applications International Corporation

SIM – Simultaneous Ion Monitoring

SQS – sediment quality standard

U – parameter not detected, associated # is the lab reporting limit

Table D-19. Historical groundwater sample results for PCBs conducted October 11, 1991 and January 18, 1992

Sample ID	Date	Aroclor 1016 8080 (µg/L)	Aroclor 1221 8080 (µg/L)	Aroclor 1232 8080 (µg/L)	Aroclor 1242 8080 (µg/L)	Aroclor 1248 8080 (µg/L)	Aroclor 1254 8080 (µg/L)	Aroclor 1260 8080 (µg/L)
C-1	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-1	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-2	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-2	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-3	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-3	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-4	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-4	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-5	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-5	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-6	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
C-6	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-7	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-7	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-8	10/12/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-8	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-9	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-9	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-10	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-10	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-11	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-11	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-12	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

Sample ID	Date	Aroclor 1016 8080 (µg/L)	Aroclor 1221 8080 (µg/L)	Aroclor 1232 8080 (µg/L)	Aroclor 1242 8080 (µg/L)	Aroclor 1248 8080 (µg/L)	Aroclor 1254 8080 (µg/L)	Aroclor 1260 8080 (µg/L)
MW-12	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-13	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-13	1/17/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-14	10/11/1991	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MW-14	1/18/1992	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

Source: (Pacific Groundwater Group 2006)

Green highlight – concentration exceeds MTCA Method A Unrestricted and/or Industrial Cleanup Level (WAC-173-340)

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

µg/L – micrograms per liter

MTCA Method A: 0.1

MW – monitoring well

U – parameter not detected; associated # is laboratory detection limit

PCB –Polychlorinated Biphenyls

Table D-20a. Historical groundwater sample results for PAHs conducted October 11 and 12, 1991: C-1 through C-6

Chemical/Sample Information	Analytical Method	C-1 (µg/L)	C-2 (µg/L)	C-3 (µg/L)	C-4 (µg/L)	C-5 (µg/L)	C-6 (µg/L)
Naphthalene	8310	1.6 U	1.6 U	1.6 U	1.6 U	3	1.6 U
Acenaphthylene	8310	1.3	0.25 U	0.25 U	7.6	0.25 U	0.25 U
Acenaphthene	8310	0.17 U	0.21	0.17 U	0.17	0.17 U	0.17 U
Fluorene	8310	0.09 U	0.09 U	0.09 U	0.09 U	0.5	0.09 U
Phenanthrene	8310	0.66	0.13	0.2	0.12 U	0.16	0.12 U
Anthracene	8310	0.19	0.11	0.38	0.1 U	0.28	0.1 U
Fluoranthene	8310	0.6	0.22	0.38	0.16 U	0.16 U	0.16 U
Pyrene	8310	0.65	0.14	0.37	0.14 U	0.14 U	0.14 U
Benzo(a)anthracene	8310	0.28	0.12	0.25	0.057 U	0.057 U	0.057 U
Chrysene	8310	0.42	0.16	0.3	0.051 U	0.051 U	0.051 U
Benzo(b)fluoranthene	8310	0.099	0.16	0.3	0.072 U	0.072 U	0.072 U
Benzo(k)fluoranthene	8310	0.2	0.12	0.3	0.068 U	0.068 U	0.068 U
Benzo(a)pyrene	8310	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U
Dibenzo(a,h)anthracene	8310	0.27	0.21	0.12	0.084 U	0.084 U	0.084 U
Benzo(g,h,i)perylene	8310	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U
Indeno(1,2,3-cd)pyrene	8310	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Toxicity Equivalent Concentrations	**TEF**						
Benzo(a)anthracene	0.1	0.042	0.016	0.03	0.00255	0.00255	0.00255
Benzo(a)pyrene	1	0.099	0.16	0.3	0.036	0.036	0.036
Benzo(b)fluoranthene	0.1	0.02	0.012	0.03	0.0034	0.0034	0.0034
Benzo(k)fluoranthene	0.1	0.00075	0.00075	0.00075	0.00075	0.00075	0.00075

CHEMICAL/SAMPLE INFORMATION	ANALYTICAL METHOD	C-1 (µG/L)	C-2 (µG/L)	C-3 (µG/L)	C-4 (µG/L)	C-5 (µG/L)	C-6 (µG/L)
Chrysene	0.01	0.0027	0.0021	0.0012	0.00042	0.00042	0.00042
Dibenzo(a,h)anthracene	0.4	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168
Indeno(1,2,3-cd)pyrene	0.1	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048
Total cPAH Toxicity Equivalent Concentrations (TEQ)		0.19	0.21	0.38	0.06	0.06	0.06
MTCA Method C Total cPAH Cleanup Level (µg/L):		0.12	0.12	0.12	0.12	0.12	0.12

Source: (Pacific Groundwater Group 2006)

Green highlight **–** concentration exceeds MTCA Method C for groundwater

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

cPAH – carcinogenic Polycyclic Aromatic Hydrocarbon

µg/L – micrograms per liter

TEF – Toxicity Equivalency Factor

TEQ – toxic equivalent

U – parameter not detected; associated # is laboratory detection limit

Table D-20b. Historical groundwater sample results for PAHs conducted October 11 and 12, 1991: Sample locations MW-7 through MW-14

Chemical/Sample Information	Analytical Method	MW-7 (µg/L)	MW-8 (µg/L)	MW-9 (µg/L)	MW-10 (µg/L)	MW-11 (µg/L)	MW-12 (µg/L)	MW-13 (µg/L)	MW-14 (µg/L)	MTCA Method C Individual Non-Carcinogenic Cleanup Level
Naphthalene100	8310	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	350
Acenaphthylene	8310	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	na
Acenaphthene	8310	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	2100
Fluorene	8310	0.09 U	0.09 U	0.29	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	1400
Phenanthrene	8310	0.12 U	0.12 U	0.72	0.5	0.12 U	0.12 U	0.12 U	0.12 U	na
Anthracene	8310	0.1 U	0.1 U	0.26	0.45	0.1 U	0.1 U	0.1 U	0.1 U	5250
Fluoranthene	8310	0.16 U	0.16 U	0.21	0.95	0.16 U	0.16 U	0.16 U	0.16 U	1400
Pyrene	8310	0.14 U	0.14 U	0.15	0.81	0.14 U	0.14 U	0.14 U	0.14 U	1050
Benzo(a)anthracene	8310	0.057 U	0.057 U	0.057 U	0.21	0.057 U	0.057 U	0.057 U	0.057 U	na
Chrysene	8310	0.051 U	0.051 U	0.051 U	0.44	0.051 U	0.051 U	0.051 U	0.054	na
Benzo(b)fluoranthene	8310	0.072 U	0.072 U	0.072 U	0.32	0.072 U	0.072 U	0.072 U	0.072 U	na
Benzo(k)fluoranthene	8310	0.068 U	0.068 U	0.068 U	0.3	0.068 U	0.068 U	0.068 U	0.068 U	na
Benzo(a)pyrene	8310	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	na
Dibenzo(a,h)anthracene	8310	0.084 U	0.084 U	0.6	0.21	0.084 U	0.084 U	0.084 U	0.084 U	na
Benzo(g,h,i)perylene	8310	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	na
Indeno(1,2,3-cd)pyrene	8310	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	na
Toxicity Equivalent Concentrations	**TEF**									
Benzo(a)anthracene	0.1	0.00255	0.00255	0.00255	0.044	0.00255	0.00255	0.00255	0.0054	na
Benzo(a)pyrene	1	0.036	0.036	0.036	0.32	0.036	0.036	0.036	0.036	na

Chemical/Sample Information	Analytical Method	MW-7 (µg/L)	MW-8 (µg/L)	MW-9 (µg/L)	MW-10 (µg/L)	MW-11 (µg/L)	MW-12 (µg/L)	MW-13 (µg/L)	MW-14 (µg/L)	MTCA Method C Individual Non-Carcinogenic Cleanup Level
Benzo(b)fluoranthene	0.1	0.0034	0.0034	0.0034	0.03	0.0034	0.0034	0.0034	0.0034	na
Benzo(k)fluoranthene	0.1	0.00075	0.00075	0.00075	0.00075	0.00075	0.00075	0.00075	0.00075	na
Chrysene	0.01	0.00042	0.00042	0.006	0.0021	0.00042	0.00042	0.00042	0.00042	na
Dibenzo(a,h)anthracene	0.4	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	na
Indeno(1,2,3-cd)pyrene	0.1	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	0.0048	na
Total cPAH Toxicity Equivalent Concentrations (TEQ)		0.06	0.06	0.07	0.42	0.06	0.06	0.06	0.07	na
MTCA Method C Total cPAH Cleanup Level (µg/L):		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	na

Source: (Pacific Groundwater Group 2006)

Green highlight **–** concentration exceeds MTCA Method C for groundwater

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

cPAH – carcinogenic Polycyclic Aromatic Hydrocarbon

µg/L – micrograms per liter

MTCA – Model Toxics Control Act

na – not applicable

PAH – Polycyclic Aromatic Hydrocarbon

TEF – Toxicity Equivalency Factor

TEQ – toxic equivalent

U – parameter not detected; associated # is laboratory detection limit

Table D-21a. Historical groundwater sample results for PAHs conducted January 17 and 18, 1992: Sample locations C-1 through C-6

Chemical/Sample Information	Analytical Method	C-1 (µg/L)	C-2 (µg/L)	C-3 (µg/L)	C-4 (µg/L)	C-5 (µg/L)	C-6 (µg/L)
Naphthalene	8310	0.14 U	0.14 U	0.14 U	0.14 U	1.3	0.14 U
Acenaphthylene	8310	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U
Acenaphthene	8310	0.02 U	0.02 U	0.16	0.02 U	0.02 U	0.02 U
Fluorene	8310	0.013 U	0.013 U	0.026	0.013 U	0.22	0.013 U
Phenanthrene	8310	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Anthracene	8310	0.014 U	0.014 U	0.027	0.014 U	0.03	0.014 U
Fluoranthene	8310	0.025 U	0.046	0.06	0.025 U	0.055	0.025 U
Pyrene	8310	0.014 U	0.084	0.11	0.014 U	0.041	0.014 U
Benzo(a)anthracene	8310	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Chrysene	8310	0.011 U	0.016	0.035	0.011 U	0.011 U	0.011 U
Benzo(b)fluoranthene	8310	0.012 U	0.02	0.02	0.012 U	0.012 U	0.012 U
Benzo(k)fluoranthene	8310	0.013 U	0.038	0.013 U	0.013 U	0.013 U	0.013 U
Benzo(a)pyrene	8310	0.011 U	0.015	0.011 U	0.011 U	0.011 U	0.011 U
Dibenzo(a,h)anthracene	8310	0.013 U	0.013 U	0.023	0.013 U	0.013 U	0.013 U
Benzo(g,h,i)perylene	8310	0.011 U	0.028	0.011 U	0.011 U	0.011 U	0.011 U
Indeno(1,2,3-cd)pyrene	8310	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Toxicity Equivalent Concentrations	**TEF**						
Benzo(a)anthracene	0.1	0.00055	0.0016	0.0035	0.00055	0.00055	0.00055
Benzo(a)pyrene	1	0.006	0.02	0.02	0.006	0.006	0.006
Benzo(b)fluoranthene	0.1	0.00065	0.0038	0.00065	0.00065	0.00065	0.00065
Benzo(k)fluoranthene	0.1	0.00055	0.0015	0.00055	0.00055	0.00055	0.00055

Chemical/Sample Information	Analytical Method	C-1 (µg/L)	C-2 (µg/L)	C-3 (µg/L)	C-4 (µg/L)	C-5 (µg/L)	C-6 (µg/L)
Chrysene	0.01	0.000065	0.000065	0.00023	0.000065	0.000065	0.000065
Dibenzo(a,h)anthracene	0.4	0.0022	0.0112	0.0022	0.0022	0.0022	0.0022
Indeno(1,2,3-cd)pyrene	0.1	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Total cPAH Toxicity Equivalent Concentrations		0.01	0.04	0.03	0.01	0.01	0.01
MTCA Method C Total cPAH Cleanup Level (µg/L):		0.12	0.12	0.12	0.12	0.12	0.12

Source: (Pacific Groundwater Group 2006)

Green highlight – concentration exceeds MTCA Method C for groundwater

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

cPAH – carcinogenic Polycyclic Aromatic Hydrocarbon

µg/L – micrograms per liter

MTCA – Model Toxics Control Act

na – not applicable

PAH – Polycyclic Aromatic Hydrocarbon

TEF – Toxicity Equivalency Factor

U – parameter not detected; associated # is laboratory detection limit

Table D-21b. Historical groundwater sample results for PAHs conducted January 17 and 18, 1992: Sample locations MW-7 through MW-14

Chemical/Sample Information	Analytical Method	MW-7 (µG/L)	MW-8 (µG/L)	MW-9 (µG/L)	MW-10 (µG/L)	MW-11 (µG/L)	MW-12 (µG/L)	MW-13 (µG/L)	MW-14 (µG/L)	MTCA Method C Individual Non-Carcinogenic Cleanup Level
Naphthalene	8310	0.14 U	0.14 U	0.56	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	350
Acenaphthylene	8310	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.9	na
Acenaphthene	8310	0.041	0.09	0.02 U	0.02 U	0.02 U	0.17	0.02 U	0.02 U	2100
Fluorene	8310	0.028	0.049	0.13	0.013 U	0.013 U	0.057	0.013 U	0.029	1400
Phenanthrene	8310	0.022	0.065	0.13	0.019 U	0.019 U	0.041	0.019 U	0.022	na
Anthracene	8310	0.014 U	0.015	0.014 U	0.014 U	0.014 U	0.019	0.014 U	0.017	5250
Fluoranthene	8310	0.025 U	0.035	0.025 U	0.027	0.025 U	0.029	0.025 U	0.046	1400
Pyrene	8310	0.014 U	0.036	0.014 U	0.022	0.014 U	0.04	0.014 U	0.033	1050
Benzo(a)anthracene	8310	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.068	na
Chrysene	8310	0.011 U	0.016	0.011 U	0.011 U	0.011 U	0.012	0.011 U	0.035	na
Benzo(b)fluoranthene	8310	0.012 U	0.012	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.029	na
Benzo(k)fluoranthene	8310	0.017	0.015	0.013 U	0.013 U	0.013 U	0.014	0.029	0.058	na
Benzo(a)pyrene	8310	0.011 U	0.013	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.072	na
Dibenzo(a,h)anthracene	8310	0.013 U	0.016	0.013 U	0.013 U	0.013 U	0.013 U	0.013 U	0.054	na
Benzo(g,h,i)perylene	8310	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.084	na
Indeno(1,2,3-cd)pyrene	8310	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.063	na
Toxicity Equivalent Concentrations	**TEF**									
Benzo(a)anthracene	0.1	0.00055	0.0016	0.00055	0.00055	0.00055	0.0012	0.00055	0.0035	na
Benzo(a)pyrene	1	0.006	0.012	0.006	0.006	0.006	0.006	0.006	0.029	na
Benzo(b)fluoranthene	0.1	0.0017	0.0015	0.00065	0.0015	0.00065	0.0014	0.0029	0.0058	na
Benzo(k)fluoranthene	0.1	0.00055	0.0013	0.00055	0.00055	0.00055	0.00055	0.00055	0.0072	na

Chemical/Sample Information	Analytical Method	MW-7 (µG/L)	MW-8 (µG/L)	MW-9 (µG/L)	MW-10 (µG/L)	MW-11 (µG/L)	MW-12 (µG/L)	MW-13 (µG/L)	MW-14 (µG/L)	MTCA Method C Individual Non-Carcinogenic Cleanup Level
Chrysene	0.01	0.000065	0.00016	0.000065	0.000065	0.000065	0.000065	0.000065	0.00054	na
Dibenzo(a,h)anthracene	0.4	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0336	na
Indeno(1,2,3-cd)pyrene	0.1	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0063	na
Total cPAH Toxicity Equivalent Concentrations		0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	na
MTCA Method C Total cPAH Cleanup Level (µg/L):		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	na

Source: (Pacific Groundwater Group 2006)

Green highlight – concentration exceeds MTCA Method C for groundwater

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

cPAH – carcinogenic Polycyclic Aromatic Hydrocarbon

µg/L – micrograms per liter

MTCA – Model Toxics Control Act

na – not applicable

PAH – Polycyclic Aromatic Hydrocarbon

TEF – Toxicity Equivalency Factor

U – parameter not detected; associated # is laboratory detection limit

Table D-22. Historical groundwater sample results for TPHs conducted October 11, 1991 and January 18, 1992

Sample ID	Date	Gasoline (µG/L)	Mineral Spirits (µg/L)	Kerosene (µg/L)	Jet Fuel (µg/L)	Diesel (µg/L)	Fuel Oil #6 (µg/L)	Lubricating Oil (µg/L)	Benzene (µg/L)	Ethyl benzene (µg/L)	Toluene (µg/L)	Total Xylenes (µg/L)
C-1	10/11/1991	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-2	10/11/1991	10 U	10 U	10 U	10 U	160	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-3	10/11/1991	10 U	10 U	10 U	10 U	40	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-4	10/11/1991	10 U	10 U	10 U	10 U	53	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-5	10/11/1991	57	10 U	10 U	10 U	130	10 U	100 U	0.9	3	0.6	3
C-6	10/11/1991	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-7	10/11/1991	27	10 U	10 U	10 U	53	10 U	100 U	0.3 U	0.3 U	0.6	0.7
MW-8	10/11/1991	39	10 U	10 U	10 U	140	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-9	10/11/1991	10 U	10 U	10 U	10 U	490	10 U	100 U	0.5	3	0.6	3
MW-10	10/11/1991	10 U	10 U	10 U	10 U	67	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-10 Dup [a]	10/11/1991	10 U	10 U	10 U	10 U	39	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-11	10/11/1991	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-12	10/11/1991	10 U	10 U	10 U	10 U	150	10 U	100 U	0.3 U	0.3 U	0.9	0.5 U
MW-13	10/11/1991	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-14	10/11/1991	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-14 Dup [b]	10/11/1991	10 U	10 U	10 U	10 U	38	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-1	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-2	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-3	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-4	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
C-5	1/18/1992	120	10 U	10 U	10 U	530	10 U	100 U	0.6	0.4	0.9	1
C-5 Dup [c]	1/18/1992	10 U	10 U	10 U	10 U	590	10 U	100 U	0.6	2	2	4
C-6	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-7	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-8	1/18/1992	10 U	10 U	10 U	10 U	150	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U

SAMPLE ID	DATE	GASOLINE (µG/L)	MINERAL SPIRITS (µg/L)	KEROSENE (µg/L)	JET FUEL (µg/L)	DIESEL (µg/L)	FUEL OIL #6 (µg/L)	LUBRICATING OIL (µg/L)	BENZENE (µg/L)	ETHYL BENZENE (µg/L)	TOLUENE (µg/L)	TOTAL XYLENES (µg/L)
MW-9	1/18/1992	40	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	1	0.7	2
MW-10	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-11	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-12	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-13	1/18/1992	10 U	10 U	10 U	10 U	10 U	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MW-14	1/18/1992	10 U	10 U	10 U	10 U	230	10 U	100 U	0.3 U	0.3 U	0.3 U	0.5 U
MTCA Method A Cleanup Level		na	na	na	na	500	500	na	5	700	1000	1000
MTCA Method C Cleanup Level		800	na	na	na	na	na	na	7.95	1750	3500	35000

Source: (Pacific Groundwater Group 2006)

[a] MW-10 Dup is sample MW-15;

[b] MW-14 Dup is Sample MW-16 for October 1991 sampling round.

[c] C-5 Dup is Sample MW-15 for January 1992 sampling round.

Green highlight – concentration exceeds MTCA Method C Industrial Cleanup Level (WAC-173-340)

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

Dup – duplicate

MTCA – Model Toxics Control Act

TPH = Total Petroleum Hydrocarbons

U – parameter not detected; associated # is laboratory detection limit

Table D-23. Historical groundwater sample results for metals conducted October 11, 1991 and January 17, 1992

Chemical/ Sample Information	Date	Analytical Method	MTCA Method C	C-1 (µg/L)	C-2 (µg/L)	C-3 (µg/L)	C-4 (µg/L)	C-5 (µg/L)	C-6 (µg/L)	MW-7 (µg/L)	MW-8 (µg/L)	MW-9 (µg/L)	MW-10 (µg/L)	MW-11 (µg/L)	MW-12 (µg/L)	MW-13 (µg/L)	MW-14 (µg/L)	MW-14 (Dup) (µg/L)
Antimony	10/11/1991	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Arsenic	10/11/1991	6010/7000	5.25	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Beryllium	10/11/1991	6010/7000		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Cadmium	10/11/1991	6010/7000	17.5	20 U	20 U	20 U	28	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Chromium	10/11/1991	6010/7000	105 (CrVI)	26	65	20 U	20 U	53	38	20 U	20 U	20 U	84	20 U	20 U	20 U	35	39
Copper	10/11/1991	6010/7000	1300	42	100	41	20 U	45	84	20 U	20 U	54	130	20 U	22	30	77	75
Lead	10/11/1991	7240		50 U	130	94	50 U	50 U	50 U	50 U	50 U	50 U	91	50 U	50 U	50 U	50 U	260
Mercury	10/11/1991	6010/7000		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	10/11/1991	6010/7000	700	50 U	50 U	50 U	59	50 U	50 U	50 U	50 U	50 U	55	50 U	50 U	50 U	52	50 U
Selenium	10/11/1991	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Silver	10/11/1991	6010/7000		50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Thallium	10/11/1991	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Zinc	10/11/1991	6010/7000	10500	140	230	120	1600	160	210	91	50 U	86	480	90	150	130	210	270
Antimony	1/17/1992	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Arsenic	1/17/1992	6010/7000	5.25	5 U	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Beryllium	1/17/1992	6010/7000		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Cadmium	1/17/1992	6010/7000	17.5	0.25 U	0.47	0.25 U	7.5	0.43	0.25 U	38	0.25 U	5.7	3.4	0.27	1.6	0.93	1.5	0.25 U
Chromium	1/17/1992	6010/7000	105 (CrVI)	20 U	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Copper	1/17/1992	6010/7000	1300	20 U	66	20 U	20 U	20 U	20 U	200	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Lead	1/17/1992	7240		17	67	6	18	5 U	5	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Mercury	1/17/1992	6010/7000		0.2 U	0.3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Chemical/ Sample Information	Date	Analytical Method	MTCA Method C	C-1 (µg/L)	C-2 (µg/L)	C-3 (µg/L)	C-4 (µg/L)	C-5 (µg/L)	C-6 (µg/L)	MW-7 (µg/L)	MW-8 (µg/L)	MW-9 (µg/L)	MW-10 (µg/L)	MW-11 (µg/L)	MW-12 (µg/L)	MW-13 (µg/L)	MW-14 (µg/L)	MW-14 (Dup) (µg/L)
Nickel	1/17/1992	6010/7000	700	50 U	50 U	50 U	120	50 U	50 U	380	50 U	170	98	50 U	110	50 U	50 U	50 U
Selenium	1/17/1992	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Silver	1/17/1992	6010/7000		50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Thallium	1/17/1992	6010/7000		100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Zinc	1/17/1992	6010/7000	10500	50 U	130	50 U	1200	50 U	50 U	6200	50 U	1300	430	50 U	490	89	140	50 U

Source: (Pacific Groundwater Group 2006)

Green highlight – concentration exceeds MTCA Method C Industrial Cleanup Level (WAC-173-340)

Yellow highlight – parameter detected

Investigation: AGI (Applied Geotechnology, Inc.)

– Data appears to be total metals analyses, although AGI (1992) report does not explicitly state that samples were not filtered.

U – parameter not detected; # is laboratory detection limit

CrVI – chromium six

Dup – duplicate

MTCA – Model Toxics Control Act

WAC – Washington Administrative Code

Table D-24. Historical groundwater sample results for metals and PCBs conducted June 5, 1984

Chemical/Sample Information	Units	Well 84-1	Well 84-1 (dupl) [a]	Well 84-2	Well 84-2 (dupl) [a]	Well A [b]	Detection limit
PCB	µg/L	–		–	–	–	1.0
Arsenic	mg/L	0.073	0.073	0.05		0.018	0.01
Cadmium	mg/L	0.0015	0.0018	0.0012		–	0.001
Chromium	mg/L	0.053	0.066	0.057		0.022	0.01
Lead	mg/L	0.048	0.045	0.15		0.016	0.005
Mercury	mg/L	–	–	0.002		–	0.002
Zinc	mg/L	0.22	0.27	0.28		0.14	
Total Dissolved Solids	mg/L	750	780	1400		11000	

Source: (Dames & Moore 1984; Pacific Groundwater Group 2006)

[a]Duplicate samples were tested for quality control check. 84-1 duplicate tested for metals only, 84-2 duplicated tested for PCB only.

[b] Detection limit for water sample from Well A is 10 ppb

– concentration is less than detection limit

Blank – no test was performed

Dupl – duplicate

Table D-25. Historical seep sample results for metals and PCBs conducted June 5, 1984

Chemical/Sample Information	Units	Seep N	Seep S	Detection limit
PCB	µg/L	–	–	1.0
Arsenic	mg/L	–	–	0.01
Cadmium	mg/L	0.0012	<0.001	0.001
Chromium	mg/L	–	–	0.01
Lead	mg/L	0.006	–	0.005
Mercury	mg/L	–	–	0.002
Zinc	mg/L	0.1	0.035	
Total Dissolved Solids	mg/L	6400	7300	

Source: (Dames & Moore 1984; Pacific Groundwater Group 2006)

– concentration is less than detection limit

Blank – no test was performed

Dupl – duplicate

References

Anchor. 2007. Duwamish/Diagonal sediment remediation project 2005 monitoring report: Elliott Bay/Duwamish restoration program panel. Panel publication 40. Prepared for King County Department of Natural Resources and Parks Elliot Bay/Duwamish restoration program. Anchor Environmental, L.L.C., Seattle, WA.

Dames & Moore. 1984. Progress report, consultation, soil and water test results, Duwamish Waterway property, Seattle, Washington, for Chiyoda International Corporation. June 25, 1984. Dames & Moore, Seattle, WA.

Pacific Environmental Group. 1991. Letter dated January 3, 1991 to S. Bruce, Chevron USA, Inc., from E. Larsen and W. Crell, PEG, regarding soil landfarming at Chevron Site 4097. Pacific Environmental Group, Inc., Redmond, WA.

Pacific Groundwater Group. 2006. T-108 interim groundwater and shoreline soil investigation final work plan. Prepared for Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Pacific Groundwater Group. 2007. Port of Seattle T-108 groundwater investigation final report. Pacific Groundwater Group, Seattle, WA.

Thorne Environmental. 1990. Quantitative chemistry results for soils stockpiled at the Chevron U.S.A. Inc. Chiyoda site, Seattle, Washington. Prepared for Chevron U.S.A. Inc. Thorne Environmental, Inc.

Appendix E Adjacent Property Analytical Information

Table E-1. 1985 S Nevada St storm drain sediment solid sample results

CHEMICAL (mg/kg)	MEASURED CONCENTRATION	SQS	CSL
Cadmium	12.3	5.1	6.7
Chromium	1,790E	260	270
Lead	1,330	450	530
Zinc	654E	410	960

Source: Ecology (2004)
CSL – cleanup screening level
E – estimated value
mg/kg – milligram per kilogram
SQS – sediment quality standard

Table E-2. Summary of PAH compounds in S Oregon St soil samples

PAH Compound[a]	Unit	Carc/ Non Carc	B06-1-1	B06-2-5	B06-2-7.5	B06-3-2.5	B06-3-5	B06-3-7.5	B06-4-1	B06-4-10	B06-4-12.5	B06-5-2.5	B06-5-5
			Sample Identifications										
1-Methylnaphthalene	mg/kg	nc	0.0075 U	0.0088 U	24	4.2	0.0087	0.0083 U	0.019	0.0081 U	0.0072 U	0.092	0.0077 U
2-Methylnaphthalene	mg/kg	nc	0.0075 U	0.0088 U	35	4.8	0.010	0.0083 U	0.026	0.0081 U	0.0072 U	0.13	0.0077 U
Acenaphthene	mg/kg	nc	0.021	0.0088 U	39	0.15	0.0098	0.0083 U	0.0075	0.0081 U	0.0072 U	0.015	0.0077 U
Acenaphthylene	mg/kg	nc	0.0075 U	0.0088 U	0.93	0.045	0.0081 U	0.0083 U	0.017	0.0081 U	0.0072 U	0.0092	0.12
Anthracene	mg/kg	nc	0.031	0.0088 U	60	0.022	0.022	0.019	0.015	0.0081 U	0.0072 U	0.014	0.052
Benzo(g,h,i)perylene	mg/kg	nc	0.062	0.024	51	0.057	0.089	0.13	0.046	0.0081 U	0.0072 U	0.086	0.24
Fluoranthene	mg/kg	nc	0.16	0.049	210	0.12	0.14	0.25	0.11	0.0081 U	0.0072 U	0.13	0.22
Fluorene	mg/kg	nc	0.015	0.0088 U	40	0.17	0.0090	0.0083 U	0.0092	0.0081 U	0.0072 U	0.013	0.011
Naphthalene [b]	mg/kg	nc	0.0075 U	0.0088 U	72	0.97	0.012	0.012	0.027	0.0081 U	0.0072 U	0.025	0.0077 U
Phenanthrene	mg/kg	nc	0.11	0.027	260	0.22	0.11	0.045	0.086	0.0081 U	0.0072 U	0.31	0.038
Pyrene	mg/kg	nc	0.16	0.058	220	0.12	0.17	0.40	0.16	0.0083	0.0087	0.17	0.32
Benzo(a)anthracene	mg/kg	c	0.080	0.023	80	0.064	0.077	0.23	0.068	0.0081 U	0.0072 U	0.086	0.32
Benzo(a)pyrene	mg/kg	c	0.089	0.030	83	0.066	0.12	0.29	0.053	0.0081 U	0.0072 U	0.075 U	0.39
Benzo(b)fluoranthene	mg/kg	c	0.11	0.035	80	0.090	0.12	0.25	0.077	0.0081 U	0.0072 U	0.13	0.46
Benzo(k)fluoranthene	mg/kg	c	0.039	0.012	25	0.019	0.042	0.081	0.023	0.0081 U	0.0072 U	0.075 U	0.15
Chrysene	mg/kg	c	0.13	0.038	110	0.20	0.13	0.31	0.14	0.0081 U	0.0072 U	0.40	0.51
Dibenz(a,h)anthracene	mg/kg	c	0.023	0.0088 U	12	0.023	0.024	0.039	0.017	0.0081 U	0.0072 U	0.075 U	0.089
Indeno(1,2,3-c,d)pyrene	mg/kg	c	0.059	0.019	43	0.039	0.076	0.11	0.035	0.0081 U	0.0072 U	0.075 U	0.22
Toxicity Equivalency Evaluation													
Benzo(a)anthracene	TEF	0.1	0.008	0.002	8	0.006	0.008	0.02	0.007	0	0	0.009	0.03
Benzo(a)pyrene	TEF	1	0.089	0.030	83	0.066	0.12	0.29	0.053	0	0	0	0.39
Benzo(b)fluoranthene	TEF	0.1	0.01	0.004	8	0.009	0.01	0.03	0.008	0	0	0.01	0.05
Benzo(k)fluoranthene	TEF	0.1	0.004	0.001	2.5	0.002	0.004	0.008	0.002	0	0	0	0.02

PAH Compound[a]	Unit	Carc/ Non Carc	Sample Identifications B06-1-1	B06-2-5	B06-2-7.5	B06-3-2.5	B06-3-5	B06-3-7.5	B06-4-1	B06-4-10	B06-4-12.5	B06-5-2.5	B06-5-5
Chrysene	TEF	0.01	0.001	0.000	1.1	0.002	0.001	0.003	0.001	0	0	0.004	0.01
Dibenz(a,h)anthracene	TEF	0.4	0.009	0	4.8	0.009	0.010	0.016	0.007	0	0	0	0.036
Indeno(1,2,3-c,d)pyrene	TEF	0.1	0.006	0.002	4.3	0.004	0.008	0.01	0.004	0	0	0	0.02
SUM			0.13	0.039	111.7	0.10	0.16	0.38	0.08	0	0	0.03	0.55
MTCA Method A Soil (Industrial)			2	2	2	2	2	2	2	2	2	2	2

Source: (Pacific Groundwater Group 2007)
[a] Analytical method: EPA 8270C/SIM
[b] Naphthalenes cleanup levels for MTCA Method A Soil (Unrestricted) and (Industrial) are 5 mg/kg
Green highlight – sum of toxic equivalents exceeds MTCA Method A Soil (Industrial)
U – parameter not detected; # – laboratory practical quantitation limit
C – carcinogen
EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
NC – non-carcinogen
PAH – Polycyclic Aromatic Hydrocarbon
ppm – parts per million
SIM – Simultaneous Ion Monitoring
TEF – toxic equivalency factor

Table E-3. Summary of PCBs Results in S Oregon St soil samples

Sample Location	Sample (mg/kg)	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCBs
B06-1	B06-1-1	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.28	0.20	0.056 U	0.056 U	0.48
	B06-1-5	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-1-12.5	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	ND
	B06-1-20	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	ND
B06-2	B06-2-5	0.066 U	0.066 U	0.066 U	0.12	0.066 U	0.37	0.30	0.066 U	0.066 U	0.79
	B06-2-7.5	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	ND
	B06-2-10	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	ND
	B06-2-12.5	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	ND
B06-3	B06-3-1	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.28	0.13	0.057 U	0.057 U	0.41
	B06-3-2.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	ND
	B06-3-5	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-3-7.5	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	ND
B06-4	BO6-4-1	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	ND
	B06-4-2.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.26	0.054 U	0.054 U	0.054 U	0.26
	B06-4-10	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-4-12.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.075	0.054 U	0.054 U	0.054 U	0.075
B06-5	B06-5-1	0.057 U	0.057 U	0.057 U	0.20	0.057 U	0.74	0.31	0.057 U	0.057 U	1.25
	B06-5-2	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.50	0.056 U	0.056 U	0.50
	B06-5-5	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	ND
	B06-5-15	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
MTCA Method A Soil (Industrial)											10

Source: (Pacific Groundwater Group 2007)
Green highlight – sum of PCBs exceeds MTCA Method A Soil (Industrial)
Analytical method: EPA 8082

EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
ND – non detect

PAH – polycyclic aromatic hydrocarbon
PQL – practical quantitation limit
TEF – toxic equivalency factor
U – parameter not detected; laboratory practical quantitation limit

Table E-4. Summary of petroleum hydrocarbon compounds in S Oregon St soil samples

Sample Location	Sample Identification (mg/kg)	NWTPH-Gx/BTEX						NWTPH-Dx	
		Benzene	Toluene	Ethyl Benzene	m,p-Xylene	o-Xylene	TPH-Gas	Diesel Range	Lube Oil
B06-1	B06-1-1	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	28 U	760
	B06-1-5	—	—	—	—	—	—	150 U	4900
	B06-1-12.5	—	—	—	—	—	—	30 U	170
	B06-1-20	—	—	—	—	—	—	34 U	100
B06-2	B06-2-5	0.020 U	0.063 U	0.063 U	0.063 U	0.063 U	6.3 U	62	580
	B06-2-7.5	0.020 U	0.055 U	0.055 U	0.055 U	0.055 U	5.5 U	310	580
	B06-2-10	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	29 U	100
	B06-2-12.5	—	—	—	—	—	—	30 U	60 U
B06-3	B06-3-1	0.020 U	0.048 U	0.048 U	0.048 U	0.048 U	4.8 U	28 U	170
	BO6-3-2.5	0.020 U	0.045 U	0.045 U	0.045 U	0.045 U	4.5 U	4500	5400
	B06-3-5	0.020 U	0.054 U	0.054 U	0.054 U	0.054 U	5.4 U	31 U	160
	B06-3-7.5	0.020 U	0.047 U	0.047 U	0.047 U	0.047 U	4.7 U	31 U	90
B06-4	B06-4-1	0.020 U	0.050 U	0.050 U	0.050 U	0.050 U	5.0 U	28 U	190
	B06-4-2.5	0.020 U	0.099 U	0.099 U	0.099 U	0.099 U	9.9 U	27 U	95
	B06-4-10	0.020 U	0.053 U	0.053 U	0.053 U	0.053 U	5.3 U	170	630
	B06-4-12.5	0.020 U	0.042 U	0.042 U	0.042 U	0.042 U	4.2 U	27 U	100
B06-5	B06-5-1	0.020 U	0.050 U	0.050 U	0.050 U	0.050 U	5.0 U	200	610
	B06-5-2.5	0.020 U	0.049 U	0.049 U	0.049 U	0.049 U	4.9 U	28 U	500
	B06-5-5	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	29 U	87
	B06-5-15	0.020 U	0.053 U	0.053 U	0.053 U	0.053 U	5.3 U	31 U	61 U
MTCA Method A Soil (Industrial)		0.03	7	6	9	9	100	2000	2000

Source: (Pacific Groundwater Group 2007)
Green highlight – sum of PCBs exceeds MTCA Method A Soil (Industrial)
U – parameter not detected; # – laboratory practical quantitation limit
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
TPH – total petroleum hydrocarbons

Table E-5. Summary of metals in S Oregon St soil samples

Sample Location	Sample Identification	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
B06-1	B06-1-1	11 U	0.63	27	24	13	49
	B06-1-5	12 U	0.61 U	52	91	18	65
	B06-1-12.5	12 U	0.60 U	13	6.0 U	8.6	24
	B06-1-20	14 U	0.68 U	23	6.8 U	9.0	29
B06-2	B06-2-5	13 U	0.66 U	19	6.6 U	4.4	20
	B06-2-7.5	11 U	1.5	100	160	26	180
	B06-2-10	12 U	0.58 U	22	13	10	30
	B06-2-12.5	12 U	0.60 U	15	8.4	15	38
B06-3	B06-3-1	11 U	1.9	25	25	11	120
	B06-3-2.5	11 U	0.54 U	28	5.9	17	36
	B06-3-5	12 U	1.4	110	180	29	310
	B06-3-7.5	13 U	0.95	16	10	9.2	30
B06-4	B06-4-1	11 U	0.82	64	46	33	2800
	B06-4-2.5	11 U	0.54 U	35	33	11	60
	B06-4-10	12 U	0.61 U	21	6.1 U	13	68
	B06-4-12.5	11 U	0.54 U	12	5.4 U	7.5	26
B06-5	B06-5-1	11 U	0.90	40	36	12	74
	B06-5-2.5	11 U	0.56 U	36	33	30	110
	B06-5-5	11 U	0.57 U	26	34	11	35
	B06-5-15	12 U	0.61 U	10	6.1 U	9.1	19
MTCA Method A Soil (Industrial)		20	2		1000		

Source: (Pacific Groundwater Group 2007)
Green highlight – concentration exceeds MTCA Method A Soil (Industrial)
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
U – parameter not detected; # – laboratory practical quantitation limit

Table E-6. Summary of PAH compounds in Oregon Street intertidal sediment samples

	PAH Concentrations - Dry Weight (mg/kg)					PAH Concentrations – TOC-Normalized (mg/kg-OC)					
PAH Compound	IT-1-6	IT-2-6	IT-2-16	IT-3-6	IT-3-12	IT-1-6	IT-2-6	IT-2-16	IT-3-6	IT-3-12	SQS
1-Methylnaphthalene	0.0083 U	0.0063 U	0.081	0.0087 U	0.0088 U	—	—	3	—	—	
2-Methylnaphthalene	0.0083 U	0.0063 U	0.13	0.0087 U	0.0088 U	—	—	5	—	—	38
Acenaphthene	0.0083 U	0.0063 U	0.046	0.0087 U	0.0088 U	—	—	2	—	—	16
Acenaphthylene	0.0083 U	0.0063 U	0.0078 U	0.0087 U	0.0088 U	—	—	—	—	—	66
Anthracene	0.0083 U	0.0063 U	0.0078 U	0.0098	0.023	—	—	—	0	1	220
Benzo(g,h,i)perylene	0.019	0.0063 U	0.0078 U	0.042	0.081	2	—	—	2	3	31
Fluoranthene	0.020	0.0063 U	0.0078 U	0.069	0.14	2	—	—	3	6	160
Fluorene	0.0083 U	0.0063 U	0.0098	0.0087 U	0.010	—	—	0	—	0	23
Naphthalene	0.0083 U	0.0063 U	0.22	0.0087 U	0.0088 U	—	—	9	—	—	99
Phenanthrene	0.0083 U	0.0063 U	0.0078 U	0.036	0.10	—	—	—	1	4	100
Pyrene	0.021	0.0063 U	0.0078 U	0.083	0.16	2	—	—	3	6	1000
Benzo(a)anthracene	0.014	0.0063 U	0.0078 U	0.050	0.078	1	—	—	2	3	110
Benzo(a)pyrene	0.022	0.0063 U	0.0078 U	0.051	0.095	2	—	—	2	4	99
Benzo(b)fluoranthene	0.032	0.0063 U	0.0078 U	0.068	0.11	3	—	—	3	4	230 (total)
Benzo(k)fluoranthene	0.012	0.0063 U	0.0078 U	0.023	0.041	1	—	—	1	2	
Chrysene	0.031	0.0063 U	0.0078 U	0.071	0.12	3	—	—	3	5	110
Dibenz(a,h)anthracene	0.0083 U	0.0063 U	0.0078 U	0.013	0.026	—	—	—	1	1	12
Indeno(1,2,3-c,d)pyrene	0.016	0.0063 U	0.0078 U	0.036	0.068	1	—	—	1	3	34
Estimated total organic content from PGG-5 and PGG-6 analytical results and grain size (%)[a]						1.15	0.47	2.47	2.47	2.47	

Source: (Pacific Groundwater Group 2007)

[a] Intertidal sediment samples not analyzed for TOC. Soil samples from boreholes PGG-5 (200 feet southeast of intertidal samples) and PGG-6 (500 feet southeast of intertidal samples) analyzed for TOC. Estimated TOC for IT samples from PGG-5 and PGG-6 results based on comparable soil/sediment description.

Green highlight – exceeds SQS

Analytical method: EPA 8270C/SIM

EPA – US Environmental Protection Agency

mg/kg-OC – mg/kg organic carbon (total organic carbon normalized)
mg/kg – milligram per kilogram
PAH –Polycyclic Aromatic Hydrocarbon
PGG – Pacific Groundwater Group
SIM – Simultaneous Ion Monitoring
SQS – Sediment Quality Standards (WAC 173-204-320)
TOC – total organic carbon
U – parameter not detected; # – laboratory practical quantitation limit
WAC – Washington Administrative Code
— not calculated, PAH not detected
Sample descriptions:

IT-1-6: Brown silt with roots and organic material
IT-1-12: Brown silt with organic material
IT-2-6: Wet, gray, sand and gravel
IT-2-16: Dark gray, wet, slightly sandy, organic smelling silt
IT-3-6: Brown, sandy silt with trace gravel
IT-3-12: Dark gray, moist, slightly sandy silt.

Table E-7. Summary of PCBs in S Oregon St intertidal sediment samples

CHEMICAL (mg/kg)	IT-1-6	IT-1-12	IT-2-6	IT-2-16	IT-3-6	IT-3-12
Aroclor 1016	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1221	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1232	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1242	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1248	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1254	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1260	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1262	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1268	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Total PCBs	ND	ND	ND	ND	ND	ND

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8082
EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
ND – non detect
PCB - polychlorinated biphenyl
U – parameter not detected; # – laboratory practical quantitation limit

Table E-8. Summary of petroleum hydrocarbon compounds in S Oregon St intertidal sediment samples

		NWTPH-Gx/BTEX						NWTPH-Dx	
SAMPLE LOCATION	SAMPLE (mg/kg)	BENZENE	TOLUENE	ETHYL BENZENE	M,P-XYLENE	O-XYLENE	TPH-GAS	DIESEL RANGE	LUBE OIL
Intertidal	IT-1-6	—	—	—	—	—	—	31 U	63 U
	IT-1-12	—	—	—	—	—	—	33 U	66 U
	IT-2-6	—	—	—	—	—	—	26 U	52 U
	IT-2-16	—	—	—	—	—	—	40[a]	110
	IT-3-6	—	—	—	—	—	—	33 U	170
	IT-3-12	—	—	—	—	—	—	38	150

SQS not established under WAC 173-204 for diesel or lube oil

Source: (Pacific Groundwater Group 2007)

[a] Identified diesel fuel #2 by lab

– parameter not analyzed

NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable

NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable

SQS – Sediment Quality Standards (WAC 173-204-320)

TPH – total petroleum hydrocarbons

U – parameter not detected; # – laboratory practical quantitation limit

WAC – Washington Administrative Code

Table E-9. Summary of metals in S Oregon St intertidal sediment samples

Sample Location	Sample (mg/kg)	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
Intertidal	IT-1-6	13 U	0.63 U	29	53	14	48
	IT-1-12	13 U	0.66 U	13	6.6 U	4.7	12
	IT-2-6	10 U	0.52 U	120	5.2 U	22	77
	IT-2-16	12 U	0.58 U	55	100	18	95
	IT-3-6	13 U	0.65 U	84	190	22	150
	IT-3-12	13 U	0.66 U	110	330	29	180
SQS		57	5.1	390	450	na	410

Source: (Pacific Groundwater Group 2007)
na – not applicable
SQS – Sediment Quality Standards (WAC 173-204-320)
U – parameter not detected; # – laboratory practical quantitation limit
WAC – Washington Administrative Code

Table E-10. Summary of PAH compounds in S Oregon St groundwater samples

PAH Compound	Unit	Carc./non Carc.	B06-2	B06-5
1-Methylnaphthalene	µg/L	nc	0.18	0.095 U
2-Methylnaphthalene	µg/L	nc	0.27	0.095 U
Acenaphthene	µg/L	nc	0.18	0.095 U
Acenaphthylene	µg/L	nc	0.097 U	0.095 U
Anthracene	µg/L	nc	0.12	0.095 U
Benzo(g,h,i)perylene	µg/L	nc	0.095	0.018
Fluoranthene	µg/L	nc	0.37	0.095 U
Fluorene	µg/L	nc	0.12	0.095 U
Naphthalene [a]	µg/L	nc	1.1	0.095 U
Phenanthrene	µg/L	nc	0.48	0.095 U
Pyrene	µg/L	nc	0.41	0.095 U
Benzo(a)anthracene	µg/L	c	0.12	0.018
Benzo(a)pyrene	µg/L	c	0.14	0.019
Benzo(b)fluoranthene	µg/L	c	0.14	0.026
Benzo(k)fluoranthene	µg/L	c	0.048	0.0095 U
Chrysene	µg/L	c	0.17	0.023
Dibenz(a,h)anthracene	µg/L	c	0.022	0.0095 U
Indeno(1,2,3-c,d)pyrene	µg/L	c	0.076	0.013
Toxicity Equivalency Evaluation				
Benzo(a)anthracene	TEF	0.1	0.01	0.002
Benzo(a)pyrene	TEF	1	0.14	0.019
Benzo(b)fluoranthene	TEF	0.1	0.01	0.003
Benzo(k)fluoranthene	TEF	0.1	0.005	0
Chrysene	TEF	0.01	0.002	0.0002
Dibenz(a,h)anthracene	TEF	0.4	0.009	0
Indeno(1,2,3-c,d)pyrene	TEF	0.1	0.008	0.001
SUM:			0.19	0.02
MTCA Method A Groundwater			0.1	0.1

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8270C/SIM
[a] Naphthalenes cleanup level for MTCA Method A Groundwater is 160 µg/L
Green highlight – sum of toxic equivalents exceeds MTCA Method A Groundwater
c – carcinogen
Carc. – carcinogen
EPA – US Environmental Protection Agency
µg/L – micrograms per liter
MTCA – Model Toxics Control Act
nc – non-carcinogen
PAH – Polycyclic Aromatic Hydrocarbon
TEF: toxicity equivalency factor
U – parameter not detected; # – laboratory practical quantitation limit

Table E-11. Summary of PCBs in S Oregon St groundwater samples

PCB	Units	B06-2	B06-5
Aroclor 1016	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1221	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1232	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1242	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1248	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1254	µg/L (ppb)	0.053	0.070
Aroclor 1260	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1262	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1268	µg/L (ppb)	0.048 U	0.048 U
Total PCBs		0.053	0.070
MTCA Method A Groundwater		0.1	0.1

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8082
µg/L – micrograms per liter
MTCA – Model Toxics Control Act
PCB – polychlorinated biphenyl
ppb – part per billion
PQL – practical quantitation limit
U – parameter not detected; # – laboratory practical quantitation limit

Table E-12. Summary of petroleum hydrocarbon compounds and metals in S Oregon St

Chemical	Unit	MTCA Method A - Groundwater	B06-2	B06-5
NWTPH-Gx/BTEX				
Benzene	µg/L	5	1.0 U	1.0 U
Toluene	µg/L	1,000	1.0 U	1.0 U
Ethyl Benzene	µg/L	700	1.0 U	1.0 U
m,p-Xylene	µg/L	1,000	1.0 U	1.0 U
o-Xylene	µg/L	1,000	1.0 U	1.0 U
TPH-Gas	µg/L	1,000	100 U	100 U
NWTPH-Dx				
Diesel Range	mg/L	0.5	0.27 U	0.26 U
Lube Oil	mg/L	0.5	1.5	0.41 U
Dissolved Metals (EPA 200.8)				
Arsenic	µg/L	5	5.7	3.0 U
Cadmium	µg/L	5	4.0 U	4.0 U
Copper	µg/L		10 U	10 U
Lead	µg/L	15	1.0 U	1.0 U
Nickel	µg/L		20 U	20 U
Zinc	µg/L		25 U	25 U

Source: (Pacific Groundwater Group 2007)
Green highlight – sum of toxic equivalents exceeds MTCA Method A Groundwater
EPA – US Environmental Protection Agency
µg/L – micrograms per liter
mg/L – milligrams per liter
MTCA – Model Toxics Control Act
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
ppb – parts per billion
PQL – practical quantitation limit
TPH – total petroleum hydrocarbons
U – parameter not detected; # – laboratory practical quantitation limit

Table E-13. Summary of Duwamish/Diagonal CSO/SD source-tracing sediment data (metals and TPH)

			Metals (mg/kg dw)					TPHs (mg/kg dw)	
Type	Count		Arsenic	Copper	Lead	Mercury	Zinc	TPH - Diesel	TPH - Oil
Catch Basin	44	Mean	11	230	410	0.28	696	4160	15,200
		Range	(3 – 40)	(29.6 – 1520)	(10 – 5,830)	(0.02 – 2.05)	(54.9 – 3,940)	(0 – 46,000)	(0 – 250,000)
Right-of-way Catch Basin	36	Mean	7.4	115	161	0.15	349	1120	4,150
		Range	(2.5 – 30)	(38.4 – 751)	(19 – 1,370)	(0.02 – 1.17)	(84.7 – 966)	(130 – 6,400)	(480 – 14,000)
In-line sediment grab	33	Mean	7.3	89	254	0.26	273		1,630
		Range	(2.5 – 23)	(22.4 – 340)	(15 – 4,910)	(0.01 – 3.3)	(85 – 718)	56,300)	(0 – 13,000)
In-line sediment trap	45	Mean	7.0	138	116	0.20	508	605	2570
		Range	(3 – 25)	(6.6 – 597)	(29 – 360)	(0.025 – 2.8)	(162 – 1,930)	(0 – 1,900)	(0 – 7,500)

Source: (Schmoyer 2008)

Note: Summary statistics were calculated using one half the detection limit for non-detected values.

CSO – combined sewer overflow

dw – dry weight

mg/kg – milligrams per kilogram

SD – storm drain

TPH – total petroleum hydrocarbons

Table E-14. Summary of Duwamish/Diagonal CSO/SD source-tracing sediment data (Phthalates, PCBs, and PAHs)

Type	Count		Phthalates, PCBs and PAHs (µg/kg dw) BEP	BBP	Total PCBs	HPAH	LPAH
Catch Basin	44	Mean	37,300	3,110	261	19,700	6,040
		Range	(130 – 200,000)	(19.5 – 18,000)	(8.5 – 3,200)	(95 – 256,800)	(57 – 44,965)
Right-of-way Catch Basin	36	Mean	9,570	1,720	90	5390	2,040
		Range	(740 – 48,000)	(19.5 – 37,000)	(9.5 – 670)	(461.5 – 24,290)	(155 – 13,800)
In-line sediment grab	33	Mean	1,960	156	123	3,120	766
		Range	(0 – 8,900)	(0 – 900)	(0 – 1,000)	(0 – 17,850)	(0 – 8,250)
In-line sediment trap	45	Mean	11,000	663	298	12,300	2,640
		Range	(0 – 67,000)	(0 – 3,400)	(22 – 3,250)	(0 – 127,580)	(0 – 19,750)

Source: (Schmoyer 2008)

Note: Summary statistics were calculated using one half the detection limit for non-detected values.

BEP – bis(2-ethylhexyl)phthalate

BBP – butylbenzylphthalate

CSO – combined sewer overflow

dw – dry weight

HPAA – high-molecular-weight polycyclic aromatic hydrocarbon

LPAH – low-molecular-weight polycyclic aromatic hydrocarbon

µg/L – micrograms per liter

SD – storm drain

PCB – polychlorinated biphenyl

Table E-15. Detection frequencies and concentration ranges for pollutants in Duwamish/Diagonal CSO/SD stormwater, 1995

Parameter	Detection Frequency	Concentration (µg/L)
Arsenic (total)	10/10	2 – 4
Cadmium (total)	10/10	0.4 – 1.3
Chromium (total)	10/10	2 – 22
Copper (total)	10/10	2 – 119
Lead (total)	10/10	9 – 68
Mercury (total)	1/10	0.3
Zinc (total)	10/10	50 – 225
Bis(2-ethylhexyl) phthalate	9/10	0.9 – 14.7
Butyl benzyl phthalate	5/10	0.79 – 1
Dimethyl phthalate	1/10	0.825
Di-n-butyl phthalate	1/10	9.13
Fluoranthene	1/10	0.84
PCBs	0/10	<0.26 – <0.5
Pyrene	1/10	0.998

Source: Ecology (2004)
CSO – combined sewer overflow
mg/kg – milligrams per kilogram
PCB – polychlorinated biphenyl
SD – storm drain

Table E-16. Storm drain sediment samples in Duwamish/ Diagonal CSO/SD system, 1985

Chemical	Measured Concentration Sample MH1	Sample MHU	SQS	CSL
Zinc (mg/kg)	293E	419E	410	960
Organic compounds (mg/kg TOC)				
Acenaphthene	83E	63U	16	57
Fluorene	65E	54U	23	79
Phenanthrene	270E	49E	100	480
Total LPAH	574	379	370	780
Fluoranthene	230E	74E	160	1,200
Benzo(a)anthracene	210E	12E	110	270
Chrysene	240E	29E	110	460
Total benzofluoranthenes	350E	66E	230	450
Benzo(a)pyrene	140E	3.4E	99	210
Indeno(1,2,3-c,d)pyrene	170E	220U	34	88
Dibenzo(a,h)anthracene	47E	340U	12	33
Benzo(g,h,i)perylene	130E	200U	31	78
Total HPAH	1,697	1,001	960	5,300
1,2-Dichlorobenzene	39XE	270U	2.3	2.3
1,4-Dichlorobenzene	5,200XE	7,100X	3.1	9
Dimethyl phthalate	56E	40U	53	53
Dibenzofuran	45E	69E	15	58
Phenol	1,500E	75B	420	1,200
4-Methylphenol	5,900E	870E	670	670

Source: Tetra Tech as cited in Ecology (2004)
B – compound detected in method blank – possible laboratory contamination
CSO – combined sewer overflow
E – estimated value
HPAH– high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg – milligrams per kilogram
SD – storm drain
TOC – total organic carbon
U – Compound not detected at value shown
X – Standard recovery <10 %

Table E-17. Storm drain sediments in Duwamish/Diagonal SD, 1985

Chemical	Units	Measured Concentration	SQS	CSL
Chromium	mg/kg	287E	260	270
Zinc	mg/kg	675E	410	960
Di-n-octyl phthalate	mg/kg TOC	560ZE	58	4,500
Indeno (1,2,3-c,d)pyrene	mg/kg TOC	85E	34	88

Source: Tetra Tech as cited in (Ecology 2004)
CSL – cleanup screening level
E – Estimated value
mg/kg – milligrams per kilogram
SD – storm drain
SQS – sediment quality standard
TOC – total organic carbon
Z – Concentration corrected for blank contribution. Value still exceeds detection limit.

References

Ecology. 2004. Lower Duwamish Waterway source control action plan for the Duwamish/Diagonal Way early action cleanup. No. 04-09-003. Washington Department of Ecology, Northwest Regional Office, Toxics Cleanup Program, Bellevue, WA.

Pacific Groundwater Group. 2007. Soil and groundwater data report, Oregon Street right-of-way, Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Schmoyer B. 2008. Personal communication (e-mail to Jeffrey Fellows, Windward Environmental, regarding source data through December 2007, with Excel attachment: source_chemistry_thru_12-07b.xls). Seattle Public Utilities, Seattle, WA. June 3, 2008.

Appendix F T-108 Reference Documentation

(Electronic copies of references provided on accompanying CD)

Title	Author	Publication Date	Type of Reference	Notes
1974 PCB Spill and Dredge Disposal				
EPA Region 10 On-Scene Coordinator's report on the Duwamish Waterway PCB spill	USEPA, Region 10	2/12/1975	Spill response report	Report includes details of the September 13, 1974 PCB spill from a transformer into the Duwamish Waterway and the subsequent cleanup efforts. Report includes maps of the spill area.
Various notes and correspondences from Port of Seattle files regarding the PCB spill and cleanup	Various	1974	Letters, maps, notes	Various letters, notes, and maps regarding the cleanup of the Slip 1 PCB spill and attempt considerations of temporary disposal areas for dredged material.
Excerpt of report regarding PCB spill from Ecology files	unknown	unknown	Report excerpt, map	Excerpt includes three pages plus a map from an unknown report on the PCB spill.
Diagonal Sewage Treatment Plant				
Metropolitan Seattle Sewerage and Drainage Survey	Brown and Caldwell	1958	Report	Report is a survey of drainage and sewage systems in the Seattle Metropolitan area. The Diagonal Way Sewage Treatment Plant is discussed in the report.
Chiyoda-Related Information				
Progress Report Consultation, Soil and Water Test Results, Duwamish Waterway Property, Seattle, Washington for Chiyoda International Corporation	Dames and Moore	6/25/1984	Data report	Data report discussing the collection of soil and water samples on the Chiyoda property. Report includes sampling of three wells, two seeps, and a sample from the Duwamish Waterway. Water and soil samples were analyzed for PCBs and metals. Includes map of sampling locations.
Excerpts of soil sampling data reports on the eastern parcel of T-108 from an undated Dames and Moore report	Dames and Moore	unknown	Data report excerpts	Dames and Moore data report excerpt contains information on historical soil boring and test pit sampling at the approximate location of the sewage disposal pits and other locations on the eastern parcel of T-108. Based on sample identification numbers, the sampling may have occurred in 1984.
Port of Seattle notes taken at time of property acquisition from Chiyoda	unknown	7/12/1984	Notes	Port of Seattle notes (hand-written) regarding PCB dredge disposal, taken at the time of property acquisition from Chiyoda
Letter from J. Dohrmann, Port of Seattle, to A. McClellan, Bogle and Gates	Port of Seattle	4/10/1984	Letter	Letter from J. Dohrmann, Senior Environmental Planner, Port of Seattle, to A. McClellan, Bogle and Gates, recommending sampling

Title	Author	Publication Date	Type of Reference	Notes
				at Chiyoda site.
Mitigation Area				
SEPA Environmental Checklist Determination of Non-Significance (DNS)	Port of Seattle	9/27/1985	SEPA Checklist	SEPA Checklist DNS for construction of the T-108 mitigation area. Checklist includes project description and assessment.
Letter from Kari Rokstad, Department of Ecology, to Robert Wells, Port of Seattle	Kari Rokstad, Ecology	10/14/1985	Business letter	Letter commenting on the mitigation project SEPA DNS.
Letter from Don Vogt, Washington State Dept. of Natural Resources (DNR), to Robert Wells, Port of Seattle, regarding 4601 Diagonal Ave S. shallow water habitat	Don Vogt, Washington State DNR	10/16/1985	Business letter	Letter agreeing to Port's SEPA DNS for mitigation area.
Letter from George Blomberg, Port of Seattle, to Alisa Ralph, USACE regarding T-108, Intertidal Mitigation Excavation, Second Revision, Corps of Engineers Public Notice of Application Reference No. 071-OYB-2-010439	George Blomberg, Port of Seattle	1/19/1987	Business letter	Letter regarding revisions to intertidal mitigation project plans.
Terminal 108 Intertidal Mitigation Site Monitoring Plan	Port of Seattle	1/1987	Report	Background information on the T-108 mitigation area and monitoring program description. Includes three maps/plan sketches. Report attached to 1/19/1987 letter from George Blomberg to Alisa Ralph.
Letter from George Blomberg, Port of Seattle, to Alisa Ralph, USACE with subject: Terminal 108 Intertidal Mitigation Excavation, Biological Monitoring Plan, Corps of Engineers Reference Number 071-OYB-2-010439	George Blomberg, Port of Seattle	1/30/1987	Business letter	Letter includes monitoring protocol for the intertidal mitigation site.
Letter from M.F. Palko, Department of Ecology, to the Port of Seattle regarding Water Quality Certification Public Notice No. 071-OYB-2-010439-R	M.F. Palko, Department of Ecology	2/19/1987	Business letter	Letter expressing compliance of mitigation project with several sections of the Federal Water Pollution Control Act and outlining several provisions to be met by the project to maintain compliance. Hydraulic Project Approval form attached to letter.
Dredging maps for the mitigation area and notes associated with City of Seattle Master Use Permit (MUP) No. 8505031	unknown	1986	Maps and notes	Maps showing mitigation area and construction notes discussing dredging and fill of mitigation site. Map of mitigation site shows small area of contaminated material to be removed to an upland disposal facility.
Letter with attached sampling methods from Gary Mauseth, Northern Technical Services, to Doug Hotchkiss, Port of Seattle, regarding benthic sampling at Terminal 30/Diagonal Way, POS #P-03925	G. Mauseth	11/7/1985	Letter report	"Diagonal Way" refers to the T-108 mitigation site. Benthic invertebrates were collected as part of the establishing monitoring plan for the mitigation project.
Engineering drawings for the mitigation area and public access area	Various	Various (mid- 1980s through early-1990s)	Engineering drawings	Engineering drawings for the construction and maintenance of the mitigation area and associated public access area.

Title	Author	Publication Date	Type of Reference	Notes
Pioneer Construction Aggregate Storage				
SEPA Environmental Checklist, DNS	Port of Seattle	3/1985	SEPA checklist	Port SEPA checklist for proposal to establish a temporary barge unloading and construction aggregate storage area on T-108. Project applicant is Pioneer Construction Materials Co.
Correspondence between L. Taylor, Port of Seattle, and W. Justen, Seattle Dept. of Construction and Land Use (DCLU)	L. Taylor, Port of Seattle and W. Justen, Seattle DCLU	1985	Business letters and map	Letter discussing comments from Seattle Dept. of Construction and Land Use comments on the SEPA DNS for the aggregate storage area. Attached location map shows approximate location of proposed aggregate storage area and approximate location of former sewage lagoons.
Lafarge Bulk Cement Transshipment Facility				
Report of Geotechnical Investigation, Port of Seattle-Terminal 108 Site, Seattle, Washington	Dames and Moore	9/7/1988	Report and map	Report outlines the planned development for construction of a Lafarge facility on the western parcel of T-108, and information on geotechnical conditions at the site. Map is a plot plan showing the proposed locations of silos, a truck scale, and roadways associated with the development.
Terminal 108, Bulk Cement Transshipment Facility, Port of Seattle SEPA Determination of Non-significance (DNS) of Proposed Action	Port of Seattle	11/4/1988	SEPA form and maps	SEPA DNS for proposed project to construct a bulk cement transshipment facility on the western parcel of T-108. Project proposal includes a barge moorage, upland storage silos and warehouse structures, rail and truck access and loading facilities, an office area, shoreline stabilization, and public access improvements for the shoreline. File includes map of T-108 and legal property description.
City of Seattle Analysis and Decision of the Director of the Department of Construction and Land Use	City of Seattle Land Use Division	11/4/1989	Analysis and Decision of the Director of the Department of Construction and Land Use form	Description and analysis of the Master Use Permit for construction of a marine terminal for bulk cement transshipment at T-108. Attached Exhibit No. 4 is a Port of Seattle SEPA DNS for the proposed action.
SEPA DNS of Proposed Action for Removal of Existing Dry Bulk Cement Storage Silos and Associated Upland Fixtures	Port of Seattle	7/21/1999	SEPA DNS form	Includes description of proposed action
Seattle Dept. of Design, Construction, and Land Use Master Use Permit Notice of Decision (Application No. 9905283) for removal of trade fixtures at Lafarge facility	Seattle Dept. of Design, Construction, and Land Use	8/10/1999	Master Use Permit Notice of Decision	Master Use Permit to demolish existing structures and fixtures on Lafarge property. Permit includes letter from Ted Graham, Lafarge Corporation, to Bill Heath, Port of Seattle regarding Termination of Port of Seattle Lease No. 02454 0 STD, and correspondence from George Blomberg, Port of Seattle, regarding equipment removal and site closeout.

Title	Author	Publication Date	Type of Reference	Notes
Letters from G. Blomberg, Port of Seattle, to Puget Sound Clean Air Agency (PSCAA) regarding Notice of Intent and Close-Out of Existing Dust Control Equipment Port of Seattle, Terminal 108, 4601 Diagonal Avenue South, Seattle, Washington, Case Number 9901092	G. Blomberg, Port of Seattle	8/10/1999 and 9/24/1999	Business letters	Notice of close-out of existing dust control equipment (including four steel dry bulk cement storage silos and a pneumatic conveyor system) at the Lafarge Corporation property on T-108 and statement that structures do not contain asbestos.
Personal communication (telephone call) from G. Blomberg, Port of Seattle, to J. Buening, Windward Environmental, regarding historical operations at the Lafarge facility	J. Buening, Windward Environmental (recorded notes of telephone conversation with G. Blomberg)	7/11/2008	Personal communication	G. Blomberg provided information on the historical use of a cement unloading pit and other operations at the Lafarge facility.
Engineering drawings for the Lafarge facility	Various	Various (1989 and 1993)	Engineering drawings	Engineering drawings for the Lafarge facility, including plans for a cover building that was never constructed.
Chevron-Related Information				
Various Port of Seattle correspondences regarding the transfer of the western parcel of T-108 to Chevron U.S.A.,	Various	1984	Port of Seattle memorandums	Correspondences include recommendations for environmental characterization of the site and a map of the site and historical sampling locations.
Underground Storage Tank Removal and Excavation Report, Chevron Service Station No. 0083, Madison Street and Boren Avenue, Seattle, Washington	Rittenhouse-Zeman & Associates, Inc.	5/9/1989	Report	Underground storage tank removal report for a Chevron station on Boren Avenue. This excavation was the source of the soil that was landfarmed on T-108.
Quantitative Chemistry Results for Soils Stockpiled at the Chevron U.S.A. Inc. Chiyoda Site, Seattle, Washington	Thorne Environmental	6/1990	Report	Report on sampling of soil stockpile stored and landfarmed on T-108 that originated from the underground storage tank excavation at a Chevron facility on Boren Avenue. Report includes data tables and map showing approximate soil stockpile location.
Letter report from E. Larsen, Pacific Environmental Group, to S. Bruce, Chevron U.S.A., Regarding Soil Landfarming at Chevron Site 4097	E. Larsen, Pacific Environmental Group	1/3/1991	Letter report	Letter report regarding background information for and details of the landfarming process conducted on T-108 by Chevron. The report also includes monitoring results of the soil after landfarming. Report includes data tables and maps of the landfarming area.
Letter and report from Applied Geotechnology, Inc. to S. Bruce, Chevron U.S.A., Inc. entitled Proposal- Plan of Action Supplemental Site Assessment Chevron U.S.A. Site 4097, 4525 Diagonal Avenue South, Seattle, Washington	Applied Geotechnology, Inc.	10/2/1991	Cover letter and report	Plan of Action to assist Chevron in preparing a Corrective Action Plan (CAP) for the eastern parcel of T-108. Report includes site history and background information, site reconnaissance observations, and a summary of the nature and extent of contamination as understood at the time report was issued.
Site Assessment Summary, Site 64534097, 4525 Diagonal Avenue S, Seattle, Washington	Applied Geotechnology Inc.	8/6/1992	Cover letter (dated 2/17/1993),	Report summarizes environmental assessments conducted on the eastern parcel of T-108 from1981 to 1992. Historical soil and groundwater data are presented in the report, as well as

Title	Author	Publication Date	Type of Reference	Notes
			report and maps	groundwater data collected by Applied Geotechnology as part of this investigation.
Supplemental Site Investigation, Chevron U.S.A. Site 64534097, 4525 Diagonal Avenue South, Seattle, Washington-DRAFT	Applied Geotechnology, Inc. (prepared for Chevron)	1/7/1992	Report	Environmental investigation including soil and groundwater data for the eastern parcel of T-108. Copy is marked with comments from Doug Hotchkiss (Port of Seattle).
Environmental Investigation Chevron U.S.A. Site No. 4097, 4525 Diagonal Avenue South, Seattle, Washington	Pacific Environmental Group, Inc.	1/5/1991	Report	Report on soil and groundwater investigation conducted on T-108 for Chevron U.S.A. Report includes maps and data tables.
Terminal 108 Redevelopment and Container Care International (CCI)				
Letter from B. Bunch, CCI, to J. Bazemore, Port of Seattle	J. Bazemore, CCI	12/9/1993	Business letter	Letter regarding CCI's Pollution Prevention Plan with attached Contingency Plan.
Letter from B. Bunch, CCI, to B. Heath and J. Bazemore, Port of Seattle	J. Bazemore, CCI	3/4/1994	Business letter	Letter regarding pollution prevention measures at T-106 W. Attachments include a letter from A. Farr regarding Ecology's NPDES Baseline General Permit for Stormwater Discharges and Port of Seattle guidance on preparing Surface Water Pollution Prevention Plans (SWPPPs), a portion of CCI's contingency plan, and internal Port messages regarding T-106 and possible
Port of Seattle Chevron Property Development Order of Magnitude Cost Estimate and Report	TAMS Consultants, Inc.	5/22/1992	Report	Report outlines container repair/storage yard development phases and associated costs, specifications for development of access road and new rail spur, and maps of project area including a groundwater elevation contour map. Appendix includes a geotechnical report by Dames and Moore dated 5/12/1992.
Letter from D. Soike, Port of Seattle, to Port staff with subject: T-108, Chevron/Chiyoda Development for Container Care, Inc. (CCI), File EN 12.1.40	D. Soike, Port of Seattle	6/2/1992	Memorandum	Memo discussing several items related to eastern parcel redevelopment. Memo discusses Chevron's use of the property to store and "land farm" soils and soil testing results.
Memo with subject: T-108 Development Railroad Access for CCI and Lafarge Files 12.1.40, 5.4.3, 5.4.5	D. Soike, Port of Seattle	7/13/1992	Memorandum	Memo from D. Soike, Port of Seattle, to A. Lowe, Manager of Harbor Planning and Acquisition regarding permits obtained by the Port of Seattle from the City of Seattle to construct a railroad spur across Diagonal Ave S.
Map: Railroad Crossing Diagonal Avenue S. Site Plan	Port of Seattle	5/21/1992	Map	Map showing railroad spur crossing Diagonal Avenue S.
Preliminary Design and Cost Estimate, Proposed Development for Container Care, T-108/Chevron/ Chiyoda, Seattle, Washington	Dames and Moore	6/23/1992	Report	Includes information about subsurface conditions on the Chevron property, utilities present along S Oregon St., and additional information about the property redevelopment and access road to T-106W.
Environmental Checklist for T-108 Improvements	Port of Seattle	6/23/1992	Environmental	Contains details of the terminal redevelopment project.

Title	Author	Publication Date	Type of Reference	Notes
(Application No. 9203345)			Checklist form	
City of Seattle Dept. of Engineering Application for Utilities Permit to the Board of Public Works	City of Seattle	7/2/1992	Utilities permit application form	Permit granted for construction and maintenance of railroad spur track along and across Diagonal Ave S.
Letter with subject: T-108- Lafarge Railroad Spur	D. Soike, Port of Seattle	8/20/1992	Business letter	Letter from D. Soike, Port of Seattle, to J. McAllister, Manager of Marine Real Estate, regarding railroad spur across Diagonal Ave S.
Map of Terminal 106W and Terminal 108 showing a proposed paved road to cross S Oregon St. and link T-108 with T-106W	Port of Seattle	No date visible on map	Map	Map of proposed access road between T-106W and T-108.
Various Correspondences Regarding T-108 Rip-Rap Repair	Various	Various dates, 1992 and 199.	Fax, business letters, notes	Correspondences regarding rip-rap repair project at the public access area of T-108.
Hydraulic Project Approval for Rip-Rap Repair project	Washington State Department of Fisheries	10/5/1992	Permit approval form	Approval and conditions of rip-rap repair project.
Shoreline Substantial Development Master Use Permit, Attachment C.2	Port of Seattle	6/25/1992	Permit application	Shoreline Substantial Development Master Use permit submitted to the City of Seattle for terminal redevelopment project. Permit application no. 9203345.
Hydraulic Project Approval (HPA) form for riprap repair project at T-30	Washington State Department of Fisheries	10/5/1992	HPA form	Hydraulic Project Approval (HPA) form for riprap repair project at T-30; relevance to T-108?
Letter from B. Hinkle, Port of Seattle, to B. Ritchie, Ecology, regarding T-108 Improvements, Environmental Checklist POS SEPA File Number (92-14)	B. Hinkle, Port of Seattle	12/9/1992	Business letter	Letter is in response to Ecology comments on the SEPA Checklist for the T-108 redevelopment; also mentions potential contamination along the north half of the S Oregon St right-of-way possibly originating from the Washington State Liquor Control Board property.
Shoreline Management Act Permit for Shoreline Management Substantial Development, Conditional Use, or Variance, Application No. 9203345	City of Seattle Dept. of Construction and Land Use	12/31/1992	SMA permit	SMA Substantial Development permit for future grading of 10,000 cubic yards of cut and fill for the improvement of an access road at T-108. Permit includes legal descriptions of T-108 parcels
Seattle Department of Construction and Land Use Notice of Decision for Application No. 9203345	Seattle Department of Construction and Land Use	12/31/1992	City of Seattle Construction and Land Use Notice of Decision	Analysis and decision regarding application for Shoreline Substantial Development permit, project Application No. 9203345; decision states that the permit is conditionally granted.
Letter with subject: T-108 Development, S/MUP Permit Conditions for Engineering Response, City S/MUP Application No. 9203345, File No. ENG 12.1.40	D.Soike, Port of Seattle	1/12/1993	Business letter	Letter from David Soike, Port of Seattle, to Michael Harr, CCI regarding the need for CCI to respond to several conditions of the City of Seattle S/MUP/building permit related to operations at T-108

Title	Author	Publication Date	Type of Reference	Notes
				in order for the permit to be issued.
Fax and letter from D. Soike, Port of Seattle, to D. Stuart, City of Seattle, and K. Jones, Manager, Engineering Street Use, Seattle Engineering Department Street Use	D. Soike, Port of Seattle	4/12/1993 (fax) and 1/28/1993 (letter)	Fax and business letter	Fax regarding the street use permits and other necessary requirements to be met by the Port prior to the Oregon St. vacation and development project (part of terminal redevelopment plans). Letter regarding the proposed paved access road to be built across S Oregon Street to link T-108 and T-106W. Attached map includes location of proposed road, utilities in the S Oregon St right-of-way, T-108 property boundaries and tenant names, and adjacent property ownership/uses.
Fax from D. Soike, Port of Seattle, to D. Stuart , City of Seattle	D. Soike, Port of Seattle	4/13/1993	Fax with attachment(s)	Fax regarding the street use permits to be met by the Port prior to the Oregon St. vacation and development project (related to terminal redevelopment project).
Master Use and Construction Application and Permit, No. 668231	City of Seattle Dept. of Construction and Land Use	5/7/1993	Master Use and Construction application and permit form	Permit for T-108 eastern parcel site development; contains basic summary of project activities.
Letter from V. Simpson, Law Offices of Hillis Clark Martin and Peterson, to D. Soike, Port of Seattle, regarding T-108 Chevron Site Redevelopment (DCLU #9203345)	V. Simpson, Law Offices of Hillis Clark Martin and Peterson	5/6/1993	Business letter	Letter regarding additional information requested by the Seattle Dept. of Construction and Land Use for Application No. 9203345 regarding the checker booth and load/unload platform.
Letter from B. Hinkle, Port of Seattle, to D. Stuart, City of Seattle Dept. of Construction and Land Use regarding Shoreline Substantial Development Permit Application No. 9203345, Terminal 108 Improvements, and letter from B. Bunch, CCI, to B. Hinkle regarding CCI spill contingency plan	B. Hinkle, Port of Seattle and B. Bunch, CCI	2/23/1993 (Hinkle letter) and 1/19/1993 (Bunch letter)	Business letters	Letter from B. Hinkle to D. Stuart provided in response to shoreline and SEPA conditions of approval necessary for issuance of Master Use Permit No. 9203345. Letter from B. Bunch to B. Hinkle includes excerpt of CCI contingency plan.
Letter from David Soike, Port of Seattle, to Sarah Armstrong, Port of Seattle, regarding rip-rap repair at T-108.	Port of Seattle	2/23/1993		Internal Port memorandum regarding rip-rap repair.
Letter from R. Krochalis, Seattle Dept. of Construction and Land Use, to the Port of Seattle, regarding posting and maintenance of Certificate of Occupancy	Rick Krochalis, Seattle Dept. of Construction and Land Use	Attached Certificate of Occupancy dated 3/9/1995	Business letter and attached certificate	Letter contains Certificate of Occupancy for “B-2 Office Trailer Checker’s Booth”, Building Permit No. 668231.
Letter from D. Soike, Port of Seattle, to B. Bunch, CCI, regarding Permit for T-108 Truck Entry Checkers Booth	D. Soike, Port of Seattle	4/7/1995	Business letter	Letter providing CCI with copies of City of Seattle permit for T-108 truck entry checkers booth, assumed to be Certificate of Occupancy for “B-2 Office Trailer Checker’s Booth”, Building Permit No. 668231.
Baseline General NPDES Permit for Storm Water	Department of	6/9/1993	NPDES	Copy of the Port’s general industrial permit issued by Ecology on

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Discharges (associated with terminal redevelopment construction storm water)	Ecology		general permit	June 9, 1993 for stormwater discharges associated with construction econ T-108. Permit No. SO3001309
Letter from J. Krull, Ecology, to D. Soike, Port of Seattle, regarding Notice of Termination of Coverage under Baseline General NPDES Permit for Storm Water Discharges for construction stormwater discharges	J. Krull, Department of Ecology	3/4/1994	NPDES general permit notice of termination	Confirmation of Notice of Termination from Ecology to the Port of Seattle for NPDES permit held for discharge of construction site storm water during terminal redevelopment activities.
Letter from V. Sutton, Ecology, to T. Sundesten, CCI, regarding Dangerous Waste Compliance Inspection at CCI (RCRA ID# WAD040197014)	V. Sutton, Ecology	9/26/2001	Business letter with attached compliance report	Letter states that there were several areas of non-compliance with Dangerous Waste Regulations identified at CCI during inspection on 8/14/2001; attached compliance report contains site photographs and inspection summary.
Letter from R. Woods, City of Seattle, to T. Sundesten, CCI, regarding results from January 10, 2002 stormwater pollution prevention re-inspection	R. Woods, City of Seattle	2/4/2002	Business letter and photographs	Letter contains inspection results and attached photographs.
Engineering Drawings related to terminal redevelopment	Various	Various (1992, 1993, and-1995)	engineering drawings	Multiple engineering drawings regarding several aspects of the T-108 redevelopment project and CCI operations on T-108.
Environmental Investigations Conducted for the Port of Seattle				
T-108 Groundwater and Shoreline Soil Investigation Final Work Plan	Pacific Groundwater Group	5/3/2006	Work plan	Work plan for soil and groundwater investigation at T-108. Includes information on previous environmental investigations. Appendix A contains a letter report from Ward Crell, Pacific Environmental Group to Joe Hickey, Department of Ecology, regarding proposed landfarming activities by Chevron at the T-108 eastern parcel. Letter report includes analytical results from soil collected at the proposed landfarming area and from soil samples collected from the soil stockpiled to be landfarmed.
Port of Seattle T-108 Interim Groundwater and Soil Investigation	Pacific Groundwater Group	12/18/2006	Report	Report includes results of an environmental investigation on T-108 including soil and groundwater sampling results. Report includes maps, well construction logs,
Port of Seattle T-108 Groundwater Investigation Final Report	Pacific Groundwater Group	10/8/2007	Report	Report includes information on site history, description, and hydrogeology, groundwater flow information, and analytical results for groundwater samples collected over 4 rounds.
Soil and Groundwater Data Report, Oregon Street Right-of-Way, Phase II Investigation	Pacific Groundwater Group	1/8/2007	Report	Results of Phase II environmental investigation of the Oregon St. Right-of-Way including bore logs, soil data, groundwater data, and intertidal sediment data
Draft South Oregon Street 2006 Environmental Data Review and Summary	Pacific Groundwater Group	2/10/2006	Report	Environmental review of the South Oregon Street right-of-way, includes information on the historical drainage channel located in

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				approximately the location of the road right-of-way.
ConGlobal Lease and NPDES Permit				
Lease Agreement between the Port of Seattle and ConGlobal Industries	Port of Seattle	4/3/2008	Lease agreement	Lease agreement between the Port of Seattle and ConGlobal Industries for ConGlobal's occupancy of T-108.
Letter from N. Winters, Ecology, to J. Banks, ConGlobal, regarding ConGlobal's Coverage under the Industrial Stormwater General Permit	N. Winters, Ecology	4/24/2008	Business letter	Business letter grants coverage for ConGlobal under NPDES Industrial Stormwater General Permit, Permit No. SO3-010569. Letter includes information on stormwater sampling requirements.
ConGlobal Industries Stormwater Pollution Prevention Plan (SWPPP)	Weston Solutions	5/8/2008	Pollution prevention plan	SWPPP prepared by Weston Solutions for ConGlobal Industries. Plan includes facility and site layout information, materials inventory, information on best management practices (BMPs), and guidance for stormwater sampling and inspections.
Reports Related to the Duwamish/Diagonal Sediment Cleanup Area				
Source Control Summary Document for Duwamish/Diagonal Sediment Cleanup Project	King County (received from Jeff Stern)	2/28/2007	Informal report (not known whether formally published)	Background information regarding the Duwamish/Diagonal sediment area early action cleanup and source control information for properties and outfalls surrounding the cleanup area.
Duwamish/Diagonal CSO/SD Sediment Remediation Project Closure Report	Anchor Environmental, LLC, EcoChem, Inc.	7/27/2005	Report	Closure report documenting work conducted during sediment remediation at the Duwamish/Diagonal. Describes dredging, transport, disposal, and capping methods utilized between November 2003 and March 2004.
Duwamish/Diagonal CSO/SD Cleanup Study Report	King County Dept. of Natural Resources and Parks, Anchor Environmental, LLC, EcoChem, Inc.	10/2005	Report	Presents information on sediment sampling within the cleanup area and results of recontamination modeling to refine final delineation of cleanup area and select the sediment cleanup design. Report includes information on the Diagonal Sewage Treatment Plant.
Duwamish/Diagonal CSO/SD Sediment Remediation Project 2005 Monitoring Report	Anchor Environmental, LLC	5/2007	Report	Report presents the results of the March and April 2005 Duwamish/Diagonal CSO/SD cleanup area sediment cap monitoring. Report includes results for two bank soil samples collected along the T-108 shoreline.
Environmental Investigations for Surrounding Properties				
Federal Center South Property Review	Ecology	not reported		
Phase I Environmental Site Assessment, Federal Center South	Herrera Environmental	7/2001	Report	Phase I Environmental Site Assessment for Federal Center South. Investigation includes a review of historical environmental

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	Consultants			information for the property and a review of regulatory database listings.
Phase I Environmental Site Assessment, T-106W, Building 1	Pinnacle Geosciences	10/28/2005	Report	Phase I Environmental Site Assessment for a portion of T-106W. Investigation includes a review of historical environmental information for the property and a review of regulatory database listings.
LDW-Related Information				
Duwamish Industrial Area Hydrogeologic Pathways Project: Duwamish Basin Groundwater Pathways Conceptual Model Report	Booth and Herman	4/1998	Report	Report includes information on the geologic history of the Duwamish Valley and information on regional stratigraphy, which is applicable to conditions at T-108.
Lower Duwamish Waterway Outfall Survey	Herrera Environmental Consultants	1/2004	Summary report and inventory spreadsheet	Summary report presents the purpose and methods of the survey; spreadsheet includes the outfall data (inventory).
Lower Duwamish Waterway Source Control Strategy	Ecology	1/2004	Report	Document outlining Ecology's strategy for implementing source control in the LDW.
Source Control Action Plan for the Duwamish/Diagonal Way Early Action Cleanup area	Ecology	12/2004	Report	Report includes information on the properties surrounding the sediment cleanup area (including T-108), and the outfalls in the vicinity of the sediment cleanup area.
King County and Seattle Public Utilities Source Control Program for the Lower Duwamish Waterway, June 2005 Progress Report	King County Department of Natural Resources and Parks and Seattle Public Utilities	6/2005	Report	Report documenting City of Seattle and King County source control efforts in the Lower Duwamish Waterway. Report includes information on business inspections, source-tracing sample collection, and atmospheric deposition monitoring, among other activities, within the LDW basin.
Combined Sewer Overflow Control Program, 2005-2006 Annual Report	King County Department of Natural Resources and Parks	10/2006	Report	Annual report on the frequency and volume of CSO events in the LDW between June 2005 and May 2006. Report also provides an overview of King County's CSO control program.
Other Engineering Drawings				
Engineering Drawings of Water Main Extension , Diagonal Avenue S	Port of Seattle	12/1989	Engineering drawings	As-built engineering drawings for water main extension to Diagonal Avenue S.
Engineering Drawings for T-108 Shoreline Stabilization	Port of Seattle	1989 and 1990	Engineering drawings	Engineering drawings showing area of shoreline stabilized with rip-rap.