Revised Technical Memorandum No. 1: Modeling, Cleanup Levels, Constituents of Concern, Remediation Levels, Conditional Points of Compliance, and Corrective Action Schedule

Site Wide Feasibility Study

PSC Georgetown Facility

Seattle, Washington

Prepared for:

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Kent, Washington 98032

June 2006

Project No. 8770

Geomatrix

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REVISED TECHNICAL MEMORANDUM NO. 1: MODELING, CLEANUP LEVELS, CONSTITUENTS OF CONCERN, REMEDIATION LEVELS, CONDITIONAL POINTS OF COMPLIANCE, AND CORRECTIVE ACTION SCHEDULE

Site Wide Feasibility Study
PSC Georgetown Facility
Seattle, Washington

1.0 PURPOSE AND SCOPE

This technical memorandum has been prepared to document work completed to date for the revised Site Wide Feasibility Study (SWFS) for the Philip Services Corporation (PSC) Georgetown facility.[1] This SWFS is intended to meet corrective action provisions of the PSC Georgetown facility RCRA Part B Permit (the Permit) and the requirements of the MTCA. The Permit, as issued under the authority of the Washington Department of Ecology (Ecology), covers the regulated areas of the former PSC facility operations. PSC closed these areas (and all dangerous waste operations within these areas) in August 2003 under a closure plan approved by Ecology. At that time, all dangerous waste operations at the facility ceased.

During 2003 and 2004, PSC implemented the hydraulic control interim measure (HCIM). The HCIM required construction of a subsurface barrier wall keyed into the aquitard underlying the Site and a pump-and-treat system designed to maintain an inward gradient to contain contaminated groundwater beneath the facility and adjacent properties. Implementation of the HCIM required PSC to purchase the TASCO property and adjoining railroad spur, and to

[1] Throughout this memorandum, the term “facility” is used to refer to the former Resource Conservation and Recovery Act (RCRA) dangerous waste operations located at 734 South Lucile Street, owned and operated by PSC. The term may also include certain properties adjacent to the former dangerous waste facility property that were acquired by PSC following closure of the dangerous waste operations in August 2003 (e.g., adjacent property to the northwest formerly owned by The Amalgamated Sugar Company [TASCO] that was impacted by historical releases from the PSC facility). The facility RCRA Part B permit (Permit) requires PSC to perform corrective action beyond the boundaries of the permitted facility to address such releases. The Washington Model Toxics Control Act (MTCA) regulations, Chapter 173-340 WAC, also require PSC to perform cleanup actions to address releases from the facility at “any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located (*see* WAC 173-340-200). For purposes of this Technical Memorandum, the term “Site” includes both the facility and other areas (e.g., TASCO) that have been affected by releases that occurred at the facility.

acquire easements on two other properties adjacent to the facility (the Stone-Drew/ Ashe & Jones [SAD] property and the Aronson property). The HCIM has proven effective in providing hydraulic control of contaminated groundwater in these areas of the Site.

The Permit requires that the SWFS address all areas affected by releases from the facility. The area addressed by the SWFS (i.e., the SWFS Area) includes the properties currently owned by PSC (the facility and the adjacent TASCO property), properties adjacent to the PSC properties (Union Pacific Rail Road [UPRR]), Aronson, and SAD properties), and the contiguous areas affected by releases from the facility extending downgradient (west) to Fourth Avenue South. After the Final Comprehensive Remedial Investigation Report and its subsequent addenda, collectively referred to as the RI Report (PSC 2003, 2004a through 2004d) were completed, additional releases to soil and groundwater from non-PSC sources were identified downgradient from the facility, near Fourth Avenue South. The specific chemicals released in these downgradient areas include many of the facility constituents of concern (COCs). These downgradient releases have resulted in an area of co-mingled releases that extend from approximately Fourth Avenue South to the Duwamish Waterway. Due to the presence of these downgradient source areas and the complexity of dealing with impacted groundwater from multiple sources, the scope of the SWFS has been limited, with Ecology concurrence, to the SWFS Area. Remedial action for the area downgradient from Fourth Avenue South will be addressed separately.

In response to comments received from Ecology on the initial draft SWFS report, PSC and Ecology have agreed to use a collaborative, phased process in preparing the revised draft SWFS report to ensure consensus among PSC, Ecology, and other interested parties on key issues that affect the SWFS. During this process, PSC will develop the five separate technical memoranda addressing the topics listed below to satisfy Permit and MTCA requirements for the complete SWFS:

1. Cleanup Levels, Constituents of Concern, Point of Compliance, Fate and Transport Modeling, and Corrective Action Schedule
2. Remediation Areas
3. Inhalation Pathway Interim Measure
4. Technology Identification and Screening
5. Remedial Alternatives Development and Evaluation

PSC will prepare and submit each technical memorandum in draft form to Ecology. Following Ecology review and comment, PSC will revise the draft memoranda as appropriate for final approval by Ecology. It was agreed that work on Technical Memoranda Nos. 2 and 3 would begin simultaneously after Ecology's final approval of Technical Memorandum No. 1 (this memorandum). Technical Memorandum No. 4 will be prepared after final approval of both Memoranda Nos. 2 and 3, and Memorandum No. 5 will be prepared after final approval of Memorandum No. 4. PSC will prepare the complete revised draft SWFS following Ecology approval of Technical Memorandum No. 5 by combining the five memoranda listed above.[2]

This memorandum provides the regulatory and technical bases under the MTCA for establishing the cleanup levels, COCs, the point(s) of compliance, and the modeling assumptions and approach to be used for completing the SWFS. This memorandum also outlines the overall cleanup action approach and schedule to be followed for preparing the Cleanup Action Plan (CAP) for the Site.

To avoid creating acronyms in the continuing text of this memorandum, a list of acronyms and shortened names for terms not otherwise defined in the text is presented below:

API	Asian Pacific Islander
ARARs	applicable state and federal laws
bgs	below ground surface
BEHP	bis-2-(ethylhexyl)phthalate
C1	Commercial 1 zone
CAS	Columbia Analytical Services
cis-1,2-DCE	cis-1,2-dichloroethene
cm/sec	centimeters per second
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CPOC	conditional point of compliance
COC	constituent of concern
COI	constituent of interest
COPC	constituent of potential concern
DO	dissolved oxygen

[2] These memoranda have been designed so that individual sections may be incorporated directly into the revised draft SWFS. It is anticipated that the text from the individual memoranda will appear in the report in a sequence different from the sequence of the memoranda as submitted to Ecology.

EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPH	Extractable Petroleum Hydrocarbon
f_{oc}	fraction organic carbon
FS	feasibility study
GAC	granular-activated compound
gpm	gallons per minute
HCIM Area	the area within the hydraulic control interim measure barrier wall
HRC	hydrogen releasing compound
ICOC	indicator constituent of concern
IG1	General Industrial 1 zone
IG2	General Industrial 2 zone
Kd	soil-water partitioning coefficient
Koc	carbon partitioning coefficients
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
L/Kg	liters per kilogram
mV	millivolts
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MDL	method detection limit
NAPL	non-aqueous phase liquid
NPDES	National Pollutant Discharge Elimination System
NPV	net present value
ORC	Oxygen Release Compound™
Outside Area	the area of study outside the boundaries of the HCIM Area
PAH	polycyclic aromatic hydrocarbons
PCE	tetrachloroethene
POC	point of compliance
PRB	permeable reactive barrier
PQL	practical quantitation limit
redox	reduction/oxidation

RI	remedial investigation
RL	remediation level
scfm	standard cubic feet per minute
SPOC	standard point of compliance
SVE	soil vapor extraction
SWFS	site wide feasibility study
TCE	trichloroethene
VC	vinyl chloride
VOC	volatile organic compound
WAC	Washington Administrative Code

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2.0 CLEANUP STANDARDS AND DEVELOPMENT OF CLEANUP LEVELS

Under the MTCA regulations, cleanup standards consist of (a) cleanup levels for hazardous substances in environmental media that are determined by Ecology to be protective of human health and the environment under specified exposure conditions; (b) the location where these cleanup levels must be met (point of compliance); and (c) other regulatory requirements that may apply to the site, as specified under WAC 173-340-700(3). To attain cleanup standards, the cleanup levels must be achieved at the applicable SPOC or CPOC within an acceptable timeframe. For the areas addressed by this SWFS, cleanup levels also must be protective of the pathways described in the conceptual site model (CSM). At a minimum, Site cleanup levels for impacted soil within the vadose zone and impacted groundwater within the water table depth interval must be met for the following media exposure pathways:

- Soil – industrial direct human exposure pathways (ingestion, inhalation, dermal absorption);
- Soil – indoor vapor inhalation pathway;
- Soil – groundwater pathway;
- Groundwater – the groundwater-to-surface water pathway (i.e., the point at which groundwater discharges to the Duwamish Waterway); and
- Groundwater – indoor vapor inhalation pathway.

For groundwater within the shallow and intermediate depth intervals, and within the deep aquifer, all exposure pathways listed above (other than those related to inhalation of vapors) must be met. The deep aquifer is not used as a source of drinking water. Due to the naturally high levels of dissolved solids, manganese, and iron, the deep aquifer is not likely to be used as a source of drinking water in the future. However, Ecology has determined that cleanup levels for the deep aquifer must allow for direct ingestion of water from this aquifer in addition to the non-inhalation pathways listed above. Therefore, cleanup levels for the deep aquifer must additionally include consideration of levels protective of drinking water.

In the RI Report cleanup levels were identified for the particular COCs listed in the RI Report. The RI Report ascertains groundwater cleanup levels that are protective of human health and the environment for the groundwater-to-surface water pathway and for the indoor inhalation pathway. In the following subsections, preliminary cleanup levels are described for use in this SWFS; these preliminary SWFS cleanup levels include consideration of natural background concentrations in soil (WAC 173-340-709), PQLs for both soil and groundwater (WAC 173-

340-705(6)), and, as directed by Ecology, direct ingestion of groundwater from the deep aquifer.

For the SWFS cleanup levels, area background concentrations for constituents present in groundwater upgradient and cross gradient from the facility have not been considered. If determined appropriate in the future, PSC may establish area background concentrations for groundwater constituents released from sources other than PSC. Area background concentrations approved by Ecology may be used in the future to establish Method C groundwater cleanup levels in accordance with the MTCA regulations. Such cleanup levels may be considered for the water table, shallow, and intermediate depth intervals as well as the deep aquifer.

In this Section 2.1 below, preliminary SWFS cleanup levels for groundwater are established; the final SWFS groundwater cleanup levels are established in Section 7. The SWFS cleanup levels established for soil in this section are considered final SWFS cleanup levels. The cleanup levels presented in this technical memorandum will be used to develop and evaluate potential remedial alternatives in this SWFS. It should be noted that final cleanup levels for the Site will be proposed and formally approved in the CAP, which will be prepared prior to implementing the selected remedial alternative. Additionally, the SWFS cleanup levels include new constituents identified in investigations conducted after completion of the final RI Report.

2.1 GROUNDWATER CLEANUP LEVELS

The groundwater cleanup levels applied in the SWFS for the water table, shallow, and intermediate depth intervals, plus the deep aquifer, are generally based on the final RI MTCA Method B groundwater cleanup levels. For the SWFS, the final RI cleanup levels were evaluated in accordance with the MTCA regulations and include consideration of PQLs in addition to the MTCA Method B risk-based criteria and ARARs. Additionally, according to Ecology comments, final groundwater cleanup levels for certain constituents may be established considering fate and transport behavior. Therefore, the preliminary SWFS groundwater cleanup levels established in this section may be modified based on site-specific fate and transport factors, as described in Section 7.0. Final SWFS groundwater cleanup levels are established in Section 7.

2.1.1 Risk-Based Cleanup Level Calculation

2.1.1.1 Water Table, Shallow, and Intermediate Depth Interval Cleanup Levels

The final RI cleanup levels applicable to the water table depth interval included calculated Method B groundwater cleanup levels based on a Residential Exposure Scenario for the inhalation of indoor air exposure pathway (Equations 750-1 and 750-2 from the MTCA regulations). The final RI cleanup levels applicable to the water table, shallow, and intermediate depth intervals included calculated Method B groundwater cleanup levels based on an API Exposure Scenario (i.e., Modified MTCA Method B) for the Consumption of Fish (Modified 730-1 and Modified 730-2) exposure pathway for the groundwater-to-surface water pathway. It should be noted that Ecology's Science Advisory Board is currently reviewing assumptions related to fish consumption rates for the API and may revise such assumptions in the future. If these assumptions are revised, it could be necessary to adjust the cleanup levels based on the fish ingestion pathway.

The MTCA regulations (WAC 173-340-705) include requirements that the total potential cancer risk from multiple constituents and/or multiple pathways must be less than 10-5 and the total noncancer hazard quotient must be less than or equal to 1.0. To comply with WAC 173-340-705(4), the Method B calculations for the final RI cleanup levels included a cancer risk factor of 1x10-6 and a hazard quotient of 0.1 for individual carcinogenic constituents. Safety factors are expected to ensure that the calculated total risks from individual COCs from all relevant exposure pathways for each receptor (i.e., the Resident or the API Fisher) are below acceptable levels. Additionally, the modified Method B groundwater cleanup calculations presented in the final RI for cPAHs were recalculated so that the total potential risk factor considering all cPAHs was equal to 1 x 10-6.

2.1.1.2 Deep Aquifer Cleanup Levels

Groundwater cleanup levels for the deep aquifer were established using the process described above for the shallow and intermediate depth intervals. However, in addition to the surface water pathway considered for the shallower groundwater, cleanup levels established for the deep aquifer also considered potential use of the groundwater as a drinking water supply, as required by Ecology, based on the assumed use of the deep aquifer for supply of drinking water.

2.1.2 Cleanup Level Selection

For groundwater less than or equal to 20 feet bgs (i.e., the water table interval), the Final RI cleanup level for each constituent was a MTCA Method B Cleanup level selected by choosing the minimum of the following:

- Residential Exposure Scenario (WAC 173-340-750 - Inhalation using MTCA Method B equations 750-1 and 750-2);
- API Fisher Exposure Scenario (MTCA Method B equations 730-1 and 730-2, i.e., the seafood intake rate was increased to 52.4 grams/day and the fish diet fraction was increased to one);
- Ambient Water Quality Criteria (AWQC), based on Human Health Consumption of Organisms only (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);
- Ecological Risk Assessment Surface Water Screening Levels (protective of aquatic biota in surface water selected, in decreasing order of preference, from the following sources:
    - Washington State AWQC, Chapter 173-201A,
    - Oak Ridge National Laboratory Surface Water Benchmarks (March 2005, http://www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html and http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html),
    - AQUIRE Effects-Based Concentrations (March 2005, www.epa.gov/ecotox/), and
    - USGS Screening Values (1999, Selection Procedure and Salient Information for Volatile Organic Compounds Emphasized in Natural Water Quality);
- AWQC Freshwater and Marine Criteria Maximum Concentration, Criteria Continuous Concentration, and Organoleptic Effects (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);
- State of Washington Freshwater and Marine Acute and Chronic effects (WAC 173-201A); and
- MTCA Method A cleanup levels (WAC 173-340 - Table 720-1).

For groundwater greater than 20 feet bgs (i.e., the shallow and intermediate depth intervals), the Final RI cleanup level for each constituent was selected by choosing the minimum of the following MTCA Method B cleanup levels:

- API Fisher Exposure Scenario (MTCA Method B equations 730-1 and 730-2);
- AWQC based on Human Health Consumption of Organisms only (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);
- Ecological Risk Assessment Surface Water Screening Levels (protective of aquatic biota in surface water selected, in decreasing order of preference, from the following sources:
    - Washington State AWQC [Chapter 173-201A], Oak Ridge National Laboratory Surface Water Benchmarks [March 2005, http://www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html and http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html],
    - AQUIRE Effects-Based Concentrations [March 2005, www.epa.gov/ecotox/], and
    - USGS Screening Values [1999, Selection Procedure and Salient Information for Volatile Organic Compounds Emphasized in Natural Water Quality]);
- AWQC Freshwater and Marine Criteria Maximum Concentration, Criteria Continuous Concentration, and Organoleptic Effects (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);
- State of Washington Freshwater and Marine Acute and Chronic effects (WAC 173-201A); and
- MTCA Method A cleanup levels (WAC 173-340 - Table 720-1).

For the deep aquifer, the SWFS cleanup level for each constituent was selected by choosing the minimum of the following MTCA Method B risk-based cleanup criteria and ARARs:

- API Fisher Exposure Scenario (Modified MTCA Method B equations 730-1 and 730-2 [i.e., the seafood intake rate was increased to 52.4 grams/day and the fish diet fraction was increased to one]);
- MTCA Method B cleanup criteria based on ingestion of groundwater (MTCA equations 720-1 and 720-2);
- Federal Maximum Contaminant Levels (MCLs);

- AWQC based on Human Health Consumption of Organisms only (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);

- Ecological Risk Assessment Surface Water Screening Levels (protective of aquatic biota in surface water selected, in decreasing order of preference, from the following sources:

  - Washington State AWQC, Chapter 173-201A,

  - Oak Ridge National Laboratory Surface Water Benchmarks (March 2005, http://www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html and http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html),

  - AQUIRE Effects-Based Concentrations (March 2005, www.epa.gov/ecotox/), and

  - USGS Screening Values (1999, Selection Procedure and Salient Information for Volatile Organic Compounds Emphasized in Natural Water Quality);

- AWQC Freshwater and Marine Criteria Maximum Concentration, Criteria Continuous Concentration, and Organoleptic Effects (Federal Clean Water Act Section 304, National Recommended Water Quality Criteria, 2004);

- State of Washington Freshwater and Marine Acute and Chronic effects criteria (WAC 173-201A); and

- MTCA Method A cleanup levels (WAC 173-340 - Table 720-1).

2.1.3 Method B Cleanup Levels for Groundwater

After selecting the minimum value from the MTCA Method B potential risk calculations and ARARs, the preliminary Method B groundwater cleanup levels were established for use in the SWFS. For some constituents, the preliminary Method B cleanup levels were revised upward to address analytical method considerations in accordance with the MTCA regulations (WAC 173-340-705(6)) so that the final cleanup levels were not lower than the PQLs. The cleanup levels established by this process are modified MTCA Method B cleanup levels. In reviewing the Method B cleanup levels based on analytical considerations, Ecology may consider the availability of improved analytical techniques and require their use. In accordance with WAC 173-340-707, if the PQL for a constituent was higher than the final groundwater cleanup level, the cleanup level was raised to the PQL level if:

- The PQL is no greater than 10 times the method detection limit (MDL); and

- The CAS PQL is not higher than the EPA-established PQL.

The PQLs were obtained from the current project laboratory, Washington State-certified CAS of Kelso, Washington. CAS performs low level and Selective Ion Monitoring (SIM) for VOC, SVOC, and PCB analyses to attain PQLs below typical reporting limits. For some PAHs, the CAS PQL was slightly higher than 10 times the MDL. In these cases, the value of 10 times the MDL was used as the PQL. Applicable analytical methods, MDLs, and PQLs (CAS and federal) used for adjusting the Method B cleanup levels are provided in Table 2-1.

The final RI cleanup levels, PQLs, and preliminary Method B SWFS cleanup levels for the water table depth interval are summarized on Table 2-2. The preliminary Method B SWFS groundwater cleanup levels for the shallow and intermediate depth intervals are shown on Tables 2-3 and 2-4, respectively. The preliminary Method B SWFS groundwater cleanup levels for the deep aquifer are summarized in Table 2-5. As noted previously, the preliminary cleanup levels presented on these tables are limited to constituents detected in groundwater or soil since February 2004, after the HCIM was completed.

As previously discussed, to ensure that the cleanup levels do not present unacceptable total risk (i.e., a total risk greater than 10-5 or hazard quotient of 1.0), the cleanup levels for individual constituents were calculated based on a risk factor of 10-6 and a hazard quotient of 0.1. By setting the cleanup levels at the PQLs for select constituents, the total risk safety factor provided by the cleanup level calculations is offset somewhat, resulting in a potential increase in the total potential risk. However, based on the following reasons, any potential increase in total potential risk should be minimal:

- Many of the SWFS cleanup levels set to the PQLs were originally based on protection of surface water; none of these constituents for which cleanup levels were adjusted to the PQLs are predicted to reach the Duwamish Waterway, based on modeling presented in this SWFS report.

- Several water table interval constituents (i.e., n-hexane, C10-C12 (EPH) aromatics, and C8-C10 (EPH) aliphatics) with cleanup levels set at PQLs had final RI cleanup levels established to be protective of the indoor air pathway. While raising the cleanup levels to the PQL would increase potential risks for those constituents, it is expected that the safety factor used to establish risk-based cleanup levels will be adequately protective of human health for the following reasons:

    - The PQL for n-hexane is only slightly greater than the cleanup level based on a 10-6 risk factor or an HI of 0.1;

- o The two EPH fractions (i.e., C10-C12 (EPH) aromatics and C8-C10 (EPH) aliphatics) have elevated PQLs due to difficulties associated with performing the analysis; and
- o Both of the EPH fractions (i.e., C10-C12 (EPH) aromatics and C8-C10 (EPH) aliphatics) comprise several different compounds, many of which have individual cleanup levels that are not based on PQLs. The individual component cleanup levels based on the inhalation pathway are expected to maintain total potential risks at acceptable levels.

2.2 SOIL CLEANUP LEVELS

Soil cleanup levels calculated during the RI are included in Table 2-7.[3] The final RI cleanup level for each soil COC was selected by choosing the minimum of the following MTCA cleanup levels:

- MTCA Method C - Industrial Cleanup Level based only on a Worker Exposure Scenario (MTCA equations 745-4, 745-5) and MTCA Method C Soil Cleanup Levels based on the Protection of Air (MTCA equations 750-1 and 750-2). These equations were modified to calculate soil cleanup levels using a 10-6 cancer risk factor and hazard quotient of 0.1 for each constituent and pathway);
- MTCA Method A Table Values for Industrial Purposes (Table 745-1); and
- Soil to Groundwater Cleanup Levels (WAC 173-340-747(4)).

The soil-to-groundwater cleanup levels were recalculated to ensure soil cleanup levels would be protective of groundwater cleanup levels based on the indoor vapor inhalation pathway and the groundwater-to-surface water pathway. The preliminary SWFS groundwater cleanup levels discussed above in Section 2.1 were used to calculate soil cleanup levels protective of groundwater; these soil cleanup levels will not be revised based on the final groundwater cleanup levels presented in Section 7. Due to the potential for exposure from multiple pathways, the final RI cleanup levels for individual constituents were calculated using a 10-6 cancer risk factor and a hazard quotient of 0.1 (for each pathway).

To establish final soil cleanup levels for the SWFS, the minimum risk-based modified Method C cleanup levels were compared to natural background levels and PQLs in accordance with the MTCA regulations (WAC 173-340-709 and WAC 173-340-705(6)) so that the final cleanup levels were not lower than natural background or the PQLs. The modified Method C cleanup levels were established as follows:

[3] For the SWFS, the saturated soil zone below the water table will be addressed through groundwater cleanup levels.

- All risk-based modified Method C soil cleanup levels established in the final RI were considered potential SWFS cleanup levels;

- Soil characterization data collected subsequent to completing the RI Report were reviewed to identify newly detected soil constituents that did not have final RI cleanup levels. For all new soil constituents, modified Method C soil cleanup levels were calculated using the same methodology that was used for the final RI cleanup levels;

- For each soil constituent, soil cleanup levels protective of the water table depth interval groundwater cleanup levels presented in Section 2.1 were calculated in accordance with the procedures specified in WAC 173-340-747;

- The lower of the risk-based modified Method C cleanup level and the level protective of groundwater for each soil constituent was selected for comparison to natural background concentrations;

- The risk-based soil cleanup level selected for each constituent was compared to the natural background concentration. If the risk-based cleanup level was less than the natural background concentration, the natural background concentration was selected for comparison to the PQL;

- If natural background concentrations were lower than the modified Method C cleanup levels (i.e., final RI cleanup levels or cleanup levels calculated using final RI cleanup level methodology), the modified Method C cleanup level was selected for comparison to the PQL; and

- If the selected natural background concentration or modified Method C cleanup level was less than the PQL, the PQL was selected as the SWFS cleanup level.

Natural background levels for metals were sourced from Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994) defined by Ecology for the Puget Sound area.[4] WAC 173-340-709(2) specifies that for the purposes of defining background concentrations, samples shall be collected from areas that have not been influenced by releases from the site and, in the case of natural background, concentrations that have not been influenced by releases from other localized human activities. Given the industrial and urban setting of the SWFS Area, Ecology-determined regional natural background levels were considered more reliable and appropriate than background calculations developed using data collected in the Georgetown area and the background calculations specified under WAC 173-340-709. PSC recognizes the difficulty in defining natural background constituent levels (e.g., that has not been impacted by localized human activities) for this purpose. Cleanup levels established in the RI Report that were below the defined Puget Sound natural background levels were adjusted up to the applicable natural background level in accordance with the limitations set forth in WAC 173-340-706(6).

Applicable PQLs were established for soil in the same manner used for groundwater that was described in Section 2.1.3. Applicable analytical methods, MDLs, and PQLs (CAS and federal) used for establishing the Method C soil cleanup levels are provided in Table 2-6. The final soil cleanup levels for the SWFS are listed in Table 2-7. These cleanup levels will be used to define soil remediation areas and for developing and evaluating remediation alternatives.

[4] The Puget Sound natural background values were calculated as the 90th percentile value using Ecology's MTCAStat program on a sample set of n=45.

3.0 CONSTITUENTS OF CONCERN

Specific COCs have been defined for use in the SWFS. For the purposes of this SWFS, COCs are defined as chemical constituents that were released to soil and groundwater at the facility and that are regulated by corrective action provisions of the facility's RCRA Part B Permit. The specific COCs to be addressed by the SWFS were identified by comparing site investigation data to the preliminary SWFS groundwater cleanup levels and the final SWFS soil cleanup levels identified in Section 2. By focusing on COCs exceeding these cleanup levels, the SWFS addresses and identifies approaches to mitigate potential risks related to the facility.

COCs are identified separately for soil and groundwater within the HCIM Area and within the Outside Area. Soil COCs within both the HCIM Area and the Outside Area were identified by reviewing RI Report soil analytical data as well as soil data collected after completion of the RI Report. Groundwater COCs for the Outside Area were identified using groundwater data collected from monitoring wells and direct push borings since completion of the HCIM in February 2004. To ensure adequate areal coverage of the Outside Area for a particular depth interval, groundwater monitoring data may be supplemented using groundwater data presented in the RI Report that was obtained from monitoring wells since 2000. For the HCIM Area, groundwater COCs were identified using a database that combined groundwater data from the RI Report, including direct push sampling data, with data collected subsequent to completing the final RI report. This expanded database was used for the HCIM Area due to the limited sampling that has been conducted inside the barrier wall since completing HCIM construction.

3.1 SOIL CONSTITUENTS OF CONCERN

Only soil samples collected above 15 feet bgs were evaluated to assess soil contamination for this SWFS. The COCs present in the saturated zone are addressed in the SWFS as a groundwater issue and are discussed in Section 3.2.

A number of soil investigations have been conducted within the SWFS Area. Soil samples were collected as part of the RI between 1987 and the present. Most RI soil samples were collected at the facility within the HCIM Area. After completion of the RI Report, several test pits and multiple soil samples were collected in 2004 and 2005 along the east boundary of the facility on UPRR property formerly leased by PSC (Kennedy/Jenks, 2005; Geomatrix, 2005) and along the SAD property line in 2005 (Geomatrix, 2005). Figure 3-1 shows the soil sample locations from the RI and the subsequent soil investigations. The 2004/2005 soil investigations expanded the dataset of soil analyses that were not considered in the RI Report. As such, it is necessary to evaluate the 2004/2005 soil sampling data to determine if additional COCs should be included in the SWFS.

The combined sampling data from the RI Report and the 2004/2005 sampling comprise the SWFS soil data set. This soil data set was analyzed using the following procedure.

1. If a constituent was identified as a COC during the RI, it was retained as a COC for the SWFS unless the highest concentration detected in the RI data set was below the SWFS cleanup levels established in Section 2 of this document. The results of this analysis are provided in Table 3-1.
2. All 2004/2005 soil analytical results were evaluated. If a constituent was detected in at least 5 percent of the sample analyses, the constituent was retained as a COPC. Constituents that were never detected above the reporting limits were eliminated as potential new COCs. The results of this analysis are provided in Table 3-2.
3. The maximum detected concentration of each new soil COPC listed in Table 3-2 was compared to the SWFS cleanup levels defined in Section 2. If the maximum detected COPC concentration was above the SWFS cleanup level, the COPC was retained as a COC for the SWFS[5.] The results of this analysis are provided in Table 3-3.

This is a conservative approach that appropriately identifies COCs relevant for the SWFS. Of the soil COCs identified in the RI Report, six were deleted based on the comparison to SWFS cleanup levels presented in Table 3-1. A total of 65 soil constituents have been identified as COCs for the SWFS, as summarized in Table 3-4. These 65 soil COC s include all COCs identified in the RI report that exceeded SWFS cleanup levels and all additional identified soil constituents detected at concentrations exceeding the SWFS cleanup levels.

3.2 GROUNDWATER CONSTITUENTS OF CONCERN

Given potentially different migration and exposure pathways, groundwater COCs for both the HCIM Area and the Outside Area have been determined within three depth intervals:

- water table depth interval,
- shallow depth interval, and

[5] Soil samples collected at background locations UP-5 and UP-7 during the 2004/2005 soil investigations were not included in this screening since they may not be representative of PSC facility-related impact due to their distance from areas where PSC operations were conducted.

- intermediate depth interval.

For the Outside Area, groundwater COCs have also been defined within the deep aquifer. The deep aquifer is below the confining layer that the barrier wall is keyed into and therefore is considered part of the Outside Area.

Groundwater COCs for the Outside Area have been identified by comparing EPCs calculated for each monitoring well to the appropriate preliminary groundwater cleanup levels described in Section 2. If the EPC for a well was greater than the relevant groundwater cleanup level for any constituent, that constituent was identified as a COC for that depth interval. Wells defined as background wells were not used to identify Site COCs. This process ensures that those constituents that may pose potential risks will be identified so that they can be addressed in the SWFS.

The data set used to calculate Outside Area EPCs was limited to data collected from groundwater monitoring wells after February 2004. These data reflect post-HCIM conditions and were collected using analytical methods capable of achieving low reporting limits. The EPCs for the Outside Area were calculated for the SWFS data set in the same way they were calculated in the RI Report. The groundwater data collected after February 2004 were grouped by area, location, and depth interval. If multiple samples were collected at the same monitoring well (e.g., during different quarterly groundwater sampling events), they were included in the calculation of EPCs. Only limited data collected since 2004 are available for inorganic constituents within all depth intervals and for constituents detected in the deep aquifer. Therefore, the post-2004 data for inorganics and for deep aquifer constituents have been supplemented to include monitoring well data collected since 2000. The broader set of data was used to ensure that the SWFS COCs include all constituents that may pose a risk to human health and the environment. The groundwater EPCs for each constituent in each well were determined as one of the following:

1. The 95 Percent Upper Confidence Limit (95% UCL) on the mean concentration if the data were normally[6] distributed.
2. The Logarithmic 95 Percent Upper Confidence Limit (Log 95% UCL) on the mean concentration if the data were either lognormally distributed or were some other non-normally distributed data sets.

[6] The Wilk Shapiro Test (for sample sizes ≤ 50), or D'AGostino Test (for sample sizes > 50), assuming an alpha of 0.05, were used to determine the distribution type of each data set.

3. If the 95 % UCL calculated in either items 1 or 2 above exceeded the maximum-detected concentration, the EPC was set to the maximum-detected concentration.

4. If the frequency of detection was zero, the EPC was set to zero.

The comparison of the EPC to the preliminary SWFS groundwater cleanup level for each constituent at each well in the Outside Area is presented in Attachment A1. Due to the limited number of data available for many wells, the maximum detected concentration was commonly selected as the EPC. This EPC calculation approach is conservative and ensures that the set of COCs identified for the Outside Area is comprehensive. Additionally, if any constituent was detected at a direct push location in the Outside Area since 2004 (and that was not detected in monitoring wells), that constituent was considered for retention as a COC. All constituents identified from direct push sampling process were already established as COCs through the EPC calculated from monitoring wells, as described above. A total of 50 constituents were identified as groundwater COCs in the Outside Area.

Due to limited sampling conducted inside the barrier wall since February 2004, the data set used to identify COCs for the HCIM Area was expanded to combine the data set used in the final RI Report with more recent data collected through November 2005. Thus, the data set used for the HCIM Area includes direct push boring data in addition to monitoring wells. Groundwater COCs for the HCIM Area were identified from all constituents for which final RI cleanup levels had been established (i.e., for all constituents retained after initial RI screening). The maximum concentration for each of these constituents that was detected in any sample within each of the three aquifer depth intervals was compared to the SWFS cleanup levels presented in Section 2. If the maximum detected concentration was greater than the SWFS cleanup level, the constituent was retained as a groundwater COC. The comparison of the maximum detected value to the cleanup level for each constituent in the HCIM Area is presented in Attachment A2. This process identified a total of 65 groundwater COCs for the HCIM Area. The full groundwater COC list is summarized in Table 3-5 for the different depth intervals within the HCIM and Outside Areas.

4.0 INDICATOR CONSTITUENTS OF CONCERN

A large number COCs have been identified for soil and groundwater impacted by facility releases. As noted in Section 3, 65 constituents were identified as COCs for the HCIM Area and 50 constituents were identified as COCs for the Outside Area (including the deep aquifer). Since the SWFS must address all groundwater constituents, the large number of COCs makes assessment of constituent fate and transport a large, complex task. WAC 173-340-703 provides for the selection of indicator COCs based on the constituent toxicity, persistence, mobility in the environment, thoroughness of testing, frequency of detection, and potential for generating hazardous degradation products. Indicator COCs (ICOCs) are identified for the SWFS so that fate and transport analyses and remedial alternatives that comprehensively address Site COCs can be evaluated efficiently.

The SWFS addresses two general areas: the HCIM Area and the Outside Area, which are substantially different from a fate and transport perspective. The HCIM Area includes the primary source areas and is totally enclosed by the low permeability barrier wall constructed as part of the HCIM. The Outside Area includes groundwater affected by releases prior to construction of the barrier wall; affected groundwater in the Outside Area migrates toward the Duwamish Waterway. Therefore, transport of COCs within the HCIM Area is less significant than transport of COCs within the Outside Area. For these reasons, ICOCs are determined for the Outside Area only.

A substantial network of monitoring wells has been established to delineate and monitor affected groundwater in the Outside Area; a representative database of groundwater quality for the COCs has been developed from these wells. The ICOCs are selected from the organic COCs identified in the Outside Area for each of the three sample depth intervals and the deep aquifer. ICOCs were not selected for the metals COCs. Fate and transport of all metals COCs is considered in Section 6.

Selection of the ICOCs considered the following:

- The relative toxicity of the constituents as evidenced by the ratio of the observed concentrations in groundwater and preliminary groundwater cleanup levels (cleanup level ratios);
- The areal distribution of the constituents as shown by the percent of wells in which each constituent was detected for each depth and maps of cleanup level ratios;

- The mobility of the constituents as shown by tabulated literature values for organic Koc; and

- The relative persistence of constituents as indicated by published biodegradation half lives, as available.

Most COCs present in the Outside Area in the immediate vicinity of the barrier wall show significant decreases in concentration between the east and the west sides of Denver Avenue South, with COC concentrations on the west side of Denver Avenue South either below or approaching the preliminary cleanup levels for many COCs. Relatively few COCs were detected above preliminary cleanup levels in areas downgradient from Denver Avenue South, indicating that most constituents are either relatively immobile or are rapidly attenuating as they migrate.

The ICOCs were selected to represent the environmental behavior of the organic COCs identified for the Outside Area. In general, ICOCs were chosen as the most widely distributed COCs that are present in highest cleanup level ratios and that represent the most significant potential risk. Indicator constituents were also selected so that modeling results for the ICOCs can be used to represent the expected range of environmental fate and transport behavior for all facility COCs. These modeling results were used to establish site-specific cleanup levels and remediation levels. Modeling of the ICOCs will also be used to design and evaluate remedial alternatives.

4.1 ICOC SELECTION APPROACH

To assist in selecting ICOCs, a series of rankings based on cleanup level ratios, areal distribution, mobility, and persistence for nonmetal COCs identified in the Outside Area in Section 3 were developed. To assist in evaluating the relative importance of individual metals COCs, a similar ranking was performed for the metals based on cleanup level ratios and mobility. However, ICOCs were not selected from the metals COCs. Persistence and areal distribution were not considered for the metals because these COCs do not biodegrade and, due to low detection limits, the detection of many metals was essentially ubiquitous. These rankings were developed for the water table, shallow, and intermediate depth intervals and the deep aquifer. A net ranking value, consisting of the sum of the individual rankings, was also developed for each COC in the different depth intervals. Ranking tables and selected ICOCs for organic constituents are shown in Tables 4-1 through 4-6. Ranking tables for metals COCs are shown in Tables 4-7 through 4-9. The methodology used to determine rankings is described in the following sections.

4.1.1 Cleanup Level Ratios

The potential toxicity associated with observed COC concentrations was evaluated by ranking cleanup level ratios, defined as the ratios of the EPCs to the preliminary groundwater cleanup levels presented in Section 3. COCs with the higher cleanup level ratios were given higher priority in selecting ICOCs because the higher cleanup level ratios represent greater potential toxicity. For each COC in each depth interval, the maximum cleanup level ratios were tabulated for each COC. These ratios were then sorted and assigned a rank, with 1 assigned to the highest cleanup level ratios (i.e., greatest exceedance of preliminary cleanup levels), 2 to the next highest, and so on. Results for organic COCs are shown in Table 4-1, and results for metals are shown on Table 4-7.

Based on this ranking, TCE, VC, toluene, and ethylbenzene rank highest for organic COCs in the water table depth interval; VC and 1,4-dioxane rank the highest in the shallow and intermediate depth intervals; and PCE and TCE ranked highest in the deep aquifer. In the shallow and intermediate depth intervals, cleanup level ratios decrease rapidly after the top two ranked organic COCs, with maximum ratios typically declining to less than two to three times the preliminary cleanup levels.

For the metals, arsenic and iron ranked highest in the water table depth interval; iron, manganese, and arsenic ranked highest in the shallow depth interval; manganese and arsenic ranked highest in the intermediate depth interval; and arsenic and barium ranked highest in the deep aquifer. Cleanup level ratios after the top two or three metals were typically less than 10.

4.1.2 Areal Distribution

In selecting ICOCs, higher priority was given to more widespread COCs than to COCs that are more limited in areal extent. The areal distribution of organic COCs was evaluated based on the percent of monitoring wells where a COC was analyzed and detected one or more times. Areal distribution of metals was not considered, as many of the metals, especially iron and manganese, were detected throughout the area, including within upgradient wells. For each organic COC in each depth interval, the percent of wells where the COC was detected was tabulated, sorted, and assigned a rank, with a rank of 1 assigned to the highest percent detections (i.e., the largest areal extent; see Table 4-2). The chlorinated VOCs (TCE, cis-1,2-DCE, VC, and 1,1-DCA) were most commonly detected in the water table depth interval, and VC and 1,4-dioxane were most commonly detected in the shallow and intermediate depth intervals. Areal distribution was also evaluated by plotting cleanup level ratios for each COC (both organics and metals), as discussed below in Section 4.1.6.

4.1.3 Mobility

The potential mobility of the COCs was evaluated based on literature values for Koc or, in the case of metals, the Kd. For each organic or metals COC in each depth interval, the Koc or Kd was tabulated, sorted, and assigned a rank, with a rank of 1 assigned to the lowest Koc (i.e., the most mobile). Values of Koc and Kd were selected from the following sources in order of preference:

1. tables in the MTCA regulations (WAC 173-340-900),
2. the EPA Soil Screening Guidance (EPA, 1996),
3. U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry Draft Toxicological Profile for Cyanide (ATSDR, 2004a),
4. the Syracuse Research Corporation's CHEMFATE database (http://www.syrres.com/esc/chemfate.htm),
5. the Groundwater Chemicals Desk Reference (Montgomery, 1991), and
6. the U.S. Army Corps of Engineers (1999).

A Kd value for iron was not identified. Iron was assigned a Kd equal to one-tenth the Kd for manganese, based on the similar dependence of these metals on redox conditions. Results of the organics and metals rankings are shown on Tables 4-3 and 4-8, respectively.

As would be expected, the most mobile organic COCs generally correspond to the most frequently detected COCs on Table 4-2. cis-1,2-DCE and VC are the most mobile COCs in the water table depth interval (Table 4-3) and are also among the most frequently detected. Similarly, VC and 1,4-dioxane are among the most mobile in the shallow and intermediate depth intervals and are also the most frequently detected in these intervals.

The metals show relatively low mobility, with Kd values ranging from 5 L/kg for selenium to 36,000 L/kg for manganese. The most mobile metals are selenium, copper, arsenic, and hexavalent chromium.

4.1.4 Persistence

Persistence of organic COCs was evaluated based on literature values for biodegradation half lives. For each organic COC in each depth interval, the half life was tabulated, sorted, and assigned a rank, with a rank of 1 assigned to the highest half life (i.e., the least biodegradable or most persistent). Results of this ranking are presented in Table 4-4.

Numeric values were assigned for half lives, where available. If the literature indicated biodegradation was unlikely to occur, then the half life was noted as No Degradation and given a rank of 1. For some constituents, no definitive information was available on whether these constituents biodegrade in natural aquifer conditions. These constituents were noted as Not Determined on the ranking table and assigned the next rank below No Degradation. Literature on some constituents indicates that they do biodegrade; however, no reliable information on degradation rates was identified. These constituents were noted as Biodegrades on the ranking table and assigned the next rank below Not Determined.

Biodegradation rates were selected from the following sources: Anaerobic Biodegradation of Organic Chemicals in Groundwater (Aronson and Howard, 1997); Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface (Wiedermeier et al., 1999); and ATSDR Toxicological Profiles (ATSDR, 1998, 1999, 2004a and 2004b). The selected biodegradation rates are for anaerobic conditions. Biodegradation rates for some of the PAHs (benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and chrysene) were only available for aerobic conditions. These constituents were noted as Biodegrades in Table 4-6.

In the water table depth interval, the most persistent organic COCs generally did not rank high in the mobility and distribution rankings (e.g., the trimethylbenzenes and dichlorobenzenes). Among the COCs for which reliable literature values of biodegradation rates were identified (i.e. a numeric value or no degradation), the trimethylbenzenes, dichlorobenzenes, and styrene ranked the highest in the water table depth interval followed by the chlorinated ethenes. In the shallow depth interval, 1,4-dioxane ranked the highest, followed by TCE and VC. 1,4-Dioxane also ranked highest in the intermediate depth interval, followed by VC and ethylbenzene.

4.1.5 Net Rankings

A net ranking was calculated for each organic and metal COC by summing the individual ranking values described above, giving equal weighting to each parameter. The COCs were then sorted based on depth interval and net ranking score. COCs with the lowest net ranking scores are those constituents with a combination of the highest concentrations relative to preliminary cleanup levels and the highest mobility, and for the organic COCs, the widest areal distribution and the least likely to biodegrade. The results of these rankings are presented in Tables 4-5 and 4-9.

In the water table depth interval, the chlorinated ethenes (PCE, TCE, and VC) rank highest among the organic COCs. The high ranking of PCE, TCE, and VC are primarily driven by the high cleanup level ratios, areal distribution, and mobility rankings.

In the shallow and intermediate depth intervals VC and 1,4-dioxane rank highest among the organic COCs, with cyanide also ranking high in the intermediate depth interval. Again, these high rankings are mostly driven by the cleanup level ratios, areal distribution, and mobility rankings, with cyanide and 1,4-dioxane also having high persistence rankings.

In the deep aquifer, PCE, TCE, and VC rank highest among the organic COCs, primarily due to the relatively high cleanup level ratios, frequency of detection, and mobility.

Among the metals, arsenic ranks highest in each depth interval, driven by the high cleanup level ratios and relatively high mobility. Copper and iron also generally rank high in all depth intervals. Selenium ranks high in the deep aquifer, primarily due to the high mobility relative to the other metals.

4.1.6 Cleanup Level Ratio Mapping

To further assist in selecting appropriate ICOCs, cleanup level ratios calculated in Section 3 for each COC in each well were mapped by sample depth interval. Figures 4-1 through 4-9 show COC cleanup level ratios for the water table depth interval; Figures 4-10 through 4-15 show COC cleanup level ratios for the shallow depth interval; Figures 4-16 through 4-22 show COC cleanup level ratios for the intermediate depth interval; and Figures 4-23 through 4-27 show COC cleanup level ratios for the deep aquifer. Between two and four COCs are shown per figure, with COCs grouped by similar constituent types (e.g., metals, halogenated VOCs, non-halogenated hydrocarbons, and miscellaneous constituents not falling under the other groupings).

4.2 WATER TABLE ICOCS

COCs in the water table depth interval were separated into four classes of chemically similar constituents: halogenated VOCs, non-halogenated hydrocarbons, metals, and other constituents. The following sections discuss the results of the ICOC screening for each of these constituent classes and identify ICOCs selected as representative of potential fate and transport of all other COCs in the water table depth interval within each of the four specific classes. Selected organic ICOCs are presented on Table 4-6.

4.2.1 Halogenated VOCs

The halogenated VOCs include the following COCs that were identified in the water table depth interval: chlorinated ethenes (PCE, TCE, DCE, and VC), chlorinated ethanes (1,1,1-TCA, 1,1-DCA, chloroethane), dichlorodifluoromethane, and chloroform. Figures 4-1 through 4-3 show cleanup level ratios for these constituents. In the net rankings presented above, TCE and VC ranked the highest of all water table depth interval COCs. Figure 4-1 supports the high rankings for these COCs, with widespread detections and relatively high cleanup level ratios.

A comparison of the distribution and magnitude of cleanup level ratios for the chlorinated ethenes to those for the chlorinated ethanes on Figure 4-2 shows that the chlorinated ethenes are both more widely distributed and occur at higher cleanup level ratios. Given that these constituents have similar mobility and biodegrade under similar conditions, the chlorinated ethenes (PCE, TCE, cis-1,2-DCE, and VC) were selected as water table ICOCs to evaluate the fate and potential risk associated with all halogenated VOCs.

4.2.2 Nonhalogenated Hydrocarbons

Seventeen constituents classified as nonhalogenated hydrocarbons were identified as COCs in the water table depth interval. These include the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), 1,2,4- and 1,3,5-trimethylbenzenes, propylbenzene, sec-butylbenzene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, styrene, cumene, n-hexane, and C8-C10 (EPH and VPH) and C10-C12 (VPH) aromatics. Figures 4-3 through 4-7 show the distribution of cleanup level ratios for these COCs.

The area in which the BTEX compounds were detected is the same or greater in extent than the area in which the other nonhalogenated hydrocarbons were detected. Additionally, the BTEX compounds were generally detected at greater cleanup level ratios and have significantly greater mobility (Table 4-3) than the other COCs in this group. Toluene had the second highest net ranking (Table 4-5) of the non-halogenated hydrocarbons. Although the C8-C10 (EPH) aromatics had a slightly higher ranking than toluene, a comparison of the areal distribution of these constituents in Figures 4-3 and 4-4 shows that toluene is more widespread. Based on this, toluene is selected as an ICOC. Although ethylbenzene only ranked sixth among the non-halogenated hydrocarbons compounds in the net rankings, it does have the highest cleanup level ratio of all water table depth interval COCs, is the fourth most mobile nonhalogenated hydrocarbon behind the other BTEX compounds, and has a relatively low biodegradation rate relative to the more mobile xylenes and toluene. Based on this, ethylbenzene was also selected as an ICOC in the water table depth interval. Using toluene and ethylbenzene as ICOCs is expected to provide a conservative estimate of the fate and potential risk associated with the nonhalogenated hydrocarbons in the water table depth interval.

4.2.3 Metals

Arsenic, barium, chromium, copper, iron, manganese, and nickel were identified as COCs in the water table depth interval. Figures 4-8 and 4-9 show cleanup level ratios for these COCs. Arsenic, iron, and manganese have the highest cleanup level ratios, and the ratios were greater than one at the highest number of locations. Barium slightly exceeds its preliminary cleanup level, with a maximum ratio of 3.5. Chromium and nickel slightly exceed preliminary cleanup levels at only one location (113-S-1) along the west side of Denver Avenue South. Copper cleanup level ratios exceeded 1 at four locations but with only fairly low concentrations (i.e., cleanup level ratios less than 2).

4.2.4 Other Constituents

Other COCs identified for the water table depth interval are 1,2-dichlorobenzene, 1,4-dichlorobenzene, and BEHP. Cleanup level ratios for these COCs are shown on Figures 4-7 and 4-8. BEHP has the second lowest mobility (Koc value of 111,100 L/Kg) of any organic COC in the water table depth interval. As such, this COC is not expected to migrate significantly downgradient of the facility. 1,2-Dichlorobenzene and 1,4-dichlorobenzene exceed preliminary cleanup levels outside the barrier wall at one location each, with cleanup level ratios of 2.3 and 1.3, respectively. These COCs are moderately mobile (Koc values of 379 and 616 L/Kg) and would be expected to migrate at roughly one-quarter to one-third the rate of groundwater flow. Based on literature values, the dichlorobenzenes are not expected to biodegrade significantly under anaerobic site conditions, although biodegradation does occur under aerobic conditions. Given the limited extent of these moderately mobile COCs, they appear to be attenuating rapidly downgradient of the HCIM Area, with all concentrations reduced to below preliminary cleanup levels in wells west of Denver Avenue and nondetectable by Sixth Avenue South. As such, no indicator COCs were selected for this group because these constituents are not expected to migrate to the Duwamish Waterway at concentrations above PQLs and exhibit limited toxicity.

4.3 SHALLOW DEPTH INTERVAL ICOCS

COCs in the shallow depth interval were separated into the same four classes of chemically similar constituents as were defined for the water table depth interval. The following subsections discuss the results of the ICOC screening for each of these constituent classes, and identify ICOCs selected as representative of potential fate and transport of all other COCs in the shallow depth interval within each of the four classes. Selected organic ICOCs are presented on Table 4-6.

4.3.1 Halogenated VOCs

Three chlorinated VOCs (TCE, VC, and 1,1-DCA) were identified as COCs in the shallow depth interval. In the ICOC screening tables, VC ranked higher than the other two constituents in terms of cleanup level ratio, areal extent, mobility, and in the net rankings. Figure 4-10 shows cleanup level ratios for these constituents, confirming that cleanup level ratios are higher and the areal distribution is greater for VC than the other VOCs.

Given that these constituents have similar mobility and biodegrade under similar conditions, VC was selected as an ICOC . Because VC is a degradation product of PCE and TCE, the compounds within the entire degradation sequence (PCE, TCE, cis-1,2-DCE, and VC) were selected as ICOCs to evaluate the fate and potential risk associated with all halogenated VOCs in the shallow depth interval.

4.3.2 Nonhalogenated Hydrocarbons

Benzene, naphthalene, and the PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene were identified as COCs in the shallow depth interval. Figures 4-11 through 4-13 show the cleanup level ratios for these COCs. A comparison of the distribution of cleanup level ratios indicates that benzene is more widespread than the other COCs. Although benzene is more degradable than naphthalene or the PAHs, it is much more mobile and has a higher potential for toxicity, based on the cleanup level ratios. Based on these factors, benzene was selected as the ICOC for the nonhalogenated hydrocarbons in the shallow depth interval.

4.3.3 Metals

Arsenic, barium, copper, hexavalent chromium, iron, and manganese were identified as COCs in the shallow depth interval. Figures 4-14 and 4-15 show cleanup level ratios for these COCs.

Arsenic, iron, and manganese are the metals with the highest and most widespread cleanup level ratios. Hexavalent chromium was detected at concentrations above its preliminary cleanup level at three locations, including locations upgradient of the facility. Iron and manganese in relatively high concentrations were also detected. This is counterintuitive because hexavalent chromium is unstable under the reducing conditions that are necessary for releasing elevated iron and manganese from the soil matrix. Assuming the measured concentrations are not an artifact of laboratory analyses, hexavalent chromium would be expected to rapidly reduce to the less soluble and much less toxic trivalent chromium.

Copper was detected at cleanup level ratios exceeding 1 at only two locations. The highest detected concentration was upgradient of the Site, at well CG-106-I. Downgradient copper concentrations exceed preliminary cleanup levels at one location along the east side of Denver Avenue South. The highest barium concentration was also detected upgradient of the Site, at well CG-106-I. Downgradient barium concentrations slightly exceed preliminary cleanup levels (maximum cleanup level ratio of 2.6).

4.3.4 Other Constituents

Cyanide, BEHP, and 1,4-dioxane were identified as COCs in the shallow depth interval. Cleanup level ratios for these constituents are shown on Figures 4-11 and 4-13. Cyanide was only detected in one well in the shallow depth interval. BEHP was detected over a larger area; however, the cleanup level ratios are relatively low (maximum of 3.6) and BEHP has extremely low mobility. As shown on Figure 4-11 and summarized in the ICOC screening tables, 1,4-dioxane shows widespread distribution, moderately high cleanup level ratios, and high mobility and is persistent. Based on these factors, 1,4-dioxane was selected as an ICOC for the shallow depth interval (see Table 4-6).

4.4 INTERMEDIATE DEPTH INTERVAL ICOCS

COCs in the intermediate depth interval were separated into the four classes of chemically similar constituents. The following sections discuss the results of the ICOC screening for each of these constituent classes and identify ICOCs selected as representative of potential fate and transport of all other COCs in the intermediate depth interval. Selected organic ICOCs for the intermediate depth interval are presented on Table 4-6.

4.4.1 Halogenated VOCs

Vinyl chloride and 1,1-DCA were identified as COCs in the intermediate depth interval. Figure 4-16 shows cleanup level ratios for these constituents. Vinyl chloride is more widely distributed and has much higher cleanup level ratios than 1,1-DCA. Given that these constituents have similar mobility and biodegrade under similar conditions, VC was selected as the ICOC for the purposes of evaluating the fate and potential risk associated with all halogenated VOCs in the intermediate depth interval. Because VC is a degradation product of PCE, TCE, and cis-1,2-DCE, these constituents will also be treated as ICOCs for the intermediate depth interval.

4.4.2 Nonhalogenated Hydrocarbons

Ethylbenzene, and the PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as nonhalogenated hydrocarbon COCs in the intermediate depth interval. Cleanup level ratios for ethylbenzene are shown on Figure 4-16, and for the PAHs on Figures 4-17 and 4-18. Although ethylbenzene was detected in slightly fewer wells than the PAHs and has a higher biodegradation rate, it was detected at a higher cleanup level ratio and is much more mobile. Therefore, ethylbenzene was selected as the ICOC for the nonhalogenated hydrocarbons in the intermediate depth interval.

4.4.3 Metals

Arsenic, barium, chromium, copper, iron, lead, manganese, nickel, and vanadium were identified as COCs in the intermediate depth interval. Figures 4-20 through 4-22 show the cleanup level ratio maps for these COCs.

Based on EPC concentrations, arsenic, copper, iron, and manganese exceed preliminary cleanup levels through most of the sampled wells in the intermediate depth interval, although data are generally limited to the area east of Fourth Avenue South. Most arsenic concentrations near the facility are more than 20 times the cleanup levels. Of the remaining metals, chromium, lead, nickel, and vanadium concentrations are less than twice the preliminary cleanup levels, while cleanup level ratios for barium, copper, iron, and manganese concentrations are typically between 2 and 10.

4.4.4 Other Constituents

Other COCs identified for the intermediate depth interval are BEHP, cyanide, carbon disulfide, and 1,4-dioxane. Cleanup level ratios for these COCs are shown on Figures 4-18 and 4-19. Carbon disulfide was detected above cleanup levels at only one location and cyanide at two locations. Cleanup level ratios for these COCs are also relatively low. Relative to cyanide and carbon disulfide, BEHP is more widespread and has moderately high cleanup level ratios; however, the mobility of BEHP is extremely low. As shown on Figure 4-19 and summarized in the ICOC screening tables, 1,4-dioxane shows the most widespread distribution of these four COCs, has moderately high cleanup level ratios, has high mobility, and is persistent. Based on this, 1,4-dioxane was selected as the ICOC for these constituents.

4.5 DEEP AQUIFER ICOCS

COCs in the deep aquifer were separated into the four classes of chemically similar constituents. The following sections discuss the results of the ICOC screening for each of these constituent classes and identify ICOCs selected as representative of potential fate and transport of all other COCs in the deep aquifer.

4.5.1 Halogenated VOCs

PCE, TCE, and VC ranked highest among organic COCs in the deep aquifer. Cleanup level ratios based on EPCs for these constituents range from 11 for VC to 47 for TCE (Table 4-1). Note that these cleanup level ratios are based on the MTCA Method B cleanup level for drinking water rather than surface water standards. PCE and TCE each exceed the cleanup level based on surface water at only one location. The EPC values for all three of these organics are strongly influenced by data collected soon after these wells were installed. More recent data collected in 2004 and 2005 indicate that concentrations of PCE and TCE range from nondetectable to less than two times the drinking water based cleanup levels. In more recent data, VC is also nondetectable to less than twice the drinking water-based cleanup levels in all wells except CG-116-127, where concentrations are approximately 10 times the cleanup level. All concentrations of PCE, TCE, and VC from the more recent data are below surface water based cleanup levels. Based on the relatively limited extent, minimal exceedances of drinking water- based cleanup levels, and no exceedances of surface water-based cleanup levels indicated by the more recent data, no halogenated VOCs were selected as ICOCs for the deep aquifer.

4.5.2 Non-Halogenated Hydrocarbons

Chrysene and diesel were identified as COCs in the deep aquifer. Chrysene has a moderately high cleanup level ratio but a very low mobility (Koc of 398,000 L/kg). Diesel has a slightly higher mobility (Koc of 2,510 L/kg) but a very low cleanup level ratio of 1.8. Based on this, neither diesel nor chrysene are expected to migrate significantly downgradient at concentrations above cleanup levels, and none of the nonhalogenated hydrocarbons were selected as ICOCs for the deep aquifer.

4.5.3 Metals

Arsenic, barium, chromium, hexavalent chromium, copper, iron, manganese, nickel, selenium, silver, vanadium, and zinc were identified as COCs in the deep depth interval. Cleanup level ratios for these COCs are shown on Figures 4-25 through 4-27.

The highest concentrations relative to cleanup levels were for arsenic and barium, followed by iron, manganese, copper, and selenium. Chromium, nickel, and zinc concentrations were between two and five times the cleanup levels.

Hexavalent chromium concentrations were up to five times the cleanup levels. Similar to the case in the shallow depth interval, the detections of hexavalent chromium with high iron and manganese concentrations and low redox is counterintuitive. Assuming the measured concentrations are not an artifact of laboratory analyses, hexavalent chromium would be expected to rapidly reduce to the less soluble and much less toxic trivalent chromium before migrating significantly downgradient.

The highest vanadium concentrations are upgradient of the facility. Vanadium concentrations decrease to below cleanup levels at well 104-D along the downgradient edge of the facility and well 102-D located southeast of the facility. Silver concentrations downgradient and southeast of the facility only slightly exceed cleanup levels, with much lower cleanup levels than other metals.

4.5.4 Other Constituents

Carbon disulfide and BEHP were identified as COCs in the deep aquifer. Cleanup level ratios for these COCs are shown on Figure 4-24. Carbon disulfide was detected at a single well and was not detected in any other deep aquifer wells. BEHP was detected in three wells, with a maximum cleanup level ratio of 6.7. BEHP does biodegrade under aerobic conditions; however, no information was found indicating whether BEHP biodegrades under the anaerobic conditions found in the deep aquifer. Given the high Koc values (111,100 L/kg) for BEHP, it is unlikely that it is migrating at any significant rate. Based on the limited areal extent of carbon disulfide and the very low mobility and extent of BEHP, neither of these COCs were considered as ICOCs.

Geomatrix

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5.0 POINT OF COMPLIANCE

To develop and evaluate a reasonable range of cleanup alternatives, a POC must be defined for contaminated sites. As defined in the MTCA regulations, the POC is the point or points at which cleanup levels must be attained. As stated previously, the POC, cleanup levels, and other applicable standards taken together define the cleanup standard. Cleanup has been completed for any site that attains the cleanup standard, as approved by Ecology. The POC or multiple POCs will be used in the SWFS for design and evaluation of potential remedial alternatives. After approval of the final SWFS, the proposed final POC(s) will be incorporated into the CAP and final design for the cleanup alternative selected in the final SWFS. The basis for selecting the POC(s) for the SWFS is defined in the following subsections The final POC(s) to be used for implementing the cleanup action will be determined after Ecology approval of the CAP and after completing the requirements specified in the MTCA regulations for approval by other agencies and property owners.

5.1 REGULATORY REQUIREMENTS

The MTCA regulations specify POCs for various media that may become contaminated. MTCA defines both the SPOC and the less stringent CPOC. The SPOC applies to all soil, groundwater, air, or surface water at or adjacent to any location where releases of hazardous substances have occurred or that has been impacted by releases from the location. A CPOC is usually defined only for groundwater, air, or surface water; however, a CPOC may be defined for soil under some circumstances. A CPOC typically applies to a specific location as near as possible to the source of the release. Site-specific conditions determine whether the SPOC or CPOC would be appropriate for a site. Several requirements are specified in the MTCA regulations for establishing a CPOC, as discussed in more detail below. The most common situation for use of a CPOC is migration of contaminated groundwater off site. In this case, a CPOC is usually established at the facility boundary beyond which contaminated groundwater has migrated. However, in certain instances a CPOC may be established beyond the facility boundary if Ecology and any landowners located between the facility source area and the CPOC approve the CPOC before it can be incorporated into a final cleanup action.

As described in the RI Report, affected media at the Site include soil and groundwater. The inhalation pathway also is significant for the SWFS; however, cleanup levels (and therefore POCs) have only been established for soil and groundwater. POCs for soil and groundwater are established separately and may be different due to different regulatory requirements and potential exposure pathways associated with the two media. The regulatory requirements for POCs in soil and groundwater are summarized in Sections 5.1.1 and 5.1.2 below.

5.1.1 Soil Point of Compliance

The regulatory requirements for the soil POC are presented in the MTCA regulations WAC 173-340-740(6). The requirements for the soil POC depend on the relevant exposure pathway. Therefore, MTCA may require different soil POCs for different COCs. The requirements specified by MTCA are as follows:

- For soil COCs whose cleanup level is based on protection of groundwater, the SPOC (e.g., in the soils throughout the Site) must be used;
- For soil COCs whose cleanup level is based on the vapor/inhalation pathway, the POC must be the soils throughout the Site (from the ground surface to the uppermost water table);
- For soil COCs whose cleanup level is based on human exposure (i.e., the Commercial Cleanup Level defined in the RI Report), the POC must include the soils throughout the Site from the ground surface to a depth of 15 feet bgs; and
- For soil COCs whose cleanup level is based on ecological exposure, additional specific requirements that must be addressed are presented in WAC 173-370-7490(4).

The soil POCs defined above by MTCA would apply to soil at the surface and beneath the Site affected by facility releases.

To determine the soil POC, it's appropriate to review the MTCA definition of soil set forth in WAC 173-340-200:

- "Soil" means a mixture of organic and inorganic solids, air, water, and biota that exists on the earth's surface above bedrock, including material of anthropogenic sources such as slag or sludge.
- "Soil biota" means invertebrate multicellular animals that live in the soil or in close contact with the soil.

Based on the strict definition established by the MTCA for soil, the absence of any one of the five cited components (organic solids, inorganic solids, air, water, or soil biota) within earthen materials would mean that the material would not be considered soil for the purposes of the

MTCA. Since soil below the water table is part of the saturated zone, air would not be present. Additionally, multicellular animals require oxygen for respiration and do not generally live below the water table, especially when it is at depths in excess of about 10 feet. Both air and biota are absent below the water table underlying the Site. These definitions, taken together, clearly indicate that the MTCA rules regarding soil were intended to apply to the vadose zone. Therefore, for the purposes of the SWFS, the soil SPOC extends from the ground surface to the water table. Earthen materials at greater depths are not considered soil, and soil cleanup levels would not apply. Affected media at depths below the water table (e.g., the saturated zone) are addressed using groundwater cleanup levels.

Soil cleanup levels for the Site were established either for protection of groundwater or for human exposure; no soil cleanup levels were established based on ecological exposure. Therefore, the soil POC will be either the shallower of (a) the SPOC (extending from the land surface to the water table) or (b) the upper 15 feet of soil, depending on the specific COC.

Although certain POCs are defined in the MTCA, remedial actions may rely on containment of waste or affected soil even though POCs specified above may not be attained. WAC 173-340-740(6)(f) provides that a site may comply with soil cleanup standards if the following conditions are met and approved by Ecology:

- The selected cleanup action is determined by Ecology to be permanent to the maximum extent practicable;
- The selected cleanup action is determined by Ecology to be protective of human health and the environment;
- The selected cleanup action uses institutional controls that prohibit or limit activities that could interfere with the long-term effectiveness of the containment system;
- The selected cleanup action incorporates compliance monitoring and periodic reviews to ensure the long-term integrity of the containment system; and
- The types, levels, and amount of hazardous substances and affected soil are specified in the draft CAP.

Thus, if containment is included as a component for a specific remedial alternative addressed in the SWFS and the draft CAP, the alternative will be designed to comply with WAC 173-340-740(6)(f).

5.1.2 Groundwater Point of Compliance

The MTCA regulations favor a permanent solution for groundwater cleanup at the SPOC. The SPOC is essentially a volume of groundwater extending from the water table to an appropriate depth, as determined by Ecology. If a permanent cleanup action (e.g., a cleanup action capable of attaining cleanup levels of all COCs in groundwater at the SPOC) is not selected for a site, the MTCA imposes additional requirements as described in WAC 173-340-360(2)(c)(ii). It is expected that the range of groundwater remediation alternatives considered in the SWFS will include nonpermanent cleanup actions that would not attain cleanup levels at the SPOC. This is discussed in more detail in Section 5.3 below.

The groundwater SPOC, as described in WAC 173-340-720(8)(b), would include all groundwater within the saturated zone beneath the Site and in any area affected by releases from the facility. Under WAC 173-340-720(8)(c), Ecology may approve use of a CPOC if the responsible person demonstrates that it is not practicable to attain the SPOC within a reasonable restoration time frame and that all practicable methods of treatment have been used. A CPOC is essentially a vertical surface extending downward from the water table and laterally so that it spans the vertical area affected by the release (e.g., the contaminated groundwater extending beyond the boundary of the facility). Groundwater cleanup levels would apply everywhere downgradient from the CPOC; groundwater cleanup levels could be exceeded upgradient from the CPOC. Given the requirement that all practicable methods of treatment must be used before a CPOC may be approved by Ecology, it is not likely that Ecology would approve a CPOC before implementation of some cleanup action to treat contaminated groundwater. For this SWFS, some remedial alternatives are considered for which it is assumed that a CPOC would be approved by Ecology.

Under the MTCA, the groundwater CPOC may be located either on site (e.g., at the boundary of the facility) or off site (e.g., beyond the facility boundary). The requirements for establishing an off-site groundwater CPOC for facilities such as the Site (facilities near, but not abutting, surface water) are set forth in WAC 173-340-720(8)(d)(ii):

- The CPOC must be located as close as practicable to the source of the release;
- The CPOC must not be located beyond the point or points where groundwater flows into surface water;
- The conditions specified in WAC 173-340-720(8)(d)(i) must be met;

- All affected property owners between the source of contamination and the CPOC agree to the CPOC location in writing; and

- The CPOC cannot be located beyond the extent of groundwater contamination exceeding cleanup levels when Ecology approves the CPOC.

As noted above, the requirements for an off-site CPOC for a site that does not abut surface water include requirements cited in WAC 173-340-720(8)(d)(i). This code specifies very specific requirements for approving a CPOC located within a surface water body at sites that do abut surface water. These requirements state that:

- Groundwater containing COCs is entering surface water and will continue to enter surface water after implementation of cleanup;

- A demonstration satisfactory to Ecology has been made (in accordance with WAC 173-340-350 to 390) that it is not practicable to meet groundwater cleanup levels within a reasonable time frame at a point within the groundwater before the groundwater enters surface water;

- No mixing zone under WAC 173-201A-100 has been used to demonstrate attainment of surface water cleanup levels;

- All known available and reasonable methods of treatment have been provided for the groundwater prior to being released to surface water;

- Discharge of affected groundwater to surface water will not result in violations of sediment quality values specified in WAC 173-204;

- Appropriate monitoring is conducted to assess the long-term performance of the selected cleanup action; and

- A notification and solicitation of comments of a proposed CPOC be mailed to natural resource trustees, the Washington State Department of Natural Resources, and the U.S. Army Corps of Engineers.

Although the regulations for establishing an off-property CPOC for sites that do not abut surface water state require that all provisions of WAC 173-340-720(8)(d)(i) must be met, this requirement is inconsistent with the application of certain provisions of WAC 173-340-720(8)(d)(i) and could not reasonably have been intended by Ecology. Specifically, it appears that the requirements specified in WAC 173-340-720(8)(d)(i)(A), (B), and (C) (the first three bullets in the immediately preceding bullet list) were intended only to apply if a CPOC located within the surface water body is being considered. The requirements described in the first bullet above (WAC 173-340-720(8)(d)(i)(A)) would prevent use of a CPOC at sites that do not abut surface water and that have not contaminated all groundwater downgradient of the site to the surface water body, thereby causing the release of site contaminants to surface water. The requirements described in the second bullet above (WAC 173-340-720(8)(d)(i)(B)) would not allow use of a CPOC for a site unless groundwater discharges to surface water at concentrations exceeding cleanup levels either now or in the future. This requirement is inconsistent with the language cited in WAC 173-340-720(8)(d)(ii), which is designed to limit degradation of groundwater that already meets cleanup levels by placing the CPOC at the front of the area exceeding cleanup levels. The requirements described in the third bullet above (WAC 173-340-720(8)(d)(i)(C)) concerning use of a mixing zone would only apply to discharges to surface water at concentrations exceeding cleanup levels.[7]

It is anticipated that an off-property CPOC will be selected for Site groundwater. The specific regulatory requirements that will be used for establishing a groundwater CPOC for the Site include the following:

- It is not practicable to attain the SPOC within a reasonable restoration time frame (WAC 173-340-720(8)(c);
- The CPOC shall be as close as practicable to the source of the release (WAC 173-340-720(8)(c);
- All practicable methods of treatment are used in the Site cleanup (WAC 173-340-720(8)(c);
- The CPOC must not be located beyond the point or points where groundwater flows into surface water (WAC 173-340-720(8)(d)(ii);
- The CPOC must not be located beyond the extent of groundwater exceeding cleanup levels for those sites where cleanup levels are attained at some point between the site and the surface water body when the CPOC is approved (WAC 173-340-720(8)(d)(ii);
- All known available and reasonable methods of treatment have been provided for the groundwater prior to being released to surface water (WAC 173-340-720(8)(d)(i);
- The discharge of affected groundwater to surface water will not result in violations of sediment quality values specified in WAC 173-204 (WAC 173-340-720(8)(d)(i);

[7] Although MTCA specifies WAC 173-201A-100 for mixing zone requirements, there is no section 100 in WAC 173-201A. Mixing zones are, however, described in WAC 173-201A-400; the requirements described in WAC 173-201A-400 apply to oceans, estuaries, rivers, streams, and lakes and cannot reasonably be applied to a subsurface saturated zone.

- Appropriate monitoring is conducted to assess the long-term performance of the selected cleanup action (WAC 173-340-720(8)(d)(i);
- All affected property owners between the source of contamination and the CPOC agree to the CPOC location in writing (WAC 173-340-720(8)(d)(ii); and
- A notification and solicitation of comments of a proposed CPOC will be mailed to natural resource trustees, the Washington State Department of Natural Resources, and the U.S. Army Corps of Engineers (WAC 173-340-720(8)(d)(i).

The regulatory requirements in the bullet list above must be met in order to use a groundwater CPOC for the Site. All but the last two bullets in this list are technical requirements that will be addressed by this SWFS for any remedial alternative that incorporates a CPOC beyond the facility boundary. The requirements specified in the last two bullets will not be addressed by the SWFS; these requirements may instead be addressed after Ecology approval of a cleanup action that incorporates a CPOC.

5.2 PROPOSED POINTS OF COMPLIANCE

To develop and evaluate a reasonable range of cleanup alternatives in this SWFS, it is necessary to establish POCs for both soil and groundwater. Given the nature and extent of contamination in the source area within the Site and in the groundwater downgradient from the source area, it is expected that cleanup alternatives will incorporate a CPOC for groundwater. It is also expected that an off-site groundwater CPOC will be considered. The POCs proposed for consideration in completing the SWFS are described in Sections 5.2.1 and 5.2.2 below.

5.2.1 Proposed Soil Point of Compliance

The soil POC proposed for the SWFS depends on the specific COCs and the basis for the specific soil cleanup levels. The soil cleanup levels for the SWFS were selected to be the lowest detectable value considering MTCA Methods A and B cleanup levels, protection of groundwater, protection of human health (including direct contact and inhalation), and natural background. Therefore, the soil POC proposed for the SWFS includes all soil from the land surface to the water table.

Remedial alternatives considered in this SWFS incorporate the above soil POC as appropriate for each of the Site soil COCs. For remedial alternatives considered in this SWFS that rely on containment and will not meet the soil POC, the requirements specified in the MTCA rules to demonstrate compliance with the soil POC are presented in the description of the alternative.

5.2.2 Proposed Groundwater Conditional Points of Compliance

In order to proceed with the SWFS, it is necessary to define POCs for the upper saturated zones comprising the water table, shallow, and intermediate depth intervals as well as for the deep aquifer. As noted above, it is expected that at least some remedial alternatives considered for groundwater will include an off-property CPOC. Due to the fully developed urban setting adjacent to the Site, it is proposed that a single, off-property CPOC be defined and incorporated into the remedial alternatives that address the water table, shallow, and intermediate depth intervals requiring a CPOC. Since the deep aquifer is separated from the upper groundwater near the facility, the POC for the deep aquifer may be different from the POC for the upper groundwater intervals. This approach will provide a common basis for development and evaluation of the remedial alternatives in this SWFS.

5.2.2.1 Water Table, Shallow, and Intermediate Depth Intervals

As noted above, the CPOC must be located as close to the source area as practicable. The source area has been enclosed by a low-permeability barrier wall. Site characterization data confirm that groundwater COC concentrations exceeding cleanup levels extend downgradient from the barrier wall. Some remedial alternatives considered in this SWFS include treatment of the groundwater immediately beyond the facility boundary. The barrier wall is located very near the downgradient facility boundary, and contaminated groundwater extends beneath a building on the SAD property located very near and downgradient of the barrier wall. This situation provides a very limited area for implementing groundwater cleanup actions. It is expected that remediation of groundwater would occur in this narrow area between the barrier wall and the SAD building. It should be noted that conducting remediation and groundwater monitoring in this area would likely affect groundwater monitoring due to the effected remediation.

Based on discussions with Ecology, a location for the CPOC for groundwater within the water table, shallow, and intermediate depth intervals has been selected. The proposed location of the groundwater CPOC for these three depth intervals is immediately downgradient of the barrier wall, as shown on Figure 5-1. Groundwater compliance monitoring will be conducted along or immediately downgradient of the CPOC. This location is consistent with the location-specific CPOC requirements cited in the MTCA regulations:

- The location is a close as practicable to the source area;
- The location is not beyond the point or points where groundwater flows into surface water; and

- The location is not beyond the extent of affected groundwater exceeding cleanup levels.

Section 5.3 demonstrates that it is not practicable to attain the groundwater SPOC. The practicability of attaining the SPOC for groundwater would be the same for all potentially applicable remedial alternatives. As noted above, the requirement for obtaining landowner approvals and notifying the government agencies would be done only after approval of the SWFS, including the proposed CPOC, by Ecology. The remaining requirements for establishing an off-property CPOC are specific to the remedial alternative and will be addressed as part of the conceptual design and development of the alternatives. These requirements will be addressed for each alternative as appropriate.

5.2.2.2 Deep Aquifer

For the purposes of completing the SWFS, Ecology has determined that the deep aquifer must be considered as a potential source or drinking water, even though groundwater within the deep aquifer contains natural manganese and iron at undesirable concentrations. Additionally, groundwater monitoring data from the RI Report indicate that arsenic, barium, chromium, hexavalent chromium, copper, nickel, silver, and vanadium are present in groundwater upgradient from the facility at concentrations exceeding cleanup levels. Since the deep aquifer must be considered a potential drinking water source, the SPOC applies to groundwater within the deep aquifer.

Although the SPOC applies to the deep aquifer, it is not practicable to monitor groundwater quality immediately beneath the facility. The upper saturated zone beneath the facility has been substantially affected by releases of several different constituents, including DNAPL. Installation of deep aquifer monitoring wells beneath the facility could carry groundwater COCs into the deep aquifer, potentially providing a migration pathway for Site constituents. Therefore, it is proposed that the monitoring location for assessing compliance with the SPOC for the deep aquifer be placed along the CPOC described above for the upper saturated zone.

5.3 PRACTICABILITY OF SOURCE AREA REMEDIATION

To use a groundwater CPOC, it must be demonstrated to the satisfaction of Ecology that remediating the source area to attain cleanup levels throughout groundwater underlying the Site within a reasonable time frame is not practicable. The discussions in this section demonstrate the practicability of remediating the source area to attain MTCA cleanup levels within a reasonable time frame. This demonstration will be used to support the off-property CPOC as appropriate for remedial alternatives considered in the SWFS. For this demonstration, the source area is considered to be the location where primary releases occurred. Secondary source areas, such as areas of contaminated soil that may release constituents to groundwater, are not considered necessarily as part of the source area considered in this section.

5.3.1 Source Area Characteristics

The source area is located on property currently owned by PSC and is primarily on the property located at 734 South Lucile Street. The source area has been under industrial use since at least 1936. Past uses have included a distillation plant for reclaiming waste solvents, paint and resin manufacturing, wood shingle staining, and storage/recycling/treatment of solvents. The property at 734 South Lucile Street was a RCRA-permitted dangerous waste management facility from 1991 until RCRA closure was completed in 2003. A microsilica concrete pad was constructed over the RCRA facility between 1991 and 1993, effectively capping much of the source area. In 2003/2004, a low-permeability barrier wall was placed completely around the source area to isolate groundwater beneath the source area as part of the HCIM. Most buildings over the source area have been demolished; the area is currently unused.

The RI Report identified five hydrogeologic units that occur with increasing depths within the SWFS Area. These hydrogeologic units are described below in depth sequence:

- The *shallow sand unit* (including fill) is the uppermost hydrogeologic unit in the study area and consists of poorly graded, fine to medium sand with fine gravel and varies from 21 to 46 feet in thickness. The upper portions of the unit may be composed of fill including material dredged from the Duwamish Waterway. The shallow sand unit grades into the intermediate sand and silt unit described below. PSC estimates a hydraulic conductivity of 3.2 x 10-2 cm/sec for the shallow sand unit based on grain size, slug test, and pumping test data.

- The *intermediate sand and silt unit* underlies the shallow sand and consists of discontinuous interbedded silty sand and sandy silt lenses with shell fragments. The unit ranges in thickness from 13 to 68 feet and is often indistinguishable from the overlying shallow sand unit. PSC estimates a hydraulic conductivity of 5.1 x 10 -3 cm/sec for the intermediate sand and silt unit based on grain size, slug test, and pumping test data. The lower hydraulic conductivity as compared to the overlying shallow sand unit is consistent with the finer-grained nature of the intermediate unit.

- The *silt unit* (confining layer) underlies the intermediate sand and silt unit and consists predominately of silt and very fine sand ranging in thickness from 11 to 50 feet. Clam shells and shell fragments are commonly present. Some borings encountered worm burrows, mud cracks, and occasional fine laminations.

Laboratory triaxial tests indicated a vertical hydraulic conductivity of 10-7 cm/sec to 5x10-6 cm/sec in this unit.

- The *deep sand and silt unit* consists of sandy silt, fine sand, and interbedded lenses of silty sand. The top of the unit lies at depths of between approximately 84 and 128 feet bgs. PSC estimates a hydraulic conductivity of 3x10-3 cm/sec for the deep sand and silt unit based on grain size, slug test, and pumping test data.

- The *bedrock* consists of consolidated sedimentary sandstone and siltstone. At a boring east of the facility, bedrock was encountered at a depth of approximately 56 feet bgs. The depth to bedrock increases to the west and is estimated to be about 330 to 660 feet near the Duwamish Waterway (PSC, 2003).

The hydrogeologic units of primary interest for the SWFS include the shallow sand unit, intermediate sand and silt unit, and silt unit. These units have been grouped into three hydrogeologic zones for sampling consistency (see Section 3.2), including a shallow zone that includes the water table and shallow depth intervals, an intermediate zone that includes the intermediate depth interval, and a silt aquitard. The depth to the water table beneath the source area is approximately 10 to 12 feet. The silt aquitard is present at depths varying from about 50 feet to about 90 feet beneath the facility. The low-permeability barrier wall has been keyed into the aquitard. The most significant groundwater contamination within the source area is above the silt aquitard.

The shallow sand unit at the facility is quite distinct from the intermediate sand and silt unit. The shallow sand unit is relatively clean sand, whereas the intermediate sand and silt unit is recognizable by the numerous silt layers. Site investigation data indicate that the shallow sand unit is fairly homogenous sand that does contain deposits of fine gravel, and extends to a depth ranging from 21 to 46 feet bgs. The intermediate sand and silt unit extends from depths ranging from about 21 to about 80 feet bgs and is highly heterogeneous, consisting of discontinuous interbedded sands and silts.

5.3.2 Source Area Contamination

The Site source area has been well characterized from several rounds of subsurface investigation, as presented in the RI Report. Releases of several different hazardous substances have occurred over nearly 70 years of industrial use. A broad range of constituents have been detected in groundwater within the source area, as noted by the range of COCs identified in Section 3 of this Technical Memorandum. The groundwater COCs present within the source area include chlorinated solvents, chlorinated aromatics, aromatic hydrocarbons, PAHs, PCBs, chlorinated and non-chlorinated phenols, 1,4-dioxane, cyanide, and several metals. Many of the constituents released within the source area have degraded to form additional COCs such as vinyl chloride or chloroethanes. Groundwater contamination is present throughout the saturated zone overlying the silt aquitard (i.e., within the water table, shallow, and intermediate depth intervals).

While no DNAPL has been observed in any soil borings, substantial evidence has been obtained that indicates that DNAPL is present in the source area. Based on research and field experience, it is generally held that DNAPL is present if dissolved concentrations of DNAPL constituents exceed 1 percent of their solubility in groundwater samples. Groundwater samples collected from nine different monitoring wells since February 2004 have shown dissolved TCE concentrations exceeding 1 percent of its solubility—one well had a concentration exceeding 10 percent of the solubility. Two wells had concentrations of 1,1,1-trichloroethane exceeding 1 percent of its solubility. Groundwater samples collected prior to February 2004 indicate that TCE, when summed with its degradation products, exceeded 1 percent of TCE solubility in the water table and shallow depth intervals. A sample collected from the intermediate zone contained TCE at about 10 percent of its solubility. These characterization data provide strong evidence that DNAPL is present at multiple depths within the source area. Site characterization data within the source area indicate that groundwater contaminated by the primary DNAPL constituents and their degradation products extend from the water table downward to the silt aquitard. Due to the age of the releases, detected concentrations, and depth of affected groundwater, it is likely that the contaminants within affected groundwater have reached equilibrium with saturated soils.

5.3.3 Source Area Remediation

Considerable experience has accrued for remediating sites that have been affected by releases of DNAPL. Early remediation of such sites was primarily done with pump-and-treat systems; this experience showed that pump and treat is not effective for remediating sites to attain low cleanup levels. Substantial research has been done to identify new and more effective remediation technologies. While the new technologies can remove DNAPL constituents, very few sites either known or very likely to have DNAPL present have been remediated to attain low cleanup levels such as those established under MTCA. Unless the very low MTCA cleanup levels can be attained, a CPOC must be incorporated into the remedial approach. Recently published research conducted for EPA has indicated that there have been no sites with documented DNAPL that have been remediated to attain MCLs (Moretti, 2005). Cleanup levels for many of the Site COCs (e.g., toluene, ethylbenzene, and Aroclor 1016) are about 1 percent of the MCL, while the cleanup level for TCE is about 16 percent of the MCL. Since many of the MTCA cleanup levels applicable to the Site are significantly lower than MCLs, it is very unlikely that the source area could be remediated to attain the applicable cleanup levels, given the above-cited remediation experience at documented DNAPL sites.

Dr. Michael Kavanaugh of Malcolm Pirnie, Inc., presented a summary of his work with the National Research Council (NRC) of their study of DNAPL source zone assessment and remediation at a Groundwater Resources Association (GRA) conference held December 7 and 8, 2005. In his presentation entitled “DNAPL Source Zone Characterization and Remediation,” Dr. Kavanaugh noted that prior work has shown that more than 99 percent of the source area mass must be removed by remediation in order to achieve MCLs. Since the MTCA cleanup levels are much lower than MCLs, it is expected that mass removal significantly greater than 99 percent would be necessary to achieve cleanup levels.

In their 2005 report, the NRC proposed an iterative protocol for making decisions regarding DNAPL site remediation. The protocol calls for establishing clear absolute and functional objectives early in the decision-making process. Absolute objectives (e.g., protect human health and the environment) are general objectives that may be attained in different ways. Functional objectives (e.g., attain numeric cleanup levels at the SPOC) provide a basis for selecting and designing remediation systems. The protocol provides for repeated re-evaluation of the absolute and functional objectives in the overall decision-making process, implicitly acknowledging the complexity and difficulty in remediating DNAPL source areas to attain functional objectives.

Other recent work has assessed the potential for remediating DNAPL sites based on the ganglion-to-pool (GTP) ratio (Abriola, 2005). This ratio is used to describe the distribution of DNAPL within the subsurface. When released to water-saturated porous media, DNAPL tends to flow downward and leave ganglia of DNAPL within the flow path, particularly in heterogeneous soils such as are present beneath the HCIM Area. When the DNAPL encounters a transition in relative porosity, the DNAPL tends to build up and form a pool. If a large quantity of DNAPL is released to homogenous sand overlying a single aquitard, a narrow trail of ganglia would form, with a large DNAPL pool forming at the top of the aquitard. This type of system would have a small GTP ratio. If the same DNAPL is released to an aquifer with numerous gradational changes and discontinuous interbedded silts, several smaller pools would form above the silts and gradational changes, diverting the downward flow of DNAPL and creating a large number of trails leaving DNAPL ganglia. This type of system would have a higher GTP ratio.

Work presented at the December 2005 GRA conference mentioned above described the effect of the GTP ratio on remediation of a DNAPL site. Dr. Linda Abriola of Tufts University presented results from simulations and laboratory testing indicating that systems with a low GTP ratio show a rapid decrease in mass flux from the source by reducing source area mass, while systems with a high GTP ratio show a much lower reduction in flux with reduction in mass. In a laboratory experiment, two runs with a low GTP ratio showed that the mass flux from the source area fell by 30 to 50 percent after the source area mass was reduced by about 50 percent. The experimental data for a high GTP ratio actually showed an increase in mass flux resulting from a 50 percent reduction in source area mass. After removal of about 75 percent of the source area mass, reductions achieved in mass flux were comparable among the three laboratory runs. In the model simulations, the high- and low-GTP ratio systems did not achieve a similar reduction in mass flux until about 95 percent of the mass was removed. Dr. Kavanaugh presented similar information at the December 2005 GRA conference. The results of the model simulations and experimental data indicate that sites with a high GTP ratio would require removal of a high fraction of source area mass to achieve the same reduction in mass flux obtained for a site with a low GTP ratio. It should be noted that sites with a high GTP ratio would be more difficult to remediate because (1) the DNAPL would be distributed in a much larger volume than for sites with a low GTP ratio and (2) the heterogeneity of the subsurface would be greater.

The Site would be best characterized as a medium to high GTP site. While there is some evidence of a DNAPL source near the surface of the silt aquitard, suggesting a potential DNAPL pool, there is also substantial evidence that DNAPL exists at shallower depths within the source area aquifer zones as well. The Site subsurface stratigraphy supports a high GTP ratio. Since dissolved DNAPL constituents are present in the water table, shallow, and intermediate depth intervals, it is likely that DNAPL ganglia are distributed areally and vertically as residual saturation. Based on the work of Drs. Abriola and Kavanaugh, substantial reductions in source area mass would be required to show any reduction in groundwater concentrations, with almost no likelihood of achieving MTCA cleanup levels over the long term. For VC within the intermediate depth interval, it would be necessary to reduce concentrations by more than 99.9 percent to achieve the cleanup level. The mass flux work indicates that this would require more than 99.9 percent removal of source area contaminant mass, which is not considered possible given Site conditions and available technologies.

For sites with old releases, another phenomenon that can adversely affect attainment of cleanup levels is back-diffusion of contaminants from low permeability units present in the aquifer.

Recent work presented by Dr. Beth Parker of the University of Waterloo at the December 2005 GRA conference showed that back diffusion can cause downgradient groundwater to exceed MCLs for more than eight years after total isolation of a source area (Chapman and Parker, 2005). Since the MTCA cleanup levels are significantly lower than MCLs, back-diffusion could cause residual concentrations to exceed cleanup levels within the source area for many years after removal of almost all constituent mass from the source area. This is especially significant for the Site based on the long period of time since the releases occurred (as long as 70 years) and the presence of discontinuous interbedded silts present in the intermediate zone. The COCs released to Site groundwater have had a long time to diffuse into the silts; it would take a long time for the COCs to back-diffuse from the silts after remediation of the areas around the silts is completed. Remediation of the silt beds would be difficult to achieve because the silt has a lower permeability than the surrounding sand, making it technically difficult to alter conditions within the silt beds for remediation.

The evidence described above indicates that it is not technically practicable to remediate the Site source area to achieve cleanup levels within a reasonable time frame. The key factors limiting remediation of the source area to attain MTCA cleanup levels are as follows:

- Constituent concentrations within the source area (e.g., VC, toluene, ethylbenzene, naphthalene, and Aroclor 1016) require reductions in excess of 99 percent to achieve the MTCA cleanup levels;
- Achieving greater than 99 percent mass reduction for such diverse constituents is technically difficult, if not impossible, to accomplish in a heterogeneous subsurface environment;
- Available evidence indicates that DNAPL is present and is distributed within the water table, shallow, and intermediate depth intervals within the source area;
- As noted above, the moderate-to-high GTP ratio expected for the Site source area indicates that a large volume within the saturated zone would require remediation to achieve significant mass reduction of Site COCs;
- Degradation products from the chlorinated solvents, most notably VC, are present at high concentrations within the intermediate depth interval and have likely diffused into the silt beds, thus creating a secondary source within the source area; and
- Due to the potential for sorption into the silt beds, it is likely that back-diffusion of VC (and possibly other COCs) from the interbedded silt would result in exceedance of its cleanup level for many years after completing source area remediation, thereby causing a long restoration time.

For these reasons, it is not practicable to remediate the source area to achieve cleanup levels within a reasonable restoration time. As a result, a CPOC is appropriate for the Site.

6.0 FATE AND TRANSPORT

Fate and transport analyses were performed for the organic and metals COCs present in groundwater as identified in Section 3. This analysis was performed for groundwater within the Outside Area. The fate and transport results of these analyses were used to evaluate:

- which COCs are not likely to reach the Duwamish Waterway at concentrations above laboratory PQLs;
- which COCs are likely to reach the Duwamish Waterway at concentrations between the PQLs and criteria based on the groundwater-to-surface water pathway; and
- which COCs potentially could reach the Duwamish Waterway at concentrations above criteria based on the groundwater-to-surface water pathway.

Groundwater criteria or cleanup levels based on the groundwater-to-surface water pathway (surface water protection criteria) are presented in Section 2 and in the RI Report. These criteria are based on MTCA Method B groundwater cleanup level requirements for groundwater discharging to surface water. In the shallow and intermediate depth intervals, the groundwater-to-surface water criteria are the same as the preliminary SWFS cleanup levels. For certain COCs in the water table depth interval and the deep aquifer (e.g., TCE and VC), the preliminary SWFS cleanup levels are based on protection of indoor air or drinking water rather than protection of surface water. Because this fate and transport analysis assesses potential migration and impacts to the Duwamish Waterway, only the surface water protection criteria are relevant to this evaluation; preliminary cleanup levels based on other potential exposure pathways are not relevant to this evaluation.

Quantitative fate and transport modeling was performed for a representative subset of the organic COCs using the BIOCHLOR model, a spreadsheet model that simulates natural attenuation processes occurring in groundwater, including biodegradation. A qualitative evaluation of the potential for downgradient migration of the metals COCs was performed based on available groundwater chemistry data (e.g., redox potential), the actual observed metals distribution in groundwater, observed changes in concentration over time, and estimated travel times from the facility to the Duwamish Waterway. The following sections discuss fate and transport analyses of organic and metal COCs.

6.1 NATURAL ATTENUATION MODELING

This section presents fate and transport modeling of organic ICOCs performed to evaluate the effectiveness of natural attenuation processes in reducing organic COC concentrations in the

Outside Area downgradient from the facility. ICOCs were selected as described in Section 4 to be representative of all organic COCs based on toxicity, mobility, areal extent, and persistence. ICOCs selected in Section 4 for fate and transport modeling and presented on Table 4-9 include:

- *Water table depth interval* – PCE, TCE, cis-1,2-DCE, VC, ethylbenzene, and toluene
- *Shallow depth interval* – PCE, TCE, cis-1,2-DCE, VC, benzene, and 1,4-dioxane
- *Intermediate depth interval* – PCE, TCE, cis-1,2-DCE, VC, ethylbenzene, and 1,4-dioxane

Natural attenuation modeling was not performed for the deep aquifer. Based on the screening presented in Section 4, no organic ICOCs were selected for the deep aquifer.

Predictive modeling was performed to assess the fate and transport of organic ICOCs identified in the Outside Area and to estimate potential future concentrations in groundwater at the Duwamish Waterway. Modeling was performed using BIOCHLOR. Modeled initial concentrations for the ICOCs were selected as the EPCs, which are representative of reasonable worst-case concentrations since the barrier wall was installed. The modeled source for all constituents was located between Denver Avenue South and the barrier wall. As a conservative assumption, PCE, TCE, cis-1,2-DCE, VC, ethylbenzene, and toluene were modeled as continuous sources (i.e., it was assumed that the source area concentration was constant). This is a conservative assumption that will lead to predictions of the maximum concentrations expected to reach the Duwamish Waterway. In reality, the concentrations in the area between Denver Avenue South and the barrier wall are expected to decrease over time as the source of these constituents is contained behind the barrier wall. Because the distribution of 1,4-dioxane concentrations appears to be the result of a short-term “pulse” type release rather than a continuous release, this ICOC was modeled with a decaying source term to more closely match measured concentrations. A sensitivity analysis was also performed to evaluate the sensitivity of model predictions to model inputs.

Based on the modeling results for the water table depth interval, the chlorinated ethenes, ethylbenzene, and toluene are unlikely to reach the Duwamish Waterway at concentrations above surface water protection criteria. Although TCE and VC could reach the waterway at concentrations above PQLs, all other ICOCs are predicted to not reach the waterway at concentrations above PQLs. Based on the sensitivity analysis, it is possible that under certain conditions PCE and cis-1,2-DCE could also reach the waterway at concentrations above PQLs. In some instances, if biodegradation is much slower than expected, TCE and VC could potentially reach the waterway at concentrations above surface water protection criteria in the water table depth interval. Ethylbenzene and toluene are predicted to not reach the Duwamish Waterway above PQLs under any conditions.

Modeling results for the shallow and intermediate depth intervals indicate that chlorinated ethenes, benzene, and ethylbenzene are unlikely to reach the Duwamish Waterway at concentrations above PQLs or surface water protection criteria. Based on the sensitivity analysis, it is possible that under certain conditions TCE and VC could reach the waterway at concentrations above PQLs, but below surface water protection criteria, in the shallow depth interval. Under no circumstances are these ICOCs predicted to reach the waterway at concentrations above PQLs in the intermediate interval.

1,4-Dioxane, which was modeled without biodegradation, is predicted to potentially reach the Duwamish Waterway at concentrations above surface water protection criteria in both the shallow and intermediate depth intervals, although observations downgradient of the areas of elevated concentrations do not support the modeling. In addition, this modeling prediction is based on concentrations from wells located approximately 300 to 1,000 feet downgradient from the facility. 1,4-Dioxane concentrations between the barrier wall and Denver Avenue South are currently below surface water protection criteria and will not result in future exceedances of surface water protection criteria downgradient of the facility.

6.1.1 Model Selection

Natural attenuation modeling was performed using BIOCHLOR (ver. 2.2) software, which was developed on behalf of the U.S. Air Force Center for Environmental Excellence by Groundwater Services, Inc. to assess natural attenuation of solutes in groundwater. BIOCHLOR has been accepted by the EPA and is available for downloading from the EPA CLU-IN web site.

BIOCHLOR simulates the natural attenuation of commonly found chlorinated solvents, although it can also be used to model natural attenuation of contaminants. BIOCHLOR is a Microsoft Excel programmed spreadsheet that simulates one-dimensional advection, three dimensional dispersion, linear adsorption, and biotransformation via reductive dechlorination for chlorinated solvents.

6.1.2 BIOCHLOR Model Input Parameters

BIOCHLOR model input parameters and sources for the values selected are summarized in Tables 6-1 through 6-3.

6.1.2.1 General Model Parameters

General model input parameters, including hydraulic conductivity, hydraulic gradient, porosity, soil bulk density, and soil total organic carbon content, are the same as those used to estimate biodegradation rates in Attachment B of this memorandum. Groundwater seepage velocities were calculated based on hydraulic conductivity, hydraulic gradient, and effective porosity values for each depth interval. Groundwater seepage velocities applied in the model for the water table/shallow depth intervals were 187 ft/yr. The groundwater seepage velocity in the intermediate depth interval in the vicinity of the facility was 6.1 ft/yr. The predominantly silty sand and silt material in the intermediate depth interval near the facility grades to a less silty, sand to the west. Based on a review of drilling logs, it appears that the predominantly silty sand and silt material extends at least 400 feet to the west of the facility, to approximately CG-126 and CG-122, along Maynard Avenue South. The groundwater velocities west of this area are likely higher than the 6.1 ft/yr estimated for near the facility. The groundwater seepage velocity applied in the model west of these locations (i.e., 400 feet downgradient of the facility) was 187 ft/yr, the same as the water table/shallow depth intervals.

Chemical-specific organic Koc are the same as were used for the ICOC screening in Section 4. Model dimensions were based on the plume dimensions at the facility and the downgradient distance to the Duwamish Waterway, where groundwater ultimately discharges to potential surface water receptors. Longitudinal (α_x) dispersivity was calculated based on the flow path length to the waterway. Transverse (α_y) dispersivity was set equal to 0.1 times α_x, based on standard of practice and best professional judgment.

6.1.2.2 Initial Concentrations

Initial concentrations for ICOCs were selected as the highest EPCs in each depth interval as presented in Section 2. The maximum initial concentrations for the chlorinated ethenes were limited to wells located in the Outside Area along Denver Avenue South. Initial concentrations for 1,4-dioxane were taken from wells CG-131-40 in the shallow depth interval and CG-122-60 in the intermediate depth interval, which are located approximately 1,000 and 300 feet downgradient from the facility, respectively. 1,4-Dioxane concentrations measured at the facility and near Denver Avenue South are below surface water protection criteria. For all modeling runs, the initial concentrations were assumed to be located just outside the barrier wall. For most constituents that were modeled, the maximum EPC was selected as the constant source area concentration. Further discussion of the source terms are presented in Section 6.1.2.3.

Based on the statistical analysis followed in calculating the EPCs (see Section 2), the EPC is typically the maximum concentration measured in a well. Selection of the highest EPCs from outside the wall generally results in selection of the maximum concentration detected outside the wall. The statistical analysis to obtain EPCs was conducted using a data set that, for select COCs, does not exhibit a normal or lognormal distribution. The data set for the select COCs (e.g., ethylbenzene and toluene) is not normally or lognormally distributed because the HCIM has been an effective containment measure and concentrations of select COCs in groundwater samples from wells adjacent to the barrier wall have exhibited significant downward trends. The use of the statistical approach to obtain the EPCs would not be applicable for compliance monitoring [WAC 173-340-720 (9)(c)(vi)], but does result in a highly conservative value that reflects a worst case for the purposes of modeling. Use of these worst-case concentration as the source concentration for each modeled constituent, combined with the continuous source area assumption described below in Section 6.1.2.3, results in conservatively high model predictions for ICOCs concentrations downgradient of the facility; the model predictions are generally higher (in some cases, much higher) than concentrations actually observed in downgradient wells.

6.1.2.3 Source Type

The source type for benzene, toluene, ethylbenzene, and the chlorinated ethenes was modeled as "continuous," meaning that the concentrations immediately outside the barrier wall are constant and do not decrease over time. This is a highly conservative assumption, since these concentrations are expected to decline over time because the source area is contained by the barrier wall, which essentially eliminates migration of COCs to the Outside Area. Therefore, it is expected that the COC mass contributing to downgradient migration will decrease due to biodegradation and migration from the modeled source zone.

The pattern of 1,4-dioxane concentrations shown on Figures 4-11 and 4-19 are not amenable to modeling with a continuous source term. Concentrations in the shallow depth interval are well below surface water protection criteria of 94.9 μg/L in the Outside Area along Denver Avenue South, which is near where any facility-related source would be located. Shallow depth interval concentrations increase to approximately 230 μg/L about 600 feet downgradient of the facility, continue to increase to about 1,300 μg/L at about 1,000 feet downgradient of the facility, and then decrease to below surface water protection criteria west of Fourth Avenue South. This type of concentration distribution implies a relatively short-term release from the facility to groundwater, rather than a continuous source or alternatively a source of 1,4-dioxane that is downgradient of the facility. For the modeling, we assumed a source at the facility, but instead of using a continuous source term, the model for 1,4-dioxane in the shallow depth interval was applied with a source decay term, which reduces the initial concentration in the model source area over time. Although the period over which any 1,4-dioxane release may have occurred is unknown, for the purposes of this analysis it was assumed that source concentrations in the shallow depth interval were reduced by 90 percent within five years of the initial release, corresponding to a source decay constant of 0.45 yr-1. This assumption seems reasonable given the relatively steep concentration gradients observed near the center of the 1,4-dioxane plume, the high concentration at the center of the plume, and the low concentrations remaining near the facility.

Due to model solution stability problems, a source decay term could not be applied for modeling 1,4-dioxane in the intermediate depth interval, and it was instead modeled using a continuous source term. However, it is apparent, based on the distribution of 1,4-dioxane in this depth interval, that it too was likely the result of a short-term release. The model results for the shallow depth interval can provide some guidance as to how 1,4-dioxane concentrations in the intermediate depth interval will respond over time.

6.1.2.4 Simulation Time

Simulation times were selected to model the maximum ICOC concentrations reaching the Duwamish Waterway for any given simulation. For the ICOCs modeled with continuous sources (benzene, ethylbenzene, toluene, PCE, TCE, cis-1,2-DCE, VC, and 1,4-dioxane in the intermediate depth interval), the simulation time was fixed at 1,000 years. This simulation time was sufficient to allow for simulation of steady state conditions, which represent maximum modeled concentrations.

In the shallow depth interval, 1,4-dioxane was modeled with a decaying source term. To find the time when the maximum predicted 1,4-dioxane concentration will reach the Duwamish Waterway, several modeling iterations were performed. The model simulation times at which the maximum concentrations reached the waterway in the shallow interval was 22 years. During the sensitivity analysis the maximum occurred at different times, depending on what parameter was being evaluated. The model time was modified as needed to ensure that maximum concentrations were also predicted and reported for the model sensitivity runs.

6.1.2.5 Biodegradation Rates

Biodegradation rates for PCE, TCE, cis-1,2-DCE, and VC are from the model calibration approach presented in Attachment B of this memorandum. 1,4-Dioxane was assumed to not biodegrade and was assigned a half life of 1,099 years in the model.

Initial biodegradation rates for benzene, ethylbenzene, and toluene were based on the literature values presented in Section 4. These rates are the average of a range of rates presented for biodegradation under anaerobic conditions (Aronson and Howard, 1997). To assess the appropriateness of these values for the modeled area, model results were compared to measured concentrations (selected as the EPCs) in wells downgradient from the facility. For the purposes of this assessment, the toluene concentration from well CG-104-S1 in the water table depth interval was used as the initial concentration rather than the concentration from CG-153-WT (the well with the highest concentration) because it lies on a more direct flow path to the downgradient wells. All other initial concentrations used in the modeling were the same as shown on Table 6-3. Table 6-4 shows modeled (using the initial biodegradation rates) and measured concentrations for ethylbenzene and toluene in the water table depth interval, benzene in the shallow depth interval, and ethylbenzene in the intermediate depth interval. Locations of the water table, shallow, and intermediate depth interval wells in Table 6-4 are shown on Figure 6-1.

In the shallow and intermediate depth intervals, model-predicted concentrations correspond closely to measured concentrations, indicating that the selected literature value biodegradation half lives of 1.1 years for benzene and 1.6 years for ethylbenzene are generally appropriate for conditions in these depth intervals. In the water table depth interval, the modeled ethylbenzene and toluene concentrations greatly over-predict the measured concentrations, and result in a much more extensive downgradient plume than has been observed at the Site. This is shown graphically on Figures 6-2 and 6-3. In these two figures the modeled (predicted) ethylbenzene and toluene concentrations using the literature value biodegradation rates are much higher than measured (observed) concentrations at every monitoring point downgradient of the facility. Based on this, the initial literature values for ethylbenzene and toluene biodegradation half lives of 1.6 and 0.98 years, respectively were deemed to be inappropriate for modeling the fate and transport of these ICOCs in the water table depth interval. Therefore, the models for ethylbenzene and toluene in the water table interval were calibrated to measured concentration data; the biodegradation rates were adjusted until modeled concentrations more closely matched observed concentrations.

Typical literature values for ethylbenzene biodegradation half lives under anaerobic conditions range from about 0.03 year to 1.9 years, while toluene half lives range from about 0.12 year to 3.2 years (Aaronson and Howard, 1997). Under aerobic conditions, half lives of less than 0.02 year are typical (Aronson et al., 1999). The models for ethylbenzene and toluene in the water table depth interval were calibrated by varying the biodegradation rates within the range's anaerobic half lives until predicted concentrations were similar to measured concentrations. Biodegradation rates for ethylbenzene and toluene of 0.11 and 0.12 year, respectively, were found to provide the best fit to field data. Results using these calibrated biodegradation rates are shown in Table 6-5 and on Figures 6-2 and 6-3.

The calibrated biodegradation rates are at the low (shorter degradation rates) end of the anaerobic half life ranges (i.e., relatively fast biodegradation is observed in the water table depth interval) and may reflect some aerobic biodegradation resulting from the introduction of oxygen at the surface of the water table depth interval. Dissolved oxygen concentrations measured during sampling of these wells have typically been low (less than 1 to 2 mg/L), indicating that if additional oxygen is reaching the water table interval it is quickly consumed. However, redox potential measurements do show a general increasing trend in redox potential downgradient from the facility, indicating more oxidizing conditions. Average measured redox potential values from the RI Report are presented in Table 6-5 and on Figures 6-2 and 6-3. Redox potential ranges from about 0 to less than 100 millivolts (mV) immediately downgradient from the facility. The redox potential then increases to between about 300 mV approximately 600 feet downgradient. The redox potential decreases to 130 to 160 mV beyond a distance of about 1,000 feet from the facility. Redox potentials in this range and dissolved oxygen concentrations of 1 to 2 mg/L are capable of supporting aerobic biological activity.

6.1.2.6 Intermediate Depth Interval Model Approach

As discussed previously, groundwater within the intermediate depth interval is expected to show two substantially different flow regimes. Near the facility, intermediate depth interval soils are predominantly interbedded silty sand and silt, and groundwater is estimated to flow at a velocity of about 6.1 ft/yr, based on hydraulic conductivity testing and gradient data presented in the RI Report. Beginning approximately 400 feet downgradient from the facility, the intermediate aquifer materials, based on boring logs, become much less silty and less interbedded. At this point the groundwater velocity is expected to be higher; more similar to the shallow depth interval of the aquifer. For the purposes of this evaluation, groundwater velocities in the intermediate depth interval 400 feet downgradient from the facility were assumed to be equal to the velocities in the water table and shallow depth intervals, or 187 ft/yr.

The different flow velocities observed in the intermediate depth interval require an appropriate modeling approach. The hydraulic component of the equations used in the BIOCHLOR model is based on a uniform groundwater velocity and does not allow for the use of different groundwater velocities in different locations. As noted above, the two groundwater flow rates observed in the intermediate depth interval do not fit the assumption of uniform flow inherent in the BIOCHLOR model. For this reason, the intermediate depth interval modeling was done by running the model in two steps, as follows. In the first step, the model was run using the 6.1 ft/yr velocity. The modeled steady state concentration at the downgradient end of the low velocity zone (established at 400 feet downgradient from the facility for the base-case models) was then used as the initial concentration to model the remaining flow path from the downgradient location to the Duwamish Waterway. Based on the 3,800 foot distance from the facility to the Duwamish Waterway, the first 400 feet was modeled with the 6.1 ft/yr seepage velocity and the remaining 3,400 feet with the 187 ft/yr velocity.

6.1.3 Natural Attenuation Modeling Results

Using the input parameters described above, model runs were performed for the different ICOCs in each sample depth interval. The chlorinated ethenes (PCE, TCE, cis-1,2-DCE, and VC) were modeled as a group, so that production of the lower chlorinated ethenes resulting from biodegradation of the higher chlorinated ethenes could be accounted for. Benzene, ethylbenzene, toluene, and 1,4-dioxane were modeled individually. Model-predicted concentrations at the Duwamish Waterway are shown on Table 6-6, along with surface water protection criteria and laboratory PQLs.

6.1.3.1 Water Table Depth Interval

In the water table depth interval, all ICOC concentrations are predicted to attenuate to below surface water protection criteria before reaching the Duwamish Waterway. TCE and VC are predicted to potentially reach the waterway at concentrations above laboratory PQLs, while PCE, cis-1,2-DCE, ethylbenzene, and toluene are predicted to be below PQLs at the waterway. The predicted reductions in concentration resulting from biodegradation and dispersion range from a low of a 66-fold reduction for TCE to complete destruction of PCE, ethylbenzene, and toluene. Based on the model output, without biodegradation only a 25 percent reduction in concentrations would be predicted. With biodegradation included in the model, more than 98 percent of the concentration reductions predicted would be due to destruction of COCs through biodegradation.

6.1.3.2 Shallow Depth Interval

In the shallow depth interval, PCE, TCE, cis-1,2-DCE, VC, and benzene are predicted to attenuate to below PQLs before reaching the Duwamish Waterway. The predicted concentration reduction for TCE is approximately 99 percent. Essentially complete destruction of PCE, cis-1,2-DCE, VC, and benzene are predicted, such that the predicted concentration reaching the waterway for these four COCs are below PQLs. Similar to the water table depth interval, without biodegradation only a 25 percent reduction in concentrations is predicted. With biodegradation included in the model, approximately 90 percent of the TCE concentration reductions and more than 98 percent of the predicted PCE, cis-1,2-DCE, and VC concentration reductions would be due to destruction of COCs through biodegradation. 1,4-Dioxane, which was modeled with a source decay term but is only subject to dispersion as an attenuation mechanism, is predicted to reach the waterway at concentrations approximately two times surface water protection criteria. It should be noted that the modeling does not match actual monitoring data in the downgradient area, which suggests that the modeling is overly conservative.

6.1.3.3 Intermediate Depth Interval

In the intermediate depth interval, PCE, TCE, cis-1,2-DCE, VC, and ethylbenzene are predicted to attenuate to below PQLs before reaching the Duwamish Waterway; essentially complete destruction is predicted for these compounds. 1,4-Dioxane is predicted to reach the waterway at concentrations above surface water protection criteria, with a concentration reduction of approximately 25 percent. In this interval, 1,4-dioxane was only modeled with a continuous source due to model solution stability problems. Because the source in reality is likely not continuous, but instead a short-term release, actual concentrations downgradient of the facility are expected to decrease by more than 25 percent and be more in line with what is predicted for the shallow depth interval. In addition, based on observed groundwater monitoring data, the modeling using zero degradation for 1,4-dioxane appears to be overly conservative.

6.1.4 Sensitivity Analysis

The sensitivity of model predictions was evaluated by varying model input parameters and comparing the change in predicted concentrations at the Duwamish Waterway. Parameters selected for the sensitivity analysis included biodegradation half lives, groundwater flow rate, dispersivity, initial concentration, and, for the intermediate depth interval, the downgradient extent of the silty, low hydraulic conductivity zone (i.e., the location of the transition from low to high groundwater velocity). Sensitivity to the source decay term was also evaluated for 1,4-

dioxane. A single parameter was adjusted for each sensitivity run. Half life, flow rate, and initial concentration were varied by multiplying or dividing the expected parameter value used in initial modeling runs by a factor of 2. Half life and flow rate were also multiplied by a factor of 3. The downgradient extent of the low hydraulic conductivity zone was reduced from 400 feet to values of 200 and 100 feet, which would increase the overall transport velocity for the intermediate depth interval. Results were generally less sensitive to dispersivity, so this parameter was varied by multiplying and dividing by a factor of 5. Results of the sensitivity analysis for the chlorinated ethenes, benzene, toluene, and ethylbenzene are shown in Table 6-7. The sensitivity analysis for 1,4-dioxane in the shallow depth interval is shown on Table 6-8.

6.1.4.1 Benzene, Ethylbenzene, Toluene, and Chlorinated Ethene Sensitivity

Model results for the ICOCs shown on Table 6-7 are most sensitive to the degradation half life and groundwater flow rate. Note that changing the groundwater flow rate by a given factor has the exact same effect on model predictions as changing the half lives by the same factor. For the water table depth interval, increasing the half life (or flow rate) by a factor of 2 increases predicted concentrations at the Duwamish Waterway by a factor of about 9 for PCE, TCE, cis-1,2-DCE, and VC.

Model results are less sensitive to the initial concentration, with a one-to-one relationship between changes in initial concentration and predicted concentration at the waterway. Predicted concentrations were relatively insensitive to changes in dispersivity, especially constituents modeled with biodegradation. Predicted concentrations decreased or were unchanged with increasing dispersivity.

In the water table depth interval, none of the sensitivity analyses led to model predictions of ethylbenzene or toluene concentrations above PQLs at the Duwamish Waterway. Increased groundwater flow rates or slower biodegradation rates do result in model predictions of the chlorinated ethene concentrations at the waterway above PQLs, and in some cases above surface water protection criteria.

In the shallow depth interval, none of the sensitivity analyses led to model predictions of benzene or chlorinated ethene concentrations above surface water protection criteria at the Duwamish Waterway. Increased groundwater flow rates or slower biodegradation rates do result in model predictions of TCE and VC concentrations at the waterway above PQLs, although the other chlorinated ethenes and benzene remain below PQLs. In the intermediate depth interval, none of the sensitivity analyses led to predicted chlorinated ethene or ethylbenzene concentrations above PQLs at the waterway.

6.1.4.2 1,4-Dioxane Sensitivity

The 1,4-dioxane sensitivity analysis in the shallow depth interval is shown on Table 6-8. Model-predicted 1,4-dioxane concentrations are moderately sensitive to all the parameters evaluated. Higher concentrations are predicted with a smaller source decay term and lower concentrations with a larger decay term. This is expected, given that a large decay term represents a shorter duration source, which in turn leads to lower total mass being released to the system and lower resultant concentrations. The decay term has relatively little effect on the predicted time to maximum concentrations at the Duwamish Waterway.

Increased flow rate also led to higher predicted concentrations. Because the amount of mass released to the system is a function of the source concentration and the groundwater flow past the source, and because the source concentration is allowed to decay over time, a higher groundwater velocity causes the model to release more mass, which again leads to higher predicted concentrations. Flow rate does have a linear relationship to the time to maximum concentration at the Duwamish Waterway, as would be expected.

Decreased dispersivity leads to higher 1,4-dioxane concentrations at the Duwamish Waterway because the plume is not allowed to spread as much, either in the direction of flow or perpendicular to the flow direction. With a decaying source, the model is more sensitive to dispersivity than it is with a continuous source. Due to solution stability problems, model sensitivity was not evaluated for increased dispersivity. As was the case with the continuous source concentration models, the model shows a one-to-one relationship between initial concentration and predicted concentration.

6.1.5 Modeling Uncertainty

There is significant uncertainty in the BIOCHLOR model parameters, particularly biodegradation rates and groundwater flow rates. However, based on the sensitivity analysis, the base-case model estimates for these parameters would need to be increased by more than a factor of 2 in the water table depth interval, and by an even greater amount in the shallow and intermediate depth intervals, before concentrations at the Duwamish Waterway would exceed surface water protection criteria. In the shallow depth interval, a groundwater flow velocity of three times the base-case model estimate, or 560 ft/yr, would not result in benzene or chlorinated ethene concentrations greater than surface water protection criteria at the waterway.

In the intermediate depth interval, increasing the groundwater flow rate in the low conductivity zone to 18.3 ft/yr and the downgradient flow rate to 560 ft/yr does not result in detectable concentrations of chlorinated ethenes or ethylbenzene at the waterway. Similarly, predicted concentrations were below PQLs if the downgradient extent of the low conductivity zone is reduced by 75 percent to 100 feet. Given the reasonably conservative approach taken to establish the modeling parameters and to select ICOCs, the sensitivity analysis indicates that the modeling results provide a reasonable assessment of the potential for organic COCs to reach the Duwamish Waterway and to determine remediation levels and site-specific cleanup levels, as described in Section 7.

6.2 FATE AND TRANSPORT OF METALS

A qualitative evaluation of the potential for downgradient migration of the metals COCs was performed based on available groundwater chemistry data (e.g., redox), the observed metals concentrations distribution, observed changes in concentration over time, and the estimated travel times for metals from the facility to the Duwamish Waterway. The following metals were identified as COCs in the Outside Area and are addressed in this evaluation:

- *Water table depth interval* – arsenic, barium, chromium, copper, iron, manganese, nickel
- *Shallow depth interval* – arsenic, barium, copper, hexavalent chromium, iron, manganese
- *Intermediate depth interval* – arsenic, barium, chromium, copper, iron, lead, manganese, nickel, vanadium
- *Deep aquifer* – arsenic, barium, chromium, copper, hexavalent chromium, iron, manganese, nickel, selenium, silver, vanadium, zinc

6.2.1 Geochemical Conditions

Geochemical conditions, particularly oxidation-reduction potential (redox), are important for evaluating metals fate and transport. Groundwater conditions in the water table, shallow, and intermediate depth intervals between the facility and the Duwamish Waterway are affected by relatively high concentrations of organic constituents, both naturally occurring and resulting from releases of contaminants from the facility and other sources. With the potential exception of portions of the water table depth interval, microbial degradation of the organic constituents uses the available dissolved oxygen and results in generally anaerobic conditions in groundwater. This can bee seen in redox and DO measurements collected during groundwater sampling. Attachment C presents average redox measurements data from the RI Report for the water table, shallow, and intermediate depth intervals. The RI Report included average DO measurements that indicated relatively high oxygen concentrations; however, more recent field measurements indicate that DO concentrations are typically less than 1 mg/L. Groundwater pH at and near the facility is near neutral, typically in the range from 6 to 8. No spatial patterns or trends were noted in the pH data.

In the water table depth interval, redox measurements show moderately oxidizing conditions upgradient of the facility, with average redox measurements of about +170 to +180 mV. By comparison, aerobic conditions are typically associated with a redox potential of about +500 mV. Immediately downgradient of the facility, redox conditions become slightly reducing, with redox measurements of about -50 mV along Denver Avenue, which corresponds with the highest organic COC concentrations in the water table depth interval. Farther downgradient redox conditions in the water table depth interval increase to levels similar to what were measured upgradient, ranging from about +100 to +300 mV.

Redox conditions upgradient of the facility are generally more reducing in the shallow and intermediate depth intervals than in the water table depth interval, with average redox measurements of +23 and -88 mV, respectively. Redox conditions become more reducing at and immediately downgradient of the facility, where organic COC concentrations are highest, with measurements of -40 to -80 mV in the shallow depth interval and -80 to -100 mV in the intermediate depth interval. In the area downgradient from the facility, redox conditions do not rebound as rapidly in the shallow depth interval as in the water table depth interval, increasing from slightly reducing conditions (-40 mV) at Maynard Avenue to slightly oxidizing conditions (+3 mV) at Fourth Avenue South. Near Second Avenue South redox increases to about +100 mV. Redox conditions in the intermediate depth interval rebound to about +40 to +80 mV west of Maynard Avenue South, and remain in this general range to at least Second Avenue South. In the area at and west of Second Avenue South, redox conditions in the intermediate depth interval are more reducing than in the shallow depth interval.

Only limited data are available for the deep aquifer; however, it appears that redox conditions are generally slightly reducing (between 0 and -100 mV) both upgradient of and at the facility. No groundwater data are available for the deep aquifer in the area downgradient from the facility.

Redox conditions exert a strong influence on the speciation and mobility of several metals, particularly arsenic, iron, and manganese. Higher concentrations and greater mobility are associated with reducing or slightly oxidizing conditions than under moderately or highly oxidizing conditions with pH at or near neutral values (Drever, 1997). Under moderately or highly oxidizing conditions, dissolved iron will be present as ferric iron and will form insoluble oxide and oxyhydroxide compounds. Metals such as arsenic, chromium, copper, lead, selenium, and zinc are strongly adsorbed to the iron oxides and oxyhydroxides, with near complete adsorption occurring at pH values in the range of 6 to 8. The adsorbed metals will be present as co-precipitants in the iron-containing minerals. In native aquifer materials exposed to reducing conditions, the ferric iron can convert to the ferrous form and dissolve into groundwater, which can result in the release of other metals co-precipitated with the iron oxides and oxyhydroxides. This has been identified as one of the major sources of naturally occurring arsenic in groundwater (Kelly et al., 2005). This is expected to be the mechanism that has resulted in the observed concentrations of many metals observed in Site groundwater, as the specific metals were not known to have been released at the facility.

Several groundwater samples have been reported to contain hexavalent chromium. The reducing conditions observed at the Site are not conducive to the stability of hexavalent chromium. Within a pH range of 6 to 8, hexavalent chromium is only stable under oxidizing conditions, with a redox of approximately 500 mV or greater (Drever, 1997). Under the less oxidizing to reducing conditions at the Site, the less soluble and less toxic trivalent form of chromium is the thermodynamically stable species. Thus, under redox conditions observed for groundwater at all depths, hexavalent chromium is expected to react with reduced constituents (such as ferrous iron) that are abundant in Site groundwater. The reported EPC values of hexavalent chromium at wells CG-106-I, CG-127-40, and CG-141-40 in the intermediate depth interval and 102-D, 104-D and CG-106-D in the deep aquifer are greater than preliminary SWFS cleanup levels. Redox conditions at and near these wells range from about -88 to +80 mV in the intermediate depth interval and about -100 to 0 mV in the deep aquifer. Rdox conditions in these ranges are not consistent with the presence of hexavalent chromium, and the detected concentrations are more likely due to analytical interferences.

6.2.2 Metals Distribution

This subsection describes the distribution of metals concentrations relative to preliminary SWFS cleanup levels. Cleanup level ratio maps for metals were presented in Section 4. Table 6-9 presents the maximum cleanup level ratios observed for the metals in each depth interval.

6.2.2.1 Water Table Depth Interval

Arsenic, iron, and manganese concentrations are present at the highest cleanup level ratios of all the metals COCs in the water table depth interval (Table 6-9 and Figures 4-8 and 4-9). Concentrations of these metals are highest near the facility, where biodegradation of organic constituents has resulted in slightly reducing conditions. Concentrations generally decrease downgradient as redox conditions become oxidizing, with iron and manganese concentrations either near or below preliminary SWFS cleanup levels in areas downgradient of Sixth Avenue South. Arsenic concentrations persist above preliminary SWFS cleanup levels farther downgradient than iron and manganese; however, downgradient of Second Avenue South arsenic concentrations generally return to concentrations similar to those measured in upgradient wells. The distribution of these metals appears similar to what would occur if these COCs were the result of a facility release. However, the simultaneous presence of the high iron and manganese concentrations with the low redox near the facility, coupled with the nearly ubiquitous presence of these metals in natural minerals, indicates that the low redox conditions (likely caused by release of biodegradable organic constituents from the facility) has caused dissolution of these metals from native aquifer materials. There have been no known releases of these metals from the facility and historical facility operations typically handled organic waste streams rather than materials with significant quantities of iron and manganese. Soil samples were not analyzed for these metals, however background concentrations (taken as the 90^{th} percentile concentration) for iron and manganese in Puget Sound are 36,128 and 1,146 mg/kg, respectively (Ecology, 1994). Given the high naturally occurring concentrations of iron and manganese in Puget Sound soils, and the lack of historical handling or release of these metals at the facility, the occurrence of these metals is apparently due to dissolution from naturally occurring sources. Since the metals originate from native aquifer materials, it is expected that the metals will precipitate from groundwater after redox conditions rebound to a more oxidizing range. This is consistent with the observed conditions downgradient of Second Avenue South.

The EPC value for chromium and nickel within the water table depth interval exceeded preliminary SWFS cleanup levels at only one monitoring point located along Denver Avenue (Figures 4-8 and 4-9). Chromium and nickel concentrations were below preliminary SWFS cleanup levels at all other locations in the water table depth interval.

Copper concentrations in the water table depth interval slightly exceed preliminary SWFS cleanup levels at four locations, with a maximum concentration of about 1.6 times the preliminary SWFS cleanup level. Concentrations are below preliminary SWFS cleanup levels at the other 10 wells sampled and analyzed for copper, including wells at and immediately downgradient of the facility. Figure 4-9 shows that the locations where copper exceeds preliminary SWFS cleanup levels is discontinuous and scattered, indicating that copper is not likely associated with a single source area or point of release.

Barium concentrations exceed preliminary SWFS cleanup levels within the water table depth interval downgradient of the facility, with a maximum concentration of 3.5 times the preliminary SWFS cleanup level along Denver Avenue South. Concentrations generally decline downgradient of the facility, with all concentrations below preliminary SWFS cleanup levels along and downgradient of Sixth Avenue South.

6.2.2.2 Shallow Depth Interval

Arsenic, iron, and manganese concentrations are highest relative to preliminary SWFS cleanup levels of all the metals COCs in the shallow depth interval (Table 6-9 and Figures 4-14 and 4-15). Unlike the water table depth interval, where redox conditions rebound relatively quickly downgradient of the facility, redox conditions in the shallow depth interval remain fairly low until about Second Avenue South. As a result, iron concentrations increase somewhat in the area downgradient of the facility and persist above preliminary SWFS cleanup levels past East Marginal Way South. Similarly, manganese concentrations do not show the level of attenuation observed in the water table depth interval and persist above preliminary SWFS cleanup levels downgradient East Marginal Way South.

The highest arsenic, barium, and copper concentrations in the shallow depth interval are located upgradient of the facility. Arsenic, barium, and copper concentrations at upgradient well CG-106-I are about 50, 12, and 9 times their respective preliminary SWFS cleanup levels. Each of these metals shows considerable attenuation in areas beneath and downgradient of the facility. Arsenic concentrations in the shallow depth interval decline to about 22 times preliminary SWFS cleanup levels at Denver Avenue South and less than 2 times preliminary SWFS cleanup levels by Fifth Avenue South. The mechanism for the attenuation of arsenic concentrations between the upgradient and downgradient side of the facility is not clear, however the continued reductions in arsenic concentrations downgradient of the facility generally match the transition form slightly reducing to slightly oxidizing redox conditions west of Maynard Avenue. Copper concentrations decline to less than two times preliminary SWFS cleanup levels by Denver Avenue South and to below preliminary SWFS cleanup levels downgradient of Denver Avenue. Barium concentrations decline to less than five times preliminary SWFS cleanup levels downgradient of the facility.

Hexavalent chromium concentrations within the shallow depth interval are also highest upgradient of the facility. The only other detections above preliminary SWFS cleanup levels in the shallow depth interval were located well downgradient of the facility, at Sixth Avenue South and First Avenue South. Concentrations immediately downgradient of the facility were all below preliminary SWFS cleanup levels.

6.2.2.3 Intermediate Depth Interval

Maps showing the intermediate depth interval cleanup level ratio distribution for metals COCs are shown on Figures 4-20 through 4-22. Chromium, lead, vanadium, and nickel concentrations only slightly exceed preliminary SWFS cleanup levels, with maximum concentrations between 1.3 and 1.5 times the preliminary SWFS cleanup levels. The distribution maps show that the locations where these metals exceed preliminary SWFS cleanup levels are discontinuous and scattered, indicating that they are not likely associated with a single source area or point of release.

In general, barium and copper concentrations are greater than preliminary SWFS cleanup levels only in the area immediately downgradient of the facility. The maximum copper concentration is about 9 times the preliminary SWFS cleanup level, and the maximum barium concentration is about 12 times its preliminary SWFS cleanup level. These concentrations are significantly higher than observed in any samples collected from the overlying water table and shallow depth intervals. As such, it is unlikely that they are related to any direct facility release; these concentrations may represent ambient groundwater conditions, or, in the case of copper, a secondary effect due to dissolution of iron oxides or oxyhydroxides. There is not a clear spatial trend observable in the concentration data, although concentrations at a well along Sixth Avenue South are below preliminary SWFS cleanup levels for copper and less than twice preliminary SWFS cleanup levels for barium.

For the intermediate depth interval, arsenic, iron, and manganese are generally found at the highest concentrations relative to preliminary SWFS cleanup levels. Monitoring data are generally limited to the area immediately downgradient of the facility, where redox conditions are low due to the presence of organics. Within this limited area, these metals do not appear to significantly attenuate; however, it is expected that they will precipitate/co-precipitate as geochemical conditions become more oxidizing.

6.2.2.4 Deep Aquifer

Constituent distribution maps for metals in the deep aquifer are shown on Figures 4-25 through 4-27. Groundwater quality data from the deep aquifer are limited to one upgradient well and/or a few wells in the immediate vicinity of the facility. As such, only a rough evaluation of the fate of metals in the deep aquifer can be presented. However, some general trends in groundwater quality between the upgradient and downgradient sides of the facility are apparent from available data.

Iron and manganese concentrations increased from the upgradient to the downgradient side of the facility (Figure 4-27), likely due to the reducing conditions in the deep aquifer. Arsenic concentrations are highest at and cross-gradient from the facility (EPC values of 24 and 32 μg/L at wells 1-D and 102-D, respectively), and lower upgradient and downgradient of the facility (EPC values of approximately 15 μg/L at wells CG-106-D and 104-D). It is unknown if the reducing conditions persist downgradient of the facility or if more oxidizing conditions occur, which would enable attenuation of these metals.

The EPC data for chromium and nickel show increased concentrations across the facility. Zinc concentrations increase from below preliminary SWFS cleanup levels at the well completed beneath the facility to up to five times preliminary SWFS cleanup levels downgradient and cross-gradient from the facility. Maximum concentrations are relatively low, with cleanup level ratios ranging from 2.7 to 5 times the preliminary SWFS cleanup level.

Selenium and barium data show increased concentrations across the facility, with maximum cleanup level ratios of 6.7 and 29, respectively. Selenium was not identified as a COC in any of the overlying aquifer depth intervals. Barium concentrations in the overlying water table and shallow depth intervals are an order of magnitude lower than in the deep aquifer. As such, it is unlikely that the detected selenium and barium concentrations are associated with a facility release.

Hexavalent chromium concentrations are highest in the upgradient well (CG-106-D). Concentrations decrease downgradient across the facility, and are less than twice preliminary SWFS cleanup levels along Denver Avenue South. Similarly, copper concentrations are highest upgradient of the facility at 19 times the preliminary SWFS cleanup level, and decrease to just over 5 times preliminary SWFS cleanup levels at Denver Avenue South. Vanadium concentrations also show decreasing concentrations across the facility and are below preliminary SWFS cleanup levels along Denver Avenue South.

Silver concentration data were only available for the two wells along Denver Avenue South. Concentrations in these wells were less than two times preliminary SWFS cleanup levels.

6.2.3 Concentration Trend Plots

The EPC values used to identify COCs and prepare the cleanup level ratio maps discussed in Section 4 are generally equal to the maximum concentration measured in a given well. In several cases metals concentrations in the first few rounds of sampling were above preliminary SWFS cleanup levels, but have since declined to near or below preliminary SWFS cleanup levels in samples collected subsequent to implementing the HCIM. The large decline of metals in many of the monitoring wells from their initial sampling suggests that part of the issue with the original sampling may be related to sediment being in the early sample event, even with low flow sampling procedures. This is a common occurrence with newly installed wells. As the well sits the sediments settle out, plus pumping for each event improves the development of the well. The result is that subsequent sampling events show a decreasing trend.

In cases where metals concentrations at and near the facility are currently below preliminary SWFS cleanup levels, it is unlikely that in the future these metals in the associated depth intervals will migrate to the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels unless something alters groundwater chemistry.

Metals concentration trend plots were prepared for select metals for which concentrations have declined to below or near preliminary SWFS cleanup levels in the vicinity of the facility. Plots were limited to data from wells at or immediately downgradient from the facility, with EPC values greater than preliminary SWFS cleanup levels. Figures 6-4 and 6-5 show chromium and nickel in the water table depth interval; Figures 6-6 through 6-10 show arsenic, chromium, copper, lead, and nickel in the intermediate depth interval; and Figures 6-11 through 6-13 show chromium, nickel, and zinc in the deep aquifer.

As shown on Figures 6-4 and 6-5, chromium and nickel were detected above preliminary SWFS cleanup levels in a single sample from water table depth interval well 113-S-1, the only well with EPC values for chromium and nickel above preliminary SWFS cleanup levels. Both chromium and nickel concentrations show a steady decline, and the five subsequent samples analyzed for chromium and six subsequent samples analyzed for nickel from this well were all below preliminary SWFS cleanup levels.

As shown on Figure 6-6, arsenic concentrations in the intermediate depth interval were well above preliminary SWFS cleanup levels in the first two to three sampling events. Arsenic concentrations have subsequently shown a generally consistent decline, and in the more recent sampling events arsenic concentrations have been at or near preliminary SWFS cleanup levels, indicating that the EPC values for these wells greatly overestimate current concentrations near the facility and provide a highly conservative indicator of potential risks for metals.

The data plotted on Figures 6-7 through 6-10 show that chromium, lead, and nickel concentrations in the intermediate depth interval were above cleanup levels in the first one or two samples, and copper was above cleanup levels in the first three samples. Following the first one or two sampling rounds, each of these metals has shown a steady decline in concentrations and all recently collected data are below preliminary SWFS cleanup levels. Copper was below its preliminary SWFS cleanup level in the final round of sampling, while the other metals were below preliminary SWFS cleanup levels in between two and four consecutive sampling events.

On Figures 6-11 through 6-13 chromium, nickel, and zinc in the deep aquifer show steady declines in concentration following the initial detections that exceeded preliminary SWFS cleanup levels. Chromium shows a slight increase in concentration in the final sampling round, but was still below preliminary SWFS cleanup levels. Nickel and zinc were below preliminary SWFS cleanup levels for the last four and last two sampling rounds, respectively.

6.2.4 Travel Times

Travel times for metals to migrate from the facility to the Duwamish Waterway were estimated based on average groundwater seepage velocities and literature values for Kd values. Groundwater seepage velocities for all depth intervals were assumed to be equal to the estimated velocity for the water table depth interval of 187 ft/yr. Given a distance from the facility to the waterway of about 3,800 feet and ignoring the effects of retardation, the minimum estimated groundwater travel time from the facility to the Duwamish Waterway would be approximately 20 years.

Retardation factors (Rf) were calculated for each metal based on the literature Kd values from Section 4, an assumed soil bulk density (ρ_b) of 1.51 kg/L, and an aquifer porosity (n) of 0.3 using the equation $Rf = 1+(\rho_b/n)\ Kd$. The travel time for each metal was then calculated as the minimum estimated groundwater travel time multiplied by the retardation factor. Values for Kd, Rf, and the resultant travel times are summarized on Table 6-9.

Estimated travel times for metals COCs were generally on the order of several thousand years, with a minimum travel time of about 500 years for selenium. This is at best an order of magnitude estimate using average literature values for Kd. However, these calculations do indicate that typical travel times for metals to migrate from the facility to the Duwamish Waterway will be in the range of hundreds to thousands of years. This suggests that the metals observed downgradient from the facility did not originate from the facility, thereby providing further support for dissolution from the native media due to changes in water chemistry.

6.2.5 Conclusions

The following sections present conclusions regarding the expected fate and transport of metals detected near the facility and identify those metals that may reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels, as summarized on Table 6-10.

6.2.5.1 Water Table Depth Interval

Based on the trend plots, chromium and nickel concentrations in the water table depth interval are currently below preliminary SWFS cleanup levels at the facility and are therefore not expected to migrate to the waterway from the facility at concentrations above preliminary SWFS cleanup levels.

Barium and copper are relatively limited in extent, and barium concentrations are below preliminary SWFS cleanup levels downgradient of the facility. Where these metals exceed the preliminary SWFS cleanup levels, they are only slightly above the cleanup levels. The fairly low concentrations, combined with the long expected travel times, indicate that the detected concentrations at the facility are not expected to reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels.

Iron concentrations attenuate to levels below preliminary SWFS cleanup levels, and manganese concentrations are less than twice preliminary SWFS cleanup levels at Fourth Avenue South. These metals are strongly influenced by redox conditions. There is also a general trend of declining iron and manganese concentrations coupled with an increasing trend for redox, which in turn is associated with lower concentrations of organic COCs. As such, iron and manganese concentrations in the water table depth interval that are associated with the release of organic constituents from the facility are not expected to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Arsenic concentrations show a declining trend to the west of the facility. However, concentrations persist above preliminary SWFS cleanup levels west of Fourth Avenue South. Based on this observed behavior, arsenic in the water table depth interval may reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels. However, as noted previously, the observed arsenic concentrations are due to localized effects of water chemistry and do not represent direct migration from the facility.

6.2.5.2 Shallow Depth Interval

Concentrations of arsenic, barium, copper, and hexavalent chromium in the shallow depth interval are highest upgradient of the facility. These metals show declining concentration trends across the facility and downgradient of Denver Avenue, with concentrations generally decreasing to less than twice the preliminary SWFS cleanup levels between Fourth Avenue South and Sixth Avenue South. These declining concentration trends, combined with the long expected travel times, indicate the detected concentrations at the facility are unlikely to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Iron and manganese concentrations show increasing trends downgradient of the facility, likely due to the persistence of reducing conditions in the shallow depth interval. The reducing conditions, and resultant dissolution of ion and manganese, are caused primarily by biodegradation of organic constituents from the facility and other urban sources. Iron and manganese may reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels.

6.2.5.3 Intermediate Depth Interval

Based on the trend plots, arsenic, chromium, copper, lead, and nickel concentrations in the intermediate depth interval are currently near or below preliminary SWFS cleanup levels at and immediately downgradient from the facility. Based on this, these metals are not expected to migrate to the Duwamish Waterway from the facility at concentrations above preliminary SWFS cleanup levels.

Barium concentrations in the intermediate depth interval are approximately four to five times greater than the concentrations present in the water table and shallow depth intervals. Therefore, the concentrations observed in the intermediate depth interval do not appear to be related to a facility release and could instead represent naturally occurring barium. In any event, concentrations decrease downgradient from the facility to less than twice the preliminary SWFS cleanup levels. This trend, combined with the long expected travel time, indicates that detected concentrations at the facility are unlikely to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Maximum vanadium concentrations in the intermediate depth interval are less than two times the preliminary SWFS cleanup levels. Based on the scattered nature of the concentration data, vanadium does not appear to be related to an identifiable source or point of release. Based on the relatively low observed concentrations, scattered distribution, and long expected travel time, vanadium is unlikely to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Iron and manganese concentrations do not show significant attenuation in the limited area in which data were collected in the intermediate depth interval downgradient of the facility. These data were collected from the area where redox conditions are low. Slightly oxidizing redox conditions further downgradient would likely result in attenuation of iron and manganese; however, these metals may still reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels.

6.2.5.4 Deep Aquifer

Based on the trend plots, chromium, nickel, and zinc concentrations in the deep aquifer are currently below preliminary SWFS cleanup levels at and immediately downgradient from the facility. Based on this, these metals are not expected to migrate to the Duwamish Waterway from the facility at concentrations above preliminary SWFS cleanup levels.

The maximum silver concentration was less than two times preliminary SWFS cleanup levels. Based on the low concentration and the long expected travel time, silver is not expected to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Concentrations of copper, hexavalent chromium, and vanadium in the deep aquifer are highest upgradient of the facility. These metals show declining concentration trends across the facility to Denver Avenue South. Vanadium concentrations are less than preliminary SWFS cleanup levels along Denver Avenue South, and copper and hexavalent chromium concentrations are five and less than two times preliminary SWFS cleanup levels along Denver Avenue, respectively. Based on the decreasing concentrations in the downgradient direction, relatively low concentrations along Denver Avenue, and long expected travel time, these metals are not expected to reach the waterway at concentrations above preliminary SWFS cleanup levels.

Selenium and barium data show increasing concentrations across the facility, with maximum cleanup level ratios of 6.7 and 29, respectively. Selenium was not identified as a COC in any of the overlying aquifer depth intervals. Barium concentrations in the overlying water table and shallow depth intervals are approximately 20 to 25 percent of concentrations in the intermediate depth interval, and an order of magnitude lower than in the deep aquifer. These concentration distributions, with low concentrations in the overlying unconfined aquifers and high concentrations in the confined deep aquifer, do not match what would be expected if selenium and barium in groundwater were the result of a facility release. Instead, these metals appear to be naturally occurring at the concentrations measured in the deep aquifer.

Iron and manganese concentrations increase across facility. Arsenic concentrations at Denver Avenue, while similar to upgradient concentrations and lower than concentrations beneath the facility, are still more than two orders of magnitude above preliminary SWFS cleanup levels. There are no data on downgradient redox conditions in the deep aquifer, and it is unknown if conditions are suitable for attenuation of these metals. Given this uncertainty, arsenic, iron, and manganese will potentially reach the Duwamish Waterway at concentrations above preliminary SWFS cleanup levels.

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7.0 GROUNDWATER REMEDIATION LEVELS AND FINAL SWFS GROUNDWATER CLEANUP LEVELS

Preliminary SWFS groundwater cleanup levels were defined in Section 2 based on protection of surface water, protection of the indoor air pathway (water table depth interval only), or potential use as drinking water (deep aquifer only). In Section 6, the fate and transport and potential attenuation of organic ICOCs and metals was evaluated with respect to transport to the Duwamish Waterway. In the following subsections, RLs and site-specific cleanup levels are developed for certain COCs by incorporating attenuation of constituent concentrations between the facility and the Duwamish River. Final SWFS cleanup levels are also determined, based on the site-specific cleanup levels and protection of the indoor air or drinking water criteria, as appropriate, for each groundwater COC and for each groundwater depth interval.

The potential for COCs to reach the Duwamish Waterway and their estimated concentrations at the discharge point were evaluated based on fate and transport analyses for the ICOCs presented in Section 6. For COCs with a potential to reach the Duwamish Waterway at concentrations greater than surface water protection criteria, RLs were developed. The RLs are concentrations at the proposed CPOC that would attenuate to attain surface water protection criteria prior to discharge to the Duwamish Waterway. It is important to note that the RLs for the water table depth interval are not necessarily protective of the indoor air pathway.

For COCs expected to reach the waterway at concentrations below the PQLs presented in Section 2, site-specific cleanup levels were developed that would apply only to this Site at the CPOC presented in Section 5. The site-specific cleanup levels are concentrations at the proposed CPOC that would attenuate to below PQLs prior to discharge to the Duwamish Waterway.

Final SWFS cleanup levels were established for groundwater COCs as follows:

- For water table depth interval COCs, the final SWFS cleanup levels are set at the lower of either the criteria protective of the inhalation pathway or the site-specific cleanup levels.

- For COCs within the shallow and intermediate depth intervals, the final SWFS cleanup levels were selected as the higher of either the site-specific cleanup level or the preliminary SWFS cleanup level.

- For COCs within the deep aquifer, the final SWFS cleanup level was established as the lower of either the site-specific cleanup level or the drinking water criteria.

Final SWFS groundwater cleanup levels established in this manner for the different depth intervals will be protective of the relevant potential exposure pathways. It should be noted that for those COCs for which site-specific cleanup levels are not determined, the final SWFS cleanup levels will be based on the preliminary SWFS cleanup levels.

7.1 DETERMINATION OF COC CLASSES

Groundwater COCs in the Outside Areas are grouped into three classes, depending on their potential to reach the Duwamish Waterway, as determined based on the fate and transport analyses of ICOCs presented in Section 6. These classes are as follows:

- **Class 1 CO**Cs are defined as those COCs that are not expected to reach the waterway at concentrations greater than laboratory PQLs (i.e., at quantifiable concentrations). Groundwater-to-surface water criteria do not apply to Class 1 COCs upgradient of the waterway. Instead, site-specific cleanup levels sufficient to keep potential future concentrations at the waterway below PQLs are established for application at and upgradient of the CPOC.

- **Class 2 COCs** are defined as those COCs that are expected to reach the Duwamish Waterway at concentrations greater than the PQL but less than surface water protection criteria. The cleanup levels based on surface water protection criteria apply to these COCs at the CPOC; development of RLs is not necessary for Class 2 COCs because the existing concentrations are not expected to result in exceedances of surface water protection criteria at the waterway. Class 2 COCs will require estimates of restoration time frames to meet cleanup levels at the CPOC.

- **Class 3 COCs** are those COCs that will potentially reach the Duwamish Waterway at concentrations greater than surface water protection criteria. These COCs require RLs to be established at the CPOC that are protective of surface water quality. The RLs will be applied at the compliance monitoring location (see Section 5) during implementation of corrective action. The ultimate goal of the corrective action is to attain cleanup levels at the CPOC. An estimate of restoration time necessary to achieve groundwater cleanup levels at the CPOC is also required for these COCs.

Sections 7.2 through 7.5 present the rationale for the each of the four chemical classifications (e.g., metals, halogenated VOCs, etc.) used to assess fate and transport behavior for each of the organic and metals COCs in each of the four saturated zones addressed in this SWFS. The determination of COC class is based on the natural attenuation modeling using the organic ICOCs and the fate and transport evaluation of metals presented in Section 6. Summaries of COCs and assigned classes for each of the depth intervals are shown on Tables 7-1 through 7-4.

7.2 WATER TABLE INTERVAL

7.2.1 Halogenated VOCs

Chlorinated ethenes (PCE, TCE, DCE, VC), chlorinated ethanes (1,1,1-TCA, 1,1-DCA, chloroethane), chloroform, and dichlorodifluoromethane were identified as COCs in the water table depth interval. The ICOCs for the water table depth interval are PCE, TCE, cis-1,2-DCE, and VC. The ICOCs were used to evaluate the fate and transport of all halogenated VOCs. Natural attenuation modeling was performed for these ICOCs. The base-case modeling indicated that these constituents would not reach the Duwamish Waterway at concentrations greater than surface water protection criteria, although TCE and VC may reach the waterway at concentrations greater than PQLs. The model is sensitive to biodegradation rates, and based on the sensitivity analysis, it is possible that these constituents (particularly TCE and VC) could reach the waterway at concentrations greater than surface water protection criteria if biodegradation is significantly slower than modeled. Therefore, TCE and VC were conservatively categorized as Class 3 COCs for the water table depth interval, with the potential to reach the waterway at concentrations above surface water protection criteria. Because RLs for VC must include the development of RLs for PCE and cis-1,2-DCE, these COCs were also categorized as Class 3.

Chloroform only exceeds preliminary SWFS cleanup levels based on protection of indoor air and is below surface water protection criteria. As such, it will not reach the Duwamish Waterway at concentrations greater than surface water protection criteria and is, therefore, categorized as a Class 1 COC for the water table depth interval. The other halogenated VOCs that were not modeled are expected to show fate and transport behavior similar to the chlorinated ethenes, as discussed in Section 4. Since the other halogenated VOCs have much lower cleanup level ratios than TCE and VC, these other COCs are not expected to reach the waterway at concentrations above surface water protection criteria, although they may exceed PQLs. Based on this, dichlorodifluoromethane, 1,1,1-TCA, 1,1-DCA, and chloroethane were categorized as Class 2 COCs for the water table depth interval.

7.2.2 Nonhalogenated Hydrocarbons

Seventeen constituents classified as nonhalogenated hydrocarbons were identified as COCs in the water table depth interval. These include the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), 1,2,4- and 1,3,5-trimethylbenzenes, propylbenzene, sec-butylbenzene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, styrene, cumene, n-hexane, and C8-C10 (EPH and VPH) and C10-C12 (EPH) aromatics. Ethylbenzene and toluene were selected as ICOCs representative of the fate of the other nonhalogenated hydrocarbons. Natural attenuation modeling and the associated sensitivity analysis indicated that ethylbenzene and toluene are not expected to reach the Duwamish Waterway at concentrations above the PQLs. Based on this, ethylbenzene and toluene were classified as Class 1 COCs.

The ICOCs, toluene and ethylbenzene, had high cleanup level ratios (133 and 1,238, respectively). The other nonhalogenated hydrocarbons are much less mobile and/or have much lower cleanup level ratios than the ICOCs, and, therefore, are not expected to reach the waterway at concentrations greater than the PQLs. Based on these considerations, the other nonhalogenated COCs within the water table depth interval are categorized as Class 1 COCs.

7.2.3 Miscellaneous Compounds

Other COCs identified for the water table depth interval are 1,2-dichlorobenzene, 1,4-dichlorobenzene, and BEHP. Natural attenuation modeling was not performed to represent these COCs; however, they are not expected to migrate to the Duwamish Waterway at concentrations exceeding PQLs. BEHP has very low mobility (K_{oc} value of 111,100 L/kg) and is not expected to migrate significantly. Both 1,2-dichlorobenzene and 1,4-dichlorobenzene exceed surface water protection criteria at only one location each within the water table depth interval outside the barrier wall. The concentrations of these two COCs relative to surface water protection criteria are low (2.3 and 1.3, respectively). These COCs are moderately mobile (K_{oc} values of 379 and 616 L/kg) and would be expected to migrate at roughly one-quarter to one-third the rate of groundwater flow. Based on literature values, the dichlorobenzenes are not expected to biodegrade significantly under anaerobic Site conditions, although biodegradation does occur under aerobic conditions. Given the limited extent of these moderately mobile COCs and their low observed concentrations, they appear to be attenuating rapidly downgradient of the Site. All concentrations for the dichlorobenzenes were below surface water protection criteria in wells west of Denver Avenue South and were below PQLs by Sixth Avenue South. As such, these COCs are not expected to reach the waterway at levels exceeding PQLs and are classified as Class 1 COCs.

7.2.4 Metals

Metals identified as COCs in the water table depth interval include arsenic, barium, chromium, copper, iron, manganese, and nickel. As discussed in Section 6, arsenic is the only water table metals COC that may migrate to the Duwamish Waterway at concentrations above surface water protection criteria. Therefore, arsenic is classified as Class 3 COC.

Chromium and nickel concentrations are currently surface water protection criteria at the facility and these metals are not expected to migrate to the waterway at concentrations above surface water protection criteria. Barium and copper are relatively limited in extent and have low exceedance ratios for cleanup levels; barium concentrations are below surface water protection criteria downgradient of the facility. These factors, combined with the long expected travel times for these metals, indicate that the detected concentrations at the facility are unlikely to reach the waterway at concentrations above surface water protection criteria, although they may exceed PQLs. Based on this evaluation, these metals are classified as Class 2 COCs for the water table depth interval.

Iron concentrations within the water table depth interval attenuate to below surface water protection criteria, and manganese concentrations are less than twice surface water protection criteria at Fourth Avenue South. These metals are strongly influenced by redox conditions, and the trend of declining iron and manganese concentrations generally follows the trend of increasing redox, which in turn is associated with lower concentrations of organic COCs. As such, iron and manganese concentrations in the water table depth interval that are associated with the release of organic constituents from the facility are not expected to reach the waterway at concentrations above surface water protection criteria, although they may reach the waterway at concentrations above PQLs. Based on this, these metals are classified as Class 2 COCs.

7.3 SHALLOW INTERVAL

7.3.1 Halogenated VOCs

Three chlorinated VOCs (TCE, VC, and 1,1-DCA) were identified as COCs in the shallow depth interval. TCE and VC were selected as ICOCs representative of the fate of 1,1-DCA, as discussed in Section 4. Natural attenuation modeling was performed for TCE and VC, as well as the parent compounds PCE and 1,2-DCE. Both the base-case and sensitivity analysis results of the modeling indicated that TCE and VC within the shallow depth interval are unlikely to reach the Duwamish Waterway at concentrations greater than surface water protection criteria, although given model sensitivity to biodegradation rates, it is possible that they will reach the waterway at concentrations greater than PQLs. Therefore, TCE, VC, and 1,1-DCA are categorized as Class 2 COCs.

7.3.2 Nonhalogenated Hydrocarbons

Benzene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene were identified as nonhalogenated hydrocarbon COCs in the shallow depth interval, with benzene selected as the

ICOC representative of the fate of the other COCs. Both the base-case and sensitivity analysis results of the natural attenuation modeling performed for benzene indicated it is unlikely to reach the Duwamish Waterway at concentrations greater than PQLs. The cleanup level ratio for benzene (2.6) and the other nonhalogenated hydrocarbon COCs (1.3 to 2.3) are all similarly low; however, benzene is much more mobile, migrating at approximately five times the rate of naphthalene, the next most mobile nonhalogenated hydrocarbon COC. As a result, the other nonhalogenated hydrocarbon COCs would take much longer to migrate to the waterway, resulting in much more time for biodegradation to reduce concentrations. The nonhalogenated hydrocarbon COCs are, therefore, unlikely to reach the waterway at concentrations greater than the PQLs. Based on these results, these COCs are categorized as Class 1 COCs for the shallow depth interval.

7.3.3 Miscellaneous Compounds

Cyanide, BEHP, and 1,4-dioxane was identified as COCs in the shallow depth interval. Under Site conditions, 1,4-dioxane is not expected to biodegrade significantly. Natural attenuation modeling indicated that 1,4-dioxane concentrations may be reduced to about twice the surface water protection criteria before reaching the Duwamish Waterway. Based on these results 1,4-dioxane is categorized as a Class 3 COC.

Cyanide was only detected in one well in the shallow depth interval. BEHP was detected at concentrations above surface water protection criteria along Denver Avenue South, but is below surface water protection criteria in wells downgradient of Denver Avenue South. Additionally, BEHP has a very low mobility and is not expected to migrate significantly. Therefore, these two COCs are not expected to migrate to the waterway at concentrations greater than the PQLs. These two COCs have been categorized as Class 1 COCs for the shallow depth interval.

7.3.4 Metals

Metals identified as COCs in the shallow depth interval include arsenic, barium, copper, hexavalent chromium, iron, and manganese. As discussed in Section 6, iron and manganese are the only shallow interval metals COCs at the facility that may migrate to the Duwamish Waterway at concentrations above surface water protection criteria. Based on this, iron and manganese within the shallow depth interval are classified as Class 3 COCs.

Arsenic, barium, copper, and hexavalent chromium concentrations are highest upgradient of the facility and show declining concentrations across the facility and downgradient of Denver

Avenue South. These declining concentration trends, combined with the long expected travel times, indicate the detected concentrations at the facility are unlikely to reach the waterway at concentrations above surface water protection criteria, although they may be above PQLs. These metals are, therefore, categorized as Class 2 COCs.

7.4 INTERMEDIATE INTERVAL

7.4.1 Halogenated VOCs

Vinyl chloride and 1,1-DCA were identified as COCs in the intermediate depth interval. Vinyl chloride was selected as an ICOC representative of the fate of 1,1-DCA. Natural attenuation modeling performed for VC (including PCE, TCE, and cis-1,2-DCE) indicated that for this depth interval it is unlikely to reach the Duwamish Waterway at concentrations greater than the PQL. The sensitivity analysis results also conclude that VC concentrations at the waterway would not be greater than the PQL. Based on the fate and transport modeling, both VC and 1,1-DCA are categorized as Class 1 COCs within the intermediate depth interval.

7.4.2 Nonhalogenated Hydrocarbons

Ethylbenzene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as COCs in the intermediate depth interval. Ethylbenzene was selected as an ICOC representative of the fate of the other nonhalogenated hydrocarbons. Both base-case and sensitivity modeling for natural attenuation performed for the ICOC (ethylbenzene) indicated that it is unlikely to reach the waterway at concentrations greater than the PQL. Based on this, the nonhalogenated COCs are categorized as Class 1 COCs for the intermediate depth interval.

7.4.3 Miscellaneous Compounds

In addition to the general classes of compounds discussed above, cyanide, carbon disulfide, 1,4-dioxane, and BEHP were identified as COCs for the intermediate depth interval. Natural attenuation modeling indicated that 1,4-dioxane concentrations may be reduced by about 25 percent due to dispersion before reaching the Duwamish Waterway, although based on analogy to 1,4-dioxane modeling in the shallow depth interval, greater concentration reductions are expected. Model-predicted concentrations were greater than surface water protection criteria adjacent to the waterway. Based on these results 1,4-dioxane is categorized as a Class 3 COC.

Although reliable biodegradation rates were not found for cyanide and carbon disulfide, these constituents appear to be attenuating rapidly downgradient of the HCIM Area. Cyanide and carbon disulfide are only slightly less mobile than 1,4-dioxane, yet are detected in a much smaller area along and immediately downgradient of Denver Avenue South. The similar mobility of these constituents, coupled with their limited areal extent, indicates that attenuation is significant; if they were not attenuating, these constituents should have a distribution similar to that of 1,4-dioxane. Based on this evaluation, cyanide and carbon disulfide are not expected to reach the waterway at concentrations greater than PQLs and are categorized as Class 1 COCs. The mobility of BEHP is very low, and it is not expected to reach the waterway at concentrations greater than PQLs. Therefore, BEHP is categorized as a Class 1 COC.

7.4.4 Metals

Arsenic, barium, chromium, copper, iron, lead, manganese, nickel, and vanadium were identified as COCs in the intermediate depth interval. Arsenic, chromium, copper, lead, and nickel concentrations in the intermediate depth interval are currently near or below surface water protection criteria at and immediately downgradient from the facility. Therefore, these five metals are not expected to migrate to the waterway from the facility at concentrations above surface water protection criteria and are categorized as Class 2 COCs.

Barium concentrations in the intermediate depth interval are approximately four to five times greater than concentrations identified in the water table and shallow depth intervals. Additionally, the observed concentration distribution for barium does not match what would be expected if the barium were related to a facility release. It appears that the observed concentrations may instead represent naturally occurring barium. In any event, observed concentrations decrease downgradient from the facility to less than two times surface water protection criteria. This decrease in barium concentrations, combined with a long expected travel time to the waterway, indicates that the detected concentrations at the facility are unlikely to reach the waterway at concentrations above surface water protection criteria. Barium is therefore categorized as a Class 2 COC for the intermediate depth interval.

Maximum vanadium concentrations in the intermediate depth interval are less than two times surface water protection criteria. Based on these low observed concentrations and the scattered nature of the concentration data, it does not appear that vanadium is related to an identifiable source or point of release. Given the relatively low concentrations, scattered distribution, and long expected travel time, vanadium is considered unlikely to reach the waterway at concentrations above surface water protection criteria, and is therefore categorized as a Class 2 COC for the intermediate depth interval.

Iron and manganese concentrations do not show significant attenuation in the limited area in which data were collected in the intermediate depth interval downgradient of the facility. Slightly oxidizing conditions that occur further downgradient may result in attenuation of iron and manganese; however, these metals may still reach the Duwamish Waterway at concentrations above surface water protection criteria. As such, iron and manganese are categorized as Class 3 COCs in the intermediate depth interval.

7.5 DEEP AQUIFER

7.5.1 Halogenated VOCs

Three chlorinated VOCs (PCE, TCE, and VC) were identified as COCs in the deep aquifer because they exceeded cleanup levels that are based on drinking water standards. The EPC values for PCE and TCE at one location each exceeded surface water protection criteria; the EPC values for VC were below surface water protection criteria. The EPC values are driven primarily by data collected soon after these deep wells were installed. More recent data collected in 2004 and 2005 indicate that all concentrations of PCE, TCE, and VC are currently below surface water protection criteria. PCE, TCE, and VC are not expected to migrate to the Duwamish Waterway at concentrations above PQLs because (1) these constituents are below surface water protection criteria at the facility, (2) these constituents have shown declining concentrations since the monitoring wells were installed, and (3) concentrations of these constituents are expected to decline downgradient due to natural attenuation,. These COCs are categorized as Class 1 COCs for the purpose of evaluating migration to the waterway within the deep aquifer.

7.5.2 Nonhalogenated Hydrocarbons

Chrysene and diesel were the only nonhalogenated hydrocarbons identified as COCs in the deep aquifer. Chrysene has a moderately high cleanup level ratio but a very low mobility (K_{oc} of 398,000 L/kg). Diesel has a higher mobility (K_{oc} of 2,510 L/kg) but a very low cleanup level ratio of 1.8. Therefore, both diesel and chrysene are expected to attenuate significantly downgradient of the facility and are not expected to reach the Duwamish Waterway at concentrations above PQLs. These deep aquifer COCs are, therefore, categorized as Class 1 COCs.

7.5.3 Miscellaneous Compounds

Carbon disulfide and bis(2-ethylhexyl) phthalate (BEHP) were identified as COCs in the deep aquifer. Cleanup level ratios for these COCs are relatively low, with BEHP at 4.3 and carbon disulfide at 6.7. Carbon disulfide was present only at a single well and was not detected in any other deep aquifer wells. BEHP was detected in two wells, one upgradient of the facility and one on the east side of Denver Avenue South. BEHP does biodegrade under aerobic conditions; however, no information was found indicating whether BEHP biodegrades under the generally anaerobic conditions found in the deep aquifer. Given the high K_{oc} values (111,100 L/kg) for BEHP, it is unlikely that it is migrating at any significant rate. Based on the limited areal extent of carbon disulfide and the very low mobility of BEHP, neither of these COCs is expected to reach the Duwamish Waterway at concentrations exceeding PQLs, and both are classified as Class 1 COCs for the deep aquifer.

7.5.4 Metals

Arsenic, barium, chromium, hexavalent chromium, copper, iron, manganese, nickel, selenium, silver, vanadium, and zinc were identified as COCs in the deep aquifer. Although initial groundwater samples analyzed for chromium, nickel, and zinc contained concentrations greater than surface water protection criteria, subsequent samples from the deep aquifer showed concentrations declining to below surface water protection criteria in the deep aquifer wells. Since chromium, nickel, and zinc are currently below surface water protection criteria, they are not expected to migrate to the waterway from the facility at concentrations above surface water protection criteria and are categorized as Class 2 COCs.

Concentrations of copper, hexavalent chromium, and vanadium in the deep aquifer are highest upgradient of the facility. These metals show declining concentration trends across the facility to Denver Avenue South. Based on the decreasing concentration trends in the downgradient direction, the relatively low concentrations present along Denver Avenue South, and the long expected travel times to the waterway, these metals are not expected to reach the waterway at concentrations above surface water protection criteria. Therefore, these metals are categorized as Class 2 COCs for the deep aquifer.

The maximum silver EPC was less than two times its cleanup level. Based on the low concentration and the long expected travel time, silver is not expected to reach the waterway at concentrations above surface water protection criteria and is categorized as a Class 2 COC.

Selenium and barium data show increasing concentration trends from the upgradient to downgradient side of the facility. Selenium was not identified as a COC in any of the overlying groundwater depth intervals; therefore, it does not appear to have migrated to the deep aquifer from a surface release. Although barium is present in the overlying groundwater, observed concentrations in the water table and shallow depth intervals are an order of magnitude lower than observed in the deep aquifer, indicating that barium in the deep aquifer is unlikely to have originated from a surface release. The observed concentration trends, coupled with the low concentrations present in the overlying water table, shallow, and intermediate depth intervals and high concentrations in the confined deep aquifer, do not match what would be expected if selenium and barium in groundwater were the result of a facility release. However, given the increasing concentrations trends from the upgradient to downgradient side of the facility and the lack of data from downgradient of the facility, selenium and barium may potentially reach the Duwamish Waterway at concentrations above surface water protection criteria and are, therefore, classified as Class 3 COCs for the deep aquifer.

Arsenic, iron, and manganese concentrations show an increasing trend across the facility. These metals are present in aquifer matrix materials, and their aqueous concentrations depend strongly on local redox conditions. There are no available data for downgradient redox conditions in the deep aquifer, and it is unknown whether conditions are suitable for attenuation of these metals. Given this uncertainty, arsenic, iron, and manganese may potentially reach the Duwamish Waterway at concentrations above surface water protection criteria and are, therefore, classified as Class 3 COCs for the deep aquifer.

7.6 DETERMINATION OF REMEDIATION LEVELS

7.6.1 Remediation Level Approach

The BIOCHLOR model was used to establish RLs for organic COCs based on the CPOC proposed in this SWFS. The RLs were established to be protective of surface water at the Duwamish Waterway during implementation of corrective action. Ultimately, cleanup levels would need to be attained at the CPOC. The RLs are concentrations at the proposed CPOC that would attenuate to attain cleanup levels protective of surface water prior to discharge to the Duwamish Waterway. Remediation levels were established for all the Class 3 organic COCs, which include the following organized by depth interval:

- *Water table depth interval* – PCE, TCE, cis-1,2-DCE, and VC
- *Shallow depth interval* – 1,4-Dioxane
- *Intermediate depth interval* – 1,4-Dioxane

No Class 3 organic COCs were identified for the deep aquifer.

Remediation levels were not established for the Class 3 metals COCs for any of the three depth intervals and the deep aquifer. Elevated concentrations of arsenic, iron, and manganese appear to be primarily related to changes in redox conditions in response to biodegradation of organic COCs. Concentrations of these metals in groundwater are expected to decline toward naturally occurring concentrations as concentrations of organic COC outside the barrier wall decline. Elevated concentrations of selenium and barium in the deep aquifer appear to be naturally occurring and not related to a facility release. As such, development of remediation levels for selenium and barium is not appropriate.

Input parameters for the natural attenuation models developed in Section 6 were used to determine RLs for the Class 3 organic COCs. All input parameters for the base-case models discussed in Section 6 were left unchanged, with the exception of the initial concentrations that were adjusted until predicted concentrations at the Duwamish Waterway were equal to surface water protection criteria. All constituents were modeled as having constant initial concentrations applied at the CPOC.

Biodegradation of PCE produces TCE, which in turn produces cis-1,2-DCE and then VC. Because of the interrelationship between the parent and daughter compounds, each of which has associated cleanup levels, there is not a unique set of RLs for these compounds that meet surface water protection criteria at the Duwamish Waterway. For these COCs, the EPC values from the natural attenuation modeling were used as a starting point; the EPCs were used to establish the relative concentrations for these constituents for the source. The assumed source concentrations (i.e., the EPC values for each COC) were varied by the same multiple until all predicted constituent concentrations were equal to or less than surface water protection criteria at the waterway. The initial concentration of the constituent that was predicted to equal surface water protection criteria at the waterway was then fixed, along with any higher chlorinated compounds, and the initial concentrations of less chlorinated compounds were varied further until they met the surface water protection criteria. For example, if after the first set of iterations predicted TCE concentrations equaled surface water protection criteria at the waterway, the PCE and TCE initial concentrations would be fixed, and the cis-1,2-DCE and VC initial concentrations would continue to be varied until one of these compounds equaled surface water protection criteria at the waterway.

In some cases, very high RLs were determined using the model. The maximum allowable RLs for PCE, TCE, cis-1,2-DCE, and VC were arbitrarily set at 1,000 μg/L. Remediation levels using the base-case input parameters are shown on Table 7-5.

7.6.2 Sensitivity Analysis

Sensitivity of the RLs to model inputs was evaluated by varying model input parameters (other than source concentration) and comparing the change in predicted RLs. Parameters selected for the sensitivity analysis included biodegradation half lives and dispersivity. Previous sensitivity analyses presented in Section 6 demonstrated that the model is equally sensitive to flow rate and biodegradation rate, so flow rate sensitivity was not included in this analysis. Sensitivity analyses on biodegradation rates varied the rates of all COCs by the same multiple of between 0.5 and 3. One additional sensitivity analysis included changing the biodegradation rate for VC only by increasing the half life by a factor of 3. Results of the sensitivity analysis are shown on Table 7-5.

7.6.3 Recommended Remediation Levels

The predicted RLs are most sensitive to changes in the biodegradation half life, particularly the VC half life. Increasing all the biodegradation half lives by a factor of 3 is unrealistically conservative. However, increasing only the VC half life by a factor of 3 results in a half life (2.46 years) that is still within the range of expected VC biodegradation rates under conditions that exist at the Site. Based on this, the remediation levels calculated with increasing the VC half life by 3 times were selected as reasonably conservative RLs that will be protective of the Duwamish Waterway. Recommended RLs are shown on Tables 7-6 through 7-8 for each of the three depth intervals with Class 3 organic COCs.

It is important to note that for the water table depth interval, the RLs for PCE, TCE, cis-1,2-DCE, and VC are not protective of the indoor air pathway. As such, corrective actions for the water table depth interval will need to consider measures to address this pathway until cleanup levels for these COCs are met.

7.7 SITE-SPECIFIC AND FINAL SWFS GROUNDWATER CLEANUP LEVELS

Site-specific cleanup levels were developed for the COCs that are not expected to reach the Duwamish Waterway above PQLs (i.e., Class 1 COCs). These site-specific cleanup levels were developed to ensure that future migration of these COCs do not reach the waterway at detectable concentrations, defined as the laboratory PQLs presented in Section 2. The site-specific cleanup levels were selected as the highest EPC values in each depth interval used in evaluating whether a COC would reach the waterway (i.e., the EPC values used to calculate the cleanup level ratios presented in Section 4). The site-specific cleanup levels are summarized on Tables 7-6 through 7-9 for each of the groundwater depth intervals.

Final SWFS groundwater cleanup levels for each depth interval were also determined and are presented on Tables 7-6 through 7-9 for each of the groundwater units addressed by this SWFS. The final SWFS cleanup levels developed in this document will be used to develop and evaluate potential remedial alternatives. Final SWFS cleanup levels that will be used in the SWFS for the Class 2 and Class 3 COCs are the preliminary SWFS cleanup levels presented in Section 2. The final SWFS cleanup levels for groundwater presented in Tables 7-6 through 7-9 are protective of the relevant potential exposure pathways considered in the final RI report and in this SWFS.

For Class 1 COCs in the shallow and intermediate depth intervals, the final SWFS cleanup level was established as the site-specific cleanup level (Tables 7-7 and 7-8). In the water table depth interval, the final SWFS cleanup level must also be protective of the indoor air pathway. Therefore, final SWFS cleanup levels for Class 1 COCs in the water table depth interval were the lower of the site-specific cleanup level and criteria protective of the inhalation pathway, as presented in Table 7-6. For COCs in the deep aquifer, the final SWFS cleanup level must also be protective of potential drinking water use. Therefore, final SWFS cleanup levels for Class 1 COCs in the deep aquifer were the lower of the site-specific cleanup level and the drinking water criteria for the deep aquifer presented in Section 2, as shown in Table 7-9.

For example, in the water table depth interval, the preliminary SWFS cleanup level for toluene is 9.8 μg/L. Toluene in the water table depth interval at concentrations up to the EPC defined in Section 3 (9,040 μg/L) is not expected to reach the waterway at concentrations above PQLs, and is classified as a Class 1 COC. Therefore the EPC value was selected as the site-specific cleanup level for toluene in the water table depth interval. However, since the site-specific cleanup level for toluene is greater than the inhalation pathway criterion of (496 μg/L), the inhalation pathway criterion is selected as the final SWFS groundwater cleanup level for the water table depth interval.

8.0 REMEDIATION TIME ESTIMATION

This section presents the approach to estimate the time frame required to attain final SWFS cleanup levels within the Outside Area at the groundwater POC. For the different remedial alternatives considered in the SWFS, it is necessary to assess the potential remediation time to support comparison and evaluation of the alternatives. These remediation time estimates are made by modeling the reduction in groundwater concentrations via biodegradation. As a conservative approach, the potential effects of flushing via groundwater advection or dilution with upgradient water are not considered. The remediation time estimates are based solely on degradation of PCE, TCE, cis-1,2-DCE, and VC because these constituents typically have the highest concentrations and areal distribution outside the HCIM Area, represent most of the risks associated with impacted groundwater, and generally degrade at a rate slower than other organic COCs.

A spreadsheet model was developed to calculate the rate of decreases in dissolved phase concentrations while tracking total dissolved and sorbed phase mass in a unit volume of aquifer. It is assumed that groundwater concentrations are in equilibrium with sorbed soil concentrations and that only the dissolved phase mass is available for biodegradation. Biodegradation was assumed to follow a first order sequential decay model. For a given constituent, the change in dissolved phase concentration is described by:

$$C_t = C_{t-1} \times \exp\left(\frac{-0.693 \times \Delta t}{t_{1/2}}\right) + R$$

where:

- C_t is the aqueous phase COC concentration at time t;
- C_{t-1} is the aqueous phase COC concentration at the previous time step;
- Δt is the time step in years;
- $t_{1/2}$ is the half life in years; and
- R is the source reaction term accounting for increased concentration due to degradation of a parent compound (e.g., PCE to TCE) during the same time step.

The general procedure is to estimate the total mass (sorbed phase and dissolved phase) of each chlorinated VOC within a unit volume of aquifer, based on the initial dissolved phase concentration of each constituent and assuming linear equilibrium partitioning. The above equation is applied to each constituent, starting with an estimated initial dissolved phase concentration and sorbed mass. At the end of each time step, the calculated change in dissolved phase concentration is used to calculate the change of total constituent mass within the unit volume of aquifer. The calculated change in mass is subtracted from the total mass from the initial or previous time step, and the new total mass is then redistributed between the sorbed and dissolved phase within the unit volume using the appropriate partitioning coefficient (Table 8-1). The newly calculated dissolved phase mass is then used to calculate the dissolved phase concentration for the start of the next time step. Biodegradation of the dissolved phase component for the next time step is then calculated. This procedure is repeated until dissolved phase concentrations of all constituents are below final SWFS cleanup levels.

This spreadsheet model describes the change in concentration over time for a unit volume of aquifer between the barrier wall and the proposed CPOC described in Section 5. The spreadsheet model does not describe contaminant migration. As groundwater migrates downgradient of the CPOC, biodegradation will continue to reduce VOC concentrations. Assuming negligible dispersion, changes in concentrations in a differential unit of water as it moves downgradient are described by the same first order sequential decay equation. Assuming the same biodegradation rates and assumptions about equilibrium partitioning apply downgradient of the CPOC, then concentrations downgradient of the facility should reduce at the same rate as concentrations between the facility and the CPOC. If equilibrium partitioning does not apply downgradient of the facility and there is more mass in the dissolved phase than would be predicted based on K_{oc} and f_{oc}, then the spreadsheet model should over-predict concentration reductions because there would be less sorbed mass in the soil to act as a "reservoir" for the dissolved phase. In either case, the remediation time estimate for the area between the barrier wall and the CPOC should represent the total remediation time for the Outside Area.

Input parameters for this remediation time estimation are presented in Table 8-1. Initial dissolved phase concentrations were selected as the highest EPC values for PCE, TCE, cis-1,2-DCE, and VC detected in the water table, shallow, and intermediate depth intervals between the barrier wall and Denver Avenue South. Partitioning coefficients were calculated using the octanol- K_{oc} from Table 4-4 with an assumed f_{oc} of 0.1 percent. The use of these f_{oc} and partitioning coefficient values with the maximum EPC values results in a conservatively high estimate of sorbed mass that acts as a reservoir to replace dissolved phase constituents as they are biodegraded, thereby reducing the net degradation rate. The net result of this assumption is a conservatively high estimate for the remediation time. A soil density of 85 pounds per cubic foot and a porosity of 0.4 were also assumed, based on average values measured at the facility (URS, 2003; PSC, 2003). Biodegradation rates estimated from calibration of the BIOCHLOR model in Attachment B of this memorandum were used for this evaluation.

Model results, using a 1-day time step, are presented in Table 8-2. The times required to meet final SWFS cleanup levels at the CPOC are estimated at up to 26 years for the water table depth interval, 9 years for the shallow depth interval, and 10 years for the intermediate depth interval. The greatest time to meet final SWFS cleanup levels in the water table and shallow depth intervals are for TCE, and the greatest time to meet final SWFS cleanup levels in the intermediate depth interval is for VC.

The sensitivity of model predictions to the time step and the selected VC biodegradation rate were evaluated. Table 8-3 shows remediation time model results first using a time step of 0.5 years, and then with a VC half life of 2.5 years. In each case, all other model parameters were the same as shown in Table 8-1. Model sensitivity to the selected time step is minimal, with the greatest differences in estimated remediation time of 1 year. This is primarily due to rounding errors associated with the larger time step.

Increasing the VC biodegradation half life from 0.82 to 2.5 years increases the remediation time estimates for VC by approximately 2.5 to 3 times. The greatest time to meet final SWFS cleanup levels in the water table depth interval is for TCE, and VC will take the greatest time to meet final SWFS cleanup levels in the shallow and intermediate depth intervals. With a VC half life of 2.5 years, the time to meet final SWFS cleanup levels in the Outside Area are estimated at up to 26 years for the water table depth interval, 13 years for the shallow depth interval, and 29 years for the intermediate depth interval.

There is considerable uncertainty in the estimated remediation times. However, based on the range of VC biodegradation rates considered, remediation time is estimated to be on the order of up to 30 years in the water table and intermediate depth intervals, and approximately 15 years in the shallow depth interval.

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9.0 CORRECTIVE ACTION SCHEDULE

PSC proposes to implement corrective action at the Site in accordance with an accelerated corrective action schedule. The standard process for cleanup of a site under the MTCA regulations requires the following steps:

- Completion and Ecology approval of a formal remedial investigation report,
- Completion and Ecology approval of a formal feasibility study report,
- Completion and Ecology approval of a formal CAP,
- Completion and Ecology approval of an Engineering Design Report, and
- Implementation of the final remedy.

PSC's progress within the standard MTCA process is summarized below:

- The RI Report for the Site has been approved by Ecology, although PSC currently is conducting additional sampling on property owned by UPRR directly adjacent to the facility's eastern boundary.

- The SWFS is being prepared in close cooperation with Ecology using a stepwise, interactive approach. A series of deliverables have been defined for the SWFS report. Each of these deliverables will be reviewed by Ecology and approved separately prior to preparing the final SWFS report. This approach allows Ecology and PSC to agree on key issues that affect preparation of the final SWFS. A total of five separate deliverables have been identified for preparation of the final SWFS report. The schedule for these deliverables, as specified in the facility RCRA Part B Permit, is as follows:

Item	Schedule
Draft Technical Memorandum 1	March 3, 2006
Technical Memorandum 2: Remediation Areas	45 days after approval of Tech. Memo 1
Technical Memorandum 3: IPIM	45 days after approval of Tech. Memo 1
Technical Memorandum 4: Remedial Technology Screening	45 days after approval of both Tech. Memo 2 & 3
Technical Memorandum 5: Remedial Alternatives Evaluation	45 days after approval of Tech. Memo 4
Revised Draft SWFS Report	60 days after approval of Tech. Memo 5

PSC proposes to accelerate the CAP development process as follows:

- In recognition of Ecology's approval of the stepwise process to complete the SWFS, PSC is including within Technical Memorandum No. 1 a critical path schedule for implementing enhanced in-situ bioremediation of Outside Area groundwater as the preferred remedial alternative. This enhanced bioremediation approach will address concentrations of select COCs in groundwater located immediately downgradient of the barrier wall in the Outside Area. Given the projected iterative approach, certain actions to implement this remedial alternative may begin independent of other remedial actions for the Site. PSC proposes to develop the engineering design for enhanced bioremediation of Outside Area groundwater concurrently with completion of the SWFS on the following schedule:

  - Upon Ecology approval of the CPOC proposed in Technical Memorandum No. 1, PSC will initiate critical negotiations with the adjacent landowner to obtain agreements necessary to support implementation of the CPOC and the enhanced bioremediation program. The proposed CPOC would extend onto SAD and Aronson properties. It is anticipated that the enhanced bioremediation program for Outside Area groundwater would be implemented solely on PSC property.

  - Upon Ecology approval of the remediation areas proposed in Technical Memorandum No. 2, PSC will initiate engineering design for enhanced bioremediation of Outside Area groundwater. Formal Ecology approval of Technical Memorandum No. 2 by Ecology will define remediation areas and will enable PSC to complete final access arrangements for subsequent Outside Area remedial action.

  - Following approval of Technical Memorandum No. 2, PSC will proceed to obtain an approved conceptual and advanced engineering design for enhanced bioremediation of Outside Area groundwater prior to final preparation of the FS and CAP for the Site. Engineering design development for enhanced bioremediation will be concurrent with final preparation of the SWFS and approval of the final FS report. PSC anticipates that the CAP, typically conceptual in nature, will include a construction-level design for enhanced bioremediation immediately downgradient of the barrier wall in the Outside

Area. The proposed schedule for developing the engineering design for enhanced bioremediation of Outside Area groundwater is as follows:

- PSC will commence engineering needed for preparation of an engineering design report with a 50 percent (50%) design for enhanced bioremediation immediately downgradient from the HCIM Area (50% Bioremediation Engineering Design Report) upon Ecology approval of Technical Memorandum No. 2. The proposed draft 50% Bioremediation Engineering Design Report will include the level of design sufficient for a design-build implementation approach. The enhanced bioremediation program will be incorporated into the CAP and bioremediation construction may begin upon Ecology approval of the CAP.

- The CAP will incorporate the approach presented in the 50% Bioremediation Engineering Design Report. The CAP will include a preliminary Engineering Report for implementing the selected cleanup alternatives for the HCIM Area and the portions of the Outside Area not addressed by the enhanced bioremediation program implemented under this accelerated approach.

The proposed critical path schedule for preparing of the CAP and implementing the enhanced bioremediation program for the Outside Area is as follows:

Item	Schedule
Submit Draft 50% Bioremediation Engineering Design Report	45 days after approval of the final draft for Tech Memo 2
Submit Draft CAP	45 days after approval of Tech Memo 5
Commence Bioremediation Program Contracting & Procurement	45 days after approval of FS and the 50% Bioremediation Engineering Report
Commence Enhanced Bioremediation Implementation	45 days after approval of final CAP and final FS

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TABLES

TABLE 2-1

GROUNDWATER PRACTICAL QUANTITATION LIMITS

PSC Georgetown Facility
Seattle, Washington

Constituent	Analytical Method	CAS PQL (μg/L)	CAS Method Detection Limit (μg/L)	Federal Reporting Limit (μg/L)	Applicable PQL (μg/L)
Arsenic	1640/200.8	0.03/0.5	0.2	--	0.03
Barium	6000/7000 series	0.05	0.03	--	0.05
Copper	6000/7000 series	0.1	0.03	--	0.1
Cyanide	9010/9012	10	3	20	10
Chromium	6000/7000 series	0.2	0.06	--	0.2
Hexavalent Chromium	SM3500-CR	10	0.02	--	0.2
Iron	6000/7000 series	20	20	--	20
Lead	6000/7000 series	0.02	0.009	--	0.02
Manganese	6000/7000 series	0.05	0.02	--	0.05
Nickel	6000/7000 series	0.2	0.06	--	0.2
Selenium	6000/7000 series	1	0.2	--	1
Silver	6000/7000 series	0.02	0.009	--	0.02
Vanadium	6000/7000 series	0.2	0.03	--	0.2
Zinc	6000/7000 series	0.5	0.3	--	0.5
Diesel	NWTPH-Dx	100	19	--	100
Gasoline	NWTPH-Gx	250	13	--	130
PCB Aroclor 1016	8082 low level	0.005	0.0031	0.005	0.005
PCB Aroclor 1232	8082 low level	0.005	0.0031	0.005	0.005
1,4-Dichlorobenzene	8270 low level	0.2	0.0133	10	0.133
1,4-Dioxane	modified '8270	0.1	--	--	0.1
2,4-Dimethylphenol	8270 low level	2	0.318	10	2
2-Methylphenol	8270 low level	0.5	0.0594	10	0.5
2-Methylnaphthalene	8270 low level	0.02	0.00268	--	0.02
4-Methylphenol	8270 low level	0.5	0.0508	--	0.5
Benzo(a)anthracene	8270 SIM PAH	0.02	0.0021	10	0.02
Benzo(b)fluoranthene	8270 SIM PAH	0.02	0.00194	10	0.0194
Benzoic Acid	8270 low level	5	1.71	--	5
Benzo(k)fluoranthene	8270 SIM PAH	0.02	0.00134	10	0.0134
Bis(2-ethylhexyl) Phthalate	8270 low level	2	0.27	10	2
C10-c12 (eph) Aromatics	NWTPH EPH	50	--	--	50
C8-c10 (eph) Aromatics	NWTPH EPH	50	--	--	50
C8-c10 (vph) Aromatics	NWTPH VPH	50	--	--	50
C8-c10 (eph) Aliphatics	NWTPH EPH	50	--	--	50
Ethane	RSK 175	0.5	0.38	--	0.5
Ethene	RSK 175	1.5	0.55	--	1.5
Methane	RSK 175	0.5	0.3	--	0.5
Chrysene	8270 SIM PAH	0.02	0.00124	10	0.0124
Dibenzo(a,h)anthracene	8270 SIM PAH	0.02	0.00162	10	0.0162
Indeno(1,2,3-cd)pyrene	8270 SIM PAH	0.02	0.00208	10	0.02
Methylphenol	8270 low level	0.5	0.0594	10	0.5
Phenol	8270 low level	0.5	0.0196	--	0.196
Pentachlorophenol	8270 low level	1	0.0283	50	0.283
Chlorobenzene	8260	0.5	0.0933	1	0.5

TABLE 2-1

GROUNDWATER PRACTICAL QUANTITATION LIMITS

PSC Georgetown Facility
Seattle, Washington

Constituent	Analytical Method	CAS PQL (µg/L)	CAS Method Detection Limit (µg/L)	Federal Reporting Limit (µg/L)	Applicable PQL (µg/L)
1,1,1-Trichloroethane	8260	0.5	0.113	1	0.5
1,1,2-Trichlorotrifluoroethane	8260	0.5	0.13	1	0.5
1,1-Dichloroethane	8260	0.5	0.0906	1	0.5
1,1-Dichloroethylene	8260 SIM	0.02	0.0047	1	0.02
1,2-Dichlorobenzene	8260	0.5	0.088	1	0.5
1,2-Dichloroethane	8260 SIM	0.2	0.0045	1	0.045
1-Methyl naphthalene	8270 SIM PAH	0.02	0.0025	1	0.02
2-Chloroethylvinyl ether	8260	5	0.333	--	3.33
2-Hexanone	8260	20	3.96	--	20
Benzene	8260	0.5	0.105	1	0.5
Carbon Disulfide	8260	0.5	0.159	--	0.5
Carbon Tetrachloride	8260	0.5	0.128	--	0.5
Chloroethane	8260	0.5	0.226	1	0.5
Chloroform	8260	0.5	0.0958	1	0.5
cis-1,2-Dichloroethylene	8260	0.5	0.116	1	0.5
Cumene	8260	2	0.068	--	0.68
Dichlorodifluoromethane	8260	0.5	0.166	--	0.5
Ethylbenzene	8260	0.5	0.13	1	0.5
Methylene Chloride	8260	2	0.193	1	1
Methyl Isobutyl Ketone	8260	20	1.8	--	18
Naphthalene	8260	2	0.285	1	1
n-Hexane	8260	1	0.18	1	1
Styrene	8260	0.5	0.0943	--	0.5
Tetrachloroethylene	8260	0.02	0.0035	1	0.02
Toluene	8260	0.5	0.0975	1	0.5
trans-1,2-Dichloroethylene	8260	0.5	0.143	1	0.5
Trichloroethylene	8260 SIM	0.02	0.005	1	0.02
Vinyl Chloride	8260 SIM	0.02	0.0081	1	0.02
Xylene (total)	8260	0.5	0.0785	1	0.5
1,2,4-Trimethylbenzene	8260	2	0.141	1	1
1,3,5-Trimethylbenzene	8260	2	0.121	1	1
p-Isopropyltoluene (4-isopropyltoluene)	8260	2	0.128	1	1
Propylbenzene	8260	2	0.098	1	0.98
sec-Butylbenzene	8260	2	0.127	1	1

Notes:
CAS = Columbia Analytical Services, Kelso, Washington (project laboratory)
Federal Reporting Limits from SW846 (www.epa.gov/epaoswer/hazwaste/test/6_series.htm)
PQL = Practical Quantitation Limit
-- = Not Available
SIM = Selective Ion Monitoring
CAS PQL selected as the Applicable PQL unless the CAS PQL was less than 10 times the CAS MDL, in which case 10 times the MDL value is considered the Applicable PQL [per WAC 173-340-707(a)], or if the CAS PQL was greater than the Federal Reporting Limit, then the Federal Reporting Limit was selected as the Applicable PQL [WAC 173-340-707(b)].

TABLE 2-2

Geomatrix

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - WATER TABLE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
1,1,1-Trichloroethane	1.10E+01	Ecological RA: ORNL	5.00E-01	1.10E+01	Ecological RA: ORNL
1,1,2-Trichlorotrifluoroethane	1.21E+03	Method B - Residential GW to Air	5.00E-01	1.21E+03	Method B - Residential GW to Air
1,1-Dichloroethane	4.70E+01	Ecological RA: ORNL	5.00E-01	4.70E+01	Ecological RA: ORNL
1,1-Dichloroethylene	2.50E+01	Ecological RA: ORNL	2.00E-02	2.50E+01	Ecological RA: ORNL
1,2,4-Trimethylbenzene	1.30E+01	Method B - Residential GW to Air	1.00E+00	1.30E+01	Method B - Residential GW to Air
1,2-Dichlorobenzene	1.40E+01	Ecological RA: ORNL	5.00E-01	1.40E+01	Ecological RA: ORNL
1,2-Dichloroethane	1.29E+01	Method B - Residential GW to Air	4.50E-02	1.29E+01	Method B - Residential GW to Air
1,3,5-Trimethylbenzene	9.76E+00	Method B - Residential GW to Air	1.00E+00	9.76E+00	Method B - Residential GW to Air
1,4-Dichlorobenzene	2.50E+00	Method B Modified - API Fisher	1.33E-01	2.50E+00	Method B Modified - API Fisher
1,4-Dioxane	9.49E+01	Method B Modified - API Fisher	1.00E-01	9.49E+01	Method B Modified - API Fisher
1-Methyl naphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
2-Hexanone	9.90E+01	Ecological RA: ORNL	2.00E+01	9.90E+01	Ecological RA: ORNL
2-Methylphenol	1.30E+01	Ecological RA: ORNL	5.00E-01	1.30E+01	Ecological RA: ORNL
2,4-Dimethylphenol	2.85E+01	Method B Modified - API Fisher	2.00E+00	2.85E+01	Method B Modified - API Fisher
2-Methylnaphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
4-Methylphenol	1.08E+02	Method B Modified - API Fisher	5.00E-01	1.08E+02	Method B Modified - API Fisher
Aroclor 1016	6.40E-05	AWQC Human Health, Organism Only	5.00E-03	5.00E-03	PQL
Aroclor 1232	5.35E-05	API Fisher	5.00E-03	5.00E-03	PQL
Arsenic	5.06E-02	Method B Modified - API Fisher	3.00E-02	5.06E-02	Method B Modified - API Fisher
Barium	4.00E+00	Ecological RA: ORNL	5.00E-02	4.00E+00	Ecological RA: ORNL
Benzene	9.60E+00	Method B - Residential GW to Air	5.00E-01	9.60E+00	Method B - Residential GW to Air
Benzo(a)anthracene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Benzo(b)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.94E-02	1.94E-02	PQL
Benzo(k)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.34E-02	1.80E-02	AWQC Human,, Organism Only
Benzoic acid	4.20E+01	Ecological RA: ORNL	5.00E+00	4.20E+01	Ecological RA: ORNL
Bis(2-ethylhexyl) phthalate	1.83E+00	Method B Modified - API Fisher	2.00E+00	2.00E+00	PQL
C10-C12 (EPH) Aromatics	9.09E+00	Method B - Residential GW to Air	5.00E+01	5.00E+01	PQL
C8-C10 (EPH) Aliphatics	1.08E+00	Method B - Residential GW to Air	5.00E+01	5.00E+01	PQL
C8-C10 (EPH) Aromatics	2.75E+02	Method B - Residential GW to Air	5.00E+01	2.75E+02	Method B - Residential GW to Air
C8-C10 (VPH) Aromatics	2.75E+02	Method B - Residential GW to Air	5.00E+01	2.75E+02	Method B - Residential GW to Air
Carbon disulfide	9.20E-01	Ecological RA: ORNL	5.00E-01	9.20E-01	Ecological RA: ORNL
Chlorobenzene	5.19E+01	Method B - Residential GW to Air	5.00E-01	5.19E+01	Method B - Residential GW to Air

TABLE 2-2

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - WATER TABLE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Chloroethane	4.61E+02	Method B Modified - API Fisher	5.00E-01	4.61E+02	Method B Modified - API Fisher
Chloroform	4.11E+00	Method B - Residential GW to Air	5.00E-01	4.11E+00	Method B - Residential GW to Air
Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	1.00E+01	Ecological RA: State AWQC
Chrysene	1.80E-02	AWQC Human Health, Organism Only	1.24E-02	1.80E-02	AWQC Human,, Organism Only
cis-1,2-Dichloroethylene	7.27E+01	Method B - Residential GW to Air	5.00E-01	7.27E+01	Method B - Residential GW to Air
Copper	3.10E+00	Ecological RA: State AWQC	1.00E-01	3.10E+00	Ecological RA: State AWQC
Cumene	7.30E+00	Ecological RA: ORNL	6.80E-01	7.30E+00	Ecological RA: ORNL
Cyanide	1.00E+00	Ecological RA: State AWQC	1.00E+01	1.00E+01	PQL
Dibenzo(a,h)anthracene	5.45E-03	API Fisher	1.62E-02	1.62E-02	PQL
Dichlorodifluoromethane	6.36E+00	Method B - Residential GW to Air	5.00E-01	6.36E+00	Method B - Residential GW to Air
Diesel	5.00E+02	Method A	1.00E+02	5.00E+02	Method A
Ethylbenzene	7.30E+00	Ecological RA: ORNL	5.00E-01	7.30E+00	Ecological RA: ORNL
Gasoline	8.00E+02	Method A	1.30E+02	8.00E+02	Method A
Hexavalent Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	1.00E+01	Ecological RA: State AWQC
Indeno(1,2,3-cd)pyrene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Iron	1.00E+03	AWQC Ecological	2.00E+01	1.00E+03	AWQC Ecological
Lead	2.50E+00	Ecological RA: State AWQC	2.00E-02	2.50E+00	Ecological RA: State AWQC
Lube Oil Hydrocarbons	5.00E+02	Method A	--	5.00E+02	Method A
Manganese	1.00E+02	AWQC Human Health, Organism Only	5.00E-02	1.00E+02	AWQC Human,, Organism Only
Methyl isobutyl ketone (MIBK)	1.70E+02	Ecological RA: ORNL	1.80E+01	1.70E+02	Ecological RA: ORNL
Methylene chloride	3.21E+02	Method B - Residential GW to Air	1.00E+00	3.21E+02	Method B - Residential GW to Air
Methylphenol	1.65E+03	Ecological RA: AQUIRE	5.00E-01	1.65E+03	Ecological RA: AQUIRE
Naphthalene	1.20E+01	Ecological RA: ORNL	1.00E+00	1.20E+01	Ecological RA: ORNL
n-Hexane	4.50E-01	Method B - Residential GW to Air	1.00E+00	1.00E+00	PQL
Nickel	8.20E+00	Ecological RA: State AWQC	2.00E-01	8.20E+00	Ecological RA: State AWQC
Pentachlorophenol	2.53E+00	Method B Modified - API Fisher	2.83E-01	2.53E+00	Method B Modified - API Fisher
Phenol	1.18E+02	Ecological RA: AQUIRE	1.96E-01	1.18E+02	Ecological RA: AQUIRE
p-Isopropyltoluene	7.49E+01	Method B - Residential GW to Air	1.00E+00	7.49E+01	Method B - Residential GW to Air
Propylbenzene	7.30E+00	Ecological RA: ORNL	9.80E-01	7.30E+00	Ecological RA: ORNL
sec-Butylbenzene	4.59E+00	Method B Modified - API Fisher	1.00E+00	4.59E+00	Method B Modified - API Fisher
Selenium	5.00E+00	Ecological RA: State AWQC	1.00E+00	5.00E+00	Ecological RA: State AWQC
Styrene	6.00E-02	Ecological RA: AQUIRE	5.00E-01	5.00E-01	PQL

TABLE 2-2

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - WATER TABLE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Tetrachloroethylene	2.02E-01	Method B Modified - API Fisher	2.00E-02	2.02E-01	Method B Modified - API Fisher
Toluene	9.80E+00	Ecological RA: ORNL	5.00E-01	9.80E+00	Ecological RA: ORNL
trans-1,2-Dichloroethylene	6.53E+01	Method B - Residential GW to Air	5.00E-01	6.53E+01	Method B - Residential GW to Air
Trichloroethylene	4.04E-01	Method B - Residential GW to Air	2.00E-02	4.04E-01	Method B - Residential GW to Air
Vanadium	2.00E+01	Ecological RA: ORNL	2.00E-01	2.00E+01	Ecological RA: ORNL
Vinyl chloride	1.28E+00	Method B - Residential GW to Air	2.00E-02	1.28E+00	Method B - Residential GW to Air
Xylenes (Total)	1.41E+02	Method B Modified - API Fisher	5.00E-01	1.41E+02	Method B Modified - API Fisher
Zinc	8.10E+01	Ecological RA: State AWQC	5.00E-01	8.10E+01	Ecological RA: State AWQC

Notes:
SWFS = Site Wide Feasibility Study
-- = No value was available
PQL = Practical Quantitation Limit
RA = Risk Assessment
ORNL = Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota
- available online at http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html and go to screening benchmark reports

MTCA = Model Toxics Control Act
Method A cleanup levels = (WAC 173-340 - Table 720-1)
Method B cleanup levels = (WAC 173-340-705)
Method B - PQL set per WAC 173-340-707
GW = Groundwater
API = Asian Pacific Islander
AWQC = Ambient Water Quality Criteria
AQUIRE = U.S. EPA AQUIRE Database - available on-line at http://www.epa.gov/ecotox/
RI = Remedial Investigation
As directed by Ecology, PSC omitted groundwater-to-surface water modeling from the RI Report. Consequently, the minimum applicable groundwater/surface water cleanup levels considered in the RI were compared to the groundwater concentrations at each location for each constituent, assuming that no dilution, attenuation, or biodegradation occurs in groundwater.
As directed by Ed Jones of Ecology on 10/5/2004, a cancer risk goal of 1E-06 and a hazard quotient of 0.1 were used to develop the final RI cleanup levels.
The cleanup levels established did not consider area background. PSC may modify the above cleanup levels in the future to consider area background if appropriate to address off-site sources.
Preliminary SWFS groundwater cleanup levels may be revised based on site-specific conditions before becoming final, as described in Section 7.0, SWFS Technical Memorandum I.

TABLE 2-3

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - SHALLOW DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
1,1,1-Trichloroethane	1.10E+01	Ecological RA: ORNL	5.00E-01	1.10E+01	Ecological RA: ORNL
1,1-Dichloroethane	4.70E+01	Ecological RA: ORNL	5.00E-01	4.70E+01	Ecological RA: ORNL
1,1-Dichloroethylene	2.50E+01	Ecological RA: ORNL	2.00E-02	2.50E+01	Ecological RA: ORNL
1,2,4-Trimethylbenzene	7.77E+01	Method B Modified - API Fisher	1.00E+00	7.77E+01	Method B Modified - API Fisher
1,2-Dichloroethane	3.06E+01	Method B Modified - API Fisher	4.50E-02	3.06E+01	Method B Modified - API Fisher
1,3,5-Trimethylbenzene	5.57E+01	Method B Modified - API Fisher	1.00E+00	5.57E+01	Method B Modified - API Fisher
1,4-Dioxane	9.49E+01	Method B Modified - API Fisher	1.00E-01	9.49E+01	Method B Modified - API Fisher
1-Methyl naphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
2,4-Dimethylphenol	2.85E+01	Method B Modified - API Fisher	2.00E+00	2.85E+01	Method B Modified - API Fisher
2-Hexanone	9.90E+01	Ecological RA: ORNL			
2-Methylnaphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
2-Methylphenol	1.30E+01	Ecological RA: ORNL	5.00E-01	1.30E+01	Ecological RA: ORNL
Arsenic	5.06E-02	Method B Modified - API Fisher	3.00E-02	5.06E-02	Method B Modified - API Fisher
Barium	4.00E+00	Ecological RA: ORNL	5.00E-02	4.00E+00	Ecological RA: ORNL
Benzene	1.17E+01	Method B Modified - API Fisher	5.00E-01	1.17E+01	Method B Modified - API Fisher
Benzo(a)anthracene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Benzo(b)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.94E-02	1.94E-02	PQL
Benzo(k)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.34E-02	1.80E-02	AWQC Human,, Organism Only
Bis(2-ethylhexyl) phthalate	1.83E+00	Method B Modified - API Fisher	2.00E+00	2.00E+00	PQL
Carbon disulfide	9.20E-01	Ecological RA: ORNL	5.00E-01	9.20E-01	Ecological RA: ORNL
Chloroethane	4.61E+02	Method B Modified - API Fisher	5.00E-01	4.61E+02	Method B Modified - API Fisher
Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	1.00E+01	Ecological RA: State AWQC
Chrysene	1.80E-02	AWQC Human Health, Organism Only	1.24E-02	1.80E-02	AWQC Human,, Organism Only
cis-1,2-Dichloroethylene	1.65E+02	Method B Modified - API Fisher	5.00E-01	1.65E+02	Method B Modified - API Fisher
Copper	3.10E+00	Ecological RA: State AWQC	1.00E-01	3.10E+00	Ecological RA: State AWQC
Cumene	7.30E+00	Ecological RA: ORNL	6.80E-01	7.30E+00	Ecological RA: ORNL
Cyanide	1.00E+00	Ecological RA: State AWQC	1.00E+01	1.00E+01	PQL
Dibenzo(a,h)anthracene	5.45E-03	API Fisher	1.62E-02	1.62E-02	PQL
Diesel	5.00E+02	Method A	1.00E+02	5.00E+02	Method A

TABLE 2-3

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - SHALLOW DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Ethylbenzene	7.30E+00	Ecological RA: ORNL	5.00E-01	7.30E+00	Ecological RA: ORNL
Gasoline	8.00E+02	Method A	1.30E+02	8.00E+02	Method A
Hexavalent Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	1.00E+01	Ecological RA: State AWQC
Indeno(1,2,3-cd)pyrene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Iron	1.00E+03	AWQC Ecological	2.00E+01	1.00E+03	AWQC Ecological
Lead	2.50E+00	Ecological RA: State AWQC	2.00E-02	2.50E+00	Ecological RA: State AWQC
Manganese	1.00E+02	AWQC Human Health, Organism Only	5.00E-02	1.00E+02	AWQC Human, Organism Only
Methylene chloride	4.95E+02	Method B Modified - API Fisher	1.00E+00	4.95E+02	Method B Modified - API Fisher
Methyl isobutyl ketone (MIBK)	1.70E+02	Ecological RA: ORNL	1.80E+01	1.70E+02	Ecological RA: ORNL
Naphthalene	1.20E+01	Ecological RA: ORNL	1.00E+00	1.20E+01	Ecological RA: ORNL
Nickel	8.20E+00	Ecological RA: State AWQC	2.00E-01	8.20E+00	Ecological RA: State AWQC
Pentachlorophenol	2.53E+00	Method B Modified - API Fisher	2.83E-01	2.53E+00	Method B Modified - API Fisher
Phenol	1.18E+02	Ecological RA: AQUIRE	1.96E-01	1.18E+02	Ecological RA: AQUIRE
p-Isopropyltoluene	1.00E+04	Ecological RA: AQUIRE	1.00E+00	1.00E+04	Ecological RA: AQUIRE
Propylbenzene	7.30E+00	Ecological RA: ORNL	9.80E-01	7.30E+00	Ecological RA: ORNL
sec-Butylbenzene	4.59E+00	Method B Modified - API Fisher	1.00E+00	4.59E+00	Method B Modified - API Fisher
Selenium	5.00E+00	Ecological RA: State AWQC	1.00E+00	5.00E+00	Ecological RA: State AWQC
Tetrachloroethylene	2.02E-01	Method B Modified - API Fisher	2.00E-02	2.02E-01	Method B Modified - API Fisher
Toluene	9.80E+00	Ecological RA: ORNL	5.00E-01	9.80E+00	Ecological RA: ORNL
trans-1,2-Dichloroethylene	1.69E+03	Method B Modified - API Fisher	5.00E-01	1.69E+03	Method B Modified - API Fisher
Trichloroethylene	7.88E-01	Method B Modified - API Fisher	2.00E-02	7.88E-01	Method B Modified - API Fisher
Vanadium	2.00E+01	Ecological RA: ORNL	2.00E-01	2.00E+01	Ecological RA: ORNL
Vinyl chloride	2.04E+00	Method B Modified - API Fisher	2.00E-02	2.04E+00	Method B Modified - API Fisher

TABLE 2-3

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - SHALLOW DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Xylenes (Total)	1.41E+02	Method B Modified - API Fisher	5.00E-01	1.41E+02	Method B Modified - API Fisher
Zinc	8.10E+01	Ecological RA: State AWQC	5.00E-01	8.10E+01	Ecological RA: State AWQC

Notes:
SWFS = Site Wide Feasibility Study
PQL = Practical Quantitation Limit
RA = Risk Assessment
ORNL = Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota
- available online at http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html and go to screening benchmark reports

MTCA = Model Toxics Control Act
Method A cleanup levels = (WAC 173-340 - Table 720-1)
Method B cleanup levels = (WAC 173-340-705)
Method B - PQL based on WAC 173-340-707
GW = Groundwater
API = Asian Pacific Islander
AWQC = Ambient Water Quality Criteria
AQUIRE = U.S. EPA AQUIRE Database - available on-line at http://www.epa.gov/ecotox/
RI = Remedial Investigation
As directed by Ecology, PSC omitted groundwater-to-surface water modeling from the RI Report. Consequently, the minimum applicable groundwater/surface water cleanup levels considered in the RI were compared to the groundwater concentrations at each location for each constituent, assuming that no dilution, attenuation, or biodegradation occurs in groundwater.
As directed by Ed Jones of Ecology on 10/5/2004, a cancer risk goal of 1E-06 and a hazard quotient of 0.1 were used to develop the final RI cleanup levels.
The cleanup levels established did not consider area background. PSC may modify the above cleanup levels in the future to consider area background if appropriate to address off-site sources.
Preliminary SWFS groundwater cleanup levels may be revised based on site-specific conditions before becoming final, as described in Section 7.0, SWFS Technical Memorandum I

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TABLE 2-4

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - INTERMEDIATE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
1,1,1-Trichloroethane	1.10E+01	Ecological RA: ORNL	5.00E-01	1.10E+01	Ecological RA: ORNL
1,1-Dichloroethane	4.70E+01	Ecological RA: ORNL	5.00E-01	4.70E+01	Ecological RA: ORNL
1,1-Dichloroethylene	2.50E+01	Ecological RA: ORNL	2.00E-02	2.50E+01	Ecological RA: ORNL
1,2,4-Trimethylbenzene	7.77E+01	Method B Modified - API Fisher	1.00E+00	7.77E+01	Method B Modified - API Fisher
1,2-Dichlorobenzene	1.40E+01	Ecological RA: ORNL	5.00E-01	1.40E+01	Ecological RA: ORNL
1,2-Dichloroethane	3.06E+01	Method B Modified - API Fisher	4.50E-02	3.06E+01	Method B Modified - API Fisher
1,4-Dioxane	9.49E+01	Method B Modified - API Fisher	1.00E-01	9.49E+01	Method B Modified - API Fisher
1-Methyl naphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
2-Methylnaphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	2.10E+00	Ecological RA: ORNL
2-Methylphenol	1.30E+01	Ecological RA: ORNL	5.00E-01	1.30E+01	Ecological RA: ORNL
2,4-Dimethylphenol	2.85E+01	Method B Modified - API Fisher	2.00E+00	2.85E+01	Method B Modified - API Fisher
4-Methylphenol	1.08E+02	Method B Modified - API Fisher	5.00E-01	1.08E+02	Method B Modified - API Fisher
Arsenic	5.06E-02	Method B Modified - API Fisher	3.00E-02	5.06E-02	Method B Modified- API Fischer
Barium	4.00E+00	Ecological RA: ORNL	5.00E-02	4.00E+00	Ecological RA: ORNL
Benzene	1.17E+01	Method B Modified - API Fisher	5.00E-01	1.17E+01	Method B Modified - API Fisher
Benzo(a)anthracene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Benzo(b)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.94E-02	1.94E-02	PQL
Benzo(k)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.34E-02	1.80E-02	AWQC Human,, Organism Only
Benzoic acid	4.20E+01	Ecological RA: ORNL	5.00E+00	4.20E+01	Ecological RA: ORNL
Bis(2-ethylhexyl) phthalate	1.83E+00	Method B Modified - API Fisher	2.00E+00	2.00E+00	PQL
Carbon disulfide	9.20E-01	Ecological RA: ORNL	5.00E-01	9.20E-01	Ecological RA: ORNL
Chloroethane	4.61E+02	Method B Modified - API Fisher	5.00E-01	4.61E+02	Method B Modified - API Fisher
Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	1.00E+01	Ecological RA: State AWQC
Chrysene	1.80E-02	AWQC Human Health, Organism Only	1.24E-02	1.80E-02	AWQC Human,, Organism Only
cis-1,2-Dichloroethylene	1.65E+02	Method B Modified - API Fisher	5.00E-01	1.65E+02	Method B Modified - API Fisher
Copper	3.10E+00	Ecological RA: State AWQC	1.00E-01	3.10E+00	Ecological RA: State AWQC
Cyanide	1.00E+00	Ecological RA: State AWQC	1.00E+01	1.00E+01	PQL
Dibenzo(a,h)anthracene	1.80E-02	AWQC Human Health, Organism Only	1.62E-02	1.80E-02	AWQC Human,, Organism Only
Diesel	5.00E+02	Method A	1.00E+02	5.00E+02	Method A

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TABLE 2-4

PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - INTERMEDIATE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Ethylbenzene	7.30E+00	Ecological RA: ORNL	5.00E-01	7.30E+00	Ecological RA: ORNL
Gasoline	8.00E+02	Method A	1.30E+02	8.00E+02	Method A
Indeno(1,2,3-cd)pyrene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	2.00E-02	PQL
Iron	1.00E+03	AWQC Ecological	2.00E+01	1.00E+03	AWQC Ecological
Lead	2.50E+00	Ecological RA: State AWQC	2.00E-02	2.50E+00	Ecological RA: State AWQC
Lube Oil Hydrocarbons	5.00E+02	Method A	--	5.00E+02	Method A
Manganese	1.00E+02	AWQC Human Health, Organism Only	5.00E-02	1.00E+02	AWQC Human Health, Organism Only
Methylene chloride	4.95E+02	Method B Modified - API Fisher	1.00E+00	4.95E+02	Method B Modified - API Fisher
Naphthalene	1.20E+01	Ecological RA: ORNL	1.00E+00	1.20E+01	Ecological RA: ORNL
n-Hexane	5.80E-01	Ecological RA: ORNL	1.00E+00	1.00E+00	PQL
Nickel	8.20E+00	Ecological RA: State AWQC	2.00E-01	8.20E+00	Ecological RA: State AWQC
Pentachlorophenol	2.53E+00	Method B Modified - API Fisher	2.83E-01	2.53E+00	Method B Modified - API Fisher
Phenol	1.18E+02	Ecological RA: AQUIRE	1.96E-01	1.18E+02	Ecological RA: AQUIRE
Propylbenzene	7.30E+00	Ecological RA: ORNL	9.80E-01	7.30E+00	Ecological RA: ORNL
Selenium	5.00E+00	Ecological RA: State AWQC	1.00E+00	5.00E+00	Ecological RA: State AWQC
Styrene	6.00E-02	Ecological RA: AQUIRE	5.00E-01	5.00E-01	PQL
Tetrachloroethylene	2.02E-01	Method B Modified - API Fisher	2.00E-02	2.02E-01	Method B Modified - API Fisher
Toluene	9.80E+00	Ecological RA: ORNL	5.00E-01	9.80E+00	Ecological RA: ORNL
trans-1,2-Dichloroethylene	1.69E+03	Method B Modified - API Fisher	5.00E-01	1.69E+03	Method B Modified - API Fisher
Trichloroethylene	7.88E-01	Method B Modified - API Fisher	2.00E-02	7.88E-01	Method B Modified - API Fisher
Vanadium	2.00E+01	Ecological RA: ORNL	2.00E-01	2.00E+01	Ecological RA: ORNL
Vinyl chloride	2.04E+00	Method B Modified - API Fisher	2.00E-02	2.04E+00	Method B Modified - API Fisher

TABLE 2-4

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PRELIMINARY SWFS GROUNDWATER CLEANUP LEVELS - INTERMEDIATE DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Xylenes (Total)	1.41E+02	Method B Modified - API Fisher	5.00E-01	1.41E+02	Method B Modified - API Fisher
Zinc	8.10E+01	Ecological RA: State AWQC	5.00E-01	8.10E+01	Ecological RA: State AWQC

Notes:
SWFS = Site Wide Feasibility Study
PQL = Practical Quantitation Limit
RA = Risk Assessment
ORNL = Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota
- available online at http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html and go to screening benchmark reports

MTCA = Model Toxics Control Act
Method A cleanup levels = (WAC 173-340 - Table 720-1)
Method B cleanup levels = (WAC 173-340-705)
Method B - PQL based on WAC 173-340-707
GW = Groundwater
API = Asian Pacific Islander
AWQC = Ambient Water Quality Criteria
AQUIRE = U.S. EPA AQUIRE Database - available on-line at http://www.epa.gov/ecotox/
RI = Remedial Investigation
As directed by Ecology, PSC omitted groundwater-to-surface water modeling from the RI Report. Consequently, the minimum applicable groundwater/surface water cleanup levels considered in the RI were compared to the groundwater concentrations at each location for each constituent, assuming that no dilution, attenuation, or biodegradation occurs in groundwater.
As directed by Ed Jones of Ecology on 10/5/2004, a cancer risk goal of 1E-06 and a hazard quotient of 0.1 were used to develop the final RI cleanup levels.
The cleanup levels established did not consider area background. PSC may modify the above cleanup levels in the future to consider area background if appropriate to address off-site sources.
Preliminary SWFS groundwater cleanup levels may be revised based on site-specific conditions before becoming final, as described in Section 7.0, SWFS Technical Memorandum I

TABLE 2-5

GROUNDWATER CLEANUP LEVELS - DEEP AQUIFER

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Drinking Water Cleanup Level (µg/L)	Basis of Drinking Water Cleanup Level	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
1,2-Dichloroethane	3.06E+01	Method B Modified - API Fisher	2.00E-01	0.481	Method B	4.80E-01	Method B Drinking Water
1-Methyl naphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	0.24	Method B	2.40E-01	Method B Drinking Water
2-Methylnaphthalene	2.10E+00	Ecological RA: ORNL	2.00E-02	3.2	Method B	2.10E+00	Ecological RA: ORNL
Arsenic	5.06E-02	Method B Modified - API Fisher	3.00E-02	0.0583	Method B	5.06E-02	Method B Modified - API Fisher
Barium	4.00E+00	Ecological RA: ORNL	5.00E-02	112	Method B	4.00E+00	Ecological RA: ORNL
Benzo(b)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.94E-02	0.0171	Method B	1.94E-02	PQL
Benzo(k)fluoranthene	1.80E-02	AWQC Human Health, Organism Only	1.34E-02	0.0171	Method B	1.80E-02	AWQC Human Health
Bis(2-ethylhexyl) phthalate	1.83E+00	Method B Modified - API Fisher	2.00E+00	6	MCL	2.00E+00	PQL
Carbon disulfide	9.20E-01	Ecological RA: ORNL	5.00E-01	80	Method B	9.20E-01	Ecological RA: ORNL
Chloroform	2.80E+01	Ecological RA: ORNL	5.00E-01	8	Method B	8.00E+00	Method B Drinking Water
Chromium	1.00E+01	Ecological RA: State AWQC	2.00E-01	100	MCL	1.00E+01	Ecological RA: State AWQC
Chrysene	1.80E-02	AWQC Human Health, Organism Only	1.24E-02	0.171	Method B	1.80E-02	AWQC Human Health
cis-1,2-Dichloroethylene	1.65E+02	Method B Modified - API Fisher	5.00E-01	8	Method B	8.00E+00	Method B Drinking Water
Copper	3.10E+00	Ecological RA: State AWQC	1.00E-01	59.2	Method B	3.10E+00	Ecological RA: State AWQC
Dibenzo(a,h)anthracene	1.80E-02	AWQC Human Health, Organism Only	1.62E-02	0.00428	Method B	1.80E-02	AWQC Human Health
Diesel	5.00E+02	Method A	1.00E+02	--	--	5.00E+02	Method A
Gasoline	8.00E+02	Method A	2.50E+02	--	--	8.00E+02	Method A
Hexavalent Chromium	1.00E+01	Ecological RA: State AWQC	1.00E+01	4.8	Method B	4.80E+00	Method B Drinking Water
Indeno(1,2,3-cd)pyrene	1.80E-02	AWQC Human Health, Organism Only	2.00E-02	0.0171	Method B	2.00E-02	PQL
Iron	1.00E+03	AWQC Ecological	2.00E+01	480	Method B	4.80E+02	Method B Drinking Water
Lead	2.50E+00	Ecological RA: State AWQC	2.00E-02	15	MCL	2.50E+00	Ecological RA: State AWQC
Manganese	1.00E+02	AWQC Human Health, Organism Only	5.00E-02	74.7	Method B	7.47E+01	Method B Drinking Water
Methane	--	--	5.00E-01	--	--	--	--
n-Hexane	5.80E-01	Ecological RA: ORNL	1.00E+00	48	Method B	1.00E+00	PQL
Nickel	8.20E+00	Ecological RA: State AWQC	2.00E-01	32	Method B	8.20E+00	Ecological RA: State AWQC
Selenium	5.00E+00	Ecological RA: State AWQC	1.00E+00	8	Method B	5.00E+00	Ecological RA: State AWQC
Silver	1.90E+00	Ecological RA: State AWQC	2.00E-02	8	Method B	1.90E+00	Ecological RA: State AWQC
Styrene	6.00E-02	Ecological RA: AQUIRE	5.00E-01	100	MCL	5.00E-01	PQL
Tetrachloroethylene	2.02E-01	Method B Modified - API Fisher	2.00E-02	0.081	Method B	0.081	Method B Drinking Water

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TABLE 2-5

GROUNDWATER CLEANUP LEVELS - DEEP AQUIFER

PSC Georgetown Facility
Seattle, Washington

Constituent	Final RI Groundwater Cleanup Level (µg/L)	Basis of Final RI Groundwater Cleanup Level	PQL (µg/L)	Drinking Water Cleanup Level (µg/L)	Basis of Drinking Water Cleanup Level	Preliminary SWFS Groundwater Cleanup Level (µg/L)	Basis of Preliminary SWFS Groundwater Cleanup Level
Toluene	9.80E+00	Ecological RA: ORNL	5.00E-01	160	Method B	9.80E+00	Ecological RA: ORNL
TotalExtractablePetroleum HC	--	--	--	--	--	--	--
Trichloroethylene	7.88E-01	Method B Modified - API Fisher	2.00E-02	0.109	Method B	1.09E-01	Method B Drinking Water
Vanadium	2.00E+01	Ecological RA: ORNL	2.00E-01	11.2	Method B	1.12E+01	Method B Drinking Water
Vinyl chloride	2.04E+00	Method B Modified - API Fisher	2.00E-02	0.0313	Method B	3.13E-02	Method B Drinking Water
Zinc	8.10E+01	Ecological RA: State AWQC	5.00E-01	480	Method B	8.10E+01	Ecological RA: State AWQC

Notes:
SWFS = Site Wide Feasibility Study
-- = No value was available
PQL = Practical Quantitation Limit
RA = Risk Assessment
ORNL = Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota
- available online at http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html and go to screening benchmark reports

MTCA = Model Toxics Control Act
Method A cleanup levels = (WAC 173-340 - Table 720-1)
Method B cleanup levels = (WAC 173-340-705)
Method B - PQL based on WAC 173-340-707
GW = Groundwater
API = Asian Pacific Islander
AWQC = Ambient Water Quality Criteria
AQUIRE = U.S. EPA AQUIRE Database - available on-line at http://www.epa.gov/ecotox/
RI = Remedial Investigation
Drinking Water Cleanup Level Based on the MCL or Minimum Method B Ingestion of Groundwater cleanup levels. Cumulative COPC Cancer Risk Goal = 1E-06 and Hazard Index Goal = 0.1(µg/L)
As directed by Ecology, PSC omitted groundwater-to-surface water modeling from the RI Report. Consequently, the minimum applicable groundwater/surface water cleanup levels considered in the RI were compared to the groundwater concentrations at each location for each constituent, assuming that no dilution, attenuation, or biodegradation occurs in groundwater.
As directed by Ed Jones of Ecology on 10/5/2004, a cancer risk goal of 1E-06 and a hazard quotient of 0.1 were used to develop the final RI cleanup levels.
The cleanup levels established did not consider area background. PSC may modify the above cleanup levels in the future to consider area background if appropriate to address off-site sources.
Preliminary SWFS groundwater cleanup levels may be revised based on site-specific conditions before becoming final, as described in Section 7.0, SWFS Technical Memorandum I.

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TABLE 2-6

SOIL PRACTICAL QUANTITATION LIMITS

PSC Georgetown Facility

Seattle, Washington

Constituent	Analytical Method	CAS PQL (mg/kg)	CAS Method Detection Limit (mg/kg)	Federal Reporting Limit (mg/kg)	Applicable PQL (mg/kg)
1,1,1-Trichloroethane	8260	0.005	0.00057	0.005	0.005
1,1-Dichloroethane	8260	0.005	0.00078	0.005	0.005
1,1-Dichloroethylene	8260	0.005	0.00069	0.005	0.005
1,2,4-Trichlorobenzene	8260	0.02	0.00077	0.005	0.005
1,2,4-Trimethylbenzene	8260	0.02	0.00082	0.005	0.005
1,2-Dichlorobenzene	8260	0.005	0.00065	0.005	0.005
1,2-Dichloroethane	8260	0.005	0.00067	0.005	0.005
1,3,5-Trimethylbenzene	8260	0.02	0.00082	0.005	0.005
2,4-Dimethylphenol	8270 low level	0.05	0.0055	0.66	0.05
2-Hexanone	8260	0.02	0.0061	--	0.02
2-Methylnaphthalene	8270 SIM PAH	0.005	0.00034	0.66	0.0034
2-Methylphenol	8270 low level	0.01	0.0034	0.66	0.01
4-Methylphenol	8270 low level	0.01	0.0029	0.66	0.01
Acetone	8260	0.02	0.01	0.005	0.005
Aroclor 1016/1242	8270 low level	0.01	0.0018	3.8	0.01
Aroclor 1254	8270 low level	0.01	0.0018	3.8	0.01
Aroclor 1260	8270 low level	0.01	0.0018	3.8	0.01
Arsenic	200.8	0.5	0.07	--	0.5
Barium	6020	0.05	0.03	--	0.05
Benzene	8260	0.005	0.00079	0.005	0.005
Benzo(a)anthracene	8270 SIM PAH	0.005	0.00016	0.66	0.0016
Benzo(a)pyrene	8270 SIM PAH	0.005	0.00022	0.66	0.0022
Benzo(b)fluoranthene	8270 SIM PAH	0.005	0.00048	0.66	0.0048
Benzo(ghi)perylene	8270 SIM PAH	0.005	0.00023	0.66	0.0023
Benzo(k)fluoranthene	8270 SIM PAH	0.005	0.00033	0.66	0.0033
Benzoic acid	8270 low level	0.2	0.096	3.3	0.2
Bis(2-ethylhexyl) phthalate	8270 low level	0.2	0.0017	--	0.017
Cadmium (food)	6020	0.05	0.007	--	0.05
Chloroethane	8260	0.005	0.00078	0.005	0.005
Chloroform	8260	0.005	0.00057	0.005	0.005
Chromium	6020	0.2	0.04	--	0.2
Chrysene	8270 SIM PAH	0.005	0.00041	--	0.0041
cis-1,2-Dichloroethylene	8260	0.005	0.00083	0.005	0.005
cis-1,3-Dichloropropene	8260	0.005	0.00076	0.005	0.005
Copper	6020	0.1	0.02	--	0.1
Cumene	8260	0.02	0.00068	0.005	0.005
Cyanide	335.2/9012A	0.1	0.03	--	0.1
Dibenzo(a,h)anthracene	8270 SIM PAH	0.005	0.00026	0.66	0.0026
Dibenzofuran	8270 SIM PAH	0.005	0.00017	0.66	0.0017
Diesel	NWTPH-Dx	25	3.4	--	25
Di-n-butyl phthalate	8270 low level	0.01	0.0026	--	0.01
di-n-octyl-phthalate	8270 low level	0.01	0.0012	0.66	0.01
Ethylbenzene	8260	0.005	0.00057	0.005	0.005
Fluoranthene	8270 SIM PAH	0.005	0.00034	0.66	0.0034

TABLE 2-6

SOIL PRACTICAL QUANTITATION LIMITS

PSC Georgetown Facility
Seattle, Washington

Constituent	Analytical Method	CAS PQL (mg/kg)	CAS Method Detection Limit (mg/kg)	Federal Reporting Limit (mg/kg)	Applicable PQL (mg/kg)
Gasoline	NWTPH-Gx	5	1	--	5
Indeno(1,2,3-cd)pyrene	8270 SIM PAH	0.005	0.00024	0.66	0.0024
Lead	6020	0.05	0.02	--	0.05
Lube Oil	NWTPH-Dx	25	3.4	--	25
Mercury	7471A	0.02	0.008	--	0.02
Methyl Isobutyl Ketone (MIBK)	8260	0.02	0.0055	0.005	0.005
Methylene chloride	8260	0.01	0.00096	0.005	0.005
Mineral Spirits	--	--	--	--	--
Naphthalene	8260	0.02	0.00089	0.005	0.005
n-Butylbenzene	8260	0.02	0.00075	0.005	0.005
Nickel	6020	0.2	0.04	--	0.2
Pentachlorophenol	8270 SIM PAH	0.2	0.015	3.3	0.15
Phenanthrene	8270 SIM PAH	0.005	0.00033	0.66	0.0033
Phenol	8270 low level	0.03	0.0019	0.66	0.019
p-Isopropyltoluene	8260	0.02	0.00072	0.005	0.005
Propylbenzene	8260	0.02	0.00072	0.005	0.005
Pyrene	8270 SIM PAH	0.005	0.00036	0.005	0.0036
sec-Butylbenzene	8260	0.02	0.00074	0.005	0.005
Selenium	6020	0.1	0.02	--	0.1
Silver	6020	0.02	0.003	--	0.02
Stoddard Solvent	--	--	--	--	--
Styrene	8260	0.005	0.00073	0.005	0.005
Tetrachloroethylene	8260	0.005	0.00031	0.005	0.0031
Toluene	8260	0.005	0.00084	0.005	0.005
trans-1,2-Dichloroethylene	8260	0.005	0.00073	0.005	0.005
trans-1,3-Dichloropropene	8260	0.005	0.0006	0.005	0.005
Trichloroethylene	8260	0.005	0.00028	0.005	0.0028
trichlorofluoromethane	8260	0.005	0.00073	0.005	0.005
Vinyl chloride	8260	0.005	0.00062	0.005	0.005
Xylenes (Total)	8260	0.005	0.0015	0.005	0.005
Zinc	6020	0.5	0.2	--	0.5

Notes:
CAS = Columbia Analytical Services, Kelso, Washington (project dedicated laboratory)
Federal Reporting Limits from SW846 (www.epa.gov/epaoswer/hazwaste/test/6_series.htm)
PQL = Practical Quantitation Limit
-- = Not Available
SIM = Selective Ion Monitoring
CAS PQL selected as the Applicable PQL unless the CAS PQL was less than 10 times the CAS MDL, in which case 10 times the MDL value is considered the Applicable PQL; or if the CAS PQL was greater than the Federal Reporting Limit, then the Federal Reporting Limit was selected as the Applicable PQL.

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TABLE 2-7

SOIL CLEANUP LEVELS

PSC Georgetown Facility
Seattle, Washington

Constituent	Minimum Industrial Risk-Based Soil Cleanup Level (mg/kg)	Minimum Industrial Risk-Based Soil Cleanup Level Basis	GW Protection Cleanup Level (mg/kg)	Puget Sound Natural Background Levels (mg/kg)	Applicable PQLs (mg/kg)	Final SWFS Soil Cleanup Level (mg/kg)	Final SWFS Soil Cleanup Level Basis
1,1,1-Trichloroethane	5.38E-01	Min. Method C Cleanup Level	7.95E-02	--	5.00E-03	7.95E-02	Protection of Groundwater
1,1-Dichloroethane	1.44E-01	Min. Method C Cleanup Level	1.55E-01	--	5.00E-03	1.44E-01	Min. Method C Cleanup Level
1,1-Dichloroethylene	1.75E-02	Min. Method C Cleanup Level	1.92E-01	--	5.00E-03	1.75E-02	Min. Method C Cleanup Level
1,2,4-Trichlorobenzene	9.02E+00	Min. Method C Cleanup Level	4.05E-01	--	5.00E-03	4.05E-01	Protection of Groundwater
1,2,4-Trimethylbenzene	1.47E-01	Min. Method C Cleanup Level	7.36E-01	--	5.00E-03	1.47E-01	Min. Method C Cleanup Level
1,2-Dichlorobenzene	1.33E+00	Min. Method C Cleanup Level	1.27E-01	--	5.00E-03	1.27E-01	Protection of Groundwater
1,2-Dichloroethane	1.18E-03	Min. Method C Cleanup Level	2.71E-02	--	5.00E-03	5.00E-03	PQL
1,3,5-Trimethylbenzene	2.45E-02	Min. Method C Cleanup Level	1.57E-01	--	5.00E-03	2.45E-02	Min. Method C Cleanup Level
2,4-Dimethylphenol	1.56E+03	Min. Method C Cleanup Level	1.53E-01	--	5.00E-02	1.53E-01	Protection of Groundwater
2-Hexanone	8.44E+03	Min. Method C Cleanup Level	1.26E-01	--	2.00E-02	1.26E-01	Protection of Groundwater
2-Methylnaphthalene	8.45E+02	Min. Method C Cleanup Level	3.60E-01	--	3.40E-03	3.60E-01	Protection of Groundwater
2-Methylphenol	3.89E+03	Min. Method C Cleanup Level	4.18E-02	--	1.00E-02	4.18E-02	Protection of Groundwater
4-Methylphenol	3.89E+02	Min. Method C Cleanup Level	2.30E-01	--	1.00E-02	2.30E-01	Protection of Groundwater
Acetone	7.00E+04	Min. Method C Cleanup Level	1.76E+00	--	5.00E-03	1.76E+00	Protection of Groundwater
Aroclor 1016/1242	1.46E+00	Min. Method C Cleanup Level	--	--	1.00E-02	1.46E+00	Min. Method C Cleanup Level
Aroclor 1254	1.46E+00	Min. Method C Cleanup Level	--	--	1.00E-02	1.46E+00	Min. Method C Cleanup Level
Aroclor 1260	1.46E+00	Min. Method C Cleanup Level	--	--	1.00E-02	1.46E+00	Min. Method C Cleanup Level
Arsenic	4.66E+00	Min. Method C Cleanup Level	6.84E-03	7.3	5.00E-01	7.30E+00	Puget Sound Background
Barium	1.24E+04	Min. Method C Cleanup Level	3.28E+00	--	5.00E-02	3.28E+00	Protection of Groundwater
Benzene	1.10E-03	Min. Method C Cleanup Level	3.36E-02	--	5.00E-03	5.00E-03	PQL
Benzo(a)anthracene	2.00E+00	Method A Ind. Cleanup Level	1.43E-01	--	1.60E-03	1.43E-01	Protection of Groundwater
Benzo(a)pyrene	2.57E-01	Min. Method C Cleanup Level	1.01E+01	--	2.20E-03	2.57E-01	Min. Method C Cleanup Level
Benzo(b)fluoranthene	2.00E+00	Method A Ind. Cleanup Level	4.66E-01	--	4.80E-03	4.66E-01	Protection of Groundwater
Benzo(ghi)perylene	--	--	---	--	2.30E-03	--	
Benzo(k)fluoranthene	2.00E+00	Method A Ind. Cleanup Level	4.32E-01	--	3.30E-03	4.32E-01	Protection of Groundwater
Benzoic acid	6.83E+05	Min. Method C Cleanup Level	4.89E-02	--	2.00E-01	2.00E-01	PQL
Bis(2-ethylhexyl) phthalate	2.08E+02	Min. Method C Cleanup Level	4.45E+00	--	1.70E-02	4.45E+00	Protection of Groundwater
Cadmium (food)	2.00E+00	Method A Ind. Cleanup Level	3.38E-02	1	5.00E-02	5.00E-02	PQL
Chloroethane	6.58E-01	Min. Method C Cleanup Level	1.67E+00	--	5.00E-03	6.58E-01	Min. Method C Cleanup Level

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TABLE 2-7

SOIL CLEANUP LEVELS

PSC Georgetown Facility
Seattle, Washington

Constituent	Minimum Industrial Risk-Based Soil Cleanup Level (mg/kg)	Minimum Industrial Risk-Based Soil Cleanup Level Basis	GW Protection Cleanup Level (mg/kg)	Puget Sound Natural Background Levels (mg/kg)	Applicable PQLs (mg/kg)	Final SWFS Soil Cleanup Level (mg/kg)	Final SWFS Soil Cleanup Level Basis
Chloroform	4.70E-04	Min. Method C Cleanup Level	1.20E-02	--	5.00E-03	5.00E-03	PQL
Chromium	2.00E+03	Method A Ind. Cleanup Level	2.00E+02	48.2	2.00E-01	2.00E+02	Protection of Groundwater
Chrysene	2.00E+00	Method A Ind. Cleanup Level	1.44E-01	--	4.10E-03	1.44E-01	Protection of Groundwater
cis-1,2-Dichloroethylene	9.93E-03	Min. Method C Cleanup Level	1.95E-01	--	5.00E-03	9.93E-03	Min. Method C Cleanup Level
cis-1,3-Dichloropropene	--	--	2.84E-04	--	5.00E-03	5.00E-03	PQL
Copper	6.91E+03	Min. Method C Cleanup Level	1.37E+00	36.4	1.00E-01	3.64E+01	Puget Sound Background
Cumene	1.52E-02	Min. Method C Cleanup Level	4.87E+00	--	5.00E-03	1.52E-02	Min. Method C Cleanup Level
Cyanide	3.73E+03	Min. Method C Cleanup Level	1.18E-02	--	1.00E-01	1.00E-01	PQL
Dibenzo(a,h)anthracene	6.42E-01	Min. Method C Cleanup Level	6.44E-01	--	2.60E-03	6.42E-01	Min. Method C Cleanup Level
Dibenzofuran	8.45E+02	Min. Method C Cleanup Level	2.91E-01	--	1.70E-03	2.91E-01	Protection of Groundwater
Diesel	2.00E+03	Method A Cleanup Level	--	--	2.50E+01	2.00E+03	Method A Cleanup Level
Di-n-butyl phthalate	7.78E+03	Min. Method C Cleanup Level	1.14E+00	--	1.00E-02	1.14E+00	Protection of Groundwater
di-n-octyl-phthalate	1.56E+03	Min. Method C Cleanup Level	6.92E+04	--	1.00E-02	1.56E+03	Min. Method C Cleanup Level
Ethylbenzene	8.02E-01	Min. Method C Cleanup Level	4.93E-02	--	5.00E-03	4.93E-02	Protection of Groundwater
Fluoranthene	3.11E+03	Min. Method C Cleanup Level	4.57E+00	--	3.40E-03	4.57E+00	Protection of Groundwater
Gasoline	3.00E+01	Method A Cleanup Level	--	--	5.00E+00	3.00E+01	Method A Cleanup Level
Indeno(1,2,3-cd)pyrene	2.00E+00	Method A Ind. Cleanup Level	1.40E+00	--	2.40E-03	1.40E+00	Protection of Groundwater
Lead	1.00E+03	Method A Ind. Cleanup Level	5.00E+02	16.8	5.00E-02	5.00E+02	Protection of Groundwater
Lube Oil	2.00E+03	Method A Cleanup Level	--	--	2.50E+01	2.00E+03	Method A Cleanup Level
Mercury	2.00E+00	Method A Ind. Cleanup Level	1.25E-02	0.07	2.00E-02	7.00E-02	Puget Sound Background
Methyl Isobutyl Ketone (MIBK)	8.50E+01	Min. Method C Cleanup Level	2.65E-01	--	5.00E-03	2.65E-01	Protection of Groundwater
Methylene chloride	1.05E-02	Min. Method C Cleanup Level	5.71E-01	--	5.00E-03	1.05E-02	Min. Method C Cleanup Level
Mineral Spirits	1.00E+02	Method A, TPH-G (no benzene)	--	--	9.00E+00	1.00E+02	Method A, TPH-G (no benzene)
Naphthalene	2.64E-01	Min. Method C Cleanup Level	3.01E-01	--	5.00E-03	2.64E-01	Min. Method C Cleanup Level
n-Butylbenzene	1.52E-01	Min. Method C Cleanup Level	2.49E-01	--	5.00E-03	1.52E-01	Min. Method C Cleanup Level
Nickel	3.73E+03	Min. Method C Cleanup Level	1.07E+01	38.2	2.00E-01	3.82E+01	Puget Sound Background
Pentachlorophenol	2.43E+01	Min. Method C Cleanup Level	3.29E-02	--	1.50E-01	1.50E-01	PQL
Phenanthrene	--	--	4.86E-01	--	3.30E-03	4.86E-01	Protection of Groundwater
Phenol	2.33E+04	Min. Method C Cleanup Level	2.04E-01	--	1.90E-02	2.04E-01	Protection of Groundwater

TABLE 2-7

SOIL CLEANUP LEVELS

PSC Georgetown Facility
Seattle, Washington

Constituent	Minimum Industrial Risk-Based Soil Cleanup Level (mg/kg)	Minimum Industrial Risk-Based Soil Cleanup Level Basis	GW Protection Cleanup Level (mg/kg)	Puget Sound Natural Background Levels (mg/kg)	Applicable PQLs (mg/kg)	Final SWFS Soil Cleanup Level (mg/kg)	Final SWFS Soil Cleanup Level Basis
p-Isopropyltoluene	1.85E+08	Min. Method C Cleanup Level	2.49E-01	--	5.00E-03	2.49E-01	Protection of Groundwater
Propylbenzene	2.25E-01	Min. Method C Cleanup Level	1.31E-01	--	5.00E-03	1.31E-01	Protection of Groundwater
Pyrene	2.33E+03	Min. Method C Cleanup Level	1.82E+02	--	3.60E-03	1.82E+02	Protection of Groundwater
sec-Butylbenzene	1.52E-01	Min. Method C Cleanup Level	2.11E-02	--	5.00E-03	2.11E-02	Protection of Groundwater
Selenium	1.75E+03	Min. Method C Cleanup Level	5.06E-01	--	1.00E-01	5.06E-01	Min. Method C Cleanup Level
Silver	9.33E+02	Min. Method C Cleanup Level	3.18E-01	--	2.00E-02	3.18E-01	Protection of Groundwater
Stoddard Solvent	1.00E+02	Method A, TPH-G (no benzene)	--	--	9.00E+00	--	Method A, TPH-G (no benzene)
Styrene	8.64E+00	Min. Method C Cleanup Level	9.96E-03	--	5.00E-03	9.96E-03	Protection of Groundwater
Tetrachloroethylene	1.90E-03	Min. Method C Cleanup Level	2.02E-03	--	3.10E-03	3.10E-03	PQL
Toluene	2.56E-01	Min. Method C Cleanup Level	5.13E-02	--	5.00E-03	5.13E-02	Protection of Groundwater
trans-1,2-Dichloroethylene	9.69E-03	Min. Method C Cleanup Level	2.46E-01	--	5.00E-03	9.69E-03	Min. Method C Cleanup Level
trans-1,3-Dichloropropene	--	--	1.02E-04	--	5.00E-03	5.00E-03	PQL
Trichloroethylene	6.24E-05	Min. Method C Cleanup Level	2.03E-03	--	2.80E-03	2.80E-03	PQL
Trichlorofluoromethane	8.61E+04	Min. Method C Cleanup Level			5.00E-03	1.70E+00	Protection of Groundwater
Vinyl chloride	1.20E-04	Min. Method C Cleanup Level	8.66E-03	--	5.00E-03	5.00E-03	PQL
Xylenes (Total)	1.80E-01	Min. Method C Cleanup Level	9.99E-01	--	5.00E-03	1.80E-01	Min. Method C Cleanup Level
Zinc	5.60E+04	Min. Method C Cleanup Level	1.01E+02	85.1	5.00E-01	1.01E+02	Protection of Groundwater

Notes:
MTCA = Model Toxics Control Act (WAC 173-340)
-- = No value was available.
SWFS = Site Wide Feasibility Study
PQL = Practical Quantitation Limit; PQL for constituents other than mineral spirits and stoddard solvent were established per WAC 173-340-707. The PQLs for mineral spirits and stoddard solvent were not available from CAS; the values cited are the lowest reported reporting limits obtained from laboratory reports received for the off-site investigation.
Minimum Ind. Soil Cleanup Level calculated using cumulative constituent Cancer Risk Goal = 1E-06 and Hazard Quotient = 0.1 and compared to Method A Soil Cleanup Levels.
Soil-to-Groundwater Cleanup Level Based on SWFS Groundwater Cleanup Level.
Puget Sound Ecology Background Levels from Natural Background Soil Metals Concentrations in Washington State. Toxics Cleanup Program, Washington State Department of Ecology. Publication # 94-115. October 1994.

TABLE 3-1

CONSTITUENT OF CONCERN SCREENING - RI SOIL CONSTITUENTS

PSC Georgetown Facility
Seattle, Washington

RI COC	Maximum Detected Concentration (μg/kg)	SWFS Cleanup Level (μg/kg)	Retain as SWFS COC?
1,1,1-Trichloroethane	5.70E+05	7.95E+01	Yes
1,1-Dichloroethane	3.10E+03	1.44E+02	Yes
1,1-Dichloroethylene	2.00E+03	1.75E+01	Yes
1,2,4-Trimethylbenzene	2.70E+04	1.47E+02	Yes
1,2-Dichlorobenzene	9.40E+03	1.27E+02	Yes
1,2-Dichloroethane	2.30E+04	5.00E+00	Yes
1,3,5-Trimethylbenzene	1.80E+04	2.45E+01	Yes
2,4-Dimethylphenol	1.20E+04	1.53E+02	Yes
2-Hexanone	4.00E+04	1.26E+02	Yes
2-Methylnaphthalene	2.30E+04	3.60E+02	Yes
2-Methylphenol	1.00E+03	4.18E+01	Yes
4-Methylphenol	1.80E+04	2.30E+02	Yes
Acetone	1.60E+04	1.76E+03	Yes
Aroclor 1016/1242	--	1.46E+03	No
Aroclor 1254	3.60E+03	1.46E+03	Yes
Aroclor 1260	5.50E+03	1.46E+03	Yes
Arsenic	2.80E+06	7.30E+03	Yes
Barium	2.97E+07	3.28E+03	Yes
Benzene	2.60E+03	5.00E+00	Yes
Benzo(a)anthracene	1.20E+03	1.43E+02	Yes
Benzo(a)pyrene	9.20E+02	2.57E+02	Yes
Benzo(b)fluoranthene	1.20E+03	4.66E+02	Yes
Benzo(ghi)perylene	6.60E+02	--	No
Benzo(k)fluoranthene	1.20E+03	4.32E+02	Yes
Benzoic acid	1.80E+03	2.00E+02	Yes
Bis(2-ethylhexyl) phthalate	4.00E+04	4.45E+03	Yes
Chloroform	4.20E+03	5.00E+00	Yes
Chromium	1.20E+07	2.00E+05	Yes
Chrysene	1.50E+03	1.44E+02	Yes
cis-1,2-Dichloroethylene	4.70E+04	9.93E+00	Yes
Copper	1.60E+07	3.64E+04	Yes
Cumene	1.80E+03	1.52E+01	Yes
Cyanide	2.50E+04	1.00E+02	Yes
Dibenzo(a,h)anthracene	6.50E+01	6.42E+02	No
Dibenzofuran	1.40E+03	2.91E+02	Yes
Ethylbenzene	3.40E+06	4.93E+01	Yes
Indeno(1,2,3-cd)pyrene	8.10E+02	1.40E+03	No
Lead	1.70E+07	5.00E+05	Yes
Mercury	1.20E+05	7.00E+01	Yes
Methyl Isobutyl Ketone (MIBK)	4.30E+04	2.65E+02	Yes
Methylene chloride	6.80E+05	1.05E+01	Yes

TABLE 3-1

CONSTITUENT OF CONCERN SCREENING - RI SOIL CONSTITUENTS

PSC Georgetown Facility
Seattle, Washington

RI COC	Maximum Detected Concentration (μg/kg)	SWFS Cleanup Level (μg/kg)	Retain as SWFS COC?
Naphthalene	8.40E+04	2.64E+02	Yes
Nickel	8.50E+06	3.82E+04	Yes
Pentachlorophenol	1.80E+03	1.50E+02	Yes
Phenanthrene	7.40E+03	4.86E+02	Yes
Phenol	5.00E+04	2.04E+02	Yes
p-Isopropyltoluene	1.90E+03	2.49E+02	Yes
Propylbenzene	5.90E+03	1.31E+02	Yes
sec-Butylbenzene	9.60E+02	2.11E+01	Yes
Silver	--	3.18E+02	No
Styrene	1.50E+04	9.96E+00	Yes
Tetrachloroethylene	2.90E+05	3.10E+00	Yes
Toluene	3.30E+06	5.13E+01	Yes
trans-1,2-Dichloroethylene	8.40E+00	9.69E+00	No
Trichloroethylene	4.60E+05	2.80E+00	Yes
Vinyl chloride	9.60E+01	5.00E+00	Yes
Xylenes (Total)	2.80E+06	1.80E+02	Yes
Zinc	5.96E+07	1.01E+05	Yes

TABLE 3-2

SCREENING OF NEW POTENTIAL SOIL CONSTITUENTS OF CONCERN

PSC Georgetown Facility
Seattle, Washington

New Soil Constituent, 2005 Soil Investigation	Frequency of Detection	Potential SWFS COC?
1,2,4-Trichlorobenzene	6.3%	Yes
Aroclor 1242	41.9%	Yes
Benzo (g,h,i) perylene	21.3%	Yes
Benzo(ghi)perylene	21.3%	Yes
Cadmium	37.5%	Yes
Chloroethane	6.3%	Yes
cis-1,3-Dichloropropene	6.3%	Yes
Dibenzo(a,h)anthracene	17.8%	Yes
Diesel Range Hydrocarbon	28.0%	Yes
Di-n-butyl phthalate	18.8%	Yes
Di-n-octyl phthalate	6.3%	Yes
Fluoranthene	12.5%	Yes
Gasoline Range Hydrocarbons	33.0%	Yes
Indeno(1,2,3-cd)pyrene	18.0%	Yes
Lube Oil Range Hydrocarbons	44.0%	Yes
Mineral Spirits	84.6%	Yes
n-Butylbenzene	58.8%	Yes
Pyrene	37.5%	Yes
Selenium	6.3%	Yes
Silver	6.3%	Yes
Stoddard Solvent	61.5%	Yes
trans-1,3-Dichloropropene	6.3%	Yes
Trichlorofluoromethane	1.5%	No

TABLE 3-3

NEW SOIL CONSTITUENT OF CONCERN SCREENING

PSC Georgetown Facility
Seattle, Washington

Potential New Soil COCs	Maximum Result, 2004/2005 Soil Investigation (μg/kg)	Final SWFS Soil Cleanup Level (μg/kg)	SWFS COC?
1,2,4-Trichlorobenzene	72	405	No
Aroclor 1242	250,000	1,460	Yes
Benzo (g,h,i) perylene	1,830	--	No
Cadmium	5,150	50	Yes
Chloroethane	127	658	No
cis-1,3-Dichloropropene	115	5	Yes
Dibenzo(a,h)anthracene	480/77	642	No
Diesel Range Hydrocarbon	5,490,000	2,000,000	Yes
Di-n-butyl phthalate	10,400	1,140	Yes
Di-n-octyl phthalate	4,440	1,556	Yes
Fluoranthene	2,920	4,570	No
Gasoline Range Hydrocarbons	24,000,000	30,000	Yes
Indeno(1,2,3-cd)pyrene	1,700/1,650	1,400	Yes
Lube Oil Range Hydrocarbons	8,020,000	2,000,000	Yes
Mineral Spirits	14,600,000	100,000	Yes
n-Butylbenzene	32,100	152	Yes
Pyrene	3,070	182,000	No
Selenium	572	506	Yes
Silver	855	318	Yes
Stoddard Solvent	36,000,000	100,000	Yes
trans-1,3-Dichloropropene	154	5	Yes

TABLE 3-4

SOIL CONSTITUENTS OF CONCERN

PSC Georgetown Facility
Seattle, Washington

1,1,1-Trichloroethane	Cyanide
1,1-Dichloroethane	Dibenzofuran
1,1-Dichloroethylene	Diesel Range Hydrocarbon
1,2,4-Trimethylbenzene	Di-n-butyl phthalate
1,2-Dichlorobenzene	Di-n-octyl phthalate
1,2-Dichloroethane	Ethylbenzene
1,3,5-Trimethylbenzene	Gasoline Range Hydrocarbons
2,4-Dimethylphenol	Indeno(1,2,3-cd)pyrene
2-Hexanone	Lead
2-Methylnaphthalene	Lube Oil Range Hydrocarbons
2-Methylphenol	Mercury
4-Methylphenol	Methyl Isobutyl Ketone (MIBK)
Acetone	Methylene chloride
Aroclor 1242	Naphthalene
Aroclor 1254	n-Butylbenzene
Aroclor 1260	Nickel
Arsenic	Pentachlorophenol
Barium	Phenanthrene
Benzene	Phenol
Benzo(a)anthracene	p-Isopropyltoluene
Benzo(a)pyrene	Propylbenzene
Benzo(b)fluoranthene	sec-Butylbenzene
Benzo(k)fluoranthene	Selenium
Benzoic acid	Silver
Bis(2-ethylhexyl) phthalate	Styrene
Cadmium	Tetrachloroethylene
Chloroform	Toluene
Chromium	trans-1,3-Dichloropropene
Chrysene	Trichloroethylene
cis-1,2-Dichloroethylene	Vinyl chloride
cis-1,3-Dichloropropene	Xylenes (Total)
Copper	Zinc
Cumene	

TABLE 3-5

GROUNDWATER CONSTITUENTS OF CONCERN

PSC Georgetown Facility
Seattle, Washington

Constituent	HCIM Area			Outside Area			
	Water Table Depth Interval	**Shallow Depth Interval**	**Intermediate Depth Interval**	**Water Table Depth Interval**	**Shallow Depth Interval**	**Intermediate Depth Interval**	**Deep Aquifer**
1,1,1-Trichloroethane	X	X	X	X			
1,1,2-Trichlorotrifluoroethane	X						
1,1-Dichloroethane	X	X	X	X	X	X	
1,1-Dichloroethene	X		X				
1,2,4-Trimethylbenzene	X		X	X			
1,2-Dichlorobenzene	X		X	X			
1,2-Dichloroethane	X	X					
1,3,5-Trimethylbenzene	X			X			
1,4-Dichlorobenzene	X			X			
1,4-Dioxane	X				X	X	
1-Methyl naphthalene	X						
2,4-Dimethylphenol	X		X				
2-Hexanone	X	X					
2-Methylnaphthalene	X						
2-Methylphenol	X		X				
4-Methylphenol	X		X				
Aroclor 1016	X						
Aroclor 1232	X						
Arsenic	X		X	X	X	X	X
Barium	X		X	X	X	X	X
Benzene	X	X	X	X	X		
Benzo(a)anthracene	X				X	X	
Benzo(b)fluoranthene	X				X	X	
Benzo(k)fluoranthene	X				X	X	
Bis(2-ethylhexyl)phthalate				X	X	X	X
Benzoic acid	X						
C10-C12 (EPH) Aromatics	X			X			
C8-C10 (EPH) Aliphatics	X						
C8-C10 (EPH) Aromatic	X			X			
C8-C10 (VPH) Aromatics	X			X			
Carbon disulfide	X	X	X			X	X
Chloroethane	X	X		X			
Chloroform	X			X			
Chromium	X		X	X		X	X
Chrysene	X				X	X	X
cis-1,2-Dichloroethylene	X	X	X	X			
Copper	X		X	X	X	X	X
Cumene	X			X			
Cyanide	X	X	X		X	X	
Dibenzo(a,h)anthracene	X			X	X	X	
Dichlorodifluoromethane	X			X			

TABLE 3-5

GROUNDWATER CONSTITUENTS OF CONCERN

PSC Georgetown Facility
Seattle, Washington

Constituent	HCIM Area			Outside Area			
	Water Table Depth Interval	Shallow Depth Interval	Intermediate Depth Interval	Water Table Depth Interval	Shallow Depth Interval	Intermediate Depth Interval	Deep Aquifer
Diesel	X		X				X
Ethylbenzene	X	X	X	X		X	
Gasoline	X						
Hexavalent Chromium					X		X
Indeno(1,2,3-cd)pyrene	X			X	X	X	
Iron		X	X	X	X	X	X
Lead	X		X			X	
Lube Oil	X		X				
Manganese	X		X	X	X	X	X
Methyl isobutyl ketone (MIBK)	X	X					
Methylphenol	X						
Naphthalene	X			X	X		
n-Hexane	X			X			
Nickel	X		X	X		X	X
Pentachlorophenol	X						
Phenol	X		X				
Propylbenzene	X			X			
sec-Butylbenzene	X			X			
Selenium							X
Silver							X
Styrene	X		X	X			
Tetrachloroethene	X	X	X	X			X
Toluene	X	X	X	X			
trans-1,2-Dichloroethene	X		X				
Trichloroethene	X	X	X	X	X		X
Vanadium			X			X	X
Vinyl chloride	X	X	X	X	X	X	X
Xylenes (Total)	X	X	X	X			
Zinc							X

TABLE 4-1

ORGANIC COCS CLEANUP LEVEL RATIO RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Cleanup Level Ratio	Rank
Ethylbenzene	Water Table	Non-HAL HC	1,238	1
Toluene	Water Table	Non-HAL HC	133	2
Trichloroethylene	Water Table	HAL VOC	126	3
Vinyl chloride	Water Table	HAL VOC	109	4
Tetrachloroethylene	Water Table	HAL VOC	77	5
1,1,1-Trichloroethane	Water Table	HAL VOC	61	6
C8-C10 (VPH) Aromatics	Water Table	Non-HAL HC	47	7
1,2,4-Trimethylbenzene	Water Table	Non-HAL HC	35	8
Xylenes (Total)	Water Table	Non-HAL HC	33	9
Styrene	Water Table	Non-HAL HC	30	10
Propylbenzene	Water Table	Non-HAL HC	26	11
1,3,5-Trimethylbenzene	Water Table	Non-HAL HC	19	12
Cumene	Water Table	Non-HAL HC	16	13
Naphthalene	Water Table	Non-HAL HC	16	14
1,1-Dichloroethane	Water Table	HAL VOC	8.2	15
Bis(2-ethylhexyl) phthalate	Water Table	MISC	7.0	16
Chloroform	Water Table	HAL VOC	4.4	17
cis-1,2-Dichloroethylene	Water Table	HAL VOC	4.1	18
Dibenzo(a,h)anthracene	Water Table	Non-HAL HC	3.3	19
Indeno(1,2,3-cd)pyrene	Water Table	Non-HAL HC	3.1	20
Chloroethane	Water Table	HAL VOC	2.8	21
C8-C10 (EPH) Aromatics	Water Table	Non-HAL HC	2.4	22
n-Hexane	Water Table	Non-HAL HC	2.3	23
1,2-Dichlorobenzene	Water Table	MISC	2.3	24
Benzene	Water Table	Non-HAL HC	2.2	25
sec-Butylbenzene	Water Table	Non-HAL HC	2.2	26
C10-C12 (EPH) Aromatics	Water Table	Non-HAL HC	2.1	27
1,4-Dichlorobenzene	Water Table	MISC	1.3	28
Dichlorodifluoromethane	Water Table	HAL VOC	1.1	29
Vinyl chloride	Shallow	HAL VOC	164	1
1,4-Dioxane	Shallow	MISC	14	2
Bis(2-ethylhexyl) phthalate	Shallow	MISC	3.6	3
Benzene	Shallow	Non-HAL HC	2.6	4
Trichloroethylene	Shallow	HAL VOC	2.6	5
Naphthalene	Shallow	Non-HAL HC	2.3	6
Benzo(k)fluoranthene	Shallow	Non-HAL HC	1.8	7
Chrysene	Shallow	Non-HAL HC	1.7	8
Benzo(a)anthracene	Shallow	Non-HAL HC	1.6	9
1,1-Dichloroethane	Shallow	HAL VOC	1.5	10
Dibenzo(a,h)anthracene	Shallow	Non-HAL HC	1.5	11
Benzo(b)fluoranthene	Shallow	Non-HAL HC	1.4	12
Indeno(1,2,3-cd)pyrene	Shallow	Non-HAL HC	1.3	13
Cyanide	Shallow	MISC	1.2	14

TABLE 4-1

ORGANIC COCS CLEANUP LEVEL RATIO RANKINGS

PSC Georgetown Facility

Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Cleanup Level Ratio	Rank
Vinyl chloride	Intermediate	HAL VOC	2,153	1
1,4-Dioxane	Intermediate	MISC	18	2
Bis(2-ethylhexyl) phthalate	Intermediate	MISC	14	3
Ethylbenzene	Intermediate	Non-HAL HC	5.0	4
Cyanide	Intermediate	MISC	3.8	5
Carbon disulfide	Intermediate	MISC	2.8	6
Chrysene	Intermediate	Non-HAL HC	2.3	7
Indeno(1,2,3-cd)pyrene	Intermediate	Non-HAL HC	2.2	8
Dibenzo(a,h)anthracene	Intermediate	Non-HAL HC	2.1	9
Benzo(k)fluoranthene	Intermediate	Non-HAL HC	1.9	10
Benzo(b)fluoranthene	Intermediate	Non-HAL HC	1.6	11
Benzo(a)anthracene	Intermediate	Non-HAL HC	1.5	12
1,1-Dichloroethane	Intermediate	HAL VOC	1.5	13
Trichloroethylene	Deep	HAL VOC	47.4	1
Tetrachloroethylene	Deep	HAL VOC	26	2
Chrysene	Deep	Non-HAL HC	14	3
Vinyl chloride	Deep	HAL VOC	11	4
Bis(2-ethylhexyl) phthalate	Deep	MISC	10	5
Carbon disulfide	Deep	MISC	6.7	6
Diesel	Deep	Non-HAL HC	1.8	7

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TABLE 4-2

ORGANIC COCS PERCENT DETECTION RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Number of Wells Sampled	Percent of Wells where Detected	Rank
Trichloroethylene	Water Table	HAL VOC	28	93	1
Vinyl chloride	Water Table	HAL VOC	28	93	1
1,1-Dichloroethane	Water Table	HAL VOC	28	86	3
cis-1,2-Dichloroethylene	Water Table	HAL VOC	28	79	4
Bis(2-ethylhexyl) phthalate	Water Table	MISC	19	68	5
Tetrachloroethylene	Water Table	HAL VOC	28	64	6
C8-C10 (EPH) Aromatics	Water Table	Non-HAL HC	8	50	7
C8-C10 (VPH) Aromatics	Water Table	Non-HAL HC	8	50	7
1,1,1-Trichloroethane	Water Table	HAL VOC	28	39	9
Benzene	Water Table	Non-HAL HC	28	39	9
Cumene	Water Table	Non-HAL HC	26	35	11
1,2-Dichlorobenzene	Water Table	MISC	28	32	12
Chloroethane	Water Table	HAL VOC	28	32	12
Chloroform	Water Table	HAL VOC	28	32	12
Toluene	Water Table	Non-HAL HC	28	32	12
Xylenes (Total)	Water Table	Non-HAL HC	28	32	12
Propylbenzene	Water Table	Non-HAL HC	27	30	17
sec-Butylbenzene	Water Table	Non-HAL HC	27	30	17
1,2,4-Trimethylbenzene	Water Table	Non-HAL HC	28	29	19
Naphthalene	Water Table	Non-HAL HC	28	29	19
1,3,5-Trimethylbenzene	Water Table	Non-HAL HC	28	25	21
C10-C12 (EPH) Aromatics	Water Table	Non-HAL HC	8	25	21
Ethylbenzene	Water Table	Non-HAL HC	28	25	21
Dibenzo(a,h)anthracene	Water Table	Non-HAL HC	21	24	24
1,4-Dichlorobenzene	Water Table	MISC	28	21	25
Indeno(1,2,3-cd)pyrene	Water Table	Non-HAL HC	19	21	25
Dichlorodifluoromethane	Water Table	HAL VOC	26	12	27
n-Hexane	Water Table	Non-HAL HC	19	5	28
Styrene	Water Table	Non-HAL HC	28	4	29
Vinyl chloride	Shallow	HAL VOC	27	96	1
1,4-Dioxane	Shallow	MISC	21	90	2
Bis(2-ethylhexyl) phthalate	Shallow	MISC	15	73	3
1,1-Dichloroethane	Shallow	HAL VOC	27	67	4
Trichloroethylene	Shallow	HAL VOC	27	56	5
Benzene	Shallow	Non-HAL HC	27	48	6
Dibenzo(a,h)anthracene	Shallow	Non-HAL HC	15	27	7
Indeno(1,2,3-cd)pyrene	Shallow	Non-HAL HC	15	27	7
Benzo(b)fluoranthene	Shallow	Non-HAL HC	15	20	9
Benzo(k)fluoranthene	Shallow	Non-HAL HC	15	13	10
Chrysene	Shallow	Non-HAL HC	15	13	10
Cyanide	Shallow	MISC	13	8	12
Naphthalene	Shallow	Non-HAL HC	27	7	13
Benzo(a)anthracene	Shallow	Non-HAL HC	15	7	14

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TABLE 4-2

ORGANIC COCS PERCENT DETECTION RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Number of Wells Sampled	Percent of Wells where Detected	Rank
Vinyl chloride	Intermediate	HAL VOC	18	100	1
1,4-Dioxane	Intermediate	MISC	14	71	2
1,1-Dichloroethane	Intermediate	HAL VOC	18	67	3
Bis(2-ethylhexyl) phthalate	Intermediate	MISC	14	64	4
Cyanide	Intermediate	MISC	14	36	5
Dibenzo(a,h)anthracene	Intermediate	Non-HAL HC	14	29	6
Indeno(1,2,3-cd)pyrene	Intermediate	Non-HAL HC	14	21	7
Benzo(a)anthracene	Intermediate	Non-HAL HC	14	14	8
Benzo(b)fluoranthene	Intermediate	Non-HAL HC	14	14	8
Benzo(k)fluoranthene	Intermediate	Non-HAL HC	14	14	8
Chrysene	Intermediate	Non-HAL HC	14	14	8
Ethylbenzene	Intermediate	Non-HAL HC	18	11	12
Carbon disulfide	Intermediate	MISC	18	6	13
Tetrachloroethylene	Deep	HAL VOC	5	80	1
Trichloroethylene	Deep	HAL VOC	5	80	1
Vinyl chloride	Deep	HAL VOC	5	80	1
Bis(2-ethylhexyl) phthalate	Deep	MISC	4	50	4
Chrysene	Deep	Non-HAL HC	4	50	4
Diesel	Deep	Non-HAL HC	4	50	4
Carbon disulfide	Deep	MISC	5	20	5

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TABLE 4-3

ORGANIC COCS PARTITIONING COEFFICIENT RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Note	K_{oc} (L/kg)	Rank
Vinyl chloride	Water Table	HAL VOC	1	18.6	1
cis-1,2-Dichloroethylene	Water Table	HAL VOC	1	35.5	2
Chloroethane	Water Table	HAL VOC	7	37.6	3
1,1-Dichloroethane	Water Table	HAL VOC	1	53	4
Chloroform	Water Table	HAL VOC	1	53	4
Benzene	Water Table	Non-HAL HC	1	62	6
Trichloroethylene	Water Table	HAL VOC	1	94	7
1,1,1-Trichloroethane	Water Table	HAL VOC	1	135	8
Toluene	Water Table	Non-HAL HC	1	140	9
Xylenes (Total)	Water Table	Non-HAL HC	1	196	10
Dichlorodifluoromethane	Water Table	HAL VOC	7	197	11
Ethylbenzene	Water Table	Non-HAL HC	1	204	12
Tetrachloroethylene	Water Table	HAL VOC	1	265	13
1,2-Dichlorobenzene	Water Table	MISC	1	379	14
1,4-Dichlorobenzene	Water Table	MISC	1	616	15
Propylbenzene	Water Table	Non-HAL HC	5	741	16
sec-Butylbenzene	Water Table	Non-HAL HC	5	891	17
Styrene	Water Table	Non-HAL HC	1	912	18
Naphthalene	Water Table	Non-HAL HC	1	1,191	19
n-Hexane	Water Table	Non-HAL HC	5	1,468	20
C8-C10 (EPH) Aromatics	Water Table	Non-HAL HC	2	1,580	21
C8-C10 (VPH) Aromatics	Water Table	Non-HAL HC	2	1,580	21
1,3,5-Trimethylbenzene	Water Table	Non-HAL HC	5	1,622	23
C10-C12 (EPH) Aromatics	Water Table	Non-HAL HC	2	2,510	24
Cumene	Water Table	Non-HAL HC	5	2,818	25
1,2,4-Trimethylbenzene	Water Table	Non-HAL HC	5	3,715	26
Bis(2-ethylhexyl) phthalate	Water Table	MISC	1	111,100	27
Dibenzo(a,h)anthracene	Water Table	Non-HAL HC	1	1,789,101	28
Indeno(1,2,3-cd)pyrene	Water Table	Non-HAL HC	3	3,470,000	29
1,4-Dioxane	Shallow	MISC	5	4	1
Cyanide	Shallow	MISC	6	4.5	2
Vinyl chloride	Shallow	HAL VOC	1	18.6	3
1,1-Dichloroethane	Shallow	HAL VOC	1	53	4
Benzene	Shallow	Non-HAL HC	1	62	5
Trichloroethylene	Shallow	HAL VOC	1	94	6
Naphthalene	Shallow	Non-HAL HC	1	1,191	7
Bis(2-ethylhexyl) phthalate	Shallow	MISC	1	111,100	8
Benzo(a)anthracene	Shallow	Non-HAL HC	1	357,537	9
Chrysene	Shallow	Non-HAL HC	3	398,000	10
Benzo(b)fluoranthene	Shallow	Non-HAL HC	4	1,230,000	11
Benzo(k)fluoranthene	Shallow	Non-HAL HC	4	1,230,000	11
Dibenzo(a,h)anthracene	Shallow	Non-HAL HC	1	1,789,101	13
Indeno(1,2,3-cd)pyrene	Shallow	Non-HAL HC	3	3,470,000	14

TABLE 4-3

ORGANIC COCS PARTITIONING COEFFICIENT RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Note	K_{oc} (L/kg)	Rank
1,4-Dioxane	Intermediate	MISC	5	3.5	1
Cyanide	Intermediate	MISC	6	4.5	2
Vinyl chloride	Intermediate	HAL VOC	1	18.6	3
Carbon disulfide	Intermediate	MISC	3	45.7	4
1,1-Dichloroethane	Intermediate	HAL VOC	1	53	5
Ethylbenzene	Intermediate	Non-HAL HC	1	204	6
Bis(2-ethylhexyl) phthalate	Intermediate	MISC	1	111,100	7
Benzo(a)anthracene	Intermediate	Non-HAL HC	1	357,537	8
Chrysene	Intermediate	Non-HAL HC	3	398,000	9
Benzo(b)fluoranthene	Intermediate	Non-HAL HC	4	1,230,000	10
Benzo(k)fluoranthene	Intermediate	Non-HAL HC	4	1,230,000	10
Dibenzo(a,h)anthracene	Intermediate	Non-HAL HC	1	1,789,101	12
Indeno(1,2,3-cd)pyrene	Intermediate	Non-HAL HC	3	3,470,000	13
Vinyl chloride	Deep	HAL VOC	1	19	1
Carbon disulfide	Deep	MISC	3	45.7	2
Trichloroethylene	Deep	HAL VOC	1	94	3
Tetrachloroethylene	Deep	HAL VOC	1	265	4
Diesel	Deep	Non-HAL HC	2	2,510	5
Bis(2-ethylhexyl) phthalate	Deep	MISC	1	111,100	6
Chrysene	Deep	Non-HAL HC	3	398,000	7

Notes:
Table 747-1 from WAC 173-340-900
Table 747-4 from WAC 173-340-900
Table 39 from Soil Screening Guidance, Technical Background Document (EPA, 1996)
Based on Benzo(a)pyrene K_{oc} from table 39 from Soil Screening Guidance, Technical Background Document (EPA, 1996)
Groundwater Chemicals Desk Reference, Volume 2 (1991)
Draft Toxicological Profile for Cyanide (ATSDR, 2004)
Syracuse Research Corporation CHEMFATE Database

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TABLE 4-4

ORGANIC COCS HALF LIFE RANKINGS

PSC Georgetown Facility

Seattle, Washington

Constituent of Concern	Zone	Constituent Class	Note	Half Life (years)	Rank
1,2,4-Trimethylbenzene	Water Table	Non-HAL HC	1	No Degradation	1
1,2-Dichlorobenzene	Water Table	MISC	4	No Degradation	1
1,3,5-Trimethylbenzene	Water Table	Non-HAL HC	1	No Degradation	1
1,4-Dichlorobenzene	Water Table	MISC	4	No Degradation	1
Styrene	Water Table	Non-HAL HC	1	No Degradation	1
Cumene	Water Table	Non-HAL HC	1	Not Determined	6
Dichlorodifluoromethane	Water Table	HAL VOC	5	Not Determined	6
Propylbenzene	Water Table	Non-HAL HC	5	Not Determined	6
sec-Butylbenzene	Water Table	Non-HAL HC	5	Not Determined	6
Bis(2-ethylhexyl) phthalate	Water Table	MISC	2	Biodegrades	10
C10-C12 (EPH) Aromatics	Water Table	Non-HAL HC	2	Biodegrades	10
C8-C10 (EPH) Aromatics	Water Table	Non-HAL HC	2	Biodegrades	10
C8-C10 (VPH) Aromatics	Water Table	Non-HAL HC	2	Biodegrades	10
Dibenzo(a,h)anthracene	Water Table	Non-HAL HC	2	Biodegrades	10
Indeno(1,2,3-cd)pyrene	Water Table	Non-HAL HC	2	Biodegrades	10
n-Hexane	Water Table	Non-HAL HC	4	Biodegrades	10
Trichloroethylene	Water Table	HAL VOC	1	7.2	17
Tetrachloroethylene	Water Table	HAL VOC	1	5.3	18
Vinyl chloride	Water Table	HAL VOC	1	3.0	19
Chloroform	Water Table	HAL VOC	1	2.4	20
Ethylbenzene	Water Table	Non-HAL HC	1	1.6	21
Xylenes (Total)	Water Table	Non-HAL HC	1	1.2	22
Benzene	Water Table	Non-HAL HC	1	1.1	23
Chloroethane	Water Table	HAL VOC	4	1	24
Toluene	Water Table	Non-HAL HC	1	0.98	25
1,1,1-Trichloroethane	Water Table	HAL VOC	1	0.83	26
cis-1,2-Dichloroethylene	Water Table	HAL VOC	3	0.58	27
Naphthalene	Water Table	Non-HAL HC	1	0.53	28
1,1-Dichloroethane	Water Table	HAL VOC	1	0.31	29
1,4-Dioxane	Shallow	MISC	1	No Degradation	1
Benzo(a)anthracene	Shallow	Non-HAL HC	2	Biodegrades	2
Benzo(b)fluoranthene	Shallow	Non-HAL HC	2	Biodegrades	2
Benzo(k)fluoranthene	Shallow	Non-HAL HC	2	Biodegrades	2
Bis(2-ethylhexyl) phthalate	Shallow	MISC	2	Biodegrades	2
Chrysene	Shallow	Non-HAL HC	2	Biodegrades	2
Cyanide	Shallow	MISC	4	Biodegrades	2
Dibenzo(a,h)anthracene	Shallow	Non-HAL HC	2	Biodegrades	2
Indeno(1,2,3-cd)pyrene	Shallow	Non-HAL HC	2	Biodegrades	2
Trichloroethylene	Shallow	HAL VOC	1	7.2	10
Vinyl chloride	Shallow	HAL VOC	1	3	11
Benzene	Shallow	Non-HAL HC	1	1.1	12
Naphthalene	Shallow	Non-HAL HC	1	0.53	13
1,1-Dichloroethane	Shallow	HAL VOC	1	0.31	14

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TABLE 4-4

ORGANIC COCS HALF LIFE RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Zone	Constituent Class	Note	Half Life (years)	Rank
1,4-Dioxane	Intermediate	MISC	1	No Degradation	1
Carbon disulfide	Intermediate	MISC	5	Not Determined	2
Benzo(a)anthracene	Intermediate	Non-HAL HC	2	Biodegrades	3
Benzo(b)fluoranthene	Intermediate	Non-HAL HC	2	Biodegrades	3
Benzo(k)fluoranthene	Intermediate	Non-HAL HC	2	Biodegrades	3
Bis(2-ethylhexyl) phthalate	Intermediate	MISC	2	Biodegrades	3
Chrysene	Intermediate	Non-HAL HC	2	Biodegrades	3
Cyanide	Intermediate	MISC	4	Biodegrades	3
Dibenzo(a,h)anthracene	Intermediate	Non-HAL HC	2	Biodegrades	3
Indeno(1,2,3-cd)pyrene	Intermediate	Non-HAL HC	2	Biodegrades	3
Vinyl chloride	Intermediate	HAL VOC	1	3	11
Ethylbenzene	Intermediate	Non-HAL HC	1	1.6	12
1,1-Dichloroethane	Intermediate	HAL VOC	1	0.31	13
Carbon disulfide	Deep	MISC	5	Not Determined	1
Bis(2-ethylhexyl) phthalate	Deep	MISC	2	Biodegrades	2
Diesel	Deep	Non-HAL HC	2	Biodegrades	2
Chrysene	Deep	Non-HAL HC	2	Biodegrades	2
Trichloroethylene	Deep	HAL VOC	1	7.2	5
Tetrachloroethylene	Deep	HAL VOC	1	5.3	6
Vinyl chloride	Deep	HAL VOC	1	3	7

Notes:

Table 57 in Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies (Aronson and Howard, 1997)

Literature sources indicate that these constituents biodegrade under; however, biodegradation rates were only identified for aerobic conditions.

Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface (Wiedermeier, et al., 1999)

ATSDR Toxicological Profile (various years)

No suitable data identified; degradation rate could not be determined.

TABLE 4-5

ORGANIC COCS NET RANKINGS

PSC Georgetown Facility
Seattle, Washington

COC	Zone	Constituent Class	Cleanup Level Ratio Rank	Percent Detected Rank	K_{oc} Rank	Half Life Rank	Net Ranking
Vinyl chloride	Water Table	HAL VOC	4	1	1	19	25
Trichloroethylene	Water Table	HAL VOC	3	1	7	17	28
Tetrachloroethylene	Water Table	HAL VOC	5	6	13	18	42
C8-C10 (VPH) Aromatics	Water Table	Non-HAL HC	7	7	21	10	45
Toluene	Water Table	Non-HAL HC	2	12	9	25	48
1,1,1-Trichloroethane	Water Table	HAL VOC	6	9	8	26	49
Propylbenzene	Water Table	Non-HAL HC	11	17	16	6	50
cis-1,2-Dichloroethylene	Water Table	HAL VOC	18	4	2	27	51
1,2-Dichlorobenzene	Water Table	MISC	24	12	14	1	51
1,1-Dichloroethane	Water Table	HAL VOC	15	3	4	29	51
Xylenes (Total)	Water Table	Non-HAL HC	9	12	10	22	53
Chloroform	Water Table	HAL VOC	17	12	4	20	53
1,2,4-Trimethylbenzene	Water Table	Non-HAL HC	8	19	26	1	54
Ethylbenzene	Water Table	Non-HAL HC	1	21	12	21	55
Cumene	Water Table	Non-HAL HC	13	11	25	6	55
1,3,5-Trimethylbenzene	Water Table	Non-HAL HC	12	21	23	1	57
Styrene	Water Table	Non-HAL HC	10	29	18	1	58
Bis(2-ethylhexyl) phthalate	Water Table	MISC	16	5	27	10	58
Chloroethane	Water Table	HAL VOC	21	12	3	24	60
C8-C10 (EPH) Aromatics	Water Table	Non-HAL HC	22	7	21	10	60
Benzene	Water Table	Non-HAL HC	25	9	6	23	63
sec-Butylbenzene	Water Table	Non-HAL HC	26	17	17	6	66
1,4-Dichlorobenzene	Water Table	MISC	28	25	15	1	69
Dichlorodifluoromethane	Water Table	HAL VOC	29	27	11	6	73
Naphthalene	Water Table	Non-HAL HC	14	19	19	28	80
n-Hexane	Water Table	Non-HAL HC	23	28	20	10	81
Dibenzo(a,h)anthracene	Water Table	Non-HAL HC	19	24	28	10	81
C10-C12 (EPH) Aromatics	Water Table	Non-HAL HC	27	21	24	10	82
Indeno(1,2,3-cd)pyrene	Water Table	Non-HAL HC	20	25	29	10	84
1,4-Dioxane	Shallow	MISC	2	2	1	1	6
Vinyl chloride	Shallow	HAL VOC	1	1	3	11	16
Bis(2-ethylhexyl) phthalate	Shallow	MISC	3	3	8	2	16
Trichloroethylene	Shallow	HAL VOC	5	5	6	10	26
Benzene	Shallow	Non-HAL HC	4	6	5	12	27
Cyanide	Shallow	MISC	14	12	2	2	30
Chrysene	Shallow	Non-HAL HC	8	10	10	2	30
Benzo(k)fluoranthene	Shallow	Non-HAL HC	7	10	11	2	30
1,1-Dichloroethane	Shallow	HAL VOC	10	4	4	14	32
Dibenzo(a,h)anthracene	Shallow	Non-HAL HC	11	7	13	2	33
Benzo(b)fluoranthene	Shallow	Non-HAL HC	12	9	11	2	34
Benzo(a)anthracene	Shallow	Non-HAL HC	9	14	9	2	34
Indeno(1,2,3-cd)pyrene	Shallow	Non-HAL HC	13	7	14	2	36
Naphthalene	Shallow	Non-HAL HC	6	13	7	13	39

TABLE 4-5

ORGANIC COCS NET RANKINGS

PSC Georgetown Facility
Seattle, Washington

COC	Zone	Constituent Class	Cleanup Level Ratio Rank	Percent Detected Rank	K_{oc} Rank	Half Life Rank	Net Ranking
1,4-Dioxane	Intermediate	MISC	2	2	1	1	6
Cyanide	Intermediate	MISC	5	5	2	3	15
Vinyl chloride	Intermediate	HAL VOC	1	1	3	11	16
Bis(2-ethylhexyl) phthalate	Intermediate	MISC	3	4	7	3	17
Carbon disulfide	Intermediate	MISC	6	13	4	2	25
Chrysene	Intermediate	Non-HAL HC	7	8	9	3	27
Dibenzo(a,h)anthracene	Intermediate	Non-HAL HC	9	6	12	3	30
Indeno(1,2,3-cd)pyrene	Intermediate	Non-HAL HC	8	7	13	3	31
Benzo(k)fluoranthene	Intermediate	Non-HAL HC	10	8	10	3	31
Benzo(a)anthracene	Intermediate	Non-HAL HC	12	8	8	3	31
Benzo(b)fluoranthene	Intermediate	Non-HAL HC	11	8	10	3	32
1,1-Dichloroethane	Intermediate	HAL VOC	13	3	5	13	34
Ethylbenzene	Intermediate	Non-HAL HC	4	12	6	12	34
Trichloroethylene	Deep	HAL VOC	1	1	3	5	10
Tetrachloroethylene	Deep	HAL VOC	2	1	4	6	13
Vinyl chloride	Deep	HAL VOC	4	1	1	7	13
Carbon disulfide	Deep	MISC	6	5	2	1	14
Chrysene	Deep	Non-HAL HC	3	4	7	2	16
Bis(2-ethylhexyl) phthalate	Deep	MISC	5	4	6	2	17
Diesel	Deep	Non-HAL HC	7	4	5	2	18

TABLE 4-6

ORGANIC INDICATOR CONSTITUENTS OF CONCERN BY DEPTH INTERVAL

PSC Georgetown Facility
Seattle, Washington

Water Table Depth Interval
PCE
TCE
cis-1,2-DCE
VC
Ethylbenzene
Toluene
Shallow Depth Interval
1,4-Dioxane
PCE
TCE
cis-1,2-DCE
VC
Benzene
Intermediate Depth Interval
1,4-Dioxane
PCE
TCE
cis-1,2-DCE
VC
Ethylbenzene
Deep Aquifer
None

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TABLE 4-7

METALS COCS CLEANUP LEVEL RATIO RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Cleanup Level Ratio	Rank
Arsenic	Water Table	Metals	558	1
Iron	Water Table	Metals	31	2
Manganese	Water Table	Metals	8.8	3
Barium	Water Table	Metals	3.5	4
Chromium	Water Table	Metals	1.9	5
Copper	Water Table	Metals	1.6	6
Nickel	Water Table	Metals	1.4	7
Iron	Shallow	Metals	38	1
Manganese	Shallow	Metals	36	2
Arsenic	Shallow	Metals	22	3
Barium	Shallow	Metals	2.6	4
Copper	Shallow	Metals	1.8	5
Hexavalent Chromium	Shallow	Metals	1.7	6
Manganese	Intermediate	Metals	63,900	1
Arsenic	Intermediate	Metals	127	2
Barium	Intermediate	Metals	12	3
Iron	Intermediate	Metals	11	4
Copper	Intermediate	Metals	8.7	5
Lead	Intermediate	Metals	1.5	6
Nickel	Intermediate	Metals	1.4	7
Chromium	Intermediate	Metals	1.4	8
Vanadium	Intermediate	Metals	1.3	9
Arsenic	Deep	Metals	643	1
Barium	Deep	Metals	29	2
Manganese	Deep	Metals	8.3	3
Iron	Deep	Metals	6.8	4
Selenium	Deep	Metals	6.7	5
Copper	Deep	Metals	5.1	6
Chromium	Deep	Metals	5.0	7
Nickel	Deep	Metals	4.7	8
Hexavalent Chromium	Deep	Metals	4.1	9
Zinc	Deep	Metals	2.7	10
Silver	Deep	Metals	1.6	11
Vanadium	Deep	Metals	1.2	12

TABLE 4-8

METALS COCS PARTITIONING COEFFICIENT RANKINGS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	K_d (L/kg)	Rank
Copper	Water Table	Metals	22	1
Arsenic	Water Table	Metals	29	2
Barium	Water Table	Metals	41	3
Nickel	Water Table	Metals	65	4
Chromium	Water Table	Metals	1,000	5
Iron	Water Table	Metals	3,600	6
Manganese	Water Table	Metals	36,000	7
Hexavalent Chromium	Shallow	Metals	19	1
Copper	Shallow	Metals	22	2
Arsenic	Shallow	Metals	29	3
Barium	Shallow	Metals	41	4
Iron	Shallow	Metals	3,600	5
Manganese	Shallow	Metals	36,000	6
Copper	Intermediate	Metals	22	1
Arsenic	Intermediate	Metals	29	2
Barium	Intermediate	Metals	41	3
Nickel	Intermediate	Metals	65	4
Chromium	Intermediate	Metals	1,000	5
Vanadium	Intermediate	Metals	1,000	5
Iron	Intermediate	Metals	3,600	7
Lead	Intermediate	Metals	10,000	8
Manganese	Intermediate	Metals	36,000	9
Selenium	Deep	Metals	5	1
Silver	Deep	Metals	8	2
Hexavalent Chromium	Deep	Metals	19	3
Copper	Deep	Metals	22	4
Arsenic	Deep	Metals	29	5
Barium	Deep	Metals	41	6
Zinc	Deep	Metals	62	7
Nickel	Deep	Metals	65	8
Chromium	Deep	Metals	1,000	9
Vanadium	Deep	Metals	1,000	9
Iron	Deep	Metals	3,600	11
Manganese	Deep	Metals	36,000	12

Notes:

Kd values are from Table 747-3 of WAC 173-340-900 where avaliable. Barium, silver, and vanadium K_d values are from the EPA Soil Screening Guidance (1996). The K_d value for Manganese is from USACE, 1999.

No available K_d values for iron were identified. The K_d for iron was set as one-tenth the manganese K_d based on similar chemical response to changes in redox and pH.

TABLE 4-9

METALS COCS NET RANKINGS
PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Constituent Class	Cleanup Level Ratio Rank	K_d Rank	Net Ranking
Arsenic	Water Table	Metals	1	2	3
Copper	Water Table	Metals	6	1	7
Barium	Water Table	Metals	4	3	7
Iron	Water Table	Metals	2	6	8
Chromium	Water Table	Metals	5	5	10
Manganese	Water Table	Metals	3	7	10
Nickel	Water Table	Metals	7	4	11
Arsenic	Shallow	Metals	3	3	6
Iron	Shallow	Metals	1	5	6
Copper	Shallow	Metals	5	2	7
Hexavalent Chromium	Shallow	Metals	6	1	7
Barium	Shallow	Metals	4	4	8
Manganese	Shallow	Metals	2	6	8
Arsenic	Intermediate	Metals	2	2	4
Barium	Intermediate	Metals	3	3	6
Copper	Intermediate	Metals	5	1	6
Manganese	Intermediate	Metals	1	9	10
Iron	Intermediate	Metals	4	7	11
Nickel	Intermediate	Metals	7	4	11
Chromium	Intermediate	Metals	8	5	13
Lead	Intermediate	Metals	6	8	14
Vanadium	Intermediate	Metals	9	5	14
Arsenic	Deep	Metals	1	5	6
Selenium	Deep	Metals	5	1	6
Barium	Deep	Metals	2	6	8
Copper	Deep	Metals	6	4	10
Hexavalent Chromium	Deep	Metals	9	3	12
Silver	Deep	Metals	11	2	13
Iron	Deep	Metals	4	11	15
Manganese	Deep	Metals	3	12	15
Chromium	Deep	Metals	7	9	16
Nickel	Deep	Metals	8	8	16
Zinc	Deep	Metals	10	7	17
Vanadium	Deep	Metals	12	9	21

TABLE 6-1

WATER TABLE AND SHALLOW DEPTH INTERVALS
GENERAL MODEL INPUT PARAMETERS

PSC Georgetown Facility
Seattle, Washington

Parameter	Value	Units	Source
Advection			
Hydraulic Conductivity	0.032	cm/s	Geometric mean of water table and shallow depth interval hydraulic conductivity values
Hydraulic Gradient	0.0017	ft/ft	Site-wide average for the water table and shallow sample intervals from the RI Report
Effective Porosity	0.3	unitless	Ecology default value
Seepage Velocity	187.6	ft/yr	Calculated from conductivity times gradient divided by porosity
Dispersion			
α_x	41.6	Feet	Based on flow path length, calculated using modified Xu and Ekstein equation
α_y	4.2	Feet	Assumed as 0.1 times α_x, based on standard of practice
α_z	0	Feet	No vertical dispersion into intermediate unit assumed
Adsorption			
Soil Bulk Density	1.51	kg/L	Ecology default value
Fraction Organic Carbon	0.001	unitless	Ecology default value
Model Dimensions			
Model Length	3800	Feet	Distance from barrier wall to Duwamish River
Model Width	1500	Feet	Sufficiently wide to define downgradient plume
Source Area Width	400	Feet	Plume width at facility, outside wall
Source Area Depth	30	Feet	Average plume thickness in water table and shallow depth intervals
Simulation Time	1,000	Years	Sufficient time to reach steady state conditions
Simulation Time (1,4-Dioxane)	22	Years	Time of maximum 1,4-Dioxane concentration at Duwamish Waterway

TABLE 6-2

INTERMEDIATE DEPTH INTERVAL
GENERAL MODEL INPUT PARAMETERS

PSC Georgetown
Seattle, Washington

Parameter	Value	Units	Source
Advection			
Hydraulic Conductivity - Near PSC Facility	0.0011	cm/s	Geometric mean of intermediate sample interval hydraulic conductivity values
Hydraulic Gradient	0.0016	ft/ft	Site-wide average for the intermediate depth interval from the RI Report
Effective Porosity	0.3	unitless	Ecology default value
Seepage Velocity - Near PSC Facility	6.1	ft/yr	Calculated from conductivity near faclility times gradient divided by porosity
Seepage Velocity - Downgradient of PSC Facility	187.6	ft/yr	Assumed to be same as water table and shallow depth interval seepage velocity
Dispersion			
α_x	41.6	Feet	Based on flow path length, calculated using modified Xu and Ekstein equation
α_y	4.2	Feet	Assumed as 0.1 times α_x, based on standard of practice
α_z	0	Feet	No vertical dispersion into intermediate unit assumed
Adsorption			
Soil Bulk Density	1.51	kg/L	Ecology default value
Fraction Organic Carbon	0.001	unitless	Ecology default value
Model Dimensions			
Model Length	3800	Feet	Distance from barrier wall to Duwamish River
Model Width	1500	Feet	Sufficiently wide to define downgradient plume
Source Area Width	400	Feet	Plume width at facility, outside wall
Source Area Depth	20	Feet	Average plume thickness in Intermediate interval
Simulation Time	1,000	Years	Sufficient time to reach steady state conditions

TABLE 6-3

CHEMICAL PARAMETERS
PSC Georgetown Facility
Seattle, Washington

Depth Interval and ICOC	Concentration (µg/L)	Well ID of Maximum Concentration	Partitioning Coefficient (L/kg)	Biodegradation Half Life (Years)
Water Table				
PCE	15.5	103-S-1	265	1.2
TCE	26.6	CG-124-WT	94	3.0
cis-1,2-DCE	300	CG-149-WT	35.5	0.65
VC	140	CG-149-WT	18.6	0.82
Ethylbenzene	9,040	104-S-1	204	0.11
Toluene	1,300	CG-153-WT	140	0.12
Shallow				
PCE	0.09	103-S-2	265	1.2
TCE	2.02	103-S-2	94	3.0
cis-1,2-DCE	8.46	103-S-2	35.5	0.65
VC	35.2	CG-119-40	18.6	0.82
Benzene	30	CG-121-40	62	1.1
1,4-Dioxane	1,370	CG-127-40	3.5	No Degradation
Intermediate				
PCE	0	Not Detected	265	1.2
TCE	0.1	104-I	94	3.0
cis-1,2-DCE	30.7	CG-115-75	35.5	0.65
VC	4,390	104-I	18.6	0.82
Ethylbenzene	36.4	CG-118-79	204	1.6
1,4-Dioxane	1,720	CG-122-60	3.5	No Degradation

TABLE 6-4

MODELED AND MEASURED BENZENE, TOLUENE, AND ETHYLBENZENE CONCENTRATIONS - INITIAL LITERATURE VALUE BIODEGRADATION RATES

PSC Georgetown Facility
Seattle, Washington

Water Table Interval

Distance Downgradient (Feet)	Location	Modeled Ethylbenzene (µg/L)	Modeled Toluene (µg/L)	Measured Ethylbenzene (µg/L)	Measured Toluene (µg/L)
0	CG-104-S1	9,040	970	9,040	970
50	CG-113-S1	8,130	822	3,540	199
250	CG-122-WT	5,319	424	ND	1.4
625	CG-128-WT	2,388	122	ND	ND
900	CG-127-WT	1,312	48	ND	ND
1000	CG-130-WT	1,053	34	ND	ND
1200	CG-131-WT	677	17.4	ND	ND
3800	Duwamish Waterway	2.11	0.00	NM	NM

Shallow Interval

Distance Downgradient (Feet)	Location	Modeled Benzene (µg/L)	Measured Benzene (µg/L)
0	CG-121-40	30	30
300	CG-129-40	12.2	24
1000	CG-131-40	1.47	0.30
1000	CG-135-40	1.47	0.80
1400	CG-134-40	0.43	0.68
3800	Duwamish Waterway	0.00	NM

Intermediate Interval

Distance Downgradient (Feet)	Location	Modeled Ethylbenzene (µg/L)	Measured Ethylbenzene (µg/L)
0	CG-118-79	36.4	36.4
100	104-I	1.62	ND
400	CG-122-60	0.00	ND
700	CG-128-70	0.00	ND
1300	CG-135-50	0.00	ND
3800	Duwamish Waterway	0.00	NM

Notes:
ND = Not Detected
NM = Not Measured
Literature value biodegradation half lives are 1.1 years for benzene, 1.6 years for ethylbenzene, and 0.98 year for toluene.

TABLE 6-5

MODEL CALIBRATION RESULTS FOR TOLUENE AND ETHYLBENZENE IN THE WATER TABLE DEPTH INTERVAL

PSC Georgetown
Seattle, Washington

Calibrated Biodegradation Rates

Distance Downgradient (Feet)	Location	Modeled		Measured		Redox Potential (mV)
		Ethylbenzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	
0	CG-104-S1	9,040	970	9,040	970	-2
50	CG-113-S1	3,526	400	3,540	199	74
250	CG-122-WT	82	11.6	ND	1.4	58
625	CG-128-WT	0.07	0.01	ND	ND	330
900	CG-127-WT	0.00	0.00	ND	ND	227
1000	CG-130-WT	0.00	0.00	ND	ND	132
1200	CG-131-WT	0.00	0.00	ND	ND	156
3800	Duwamish Waterway	0.00	0.00	NM	NM	NA

Notes:
ND = Not Detected
NM = Not Measured
Calibrated biodegradation half lives were 0.11 year for ethylbenzene and 0.12 year for toluene.

TABLE 6-6

NATURAL ATTENUATION MODEL RESULTS

PSC Georgetown
Seattle, Washington

Depth Interval and ICOC	Initial Concentration (μg/L)	Modeled Concentration at Duwamish Waterway (μg/L)	Surface Water Protection Criteria (μg/L)	Laboratory Practical Quantitation Limit (μg/L)
Water Table				
PCE	15.5	0.000	0.20	0.02
TCE	26.6	0.402	0.79	0.02
cis-1,2-DCE	300	0.082	165	0.5
VC	140	0.092	2.04	0.02
Ethylbenzene	9,040	0.000	7.3	0.5
Toluene	1,300	0.000	9.8	0.5
Shallow				
PCE	0.1	0.000	0.20	0.02
TCE	2.02	0.018	0.79	0.02
cis-1,2-DCE	8.46	0.004	165	0.5
VC	35.2	0.004	2.04	0.02
Benzene	30	0.000	11.7	0.5
1,4-Dioxane	1,370	200	94.9	0.1
Intermediate				
PCE	0	0.000	0.20	0.02
TCE	0.1	0.000	0.79	0.02
cis-1,2-DCE	30.7	0.000	165	0.5
VC	4,390	0.000	2.04	0.02
Ethylbenzene	36.4	0.000	7.3	0.5
1,4-Dioxane	1,720	1,270	94.9	0.1

Notes:
μg/L = micrograms per liter

TABLE 6-7

SENSITIVITY ANALYSIS
PSC Georgetown
Seattle, Washington

Depth Interval and ICOC	Sensitivity Parameter Change and Predicted Concentrations in µg/L												
	Base Case	Half Life x 0.5	Half Life x 2	Half Life x 3	Flow Rate x 0.5	Flow Rate x 2	Flow Rate x 3	Dispersivity x 0.2	Dispersivity x 5	Initial Concentration x 0.5	Initial Concentration x 2	Width of Low Velocity Zone x 0.5	Width of Low Velocity Zone x 0.25
Water Table													
PCE	0.00	0.00	0.05	0.27	0.00	0.05	0.27	0.00	0.00	0.00	0.00	NA	NA
TCE	0.40	0.01	3.49	7.16	0.01	3.49	7.16	0.45	0.38	0.20	0.80	NA	NA
cis-1,2-DCE	0.08	0.00	0.72	1.68	0.00	0.72	1.68	0.09	0.08	0.04	0.16	NA	NA
VC	0.09	0.00	1.02	4.19	0.00	1.02	4.19	0.10	0.09	0.05	0.18	NA	NA
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
Toluene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
Shallow													
PCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
TCE	0.02	0.00	0.16	0.34	0.00	0.16	0.34	0.02	0.02	0.01	0.04	NA	NA
cis-1,2-DCE	0.00	0.00	0.03	0.08	0.00	0.03	0.08	0.00	0.00	0.00	0.01	NA	NA
VC	0.00	0.00	0.05	0.26	0.00	0.05	0.26	0.00	0.00	0.00	0.01	NA	NA
Benzene	0.00	0.00	0.06	0.38	0.00	0.06	0.38	0.00	0.00	0.00	0.00	NA	NA
Intermediate													
PCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cis-1,2-DCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
NA = Not applicable. The low seepage velocity zone near the facility was only modeled in the intermediate depth interval.

TABLE 6-8

1,4-DIOXANE SENSITIVITY ANALYSIS
PSC Georgetown
Seattle, Washington

Depth Interval and ICOC	Sensitivity Parameter Change								
	Base Case	Source Decay Term 0.3 yr^{-1}	Source Decay Term 0.7 yr^{-1}	Flow Rate x 0.5	Flow Rate x 2	Dispersivity x 0.2	Dispersivity x 5	Initial Concentration x 0.5	Initial Concentration x 2
Shallow									
1,4-Dioxane Concentration (µg/L)	221	572	118	100	367	557	Not Stable(1)	111	425
Time to Maximum Concentration (years)	22	24	21	42	12	22	Not Stable(1)	22	22

Notes:
1. Not Stable - the model solution was not stable with this input paramter, and no sensitivity analysis run was performed.

Geomatrix

TABLE 6-9

METALS CLEANUP LEVEL RATIOS AND TRAVEL TIMES TO DUWAMISH WATERWAY

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval	Maximum Cleanup Level Ratio	Kd[1] (L/kg)	Retardation Factor	Travel Time[3] (Years)
Arsenic	Water Table	558	29	147	2,939
Barium	Water Table	3.5	41	207	4,147
Chromium (Total)	Water Table	1.4	1,000	5,034	100,687
Copper	Water Table	1.6	22	112	2,235
Iron[2]	Water Table	31	3,600	18,121	362,420
Manganese	Water Table	8.8	36,000	181,201	3,624,020
Nickel	Water Table	1.4	65	328	6,563
Arsenic	Shallow	22	29	147	2,939
Barium	Shallow	2.6	41	207	4,147
Copper	Shallow	1.8	22	112	2,235
Hexavalent Chromium	Shallow	1.7	19	97	1,933
Iron[2]	Shallow	38	3,600	18,121	362,420
Manganese	Shallow	36	36,000	181,201	3,624,020
Arsenic	Intermediate	127	29	147	2,939
Barium	Intermediate	12	41	207	4,147
Chromium (Total)	Intermediate	1.4	1,000	5,034	100,687
Copper	Intermediate	8.7	22	112	2,235
Iron[2]	Intermediate	11	3,600	18,121	362,420
Lead	Intermediate	1.5	10,000	50,334	1,006,687
Manganese	Intermediate	63,900	36,000	181,201	3,624,020
Nickel	Intermediate	1.4	65	328	6,563
Vanadium	Intermediate	1.3	1,000	5,034	100,687
Arsenic	Deep	643	29	147	2,939
Barium	Deep	29	41	207	4,147
Chromium (Total)	Deep	5.0	1,000	5,034	100,687
Copper	Deep	5.1	22	112	2,235
Hexavalent Chromium	Deep	4.1	19	97	1,933
Iron[2]	Deep	6.8	3,600	18,121	362,420
Manganese	Deep	8.3	36,000	181,201	3,624,020
Nickel	Deep	4.7	65	328	6,563
Selenium	Deep	6.7	5	26	523
Silver	Deep	1.6	8.3	43	856
Vanadium	Deep	1.2	1,000	5,034	100,687
Zinc	Deep	2.7	62	313	6,261

Notes:

1. Kd values are from Table 747-3 of WAC 173-340-900 where available. Barium, silver, and vanadium Kd values are from the EPA Soil Screening Guidance (1996) Table C-3, assuming a pH of 6.8. The Kd value for manganese is from USACE, 1999.
2. No available Kd values for iron were identified. The Kd for iron was set as one-tenth the manganese Kd based on similar chemical response to changes in redox and pH.
3. Estimated travel times based on an unretarded travel time from the facility to the Duwamish Waterway of 20 years.

TABLE 6-10

METALS POTENTIALLY REACHING THE DUWAMISH WATERWAY ABOVE CLEANUP LEVELS

PSC Georgetown Facility
Seattle, Washington

Constituent of Concern	Sample Depth Interval
Arsenic	Water Table
Iron	Shallow
Manganese	Shallow
Iron	Intermediate
Manganese	Intermediate
Arsenic	Deep
Iron	Deep
Manganese	Deep

TABLE 7-1

WATER TABLE DEPTH INTERVAL COC CLASSES

PSC Georgetown Facility
Seattle, Washington

Constituent	Class
Halogenated VOCs	
Tetrachloroethylene	3
Trichloroethylene	3
cis-1,2-Dichloroethylene	3
Vinyl chloride	3
1,1,1-Trichloroethane	2
1,1-Dichloroethane	2
Chloroethane	2
Chloroform	1
Dichlorodifluoromethane	2
Non-Halogenated Hydrocarbons	
Benzene	1
Toluene	1
Ethylbenzene	1
Xylenes (Total)	1
C10-C12 (EPH) Aromatics	1
C8-C10 (EPH) Aromatics	1
C8-C10 (VPH) Aromatics	1
1,2,4-Trimethylbenzene	1
1,3,5-Trimethylbenzene	1
Dibenzo(a,h)anthracene	1
Indeno(1,2,3-cd)pyrene	1
Cumene	1
Naphthalene	1
n-Hexane	1
Propylbenzene	1
sec-Butylbenzene	1
Styrene	1
Miscellaneous Compounds	
bis(2-ethylhexyl)Phthalate	1
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	1
Metals	
Arsenic	3
Barium	2
Chromium	2
Copper	2
Iron	2
Manganese	2
Nickel	2

Notes:
Class 1 = COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.
Class 2 = COCs that are expected to reach the Duwamish Waterway at concentrations greater than the PQL but less than groundwater cleanup levels.
Class 3 = COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

TABLE 7-2

SHALLOW DEPTH INTERVAL COC CLASSES

PSC Georgetown Facility
Seattle, Washington

Constituent	Class
Halogenated VOCs	
Trichloroethylene	2
Vinyl chloride	2
1,1-Dichloroethane	2
Non-Halogenated Hydrocarbons	
Benzene	1
Benzo(a)anthracene	1
Benzo(b)fluoranthene	1
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	1
Indeno(1,2,3-cd)pyrene	1
Naphthalene	1
Miscellaneous Compounds	
1,4-Dioxane	3
bis(2-ethylhexyl)Phthalate	1
Cyanide	1
Metals	
Arsenic	2
Barium	2
Copper	2
Hexavalent Chromium	2
Iron	3
Manganese	3

Notes:
Class 1 = COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.
Class 2 = COCs that are expected to reach the Duwamish Waterway at concentrations greater than the PQL but less than groundwater cleanup levels.
Class 3 = COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

TABLE 7-3

INTERMEDIATE DEPTH INTERVAL COC CLASSES

PSC Georgetown Facility
Seattle, Washington

Constituent	Class
Halogenated VOCs	
1,1-Dichloroethane	1
Vinyl chloride	1
Non-Halogenated Hydrocarbons	
Ethylbenzene	1
Benzo(a)anthracene	1
Benzo(b)fluoranthene	1
Benzo(k)fluoranthene	1
Chrysene	1
Dibenzo(a,h)anthracene	1
Indeno(1,2,3-cd)pyrene	1
Miscellaneous Compounds	
1,4-Dioxane	3
bis(2-ethylhexyl)Phthalate	1
Carbon disulfide	1
Cyanide	1
Metals	
Arsenic	2
Barium	2
Chromium	2
Copper	2
Iron	3
Lead	2
Manganese	3
Nickel	2
Vanadium	2

Notes:

Class 1 = COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.

Class 2 = COCs that are expected to reach the Duwamish Waterway at concentrations greater than the PQL but less than groundwater cleanup levels.

Class 3 = COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

TABLE 7-4

DEEP AQUIFER COC CLASSES
PSC Georgetown Facility
Seattle, Washington

Constituent	Class
Halogenated VOCs	
Tetrachloroethylene	1
Trichloroethylene	1
Vinyl chloride	1
Non-Halogenated Hydrocarbons	
Chrysene	1
Diesel	1
Miscellaneous Compounds	
bis(2-ethylhexyl)Phthalate	1
Carbon disulfide	1
Metals	
Arsenic	3
Barium	3
Chromium	2
Copper	2
Hexavalent Chromium	2
Iron	3
Manganese	3
Nickel	2
Selenium	3
Silver	2
Vanadium	2
Zinc	2

Notes:
Class 1 = COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.
Class 2 = COCs that are expected to reach the Duwamish Waterway at concentrations greater than the PQL but less than groundwater cleanup levels.
Class 3 = COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

TABLE 7-5

REMEDIATION LEVELS AND SENSITIVITY ANALYSIS
PSC Georgetown Facility
Seattle, Washington

ICOC	Base Case Remediation Level	Sensitivity Analysis Remediation Levels					
		Half Life x 0.5	Half Life x 2	Half Life x 3	VC Half Life x 3	Dispersivity x 0.2	Dispersivity x 5
Water Table							
Tetrachloroethylene	30	1,000	3.4	1.7	16	26	32
Trichloroethylene	52	1,000	5.6	2.9	27	46	55
cis-1,2-Dichloroethylene	1,000	1,000	1,000	200	310	1,000	1,000
Vinyl Chloride	1,000	1,000	1,000	94	145	1,000	1,000
Shallow							
1,4-Dioxane	128	NA	NA	NA	NA	96	245
Intermediate							
1,4-Dioxane	128	NA	NA	NA	NA	96	245

Notes:
Remediation levels are in µg/L.
NA = Not applicable

TABLE 7-6

WATER TABLE DEPTH INTERVAL REMEDIATION LEVELS AND SITE-SPECIFIC CLEANUP LEVELS

PSC Georgetown
Seattle, Washington

Constituent	Class	Remediation Level (µg/L)	Preliminary SWFS Cleanup Level (µg/L)	Inhalation Pathway Criteria (µg/L)	Site-Specific Cleanup Level (µg/L)	Final SWFS Cleanup Level (µg/L)
Halogenated VOCs						
Tetrachloroethylene	3	16	0.2	---	NA	0.2
Trichloroethylene	3	27	0.4	---	NA	0.4
cis-1,2-Dichloroethylene	3	310	72.7	---	NA	72.7
Vinyl chloride	3	145	1.28	---	NA	1.28
1,1,1-Trichloroethane	2	NA	11	---	NA	11
1,1-Dichloroethane	2	NA	47	---	NA	47
Chloroethane	2	NA	461	---	NA	461
Chloroform	1	NA	4.11	4.11	18.2	4.11
Dichlorodifluoromethane	2	NA	6.36	---	NA	6.36
Non-Halogenated Hydrocarbons						
Benzene	1	NA	9.6	9.6	21.1	9.6
Toluene	1	NA	9.8	496	9,040	496
Ethylbenzene	1	NA	7.3	1,262	1,300	1,262
Xylenes (Total)	1	NA	141	144	4,654	144
C10-C12 (EPH) Aromatics	1	NA	528	---	NA	528
C8-C10 (EPH) Aromatics	1	NA	120	---	NA	120
C8-C10 (VPH) Aromatics	1	NA	120	---	NA	120
1,2,4-Trimethylbenzene	1	NA	13	13	450	13
1,3,5-Trimethylbenzene	1	NA	9.76	9.76	190	9.76
Dibenzo(a,h)anthracene	1	NA	0.02	NA	0.0667	0.0667
Indeno(1,2,3-cd)pyrene	1	NA	0.02	NA	0.0616	0.0616
Cumene	1	NA	7.3	74.9	120	74.9
Naphthalene	1	NA	12	59.2	192	59.2
n-Hexane	1	NA	0.45	0.45	2.3	0.45
Propylbenzene	1	NA	7.3	26.9	190	26.9
sec-Butylbenzene	1	NA	4.6	23.1	10	10
Styrene	1	NA	0.5	3,646	15	15
Miscellaneous Compounds						
bis(2-ethylhexyl)Phthalate	1	NA	2	NA	24.7	24.7
1,2-Dichlorobenzene	1	NA	14	1,118	31.6	31.6
1,4-Dichlorobenzene	1	NA	2.5	3,504	3.2	3.2
Metals						
Arsenic	3	NA	0.051	---	NA	0.051
Barium	2	NA	4	---	NA	4
Chromium	2	NA	10	---	NA	10
Copper	2	NA	3.1	---	NA	3.1
Iron	2	NA	1,000	---	NA	1,000
Manganese	2	NA	100	---	NA	100
Nickel	2	NA	8.2	---	NA	8.2

Notes:
Class 1 - COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.
Class 2 - COCs that are expected to reach the Duwamish Waterway at concentrations greater levels than the PQL but less than groundwater cleanup levels.
Class 3 - COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.
Remediation levels were not established for Class 3 metals COCs
--- only COCs with site-specific cleanup levels were compared to the residential groundwater to air criteria in determining final SWFS cleanup levels
NA = Not applicable

TABLE 7-7

SHALLOW DEPTH INTERVAL REMEDIATION LEVELS AND SITE-SPECIFIC CLEANUP LEVELS

PSC Georgetown
Seattle, Washington

Constituent	Class	Remediation Level (µg/L)	Preliminary SWFS Cleanup Level (µg/L)	Site-Specific Cleanup Level (µg/L)	Final SWFS Cleanup Level (µg/L)
Halogenated VOCs					
Trichloroethylene	2	NA	0.79	NA	0.79
Vinyl chloride	2	NA	2.04	NA	2.04
1,1-Dichloroethane	2	NA	47	NA	47
Non-Halogenated Hydrocarbons					
Benzene	1	NA	11.7	30	30
Benzo(a)anthracene	1	NA	0.02	0.0317	0.0317
Benzo(b)fluoranthene	1	NA	0.0194	0.0273	0.0273
Benzo(k)fluoranthene	1	NA	0.018	0.0369	0.0369
Chrysene	1	NA	0.018	0.0338	0.0338
Dibenzo(a,h)anthracene	1	NA	0.018	0.0291	0.0291
Indeno(1,2,3-cd)pyrene	1	NA	0.02	0.0254	0.0254
Naphthalene	1	NA	12	27.2	27.2
Miscellaneous Compounds					
1,4-Dioxane	3	128	94.9	NA	94.9
bis(2-ethylhexyl)Phthalate	1	NA	2	7.11	7.11
Cyanide	1	NA	10	11.8	11.8
Metals					
Arsenic	2	NA	0.051	NA	0.051
Barium	2	NA	4	NA	4
Copper	2	NA	10	NA	10
Hexavalent Chromium	2	NA	10	NA	10
Iron	3	NA	1,000	NA	1,000
Manganese	3	NA	100	NA	100

Notes:

Class 1 - COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.

Class 2 - COCs that are expected to reach the Duwamish Waterway at concentrations greater levels than the PQL but less than groundwater cleanup levels.

Class 3 - COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

Remediation levels were not established for Class 3 metals COCs

NA = Not applicable

TABLE 7-8

INTERMEDIATE DEPTH INTERVAL REMEDIATION LEVELS AND SITE-SPECIFIC CLEANUP LEVELS

PSC Georgetown
Seattle, Washington

Constituent	Class	Remediation Level (µg/L)	Preliminary SWFS Cleanup Level (µg/L)	Site-Specific Cleanup Level (µg/L)	Final SWFS Cleanup Level (µg/L)
Halogenated VOCs					
1,1-Dichloroethane	1	NA	47	68	68
Vinyl chloride	1	NA	2.04	4,390	4,390
Non-Halogenated Hydrocarbons					
Ethylbenzene	1	NA	7.3	36.4	36.4
Benzo(a)anthracene	1	NA	0.02	0.0294	0.0294
Benzo(b)fluoranthene	1	NA	0.0194	0.0316	0.0316
Benzo(k)fluoranthene	1	NA	0.018	0.0384	0.0384
Chrysene	1	NA	0.018	0.0451	0.0451
Dibenzo(a,h)anthracene	1	NA	0.018	0.0425	0.0425
Indeno(1,2,3-cd)pyrene	1	NA	0.02	0.0431	0.0431
Miscellaneous Compounds					
1,4-Dioxane	3	128	94.9	NA	94.9
bis(2-ethylhexyl)Phthalate	1	NA	2	9.51	9.51
Carbon disulfide	1	NA	0.92	2.6	2.6
Cyanide	1	NA	1	3.8	3.8
Metals					
Arsenic	2	NA	0.051	NA	0.051
Barium	2	NA	4	NA	4
Chromium	2	NA	10	NA	10
Copper	2	NA	3.1	NA	3.1
Iron	3	NA	1,000	NA	1,000
Lead	2	NA	2.5	NA	2.5
Manganese	3	NA	100	NA	100
Nickel	2	NA	8.2	NA	8.2
Vanadium	2	NA	20	NA	20

Notes:

Class 1 - COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.

Class 2 - COCs that are expected to reach the Duwamish Waterway at concentrations greater levels than the PQL but less than groundwater cleanup levels.

Class 3 - COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.

Remediation levels were not established for Class 3 metals COCs.

NA = Not applicable

TABLE 7-9

DEEP AQUIFER SITE-SPECIFIC CLEANUP LEVELS

PSC Georgetown
Seattle, Washington

Constituent	Class	Remediation Level (µg/L)	Preliminary SWFS Cleanup Level (µg/L)	Drinking Water Criteria (µg/L)	Site-Specific Cleanup Level (µg/L)	Final SWFS Cleanup Level (µg/L)
Halogenated VOCs						
Tetrachloroethylene	1	NA	0.081	---	NA	0.081
Trichloroethylene	1	NA	0.11	---	NA	0.11
Vinyl chloride	1	NA	0.031	---	NA	0.031
Non-Halogenated Hydrocarbons						
Chrysene	1	NA	0.018	0.171	0.273	0.171
Diesel	1	NA	NA	---	NA	500
Miscellaneous Compounds						
bis(2-ethylhexyl)Phthalate	1	NA	2	6	2.06	2.06
Carbon disulfide	1	NA	0.92	80	6.2	6.2
Metals						
Arsenic	3	NA	0.051	---	NA	0.051
Barium	3	NA	4	---	NA	4
Chromium	2	NA	10	---	NA	10
Copper	2	NA	3.1	---	NA	3.1
Hexavalent Chromium	2	NA	4.8	---	NA	4.8
Iron	3	NA	480	---	NA	480
Manganese	3	NA	74.7	---	NA	74.7
Nickel	2	NA	8.2	---	NA	8.2
Selenium	3	NA	5	---	NA	5
Silver	2	NA	1.9	---	NA	1.9
Vanadium	2	NA	11.2	---	NA	11.2
Zinc	2	NA	81	---	NA	81

Notes:
Class 1 - COCs that are not expected to reach the Duwamish Waterway at concentrations greater than laboratory PQLs.
Class 2 - COCs that are expected to reach the Duwamish Waterway at concentrations greater levels than the PQL but less than groundwater cleanup levels.
Class 3 - COCs that will potentially reach the Duwamish Waterway at concentrations greater than cleanup levels.
Remediation levels were not established for Class 3 metals COCs
--- only COCs with site-specific cleanup levels were compared to the drinking water criteria in determining final SWFS cleanup levels
NA = Not applicable

TABLE 8-1

REMEDIATION TIME MODEL INPUT PARAMETERS
PSC Georgetown Facility
Seattle, Washington

Parameter	Value	Units	Source
Soil Parameters			
Dry Density	85	lb/ft3	Average value measured at site
Total Porosity	0.4	---	Average value measured at site
Initial Concentrations - Water Table			
PCE	15.5	µg/L	Maximum EPC Value in Water Table Interval
TCE	26.6	µg/L	Maximum EPC Value in Water Table Interval
CIS	300	µg/L	Maximum EPC Value in Water Table Interval
VC	140	µg/L	Maximum EPC Value in Water Table Interval
Initial Concentrations - Shallow			
PCE	0.1	µg/L	Maximum EPC Value in Shallow Interval
TCE	2.02	µg/L	Maximum EPC Value in Shallow Interval
CIS	30.7	µg/L	Maximum EPC Value in Shallow Interval
VC	35.2	µg/L	Maximum EPC Value in Shallow Interval
Initial Concentrations - Intermediate			
PCE	0	µg/L	Maximum EPC Value in Intermediate Interval
TCE	0.1	µg/L	Maximum EPC Value in Intermediate Interval
CIS	24.7	µg/L	Maximum EPC Value in Intermediate Interval
VC	4,390	µg/L	Maximum EPC Value in Intermediate Interval
Partitioning Coefficients			
PCE	0.265	L/kg	Ecology default value times foc of 0.001
TCE	0.094	L/kg	Ecology default value times foc of 0.001
DCE	0.036	L/kg	Ecology default value times foc of 0.001
VC	0.019	L/kg	Ecology default value times foc of 0.001
1st Order Decay Half Life - Natural Attenuation Rates			
PCE to DCE	1.2	Years	Calibrated Rates (Attachment B)
TCE to DCE	3.0	Years	Calibrated Rates (Attachment B)
DCE to VC	0.65	Years	Calibrated Rates (Attachment B)
VC to Ethene	0.82	Years	Calibrated Rates (Attachment B)

Notes:
µg/L = micrograms per liter
L/kg - liters per kilogram

TABLE 8-2

REMEDIATION TIME MODEL RESULTS

PSC Georgetown
Seattle, Washington

Constituent	Water Table Depth Interval Final SWFS Cleanup Level (µg/L)	Water Table Depth Interval Restoration Time (Years)	Final SWFS Cleanup Level (µg/L)	Shallow Depth Interval Restoration Time (Years)	Intermediate Depth Interval Restoration Time (Years)
PCE	0.2	12	0	0	0
TCE	0.4	26	0	9	0
DCE	72.7	2	165	0	0
VC	1.28	9	2.04	5	10

Notes:
DCE and VC cleanup levels are for water table (first value) and shallow and intermediate depth intervals (second value).

TABLE 8-3

REMEDIATION TIME MODEL SENSITIVITY

PSC Georgetown

Seattle, Washington

Model Times Step of 0.5 Years

Constituent	Final SWFS Cleanup Level (µg/L)	Water Table Depth Interval Time (Years)	Shallow Depth Interval Time (Years)	Intermediate Depth Interval Time (Years)
PCE	0.2	13	0	0
TCE	0.4	27	9	0
DCE	72.7/165	2	0	0
VC	1.28/2.04	10	6	10

Vinyl Chloride Half Life of 2.5 Years

Constituent	Final SWFS Cleanup Level (µg/L)	Water Table Depth Interval Restoration Time (Years)	Shallow Depth Interval Restoration Time (Years)	Intermediate Depth Interval Restoration Time (Years)
PCE	0.2	12	0	0
TCE	0.4	26	9	0
DCE	72.7/165	2	0	0
VC	1.28/2.04	23	13	29

Notes:

DCE and VC cleanup levels are for water table (first value) and shallow and intermediate depth intervals (second value).

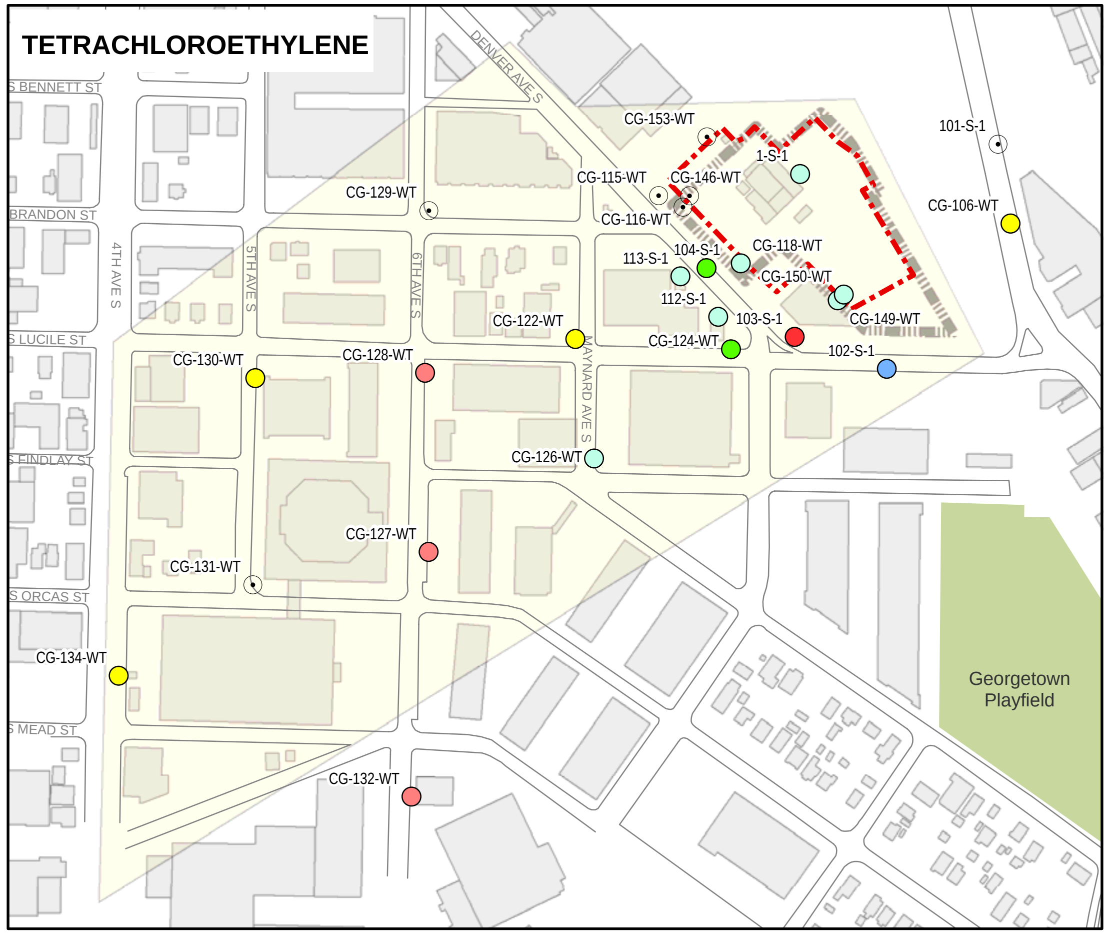
Geomatrix

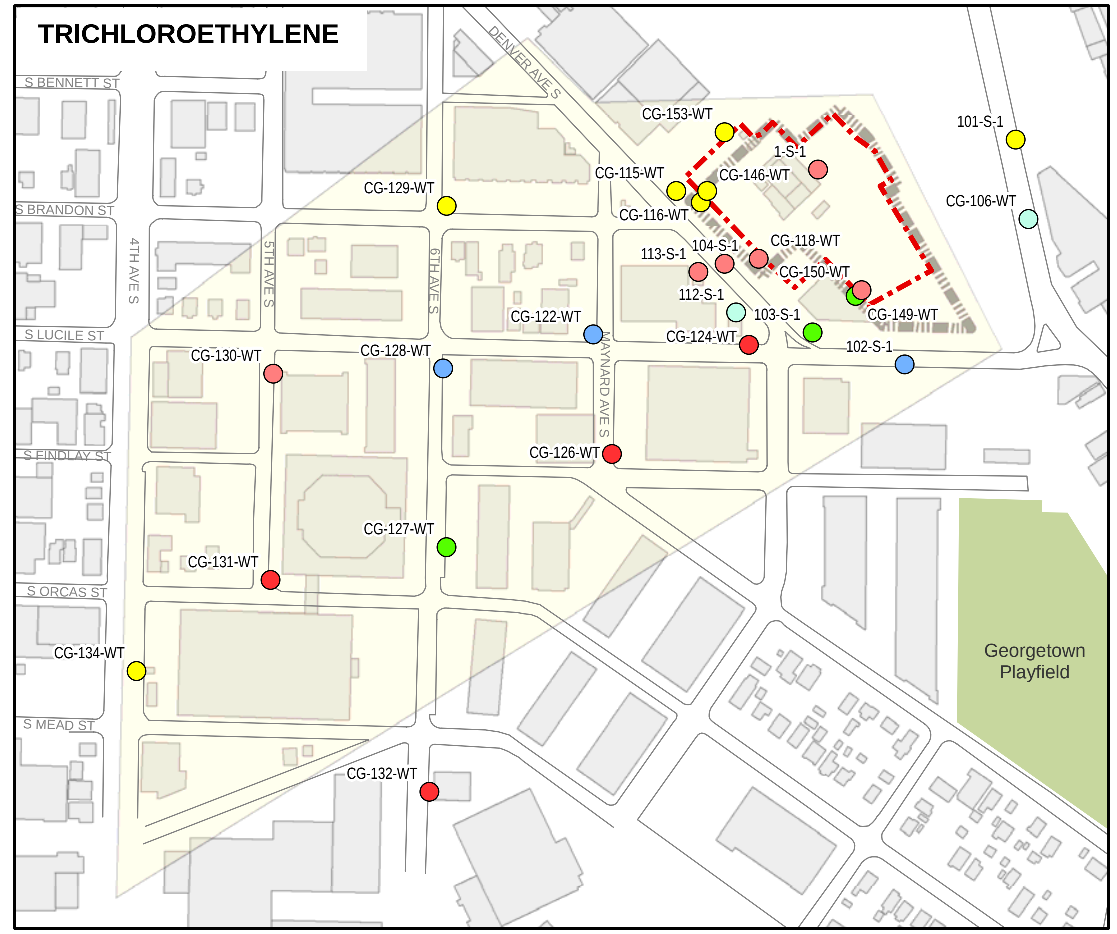
FIGURES

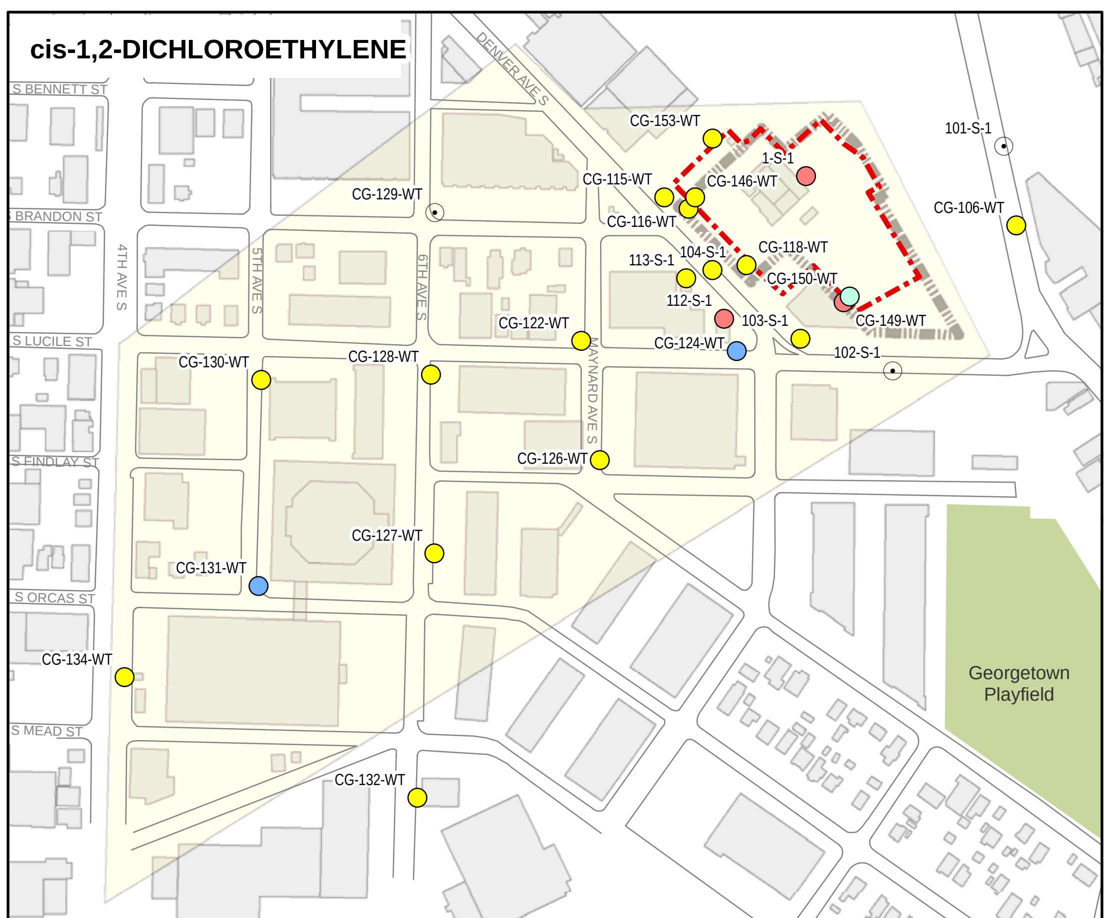
S:\8770_2006\001FS_TechMemo1\OffSiteSoil030206land.mxd

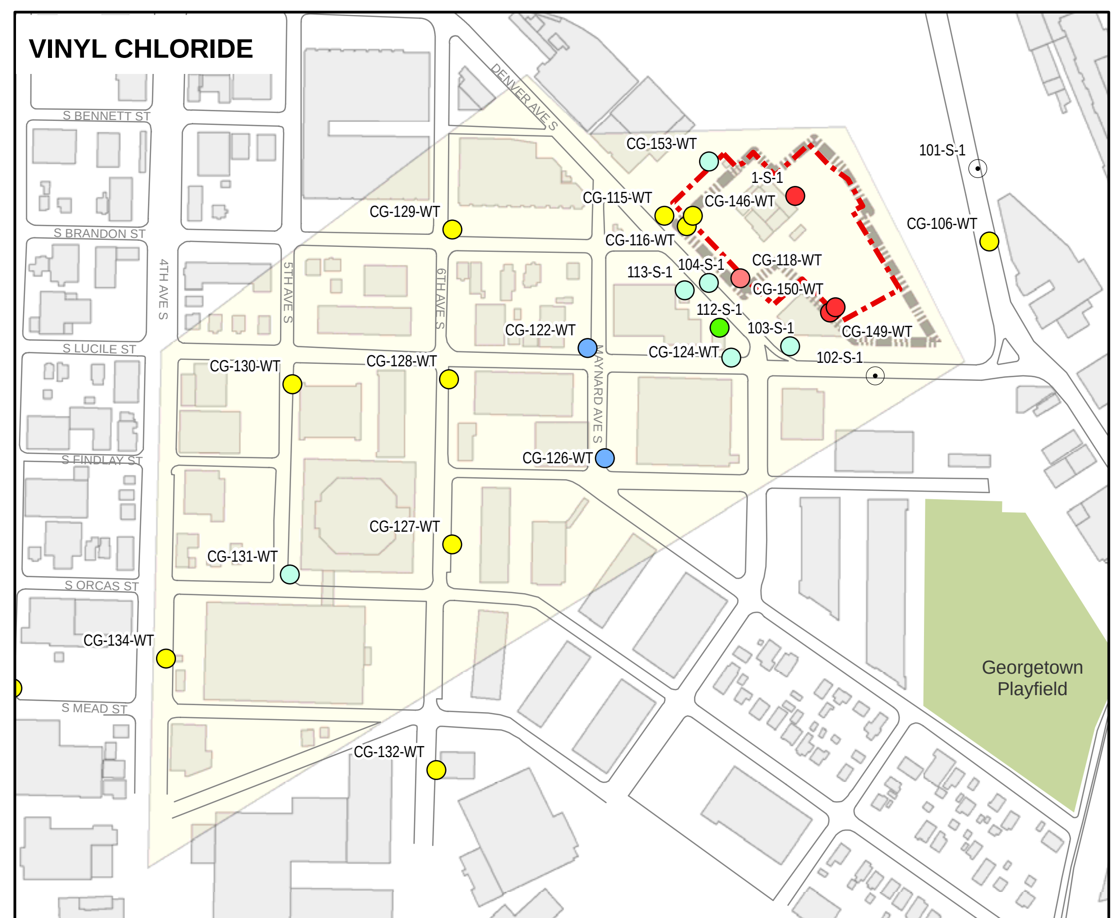
SOIL SAMPLE LOCATIONS
PSC Georgetown
Seattle, Washington

By: jem	Date: 2/17/2006	Project No. 8770
Geomatrix		Figure 3-1







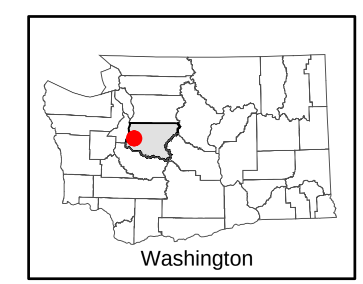


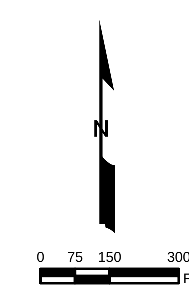
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.





WATER TABLE WELL
TETRACHLOROETHYLENE, TRICHLOROETHYLENE, cis-1,2-DICHLOROETHYLENE, VINYL CHLORIDE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-1

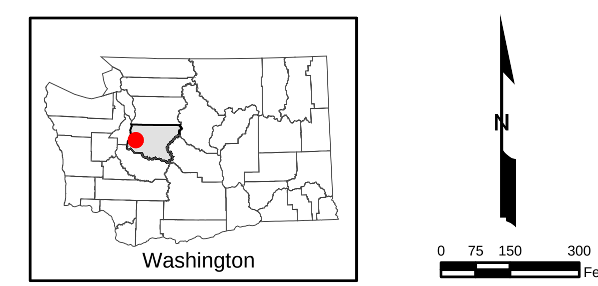
S:\8770_2006\001FS_TechMemo1WT_Tet_Tri_cis_VC.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



WATER TABLE WELL
1,1,1-TRICHLOROETHANE, 1,1-DICHLOROETHANE,
CHLOROETHANE, DICHLORODIFLUOROMETHANE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-2

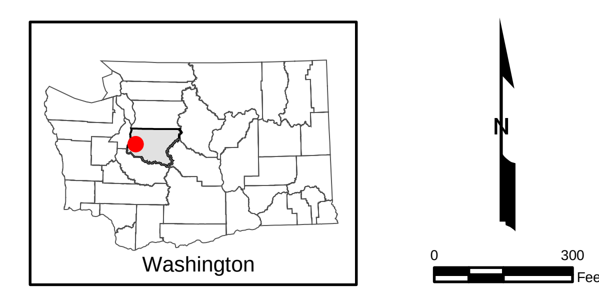
S:\8770_2006\001FS_TechMemo1WT_Tric_Dich_Chloro_Dich021606.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

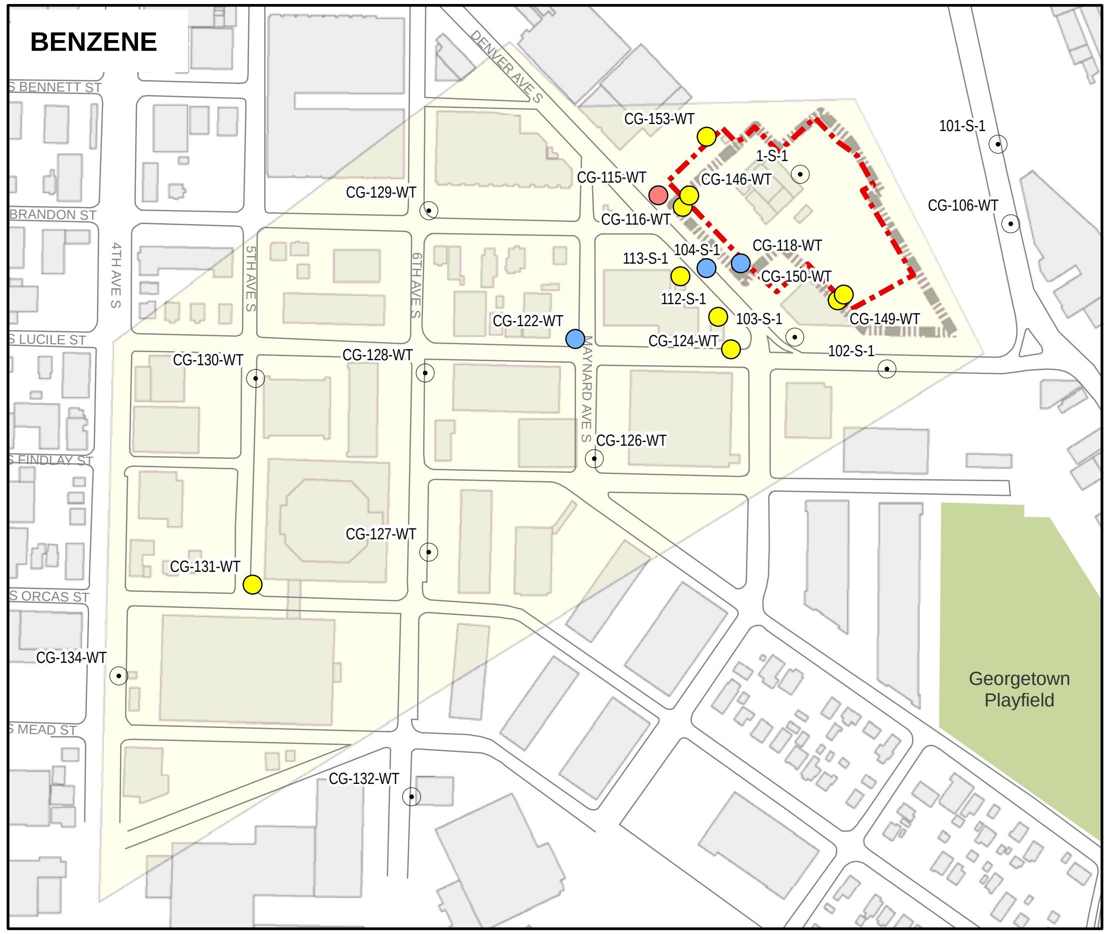
NOTE: Concentrations are normalized to the COC Cleanup Level.

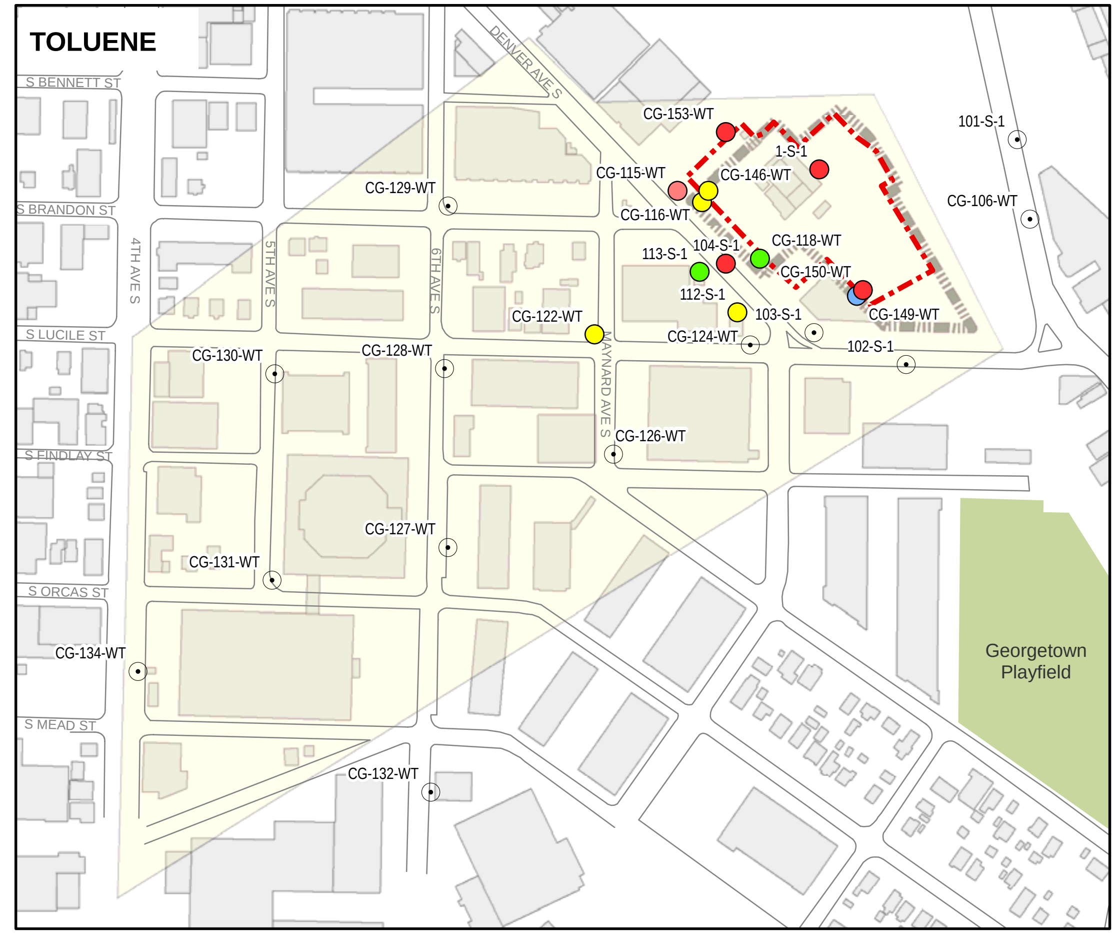


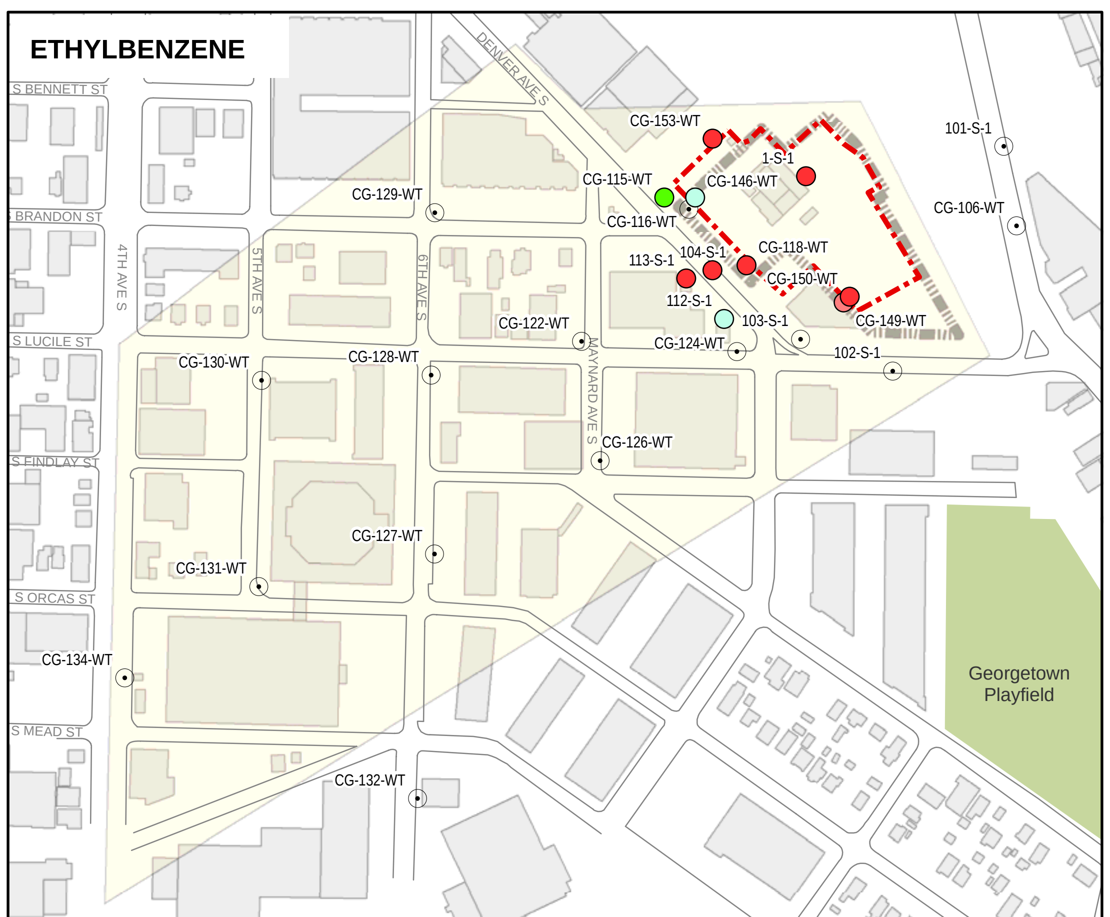
WATER TABLE WELL
C10-C12 (EPH) AROMATICS, C8-C10 (EPH) AROMATICS
C8-C10 (VPH) AROMATICS, CHLOROFORM
PSC Georgetown
Seattle, Washington

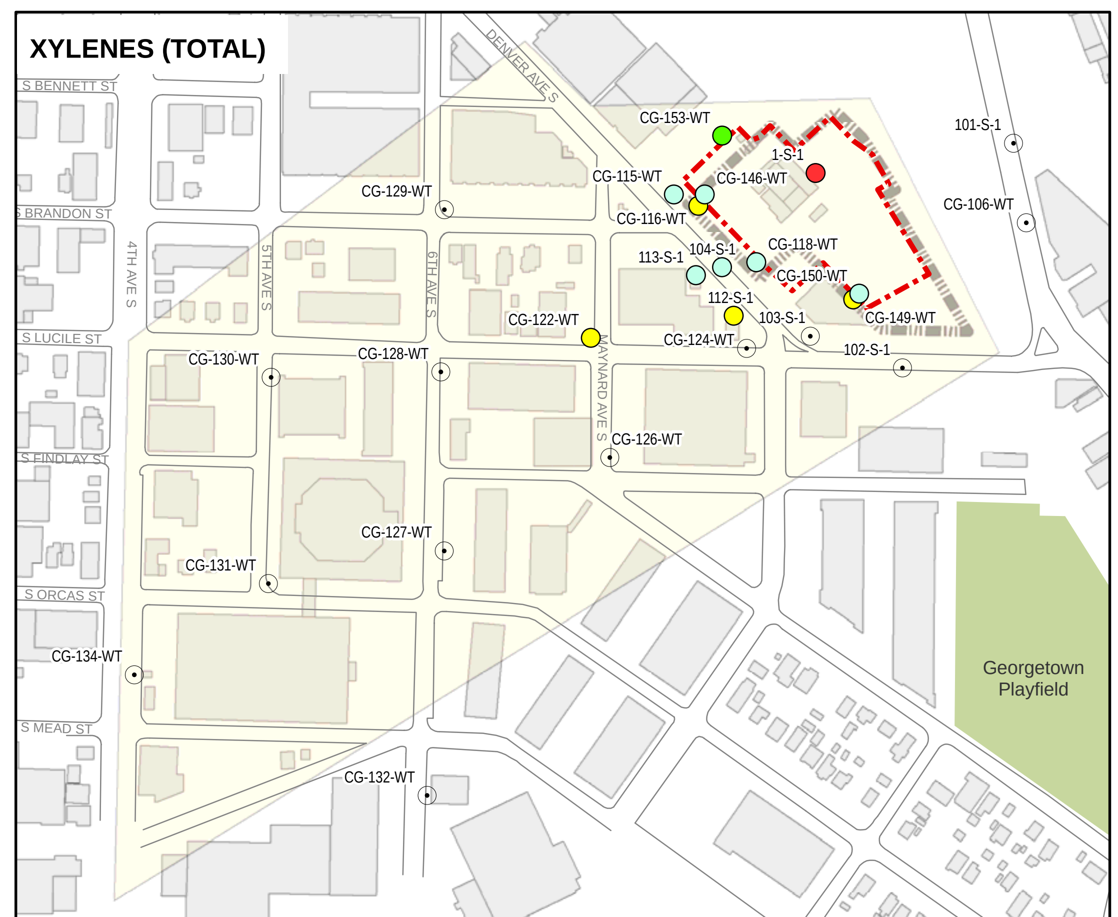
By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-3

S:\8770_2006\001FS_TechMemo1WT_Aromatics_021606.mxd







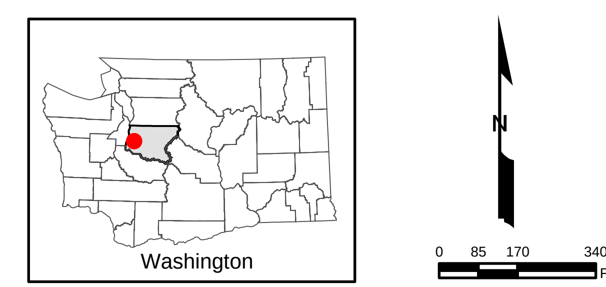


Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



WATER TABLE WELL
BENZENE, TOLUENE, ETHYLBENZENE
XYLENES (TOTAL)
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-4

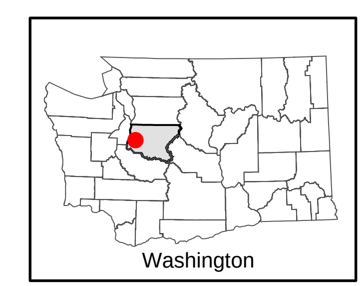
S:\8770_2006\001FS_TechMemo01WT_Ben_Tol_Ethy_Xy_021606.mxd

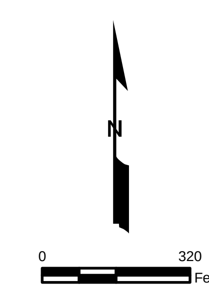
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

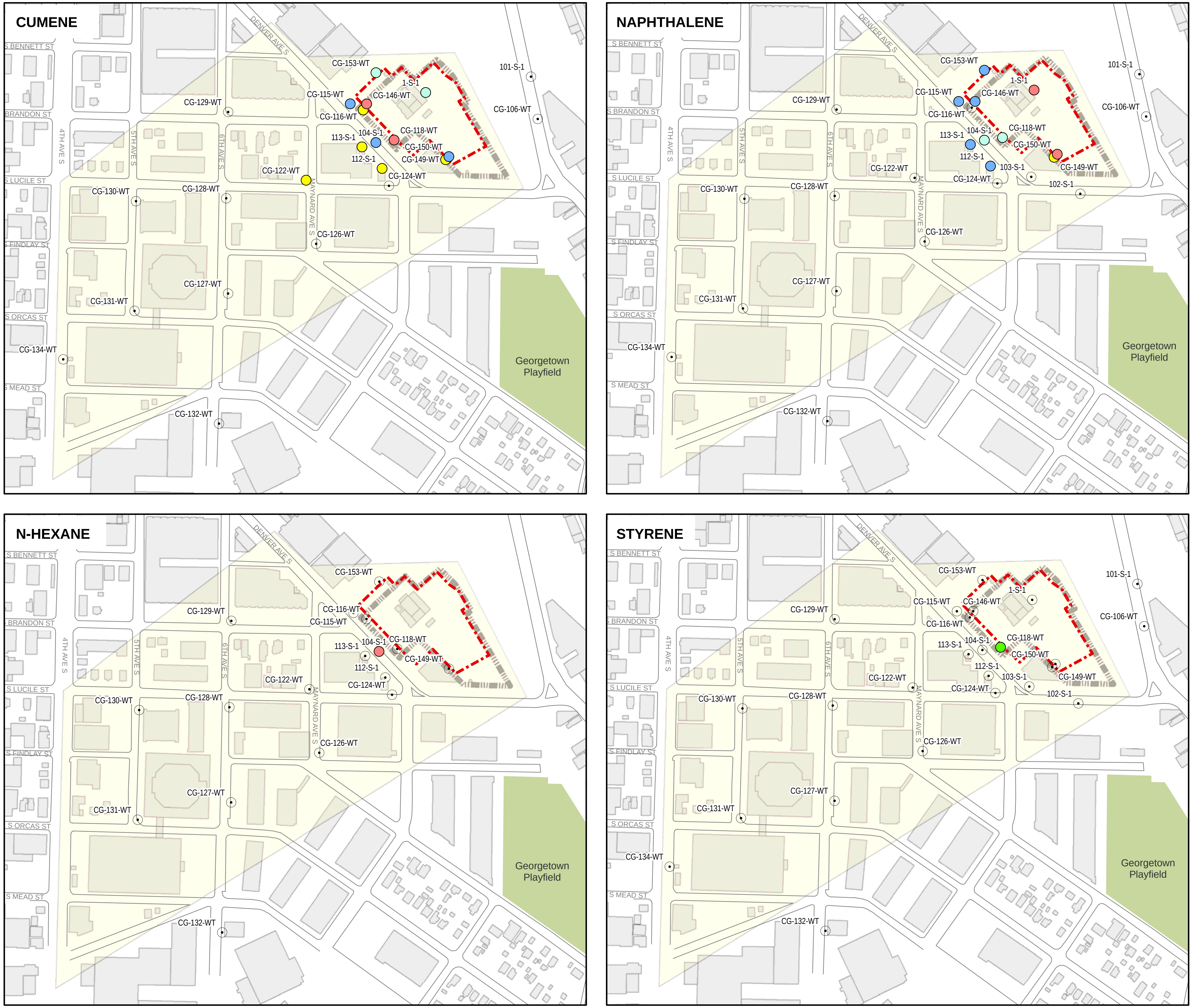




WATER TABLE WELL
1,2,4-TRIMETHYLBENZENE, 1,3,5-TRIMETHYLBENZENE,
PROPYLBENZENE, SEC-BUTYLBENZENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-5

S:\8770_2006\001FS_TechMemo1WT_Trim_Prop_But_021606.mxd

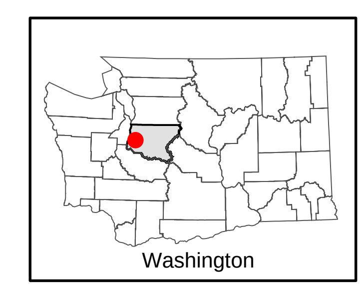


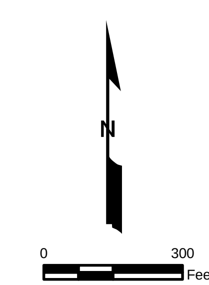
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.





WATER TABLE WELL
CUMENE, NAPHTHALENE, N-HEXANE, STYRENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-6

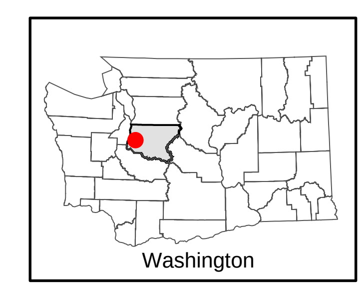
S:\8770_2006\001FS_TechMemo1WT_Cume_Nap_Hex_Sty_021606.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



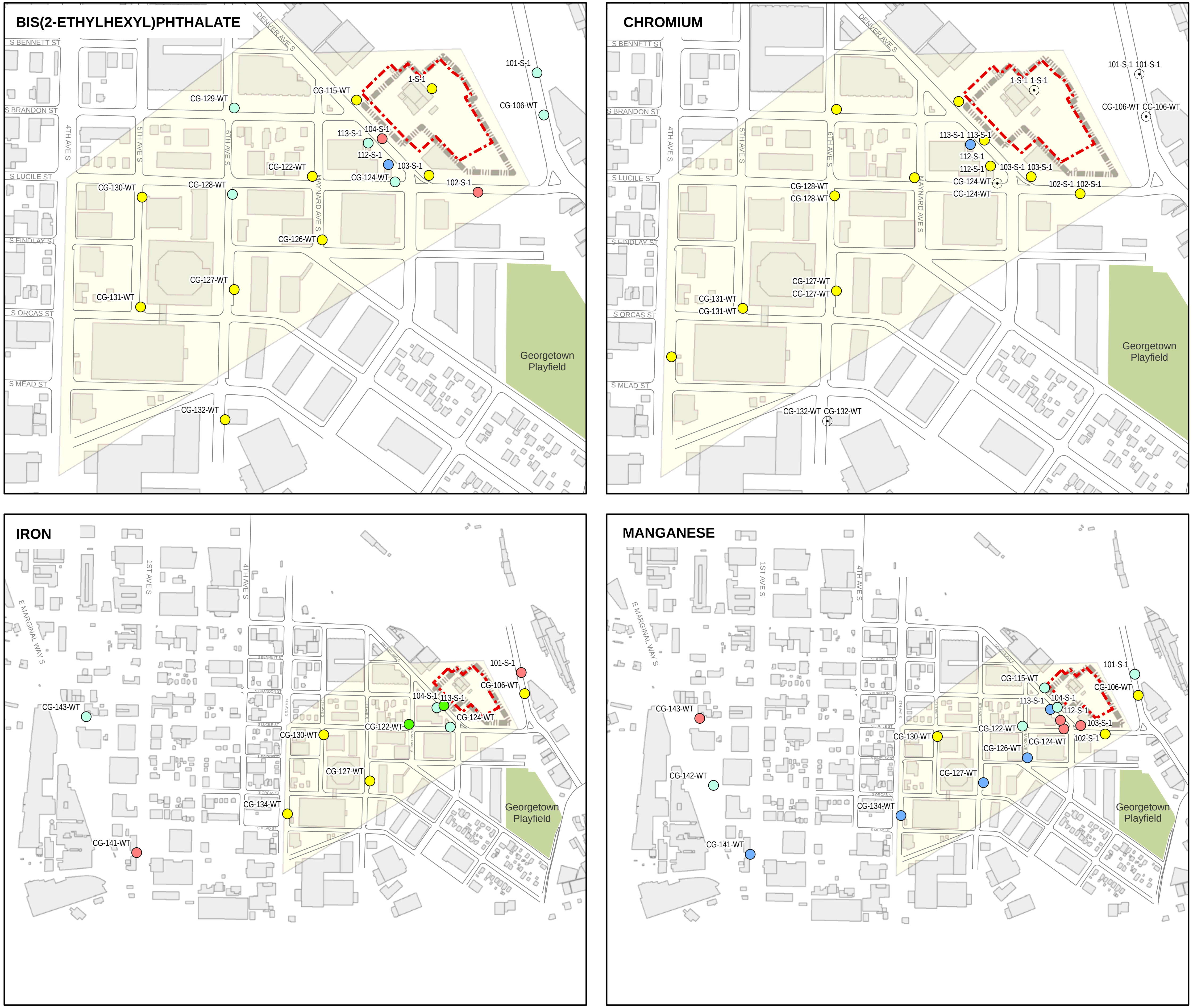
N

0 300 Feet

WATER TABLE WELL
1,2-DICHLOROBENZENE, 1,4-DICHLOROBENZENE,
DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-7

S:\8770_2006\001FS_TechMemo1WT_Dich_Cyanide_021606.mxd

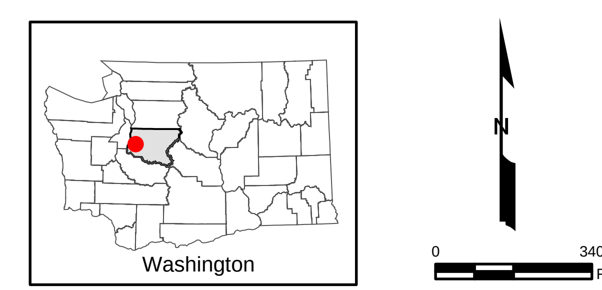


Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



WATER TABLE WELL
BIS(2-ETHYLHEXYL)PHTHALATE, CHROMIUM,
IRON, MANGANESE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-8

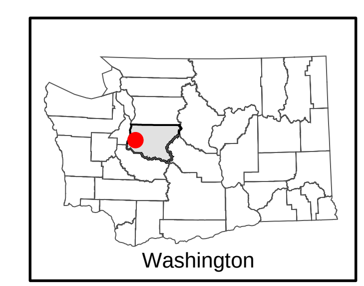
S:\8770_2006\001FS_TechMemo1\WT_bis_Chromium_Fe_Mn_050306.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 2500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

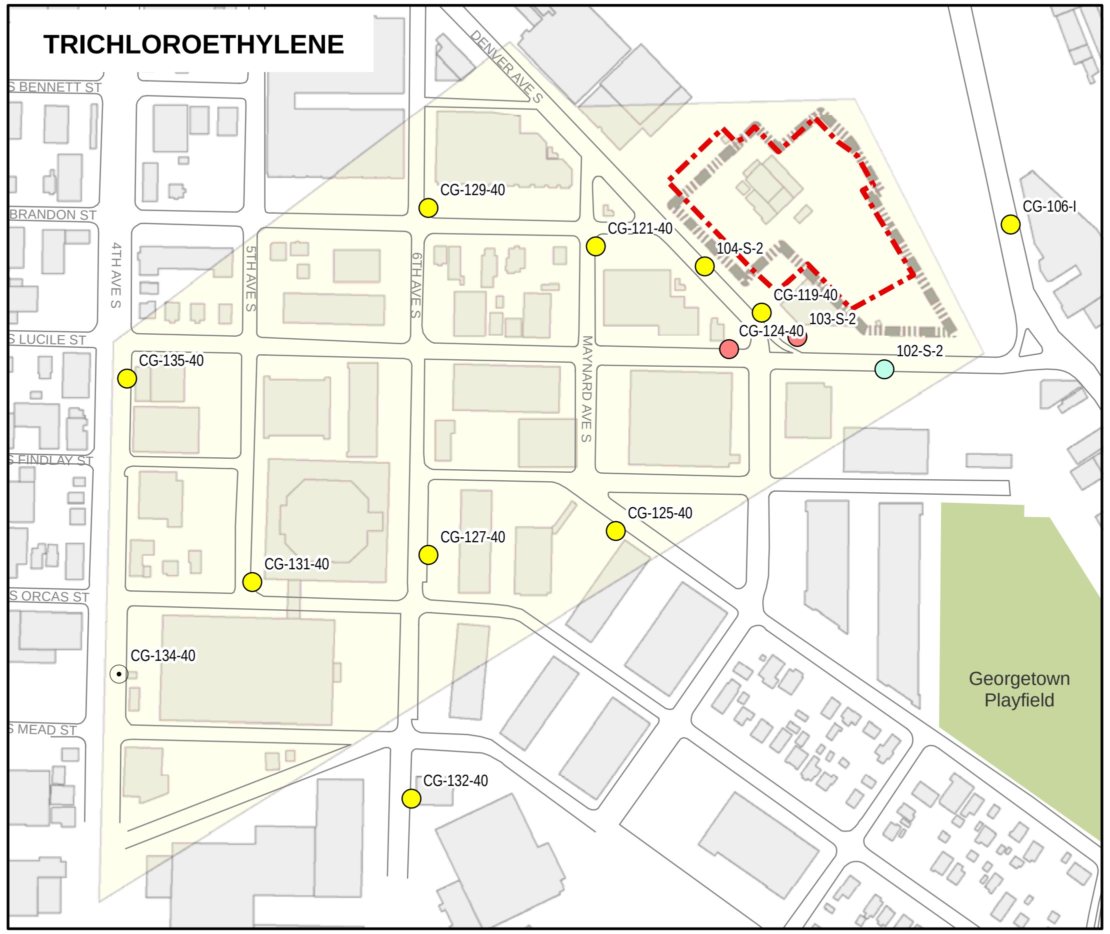


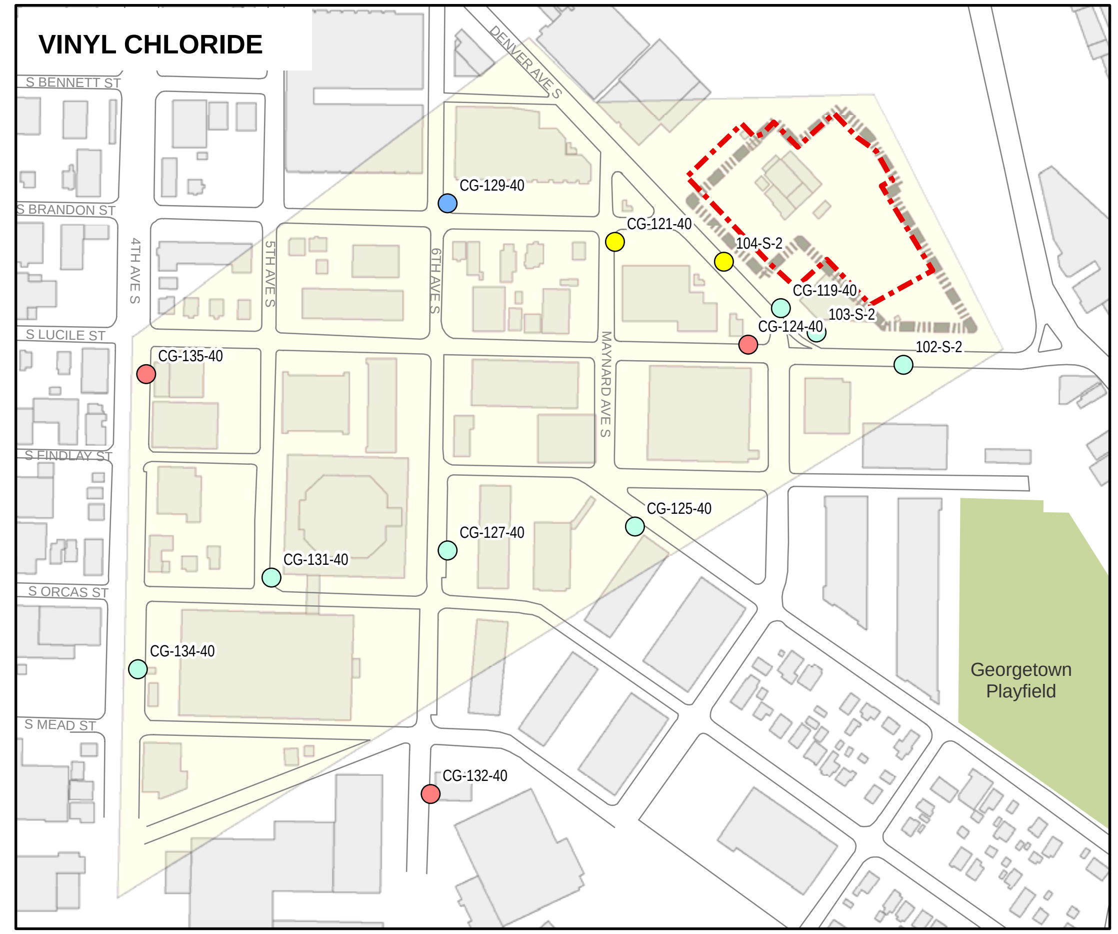
N
0 340 Feet

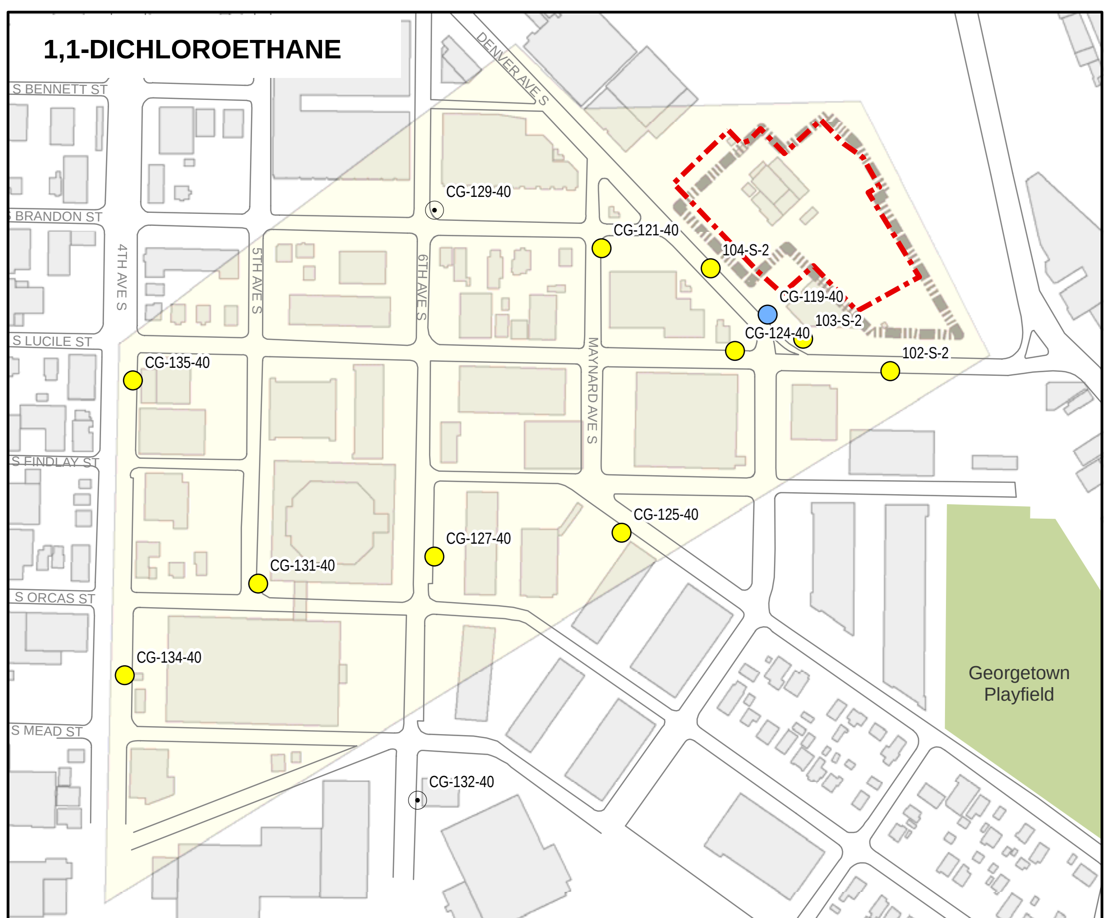
WATER TABLE WELL
ARSENIC, COPPER, NICKEL, BARIUM
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-9

S:\8770_2006\001FS_TechMemo1WT_As_Cu_Ni_Ba_021606.mxd





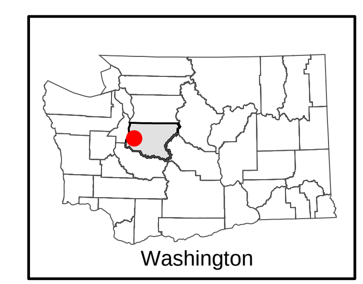


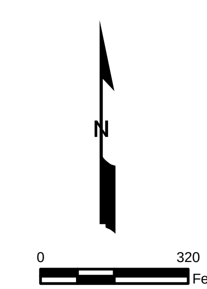
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.





SHALLOW WELL
TRICHLOROETHYLENE, VINYL CHLORIDE
1,1-DICHLOROETHANE
PSC Georgetown
Seattle, Washington

By: klb | Date: 5/03/2006 | Project No. 8770

Geomatrix | Figure **4-10**

S:\8770_2006\001FS_TechMemo1\Sh_Tri_VC_Dich021006.mxd

Explanation

Cleanup Level Ratio

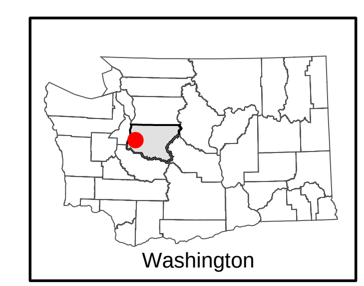
- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected

Barrier Wall

Site Wide Feasibility Study Area

PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



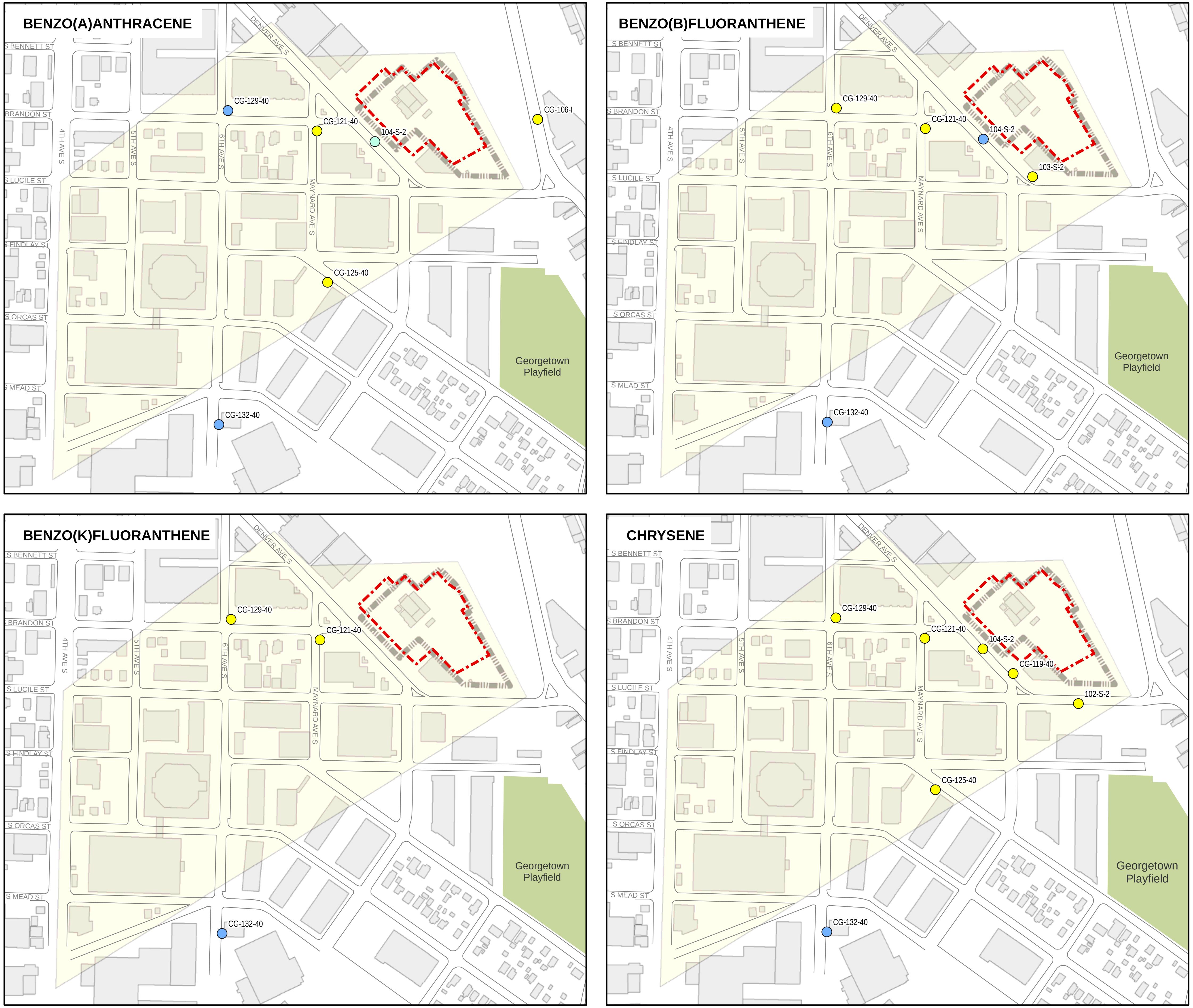
N

0 300 Feet

SHALLOW WELL
BENZENE, NAPHTHALENE,
1,4-DIOXANE, CYANIDE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-11

S:\8770_2006\001FS_TechMemo1\Sh_Ben_Nap_Diox_Cyan_021006.mxd



Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

Washington

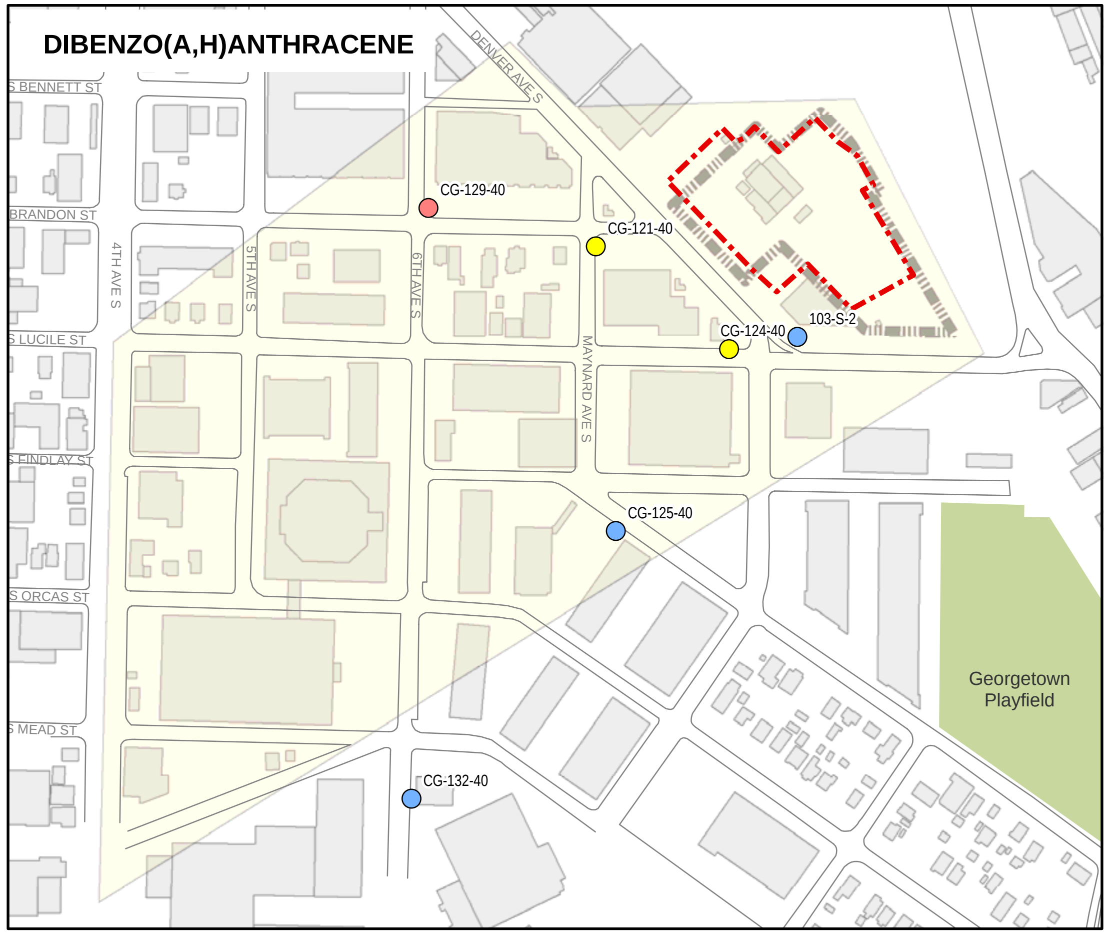
0 320 Feet

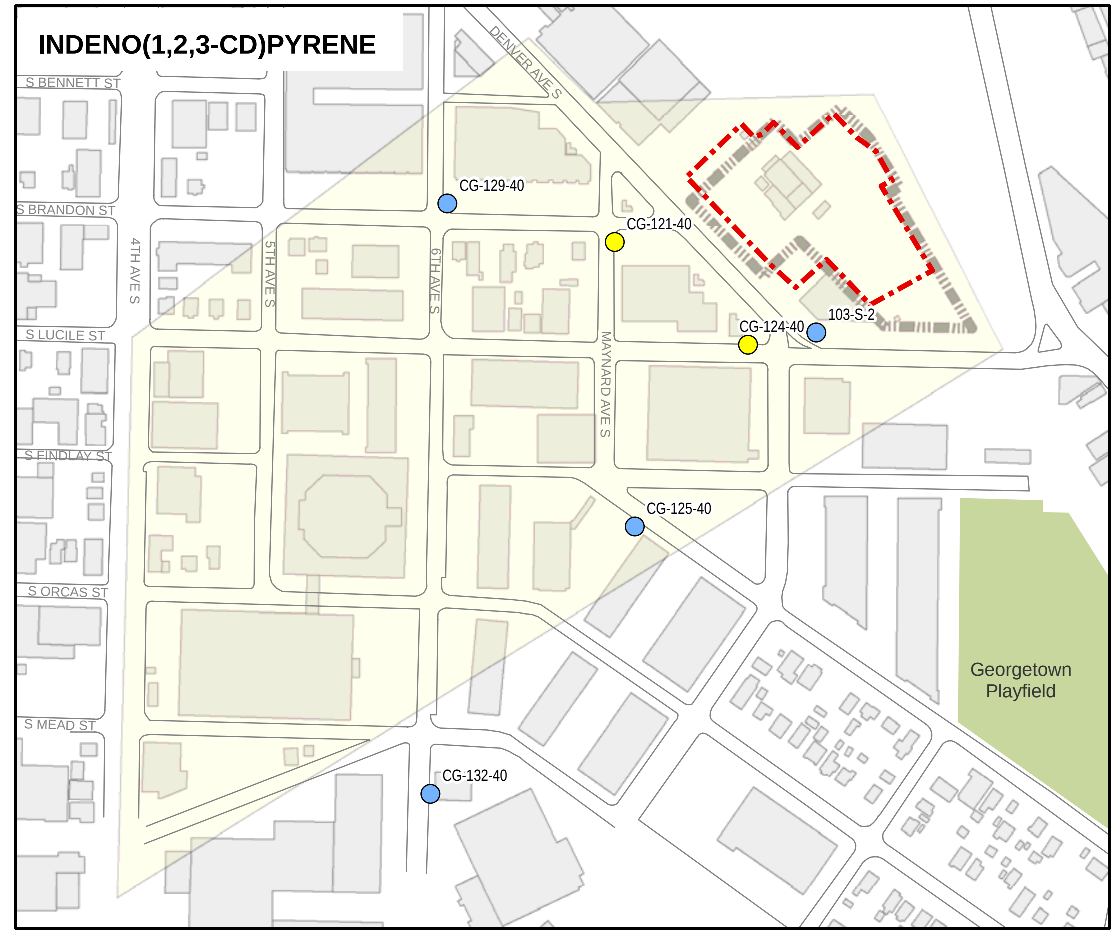
N

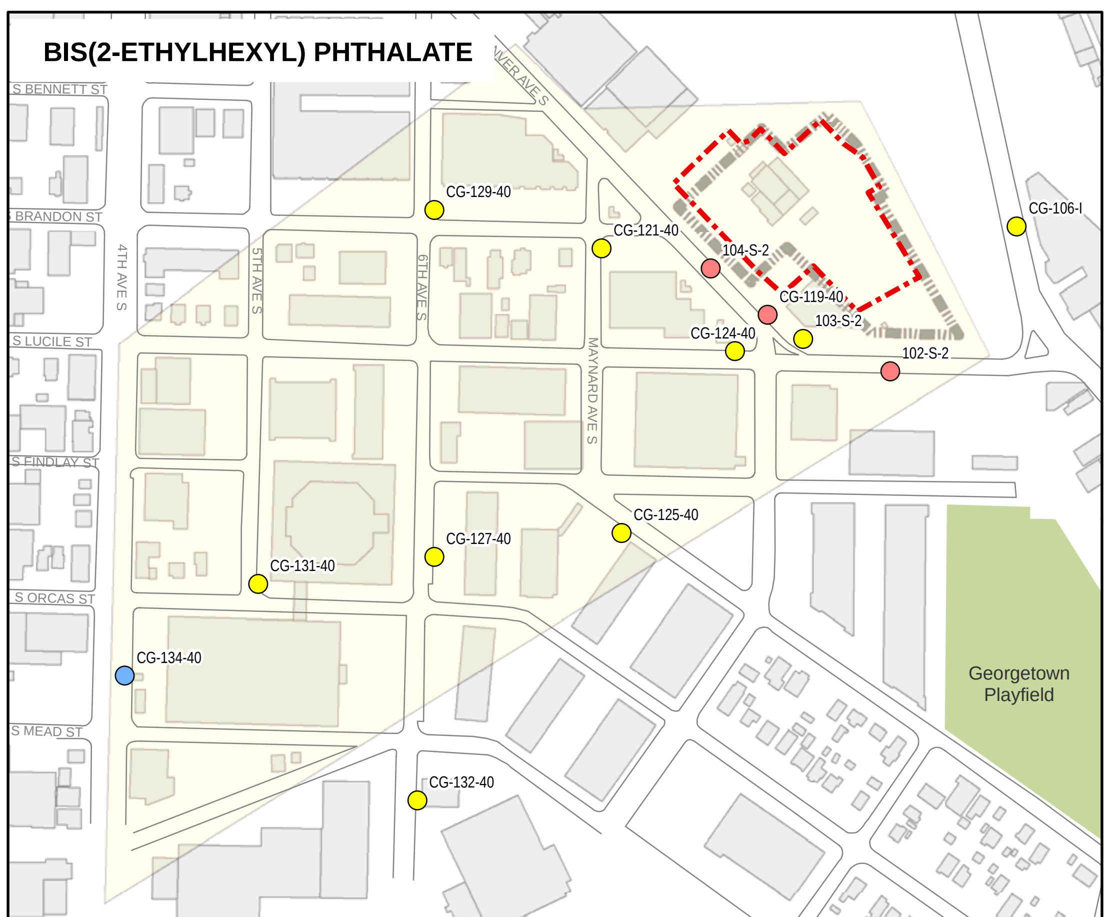
SHALLOW WELL
BENZO(A)ANTHRACENE, BENZO(B)FLUORANTHENE,
BENZO(K)FLUORANTHENE, CHRYSENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-12

S:\8770_2006\001FS_TechMemo1\Sh_Benzo_abk_Chrys050306.mxd





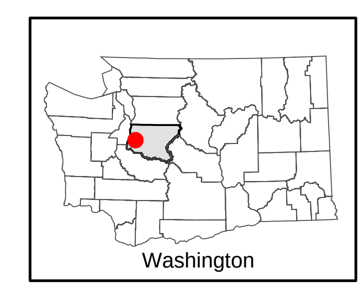


Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



N

0 300 Feet

SHALLOW WELL
DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE,
BIS(2-ETHYLHEXYL) PHTHALATE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-13

S:\8770_2006\001FS_TechMemo1\Sh_Dib_Ind_Bis_050306.mxd

Explanation

Cleanup Level Ratio

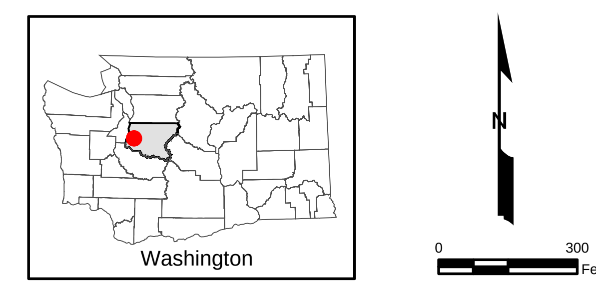
- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected

Barrier Wall

Site Wide Feasibility Study Area

PSC Property

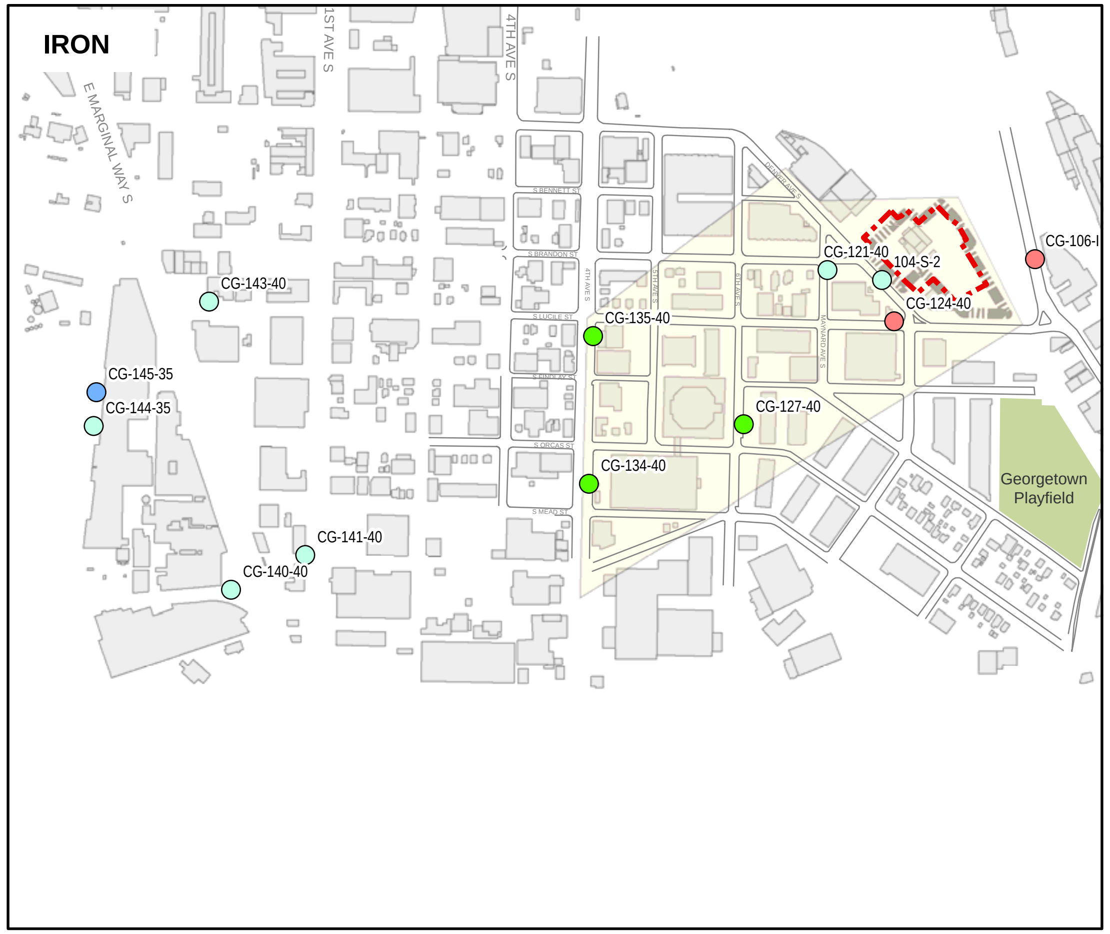
NOTE: Concentrations are normalized to the COC Cleanup Level.

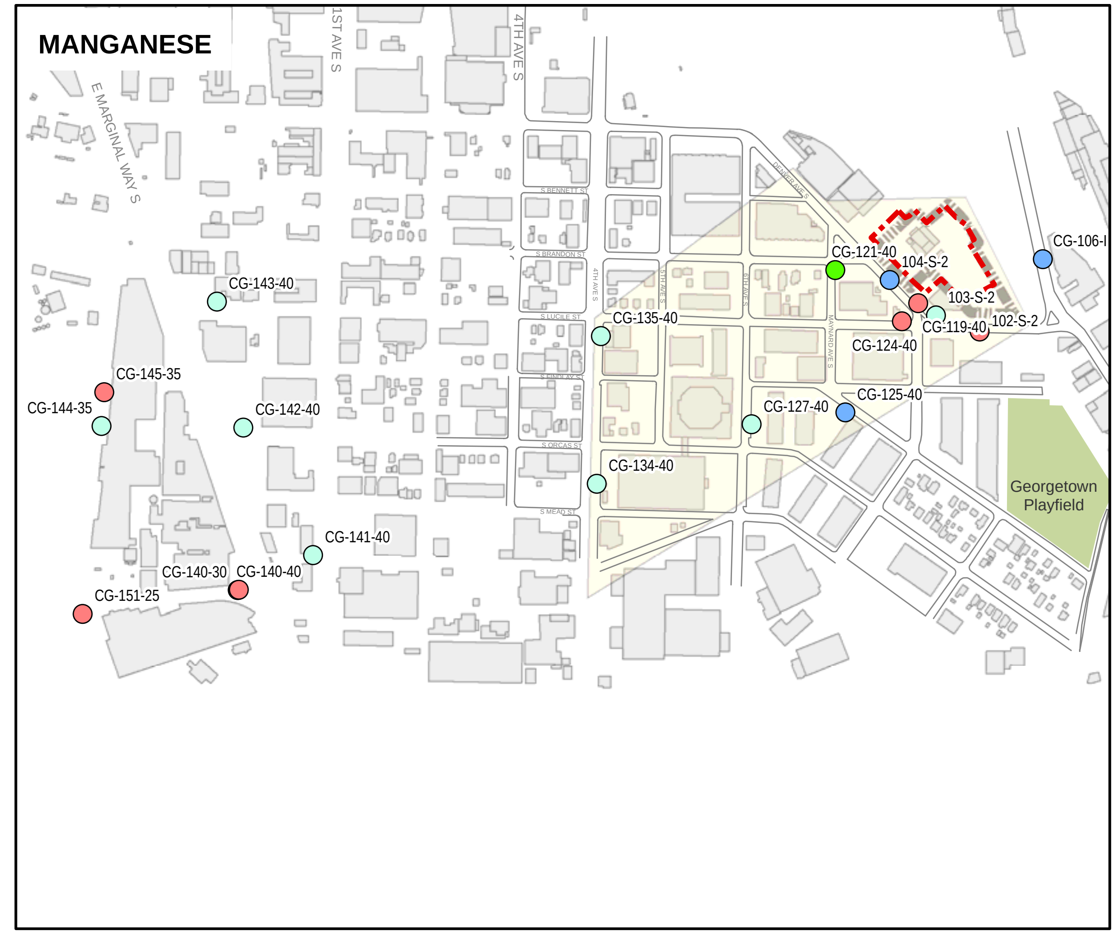


SHALLOW WELL
BARIUM, HEXAVALENT CHROMIUM,
COPPER, ARSENIC
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-14

S:\8770_2006\001FS_TechMemo1\Sh_Bar_Chrom_Cu_021006.mxd



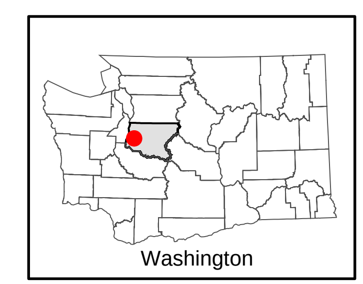


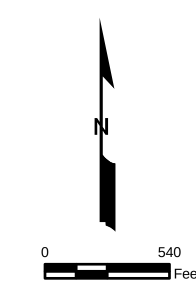
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 200
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

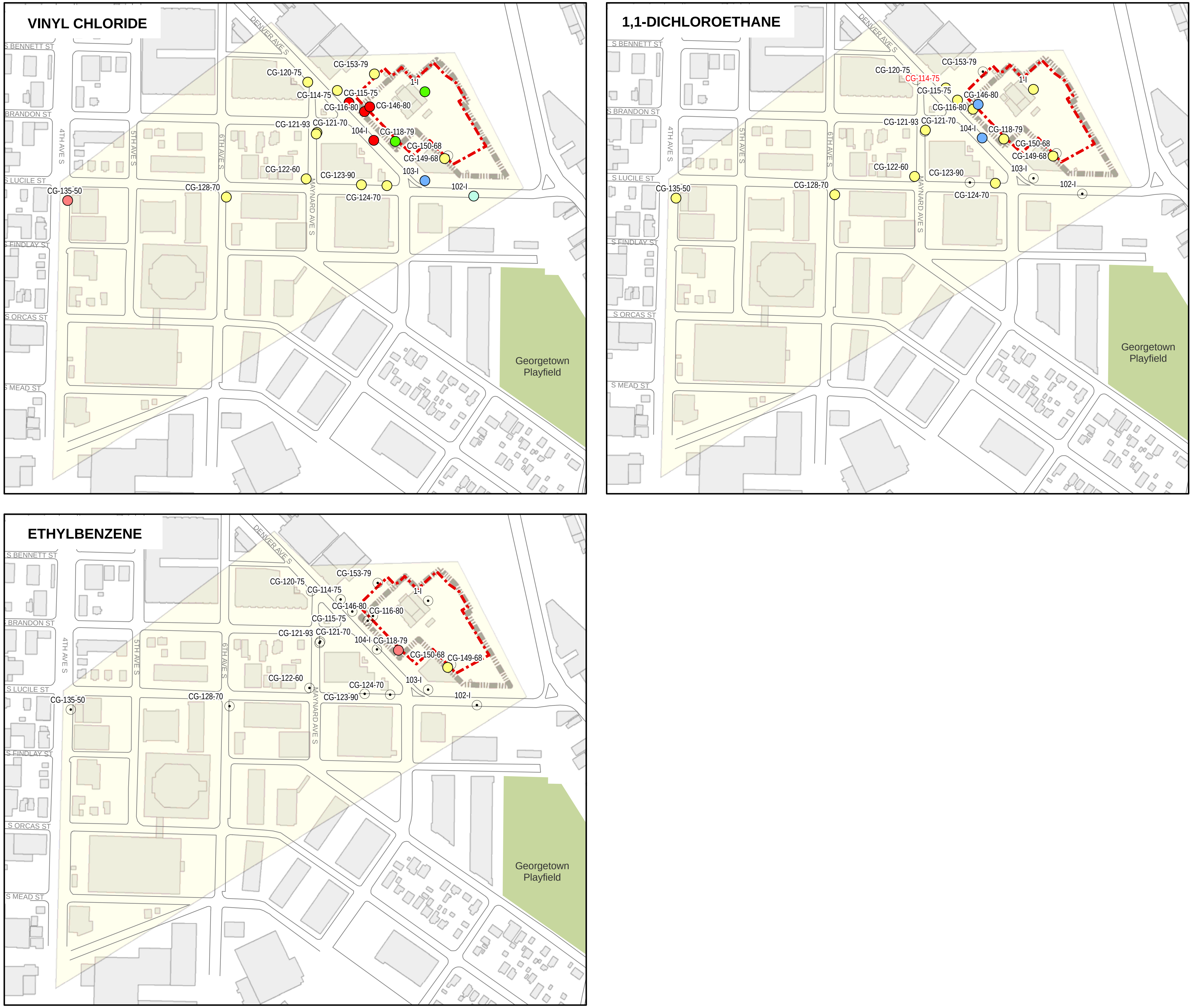




SHALLOW WELL
IRON, MANGANESE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-15

S:\8770_2006\001FS_TechMemo1\Sh_Fe_Mn_021006.mxd

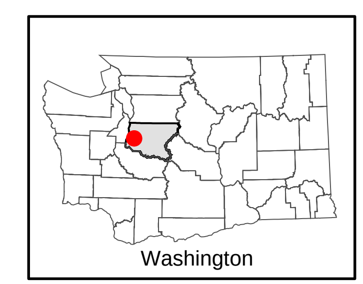


Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



N

0 300 Feet

INTERMEDIATE WELL
VINYL CHLORIDE, 1,1-DICHLOROETHANE,
ETHYLBENZENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-16

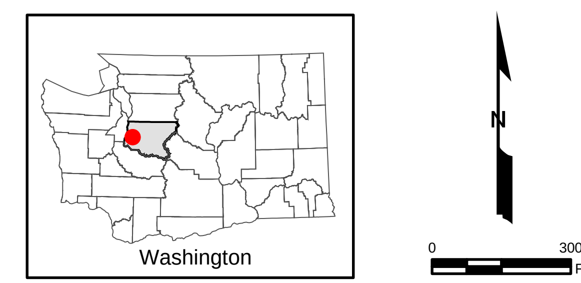
S:\8770_2006\001FS_TechMemo1\Int_VC_DICH_Ethyl021506.mxd

Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

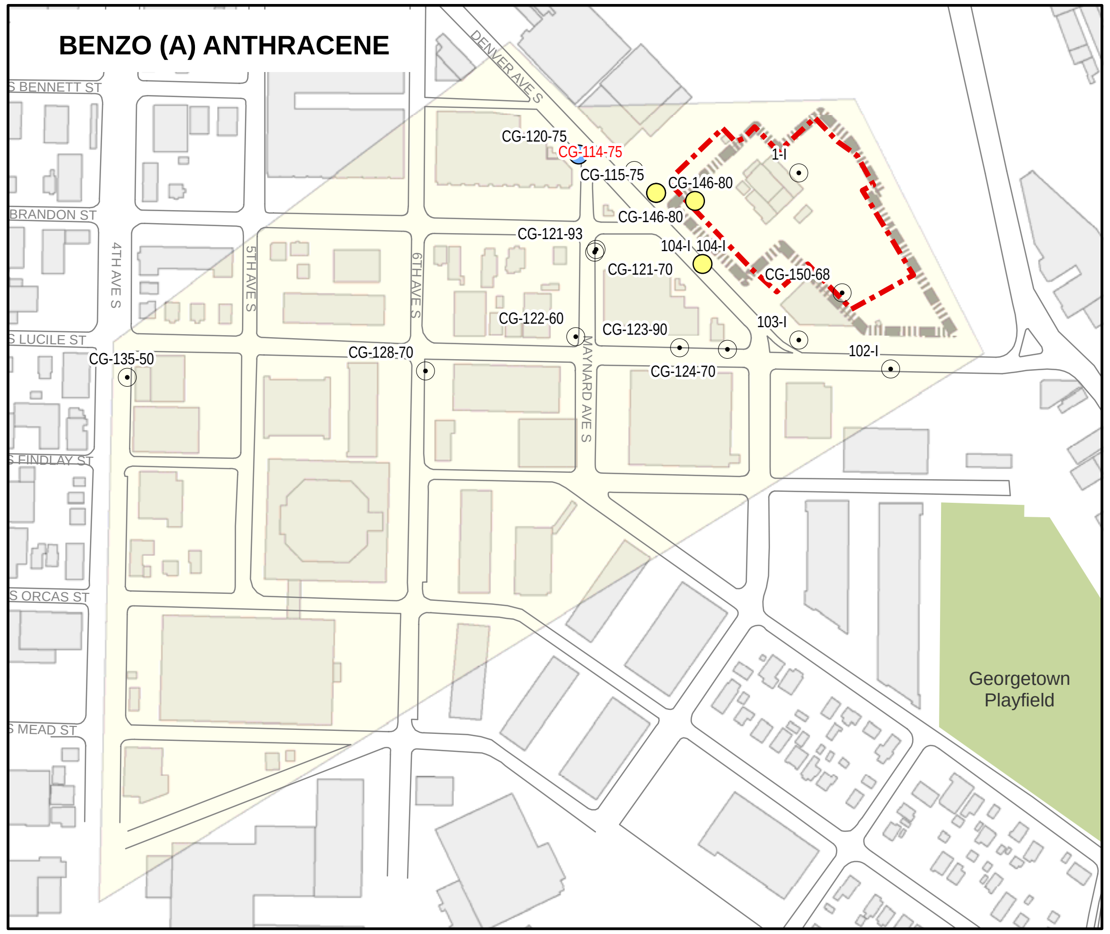
NOTE: Concentrations are normalized to the COC Cleanup Level.

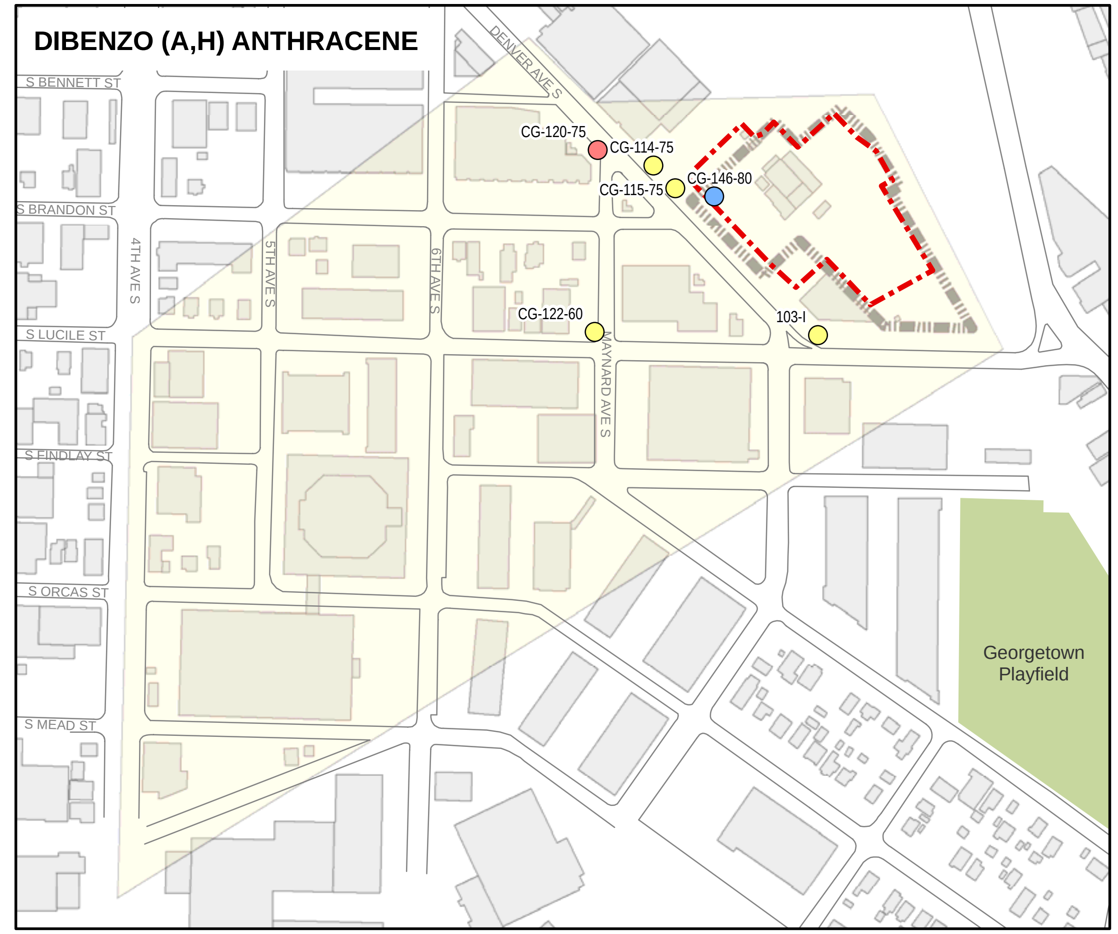


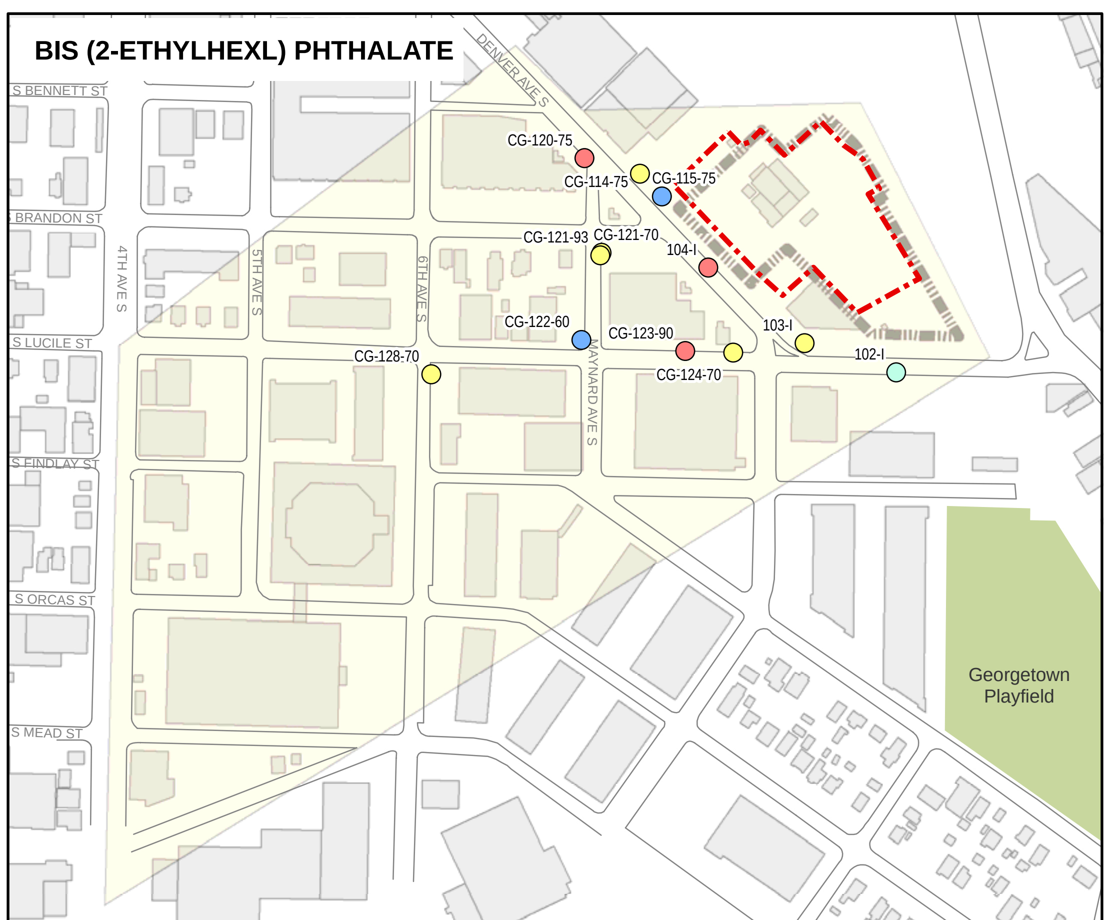
INTERMEDIATE WELL
BENZO (B) FLUORANTHENE, BENZO (K) FLUORANTHENE,
CHRYSENE, INDENO (1,2,3-CD) PYRENE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-17

S:\8770_2006\001FS_TechMemo1\Int_Benzo_Chry_Indeno_021506.mxd





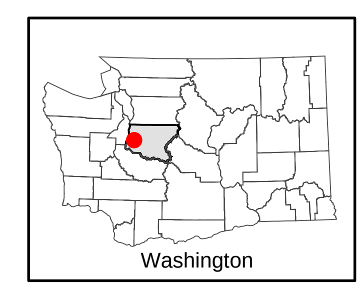


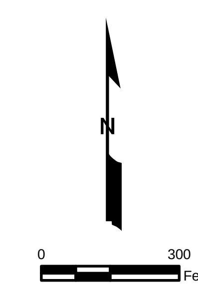
Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

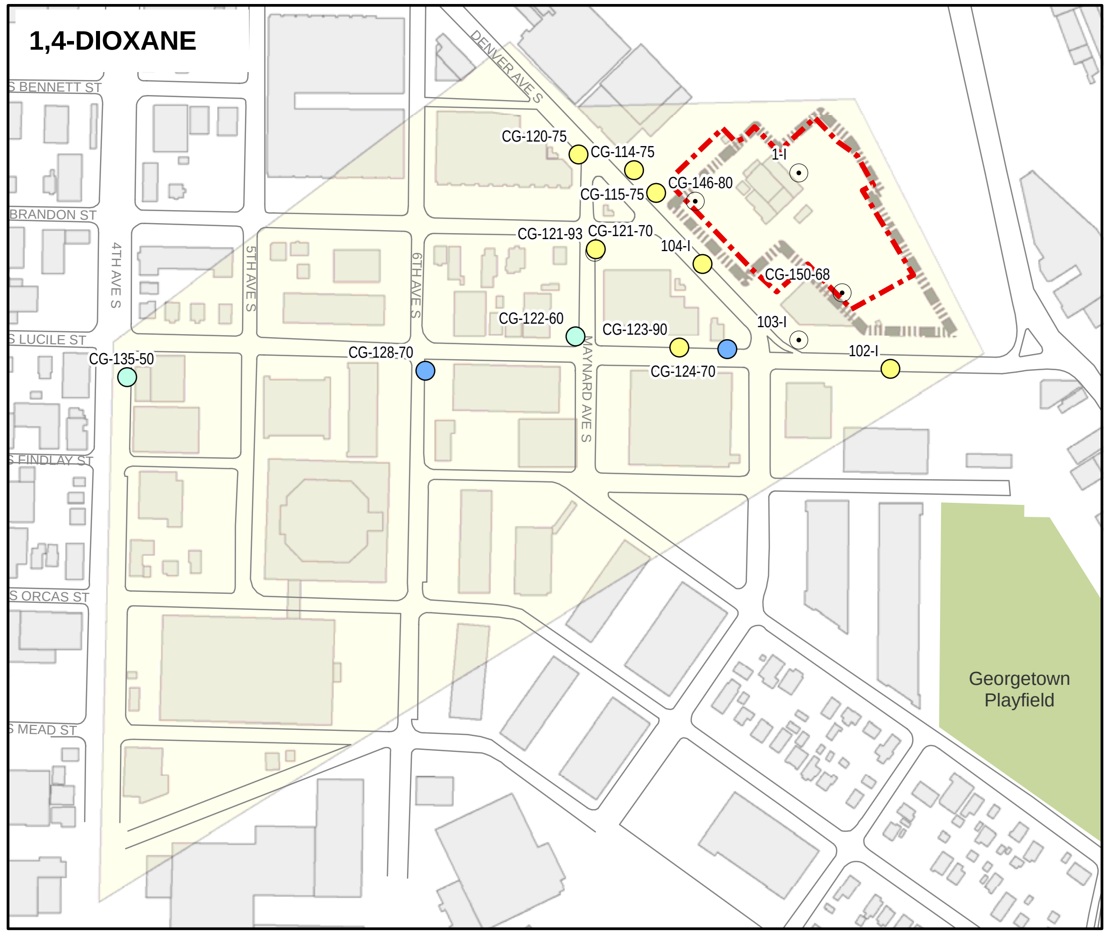


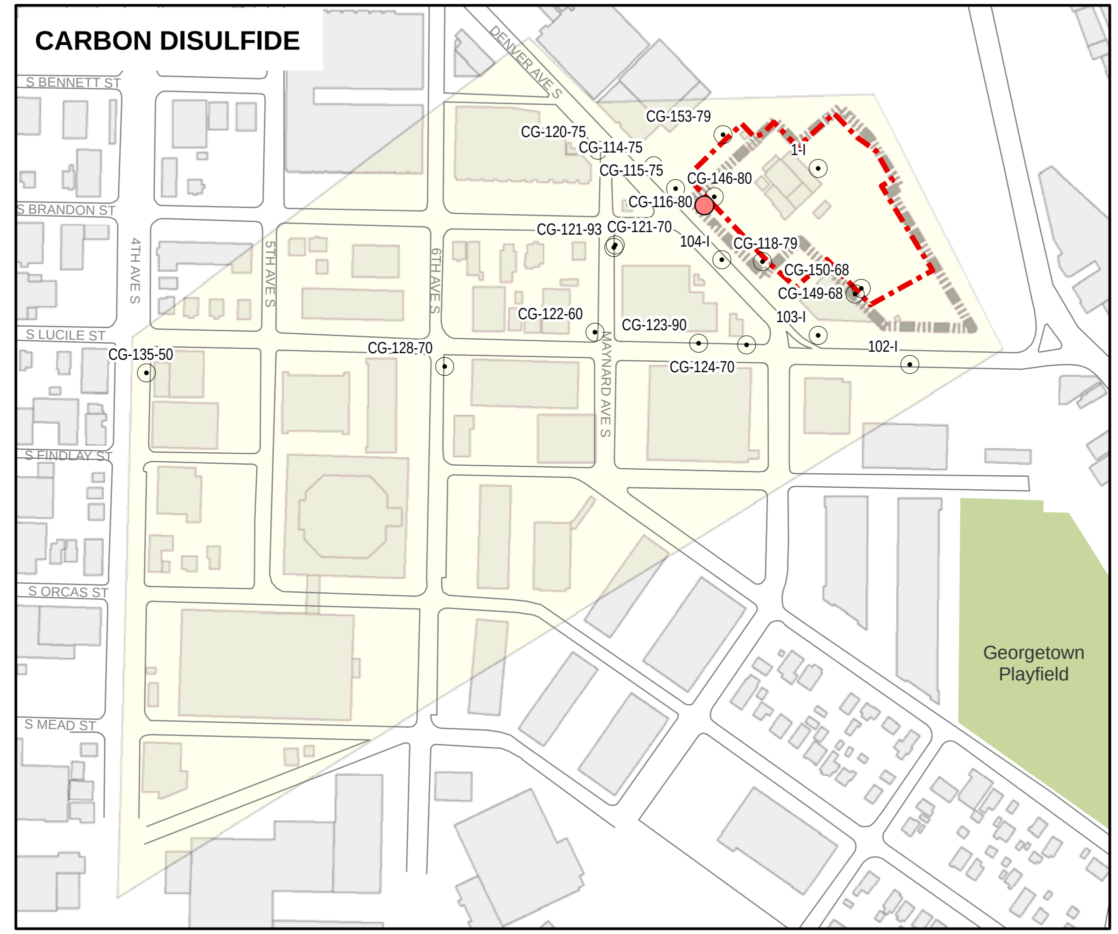


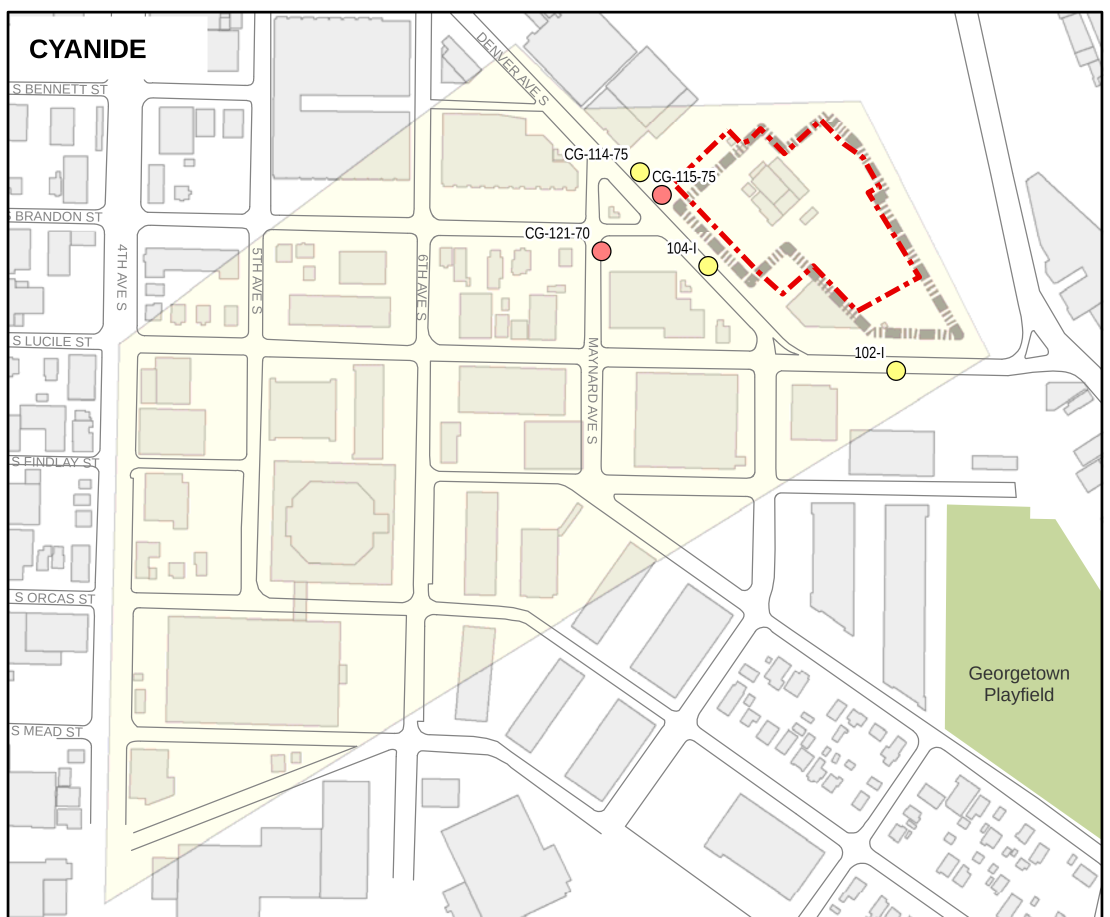
INTERMEDIATE WELL
BENZO(A)ANTHRACENE, DIBENZO(A,H)ANTHRACENE,
BIS(2-ETHYLHEXL) PHTHALATE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-18

S:\8770_2006\001FS_TechMemo1\Int_Benzo_DIB_BIS_050306.mxd





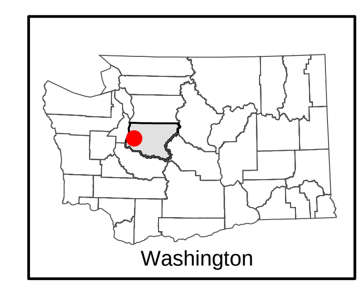


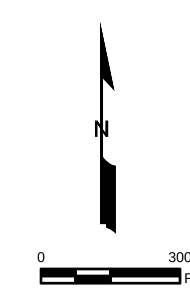
Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

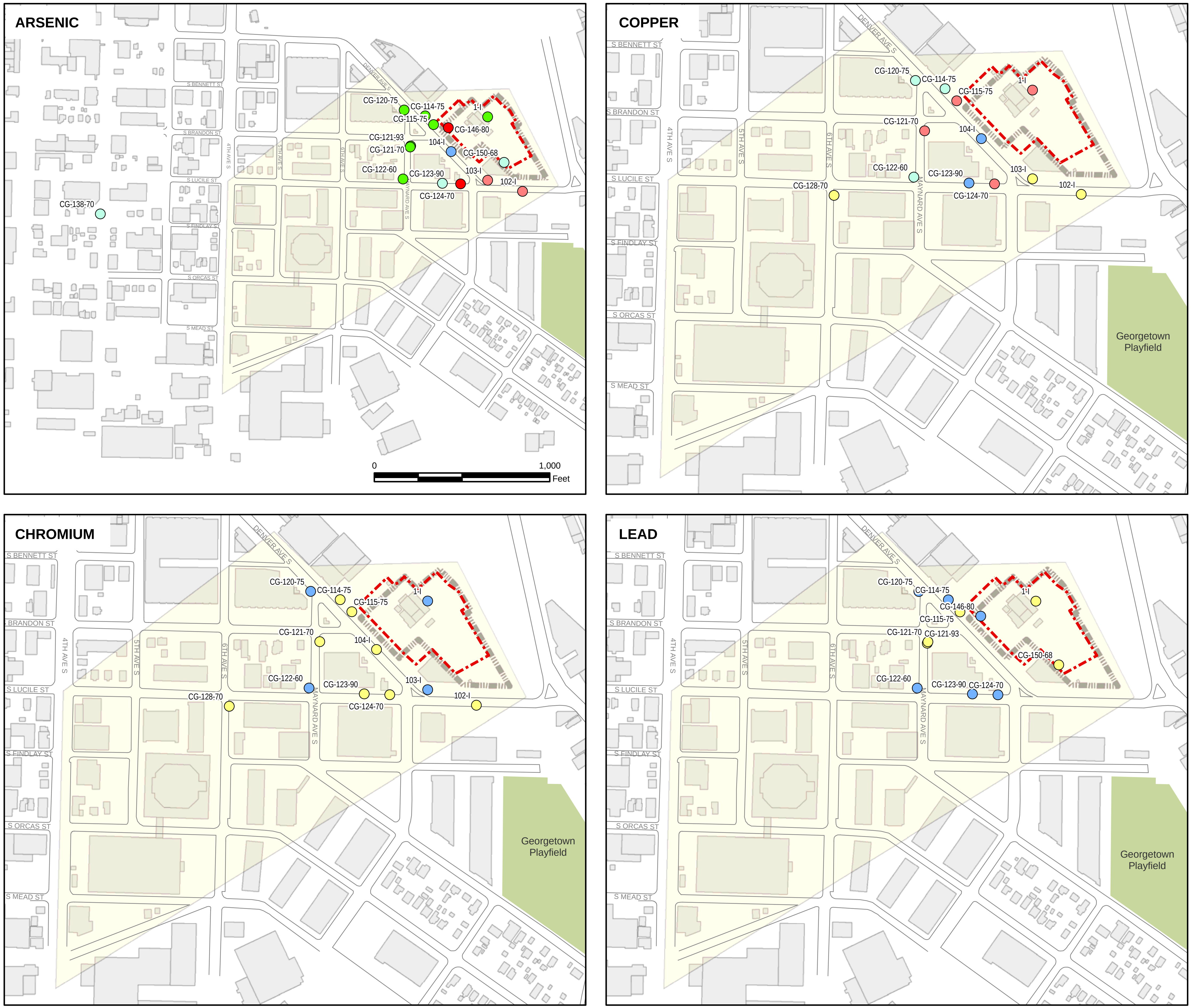




INTERMEDIATE WELL
1,4-DIOXANE, CARBON DISULFIDE, CYANIDE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-19

S:\8770_2006\001FS_TechMemo1\Int_Dio_CarbonDi_Cyan_021506.mxd

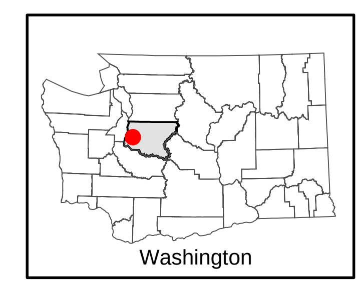


Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



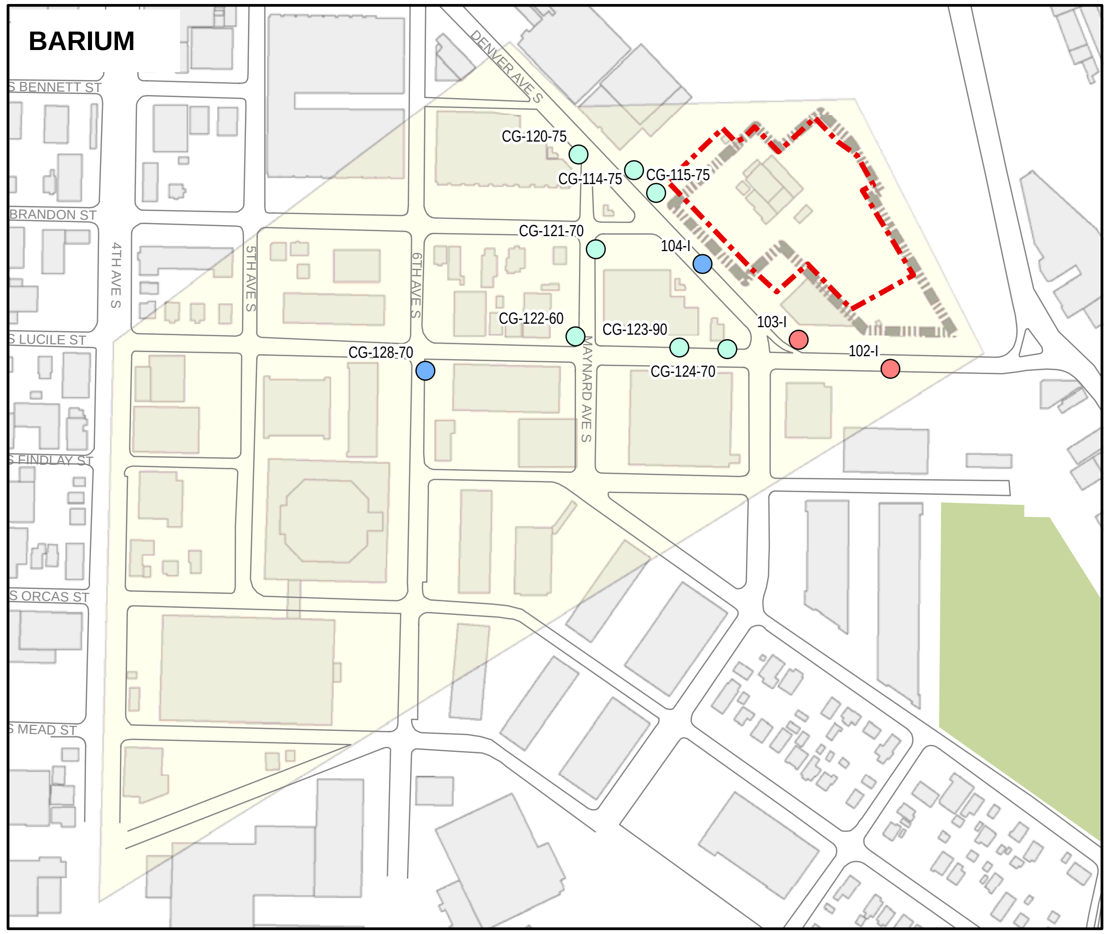
N

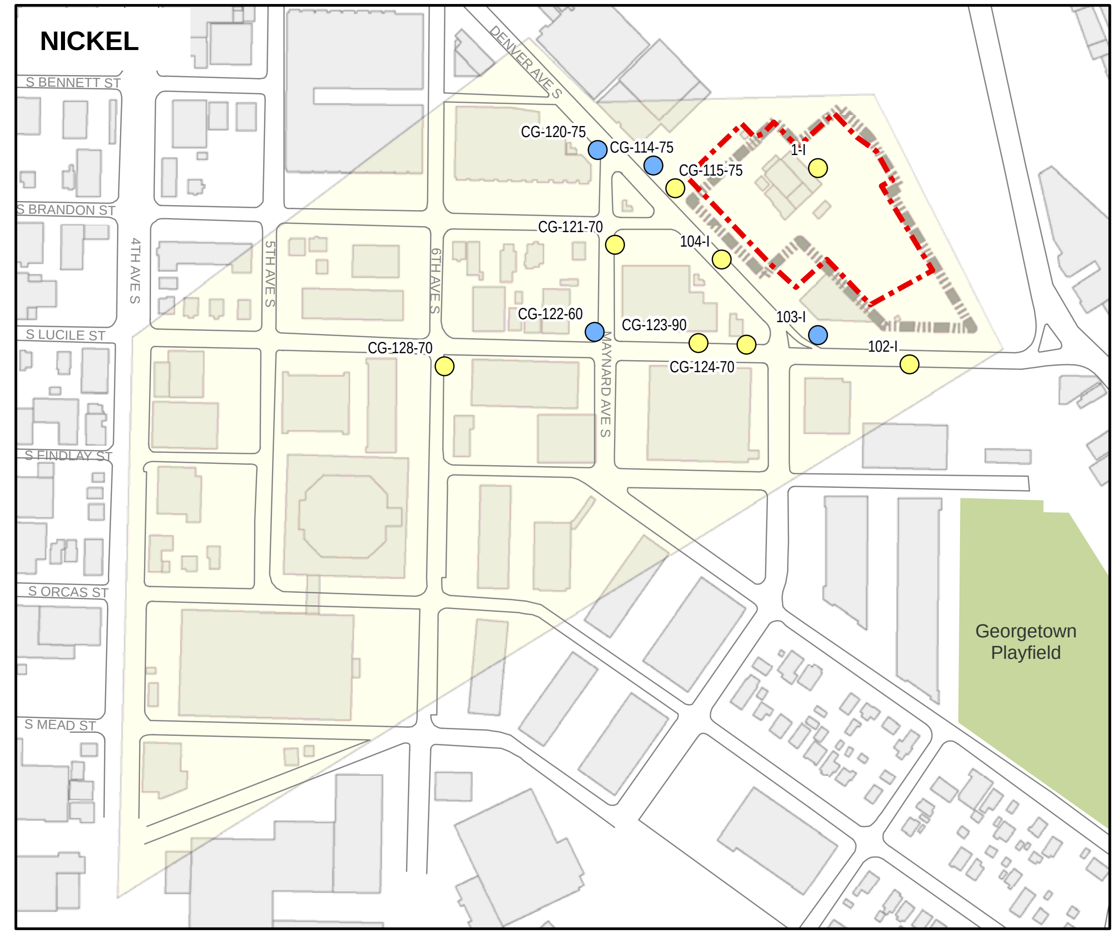
0 300 Feet

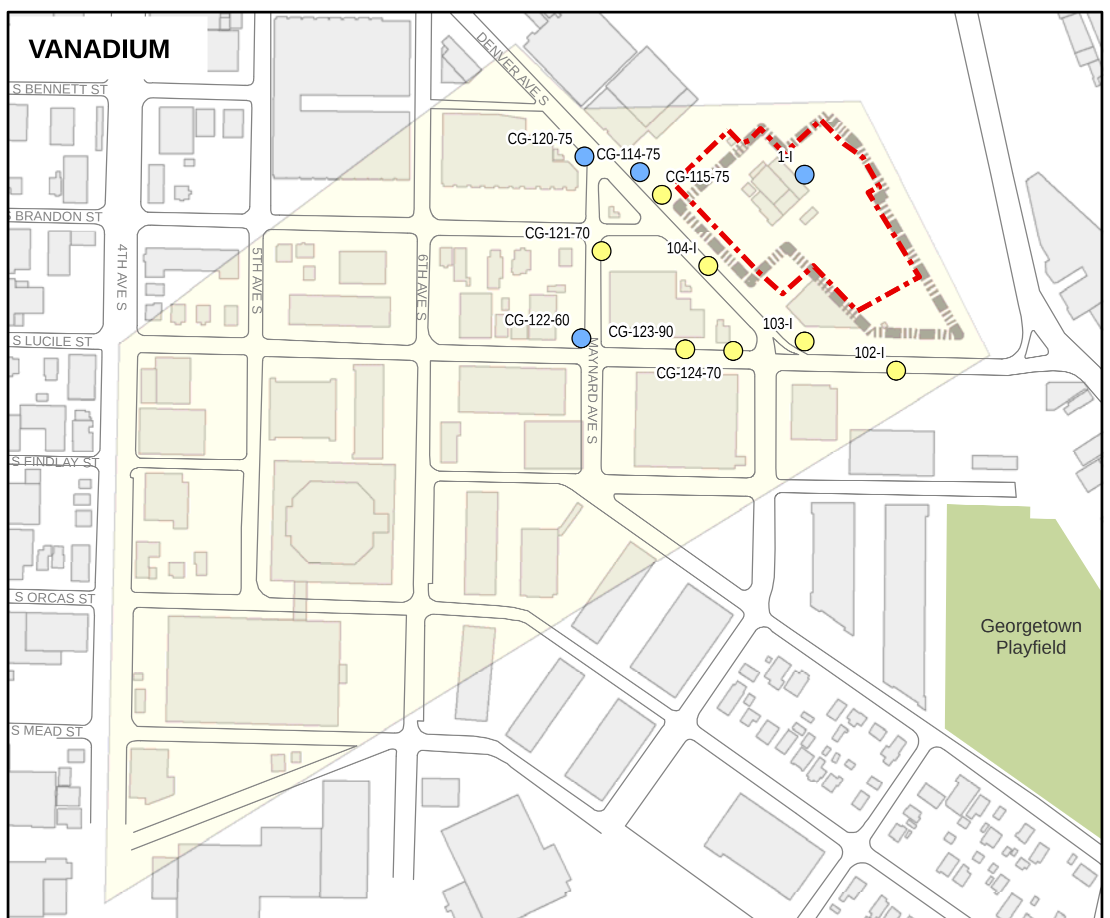
INTERMEDIATE WELL
ARSENIC, COPPER, CHROMIUM, LEAD
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-20

S:\8770_2006\001FS_TechMemo1\Int_As_Cu_Ch_Pb__021506.mxd





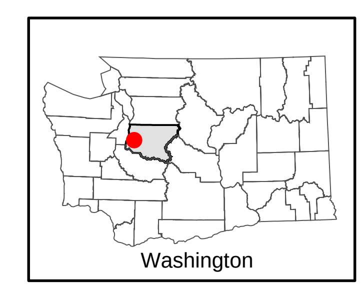


Explanation

Cleanup Level Ratio

- 0-1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 12500
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



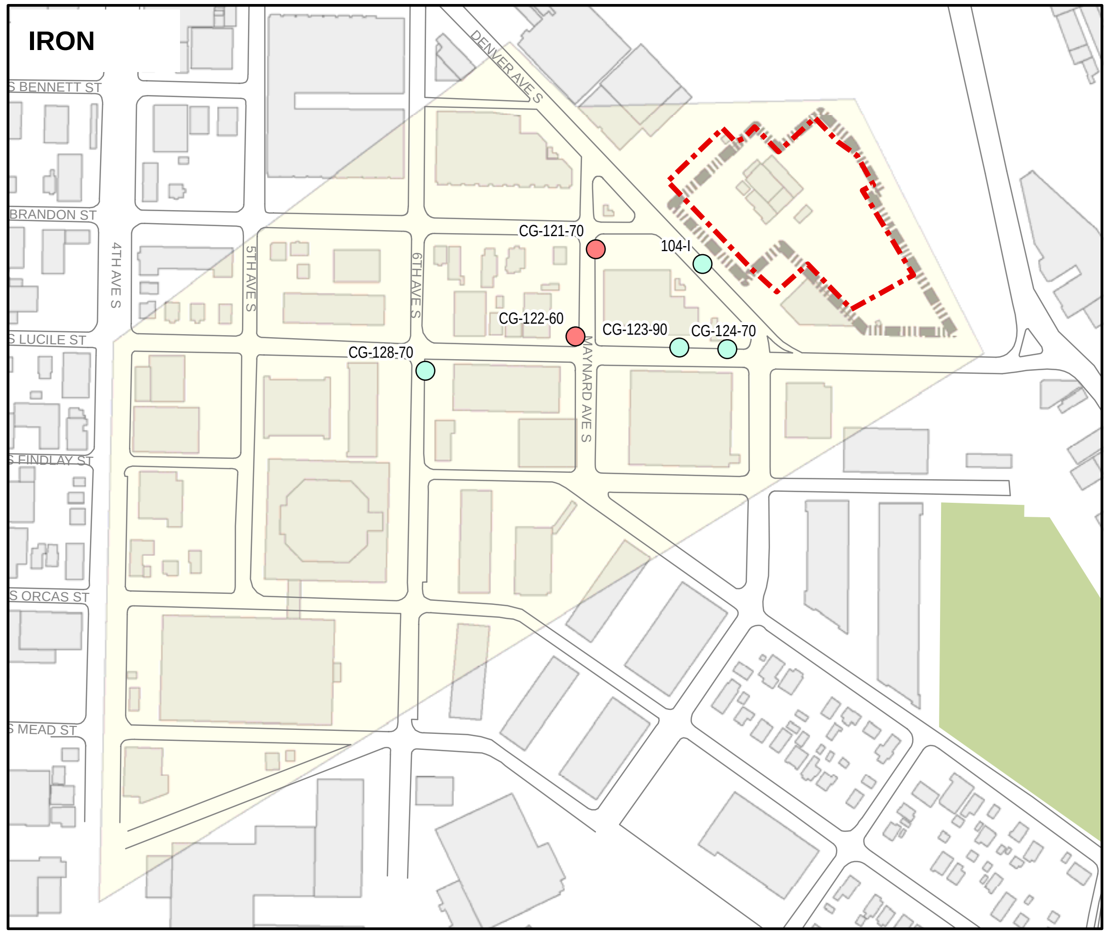
N

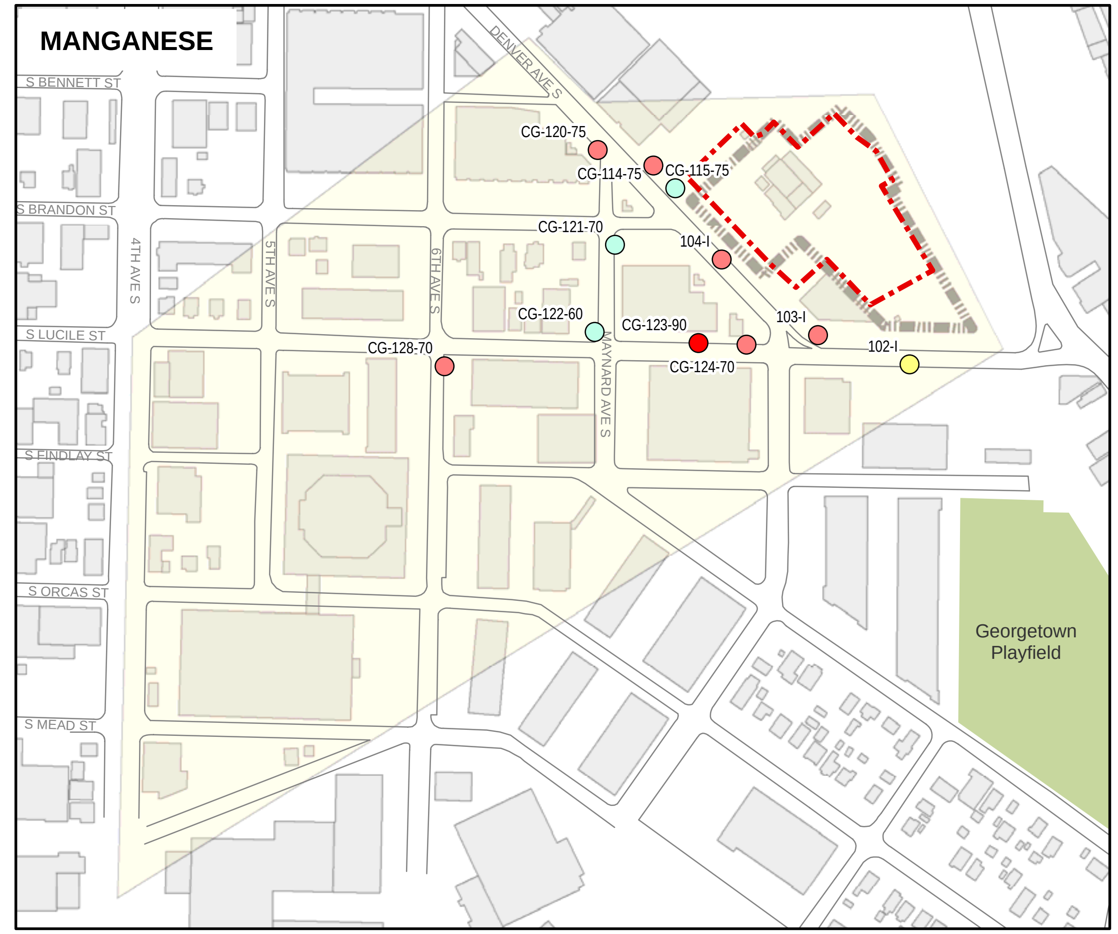
0 300 Feet

INTERMEDIATE WELL
BARIUM, NICKEL, VANADIUM
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-21

S:\8770_2006\001FS_TechMemo1\Int_Ba_Ni_Va_021506.mxd



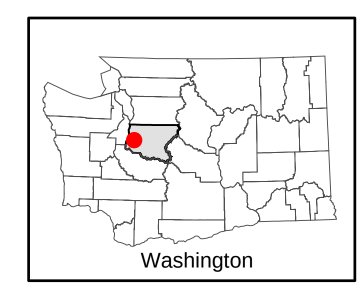


Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- 50.01 - 70000
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



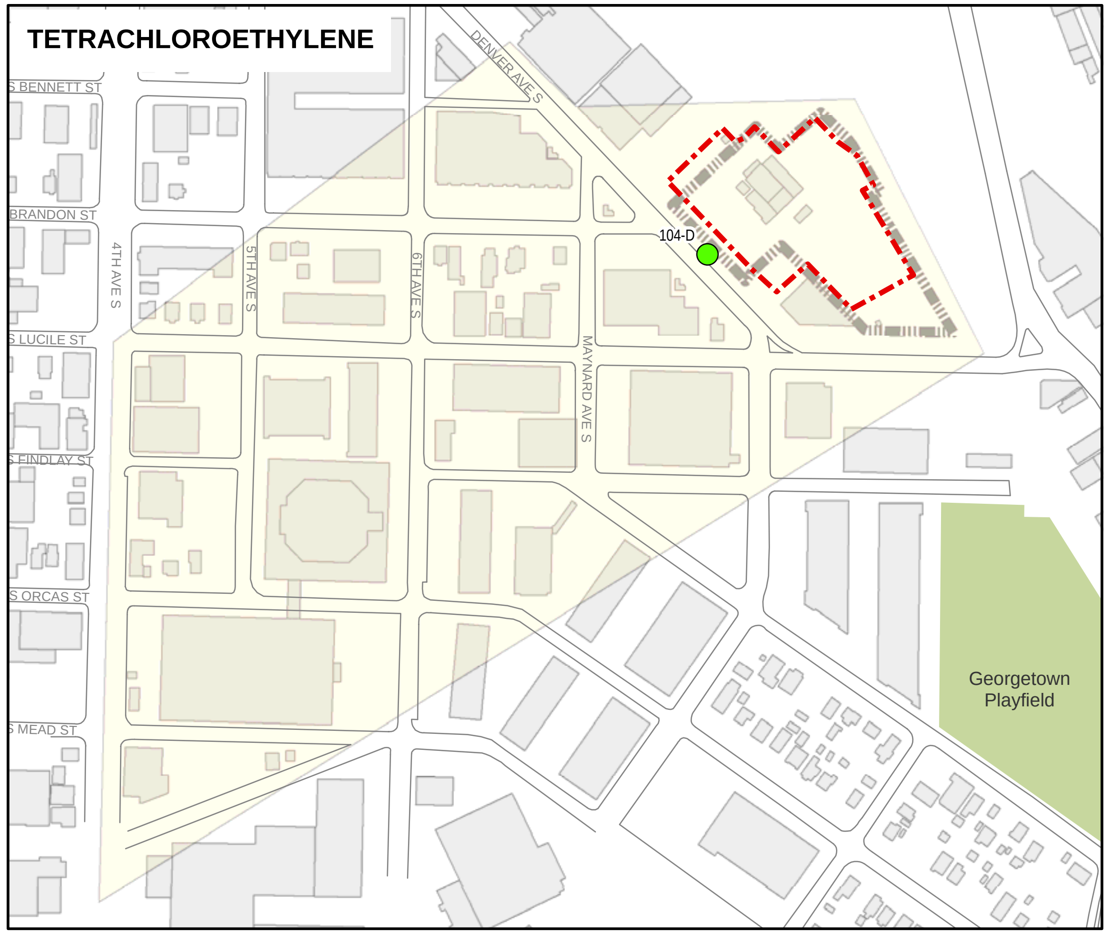
N

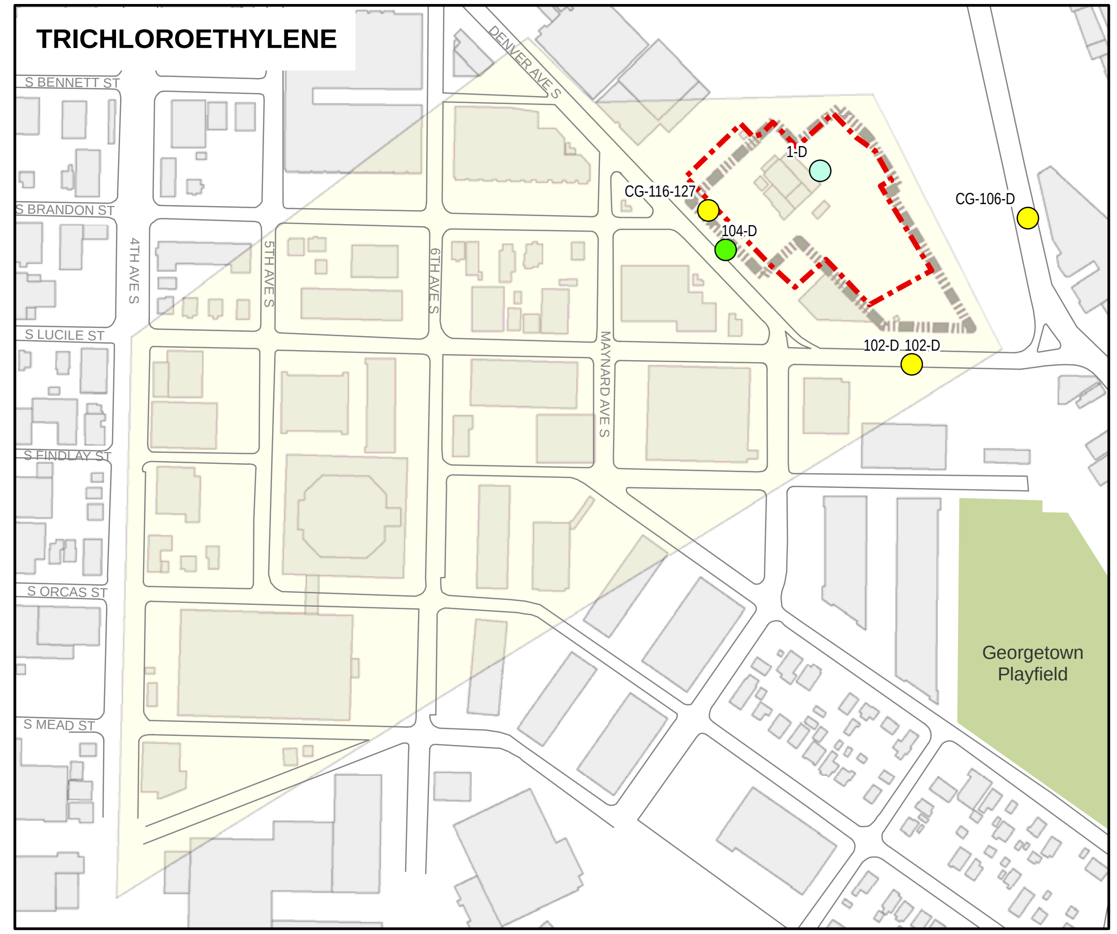
0 300 Feet

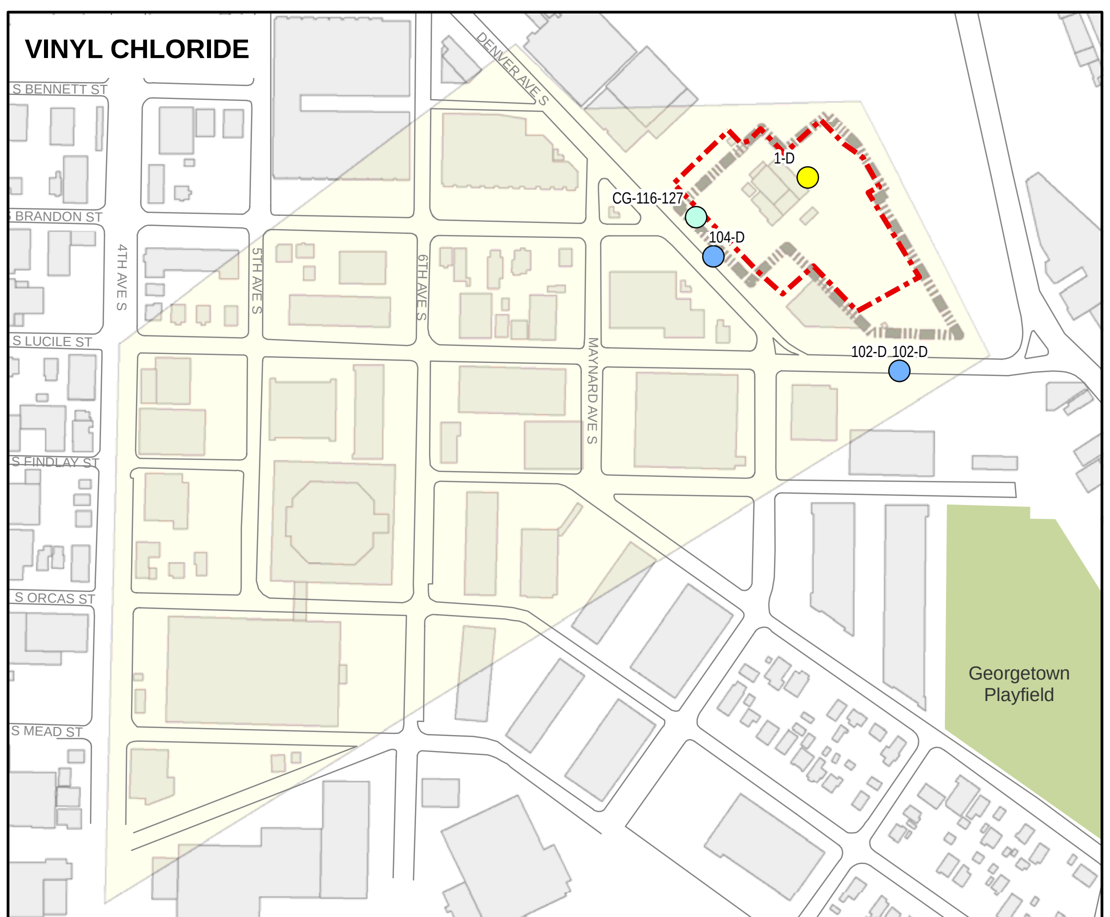
INTERMEDIATE WELL
IRON, MANGANESE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-22

S:\8770_2006\001FS_TechMemo1\Int_Mn_Fe_021506.mxd





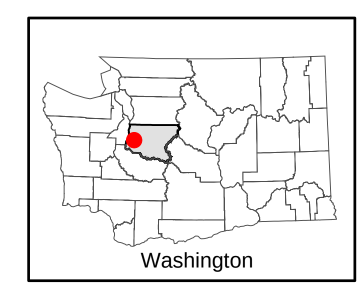


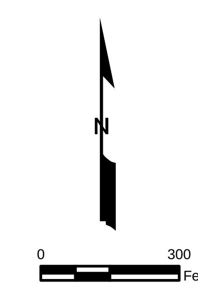
Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.





DEEP WELL
TETRACHLOROETHYLENE, TRICHLOROETHYLENE
VINYL CHLORIDE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-23

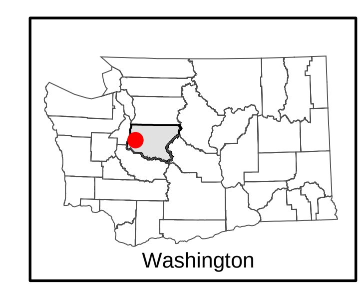
S:\8770_2006\001FS_TechMemo01\Deep_Tetra_Tric_VC_050306.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



0 300 Feet

DEEP WELL
CHRYSENE, DIESEL.
BIS(2-ETHYLHEXYL) PHTHALATE,
CARBON DISULFIDE,
PSC Georgetown
Seattle, Washington

By: klb | Date: 5/03/2006 | Project No. 8770

Geomatrix | Figure **4-24**

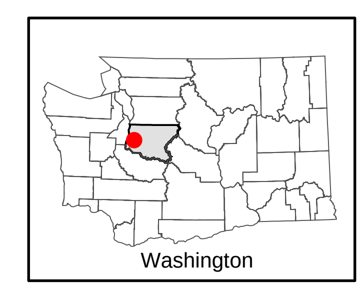
S:\8770_2006\001FS_TechMemo01\Deep_BIS_Carb_021606.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 900
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.

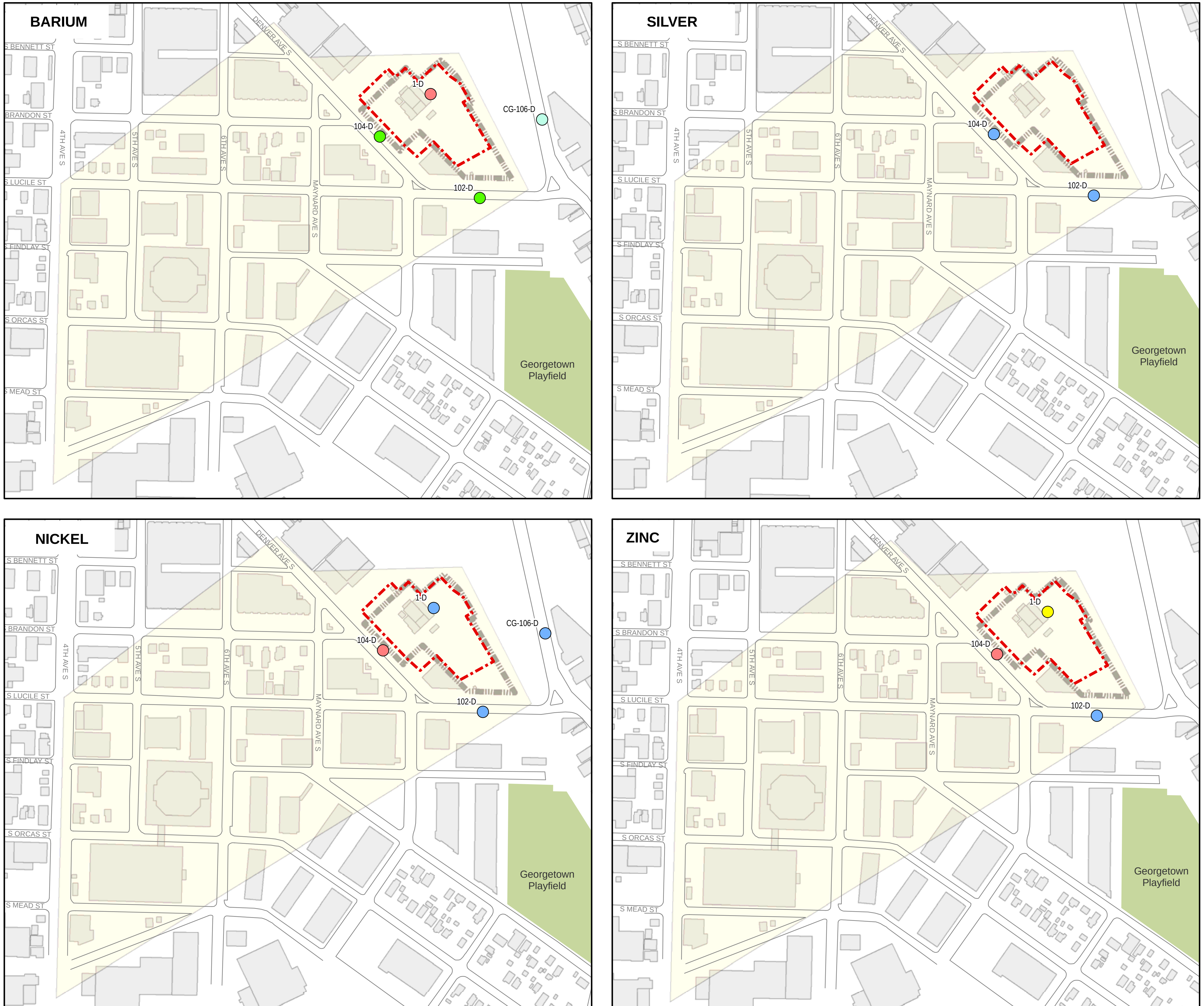


N
0 300 Feet

DEEP WELL
ARSENIC, CHROMIUM, SELENIUM,
HEXAVALENT CHROMIUM
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-25

S:\8770_2006\001FS_TechMemo1\Deep_As_Ch_Se_Zn021506.mxd

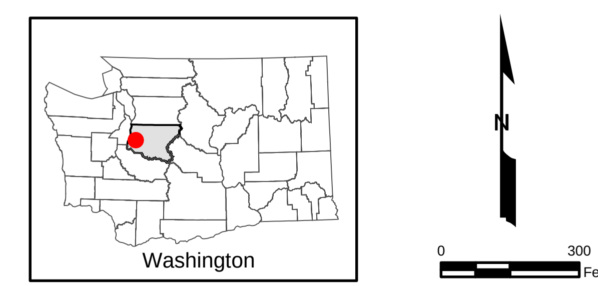


Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



DEEP WELL
BARIUM, SILVER, NICKEL, ZINC
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-26

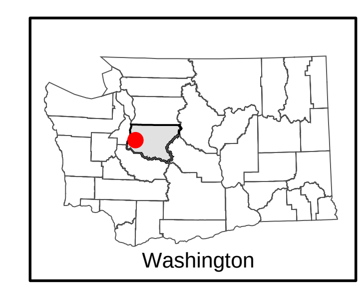
S:\8770_2006\001FS_TechMemo1\Deep_Ba_Ag_Ni021506.mxd

Explanation

Cleanup Level Ratio

- 0 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 20
- 20.01 - 50
- Constituent Not Detected
- Barrier Wall
- Site Wide Feasibility Study Area
- PSC Property

NOTE: Concentrations are normalized to the COC Cleanup Level.



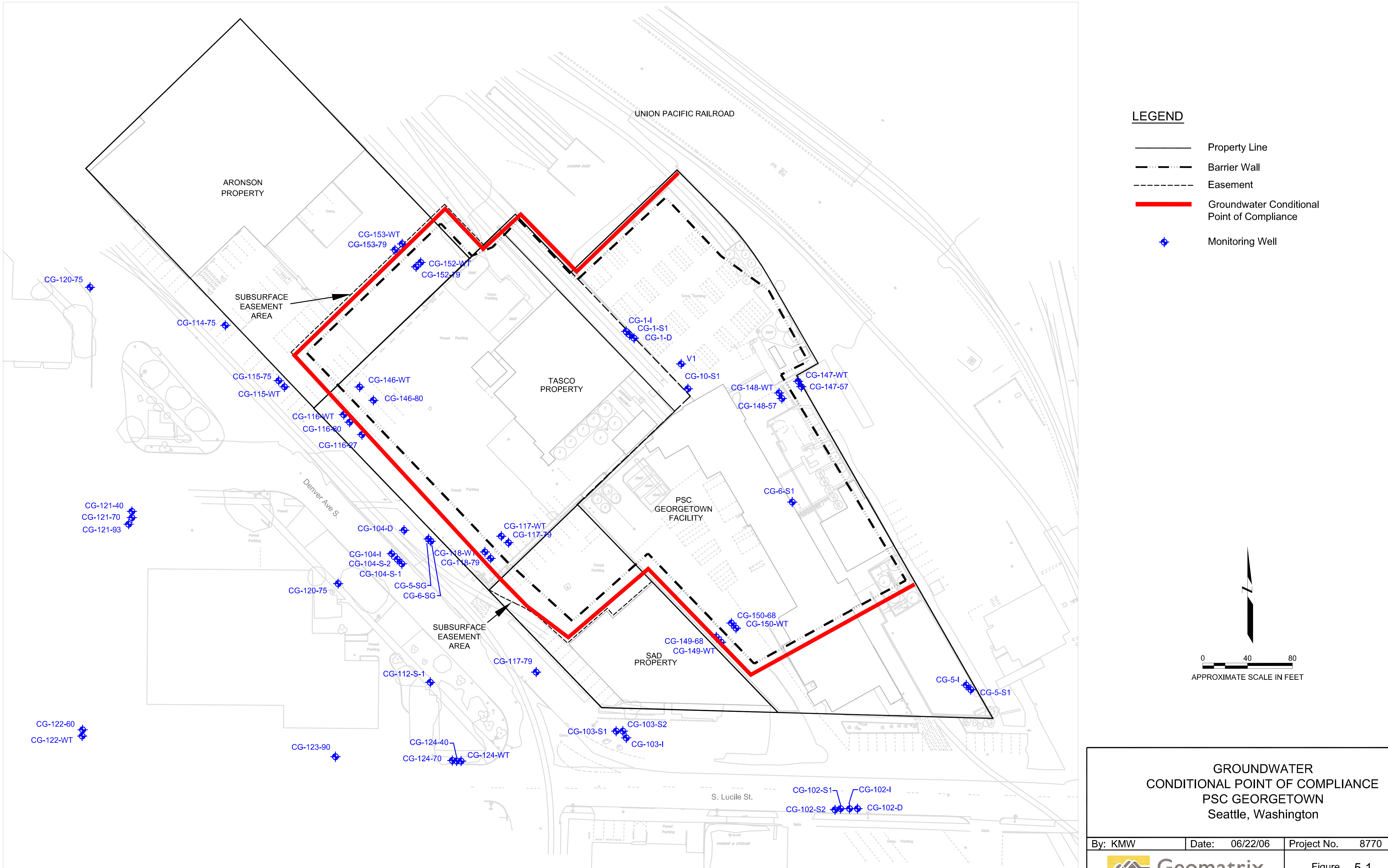
N

0 300 Feet

DEEP WELL
COPPER, VANADIUM, IRON, MANGANESE
PSC Georgetown
Seattle, Washington

By: klb	Date: 5/03/2006	Project No. 8770
Geomatrix		Figure 4-27

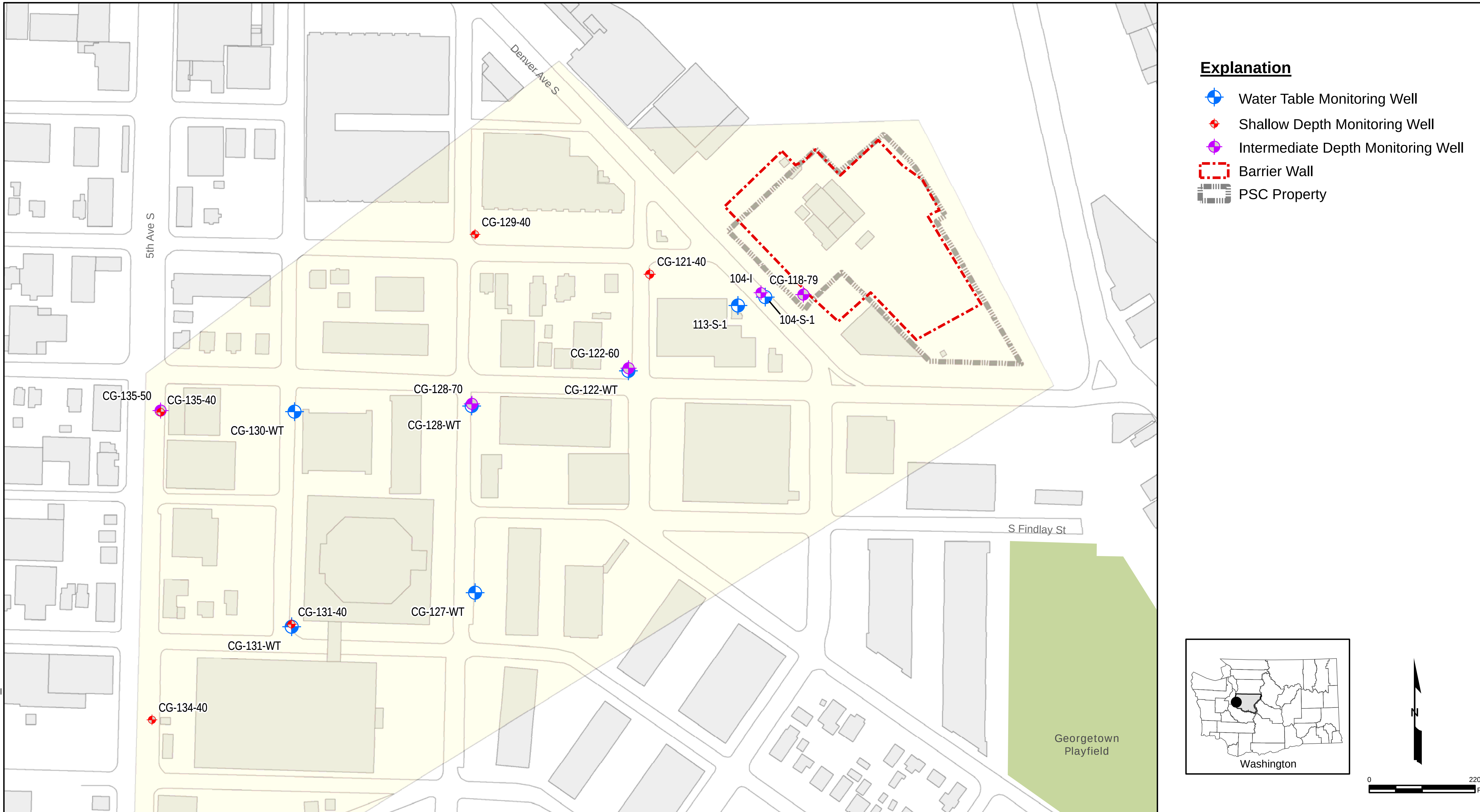
S:\8770_2006\001FS_TechMemo1\Deep_Fe_Mn_Cu_Van_050306.mxd



GROUNDWATER
CONDITIONAL POINT OF COMPLIANCE
PSC GEORGETOWN
Seattle, Washington

By: KMW	Date: 06/22/06	Project No. 8770
Geomatrix		Figure 5-1

Plot Date: 06/22/06 - 3:05pm, Plotted by: astenberg
Drawing Path: S:\8770_2006\001FS_TechMemo1\CAD\, Drawing Name: FIG5-1_GW_Cond_Pt_Compliance.dwg



WELLS USED FOR ASSESSMENT OF BENZENE, TOLUENE, & ETHYLBENZENE BIODEGRADATION RATES
PSC Georgetown
Seattle, Washington

By: klb | Date: 5/04/2006 | Project No. 8770

Geomatrix | Figure 6-1

S:\8770_2006\001FS_TechMemo1\AssesWellforBenzTol_Eth050406.mxd

Figure 6-2: Modeled and Measured Ethylbenzene Concentrations
Water Table Depth Interval

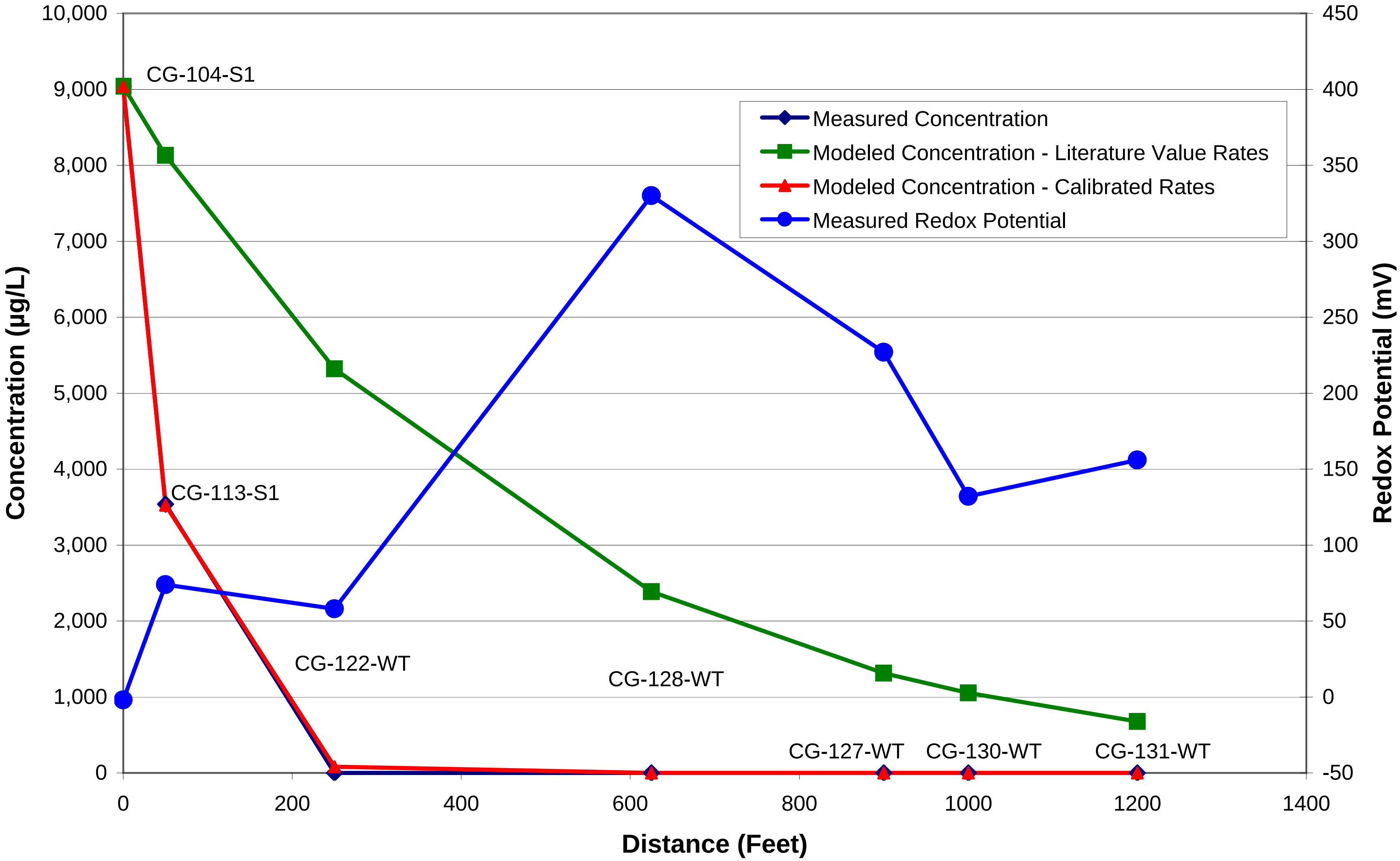
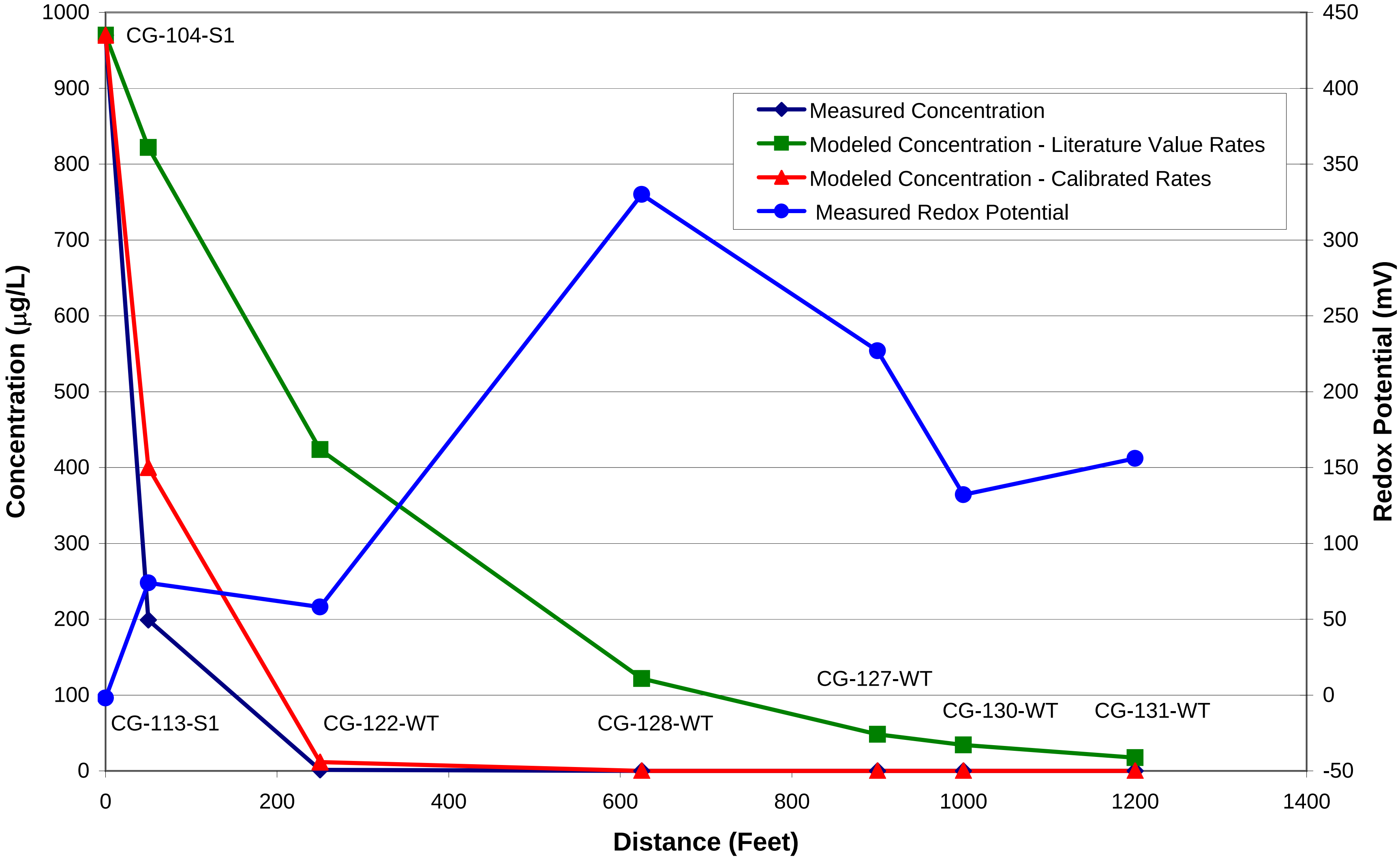


Figure 6-3: Modeled and Measured Toluene Concentrations
Water Table Depth Interval



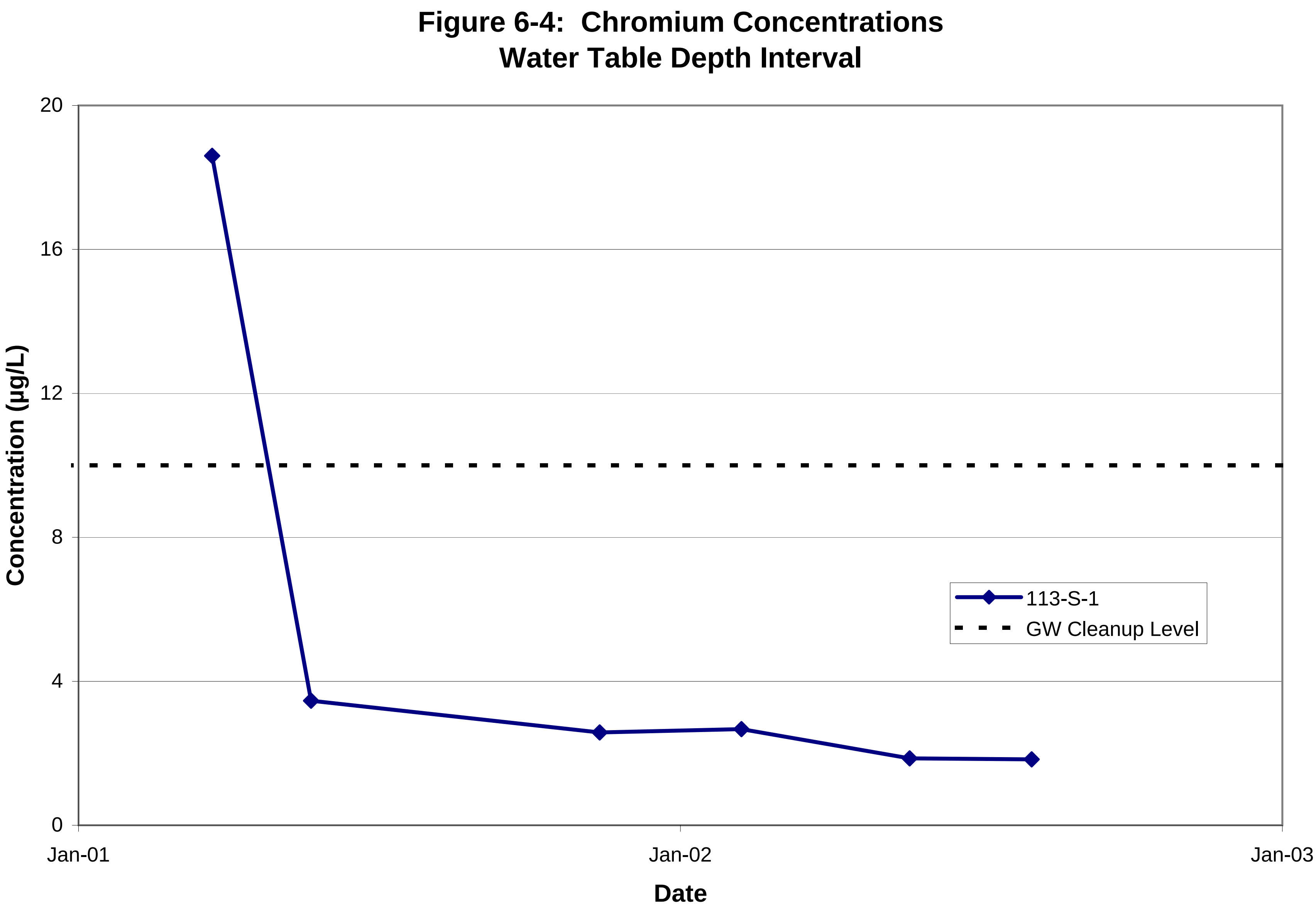


Figure 6-4: Chromium Concentrations
Water Table Depth Interval
Concentration (µg/L)
20
16
12
8
4
0
Jan-01
Jan-02
Jan-03
Date
113-S-1
GW Cleanup Level

Figure 6-5: Nickel Concentrations
Water Table Depth Interval

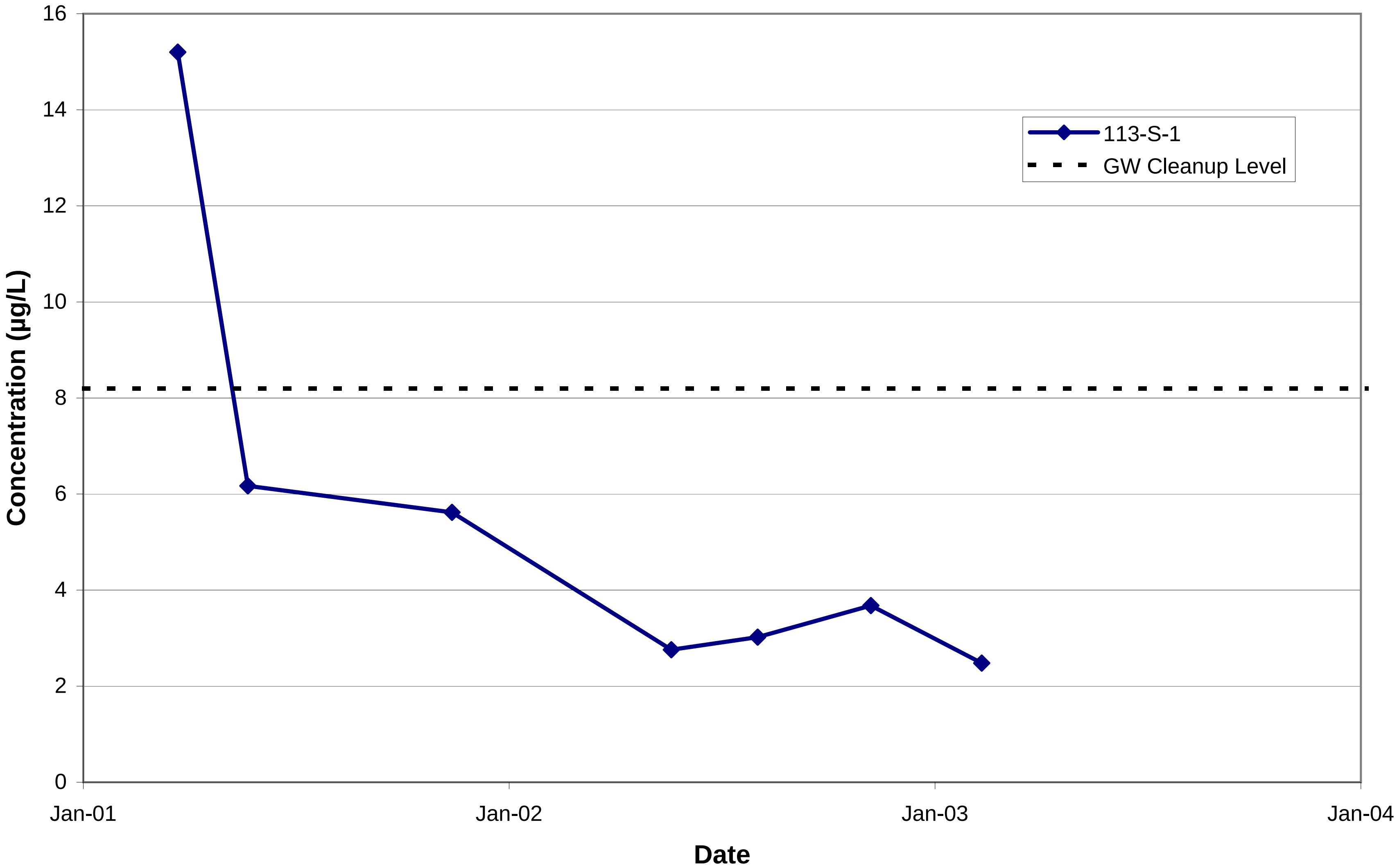


Figure 6-6: Arsenic Concentrations
Intermediate Depth interval

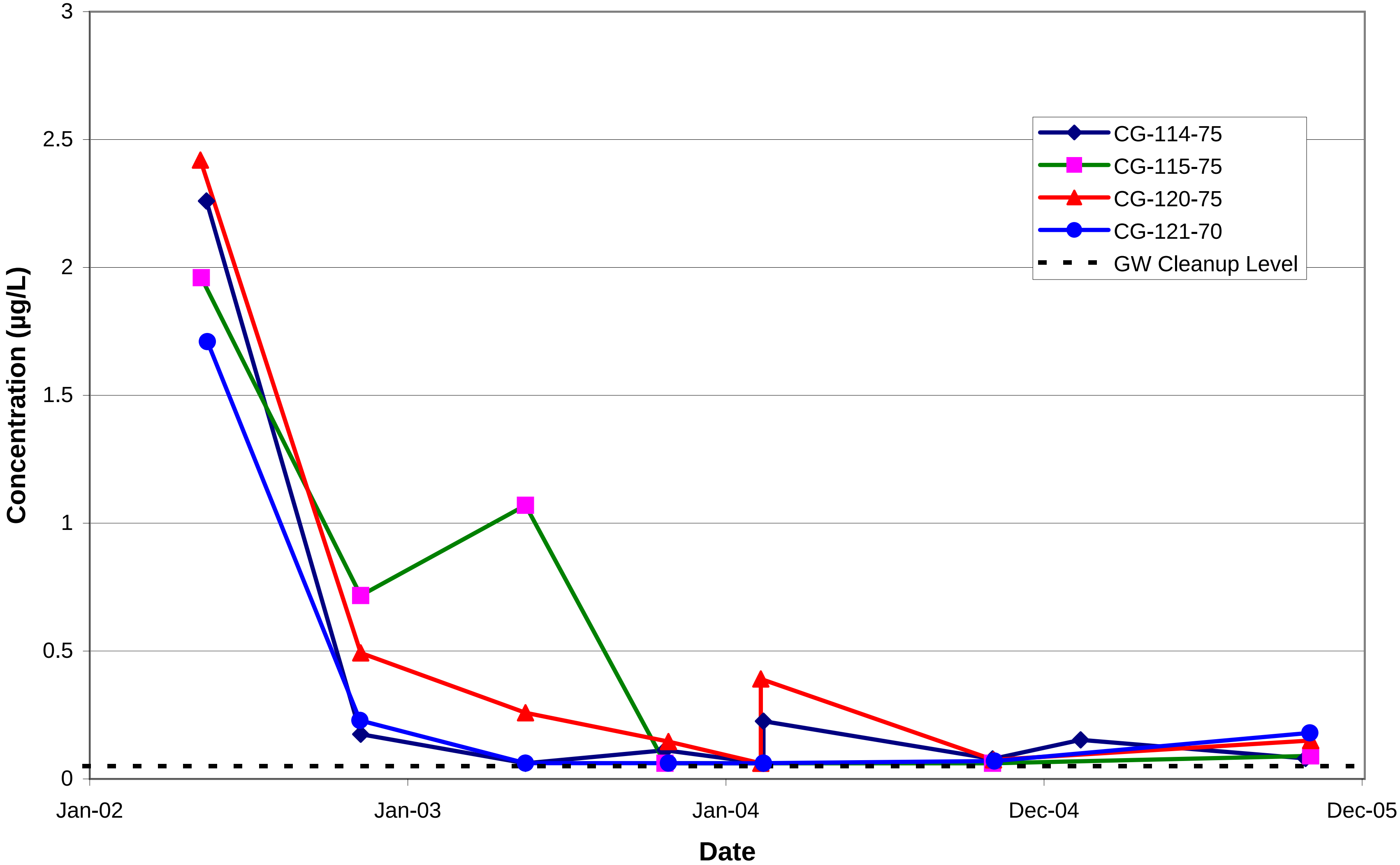


Figure 6-7: Chromium Concentrations
Intermediate Depth Interval

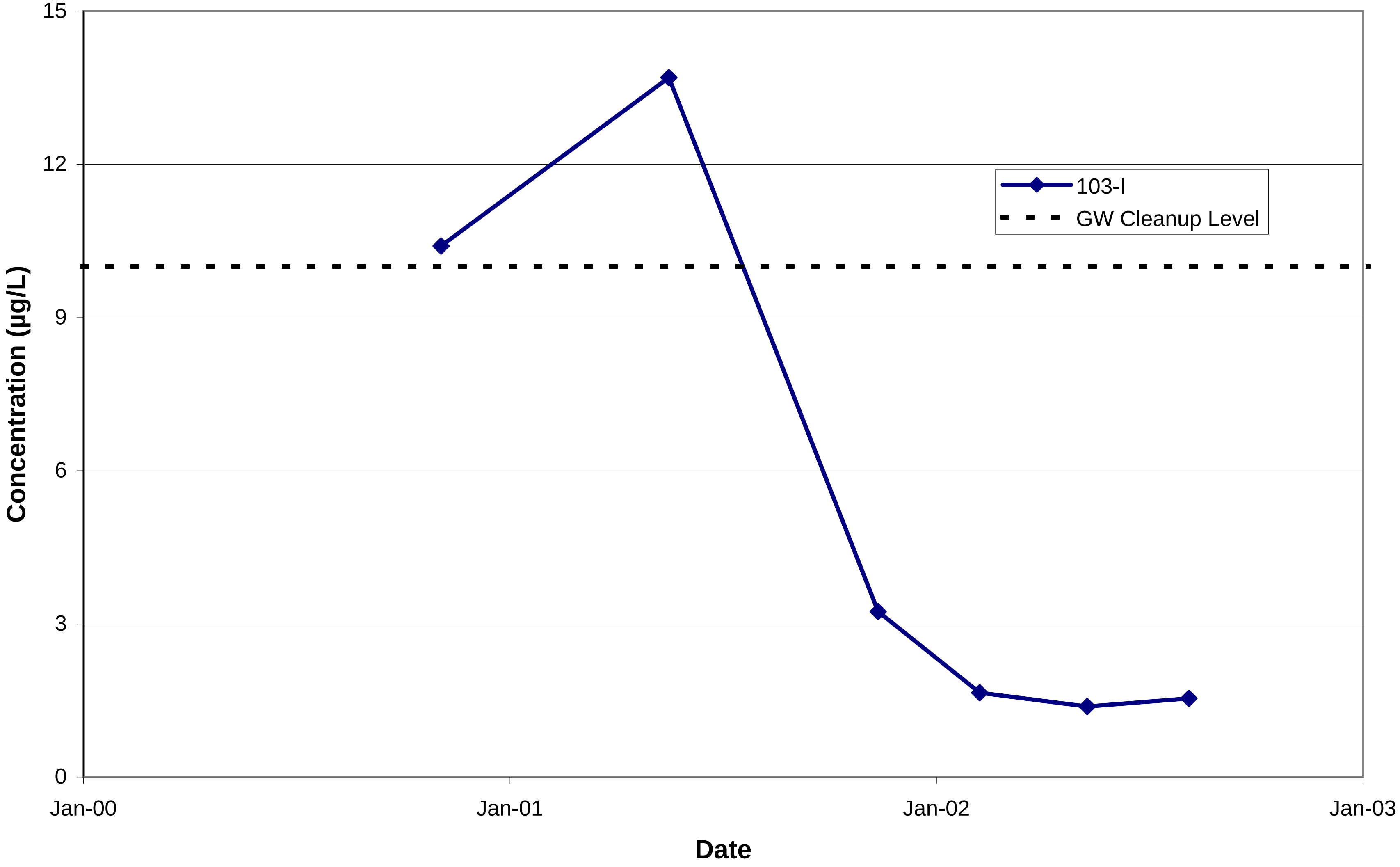


Figure 6-8: Copper Concentrations
Intermediate Depth Interval

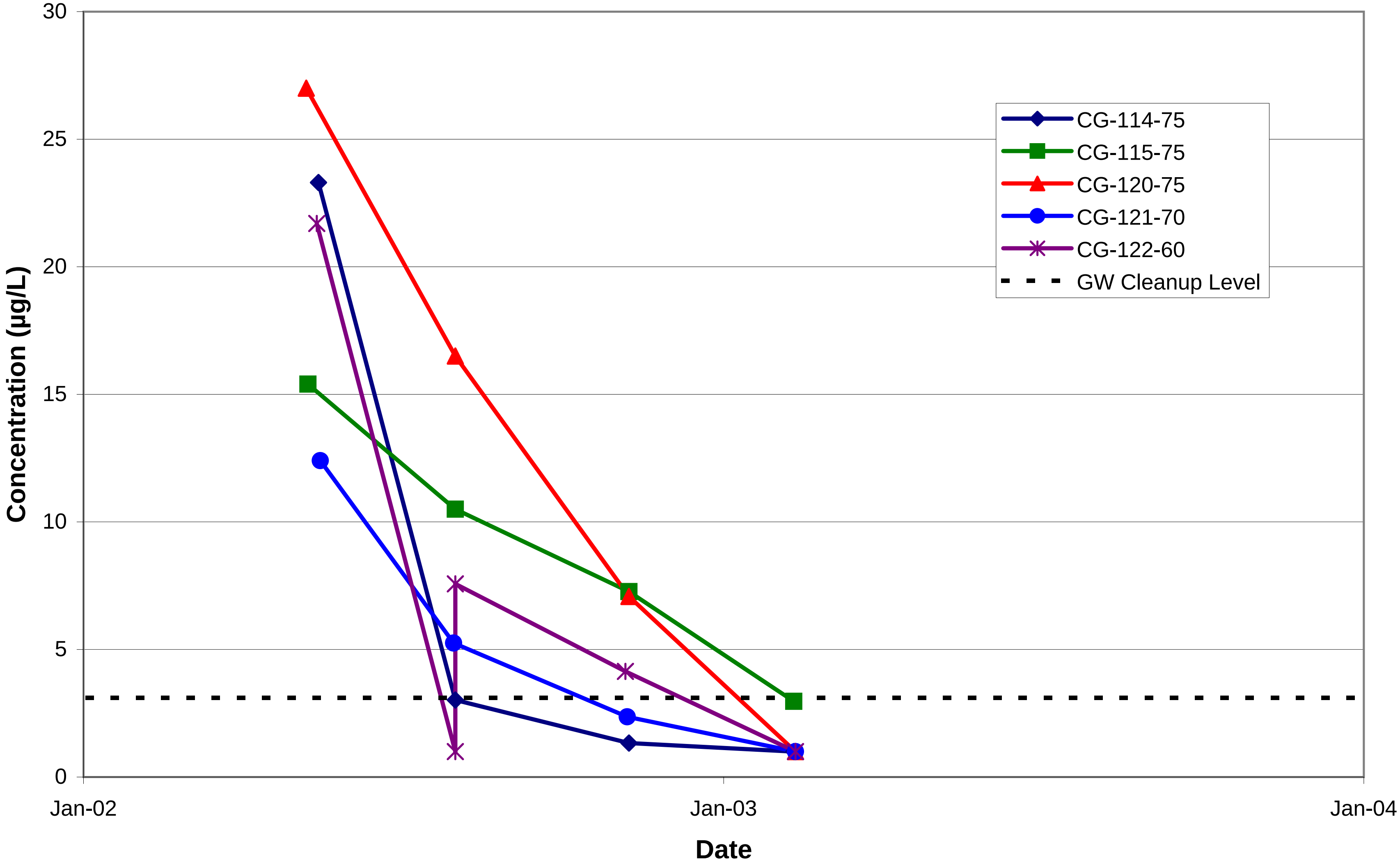


Figure 6-9: Lead Concentrations
Intermediate Depth Interval

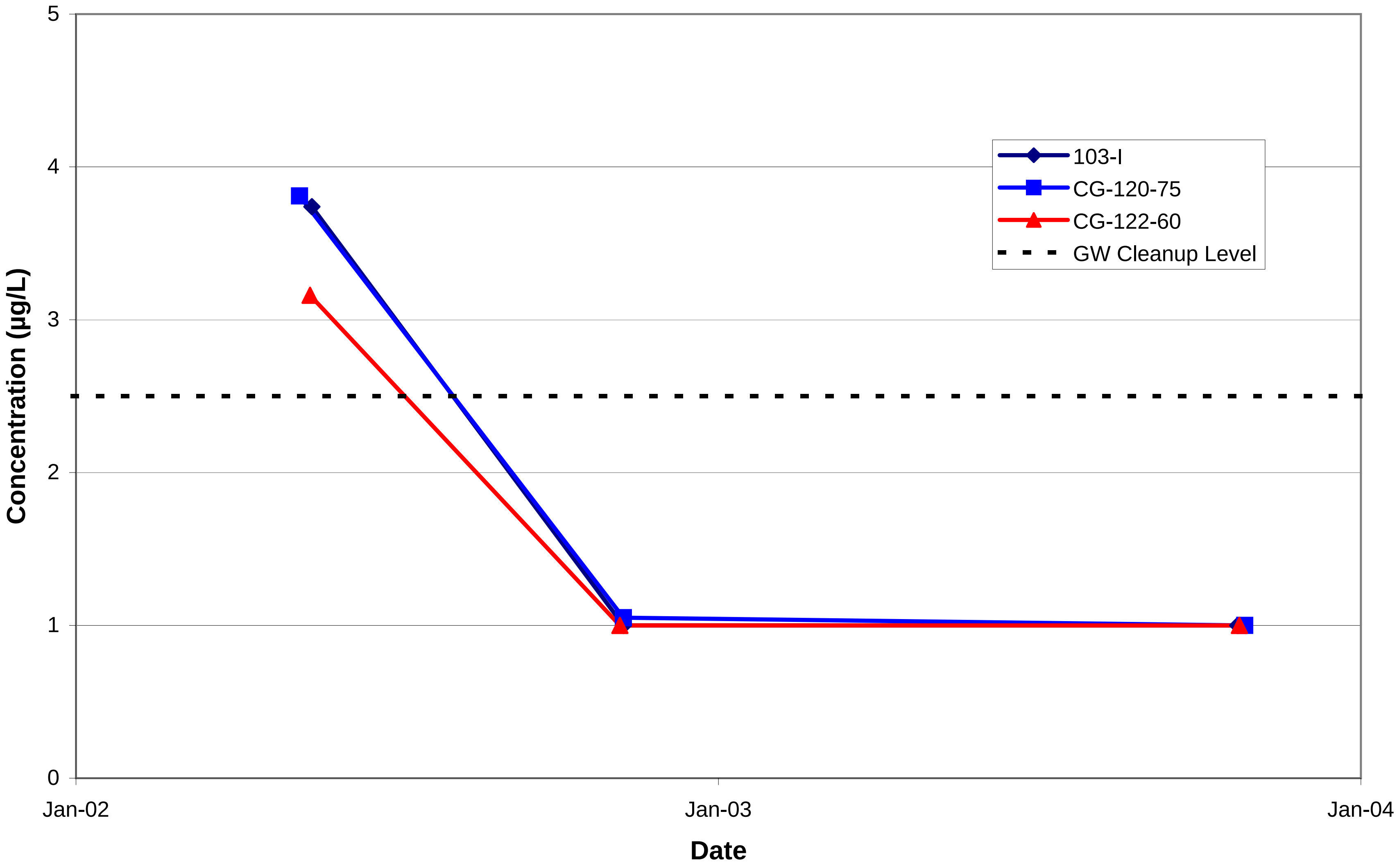


Figure 6-10: Nickel Concentrations
Intermediate Depth Interval

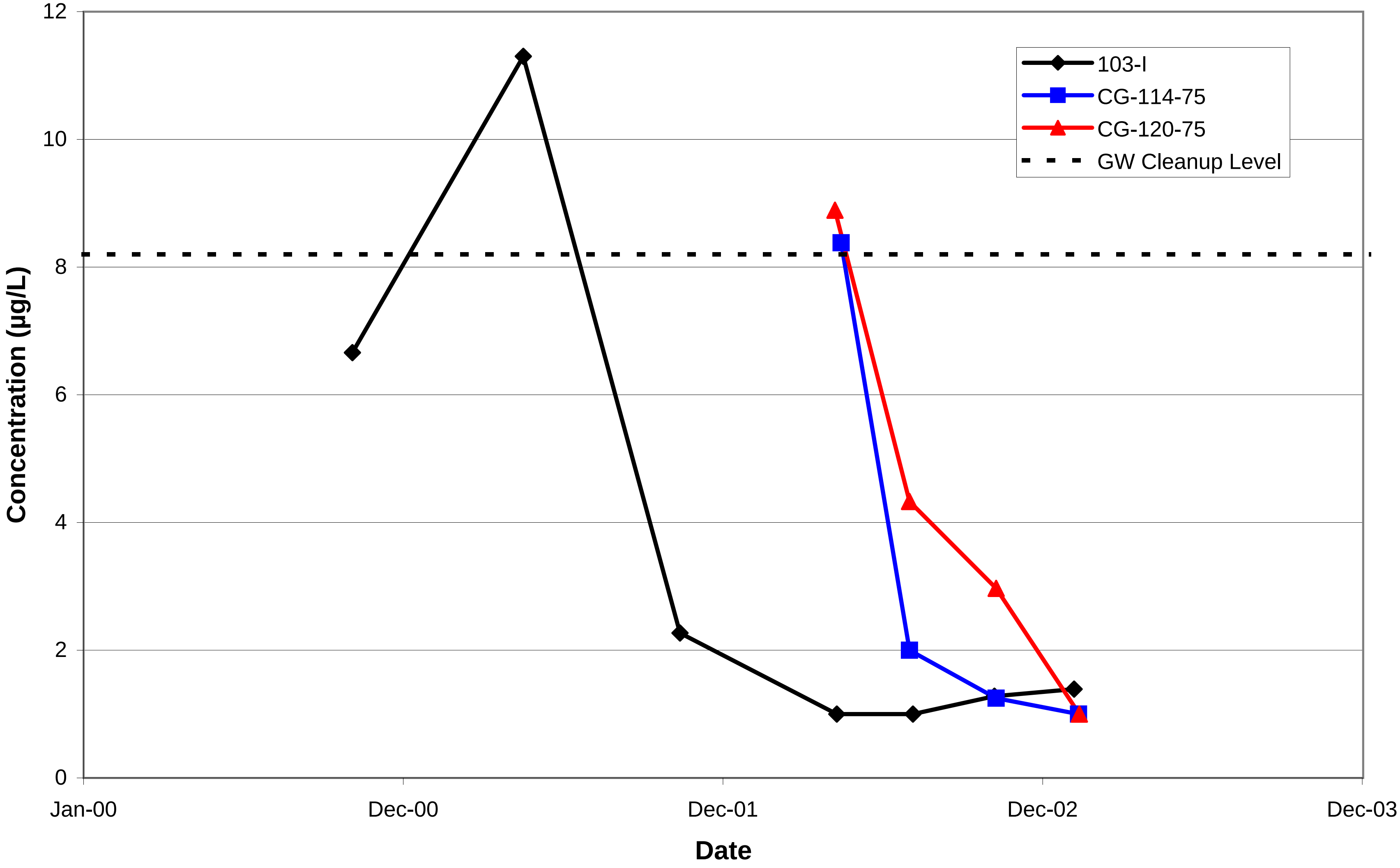
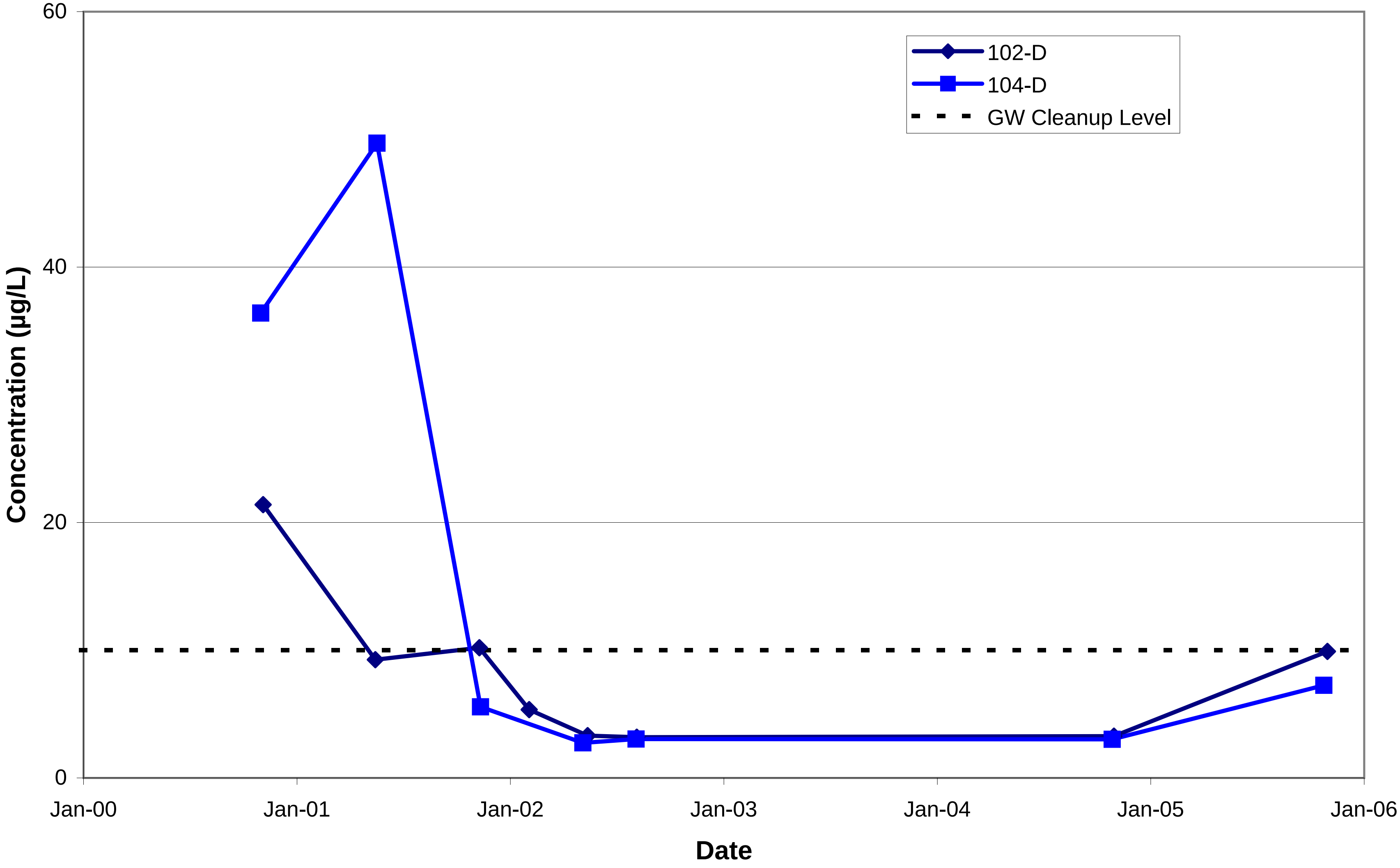


Figure 6-11: Chromium Concentrations
Deep Aquifer



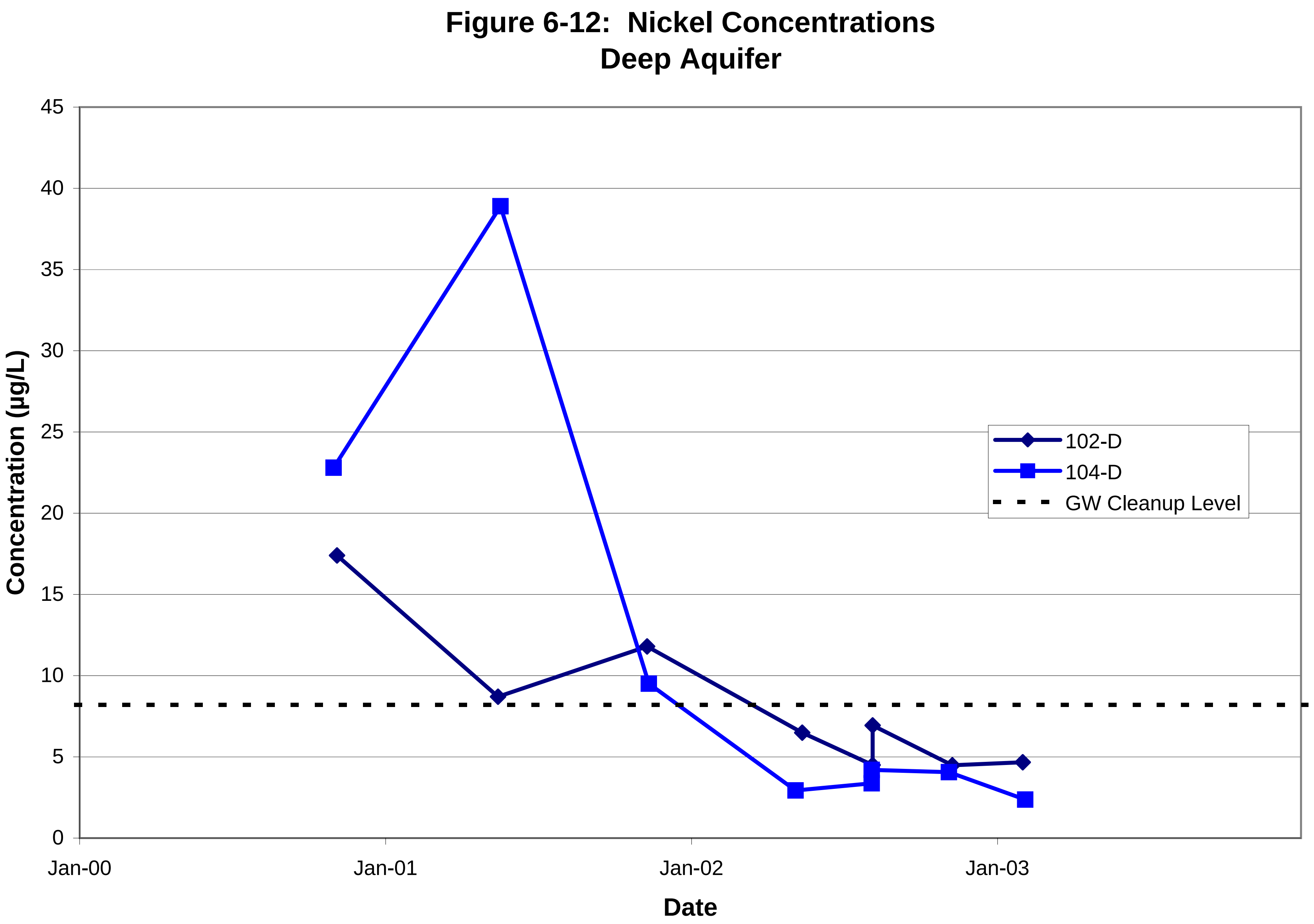
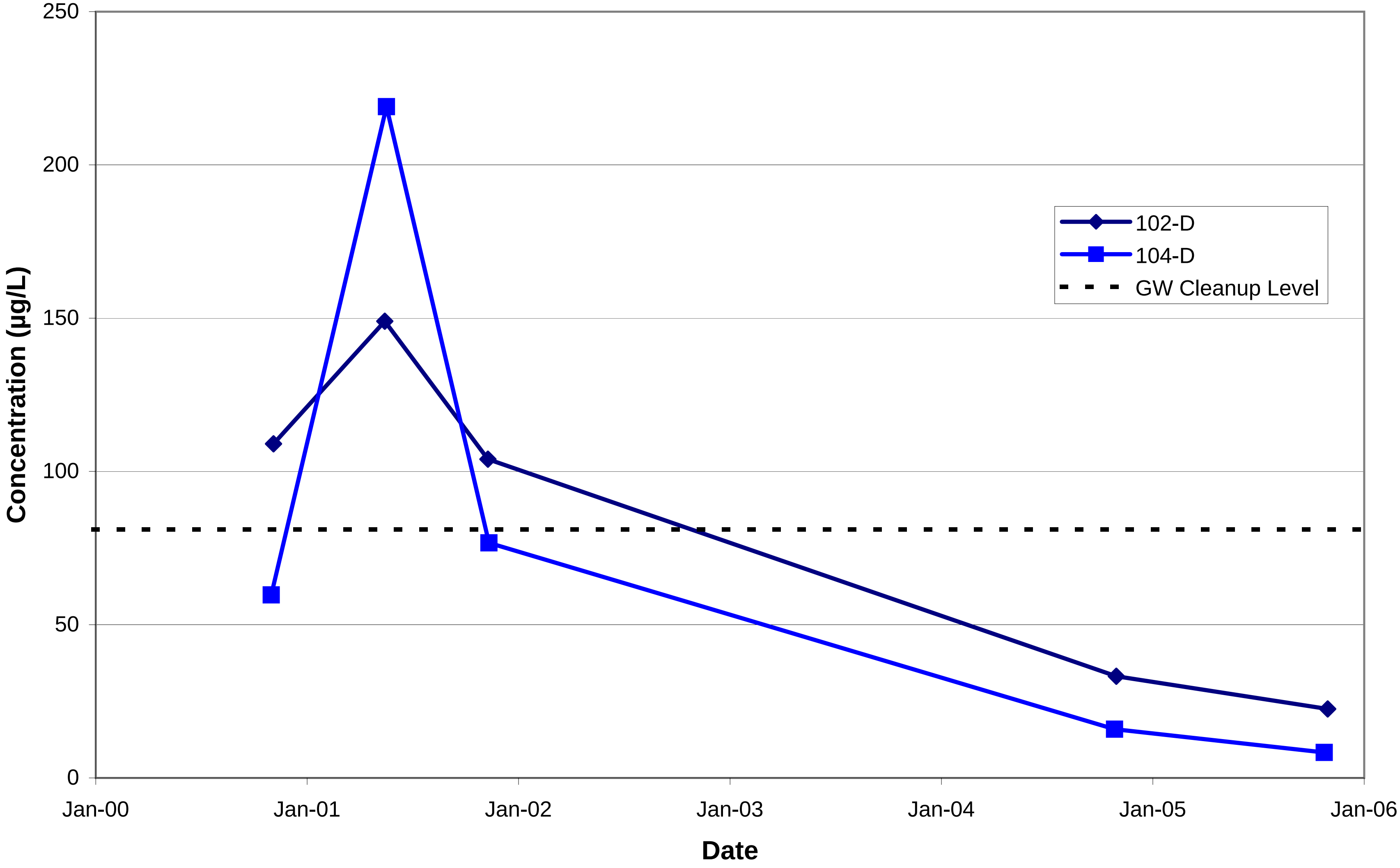


Figure 6-12: Nickel Concentrations
Deep Aquifer
Concentration (µg/L)
45
40
35
30
25
20
15
10
5
0
Jan-00
Jan-01
Jan-02
Jan-03
Date
102-D
104-D
GW Cleanup Level

Figure 6-13: Zinc Concentrations
Deep Aquifer



ATTACHMENT A

Comparison of Groundwater Concentration to SWFS Cleanup Levels

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
101-S-1																							
101-S-1	1,1-Dichloroethylene	2	50.0	5.80E-03	2.50E+01	0.00	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	5.80E-03	5.80E-03	1.54E-02	1.36E-02	7.60E-02	1.42E+11	Unknown
101-S-1	Arsenic	12	50.0	4.30E-01	5.06E-02	8.50	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.75E-01	4.30E-01	3.69E-01	1.52E-01	4.48E-01	5.10E-01	Unknown
101-S-1	Bis(2-ethylhexyl) phthalate	2	50.0	2.60E-01	2.00E+00	0.13	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	2.60E-01	2.60E-01	6.30E-01	5.23E-01	2.97E+00	6.30E+10	Unknown
101-S-1	Chloroform	2	100.0	1.82E+01	4.11E+00	4.43	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+00	1.82E+01	9.75E+00	1.20E+01	6.31E+01	3.86E+43	Unknown
101-S-1	Chromium	6	33.3	2.14E+00	1.00E+01	0.21	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.80E+00	2.14E+00	9.90E-01	7.67E-01	1.62E+00	2.79E+00	Unknown
101-S-1	Copper	9	22.2	1.09E+00	3.10E+00	0.35	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.40E+00	1.72E+00	7.36E-01	4.74E-01	1.03E+00	1.09E+00	Unknown
101-S-1	Cyanide	15	13.3	6.13E+00	1.00E+01	0.61	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	1.00E+01	1.66E+00	1.00E+01	4.94E+00	1.74E+00	5.73E+00	6.13E+00	Unknown
101-S-1	Iron	4	25.0	2.93E+03	1.00E+03	2.93	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.50E+02	5.00E+02	2.93E+03	2.93E+03	8.33E+02	1.40E+03	2.48E+03	9.29E+07	Lognormal
101-S-1	Lead	12	8.3	8.88E-01	2.50E+00	0.36	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.72E+00	2.72E+00	6.85E-01	6.41E-01	1.02E+00	8.88E-01	Unknown
101-S-1	Manganese	10	50.0	6.69E+02	1.00E+02	6.69	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.22E+01	9.88E+02	1.09E+02	3.09E+02	2.88E+02	6.69E+02	Unknown
101-S-1	Nickel	8	37.5	1.62E+00	8.20E+00	0.20	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.36E+00	1.98E+00	9.05E-01	5.89E-01	1.30E+00	1.62E+00	Unknown
101-S-1	Selenium	9	11.1	7.92E-01	5.00E+00	0.16	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.50E+00	1.50E+00	6.11E-01	3.33E-01	8.18E-01	7.92E-01	Unknown
101-S-1	Trichloroethylene	2	50.0	2.60E-01	4.04E-01	0.64	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	2.60E-01	2.60E-01	1.43E-01	1.66E-01	8.84E-01	4.68E+32	Unknown
101-S-1	Vanadium	4	75.0	1.23E+00	2.00E+01	0.06	Upgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.06E+00	1.23E+00	9.71E-01	3.23E-01	1.35E+00	2.15E+00	Normal/Lognormal
102-I																							
102-I	1,4-Dioxane	4	75.0	1.47E+00	9.49E+01	0.02	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.50E-01	1.47E+00	9.75E-01	4.07E-01	1.45E+00	2.48E+00	Normal/Lognormal
102-I	Arsenic	5	40.0	1.33E-01	5.06E-02	2.63	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	6.13E-02	8.00E-02	9.42E-02	1.33E-01	6.57E-02	4.60E-02	1.10E-01	2.32E-01	Normal/Lognormal
102-I	Barium	7	71.4	1.51E+01	4.00E+00	3.78	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	9.80E+00	1.51E+01	1.07E+01	4.36E+00	1.39E+01	1.78E+01	Normal/Lognormal
102-I	Benzene	8	100.0	3.64E+00	1.17E+01	0.31	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.20E+00	3.83E+00	3.20E+00	5.15E-01	3.54E+00	3.64E+00	Normal/Lognormal
102-I	Chromium	5	60.0	2.17E+00	1.00E+01	0.22	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.25E+00	2.17E+00	1.15E+00	6.96E-01	1.82E+00	3.77E+00	Normal/Lognormal
102-I	cis-1,2-Dichloroethylene	8	100.0	2.06E+00	1.65E+02	0.01	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	6.80E-01	2.25E+00	1.41E+00	5.76E-01	1.79E+00	2.06E+00	Normal/Lognormal
102-I	Copper	7	28.6	1.39E+00	3.10E+00	0.45	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.20E+00	1.82E+00	7.89E-01	5.24E-01	1.17E+00	1.39E+00	Unknown
102-I	Cyanide	14	14.3	7.15E+00	1.00E+01	0.71	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	3.00E+00	1.94E+01	5.89E+00	3.93E+00	7.74E+00	7.15E+00	Unknown
102-I	Manganese	4	100.0	5.82E+01	1.00E+02	0.58	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.87E+01	5.82E+01	5.41E+01	4.03E+00	5.88E+01	5.95E+01	Normal/Lognormal
102-I	Nickel	7	42.9	1.41E+00	8.20E+00	0.17	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.02E+00	1.69E+00	8.31E-01	4.64E-01	1.17E+00	1.41E+00	Unknown
102-I	Pentachlorophenol	4	25.0	1.55E-01	2.53E+00	0.06	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	1.55E-01	1.55E-01	1.71E-01	2.15E-01	4.24E-01	7.45E+02	Normal/Lognormal
102-I	Selenium	7	14.3	7.66E-01	5.00E+00	0.15	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.12E+00	1.12E+00	5.89E-01	2.34E-01	7.61E-01	7.66E-01	Unknown
102-I	Vanadium	3	100.0	1.81E+00	2.00E+01	0.09	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.50E+00	1.81E+00	1.68E+00	1.63E-01	1.96E+00	2.04E+00	Normal/Lognormal
102-I	Vinyl chloride	8	100.0	1.31E+01	2.04E+00	6.41	S Crossgrade	53	63	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	5.99E+00	1.53E+01	9.42E+00	3.82E+00	1.20E+01	1.31E+01	Normal/Lognormal
102-S-1																							
102-S-1	1,1,1-Trichloroethane	3	100.0	1.85E+01	1.10E+01	1.68	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.29E+00	1.85E+01	1.21E+01	6.13E+00	2.24E+01	1.87E+02	Normal/Lognormal
102-S-1	1,1-Dichloroethane	3	100.0	4.95E+00	4.70E+01	0.11	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.48E+00	4.95E+00	3.64E+00	1.24E+00	5.73E+00	1.14E+01	Normal/Lognormal
102-S-1	1,1-Dichloroethylene	3	100.0	1.89E-01	2.50E+01	0.01	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.46E-01	1.89E-01	1.70E-01	2.21E-02	2.07E-01	2.24E-01	Normal/Lognormal
102-S-1	Arsenic	9	33.3	6.76E-01	5.06E-02	13.36	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.30E-01	9.55E-01	5.81E-01	1.52E-01	6.75E-01	6.76E-01	Unknown
102-S-1	Bis(2-ethylhexyl) phthalate	1	100.0	9.34E+00	2.00E+00	4.67	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.34E+00	9.34E+00	9.34E+00	--	N/A	N/A	Unknown
102-S-1	Chromium	5	60.0	4.24E+00	1.00E+01	0.42	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.01E+00	4.24E+00	1.47E+00	1.57E+00	2.97E+00	1.02E+01	Lognormal
102-S-1	Copper	7	100.0	3.00E+00	3.10E+00	0.97	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.36E+00	4.11E+00	2.04E+00	1.01E+00	2.78E+00	3.00E+00	Lognormal
102-S-1	Manganese	4	100.0	7.65E+01	1.00E+02	0.77	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.66E+01	7.65E+01	5.40E+01	1.74E+01	7.45E+01	9.25E+01	Normal/Lognormal
102-S-1	Nickel	7	57.1	1.70E+00	8.20E+00	0.21	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.01E+00	1.90E+00	9.59E-01	5.16E-01	1.34E+00	1.70E+00	Normal/Lognormal
102-S-1	Tetrachloroethylene	3	100.0	1.09E-01	2.02E-01	0.54	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.05E-01	1.09E-01	1.07E-01	1.80E-03	1.10E-01	1.10E-01	Normal/Lognormal
102-S-1	Trichloroethylene	3	100.0	3.66E-01	4.04E-01	0.91	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.34E-01	3.66E-01	3.46E-01	1.78E-02	3.76E-01	3.79E-01	Normal/Lognormal
102-S-1	Vanadium	3	100.0	3.87E+00	2.00E+01	0.19	S Crossgrade	7.3	17.3	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.38E+00	3.87E+00	3.32E+00	8.16E-01	4.69E+00	6.95E+00	Normal/Lognormal
102-S-2																							
102-S-2	1,1-Dichloroethane	7	28.6	1.20E-01	4.70E+01	0.00	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	1.10E-01	1.20E-01	3.54E-01	1.87E-01	4.92E-01	8.67E-01	Unknown
102-S-2	1,2-Dichloroethane	7	42.9	7.00E-03	3.06E+01	0.00	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	4.90E-03	7.00E-03	3.13E-02	2.34E-02	4.84E-02	2.46E-01	Unknown
102-S-2	Benzene	7	100.0	3.75E+00	1.17E+01	0.32	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.00E+00	3.92E+00	3.47E+00	3.44E-01	3.72E+00	3.75E+00	Normal/Lognormal
102-S-2	Chromium	4	100.0	1.58E+00	1.00E+01	0.16	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.04E+00	1.58E+00	1.31E+00	2.35E-01	1.58E+00	1.69E+00	Normal/Lognormal
102-S-2	cis-1,2-Dichloroethylene	7	42.9	5.89E-01	1.65E+02	0.00	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.30E-01	6.70E-01	5.40E-01	6.45E-02	5.87E-01	5.89E-01	Unknown
102-S-2	Copper	6	33.3	1.32E+00	3.10E+00	0.43	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.00E+00	1.50E+00	7.50E-01	4.18E-01	1.09E+00	1.32E+00	Unknown
102-S-2	Manganese	4	100.0	4.65E+02	1.00E+02	4.65	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.85E+02	4.65E+02	4.20E+02	3.70E+01	4.63E+02	4.70E+02	Normal/Lognormal
102-S-2	Phenol	4	25.0	8.05E-02	1.18E+02	0.00	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	8.05E-02	8.05E-02	3.77E+00	2.46E+00	6.66E+00	1.51E+08	Unknown

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
102-S-2	Trichloroethylene	7	42.9	9.60E-03	7.88E-01	0.01	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	9.10E-03	9.60E-03	1.40E-02	7.54E-03	1.95E-02	2.23E-02	Unknown
102-S-2	Vanadium	3	100.0	2.46E+00	2.00E+01	0.12	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.97E+00	2.46E+00	2.23E+00	2.46E-01	2.64E+00	2.78E+00	Normal/Lognormal
102-S-2	Vinyl chloride	7	100.0	2.77E+01	2.04E+00	13.56	S Crossgrade	20	30	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.30E+01	2.95E+01	2.11E+01	6.19E+00	2.56E+01	2.77E+01	Normal/Lognormal
103-I																							
103-I	Arsenic	5	60.0	1.56E-01	5.06E-02	3.08	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	6.13E-02	1.20E-01	7.86E-02	1.56E-01	8.53E-02	4.72E-02	1.30E-01	2.45E-01	Normal/Lognormal
103-I	Barium	7	57.1	1.34E+01	4.00E+00	3.36	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	8.30E+00	1.57E+01	8.51E+00	3.98E+00	1.14E+01	1.34E+01	Normal/Lognormal
103-I	Chromium	6	100.0	1.37E+01	1.00E+01	1.37	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.38E+00	1.37E+01	5.32E+00	5.36E+00	9.73E+00	3.83E+01	Lognormal
103-I	cis-1,2-Dichloroethylene	5	20.0	1.60E-01	1.65E+02	0.00	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.60E-01	1.60E-01	4.32E-01	1.52E-01	5.77E-01	9.68E-01	Unknown
103-I	Copper	7	28.6	1.53E+00	3.10E+00	0.49	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.22E+00	2.04E+00	8.23E-01	6.00E-01	1.26E+00	1.53E+00	Unknown
103-I	Dibenzo(a,h)anthracene	4	25.0	4.25E-02	1.62E-02	2.62	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	4.25E-02	4.25E-02	1.41E-02	1.89E-02	3.64E-02	1.84E+00	Unknown
103-I	Indeno(1,2,3-cd)pyrene	4	25.0	4.31E-02	2.00E-02	2.16	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	4.31E-02	4.31E-02	1.42E-02	1.92E-02	3.69E-02	1.97E+00	Unknown
103-I	Manganese	5	100.0	3.85E+02	1.00E+02	3.85	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.32E+02	4.06E+02	2.95E+02	7.09E+01	3.63E+02	3.85E+02	Normal/Lognormal
103-I	Nickel	7	71.4	1.13E+01	8.20E+00	1.38	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.28E+00	1.13E+01	3.41E+00	4.08E+00	6.41E+00	3.06E+01	Lognormal
103-I	Vanadium	3	66.7	1.51E+00	2.00E+01	0.08	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.42E+00	1.51E+00	1.14E+00	5.59E-01	2.09E+00	4.32E+01	Normal/Lognormal
103-I	Vinyl chloride	5	100.0	2.90E+00	2.04E+00	1.42	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.01E+00	2.90E+00	2.12E+00	7.63E-01	2.85E+00	3.89E+00	Normal/Lognormal
103-I	Zinc	3	33.3	1.69E+01	8.10E+01	0.21	S Crossgrade	61	71	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.69E+01	1.69E+01	8.97E+00	6.87E+00	2.05E+01	9.14E+02	Unknown
103-S-1																							
103-S-1	1,1,1-Trichloroethane	3	100.0	6.52E+00	1.10E+01	0.59	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.66E+00	6.52E+00	5.17E+00	1.44E+00	7.60E+00	1.22E+01	Normal/Lognormal
103-S-1	1,1,2-Trichlorotrifluoroethane	2	100.0	6.17E+00	1.21E+03	0.01	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.85E+00	6.17E+00	6.01E+00	2.26E-01	7.02E+00	6.85E+00	Unknown
103-S-1	1,1-Dichloroethane	3	100.0	1.81E+01	4.70E+01	0.39	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.73E+00	1.81E+01	1.32E+01	4.70E+00	2.12E+01	4.69E+01	Normal/Lognormal
103-S-1	1,1-Dichloroethylene	3	66.7	3.83E-01	2.50E+01	0.02	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.49E-01	3.83E-01	4.11E-01	7.92E-02	5.44E-01	6.31E-01	Normal/Lognormal
103-S-1	1,2-Dichloroethane	3	66.7	5.05E-01	1.29E+01	0.04	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.71E-01	5.05E-01	3.92E-01	1.91E-01	7.15E-01	1.50E+01	Unknown
103-S-1	Arsenic	8	100.0	8.83E+00	5.06E-02	174.45	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.22E+00	9.80E+00	7.71E+00	1.67E+00	8.83E+00	9.43E+00	Normal
103-S-1	Barium	2	100.0	9.93E+00	4.00E+00	2.48	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.40E+00	9.93E+00	7.67E+00	3.20E+00	2.20E+01	9.09E+02	Unknown
103-S-1	Chromium	5	100.0	4.90E+00	1.00E+01	0.49	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.20E+00	5.28E+00	3.94E+00	8.21E-01	4.72E+00	4.90E+00	Normal/Lognormal
103-S-1	cis-1,2-Dichloroethylene	3	100.0	1.54E+01	7.27E+01	0.21	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.71E+00	1.54E+01	1.23E+01	4.06E+00	1.91E+01	4.57E+01	Normal/Lognormal
103-S-1	Copper	7	28.6	1.02E+00	3.10E+00	0.33	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.00E+00	1.32E+00	6.89E-01	3.35E-01	9.35E-01	1.02E+00	Unknown
103-S-1	Manganese	4	100.0	3.53E+02	1.00E+02	3.53	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.71E+02	3.53E+02	2.88E+02	8.18E+01	3.84E+02	5.11E+02	Normal/Lognormal
103-S-1	Nickel	7	100.0	2.35E+00	8.20E+00	0.29	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.11E+00	2.44E+00	1.76E+00	5.44E-01	2.16E+00	2.35E+00	Normal/Lognormal
103-S-1	Pentachlorophenol	1	100.0	6.81E-01	2.53E+00	0.27	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.81E-01	6.81E-01	6.81E-01	--	N/A	N/A	Unknown
103-S-1	Tetrachloroethylene	2	100.0	1.55E+01	2.02E-01	76.73	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.50E+01	1.55E+01	1.52E+01	3.89E-01	1.70E+01	1.66E+01	Unknown
103-S-1	Trichloroethylene	3	100.0	1.72E+01	4.04E-01	42.57	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.70E+00	1.72E+01	1.38E+01	3.79E+00	2.02E+01	3.24E+01	Normal/Lognormal
103-S-1	Vanadium	3	66.7	1.90E+00	2.00E+01	0.10	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.51E+00	1.90E+00	1.30E+00	7.23E-01	2.52E+00	1.59E+02	Normal/Lognormal
103-S-1	Vinyl chloride	3	100.0	1.03E+01	1.28E+00	8.04	S Crossgrade	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.93E+00	1.03E+01	5.43E+00	4.22E+00	1.25E+01	6.33E+02	Lognormal
103-S-2																							
103-S-2	1,1-Dichloroethane	5	100.0	1.59E+00	4.70E+01	0.03	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.29E+00	1.59E+00	1.44E+00	1.39E-01	1.58E+00	1.60E+00	Normal/Lognormal
103-S-2	1,1-Dichloroethylene	5	100.0	2.42E-01	2.50E+01	0.01	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.40E-01	2.42E-01	1.83E-01	5.22E-02	2.33E-01	2.56E-01	Unknown
103-S-2	1,2-Dichloroethane	5	100.0	2.85E-01	3.06E+01	0.01	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.79E-01	2.93E-01	2.26E-01	4.83E-02	2.72E-01	2.85E-01	Normal/Lognormal
103-S-2	1,4-Dioxane	4	75.0	1.65E+01	9.49E+01	0.17	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.00E+00	1.65E+01	1.01E+01	7.38E+00	1.87E+01	6.36E+05	Normal/Lognormal
103-S-2	Benzene	5	100.0	5.23E+00	1.17E+01	0.45	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.00E+00	5.23E+00	3.73E+00	1.60E+00	5.26E+00	1.34E+01	Normal
103-S-2	Benzo(b)fluoranthene	4	25.0	1.41E-02	1.94E-02	0.73	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.41E-02	1.41E-02	6.99E-03	4.77E-03	1.26E-02	2.77E-02	Lognormal
103-S-2	Chromium	5	60.0	1.30E+00	1.00E+01	0.13	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.03E+00	1.30E+00	9.14E-01	3.91E-01	1.29E+00	1.88E+00	Normal/Lognormal
103-S-2	cis-1,2-Dichloroethylene	5	100.0	8.46E+00	1.65E+02	0.05	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.00E+00	8.46E+00	6.00E+00	1.71E+00	7.63E+00	8.46E+00	Normal/Lognormal
103-S-2	Copper	7	14.3	7.48E-01	3.10E+00	0.24	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.08E+00	1.08E+00	5.83E-01	2.19E-01	7.44E-01	7.48E-01	Unknown
103-S-2	Dibenzo(a,h)anthracene	4	25.0	2.55E-02	1.62E-02	1.57	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	2.55E-02	2.55E-02	9.84E-03	1.05E-02	2.21E-02	1.90E-01	Lognormal
103-S-2	Indeno(1,2,3-cd)pyrene	4	25.0	2.38E-02	2.00E-02	1.19	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	2.38E-02	2.38E-02	9.41E-03	9.61E-03	2.07E-02	1.46E-01	Lognormal
103-S-2	Manganese	5	100.0	6.27E+02	1.00E+02	6.27	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.87E+02	6.43E+02	4.13E+02	1.46E+02	5.52E+02	6.27E+02	Normal/Lognormal
103-S-2	Nickel	7	28.6	2.61E+00	8.20E+00	0.32	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.41E+00	3.35E+00	1.04E+00	1.07E+00	1.83E+00	2.61E+00	Unknown
103-S-2	trans-1,2-Dichloroethylene	5	20.0	3.40E-01	1.69E+03	0.00	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.40E-01	3.40E-01	4.68E-01	7.16E-02	5.36E-01	5.65E-01	Unknown
103-S-2	Trichloroethylene	5	100.0	2.02E+00	7.88E-01	2.57	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.20E+00	2.08E+00	1.60E+00	3.33E-01	1.92E+00	2.02E+00	Normal/Lognormal
103-S-2	Vanadium	3	66.7	1.19E+00	2.00E+01	0.06	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.09E+00	1.19E+00	9.27E-01	3.73E-01	1.56E+00	7.86E+00	Normal/Lognormal
103-S-2	Vinyl chloride	5	100.0	2.12E+01	2.04E+00	10.40	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.60E+00	2.12E+01	1.19E+01	5.49E+00	1.71E+01	2.12E+01	Normal/Lognormal

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
103-S-2	Zinc	3	33.3	1.00E+01	8.10E+01	0.12	S Crossgrade	25	35	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.00E+01	1.00E+01	6.67E+00	2.89E+00	1.15E+01	2.99E+01	Unknown
104-I																							
104-I	1,1-Dichloroethane	5	100.0	6.80E+01	4.70E+01	1.45	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.14E+01	6.80E+01	5.42E+01	1.14E+01	6.51E+01	6.89E+01	Normal/Lognormal
104-I	1,1-Dichloroethylene	5	20.0	9.20E-02	2.50E+01	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	1.00E+01	9.20E-02	9.20E-02	1.13E+00	2.17E+00	3.20E+00	7.28E+04	Lognormal
104-I	1,2-Dichloroethane	5	40.0	1.05E-01	3.06E+01	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E+01	1.00E-01	1.05E-01	1.15E+00	2.16E+00	3.21E+00	4.39E+03	Lognormal
104-I	1,4-Dioxane	3	100.0	2.43E+01	9.49E+01	0.26	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.22E+01	2.43E+01	2.29E+01	1.18E+00	2.49E+01	2.51E+01	Unknown
104-I	1-Methyl naphthalene	4	25.0	3.00E-03	2.10E+00	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	3.00E-03	3.00E-03	3.83E-02	2.35E-02	6.59E-02	1.24E+02	Unknown
104-I	Arsenic	4	50.0	9.41E-02	5.06E-02	1.86	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	6.13E-02	6.15E-02	8.53E-02	9.41E-02	6.02E-02	3.43E-02	1.00E-01	2.98E-01	Normal/Lognormal
104-I	Barium	10	30.0	5.00E+00	4.00E+00	1.25	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	4.00E+00	1.00E+01	4.40E+00	5.00E+00	4.30E+00	1.23E+00	5.01E+00	5.68E+00	Unknown
104-I	Benzene	4	50.0	1.37E+00	1.17E+01	0.12	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	1.10E+00	1.37E+00	1.87E+00	7.39E-01	2.74E+00	4.23E+00	Normal/Lognormal
104-I	Bis(2-ethylhexyl) phthalate	4	25.0	9.51E+00	2.00E+00	4.76	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	2.34E-01	2.00E+00	9.51E+00	9.51E+00	2.82E+00	4.48E+00	8.08E+00	1.19E+06	Lognormal
104-I	Chloroethane	5	40.0	5.10E+00	4.61E+02	0.01	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	4.00E+01	3.46E+00	5.10E+00	7.71E+00	6.90E+00	1.43E+01	2.61E+01	Unknown
104-I	Chromium	8	100.0	6.13E+00	1.00E+01	0.61	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.02E+00	7.60E+00	4.71E+00	1.58E+00	5.76E+00	6.13E+00	Normal/Lognormal
104-I	cis-1,2-Dichloroethylene	5	20.0	2.20E-01	1.65E+02	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+01	2.20E-01	2.20E-01	6.14E+00	8.09E+00	1.39E+01	3.94E+04	Normal/Lognormal
104-I	Copper	10	90.0	4.89E+00	3.10E+00	1.58	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.34E+00	1.20E+01	2.95E+00	3.24E+00	4.83E+00	4.89E+00	Unknown
104-I	Cyanide	12	8.3	6.20E+00	1.00E+01	0.62	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	1.00E+01	1.00E+01	1.00E+01	5.21E+00	1.67E+00	6.07E+00	6.20E+00	Unknown
104-I	Ethane	4	100.0	3.71E+02	--	--	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	9.90E+01	3.71E+02	2.78E+02	1.24E+02	4.25E+02	1.42E+03	Normal/Lognormal
104-I	Ethene	4	100.0	6.27E+03	--	--	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.40E+03	6.27E+03	4.17E+03	1.40E+03	5.82E+03	6.74E+03	Unknown
104-I	Iron	10	90.0	9.46E+03	1.00E+03	9.46	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+02	5.00E+02	1.88E+03	9.46E+03	3.91E+03	2.89E+03	5.59E+03	1.42E+04	Normal/Lognormal
104-I	Manganese	9	100.0	4.10E+02	1.00E+02	4.10	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.19E+02	4.92E+02	2.98E+02	1.04E+02	3.62E+02	4.10E+02	Normal/Lognormal
104-I	Methane	4	100.0	3.47E+04	--	--	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.00E+04	3.47E+04	2.51E+04	6.55E+03	3.28E+04	3.61E+04	Normal/Lognormal
104-I	Naphthalene	5	20.0	7.30E-03	1.20E+01	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+01	7.30E-03	7.30E-03	2.05E+00	2.03E+00	3.99E+00	3.90E+08	Normal/Lognormal
104-I	Nickel	10	100.0	3.20E+00	8.20E+00	0.39	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.16E+00	5.20E+00	2.27E+00	1.28E+00	3.01E+00	3.20E+00	Lognormal
104-I	Toluene	2	50.0	1.30E-01	9.80E+00	0.01	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.30E-01	1.30E-01	3.15E-01	2.62E-01	1.48E+00	3.15E+10	Unknown
104-I	trans-1,2-Dichloroethylene	5	100.0	2.83E+02	1.69E+03	0.17	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.90E+01	2.83E+02	1.29E+02	9.54E+01	2.20E+02	4.75E+02	Normal/Lognormal
104-I	Trichloroethylene	3	33.3	7.70E-02	7.88E-01	0.10	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	7.70E-02	7.70E-02	3.73E-02	3.52E-02	9.66E-02	6.99E+02	Normal/Lognormal
104-I	Vanadium	5	100.0	7.90E+00	2.00E+01	0.40	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.40E+00	8.60E+00	5.67E+00	1.75E+00	7.34E+00	7.90E+00	Normal/Lognormal
104-I	Vinyl chloride	5	100.0	4.39E+03	2.04E+00	2153.14	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	8.64E+02	4.39E+03	1.79E+03	1.48E+03	3.20E+03	5.66E+03	Lognormal
104-I	Xylenes (Total)	5	20.0	6.20E-01	1.41E+02	0.00	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	3.00E+00	9.00E+01	6.20E-01	6.20E-01	1.54E+01	1.79E+01	3.25E+01	5.81E+04	Normal/Lognormal
104-I	Zinc	6	66.7	2.83E+01	8.10E+01	0.35	Area 2	55.5	65.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	5.56E+00	2.83E+01	1.15E+01	8.99E+00	1.89E+01	3.17E+01	Lognormal
104-S-1																							
104-S-1	1,1,1-Trichloroethane	3	66.7	2.10E+01	1.10E+01	1.91	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.57E+00	2.10E+01	8.36E+00	1.11E+01	2.70E+01	2.06E+15	Normal/Lognormal
104-S-1	1,1,2-Trichlorotrifluoroethane	4	25.0	4.05E+00	1.21E+03	0.00	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+02	4.05E+00	4.05E+00	3.88E+01	4.66E+01	9.36E+01	4.82E+09	Normal/Lognormal
104-S-1	1,1-Dichloroethane	3	100.0	1.15E+02	4.70E+01	2.45	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.77E+01	1.15E+02	5.99E+01	4.99E+01	1.44E+02	2.29E+05	Normal/Lognormal
104-S-1	1,1-Dichloroethylene	3	66.7	2.45E-01	2.50E+01	0.01	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.70E-02	2.45E-01	2.71E-01	2.18E-01	6.38E-01	4.92E+03	Normal/Lognormal
104-S-1	1,2,4-Trimethylbenzene	5	100.0	2.12E+02	1.30E+01	16.29	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+02	2.12E+02	1.82E+02	3.70E+01	2.17E+02	2.33E+02	Normal/Lognormal
104-S-1	1,2-Dichlorobenzene	3	100.0	3.95E+00	1.40E+01	0.28	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.55E+00	3.95E+00	2.77E+00	1.20E+00	4.79E+00	2.26E+01	Normal/Lognormal
104-S-1	1,2-Dichloroethane	3	66.7	3.10E+00	1.29E+01	0.24	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.12E+00	3.10E+00	1.57E+00	1.36E+00	3.86E+00	4.08E+03	Normal/Lognormal
104-S-1	1,3,5-Trimethylbenzene	3	100.0	5.95E+01	9.76E+00	6.10	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.60E+01	5.95E+01	4.85E+01	1.18E+01	6.85E+01	9.59E+01	Normal/Lognormal
104-S-1	1,4-Dichlorobenzene	3	33.3	8.60E-01	2.50E+00	0.34	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.50E+00	8.60E-01	8.60E-01	8.70E-01	3.75E-01	1.50E+00	6.35E+00	Normal/Lognormal
104-S-1	1,4-Dioxane	4	100.0	4.05E+01	9.49E+01	0.43	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.19E+00	4.05E+01	1.61E+01	1.65E+01	3.56E+01	5.88E+02	Normal/Lognormal
104-S-1	1-Methyl naphthalene	4	75.0	3.90E-01	2.10E+00	0.19	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.25E-01	3.90E-01	3.97E-01	7.41E-02	4.84E-01	5.11E-01	Normal/Lognormal
104-S-1	2,4-Dimethylphenol	4	75.0	1.78E+01	2.85E+01	0.62	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	3.10E+00	1.78E+01	9.18E+00	6.62E+00	1.70E+01	1.08E+02	Normal/Lognormal
104-S-1	2-Methylnaphthalene	2	50.0	2.95E-01	2.10E+00	0.14	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.95E-01	2.95E-01	3.98E-01	1.45E-01	1.04E+00	1.27E+01	Unknown
104-S-1	2-Methylphenol	4	25.0	1.14E+01	1.30E+01	0.88	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	4.90E-01	1.00E+01	1.14E+01	1.14E+01	5.41E+00	4.58E+00	1.08E+01	6.15E+05	Normal/Lognormal
104-S-1	Arsenic	10	90.0	1.62E+01	5.06E-02	319.43	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.29E+00	2.09E+01	1.27E+01	5.91E+00	1.62E+01	5.73E+01	Normal
104-S-1	Barium	5	100.0	1.39E+01	4.00E+00	3.48	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.17E+00	1.39E+01	1.08E+01	2.43E+00	1.31E+01	1.39E+01	Normal/Lognormal
104-S-1	Benzene	3	100.0	1.54E+01	9.60E+00	1.60	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.90E+00	1.54E+01	1.06E+01	6.74E+00	2.20E+01	3.68E+04	Normal/Lognormal
104-S-1	Bis(2-ethylhexyl) phthalate	4	50.0	4.97E+00	2.00E+00	2.49	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.19E+00	2.00E+00	5.79E-02	4.97E+00	1.66E+00	2.24E+00	4.29E+00	1.34E+06	Normal/Lognormal
104-S-1	C10-C12 (EPH) Aromatics	2	100.0	1.05E+02	5.00E+01	2.10	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.62E+01	1.05E+02	9.06E+01	2.04E+01	1.82E+02	3.27E+02	Unknown
104-S-1	C8-C10 (EPH) Aromatics	1	100.0	6.50E+02	2.75E+02	2.36	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.50E+02	6.50E+02	6.50E+02	--	N/A	N/A	Unknown
104-S-1	C8-C10 (VPH) Aromatics	2	100.0	1.29E+04	2.75E+02	46.91	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.95E+03	1.29E+04	7.42E+03	7.73E+03	4.19E+04	4.18E+25	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
104-S-1	Chlorobenzene	4	25.0	1.05E+00	5.19E+01	0.02	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	5.00E+01	1.05E+00	1.05E+00	6.76E+00	1.22E+01	2.11E+01	4.83E+06	Lognormal
104-S-1	Chloroethane	5	100.0	6.66E+02	4.61E+02	1.45	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.46E+02	6.66E+02	3.96E+02	2.08E+02	5.94E+02	1.10E+03	Normal/Lognormal
104-S-1	Chromium	5	100.0	2.84E+00	1.00E+01	0.28	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.25E+00	2.84E+00	2.18E+00	5.79E-01	2.73E+00	3.21E+00	Normal/Lognormal
104-S-1	cis-1,2-Dichloroethylene	4	75.0	3.31E+00	7.27E+01	0.05	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+01	5.00E+01	1.35E+00	3.31E+00	7.78E+00	1.15E+01	2.13E+01	1.04E+04	Lognormal
104-S-1	Copper	7	57.1	2.55E+00	3.10E+00	0.82	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.07E+00	3.04E+00	1.15E+00	9.01E-01	1.81E+00	2.55E+00	Lognormal
104-S-1	Cumene	1	100.0	9.80E+00	7.30E+00	1.34	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.80E+00	9.80E+00	9.80E+00	--	N/A	N/A	Unknown
104-S-1	Cyanide	13	23.1	7.66E+00	1.00E+01	0.77	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.00E+01	1.25E+01	6.35E+00	2.63E+00	7.64E+00	7.66E+00	Unknown
104-S-1	Dibenzo(a,h)anthracene	4	25.0	2.20E-03	1.62E-02	0.14	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.00E-01	2.20E-03	2.20E-03	1.56E-02	2.30E-02	4.26E-02	1.76E+01	Lognormal
104-S-1	Dichlorodifluoromethane	1	100.0	2.50E+00	6.36E+00	0.39	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.50E+00	2.50E+00	2.50E+00	--	N/A	N/A	Unknown
104-S-1	Ethane	4	100.0	5.26E+02	--	--	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+02	5.26E+02	2.83E+02	1.74E+02	4.87E+02	1.24E+03	Normal/Lognormal
104-S-1	Ethene	4	75.0	2.34E+02	--	--	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.68E+01	2.34E+02	7.51E+01	1.07E+02	2.01E+02	2.57E+06	Normal/Lognormal
104-S-1	Ethylbenzene	5	100.0	9.04E+03	7.30E+00	1238.36	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.20E+03	9.04E+03	5.50E+03	3.04E+03	8.40E+03	3.19E+04	Normal/Lognormal
104-S-1	Iron	10	100.0	2.64E+04	1.00E+03	26.41	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.57E+04	3.07E+04	2.30E+04	4.75E+03	2.58E+04	2.64E+04	Normal/Lognormal
104-S-1	Manganese	9	100.0	6.77E+02	1.00E+02	6.77	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.24E+01	6.77E+02	4.76E+02	1.59E+02	5.74E+02	8.44E+02	Unknown
104-S-1	Methane	4	100.0	1.23E+04	--	--	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.35E+03	1.23E+04	6.67E+03	5.99E+03	1.37E+04	2.13E+06	Normal/Lognormal
104-S-1	Methylene chloride	4	50.0	6.52E+00	3.21E+02	0.02	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	2.50E+02	1.50E+00	6.52E+00	3.39E+01	6.08E+01	1.05E+02	1.41E+08	Lognormal
104-S-1	Methylphenol	3	33.3	1.27E+01	1.65E+03	0.01	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.27E+01	1.27E+01	7.57E+00	4.45E+00	1.51E+01	1.13E+02	Unknown
104-S-1	Naphthalene	3	100.0	1.92E+02	1.20E+01	16.00	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.00E+01	1.92E+02	7.99E+01	9.72E+01	2.44E+02	9.94E+07	Normal/Lognormal
104-S-1	n-Hexane	1	100.0	2.31E+00	1.00E+00	2.31	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.31E+00	2.31E+00	2.31E+00	--	N/A	N/A	Unknown
104-S-1	Nickel	7	85.7	4.63E+00	8.20E+00	0.56	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.73E+00	4.63E+00	3.04E+00	1.53E+00	4.16E+00	9.38E+00	Normal/Lognormal
104-S-1	p-Isopropyltoluene	2	100.0	4.49E+00	7.49E+01	0.06	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.65E+00	4.49E+00	3.07E+00	2.01E+00	1.20E+01	3.16E+06	Unknown
104-S-1	Propylbenzene	2	100.0	3.15E+01	7.30E+00	4.32	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.55E+01	3.15E+01	2.35E+01	1.13E+01	7.40E+01	1.90E+04	Unknown
104-S-1	sec-Butylbenzene	2	50.0	1.65E+00	4.59E+00	0.36	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.65E+00	1.65E+00	1.08E+00	8.13E-01	4.71E+00	4.40E+08	Unknown
104-S-1	Selenium	7	14.3	8.35E-01	5.00E+00	0.17	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.27E+00	1.27E+00	6.10E-01	2.91E-01	8.24E-01	8.35E-01	Unknown
104-S-1	Tetrachloroethylene	1	100.0	3.60E-01	2.02E-01	1.78	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.60E-01	3.60E-01	3.60E-01	--	N/A	N/A	Unknown
104-S-1	Toluene	4	100.0	9.70E+02	9.80E+00	98.98	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.56E+00	9.70E+02	4.62E+02	5.28E+02	1.08E+03	4.76E+16	Normal/Lognormal
104-S-1	TotalExtractablePetroleum HC	2	50.0	7.55E+02	--	--	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+02	4.00E+02	7.55E+02	7.55E+02	4.78E+02	3.92E+02	2.23E+03	2.36E+13	Unknown
104-S-1	TotalVolatilePetroleum HC	2	100.0	1.01E+04	--	--	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.40E+03	1.01E+04	6.25E+03	5.44E+03	3.06E+04	2.15E+16	Unknown
104-S-1	trans-1,2-Dichloroethylene	4	75.0	4.45E+00	6.53E+01	0.07	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+01	5.00E+01	2.98E+00	4.45E+00	8.88E+00	1.08E+01	2.15E+01	4.66E+02	Lognormal
104-S-1	Trichloroethylene	3	66.7	5.80E-01	4.04E-01	1.44	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.68E-01	5.80E-01	5.49E-01	4.31E-02	6.22E-01	6.40E-01	Normal/Lognormal
104-S-1	Vanadium	3	100.0	6.60E+00	2.00E+01	0.33	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.04E+00	6.60E+00	4.88E+00	2.48E+00	9.06E+00	2.70E+02	Normal/Lognormal
104-S-1	Vinyl chloride	3	100.0	6.68E+00	1.28E+00	5.21	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.85E+00	6.68E+00	4.18E+00	2.17E+00	7.83E+00	3.48E+01	Normal/Lognormal
104-S-1	Xylenes (Total)	5	100.0	1.89E+03	1.41E+02	13.41	Area 2	7.5	17.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.95E+02	1.89E+03	1.39E+03	6.01E+02	1.96E+03	3.61E+03	Normal/Lognormal
104-S-2																							
104-S-2	1,1-Dichloroethane	2	50.0	3.32E+00	4.70E+01	0.07	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.32E+00	3.32E+00	2.91E+00	5.80E-01	5.50E+00	8.23E+00	Unknown
104-S-2	1,2,4-Trimethylbenzene	2	50.0	8.05E+00	7.77E+01	0.10	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	8.05E+00	8.05E+00	4.53E+00	4.99E+00	2.68E+01	1.65E+27	Unknown
104-S-2	1,2-Dichloroethane	2	50.0	1.24E-01	3.06E+01	0.00	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.24E-01	1.24E-01	8.70E-02	5.23E-02	3.21E-01	7.24E+03	Unknown
104-S-2	1,4-Dioxane	1	100.0	2.36E+00	9.49E+01	0.02	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.36E+00	2.36E+00	2.36E+00	--	N/A	N/A	Unknown
104-S-2	Arsenic	8	50.0	1.14E+00	5.06E-02	22.46	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.09E-01	1.89E+00	5.80E-01	5.44E-01	9.44E-01	1.14E+00	Lognormal
104-S-2	Barium	2	100.0	5.26E+00	4.00E+00	1.32	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.51E+00	5.26E+00	4.89E+00	5.30E-01	7.25E+00	7.53E+00	Unknown
104-S-2	Benzene	2	50.0	1.30E+00	1.17E+01	0.11	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	2.50E+00	2.50E+00	1.30E+00	1.30E+00	1.28E+00	3.54E-02	1.43E+00	1.40E+00	Unknown
104-S-2	Bis(2-ethylhexyl) phthalate	1	100.0	5.72E+00	2.00E+00	2.86	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	5.72E+00	5.72E+00	5.72E+00	--	N/A	N/A	Unknown
104-S-2	Chloroethane	2	100.0	1.40E+02	4.61E+02	0.30	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.72E+01	1.40E+02	1.09E+02	4.44E+01	3.07E+02	1.01E+04	Unknown
104-S-2	Chromium	5	80.0	2.35E+00	1.00E+01	0.24	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.32E+00	2.35E+00	1.62E+00	7.41E-01	2.33E+00	5.05E+00	Normal/Lognormal
104-S-2	Copper	7	100.0	5.73E+00	3.10E+00	1.85	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.22E+00	5.73E+00	3.30E+00	1.64E+00	4.50E+00	6.07E+00	Normal/Lognormal
104-S-2	Cyanide	10	30.0	1.18E+01	1.00E+01	1.18	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.01E+01	2.15E+01	7.95E+00	5.52E+00	1.12E+01	1.18E+01	Unknown
104-S-2	Ethane	3	100.0	5.03E+02	--	--	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.88E+02	5.03E+02	3.61E+02	1.60E+02	6.31E+02	4.23E+03	Normal/Lognormal
104-S-2	Ethene	3	33.3	1.37E+01	--	--	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.37E+01	1.37E+01	7.90E+00	5.02E+00	1.64E+01	1.87E+02	Unknown
104-S-2	Ethylbenzene	2	50.0	3.62E+00	7.30E+00	0.50	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.62E+00	3.62E+00	3.06E+00	7.92E-01	6.60E+00	1.61E+01	Unknown
104-S-2	Hexavalent Chromium	1	100.0	6.74E+00	1.00E+01	0.67	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.74E+00	6.74E+00	6.74E+00	--	N/A	N/A	Unknown
104-S-2	Iron	8	100.0	1.44E+04	1.00E+03	14.42	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	5.14E+03	1.66E+04	1.04E+04	3.78E+03	1.29E+04	1.44E+04	Normal/Lognormal
104-S-2	Lead	7	14.3	7.84E-01	2.50E+00	0.31	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.16E+00	1.16E+00	5.94E-01	2.49E-01	7.77E-01	7.84E-01	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
104-S-2	Manganese	9	100.0	1.22E+02	1.00E+02	1.22	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.37E+01	1.40E+02	1.00E+02	2.67E+01	1.17E+02	1.22E+02	Normal/Lognormal
104-S-2	Methane	3	100.0	5.47E+03	--	--	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.71E+03	5.47E+03	4.07E+03	2.06E+03	7.54E+03	2.15E+05	Normal/Lognormal
104-S-2	Naphthalene	2	50.0	2.46E+00	1.20E+01	0.21	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	2.50E+00	2.50E+00	2.46E+00	2.46E+00	1.86E+00	8.56E-01	5.67E+00	7.83E+02	Unknown
104-S-2	Nickel	7	28.6	1.06E+00	8.20E+00	0.13	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.09E+00	1.31E+00	7.00E-01	3.47E-01	9.55E-01	1.06E+00	Unknown
104-S-2	Trichloroethylene	2	100.0	7.30E-02	7.88E-01	0.09	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.50E-02	7.30E-02	6.90E-02	5.66E-03	9.43E-02	9.38E-02	Unknown
104-S-2	Vanadium	3	100.0	4.23E+00	2.00E+01	0.21	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.00E+00	4.23E+00	2.75E+00	1.28E+00	4.91E+00	1.54E+01	Unknown
104-S-2	Vinyl chloride	2	100.0	3.32E-01	2.04E+00	0.16	Area 2	20.5	30.5	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.11E-01	3.32E-01	3.22E-01	1.48E-02	3.88E-01	3.78E-01	Unknown
112-S-1																							
112-S-1	1,1,1-Trichloroethane	7	100.0	2.38E+02	1.10E+01	21.64	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.00E+01	2.38E+02	8.58E+01	9.25E+01	1.54E+02	4.46E+02	Lognormal
112-S-1	1,1,2-Trichlorotrifluoroethane	5	80.0	6.92E+01	1.21E+03	0.06	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.13E+01	6.92E+01	2.94E+01	2.72E+01	5.53E+01	3.99E+04	Normal/Lognormal
112-S-1	1,1-Dichloroethane	8	100.0	3.85E+02	4.70E+01	8.19	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.20E+01	3.85E+02	1.69E+02	1.50E+02	2.69E+02	8.10E+02	Normal/Lognormal
112-S-1	1,1-Dichloroethylene	8	87.5	4.65E+00	2.50E+01	0.19	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	8.00E+00	8.00E+00	3.00E-01	4.65E+00	2.03E+00	1.78E+00	3.22E+00	8.98E+00	Normal/Lognormal
112-S-1	1,2,4-Trimethylbenzene	8	62.5	3.62E+01	1.30E+01	2.78	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	2.45E+00	3.62E+01	1.46E+01	1.48E+01	2.45E+01	6.63E+02	Unknown
112-S-1	1,2-Dichlorobenzene	8	87.5	5.45E+00	1.40E+01	0.39	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	8.00E+00	8.00E+00	1.40E+00	6.75E+00	3.05E+00	1.83E+00	4.28E+00	5.45E+00	Normal/Lognormal
112-S-1	1,2-Dichloroethane	8	75.0	2.62E+00	1.29E+01	0.20	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	8.00E+00	2.20E-01	2.62E+00	1.36E+00	1.42E+00	2.30E+00	6.53E+00	Lognormal
112-S-1	1,3,5-Trimethylbenzene	8	25.0	7.78E+00	9.76E+00	0.80	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	8.00E+00	2.70E+00	7.78E+00	2.31E+00	2.53E+00	4.00E+00	8.64E+00	Lognormal
112-S-1	1,4-Dichlorobenzene	7	71.4	1.05E+00	2.50E+00	0.42	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.80E-01	1.46E+00	6.39E-01	3.94E-01	9.28E-01	1.05E+00	Lognormal
112-S-1	1,4-Dioxane	4	75.0	1.21E+01	9.49E+01	0.13	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.34E+00	1.21E+01	4.43E+00	5.21E+00	1.06E+01	3.80E+03	Normal/Lognormal
112-S-1	1-Methyl naphthalene	4	100.0	3.06E-01	2.10E+00	0.15	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.70E-02	3.06E-01	2.27E-01	1.23E-01	3.71E-01	6.65E+00	Normal
112-S-1	Arsenic	8	100.0	2.12E+01	5.06E-02	418.33	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.06E+01	2.33E+01	1.71E+01	4.49E+00	2.01E+01	2.12E+01	Normal/Lognormal
112-S-1	Benzene	8	62.5	6.50E-01	9.60E+00	0.07	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	4.00E+00	2.50E-01	6.50E-01	5.98E-01	5.89E-01	9.92E-01	1.25E+00	Lognormal
112-S-1	C8-C10 (VPH) Aromatics	2	50.0	5.48E+01	2.75E+02	0.20	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+01	5.00E+01	5.48E+01	5.48E+01	3.99E+01	2.11E+01	1.34E+02	1.66E+05	Unknown
112-S-1	Chlorobenzene	8	75.0	4.65E+00	5.19E+01	0.09	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	8.00E+00	7.60E-01	4.65E+00	2.10E+00	1.59E+00	3.16E+00	5.77E+00	Normal/Lognormal
112-S-1	Chloroethane	8	100.0	1.98E+02	4.61E+02	0.43	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.40E+00	1.98E+02	6.08E+01	6.40E+01	1.04E+02	2.07E+03	Normal/Lognormal
112-S-1	Chloroform	8	62.5	1.72E+00	4.11E+00	0.42	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	6.00E-01	8.00E+00	7.50E-01	1.72E+00	1.32E+00	1.17E+00	2.10E+00	3.20E+00	Lognormal
112-S-1	Chromium	4	50.0	3.22E+00	1.00E+01	0.32	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.65E+00	3.22E+00	1.72E+00	1.42E+00	3.39E+00	1.13E+02	Normal/Lognormal
112-S-1	cis-1,2-Dichloroethylene	8	100.0	1.72E+02	7.27E+01	2.37	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.80E+00	1.72E+02	6.42E+01	6.43E+01	1.07E+02	4.61E+02	Normal/Lognormal
112-S-1	Copper	6	66.7	4.44E+00	3.10E+00	1.43	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.14E+00	4.44E+00	2.23E+00	1.58E+00	3.53E+00	1.42E+01	Normal/Lognormal
112-S-1	Cumene	3	100.0	1.20E+00	7.30E+00	0.16	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.10E-01	1.20E+00	8.70E-01	4.11E-01	1.56E+00	1.94E+01	Normal/Lognormal
112-S-1	Ethylbenzene	8	87.5	4.15E+01	7.30E+00	5.68	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	1.80E-01	4.15E+01	1.58E+01	1.63E+01	2.67E+01	1.96E+04	Normal/Lognormal
112-S-1	Manganese	4	100.0	3.63E+02	1.00E+02	3.63	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.79E+02	3.63E+02	3.29E+02	3.63E+01	3.72E+02	3.82E+02	Normal/Lognormal
112-S-1	Naphthalene	8	62.5	1.44E+01	1.20E+01	1.20	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.10E-02	2.00E+00	7.38E+00	1.99E+01	9.16E+00	7.84E+00	1.44E+01	1.51E+05	Normal
112-S-1	Nickel	6	100.0	4.01E+00	8.20E+00	0.49	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.48E+00	4.33E+00	2.48E+00	1.15E+00	3.43E+00	4.01E+00	Normal/Lognormal
112-S-1	p-Isopropyltoluene	4	50.0	1.56E+01	7.49E+01	0.21	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.20E+01	1.56E+01	7.40E+00	7.53E+00	1.63E+01	7.07E+04	Normal/Lognormal
112-S-1	Propylbenzene	4	100.0	3.76E+00	7.30E+00	0.52	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.90E-01	3.76E+00	1.71E+00	1.45E+00	3.42E+00	5.95E+01	Normal/Lognormal
112-S-1	sec-Butylbenzene	4	100.0	2.86E+00	4.59E+00	0.62	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.00E+00	2.86E+00	1.72E+00	8.03E-01	2.66E+00	4.09E+00	Normal/Lognormal
112-S-1	Tetrachloroethylene	7	100.0	1.93E+00	2.02E-01	9.57	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.51E-01	2.14E+00	1.46E+00	4.68E-01	1.80E+00	1.93E+00	Normal/Lognormal
112-S-1	Toluene	8	25.0	1.16E+00	9.80E+00	0.12	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.50E-01	8.00E+00	1.20E-01	1.16E+00	8.79E-01	1.31E+00	1.76E+00	7.04E+00	Lognormal
112-S-1	trans-1,2-Dichloroethylene	8	87.5	3.49E+00	6.53E+01	0.05	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	8.00E+00	8.00E+00	8.60E-01	3.49E+00	2.07E+00	1.26E+00	2.91E+00	4.00E+00	Normal/Lognormal
112-S-1	Trichloroethylene	7	100.0	6.36E+00	4.04E-01	15.74	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.00E+00	6.36E+00	3.92E+00	1.67E+00	5.15E+00	8.03E+00	Normal/Lognormal
112-S-1	Vanadium	3	100.0	5.49E+00	2.00E+01	0.27	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.55E+00	5.49E+00	4.50E+00	9.71E-01	6.14E+00	7.69E+00	Normal/Lognormal
112-S-1	Vinyl chloride	8	100.0	3.21E+01	1.28E+00	25.04	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.80E-01	3.21E+01	1.02E+01	1.23E+01	1.84E+01	1.47E+02	Lognormal
112-S-1	Xylenes (Total)	8	37.5	3.68E+01	1.41E+02	0.26	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	3.00E+00	6.78E+00	3.68E+01	9.25E+00	1.41E+01	1.87E+01	4.87E+02	Lognormal
113-S-1																							
113-S-1	1,1,1-Trichloroethane	5	100.0	1.60E+01	1.10E+01	1.45	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.05E+00	1.60E+01	5.20E+00	6.05E+00	1.10E+01	3.10E+01	Unknown
113-S-1	1,1,2-Trichlorotrifluoroethane	4	75.0	9.72E+00	1.21E+03	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	8.00E+01	8.00E+01	3.74E+00	9.72E+00	1.57E+01	1.64E+01	3.50E+01	6.97E+02	Normal/Lognormal
113-S-1	1,1-Dichloroethane	6	83.3	7.08E+01	4.70E+01	1.51	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+01	4.00E+01	2.40E+01	7.50E+01	3.85E+01	2.07E+01	5.55E+01	7.08E+01	Normal/Lognormal
113-S-1	1,1-Dichloroethylene	5	60.0	8.80E-01	2.50E+01	0.04	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.30E-02	8.80E-01	4.15E-01	3.29E-01	7.29E-01	6.97E+00	Normal/Lognormal
113-S-1	1,2,4-Trimethylbenzene	6	100.0	9.40E+01	1.30E+01	7.22	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.50E+01	9.40E+01	4.79E+01	3.37E+01	7.56E+01	1.72E+02	Normal/Lognormal
113-S-1	1,2-Dichlorobenzene	4	75.0	1.58E+00	1.40E+01	0.11	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.40E-01	1.58E+00	9.78E-01	5.92E-01	1.67E+00	6.17E+00	Normal/Lognormal
113-S-1	1,2-Dichloroethane	5	40.0	8.17E-01	1.29E+01	0.06	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.90E-01	8.17E-01	5.21E-01	1.89E-01	7.01E-01	8.46E-01	Normal/Lognormal
113-S-1	1,3,5-Trimethylbenzene	5	100.0	2.33E+01	9.76E+00	2.39	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.80E+00	2.33E+01	1.08E+01	9.15E+00	1.96E+01	9.64E+01	Normal/Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information									
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
113-S-1	1,4-Dichlorobenzene	4	25.0	3.06E-01	2.50E+00	0.12	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	3.06E-01	3.06E-01	3.89E-01	1.30E-01	5.42E-01	7.23E-01	Normal/Lognormal
113-S-1	1,4-Dioxane	4	100.0	9.30E+00	9.49E+01	0.10	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.49E+00	9.30E+00	5.45E+00	3.74E+00	9.85E+00	1.06E+02	Normal/Lognormal
113-S-1	1-Methyl naphthalene	4	75.0	2.06E-01	2.10E+00	0.10	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	3.10E-02	2.06E-01	1.06E-01	8.08E-02	2.01E-01	2.29E+00	Normal/Lognormal
113-S-1	2-Methylnaphthalene	2	50.0	1.20E-02	2.10E+00	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.20E-02	1.20E-02	3.10E-02	2.69E-02	1.51E-01	7.14E+10	Unknown
113-S-1	Arsenic	9	100.0	2.19E+01	5.06E-02	431.88	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.81E+00	2.41E+01	1.65E+01	5.79E+00	2.01E+01	2.19E+01	Normal/Lognormal
113-S-1	Barium	2	50.0	4.03E+00	4.00E+00	1.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	4.03E+00	4.03E+00	3.02E+00	1.44E+00	9.42E+00	2.05E+03	Unknown
113-S-1	Benzene	5	100.0	7.47E+00	9.60E+00	0.78	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.10E-01	7.47E+00	3.55E+00	2.70E+00	6.13E+00	2.27E+01	Normal/Lognormal
113-S-1	Benzo(b)fluoranthene	4	25.0	1.51E-02	1.94E-02	0.78	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.51E-02	1.51E-02	7.24E-03	5.27E-03	1.34E-02	3.32E-02	Lognormal
113-S-1	Benzo(k)fluoranthene	4	25.0	1.10E-02	1.80E-02	0.61	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.10E-02	1.10E-02	6.21E-03	3.24E-03	1.00E-02	1.56E-02	Normal/Lognormal
113-S-1	C8-C10 (EPH) Aromatics	1	100.0	8.40E+01	2.75E+02	0.31	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.40E+01	8.40E+01	8.40E+01	--	N/A	N/A	Unknown
113-S-1	C8-C10 (VPH) Aromatics	2	100.0	3.00E+03	2.75E+02	10.92	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.40E+02	3.00E+03	1.57E+03	2.02E+03	1.06E+04	5.15E+60	Unknown
113-S-1	Chlorobenzene	5	20.0	2.80E-01	5.19E+01	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+01	2.80E-01	2.80E-01	4.36E+00	8.75E+00	1.27E+01	4.97E+03	Unknown
113-S-1	Chloroethane	6	100.0	1.96E+02	4.61E+02	0.43	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.74E+01	1.96E+02	1.05E+02	6.41E+01	1.58E+02	3.05E+02	Normal/Lognormal
113-S-1	Chromium	6	100.0	1.86E+01	1.00E+01	1.86	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.83E+00	1.86E+01	5.17E+00	6.61E+00	1.06E+01	2.07E+01	Unknown
113-S-1	cis-1,2-Dichloroethylene	6	83.3	2.00E+01	7.27E+01	0.28	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+01	4.00E+01	3.75E+00	2.00E+01	1.20E+01	7.50E+00	1.82E+01	4.05E+01	Normal/Lognormal
113-S-1	Copper	7	57.1	1.70E+00	3.10E+00	0.55	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.03E+00	1.77E+00	9.61E-01	4.88E-01	1.32E+00	1.70E+00	Normal/Lognormal
113-S-1	Cumene	1	100.0	1.70E+00	7.30E+00	0.23	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.70E+00	1.70E+00	1.70E+00	--	N/A	N/A	Unknown
113-S-1	Dibenzo(a,h)anthracene	4	25.0	6.67E-02	1.62E-02	4.12	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	6.67E-02	6.67E-02	2.01E-02	3.10E-02	5.67E-02	2.17E+01	Unknown
113-S-1	Ethylbenzene	6	100.0	3.54E+03	7.30E+00	484.93	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.10E+01	3.54E+03	1.63E+03	1.50E+03	2.86E+03	4.40E+05	Normal/Lognormal
113-S-1	Indeno(1,2,3-cd)pyrene	4	25.0	6.16E-02	2.00E-02	3.08	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	6.16E-02	6.16E-02	1.89E-02	2.85E-02	5.24E-02	1.36E+01	Unknown
113-S-1	Iron	2	100.0	1.28E+04	1.00E+03	12.80	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.04E+04	1.28E+04	1.16E+04	1.70E+03	1.92E+04	2.21E+04	Unknown
113-S-1	Manganese	6	100.0	1.95E+02	1.00E+02	1.95	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.11E+02	2.21E+02	1.52E+02	4.14E+01	1.86E+02	1.95E+02	Normal/Lognormal
113-S-1	Naphthalene	5	100.0	1.31E+01	1.20E+01	1.09	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.00E+00	1.31E+01	6.20E+00	4.95E+00	1.09E+01	3.65E+01	Normal/Lognormal
113-S-1	Nickel	7	100.0	1.14E+01	8.20E+00	1.39	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.48E+00	1.52E+01	5.56E+00	4.48E+00	8.85E+00	1.14E+01	Lognormal
113-S-1	p-Isopropyltoluene	3	66.7	3.70E-01	7.49E+01	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.00E-01	3.70E-01	3.57E-01	1.50E-01	6.10E-01	2.75E+00	Normal/Lognormal
113-S-1	Propylbenzene	3	100.0	6.15E+00	7.30E+00	0.84	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.30E+00	6.15E+00	4.05E+00	1.95E+00	7.34E+00	3.89E+01	Normal/Lognormal
113-S-1	sec-Butylbenzene	3	66.7	4.30E-01	4.59E+00	0.09	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.20E-01	4.30E-01	4.17E-01	9.07E-02	5.70E-01	7.36E-01	Normal/Lognormal
113-S-1	Selenium	7	14.3	1.20E+00	5.00E+00	0.24	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.01E+00	2.01E+00	7.16E-01	5.71E-01	1.13E+00	1.20E+00	Unknown
113-S-1	Tetrachloroethylene	5	100.0	1.60E+00	2.02E-01	7.92	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.82E-01	1.60E+00	1.22E+00	4.40E-01	1.64E+00	2.57E+00	Normal/Lognormal
113-S-1	Toluene	6	100.0	1.99E+02	9.80E+00	20.31	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.90E-01	1.99E+02	5.64E+01	8.74E+01	1.28E+02	1.82E+07	Lognormal
113-S-1	TotalExtractablePetroleum HC	2	50.0	8.40E+01	--	--	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	3.00E+02	3.00E+02	8.40E+01	8.40E+01	1.17E+02	4.67E+01	3.25E+02	8.43E+03	Unknown
113-S-1	TotalVolatilePetroleum HC	2	100.0	4.00E+03	--	--	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.40E+02	4.00E+03	2.07E+03	2.73E+03	1.43E+04	1.58E+72	Unknown
113-S-1	trans-1,2-Dichloroethylene	6	83.3	1.30E+00	6.53E+01	0.02	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+01	4.00E+01	6.60E-01	1.30E+00	4.12E+00	7.78E+00	1.05E+01	6.73E+01	Unknown
113-S-1	Trichloroethylene	5	100.0	1.30E+00	4.04E-01	3.22	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.78E-01	1.30E+00	1.15E+00	2.18E-01	1.36E+00	1.47E+00	Normal
113-S-1	Vanadium	4	75.0	6.28E+00	2.00E+01	0.31	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	4.81E+00	6.36E+00	5.26E+00	7.36E-01	6.13E+00	6.28E+00	Unknown
113-S-1	Vinyl chloride	5	100.0	8.50E+00	1.28E+00	6.63	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.11E+00	8.50E+00	3.80E+00	2.67E+00	6.34E+00	9.26E+00	Lognormal
113-S-1	Xylenes (Total)	5	100.0	8.97E+02	1.41E+02	6.38	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.89E+01	8.97E+02	4.01E+02	3.53E+02	7.38E+02	3.36E+04	Normal/Lognormal
CG-106-I																							
CG-106-I	1-Methyl naphthalene	2	50.0	2.80E-03	2.10E+00	0.00	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	2.80E-03	2.80E-03	2.64E-02	3.34E-02	1.75E-01	1.85E+49	Unknown
CG-106-I	Arsenic	8	87.5	2.61E+00	5.06E-02	51.58	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.10E-01	1.10E-01	2.23E-01	2.61E+00	6.53E-01	8.16E-01	1.20E+00	3.24E+00	Lognormal
CG-106-I	Barium	3	100.0	4.69E+01	4.00E+00	11.73	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.90E+00	4.69E+01	2.05E+01	2.29E+01	5.91E+01	1.11E+06	Lognormal
CG-106-I	Bis(2-ethylhexyl) phthalate	2	50.0	1.80E-01	2.00E+00	0.09	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.80E-01	1.80E-01	5.90E-01	5.80E-01	3.18E+00	4.86E+17	Unknown
CG-106-I	Chromium	3	100.0	7.45E+00	1.00E+01	0.75	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.58E+00	7.45E+00	3.54E+00	3.39E+00	9.25E+00	6.25E+03	Unknown
CG-106-I	Copper	6	83.3	2.78E+01	3.10E+00	8.97	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.34E+00	2.78E+01	6.02E+00	1.07E+01	1.48E+01	1.34E+02	Lognormal
CG-106-I	Ethane	4	25.0	1.10E+00	--	--	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.10E+00	1.10E+00	4.03E+00	1.95E+00	6.32E+00	4.33E+01	Unknown
CG-106-I	Hexavalent Chromium	1	100.0	1.69E+01	1.00E+01	1.69	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.69E+01	1.69E+01	1.69E+01	--	N/A	N/A	Unknown
CG-106-I	Iron	7	100.0	2.02E+03	1.00E+03	2.02	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.24E+03	2.18E+03	1.69E+03	3.53E+02	1.95E+03	2.02E+03	Normal/Lognormal
CG-106-I	Lead	7	14.3	2.78E+00	2.50E+00	1.11	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.36E+00	4.36E+00	1.05E+00	1.46E+00	2.12E+00	2.78E+00	Unknown
CG-106-I	Manganese	7	100.0	1.66E+02	1.00E+02	1.66	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.03E+02	1.88E+02	1.39E+02	3.04E+01	1.61E+02	1.66E+02	Normal/Lognormal
CG-106-I	Methane	4	100.0	3.58E+04	--	--	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.10E+04	3.58E+04	3.03E+04	6.89E+03	3.84E+04	4.43E+04	Normal/Lognormal
CG-106-I	Nickel	6	50.0	6.00E+00	8.20E+00	0.73	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.17E+00	6.00E+00	1.66E+00	2.16E+00	3.43E+00	9.43E+00	Lognormal
CG-106-I	Vanadium	1	100.0	1.67E+01	2.00E+01	0.84	Upgrade	26	36	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.67E+01	1.67E+01	1.67E+01	--	N/A	N/A	Unknown

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-106-WT																							
CG-106-WT	1,1-Dichloroethane	2	50.0	2.90E-01	4.70E+01	0.01	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.90E-01	2.90E-01	3.95E-01	1.48E-01	1.06E+00	1.63E+01	Unknown
CG-106-WT	1,1-Dichloroethylene	2	50.0	7.10E-03	2.50E+01	0.00	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	7.10E-03	7.10E-03	1.61E-02	1.27E-02	7.26E-02	6.21E+07	Unknown
CG-106-WT	1,2-Dichloroethane	2	50.0	1.00E-01	1.29E+01	0.01	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.00E-01	1.00E-01	7.50E-02	3.54E-02	2.33E-01	4.37E+01	Unknown
CG-106-WT	Arsenic	7	71.4	5.70E-01	5.06E-02	11.25	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.60E-01	1.00E+00	2.07E-01	5.70E-01	3.56E-01	1.77E-01	4.86E-01	8.67E-01	Normal/Lognormal
CG-106-WT	Bis(2-ethylhexyl) phthalate	2	50.0	2.06E+00	2.00E+00	1.03	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	6.60E-01	6.60E-01	2.06E+00	2.06E+00	1.20E+00	1.22E+00	6.66E+00	3.40E+20	Unknown
CG-106-WT	Chloroform	2	100.0	1.31E+01	4.11E+00	3.19	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.50E+00	1.31E+01	7.30E+00	8.20E+00	4.39E+01	3.55E+29	Unknown
CG-106-WT	cis-1,2-Dichloroethylene	2	50.0	8.60E-01	7.27E+01	0.01	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.60E-01	8.60E-01	6.80E-01	2.55E-01	1.82E+00	2.71E+01	Unknown
CG-106-WT	Copper	6	16.7	8.01E-01	3.10E+00	0.26	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.05E+00	1.05E+00	5.92E-01	2.25E-01	7.76E-01	8.01E-01	Unknown
CG-106-WT	Dibenzo(a,h)anthracene	2	50.0	1.28E-02	1.62E-02	0.79	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	7.70E-03	1.28E-02	1.28E-02	8.33E-03	6.33E-03	3.66E-02	4.38E+06	Unknown
CG-106-WT	Indeno(1,2,3-cd)pyrene	2	50.0	1.18E-02	2.00E-02	0.59	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	7.70E-03	7.70E-03	1.18E-02	1.18E-02	7.83E-03	5.62E-03	3.29E-02	2.86E+05	Unknown
CG-106-WT	Iron	7	28.6	3.23E+02	1.00E+03	0.32	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.50E+02	3.00E+02	1.89E+01	3.23E+02	1.45E+02	9.35E+01	2.14E+02	5.81E+02	Normal/Lognormal
CG-106-WT	Manganese	7	85.7	3.76E+01	1.00E+02	0.38	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.35E+01	3.76E+01	2.27E+01	1.12E+01	3.10E+01	5.53E+01	Normal/Lognormal
CG-106-WT	Methane	4	75.0	1.56E+01	--	--	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.20E+00	1.20E+00	1.66E+00	1.56E+01	8.22E+00	8.20E+00	1.79E+01	3.52E+05	Normal/Lognormal
CG-106-WT	Nickel	6	50.0	1.61E+00	8.20E+00	0.20	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.05E+00	1.61E+00	9.37E-01	5.12E-01	1.36E+00	1.95E+00	Normal/Lognormal
CG-106-WT	Pentachlorophenol	2	50.0	2.00E+00	2.53E+00	0.79	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	2.00E+00	2.00E+00	1.01E+00	1.40E+00	7.25E+00	8.24E+117	Unknown
CG-106-WT	Tetrachloroethylene	2	50.0	1.19E-01	2.02E-01	0.59	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	1.19E-01	1.19E-01	1.85E-01	9.26E-02	5.98E-01	3.00E+02	Unknown
CG-106-WT	Trichloroethylene	2	100.0	2.37E+00	4.04E-01	5.87	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.90E+00	2.37E+00	2.14E+00	3.32E-01	3.62E+00	4.33E+00	Unknown
CG-106-WT	Vanadium	1	100.0	1.47E+00	2.00E+01	0.07	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.47E+00	1.47E+00	1.47E+00	--	N/A	N/A	Unknown
CG-106-WT	Vinyl chloride	2	50.0	2.20E-01	1.28E+00	0.17	Upgrade	4	14	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.20E-01	2.20E-01	1.15E-01	1.48E-01	7.78E-01	3.75E+57	Unknown
CG-114-75																							
CG-114-75	1,1-Dichloroethane	5	20.0	1.70E-01	4.70E+01	0.00	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.70E-01	1.70E-01	4.34E-01	1.48E-01	5.75E-01	9.09E-01	Unknown
CG-114-75	1,2-Dichloroethane	5	20.0	9.10E-03	3.06E+01	0.00	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	9.10E-03	9.10E-03	4.18E-02	1.83E-02	5.93E-02	2.11E-01	Unknown
CG-114-75	1,4-Dioxane	4	100.0	5.26E+00	9.49E+01	0.06	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.55E+00	5.26E+00	3.11E+00	1.61E+00	5.01E+00	1.00E+01	Normal/Lognormal
CG-114-75	2-Methylnaphthalene	2	50.0	2.90E-03	2.10E+00	0.00	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	2.90E-03	2.90E-03	2.65E-02	3.33E-02	1.75E-01	1.08E+48	Unknown
CG-114-75	Arsenic	8	75.0	2.26E+00	5.06E-02	44.66	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	6.13E-02	8.00E-02	7.81E-02	2.26E+00	3.84E-01	7.61E-01	8.94E-01	2.85E+00	Lognormal
CG-114-75	Barium	4	50.0	3.12E+01	4.00E+00	7.80	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	4.00E+00	1.00E+01	5.29E+00	3.12E+01	1.09E+01	1.36E+01	2.69E+01	1.93E+03	Lognormal
CG-114-75	Benzo(a)anthracene	4	25.0	1.05E-02	2.00E-02	0.53	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.05E-02	1.05E-02	6.09E-03	2.99E-03	9.61E-03	1.42E-02	Normal/Lognormal
CG-114-75	Chromium	2	100.0	9.40E+00	1.00E+01	0.94	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.31E+00	9.40E+00	5.36E+00	5.72E+00	3.09E+01	2.70E+24	Unknown
CG-114-75	Chrysene	4	25.0	1.11E-02	1.80E-02	0.62	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.11E-02	1.11E-02	6.24E-03	3.29E-03	1.01E-02	1.59E-02	Normal/Lognormal
CG-114-75	Copper	4	75.0	2.33E+01	3.10E+00	7.52	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.33E+00	2.33E+01	7.04E+00	1.09E+01	1.99E+01	2.46E+05	Lognormal
CG-114-75	Cyanide	8	37.5	7.81E+00	1.00E+01	0.78	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	3.00E+00	1.18E+01	5.73E+00	2.59E+00	7.46E+00	7.81E+00	Unknown
CG-114-75	Dibenzo(a,h)anthracene	4	25.0	1.64E-02	1.62E-02	1.01	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	7.70E-03	1.00E-02	1.64E-02	1.64E-02	7.56E-03	5.92E-03	1.45E-02	4.20E-02	Lognormal
CG-114-75	Lead	3	33.3	3.74E+00	2.50E+00	1.50	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.74E+00	3.74E+00	1.58E+00	1.87E+00	4.73E+00	4.97E+05	Unknown
CG-114-75	Manganese	4	100.0	3.84E+02	1.00E+02	3.84	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.87E+02	3.84E+02	3.33E+02	4.24E+01	3.83E+02	3.94E+02	Normal/Lognormal
CG-114-75	Nickel	4	75.0	8.38E+00	8.20E+00	1.02	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.25E+00	8.38E+00	3.03E+00	3.62E+00	7.29E+00	7.14E+02	Normal/Lognormal
CG-114-75	Vanadium	1	100.0	2.18E+01	2.00E+01	1.09	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.18E+01	2.18E+01	2.18E+01	--	N/A	N/A	Unknown
CG-114-75	Vinyl chloride	5	60.0	4.30E-02	2.04E+00	0.02	Area 2	64.17	74.17	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.60E-02	4.30E-02	2.58E-02	1.58E-02	4.09E-02	1.07E-01	Normal/Lognormal
CG-115-75																							
CG-115-75	1,1-Dichloroethane	8	100.0	8.95E+00	4.70E+01	0.19	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	8.10E-01	8.95E+00	3.50E+00	3.35E+00	5.74E+00	1.01E+01	Lognormal
CG-115-75	1,1-Dichloroethylene	8	12.5	7.40E-02	2.50E+01	0.00	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E+00	7.40E-02	7.40E-02	3.35E-01	8.75E-01	9.21E-01	1.05E+01	Unknown
CG-115-75	1,2-Dichloroethane	8	50.0	1.13E-01	3.06E+01	0.00	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	5.00E+00	2.55E-02	1.13E-01	3.58E-01	8.66E-01	9.38E-01	3.16E+00	Unknown
CG-115-75	1,4-Dioxane	4	100.0	1.53E+00	9.49E+01	0.02	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	9.95E-01	1.53E+00	1.28E+00	2.28E-01	1.55E+00	1.67E+00	Normal/Lognormal
CG-115-75	Arsenic	6	50.0	1.96E+00	5.06E-02	38.74	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	6.12E-02	9.00E-02	7.17E-01	1.96E+00	6.42E-01	7.78E-01	1.28E+00	9.01E+02	Normal/Lognormal
CG-115-75	Barium	4	100.0	3.29E+01	4.00E+00	8.23	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	5.87E+00	3.29E+01	2.12E+01	1.13E+01	3.45E+01	2.35E+02	Normal/Lognormal
CG-115-75	Benzene	8	62.5	1.25E+00	1.17E+01	0.11	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	2.50E+00	1.80E-01	1.27E+00	5.21E-01	4.66E-01	8.33E-01	1.25E+00	Unknown
CG-115-75	Benzo(b)fluoranthene	4	25.0	2.13E-02	1.94E-02	1.10	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.13E-02	2.13E-02	9.83E-03	7.78E-03	1.90E-02	6.51E-02	Normal/Lognormal
CG-115-75	Benzo(k)fluoranthene	4	25.0	1.51E-02	1.80E-02	0.84	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.51E-02	1.51E-02	8.28E-03	4.76E-03	1.39E-02	2.67E-02	Normal/Lognormal
CG-115-75	Bis(2-ethylhexyl) phthalate	4	25.0	6.45E-01	2.00E+00	0.32	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.23E+00	3.42E+00	6.45E-01	6.45E-01	9.98E-01	5.09E-01	1.60E+00	2.71E+00	Normal/Lognormal
CG-115-75	Chloroethane	8	87.5	4.38E+00	4.61E+02	0.01	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	2.20E+00	6.34E+00	3.32E+00	1.36E+00	4.23E+00	4.38E+00	Lognormal
CG-115-75	Chromium	2	100.0	6.45E+00	1.00E+01	0.65	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	5.14E+00	6.45E+00	5.79E+00	9.30E-01	9.94E+00	1.21E+01	Unknown
CG-115-75	cis-1,2-Dichloroethylene	8	50.0	3.07E+01	1.65E+02	0.19	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	2.10E-01	3.07E+01	7.12E+00	1.25E+01	1.55E+01	1.04E+03	Unknown

ATTACHMENT A-1

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

Geomatrix

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-115-75	Copper	4	100.0	1.54E+01	3.10E+00	4.97	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.97E+00	1.54E+01	9.04E+00	5.25E+00	1.52E+01	7.01E+01	Normal/Lognormal
CG-115-75	Cyanide	9	100.0	3.80E+01	1.00E+01	3.80	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	8.00E+00	4.30E+01	3.17E+01	1.02E+01	3.80E+01	5.00E+01	Normal
CG-115-75	Dibenzo(a,h)anthracene	4	25.0	3.17E-02	1.62E-02	1.96	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.17E-02	3.17E-02	1.24E-02	1.29E-02	2.76E-02	2.53E-01	Lognormal
CG-115-75	Indeno(1,2,3-cd)pyrene	4	25.0	3.43E-02	2.00E-02	1.72	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.43E-02	3.43E-02	1.31E-02	1.42E-02	2.98E-02	3.44E-01	Lognormal
CG-115-75	Lead	4	50.0	2.22E+00	2.50E+00	0.89	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	1.00E+00	1.20E+00	2.22E+00	9.86E-01	9.54E-01	2.11E+00	9.76E+06	Normal/Lognormal
CG-115-75	Manganese	4	100.0	7.11E+02	1.00E+02	7.11	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.70E+02	7.11E+02	5.36E+02	1.39E+02	7.00E+02	8.17E+02	Normal/Lognormal
CG-115-75	Naphthalene	8	25.0	7.60E-01	1.20E+01	0.06	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	8.00E-03	2.50E+00	7.40E-01	7.60E-01	6.57E-01	4.41E-01	9.52E-01	1.36E+02	Normal
CG-115-75	Nickel	4	75.0	5.47E+00	8.20E+00	0.67	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.91E+00	5.47E+00	3.77E+00	2.29E+00	6.46E+00	7.73E+02	Normal
CG-115-75	Propylbenzene	4	25.0	1.30E-01	7.30E+00	0.02	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.30E-01	1.30E-01	6.58E-01	4.23E-01	1.16E+00	2.84E+01	Normal/Lognormal
CG-115-75	trans-1,2-Dichloroethylene	8	100.0	5.50E+02	1.69E+03	0.33	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.50E+00	5.50E+02	1.21E+02	1.91E+02	2.49E+02	6.45E+03	Lognormal
CG-115-75	Vanadium	1	100.0	1.64E+01	2.00E+01	0.82	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.64E+01	1.64E+01	1.64E+01	--	N/A	N/A	Unknown
CG-115-75	Vinyl chloride	8	100.0	3.08E+02	2.04E+00	151.06	Area 2	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.45E-01	3.08E+02	5.66E+01	1.12E+02	1.32E+02	1.71E+06	Lognormal
CG-115-WT																							
CG-115-WT	1,1-Dichloroethane	8	50.0	1.18E+00	4.70E+01	0.03	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	3.85E-01	1.18E+00	1.13E+00	1.58E+00	2.19E+00	2.83E+00	Unknown
CG-115-WT	1,2,4-Trimethylbenzene	8	87.5	1.80E+02	1.30E+01	13.83	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	3.90E-01	1.80E+02	5.21E+01	6.09E+01	9.29E+01	4.40E+04	Normal/Lognormal
CG-115-WT	1,2-Dichlorobenzene	8	75.0	2.65E+00	1.40E+01	0.19	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	4.10E-01	2.65E+00	1.53E+00	1.58E+00	2.59E+00	4.31E+00	Lognormal
CG-115-WT	1,2-Dichloroethane	8	87.5	1.87E-01	1.29E+01	0.01	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.10E-01	1.87E-01	1.94E-01	1.27E-01	2.79E-01	2.92E-01	Unknown
CG-115-WT	1,3,5-Trimethylbenzene	8	50.0	3.89E+01	9.76E+00	3.98	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.47E+01	3.89E+01	1.34E+01	1.55E+01	2.38E+01	1.20E+03	Lognormal
CG-115-WT	1,4-Dichlorobenzene	8	37.5	2.60E-01	2.50E+00	0.10	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E+00	1.30E-01	2.60E-01	2.07E-01	1.46E-01	3.05E-01	5.65E-01	Normal/Lognormal
CG-115-WT	1,4-Dioxane	4	25.0	2.11E+00	9.49E+01	0.02	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.11E+00	2.11E+00	9.03E-01	8.05E-01	1.85E+00	7.18E+00	Unknown
CG-115-WT	1-Methyl naphthalene	4	100.0	1.12E+00	2.10E+00	0.53	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.70E-01	1.12E+00	6.59E-01	3.58E-01	1.08E+00	2.97E+00	Normal/Lognormal
CG-115-WT	2-Methylnaphthalene	2	100.0	2.17E-01	2.10E+00	0.10	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.00E-02	2.17E-01	1.44E-01	1.04E-01	6.08E-01	7.52E+06	Unknown
CG-115-WT	Arsenic	6	83.3	2.49E+00	5.06E-02	49.21	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	9.30E-01	9.30E-01	1.20E+00	2.49E+00	1.64E+00	7.27E-01	2.24E+00	3.90E+00	Normal/Lognormal
CG-115-WT	Barium	2	50.0	5.04E+00	4.00E+00	1.26	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	5.04E+00	5.04E+00	3.52E+00	2.15E+00	1.31E+01	4.45E+05	Unknown
CG-115-WT	Benzene	8	87.5	2.11E+01	9.60E+00	2.20	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	7.90E-01	2.72E+01	5.28E+00	8.91E+00	1.12E+01	2.11E+01	Lognormal
CG-115-WT	C10-C12 (EPH) Aromatics	3	33.3	5.10E+01	5.00E+01	1.02	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.80E+01	5.00E+01	5.10E+01	5.10E+01	3.33E+01	1.53E+01	5.91E+01	1.79E+02	Normal/Lognormal
CG-115-WT	C8-C10 (EPH) Aromatics	3	33.3	9.25E+01	2.75E+02	0.34	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.80E+01	1.00E+02	9.25E+01	9.25E+01	5.55E+01	3.46E+01	1.14E+02	4.03E+03	Normal/Lognormal
CG-115-WT	C8-C10 (VPH) Aromatics	6	66.7	2.61E+02	2.75E+02	0.95	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+01	5.00E+01	1.01E+02	2.61E+02	1.16E+02	8.98E+01	1.90E+02	8.09E+02	Normal/Lognormal
CG-115-WT	Chlorobenzene	8	75.0	1.63E+00	5.19E+01	0.03	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	5.50E-01	1.63E+00	1.40E+00	1.51E+00	2.41E+00	3.15E+00	Lognormal
CG-115-WT	Chloroethane	8	100.0	1.79E+02	4.61E+02	0.39	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.90E+00	1.79E+02	3.58E+01	5.97E+01	7.58E+01	4.08E+02	Lognormal
CG-115-WT	Chromium	2	100.0	3.04E+00	1.00E+01	0.30	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.94E+00	3.04E+00	2.49E+00	7.78E-01	5.96E+00	2.87E+01	Unknown
CG-115-WT	cis-1,2-Dichloroethylene	8	25.0	1.90E-01	7.27E+01	0.00	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+01	1.70E-01	1.90E-01	9.51E-01	1.64E+00	2.05E+00	3.47E+00	Unknown
CG-115-WT	Copper	4	75.0	4.84E+00	3.10E+00	1.56	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.16E+00	4.84E+00	2.60E+00	1.80E+00	4.71E+00	1.22E+02	Normal/Lognormal
CG-115-WT	Cumene	3	100.0	8.20E+00	7.30E+00	1.12	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.40E+00	8.20E+00	5.97E+00	2.42E+00	1.00E+01	4.04E+01	Normal/Lognormal
CG-115-WT	Dibenzo(a,h)anthracene	4	25.0	2.40E-02	1.62E-02	1.48	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.40E-02	2.40E-02	1.05E-02	9.11E-03	2.12E-02	9.44E-02	Lognormal
CG-115-WT	Ethylbenzene	8	50.0	1.49E+02	7.30E+00	20.41	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	9.77E+00	1.49E+02	3.23E+01	5.19E+01	6.70E+01	5.26E+05	Lognormal
CG-115-WT	Indeno(1,2,3-cd)pyrene	4	25.0	3.43E-02	2.00E-02	1.72	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.43E-02	3.43E-02	1.31E-02	1.42E-02	2.98E-02	3.44E-01	Lognormal
CG-115-WT	Lead	5	60.0	1.13E+00	2.50E+00	0.45	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.10E-01	1.13E+00	7.28E-01	3.55E-01	1.07E+00	1.49E+00	Normal/Lognormal
CG-115-WT	Manganese	4	100.0	5.31E+02	1.00E+02	5.31	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.53E+02	5.31E+02	3.91E+02	1.30E+02	5.43E+02	7.13E+02	Normal/Lognormal
CG-115-WT	Methylene chloride	8	12.5	2.35E-01	3.21E+02	0.00	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	3.00E-01	5.00E+01	2.35E-01	2.35E-01	4.55E+00	8.33E+00	1.01E+01	1.14E+02	Lognormal
CG-115-WT	Naphthalene	8	100.0	2.37E+01	1.20E+01	1.98	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.80E+00	2.37E+01	9.27E+00	7.17E+00	1.41E+01	2.58E+01	Normal/Lognormal
CG-115-WT	Nickel	4	100.0	1.94E+00	8.20E+00	0.24	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.19E+00	1.94E+00	1.48E+00	3.37E-01	1.87E+00	2.03E+00	Normal/Lognormal
CG-115-WT	Phenol	4	25.0	6.70E-01	1.18E+02	0.01	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	6.70E-01	6.70E-01	3.92E+00	2.17E+00	6.46E+00	2.45E+02	Unknown
CG-115-WT	p-Isopropyltoluene	4	75.0	1.25E+00	7.49E+01	0.02	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.30E-01	1.25E+00	7.73E-01	4.80E-01	1.34E+00	5.68E+01	Normal/Lognormal
CG-115-WT	Propylbenzene	4	100.0	1.45E+01	7.30E+00	1.99	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.20E+00	1.45E+01	1.00E+01	4.08E+00	1.48E+01	2.51E+01	Normal/Lognormal
CG-115-WT	sec-Butylbenzene	4	100.0	1.58E+00	4.59E+00	0.34	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.50E-01	1.58E+00	1.10E+00	4.41E-01	1.62E+00	2.84E+00	Normal/Lognormal
CG-115-WT	Toluene	7	85.7	2.79E+01	9.80E+00	2.84	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.50E-01	2.79E+01	4.98E+00	1.01E+01	1.24E+01	1.16E+02	Lognormal
CG-115-WT	TotalExtractablePetroleum HC	6	16.7	1.18E+02	--	--	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	9.60E+01	4.00E+02	1.18E+02	1.18E+02	1.24E+02	6.38E+01	1.76E+02	3.00E+02	Normal/Lognormal
CG-115-WT	TotalVolatilePetroleum HC	6	33.3	5.88E+02	--	--	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+01	3.50E+02	1.93E+02	5.88E+02	1.97E+02	2.06E+02	3.67E+02	4.27E+03	Lognormal
CG-115-WT	trans-1,2-Dichloroethylene	8	50.0	1.17E+00	6.53E+01	0.02	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	3.50E-01	1.17E+00	1.12E+00	1.59E+00	2.19E+00	2.82E+00	Unknown
CG-115-WT	Trichloroethylene	8	62.5	5.30E-02	4.04E-01	0.13	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	1.00E+00	1.10E-02	5.30E-02	8.33E-02	1.69E-01	1.96E-01	4.33E-01	Unknown
CG-115-WT	Vanadium	1	100.0	9.10E+00	2.00E+01	0.46	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.10E+00	9.10E+00	9.10E+00	--	N/A	N/A	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information									
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-115-WT	Vinyl chloride	8	87.5	6.87E-01	1.28E+00	0.54	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.30E-02	6.87E-01	3.04E-01	2.21E-01	4.51E-01	9.30E-01	Normal/Lognormal
CG-115-WT	Xylenes (Total)	8	100.0	2.18E+03	1.41E+02	15.51	Area 2	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.90E-01	2.18E+03	4.12E+02	7.45E+02	9.12E+02	5.47E+06	Lognormal
CG-116-80																							
CG-116-80	1,1-Dichloroethane	8	100.0	2.97E+01	4.70E+01	0.63	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.50E+01	3.18E+01	2.82E+01	2.08E+00	2.96E+01	2.97E+01	Normal/Lognormal
CG-116-80	1,1-Dichloroethylene	8	12.5	6.60E-03	2.50E+01	0.00	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E+01	6.60E-03	6.60E-03	3.26E+00	4.48E+00	6.26E+00	4.57E+05	Lognormal
CG-116-80	1,2-Dichloroethane	8	37.5	1.50E-01	3.06E+01	0.00	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+01	1.60E-02	1.50E-01	3.29E+00	4.46E+00	6.27E+00	4.38E+03	Lognormal
CG-116-80	Benzene	8	62.5	1.18E+00	1.17E+01	0.10	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	1.00E+01	8.20E-01	1.18E+00	2.15E+00	1.85E+00	3.38E+00	5.26E+00	Unknown
CG-116-80	Carbon disulfide	5	20.0	2.60E+00	9.20E-01	2.83	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	2.60E+00	2.60E+00	7.20E-01	1.05E+00	1.72E+00	1.00E+01	Unknown
CG-116-80	Chloroethane	8	12.5	2.30E-01	4.61E+02	0.00	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	2.00E+01	2.30E-01	2.30E-01	3.34E+00	4.41E+00	6.30E+00	1.33E+02	Unknown
CG-116-80	cis-1,2-Dichloroethylene	8	25.0	3.14E+00	1.65E+02	0.02	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	2.00E+01	1.50E-01	3.14E+00	3.66E+00	4.28E+00	6.53E+00	2.42E+02	Lognormal
CG-116-80	trans-1,2-Dichloroethylene	7	100.0	7.46E+01	1.69E+03	0.04	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.50E+01	7.46E+01	4.07E+01	2.23E+01	5.71E+01	8.61E+01	Normal/Lognormal
CG-116-80	Vinyl chloride	8	100.0	2.91E+03	2.04E+00	1427.97	Area 2	79.5	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	6.20E+02	3.27E+03	1.58E+03	9.14E+02	2.19E+03	2.91E+03	Normal/Lognormal
CG-116-WT																							
CG-116-WT	1,1-Dichloroethane	8	100.0	2.66E+00	4.70E+01	0.06	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+00	3.24E+00	2.16E+00	5.72E-01	2.54E+00	2.66E+00	Normal/Lognormal
CG-116-WT	1,1-Dichloroethylene	8	12.5	5.00E-03	2.50E+01	0.00	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	5.00E-03	5.00E-03	1.88E-02	8.76E-03	2.46E-02	3.68E-02	Unknown
CG-116-WT	1,2-Dichlorobenzene	8	37.5	5.91E-01	1.40E+01	0.04	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.80E-01	6.80E-01	5.44E-01	6.72E-02	5.89E-01	5.91E-01	Unknown
CG-116-WT	1,2-Dichloroethane	8	87.5	3.00E-01	1.29E+01	0.02	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.21E-01	3.00E-01	1.84E-01	9.05E-02	2.44E-01	3.45E-01	Normal/Lognormal
CG-116-WT	Benzene	8	87.5	1.30E+00	9.60E+00	0.14	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	5.60E-01	1.30E+00	8.38E-01	3.54E-01	1.07E+00	1.43E+00	Normal/Lognormal
CG-116-WT	Chlorobenzene	8	37.5	5.29E-01	5.19E+01	0.01	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.60E-01	5.70E-01	5.08E-01	3.15E-02	5.29E-01	5.29E-01	Normal/Lognormal
CG-116-WT	Chloroethane	8	100.0	2.18E+01	4.61E+02	0.05	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.10E+00	2.18E+01	1.28E+01	6.79E+00	1.74E+01	2.28E+01	Normal/Lognormal
CG-116-WT	cis-1,2-Dichloroethylene	8	50.0	1.06E+00	7.27E+01	0.01	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.30E-01	1.58E+00	6.96E-01	4.18E-01	9.76E-01	1.06E+00	Unknown
CG-116-WT	Cumene	3	33.3	1.20E-01	7.30E+00	0.02	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.20E-01	1.20E-01	7.07E-01	5.08E-01	1.56E+00	1.07E+06	Unknown
CG-116-WT	Methylene chloride	8	12.5	3.60E-01	3.21E+02	0.00	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	2.90E-01	5.00E+00	3.60E-01	3.60E-01	1.75E+00	1.06E+00	2.46E+00	1.08E+01	Unknown
CG-116-WT	Toluene	8	25.0	5.76E-01	9.80E+00	0.06	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	6.50E-01	1.00E+00	1.90E-01	7.40E-01	4.69E-01	1.59E-01	5.76E-01	6.71E-01	Normal
CG-116-WT	trans-1,2-Dichloroethylene	8	37.5	4.50E-01	6.53E+01	0.01	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.60E-01	4.50E-01	4.69E-01	5.06E-02	5.03E-01	5.10E-01	Unknown
CG-116-WT	Trichloroethylene	8	75.0	4.28E-02	4.04E-01	0.11	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	3.30E-02	5.20E-02	3.55E-02	8.75E-03	4.14E-02	4.28E-02	Normal/Lognormal
CG-116-WT	Vinyl chloride	8	100.0	1.24E+00	1.28E+00	0.97	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.10E-02	1.24E+00	5.30E-01	3.88E-01	7.90E-01	1.87E+00	Normal/Lognormal
CG-116-WT	Xylenes (Total)	8	25.0	6.60E-01	1.41E+02	0.00	Area 2	15.6	5.8	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	3.00E+00	6.60E-01	6.60E-01	1.17E+00	4.65E-01	1.48E+00	1.82E+00	Unknown
CG-118-79																							
CG-118-79	1,1-Dichloroethane	8	25.0	1.98E+00	4.70E+01	0.04	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	1.40E-01	2.97E+00	7.01E-01	9.28E-01	1.32E+00	1.98E+00	Lognormal
CG-118-79	1,2,4-Trimethylbenzene	8	12.5	1.32E+00	7.77E+01	0.02	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.79E+00	1.79E+00	8.49E-01	4.54E-01	1.15E+00	1.32E+00	Unknown
CG-118-79	Chloroethane	8	12.5	2.81E+00	4.61E+02	0.01	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	4.85E+00	4.85E+00	9.50E-01	1.58E+00	2.01E+00	2.81E+00	Unknown
CG-118-79	cis-1,2-Dichloroethylene	8	12.5	2.38E+00	1.65E+02	0.01	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	4.19E+00	4.19E+00	8.68E-01	1.35E+00	1.77E+00	2.38E+00	Unknown
CG-118-79	Ethylbenzene	8	25.0	3.64E+01	7.30E+00	4.99	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	1.70E-01	3.64E+01	4.88E+00	1.27E+01	1.34E+01	7.74E+01	Unknown
CG-118-79	Toluene	8	25.0	4.26E+00	9.80E+00	0.43	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	7.30E-01	6.85E+00	1.26E+00	2.26E+00	2.78E+00	4.26E+00	Unknown
CG-118-79	trans-1,2-Dichloroethylene	8	12.5	6.63E+00	1.69E+03	0.00	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	9.41E+00	9.41E+00	1.52E+00	3.19E+00	3.66E+00	6.63E+00	Unknown
CG-118-79	Trichloroethylene	7	28.6	7.30E-03	7.88E-01	0.01	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	5.20E-03	7.30E-03	1.54E-02	9.17E-03	2.21E-02	3.40E-02	Lognormal
CG-118-79	Vinyl chloride	8	100.0	8.02E+01	2.04E+00	39.34	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	9.50E-02	8.02E+01	1.02E+01	2.83E+01	2.91E+01	1.48E+03	Unknown
CG-118-79	Xylenes (Total)	8	12.5	1.06E+01	1.41E+02	0.08	Area 2	79	69.5	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	3.00E+00	1.35E+01	1.35E+01	2.62E+00	4.41E+00	5.58E+00	1.06E+01	Unknown
CG-118-WT																							
CG-118-WT	1,1,1-Trichloroethane	6	83.3	1.80E+01	1.10E+01	1.64	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.90E+00	1.80E+01	7.52E+00	5.88E+00	1.24E+01	2.69E+01	Normal/Lognormal
CG-118-WT	1,1,2-Trichlorotrifluoroethane	5	40.0	2.67E+01	1.21E+03	0.02	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+01	8.00E+01	5.90E+00	2.67E+01	2.05E+01	1.36E+01	3.35E+01	1.01E+02	Normal/Lognormal
CG-118-WT	1,1-Dichloroethane	8	100.0	2.34E+02	4.70E+01	4.99	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.17E+01	3.34E+02	1.02E+02	9.84E+01	1.67E+02	2.34E+02	Lognormal
CG-118-WT	1,1-Dichloroethylene	7	42.9	2.40E-01	2.50E+01	0.01	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+01	1.20E-01	2.40E-01	2.37E+00	3.79E+00	5.15E+00	1.43E+02	Lognormal
CG-118-WT	1,2,4-Trimethylbenzene	8	100.0	3.30E+02	1.30E+01	25.36	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.45E+01	3.30E+02	1.52E+02	1.10E+02	2.26E+02	4.96E+02	Normal/Lognormal
CG-118-WT	1,2-Dichlorobenzene	6	83.3	1.40E+01	1.40E+01	1.00	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.36E+00	1.40E+01	8.43E+00	4.77E+00	1.23E+01	4.05E+01	Normal/Lognormal
CG-118-WT	1,2-Dichloroethane	6	83.3	4.00E+00	1.29E+01	0.31	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	5.20E-01	4.00E+00	2.16E+00	1.86E+00	3.69E+00	9.84E+00	Normal/Lognormal
CG-118-WT	1,3,5-Trimethylbenzene	5	100.0	7.00E+01	9.76E+00	7.17	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.22E+01	7.00E+01	4.74E+01	1.92E+01	6.57E+01	9.20E+01	Normal/Lognormal
CG-118-WT	1,4-Dichlorobenzene	5	80.0	3.20E+00	2.50E+00	1.28	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.63E+00	3.20E+00	2.17E+00	1.14E+00	3.26E+00	1.11E+01	Normal/Lognormal
CG-118-WT	Benzene	6	83.3	1.33E+01	9.60E+00	1.39	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.00E+00	1.33E+01	6.70E+00	5.06E+00	1.09E+01	2.05E+01	Lognormal
CG-118-WT	Chlorobenzene	8	50.0	6.30E+00	5.19E+01	0.12	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+01	3.90E+00	6.30E+00	7.03E+00	5.86E+00	1.10E+01	3.58E+01	Lognormal
CG-118-WT	Chloroethane	8	100.0	1.30E+03	4.61E+02	2.82	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.28E+02	1.30E+03	4.64E+02	4.59E+02	7.72E+02	1.43E+03	Lognormal

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-118-WT	cis-1,2-Dichloroethylene	8	62.5	8.10E+00	7.27E+01	0.11	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	4.00E+01	2.94E+00	8.10E+00	7.71E+00	5.53E+00	1.14E+01	1.44E+01	Lognormal
CG-118-WT	Cumene	3	100.0	2.10E+01	7.30E+00	2.88	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+01	2.10E+01	1.60E+01	4.36E+00	2.33E+01	3.20E+01	Normal/Lognormal
CG-118-WT	Dichlorodifluoromethane	3	66.7	6.90E+00	6.36E+00	1.08	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	2.50E+00	6.90E+00	3.97E+00	2.54E+00	8.25E+00	9.82E+01	Unknown
CG-118-WT	Ethylbenzene	8	100.0	2.19E+03	7.30E+00	299.86	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.53E+02	2.22E+03	1.32E+03	5.76E+02	1.71E+03	2.19E+03	Normal/Lognormal
CG-118-WT	Methylene chloride	8	12.5	3.80E+00	3.21E+02	0.01	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	3.00E+00	2.00E+02	3.80E+00	3.80E+00	2.38E+01	3.52E+01	4.73E+01	5.38E+02	Lognormal
CG-118-WT	Naphthalene	7	85.7	1.20E+02	1.20E+01	10.00	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	1.51E+01	1.20E+02	5.29E+01	4.28E+01	8.43E+01	1.06E+03	Normal/Lognormal
CG-118-WT	p-Isopropyltoluene	4	100.0	7.70E+00	7.49E+01	0.10	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.60E+00	7.70E+00	6.62E+00	1.38E+00	8.25E+00	9.43E+00	Normal/Lognormal
CG-118-WT	Propylbenzene	4	100.0	3.22E+01	7.30E+00	4.41	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.90E+01	3.22E+01	2.73E+01	6.24E+00	3.46E+01	4.00E+01	Normal/Lognormal
CG-118-WT	sec-Butylbenzene	4	100.0	7.93E+00	4.59E+00	1.73	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.10E+00	7.93E+00	6.71E+00	1.25E+00	8.17E+00	8.89E+00	Normal/Lognormal
CG-118-WT	Styrene	1	100.0	1.50E+01	5.00E-01	30.00	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.50E+01	1.50E+01	1.50E+01	--	N/A	N/A	Unknown
CG-118-WT	Tetrachloroethylene	5	100.0	3.26E+00	2.02E-01	16.14	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.50E-01	3.26E+00	1.86E+00	9.31E-01	2.75E+00	4.46E+00	Normal/Lognormal
CG-118-WT	Toluene	5	100.0	2.01E+02	9.80E+00	20.51	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.80E+00	2.01E+02	7.77E+01	8.22E+01	1.56E+02	1.11E+04	Normal/Lognormal
CG-118-WT	trans-1,2-Dichloroethylene	8	50.0	9.59E+00	6.53E+01	0.15	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+01	4.70E+00	9.59E+00	8.15E+00	5.73E+00	1.20E+01	4.78E+01	Normal
CG-118-WT	Trichloroethylene	5	100.0	1.80E+00	4.04E-01	4.46	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.30E-01	1.80E+00	1.21E+00	4.14E-01	1.60E+00	2.01E+00	Normal/Lognormal
CG-118-WT	Vinyl chloride	5	100.0	5.64E+00	1.28E+00	4.40	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.80E+00	5.64E+00	3.55E+00	1.66E+00	5.13E+00	7.36E+00	Normal/Lognormal
CG-118-WT	Xylenes (Total)	8	75.0	8.10E+02	1.41E+02	5.76	Area 2	14.7	4.9	Water Table	FALSE	Groundwater	MW	TRUE	3.00E+01	1.20E+02	1.63E+02	8.10E+02	3.41E+02	2.70E+02	5.22E+02	4.30E+03	Normal/Lognormal
CG-119-40																							
CG-119-40	1,1-Dichloroethane	8	100.0	7.21E+01	4.70E+01	1.53	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.15E+00	1.03E+02	4.48E+01	4.08E+01	7.21E+01	2.07E+03	Normal
CG-119-40	1,1-Dichloroethylene	8	100.0	1.55E-01	2.50E+01	0.01	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.80E-02	2.13E-01	9.79E-02	5.54E-02	1.35E-01	1.55E-01	Normal/Lognormal
CG-119-40	1,2,4-Trimethylbenzene	8	12.5	5.30E-01	7.77E+01	0.01	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	5.30E-01	5.30E-01	6.29E-01	2.29E-01	7.82E-01	8.08E-01	Unknown
CG-119-40	1,2-Dichloroethane	8	100.0	2.86E-01	3.06E+01	0.01	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.61E-01	3.00E-01	2.37E-01	5.48E-02	2.74E-01	2.86E-01	Normal/Lognormal
CG-119-40	1,3,5-Trimethylbenzene	8	12.5	1.30E-01	5.57E+01	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.30E-01	1.30E-01	5.79E-01	2.90E-01	7.73E-01	1.14E+00	Unknown
CG-119-40	1,4-Dioxane	4	75.0	5.47E+00	9.49E+01	0.06	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.30E+00	5.47E+00	2.38E+00	2.18E+00	4.95E+00	1.33E+02	Normal/Lognormal
CG-119-40	2-Methylnaphthalene	2	50.0	3.40E-03	2.10E+00	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	3.40E-03	3.40E-03	2.67E-02	3.30E-02	1.74E-01	4.28E+42	Unknown
CG-119-40	Benzene	8	100.0	5.65E+00	1.17E+01	0.48	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.20E+00	6.36E+00	5.10E+00	7.21E-01	5.59E+00	5.65E+00	Normal/Lognormal
CG-119-40	Bis(2-ethylhexyl) phthalate	4	25.0	7.11E+00	2.00E+00	3.56	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.49E+00	5.69E+00	7.11E+00	7.11E+00	2.93E+00	2.94E+00	6.39E+00	1.99E+02	Normal/Lognormal
CG-119-40	Chloroethane	8	62.5	3.40E+01	4.61E+02	0.07	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.50E+01	6.31E+01	1.98E+01	2.13E+01	3.40E+01	1.03E+04	Normal
CG-119-40	cis-1,2-Dichloroethylene	8	100.0	4.46E+00	1.65E+02	0.03	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.50E+00	5.29E+00	3.11E+00	1.30E+00	3.98E+00	4.46E+00	Normal/Lognormal
CG-119-40	Ethylbenzene	8	12.5	1.60E-01	7.30E+00	0.02	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	1.60E-01	1.60E-01	3.95E-01	1.48E-01	4.94E-01	6.00E-01	Unknown
CG-119-40	Manganese	4	100.0	3.21E+02	1.00E+02	3.21	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.30E+02	3.21E+02	2.71E+02	4.03E+01	3.18E+02	3.31E+02	Normal/Lognormal
CG-119-40	Methylene chloride	8	12.5	3.20E-01	4.95E+02	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	5.00E+00	3.20E-01	3.20E-01	1.85E+00	9.18E-01	2.47E+00	4.64E+00	Unknown
CG-119-40	Phenol	4	25.0	1.70E-01	1.18E+02	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.70E-01	1.70E-01	3.79E+00	2.42E+00	6.63E+00	4.58E+05	Unknown
CG-119-40	trans-1,2-Dichloroethylene	8	37.5	4.10E-01	1.69E+03	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.80E-01	4.10E-01	4.61E-01	5.41E-02	4.97E-01	5.03E-01	Unknown
CG-119-40	Trichloroethylene	8	100.0	3.96E-01	7.88E-01	0.50	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.68E-01	4.30E-01	3.48E-01	5.97E-02	3.88E-01	3.96E-01	Normal/Lognormal
CG-119-40	Vanadium	1	100.0	1.49E+00	2.00E+01	0.07	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.49E+00	1.49E+00	1.49E+00	--	N/A	N/A	Unknown
CG-119-40	Vinyl chloride	8	100.0	3.52E+01	2.04E+00	17.26	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.30E+00	3.52E+01	1.39E+01	1.14E+01	2.15E+01	4.38E+01	Normal/Lognormal
CG-119-40	Xylenes (Total)	8	12.5	3.80E-01	1.41E+02	0.00	Area 2	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	3.00E+00	3.80E-01	3.80E-01	1.11E+00	5.40E-01	1.47E+00	2.13E+00	Unknown
CG-120-75																							
CG-120-75	1,4-Dioxane	3	100.0	5.26E+00	9.49E+01	0.06	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.00E+00	5.26E+00	3.28E+00	1.74E+00	6.21E+00	3.44E+01	Normal/Lognormal
CG-120-75	Arsenic	7	85.7	2.42E+00	5.06E-02	47.83	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.50E-01	1.50E-01	7.47E-02	2.42E+00	5.51E-01	8.39E-01	1.17E+00	4.96E+00	Lognormal
CG-120-75	Barium	4	75.0	3.80E+01	4.00E+00	9.50	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	1.07E+01	3.80E+01	1.61E+01	1.54E+01	3.42E+01	6.40E+03	Normal/Lognormal
CG-120-75	Benzo(a)anthracene	3	33.3	2.94E-02	2.00E-02	1.47	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.94E-02	2.94E-02	1.41E-02	1.33E-02	3.66E-02	3.81E+01	Normal/Lognormal
CG-120-75	Benzo(b)fluoranthene	3	33.3	3.16E-02	1.94E-02	1.63	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.16E-02	3.16E-02	1.49E-02	1.46E-02	3.94E-02	8.15E+01	Normal/Lognormal
CG-120-75	Benzo(k)fluoranthene	3	33.3	3.84E-02	1.80E-02	2.13	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.84E-02	3.84E-02	1.71E-02	1.85E-02	4.83E-02	7.55E+02	Normal/Lognormal
CG-120-75	Bis(2-ethylhexyl) phthalate	3	66.7	5.96E+00	2.00E+00	2.98	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	3.81E+00	3.81E+00	3.80E-01	5.96E+00	2.75E+00	2.88E+00	7.61E+00	2.00E+08	Normal/Lognormal
CG-120-75	Chromium	2	100.0	1.02E+01	1.00E+01	1.02	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.17E+00	1.02E+01	7.19E+00	4.26E+00	2.62E+01	4.20E+05	Unknown
CG-120-75	Chrysene	3	33.3	4.51E-02	1.80E-02	2.51	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	4.51E-02	4.51E-02	1.94E-02	2.23E-02	5.70E-02	5.72E+03	Normal/Lognormal
CG-120-75	Copper	4	75.0	2.70E+01	3.10E+00	8.71	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	7.08E+00	2.70E+01	1.28E+01	1.15E+01	2.63E+01	4.85E+06	Normal/Lognormal
CG-120-75	Dibenzo(a,h)anthracene	3	33.3	1.08E-02	1.62E-02	0.67	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.08E-02	1.08E-02	7.93E-03	2.90E-03	1.28E-02	3.28E-02	Normal/Lognormal
CG-120-75	Indeno(1,2,3-cd)pyrene	3	33.3	2.39E-02	2.00E-02	1.20	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.39E-02	2.39E-02	1.23E-02	1.02E-02	2.94E-02	5.17E+00	Normal/Lognormal
CG-120-75	Lead	2	100.0	3.81E+00	2.50E+00	1.52	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.05E+00	3.81E+00	2.43E+00	1.95E+00	1.11E+01	2.78E+10	Unknown
CG-120-75	Manganese	4	100.0	2.68E+02	1.00E+02	2.68	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.03E+02	2.68E+02	1.62E+02	7.27E+01	2.48E+02	3.49E+02	Normal/Lognormal

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-120-75	Nickel	4	75.0	8.89E+00	8.20E+00	1.08	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.97E+00	8.89E+00	4.17E+00	3.52E+00	8.32E+00	1.78E+03	Normal/Lognormal
CG-120-75	Pentachlorophenol	3	33.3	6.54E-01	2.53E+00	0.26	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	6.54E-01	6.54E-01	3.86E-01	3.25E-01	9.34E-01	1.08E+13	Normal/Lognormal
CG-120-75	Selenium	4	25.0	1.07E+00	5.00E+00	0.21	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.07E+00	1.07E+00	6.43E-01	2.85E-01	9.78E-01	1.28E+00	Unknown
CG-120-75	Vanadium	1	100.0	2.40E+01	2.00E+01	1.20	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.40E+01	2.40E+01	2.40E+01	--	N/A	N/A	Unknown
CG-120-75	Vinyl chloride	4	25.0	2.60E-02	2.04E+00	0.01	Area 3	65	75	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.60E-02	2.60E-02	1.40E-02	8.00E-03	2.34E-02	3.78E-02	Unknown
CG-121-40																							
CG-121-40	1,1-Dichloroethane	8	37.5	4.20E-01	4.70E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	3.60E-01	4.20E-01	6.44E-01	5.51E-01	1.01E+00	1.04E+00	Unknown
CG-121-40	1,2,4-Trimethylbenzene	8	37.5	4.80E-01	7.77E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	2.60E-01	4.80E-01	6.38E-01	5.58E-01	1.01E+00	1.09E+00	Unknown
CG-121-40	1,2-Dichloroethane	8	50.0	1.30E-01	3.06E+01	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.00E-01	1.30E-01	8.48E-02	3.82E-02	1.10E-01	1.30E-01	Unknown
CG-121-40	1,4-Dioxane	4	100.0	1.38E+01	9.49E+01	0.15	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	8.50E+00	1.38E+01	1.07E+01	2.25E+00	1.33E+01	1.43E+01	Normal/Lognormal
CG-121-40	Arsenic	5	20.0	1.17E-01	5.06E-02	2.31	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-02	6.16E-02	1.17E-01	1.17E-01	4.68E-02	3.93E-02	8.43E-02	1.36E-01	Unknown
CG-121-40	Barium	2	100.0	8.30E+00	4.00E+00	2.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.30E+00	8.30E+00	7.80E+00	7.07E-01	1.10E+01	1.10E+01	Unknown
CG-121-40	Benzene	8	100.0	3.00E+01	1.17E+01	2.57	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.80E+01	3.20E+01	2.91E+01	1.42E+00	3.00E+01	3.00E+01	Lognormal
CG-121-40	Bis(2-ethylhexyl) phthalate	3	66.7	9.90E-01	2.00E+00	0.50	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.55E+00	2.55E+00	5.54E-01	9.90E-01	9.40E-01	3.63E-01	1.55E+00	5.22E+00	Normal/Lognormal
CG-121-40	Chloroethane	8	100.0	1.14E+02	4.61E+02	0.25	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.40E+01	1.42E+02	9.88E+01	2.05E+01	1.13E+02	1.14E+02	Normal/Lognormal
CG-121-40	cis-1,2-Dichloroethylene	8	37.5	4.80E-01	1.65E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	3.70E-01	4.80E-01	6.64E-01	5.42E-01	1.03E+00	1.04E+00	Unknown
CG-121-40	Copper	4	50.0	1.18E+00	3.10E+00	0.38	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.17E+00	1.18E+00	8.38E-01	3.90E-01	1.30E+00	2.43E+00	Unknown
CG-121-40	Cumene	3	100.0	8.40E-01	7.30E+00	0.12	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.40E-01	8.40E-01	7.47E-01	1.01E-01	9.16E-01	9.96E-01	Normal/Lognormal
CG-121-40	Ethylbenzene	8	37.5	1.90E-01	7.30E+00	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	1.30E-01	1.90E-01	5.63E-01	6.04E-01	9.67E-01	1.57E+00	Lognormal
CG-121-40	Iron	1	100.0	1.45E+04	1.00E+03	14.50	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.45E+04	1.45E+04	1.45E+04	--	N/A	N/A	Unknown
CG-121-40	Manganese	5	100.0	3.64E+03	1.00E+02	36.40	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.27E+03	3.76E+03	3.45E+03	1.91E+02	3.63E+03	3.64E+03	Normal/Lognormal
CG-121-40	Methylene chloride	8	25.0	2.20E+00	4.95E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.10E+00	2.00E+01	1.90E+00	2.20E+00	3.14E+00	2.82E+00	5.03E+00	5.72E+00	Unknown
CG-121-40	Nickel	4	100.0	3.06E+00	8.20E+00	0.37	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.42E+00	3.06E+00	2.26E+00	6.70E-01	3.05E+00	3.87E+00	Normal/Lognormal
CG-121-40	Phenol	3	33.3	9.50E-01	1.18E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	9.50E-01	9.50E-01	3.65E+00	2.34E+00	7.59E+00	2.20E+04	Unknown
CG-121-40	Toluene	8	87.5	1.93E+00	9.80E+00	0.20	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	1.40E+00	2.10E+00	1.75E+00	2.40E-01	1.91E+00	1.93E+00	Normal/Lognormal
CG-121-40	trans-1,2-Dichloroethylene	8	37.5	4.80E-01	1.69E+03	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	4.20E-01	4.80E-01	6.73E-01	5.37E-01	1.03E+00	1.03E+00	Unknown
CG-121-40	Trichloroethylene	8	50.0	3.09E-02	7.88E-01	0.04	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	1.90E-02	3.60E-02	2.26E-02	7.35E-03	2.75E-02	3.09E-02	Normal/Lognormal
CG-121-40	Vanadium	1	100.0	2.63E+00	2.00E+01	0.13	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.63E+00	2.63E+00	2.63E+00	--	N/A	N/A	Unknown
CG-121-40	Vinyl chloride	8	100.0	9.47E-01	2.04E+00	0.46	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.80E-01	9.47E-01	6.99E-01	2.29E-01	8.52E-01	9.49E-01	Normal/Lognormal
CG-121-40	Xylenes (Total)	8	87.5	5.78E+00	1.41E+02	0.04	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.20E+01	1.20E+01	3.60E+00	6.20E+00	5.05E+00	8.79E-01	5.63E+00	5.78E+00	Normal/Lognormal
CG-121-70																							
CG-121-70	1,1-Dichloroethane	8	37.5	5.51E-01	4.70E+01	0.01	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.10E-01	6.30E-01	5.21E-01	4.52E-02	5.52E-01	5.51E-01	Unknown
CG-121-70	1,2-Dichloroethane	8	37.5	3.10E-02	3.06E+01	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	2.60E-02	3.10E-02	4.19E-02	1.13E-02	4.94E-02	5.33E-02	Unknown
CG-121-70	1,4-Dioxane	4	100.0	1.45E+01	9.49E+01	0.15	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.12E+01	1.46E+01	1.25E+01	1.48E+00	1.42E+01	1.45E+01	Normal/Lognormal
CG-121-70	Arsenic	7	57.1	1.71E+00	5.06E-02	33.79	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	6.15E-02	1.80E-01	6.18E-02	1.71E+00	3.17E-01	6.18E-01	7.71E-01	4.73E+00	Lognormal
CG-121-70	Barium	4	75.0	3.04E+01	4.00E+00	7.60	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	6.68E+00	3.04E+01	1.39E+01	1.16E+01	2.76E+01	1.89E+02	Normal/Lognormal
CG-121-70	Benzene	8	37.5	2.91E-01	1.17E+01	0.02	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	2.80E-01	3.30E-01	2.70E-01	3.07E-02	2.91E-01	2.91E-01	Unknown
CG-121-70	Bis(2-ethylhexyl) phthalate	3	66.7	7.70E-01	2.00E+00	0.39	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	8.68E+00	8.68E+00	4.57E-01	7.70E-01	1.86E+00	2.16E+00	5.49E+00	8.52E+05	Normal/Lognormal
CG-121-70	Chloroethane	8	100.0	1.71E+01	4.61E+02	0.04	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.30E+01	2.01E+01	1.57E+01	2.01E+00	1.70E+01	1.71E+01	Lognormal
CG-121-70	Chromium	2	100.0	6.37E+00	1.00E+01	0.64	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.60E+00	6.37E+00	3.99E+00	3.37E+00	1.90E+01	1.51E+12	Unknown
CG-121-70	Copper	4	75.0	1.24E+01	3.10E+00	4.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.36E+00	1.24E+01	5.13E+00	5.23E+00	1.13E+01	9.13E+03	Normal/Lognormal
CG-121-70	Cyanide	9	100.0	2.85E+01	1.00E+01	2.85	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.95E+01	3.10E+01	2.57E+01	3.80E+00	2.81E+01	2.85E+01	Normal/Lognormal
CG-121-70	Iron	1	100.0	3.58E+03	1.00E+03	3.58	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.58E+03	3.58E+03	3.58E+03	--	N/A	N/A	Unknown
CG-121-70	Lead	3	33.3	2.12E+00	2.50E+00	0.85	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.12E+00	2.12E+00	1.04E+00	9.35E-01	2.62E+00	6.99E+02	Unknown
CG-121-70	Manganese	5	100.0	9.77E+02	1.00E+02	9.77	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	7.59E+02	1.02E+03	8.67E+02	1.02E+02	9.64E+02	9.77E+02	Normal/Lognormal
CG-121-70	Methylene chloride	8	25.0	4.30E-01	4.95E+02	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	3.50E-01	5.00E+00	3.90E-01	4.30E-01	1.69E+00	1.12E+00	2.44E+00	1.02E+01	Unknown
CG-121-70	Nickel	4	75.0	5.53E+00	8.20E+00	0.67	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.89E+00	5.53E+00	2.63E+00	2.12E+00	5.12E+00	1.53E+02	Normal/Lognormal
CG-121-70	Vanadium	1	100.0	1.49E+01	2.00E+01	0.75	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.49E+01	1.49E+01	1.49E+01	--	N/A	N/A	Unknown
CG-121-70	Vinyl chloride	8	100.0	4.56E-01	2.04E+00	0.22	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.10E-01	5.20E-01	4.01E-01	7.03E-02	4.48E-01	4.56E-01	Normal/Lognormal
CG-121-93																							
CG-121-93	Arsenic	3	66.7	2.21E+00	5.06E-02	43.68	Area 3	92.7	83.2	Intermediate	FALSE	Groundwater	MW	TRUE	8.00E-02	8.00E-02	4.18E-01	2.21E+00	8.89E-01	1.16E+00	2.84E+00	5.13E+16	Normal/Lognormal
CG-121-93	Bis(2-ethylhexyl) phthalate	4	25.0	6.36E-02	2.00E+00	0.03	Area 3	92.7	83.2	Intermediate	FALSE	Groundwater	MW	TRUE	6.32E-01	6.42E+00	6.36E-02	6.36E-02	1.15E+00	1.43E+00	2.83E+00	8.38E+04	Normal/Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-121-93	Lead	2	50.0	4.80E-01	2.50E+00	0.19	Area 3	92.7	83.2	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.80E-01	4.80E-01	4.90E-01	1.41E-02	5.53E-01	5.41E-01	Unknown
CG-121-93	Vinyl chloride	8	75.0	8.80E-01	2.04E+00	0.43	Area 3	92.7	83.2	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.20E-02	8.80E-01	2.53E-01	3.21E-01	4.68E-01	1.70E+01	Lognormal
CG-122-60																							
CG-122-60	1,1-Dichloroethane	5	40.0	1.19E+00	4.70E+01	0.03	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.20E-01	1.19E+00	5.62E-01	3.88E-01	9.32E-01	3.51E+00	Normal/Lognormal
CG-122-60	1,2-Dichloroethane	5	20.0	1.00E-02	3.06E+01	0.00	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.00E-02	1.00E-02	4.20E-02	1.79E-02	5.91E-02	1.80E-01	Unknown
CG-122-60	1,4-Dioxane	3	100.0	1.72E+03	9.49E+01	18.13	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.55E+02	1.72E+03	1.06E+03	6.83E+02	2.21E+03	5.43E+05	Normal/Lognormal
CG-122-60	Arsenic	7	71.4	1.99E+00	5.06E-02	39.33	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	6.10E-02	1.10E-01	9.56E-02	1.99E+00	4.07E-01	7.05E-01	9.25E-01	5.92E+00	Lognormal
CG-122-60	Barium	4	100.0	4.83E+01	4.00E+00	12.08	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	9.63E+00	4.83E+01	2.30E+01	1.73E+01	4.34E+01	1.54E+02	Normal/Lognormal
CG-122-60	Benzene	5	20.0	9.40E-01	1.17E+01	0.08	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	9.40E-01	9.40E-01	3.88E-01	3.09E-01	6.82E-01	1.02E+00	Unknown
CG-122-60	Bis(2-ethylhexyl) phthalate	3	66.7	2.80E+00	2.00E+00	1.40	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.07E+01	1.07E+01	1.67E+00	2.80E+00	3.27E+00	1.89E+00	6.45E+00	7.93E+01	Normal/Lognormal
CG-122-60	Chloroethane	5	80.0	2.76E+01	4.61E+02	0.06	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.90E+01	2.82E+01	1.78E+01	1.03E+01	2.76E+01	3.83E+04	Normal
CG-122-60	Chromium	2	100.0	1.03E+01	1.00E+01	1.03	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.16E+00	1.03E+01	7.23E+00	4.34E+00	2.66E+01	5.77E+05	Unknown
CG-122-60	Copper	4	75.0	2.17E+01	3.10E+00	7.00	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.14E+00	2.17E+01	8.48E+00	9.28E+00	1.94E+01	2.20E+05	Normal/Lognormal
CG-122-60	Iron	1	100.0	2.67E+03	1.00E+03	2.67	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.67E+03	2.67E+03	2.67E+03	--	N/A	N/A	Unknown
CG-122-60	Lead	3	33.3	3.16E+00	2.50E+00	1.26	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.16E+00	3.16E+00	1.39E+00	1.54E+00	3.98E+00	5.68E+04	Unknown
CG-122-60	Manganese	5	100.0	5.43E+02	1.00E+02	5.43	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.12E+02	5.86E+02	4.71E+02	6.77E+01	5.36E+02	5.43E+02	Normal/Lognormal
CG-122-60	Methylene chloride	5	20.0	2.10E+00	4.95E+02	0.00	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	2.10E+00	2.10E+00	2.42E+00	1.79E-01	2.59E+00	2.62E+00	Unknown
CG-122-60	Nickel	4	100.0	8.69E+00	8.20E+00	1.06	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.00E+00	8.69E+00	4.10E+00	3.30E+00	7.99E+00	1.08E+02	Normal/Lognormal
CG-122-60	Vanadium	1	100.0	2.58E+01	2.00E+01	1.29	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.58E+01	2.58E+01	2.58E+01	--	N/A	N/A	Unknown
CG-122-60	Vinyl chloride	5	100.0	1.59E+00	2.04E+00	0.78	Area 3	50	60	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	5.78E-01	1.59E+00	1.13E+00	4.87E-01	1.59E+00	2.41E+00	Normal/Lognormal
CG-122-WT																							
CG-122-WT	1,1-Dichloroethane	6	83.3	1.80E+01	4.70E+01	0.38	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	7.08E+00	1.80E+01	9.30E+00	5.34E+00	1.37E+01	3.06E+01	Normal/Lognormal
CG-122-WT	1,1-Dichloroethylene	6	16.7	1.20E-02	2.50E+01	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	1.00E+00	1.20E-02	1.20E-02	1.02E-01	1.95E-01	2.62E-01	1.87E+00	Unknown
CG-122-WT	1,2-Dichlorobenzene	5	20.0	4.00E-01	1.40E+01	0.03	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	4.00E-01	4.00E-01	7.80E-01	6.83E-01	1.43E+00	2.43E+00	Unknown
CG-122-WT	1,2-Dichloroethane	6	66.7	1.47E-01	1.29E+01	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E+00	1.13E-01	1.47E-01	1.74E-01	1.63E-01	3.08E-01	5.32E-01	Lognormal
CG-122-WT	1,4-Dioxane	3	100.0	4.55E+00	9.49E+01	0.05	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.75E+00	4.55E+00	3.87E+00	9.75E-01	5.51E+00	8.37E+00	Normal/Lognormal
CG-122-WT	1-Methyl naphthalene	3	33.3	1.70E-02	2.10E+00	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.70E-02	1.70E-02	3.90E-02	1.91E-02	7.11E-02	1.51E+00	Unknown
CG-122-WT	2-Methylnaphthalene	1	100.0	6.40E-03	2.10E+00	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.40E-03	6.40E-03	6.40E-03	--	N/A	N/A	Unknown
CG-122-WT	Arsenic	6	100.0	2.82E+01	5.06E-02	558.07	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.38E+01	2.95E+01	2.10E+01	5.97E+00	2.59E+01	2.82E+01	Normal/Lognormal
CG-122-WT	Barium	2	100.0	5.56E+00	4.00E+00	1.39	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.16E+00	5.56E+00	4.86E+00	9.90E-01	9.28E+00	1.43E+01	Unknown
CG-122-WT	Benzene	6	100.0	1.23E+01	9.60E+00	1.28	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.70E+00	1.35E+01	1.00E+01	2.22E+00	1.19E+01	1.23E+01	Normal/Lognormal
CG-122-WT	Bis(2-ethylhexyl) phthalate	3	66.7	8.30E-01	2.00E+00	0.42	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	3.13E+00	3.13E+00	1.99E-01	8.30E-01	8.65E-01	6.84E-01	2.02E+00	3.31E+04	Normal/Lognormal
CG-122-WT	C8-C10 (EPH) Aromatics	1	100.0	6.10E+01	2.75E+02	0.22	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.10E+01	6.10E+01	6.10E+01	--	N/A	N/A	Unknown
CG-122-WT	Chlorobenzene	5	20.0	6.10E-01	5.19E+01	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	6.10E-01	6.10E-01	8.22E-01	6.60E-01	1.45E+00	2.23E+00	Unknown
CG-122-WT	Chloroethane	6	100.0	9.58E+01	4.61E+02	0.21	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.58E+01	1.03E+02	7.52E+01	1.88E+01	9.07E+01	9.58E+01	Normal/Lognormal
CG-122-WT	Chromium	2	50.0	1.82E+00	1.00E+01	0.18	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.82E+00	1.82E+00	1.16E+00	9.33E-01	5.33E+00	1.49E+10	Unknown
CG-122-WT	cis-1,2-Dichloroethylene	6	83.3	1.72E+00	7.27E+01	0.02	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	1.06E+00	1.72E+00	1.48E+00	3.70E-01	1.78E+00	1.90E+00	Normal/Lognormal
CG-122-WT	Cumene	1	100.0	3.00E+00	7.30E+00	0.41	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.00E+00	3.00E+00	3.00E+00	--	N/A	N/A	Unknown
CG-122-WT	Iron	1	100.0	3.14E+04	1.00E+03	31.40	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.14E+04	3.14E+04	3.14E+04	--	N/A	N/A	Unknown
CG-122-WT	Manganese	5	100.0	5.69E+02	1.00E+02	5.69	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.51E+02	5.77E+02	5.11E+02	5.33E+01	5.62E+02	5.69E+02	Normal/Lognormal
CG-122-WT	Methylene chloride	5	20.0	4.70E-01	3.21E+02	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E+00	2.00E+01	4.70E-01	4.70E-01	3.59E+00	3.69E+00	7.11E+00	7.38E+01	Lognormal
CG-122-WT	Nickel	4	100.0	5.44E+00	8.20E+00	0.66	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.65E+00	5.44E+00	5.03E+00	4.05E-01	5.50E+00	5.57E+00	Normal/Lognormal
CG-122-WT	Propylbenzene	3	100.0	1.55E+00	7.30E+00	0.21	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.46E+00	1.55E+00	1.50E+00	4.51E-02	1.58E+00	1.59E+00	Normal/Lognormal
CG-122-WT	sec-Butylbenzene	3	33.3	2.40E-01	4.59E+00	0.05	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.40E-01	2.40E-01	4.13E-01	1.50E-01	6.66E-01	2.23E+00	Unknown
CG-122-WT	Tetrachloroethylene	5	60.0	8.60E-02	2.02E-01	0.43	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-01	5.00E-02	8.60E-02	9.86E-02	8.82E-02	1.83E-01	6.31E-01	Normal/Lognormal
CG-122-WT	Toluene	6	50.0	1.40E+00	9.80E+00	0.14	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	7.20E-01	1.40E+00	1.03E+00	5.89E-01	1.51E+00	2.15E+00	Normal/Lognormal
CG-122-WT	trans-1,2-Dichloroethylene	6	50.0	1.21E+00	6.53E+01	0.02	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	4.00E+00	8.80E-01	1.21E+00	1.03E+00	5.59E-01	1.49E+00	2.05E+00	Normal/Lognormal
CG-122-WT	Trichloroethylene	6	100.0	4.91E-01	4.04E-01	1.22	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.59E-01	4.91E-01	3.94E-01	9.64E-02	4.73E-01	5.10E-01	Normal/Lognormal
CG-122-WT	Vanadium	1	100.0	5.36E+00	2.00E+01	0.27	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.36E+00	5.36E+00	5.36E+00	--	N/A	N/A	Unknown
CG-122-WT	Vinyl chloride	6	100.0	1.40E+00	1.28E+00	1.09	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.69E-01	1.40E+00	1.08E+00	2.89E-01	1.31E+00	1.44E+00	Normal/Lognormal
CG-122-WT	Xylenes (Total)	5	20.0	7.90E-01	1.41E+02	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	3.00E+00	1.20E+01	7.90E-01	7.90E-01	2.26E+00	2.11E+00	4.27E+00	9.62E+00	Lognormal
CG-123-90																							

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-123-90	1,4-Dioxane	1	100.0	5.00E+00	9.49E+01	0.05	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	5.00E+00	5.00E+00	5.00E+00	--	N/A	N/A	Unknown
CG-123-90	Arsenic	5	60.0	2.72E-01	5.06E-02	5.38	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	6.11E-02	1.20E-01	6.75E-02	2.72E-01	1.00E-01	9.74E-02	1.93E-01	5.13E-01	Lognormal
CG-123-90	Barium	4	100.0	3.43E+01	4.00E+00	8.58	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.75E+01	3.43E+01	2.45E+01	7.05E+00	3.28E+01	3.80E+01	Normal/Lognormal
CG-123-90	Bis(2-ethylhexyl) phthalate	3	66.7	5.57E+00	2.00E+00	2.79	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	3.06E+00	3.06E+00	3.40E+00	5.57E+00	3.50E+00	2.02E+00	6.91E+00	1.90E+02	Normal/Lognormal
CG-123-90	Chromium	2	100.0	3.32E+00	1.00E+01	0.33	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.90E+00	3.32E+00	2.61E+00	1.00E+00	7.09E+00	1.33E+02	Unknown
CG-123-90	Copper	4	75.0	6.19E+00	3.10E+00	2.00	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.54E+00	6.19E+00	2.57E+00	2.50E+00	5.51E+00	1.82E+02	Normal/Lognormal
CG-123-90	Iron	1	100.0	1.10E+04	1.00E+03	11.00	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.10E+04	1.10E+04	1.10E+04	--	N/A	N/A	Unknown
CG-123-90	Lead	5	20.0	3.00E+00	2.50E+00	1.20	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	1.80E-01	1.00E+00	3.00E+00	3.00E+00	9.18E-01	1.18E+00	2.04E+00	4.40E+01	Lognormal
CG-123-90	Manganese	5	100.0	6.39E+06	1.00E+02	--	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.56E+02	6.39E+06	1.28E+06	2.86E+06	4.00E+06	3.42E+25	Unknown
CG-123-90	Nickel	4	75.0	3.40E+00	8.20E+00	0.41	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.52E+00	3.40E+00	1.81E+00	1.20E+00	3.22E+00	2.42E+01	Normal/Lognormal
CG-123-90	Vanadium	1	100.0	8.26E+00	2.00E+01	0.41	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	8.26E+00	8.26E+00	8.26E+00	--	N/A	N/A	Unknown
CG-123-90	Vinyl chloride	4	100.0	2.71E-01	2.04E+00	0.13	Area 3	79.83	89.83	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	7.20E-02	2.71E-01	1.55E-01	8.34E-02	2.53E-01	5.42E-01	Normal/Lognormal
CG-124-40																							
CG-124-40	1,1-Dichloroethane	8	100.0	8.74E+00	4.70E+01	0.19	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	5.80E+00	1.04E+01	7.61E+00	1.49E+00	8.61E+00	8.74E+00	Normal/Lognormal
CG-124-40	1,1-Dichloroethylene	8	100.0	1.09E-01	2.50E+01	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	5.70E-02	1.57E-01	8.38E-02	3.28E-02	1.06E-01	1.09E-01	Lognormal
CG-124-40	1,2-Dichloroethane	8	100.0	3.68E-01	3.06E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.52E-01	4.32E-01	3.25E-01	5.55E-02	3.62E-01	3.68E-01	Normal/Lognormal
CG-124-40	1,4-Dioxane	3	100.0	1.42E+00	9.49E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.20E+00	1.42E+00	1.32E+00	1.11E-01	1.51E+00	1.56E+00	Normal/Lognormal
CG-124-40	Benzene	8	100.0	4.55E+00	1.17E+01	0.39	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.40E+00	4.65E+00	4.17E+00	4.88E-01	4.50E+00	4.55E+00	Normal/Lognormal
CG-124-40	Bis(2-ethylhexyl) phthalate	3	33.3	4.22E-01	2.00E+00	0.21	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	3.24E+00	4.22E-01	4.22E-01	1.01E+00	5.99E-01	2.02E+00	8.01E+01	Normal/Lognormal
CG-124-40	Chloroethane	8	100.0	6.35E+00	4.61E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.99E+00	7.84E+00	5.69E+00	9.60E-01	6.33E+00	6.35E+00	Unknown
CG-124-40	Chromium	2	50.0	1.52E+00	1.00E+01	0.15	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.52E+00	1.52E+00	1.01E+00	7.21E-01	4.23E+00	2.85E+07	Unknown
CG-124-40	cis-1,2-Dichloroethylene	8	100.0	2.31E+00	1.65E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.80E+00	2.58E+00	2.11E+00	2.72E-01	2.29E+00	2.31E+00	Normal/Lognormal
CG-124-40	Copper	4	25.0	2.00E+00	3.10E+00	0.65	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.00E+00	2.00E+00	8.75E-01	7.50E-01	1.76E+00	6.04E+00	Unknown
CG-124-40	Dibenzo(a,h)anthracene	3	33.3	1.27E-02	1.62E-02	0.78	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.27E-02	1.27E-02	8.57E-03	3.88E-03	1.51E-02	6.54E-02	Normal/Lognormal
CG-124-40	Ethane	4	25.0	3.00E+00	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	3.00E+00	3.00E+00	4.50E+00	1.00E+00	5.68E+00	6.70E+00	Unknown
CG-124-40	Ethene	4	75.0	1.10E+01	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	7.40E+00	1.10E+01	8.38E+00	2.72E+00	1.16E+01	1.58E+01	Normal/Lognormal
CG-124-40	Indeno(1,2,3-cd)pyrene	3	33.3	1.35E-02	2.00E-02	0.68	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.35E-02	1.35E-02	8.83E-03	4.31E-03	1.61E-02	8.89E-02	Normal/Lognormal
CG-124-40	Iron	6	100.0	4.85E+03	1.00E+03	4.85	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.38E+03	4.85E+03	4.29E+03	5.76E+02	4.76E+03	4.87E+03	Normal/Lognormal
CG-124-40	Manganese	5	100.0	2.61E+02	1.00E+02	2.61	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.35E+02	2.70E+02	2.47E+02	1.42E+01	2.61E+02	2.61E+02	Normal/Lognormal
CG-124-40	Methane	4	100.0	2.77E+03	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.17E+03	2.77E+03	1.98E+03	8.57E+02	2.98E+03	5.05E+03	Normal/Lognormal
CG-124-40	Nickel	4	50.0	1.44E+00	8.20E+00	0.18	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.08E+00	1.44E+00	8.80E-01	4.63E-01	1.42E+00	3.06E+00	Normal/Lognormal
CG-124-40	Pentachlorophenol	3	33.3	1.78E-01	2.53E+00	0.07	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	1.78E-01	1.78E-01	2.28E-01	2.32E-01	6.18E-01	4.74E+08	Normal/Lognormal
CG-124-40	Phenol	3	33.3	1.60E-01	1.18E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.60E-01	1.60E-01	3.39E+00	2.79E+00	8.10E+00	8.11E+16	Unknown
CG-124-40	Toluene	8	12.5	5.70E-01	9.80E+00	0.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.90E-01	1.00E+00	7.20E-01	7.20E-01	4.52E-01	1.77E-01	5.70E-01	7.43E-01	Normal
CG-124-40	trans-1,2-Dichloroethylene	8	37.5	2.50E-01	1.69E+03	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.20E-01	2.50E-01	4.03E-01	1.35E-01	4.93E-01	5.59E-01	Unknown
CG-124-40	Trichloroethylene	8	100.0	1.91E+00	7.88E-01	2.43	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.10E+00	2.24E+00	1.58E+00	3.86E-01	1.84E+00	1.91E+00	Normal/Lognormal
CG-124-40	Vanadium	1	100.0	4.09E+00	2.00E+01	0.20	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.09E+00	4.09E+00	4.09E+00	--	N/A	N/A	Unknown
CG-124-40	Vinyl chloride	8	100.0	5.32E+00	2.04E+00	2.61	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.40E+00	6.44E+00	4.46E+00	1.11E+00	5.20E+00	5.32E+00	Normal/Lognormal
CG-124-70																							
CG-124-70	1,1-Dichloroethane	8	50.0	9.35E-01	4.70E+01	0.02	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.60E-01	1.20E+00	6.53E-01	3.13E-01	8.62E-01	9.35E-01	Unknown
CG-124-70	1,2-Dichloroethane	8	87.5	2.50E-01	3.06E+01	0.01	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	3.80E-02	2.50E-01	1.46E-01	7.93E-02	1.99E-01	3.21E-01	Normal/Lognormal
CG-124-70	1,4-Dioxane	3	100.0	1.27E+02	9.49E+01	1.34	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	9.60E+01	1.27E+02	1.14E+02	1.63E+01	1.42E+02	1.57E+02	Normal/Lognormal
CG-124-70	1-Methyl naphthalene	3	33.3	5.30E-03	2.10E+00	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	5.30E-03	5.30E-03	3.51E-02	2.58E-02	7.86E-02	2.99E+05	Unknown
CG-124-70	Arsenic	8	87.5	6.45E+00	5.06E-02	127.47	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	6.15E-02	6.15E-02	7.98E-02	6.45E+00	1.62E+00	2.18E+00	3.08E+00	1.53E+02	Lognormal
CG-124-70	Barium	4	100.0	2.52E+01	4.00E+00	6.30	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	7.78E+00	2.52E+01	1.40E+01	7.74E+00	2.31E+01	4.13E+01	Normal/Lognormal
CG-124-70	Benzene	8	87.5	1.11E+00	1.17E+01	0.10	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	2.10E-01	1.11E+00	6.41E-01	3.36E-01	8.66E-01	1.24E+00	Normal/Lognormal
CG-124-70	Bis(2-ethylhexyl) phthalate	3	33.3	7.54E-01	2.00E+00	0.38	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	6.00E-01	1.61E+00	7.54E-01	7.54E-01	6.20E-01	2.78E-01	1.09E+00	1.09E+01	Normal/Lognormal
CG-124-70	Chloroethane	8	75.0	1.07E+01	4.61E+02	0.02	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.20E-01	1.21E+01	2.70E+00	3.87E+00	5.29E+00	1.07E+01	Lognormal
CG-124-70	Chromium	2	100.0	6.01E+00	1.00E+01	0.60	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.95E+00	6.01E+00	3.98E+00	2.87E+00	1.68E+01	1.73E+08	Unknown
CG-124-70	Copper	4	75.0	1.22E+01	3.10E+00	3.94	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.46E+00	1.22E+01	4.24E+00	5.39E+00	1.06E+01	4.94E+03	Normal/Lognormal
CG-124-70	Ethane	4	100.0	4.36E+01	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.50E+01	4.36E+01	3.72E+01	8.32E+00	4.70E+01	5.51E+01	Normal/Lognormal
CG-124-70	Ethene	4	100.0	1.42E+02	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.90E+01	1.42E+02	1.02E+02	4.21E+01	1.51E+02	2.85E+02	Normal/Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-124-70	Iron	6	100.0	8.34E+03	1.00E+03	8.34	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	6.17E+03	8.64E+03	7.39E+03	9.74E+02	8.19E+03	8.34E+03	Normal/Lognormal
CG-124-70	Lead	7	14.3	2.82E+00	2.50E+00	1.13	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	4.00E-02	1.00E+00	2.82E+00	2.82E+00	7.63E-01	9.25E-01	1.44E+00	2.58E+01	Unknown
CG-124-70	Manganese	5	100.0	3.50E+02	1.00E+02	3.50	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.71E+02	3.71E+02	3.09E+02	3.84E+01	3.45E+02	3.50E+02	Normal/Lognormal
CG-124-70	Methane	4	100.0	2.92E+04	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.50E+04	2.92E+04	2.19E+04	7.19E+03	3.03E+04	3.92E+04	Normal/Lognormal
CG-124-70	Nickel	4	75.0	5.69E+00	8.20E+00	0.69	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.25E+00	5.69E+00	2.40E+00	2.30E+00	5.10E+00	1.51E+02	Normal/Lognormal
CG-124-70	Selenium	4	100.0	4.34E+00	5.00E+00	0.87	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.83E+00	4.34E+00	3.89E+00	7.12E-01	4.73E+00	5.23E+00	Unknown
CG-124-70	Trichloroethylene	8	12.5	2.61E-02	7.88E-01	0.03	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	2.90E-02	2.90E-02	1.69E-02	8.18E-03	2.24E-02	2.61E-02	Unknown
CG-124-70	Vanadium	1	100.0	1.62E+01	2.00E+01	0.81	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.62E+01	1.62E+01	1.62E+01	--	N/A	N/A	Unknown
CG-124-70	Vinyl chloride	8	100.0	1.61E+00	2.04E+00	0.79	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.10E-01	1.81E+00	9.58E-01	5.13E-01	1.30E+00	1.61E+00	Normal/Lognormal
CG-124-WT																							
CG-124-WT	1,1,1-Trichloroethane	9	100.0	7.57E+01	1.10E+01	6.88	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.60E+00	7.57E+01	2.44E+01	2.74E+01	4.14E+01	9.98E+01	Lognormal
CG-124-WT	1,1,2-Trichlorotrifluoroethane	4	100.0	2.46E+01	1.21E+03	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.08E+01	2.46E+01	1.65E+01	6.14E+00	2.37E+01	3.15E+01	Normal/Lognormal
CG-124-WT	1,1-Dichloroethane	9	100.0	8.12E+01	4.70E+01	1.73	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.80E+00	8.54E+01	3.24E+01	3.01E+01	5.10E+01	8.12E+01	Lognormal
CG-124-WT	1,1-Dichloroethylene	9	100.0	1.53E+00	2.50E+01	0.06	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.83E-01	1.89E+00	1.14E+00	4.64E-01	1.43E+00	1.53E+00	Normal/Lognormal
CG-124-WT	1,2-Dichloroethane	9	88.9	1.20E+00	1.29E+01	0.09	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.60E-01	1.87E+00	5.56E-01	5.42E-01	8.92E-01	1.20E+00	Lognormal
CG-124-WT	1,4-Dioxane	3	33.3	2.50E+00	9.49E+01	0.03	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.50E+00	2.50E+00	1.17E+00	1.15E+00	3.11E+00	3.79E+03	Unknown
CG-124-WT	Arsenic	6	100.0	1.13E+01	5.06E-02	223.32	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.84E+00	1.13E+01	5.89E+00	3.33E+00	8.63E+00	1.17E+01	Normal/Lognormal
CG-124-WT	Benzene	9	33.3	2.00E-01	9.60E+00	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	1.80E-01	2.00E-01	2.29E-01	3.22E-02	2.49E-01	2.53E-01	Unknown
CG-124-WT	Bis(2-ethylhexyl) phthalate	3	33.3	9.70E-01	2.00E+00	0.49	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	6.65E+00	9.70E-01	9.70E-01	1.77E+00	1.35E+00	4.04E+00	1.79E+02	Lognormal
CG-124-WT	Chloroform	9	66.7	1.66E+00	4.11E+00	0.40	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	3.10E-01	1.00E+00	3.00E-01	1.96E+00	7.23E-01	5.91E-01	1.09E+00	1.66E+00	Normal/Lognormal
CG-124-WT	cis-1,2-Dichloroethylene	9	100.0	7.28E+01	7.27E+01	1.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.20E+00	7.28E+01	3.12E+01	2.61E+01	4.74E+01	8.28E+01	Lognormal
CG-124-WT	Copper	4	100.0	1.80E+00	3.10E+00	0.58	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.24E+00	1.80E+00	1.45E+00	2.46E-01	1.73E+00	1.81E+00	Normal/Lognormal
CG-124-WT	Dibenzo(a,h)anthracene	3	33.3	1.80E-02	1.62E-02	1.11	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.80E-02	1.80E-02	1.03E-02	6.81E-03	2.18E-02	5.28E-01	Normal/Lognormal
CG-124-WT	Indeno(1,2,3-cd)pyrene	3	33.3	1.73E-02	2.00E-02	0.87	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.73E-02	1.73E-02	1.01E-02	6.41E-03	2.09E-02	4.00E-01	Normal/Lognormal
CG-124-WT	Iron	6	100.0	5.84E+03	1.00E+03	5.84	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.90E+03	5.84E+03	3.71E+03	1.58E+03	5.00E+03	6.59E+03	Normal/Lognormal
CG-124-WT	Manganese	5	100.0	2.79E+02	1.00E+02	2.79	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.09E+02	2.82E+02	2.49E+02	2.68E+01	2.74E+02	2.79E+02	Normal/Lognormal
CG-124-WT	Methane	4	100.0	4.62E+02	--	--	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.95E+00	4.62E+02	1.28E+02	2.23E+02	3.90E+02	3.33E+07	Lognormal
CG-124-WT	Nickel	4	100.0	4.66E+00	8.20E+00	0.57	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.15E+00	4.66E+00	3.45E+00	1.07E+00	4.71E+00	6.09E+00	Normal/Lognormal
CG-124-WT	Pentachlorophenol	3	33.3	8.07E-01	2.53E+00	0.32	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	8.07E-01	8.07E-01	4.37E-01	3.93E-01	1.10E+00	1.54E+14	Normal/Lognormal
CG-124-WT	Tetrachloroethylene	9	100.0	8.39E+00	2.02E-01	41.54	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.73E+00	8.92E+00	6.77E+00	1.72E+00	7.83E+00	8.39E+00	Normal/Lognormal
CG-124-WT	trans-1,2-Dichloroethylene	9	100.0	1.84E+00	6.53E+01	0.03	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.30E-01	2.02E+00	1.27E+00	5.46E-01	1.60E+00	1.84E+00	Normal/Lognormal
CG-124-WT	Trichloroethylene	9	100.0	2.66E+01	4.04E-01	65.94	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.70E+01	3.10E+01	2.34E+01	4.42E+00	2.61E+01	2.66E+01	Normal/Lognormal
CG-124-WT	Vanadium	1	100.0	2.06E+00	2.00E+01	0.10	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.06E+00	2.06E+00	2.06E+00	--	N/A	N/A	Unknown
CG-124-WT	Vinyl chloride	9	100.0	2.42E+01	1.28E+00	18.85	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.90E+00	2.81E+01	1.51E+01	7.71E+00	1.99E+01	2.42E+01	Normal/Lognormal
CG-125-40																							
CG-125-40	1,1-Dichloroethane	4	100.0	4.92E+00	4.70E+01	0.10	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.90E+00	4.92E+00	3.96E+00	8.27E-01	4.93E+00	5.48E+00	Normal/Lognormal
CG-125-40	1,1-Dichloroethylene	4	25.0	5.90E-03	2.50E+01	0.00	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	5.90E-03	5.90E-03	1.65E-02	9.99E-03	2.82E-02	1.34E-01	Normal/Lognormal
CG-125-40	1,2-Dichloroethane	4	25.0	4.70E-02	3.06E+01	0.00	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.00E-01	4.70E-02	4.70E-02	3.80E-02	2.20E-02	6.39E-02	7.78E+00	Unknown
CG-125-40	1,4-Dioxane	3	100.0	2.29E+02	9.49E+01	2.41	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.00E+01	2.29E+02	1.65E+02	8.37E+01	3.06E+02	8.08E+03	Normal/Lognormal
CG-125-40	Barium	2	100.0	5.66E+00	4.00E+00	1.42	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.22E+00	5.66E+00	4.94E+00	1.02E+00	9.49E+00	1.49E+01	Unknown
CG-125-40	Benzene	4	100.0	1.78E+00	1.17E+01	0.15	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.10E+00	1.78E+00	1.50E+00	2.89E-01	1.84E+00	2.04E+00	Normal/Lognormal
CG-125-40	Bis(2-ethylhexyl) phthalate	3	33.3	3.75E-01	2.00E+00	0.19	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.12E+00	2.00E+00	3.75E-01	3.75E-01	6.45E-01	3.21E-01	1.19E+00	6.26E+00	Normal/Lognormal
CG-125-40	Chloroethane	4	100.0	3.44E+00	4.61E+02	0.01	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.90E+00	3.44E+00	2.64E+00	6.62E-01	3.42E+00	3.92E+00	Normal/Lognormal
CG-125-40	Chromium	2	100.0	2.81E+00	1.00E+01	0.28	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.47E+00	2.81E+00	2.64E+00	2.40E-01	3.71E+00	3.74E+00	Unknown
CG-125-40	cis-1,2-Dichloroethylene	4	100.0	2.44E+00	1.65E+02	0.01	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.30E+00	2.44E+00	2.00E+00	5.16E-01	2.60E+00	3.18E+00	Normal/Lognormal
CG-125-40	Copper	4	25.0	1.24E+00	3.10E+00	0.40	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.24E+00	1.24E+00	6.85E-01	3.70E-01	1.12E+00	1.71E+00	Unknown
CG-125-40	Hexavalent Chromium	1	100.0	5.07E+00	1.00E+01	0.51	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	5.07E+00	5.07E+00	5.07E+00	--	N/A	N/A	Unknown
CG-125-40	Manganese	4	100.0	1.45E+02	1.00E+02	1.45	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.20E+02	1.45E+02	1.31E+02	1.08E+01	1.44E+02	1.46E+02	Normal/Lognormal
CG-125-40	Nickel	4	75.0	1.56E+00	8.20E+00	0.19	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.18E+00	1.56E+00	1.15E+00	4.59E-01	1.69E+00	3.60E+00	Normal/Lognormal
CG-125-40	Selenium	4	25.0	1.35E+00	5.00E+00	0.27	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.35E+00	1.35E+00	7.13E-01	4.25E-01	1.21E+00	2.06E+00	Unknown
CG-125-40	Trichloroethylene	4	25.0	3.70E-02	7.88E-01	0.05	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	2.00E-02	3.70E-02	3.70E-02	1.55E-02	1.45E-02	3.26E-02	2.52E-01	Normal/Lognormal
CG-125-40	Vanadium	1	100.0	1.14E+01	2.00E+01	0.57	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.14E+01	1.14E+01	1.14E+01	--	N/A	N/A	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-125-40	Vinyl chloride	4	100.0	1.08E+01	2.04E+00	5.30	SW Crossgrade	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.60E+00	1.08E+01	6.28E+00	3.39E+00	1.03E+01	2.66E+01	Normal/Lognormal
CG-126-WT																							
CG-126-WT	1,1,1-Trichloroethane	6	100.0	3.72E+00	1.10E+01	0.34	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.10E-01	3.74E+00	2.05E+00	9.88E-01	2.86E+00	3.72E+00	Normal/Lognormal
CG-126-WT	1,1-Dichloroethane	6	100.0	1.01E+01	4.70E+01	0.22	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.39E+00	1.10E+01	8.96E+00	1.25E+00	9.99E+00	1.01E+01	Normal/Lognormal
CG-126-WT	1,1-Dichloroethylene	6	100.0	2.12E+00	2.50E+01	0.08	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.20E+00	2.58E+00	1.61E+00	5.07E-01	2.03E+00	2.12E+00	Normal/Lognormal
CG-126-WT	1,2-Dichloroethane	6	50.0	7.42E-02	1.29E+01	0.01	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	4.50E-02	9.50E-02	5.67E-02	1.89E-02	7.22E-02	7.42E-02	Unknown
CG-126-WT	1,4-Dioxane	3	33.3	4.02E+00	9.49E+01	0.04	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.02E+00	4.02E+00	1.67E+00	2.03E+00	5.10E+00	1.33E+06	Unknown
CG-126-WT	Arsenic	6	100.0	1.95E+00	5.06E-02	38.51	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.32E+00	2.06E+00	1.67E+00	2.83E-01	1.90E+00	1.95E+00	Normal/Lognormal
CG-126-WT	Barium	2	50.0	5.83E+00	4.00E+00	1.46	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	4.00E+00	4.00E+00	5.83E+00	5.83E+00	3.92E+00	2.71E+00	1.60E+01	3.03E+07	Unknown
CG-126-WT	Bis(2-ethylhexyl) phthalate	3	66.7	3.00E-01	2.00E+00	0.15	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	7.36E-01	7.36E-01	9.37E-02	3.00E-01	2.54E-01	1.43E-01	4.95E-01	4.32E+01	Normal/Lognormal
CG-126-WT	cis-1,2-Dichloroethylene	6	100.0	1.10E+01	7.27E+01	0.15	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.83E+00	1.10E+01	6.88E+00	2.85E+00	9.23E+00	1.13E+01	Normal/Lognormal
CG-126-WT	Copper	4	100.0	4.23E+00	3.10E+00	1.36	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.29E+00	4.23E+00	3.87E+00	4.28E-01	4.37E+00	4.49E+00	Normal/Lognormal
CG-126-WT	Manganese	4	100.0	1.86E+02	1.00E+02	1.86	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.34E+02	1.86E+02	1.60E+02	2.14E+01	1.85E+02	1.92E+02	Normal/Lognormal
CG-126-WT	Nickel	4	100.0	4.53E+00	8.20E+00	0.55	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.08E+00	4.53E+00	3.74E+00	6.28E-01	4.47E+00	4.71E+00	Normal/Lognormal
CG-126-WT	Phenol	3	33.3	1.90E-01	1.18E+02	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.90E-01	1.90E-01	3.40E+00	2.78E+00	8.08E+00	2.02E+15	Unknown
CG-126-WT	Tetrachloroethylene	6	100.0	1.86E+00	2.02E-01	9.22	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.10E+00	2.06E+00	1.50E+00	3.43E-01	1.78E+00	1.86E+00	Normal/Lognormal
CG-126-WT	Trichloroethylene	6	100.0	1.91E+01	4.04E-01	47.32	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+01	2.08E+01	1.63E+01	2.85E+00	1.87E+01	1.91E+01	Normal/Lognormal
CG-126-WT	Vanadium	1	100.0	2.04E+00	2.00E+01	0.10	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.04E+00	2.04E+00	2.04E+00	--	N/A	N/A	Unknown
CG-126-WT	Vinyl chloride	6	100.0	2.48E+00	1.28E+00	1.93	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.40E-02	2.48E+00	8.80E-01	9.47E-01	1.66E+00	1.22E+02	Normal/Lognormal
CG-127-40																							
CG-127-40	1,1-Dichloroethane	5	100.0	7.58E+00	4.70E+01	0.16	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.67E+00	7.60E+00	7.14E+00	4.21E-01	7.55E+00	7.58E+00	Normal/Lognormal
CG-127-40	1,1-Dichloroethylene	5	100.0	1.56E-01	2.50E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.20E-01	1.56E-01	1.40E-01	1.63E-02	1.56E-01	1.59E-01	Normal/Lognormal
CG-127-40	1,2-Dichloroethane	5	100.0	2.29E-01	3.06E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.91E-01	2.30E-01	2.14E-01	1.47E-02	2.28E-01	2.29E-01	Normal/Lognormal
CG-127-40	1,4-Dioxane	3	100.0	1.37E+03	9.49E+01	14.44	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.14E+02	1.37E+03	7.81E+02	5.15E+02	1.65E+03	2.92E+04	Normal/Lognormal
CG-127-40	Barium	2	100.0	1.03E+01	4.00E+00	2.58	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.93E+00	1.03E+01	1.01E+01	2.62E-01	1.13E+01	1.10E+01	Unknown
CG-127-40	Benzene	5	100.0	7.85E-01	1.17E+01	0.07	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.00E-01	8.20E-01	7.34E-01	5.08E-02	7.82E-01	7.85E-01	Normal/Lognormal
CG-127-40	Bis(2-ethylhexyl) phthalate	3	33.3	9.02E-01	2.00E+00	0.45	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	3.45E+00	9.02E-01	9.02E-01	1.21E+00	4.50E-01	1.97E+00	3.84E+00	Normal/Lognormal
CG-127-40	Chloroethane	5	100.0	3.06E+00	4.61E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.55E+00	3.07E+00	2.83E+00	2.20E-01	3.04E+00	3.06E+00	Normal/Lognormal
CG-127-40	Chromium	2	50.0	7.90E-01	1.00E+01	0.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	7.90E-01	7.90E-01	6.45E-01	2.05E-01	1.56E+00	8.18E+00	Unknown
CG-127-40	cis-1,2-Dichloroethylene	5	100.0	5.17E+00	1.65E+02	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.40E+00	5.17E+00	4.90E+00	3.26E-01	5.21E+00	5.25E+00	Normal/Lognormal
CG-127-40	Copper	2	50.0	4.70E-01	3.10E+00	0.15	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.70E-01	4.70E-01	4.85E-01	2.12E-02	5.80E-01	5.65E-01	Unknown
CG-127-40	Ethane	4	100.0	2.09E+03	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.90E+02	2.09E+03	1.64E+03	4.72E+02	2.20E+03	2.88E+03	Normal/Lognormal
CG-127-40	Ethene	4	100.0	3.91E+01	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.70E+01	3.91E+01	3.22E+01	1.02E+01	4.41E+01	6.74E+01	Unknown
CG-127-40	Hexavalent Chromium	1	100.0	1.31E+01	1.00E+01	1.31	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.31E+01	1.31E+01	1.31E+01	--	N/A	N/A	Unknown
CG-127-40	Iron	5	100.0	2.09E+04	1.00E+03	20.86	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.90E+04	2.14E+04	2.00E+04	8.69E+02	2.08E+04	2.09E+04	Normal/Lognormal
CG-127-40	Manganese	5	100.0	1.41E+03	1.00E+02	14.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.36E+03	1.42E+03	1.39E+03	2.30E+01	1.41E+03	1.41E+03	Normal/Lognormal
CG-127-40	Methane	4	100.0	1.94E+04	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.50E+03	1.94E+04	1.43E+04	4.67E+03	1.97E+04	2.55E+04	Normal/Lognormal
CG-127-40	Methylene chloride	5	20.0	2.20E-01	4.95E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	2.20E-01	2.20E-01	2.04E+00	1.02E+00	3.02E+00	4.90E+01	Unknown
CG-127-40	Nickel	2	100.0	3.12E+00	8.20E+00	0.38	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.43E+00	3.12E+00	2.28E+00	1.20E+00	7.61E+00	8.51E+03	Unknown
CG-127-40	Trichloroethylene	5	40.0	2.50E-02	7.88E-01	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	5.00E-02	5.10E-03	2.50E-02	1.66E-02	1.06E-02	2.67E-02	1.21E-01	Unknown
CG-127-40	Vinyl chloride	5	100.0	1.26E+01	2.04E+00	6.16	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.40E+00	1.32E+01	9.83E+00	2.19E+00	1.19E+01	1.26E+01	Normal/Lognormal
CG-127-40	Zinc	2	50.0	1.61E+00	8.10E+01	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.61E+00	1.61E+00	3.31E+00	2.40E+00	1.40E+01	1.83E+08	Unknown
CG-127-WT																							
CG-127-WT	1,1,1-Trichloroethane	5	20.0	3.90E-01	1.10E+01	0.04	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.90E-01	3.90E-01	4.78E-01	4.92E-02	5.25E-01	5.36E-01	Unknown
CG-127-WT	1,1-Dichloroethane	5	100.0	4.16E+00	4.70E+01	0.09	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.99E+00	4.17E+00	3.44E+00	6.09E-01	4.03E+00	4.16E+00	Unknown
CG-127-WT	1,1-Dichloroethylene	5	100.0	4.35E-01	2.50E+01	0.02	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.57E-01	4.35E-01	3.33E-01	1.07E-01	4.35E-01	5.85E-01	Normal/Lognormal
CG-127-WT	1,2-Dichloroethane	5	20.0	2.60E-02	1.29E+01	0.00	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.00E-01	2.60E-02	2.60E-02	3.62E-02	2.03E-02	5.56E-02	5.23E-01	Normal
CG-127-WT	1,4-Dioxane	3	33.3	3.00E+00	9.49E+01	0.03	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.00E+00	3.00E+00	1.33E+00	1.44E+00	3.77E+00	3.02E+04	Unknown
CG-127-WT	Arsenic	5	100.0	3.12E+00	5.06E-02	61.60	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.45E+00	3.25E+00	2.72E+00	3.60E-01	3.07E+00	3.12E+00	Normal/Lognormal
CG-127-WT	Barium	1	100.0	1.38E+00	4.00E+00	0.35	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.38E+00	1.38E+00	1.38E+00	--	N/A	N/A	Unknown
CG-127-WT	Bis(2-ethylhexyl) phthalate	2	50.0	1.18E-01	2.00E+00	0.06	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	1.18E-01	1.18E-01	5.59E-01	6.24E-01	3.34E+00	4.37E+27	Unknown
CG-127-WT	Chloroform	5	20.0	5.19E-01	4.11E+00	0.13	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.30E-01	5.30E-01	5.06E-01	1.34E-02	5.19E-01	5.19E-01	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-127-WT	Chromium	2	50.0	6.60E-01	1.00E+01	0.07	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.60E-01	6.60E-01	5.80E-01	1.13E-01	1.09E+00	1.58E+00	Unknown
CG-127-WT	cis-1,2-Dichloroethylene	5	100.0	2.98E+00	7.27E+01	0.04	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.13E+00	2.98E+00	2.13E+00	7.34E-01	2.83E+00	3.60E+00	Normal/Lognormal
CG-127-WT	Copper	2	100.0	4.57E+00	3.10E+00	1.47	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.05E+00	4.57E+00	4.31E+00	3.68E-01	5.95E+00	5.94E+00	Unknown
CG-127-WT	Hexavalent Chromium	1	100.0	9.61E+00	1.00E+01	0.96	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.61E+00	9.61E+00	9.61E+00	--	N/A	N/A	Unknown
CG-127-WT	Iron	5	20.0	3.43E+01	1.00E+03	0.03	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.50E+02	3.00E+02	3.43E+01	3.43E+01	1.12E+02	5.42E+01	1.64E+02	3.78E+02	Normal/Lognormal
CG-127-WT	Manganese	5	100.0	1.39E+02	1.00E+02	1.39	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.06E+02	1.46E+02	1.22E+02	1.57E+01	1.37E+02	1.39E+02	Normal/Lognormal
CG-127-WT	Methane	4	75.0	4.83E+00	--	--	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.20E+00	1.20E+00	1.62E+00	4.83E+00	2.26E+00	1.81E+00	4.39E+00	4.37E+01	Normal/Lognormal
CG-127-WT	Nickel	2	100.0	2.65E+00	8.20E+00	0.32	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.64E+00	2.65E+00	2.15E+00	7.14E-01	5.33E+00	3.58E+01	Unknown
CG-127-WT	Tetrachloroethylene	5	100.0	4.32E-01	2.02E-01	2.14	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.35E-01	4.61E-01	3.80E-01	4.89E-02	4.27E-01	4.32E-01	Normal/Lognormal
CG-127-WT	Trichloroethylene	5	100.0	1.21E+01	4.04E-01	29.95	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.65E+00	1.21E+01	1.07E+01	1.39E+00	1.20E+01	1.23E+01	Normal/Lognormal
CG-127-WT	Vinyl chloride	5	100.0	6.67E-01	1.28E+00	0.52	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.70E-02	6.67E-01	2.52E-01	2.53E-01	4.94E-01	4.22E+00	Normal/Lognormal
CG-127-WT	Zinc	2	50.0	1.50E+00	8.10E+01	0.02	Area 3	6	16	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.50E+00	1.50E+00	3.25E+00	2.47E+00	1.43E+01	1.87E+09	Unknown
CG-128-70																							
CG-128-70	1,1-Dichloroethane	4	25.0	1.70E-01	4.70E+01	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.70E-01	1.70E-01	4.18E-01	1.65E-01	6.12E-01	1.47E+00	Unknown
CG-128-70	1,4-Dioxane	3	100.0	1.58E+02	9.49E+01	1.67	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	6.80E+01	1.58E+02	1.04E+02	4.76E+01	1.84E+02	6.09E+02	Normal/Lognormal
CG-128-70	Barium	2	50.0	7.08E+00	4.00E+00	1.77	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	7.08E+00	7.08E+00	6.04E+00	1.47E+00	1.26E+01	2.66E+01	Unknown
CG-128-70	Bis(2-ethylhexyl) phthalate	3	33.3	4.71E-01	2.00E+00	0.24	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	8.80E-01	3.45E+00	4.71E-01	4.71E-01	8.79E-01	7.33E-01	2.11E+00	2.25E+02	Normal/Lognormal
CG-128-70	Chloroethane	4	50.0	1.27E+00	4.61E+02	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	2.80E+00	1.17E+00	1.27E+00	1.09E+00	4.01E-01	1.56E+00	2.97E+00	Normal/Lognormal
CG-128-70	Chromium	2	50.0	1.04E+00	1.00E+01	0.10	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.04E+00	1.04E+00	7.70E-01	3.82E-01	2.47E+00	1.01E+03	Unknown
CG-128-70	Copper	2	100.0	2.29E+00	3.10E+00	0.74	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.80E-01	2.29E+00	1.29E+00	1.42E+00	7.63E+00	1.20E+27	Unknown
CG-128-70	Ethane	4	100.0	3.06E+01	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.60E+01	3.06E+01	2.13E+01	6.54E+00	2.90E+01	3.36E+01	Normal/Lognormal
CG-128-70	Ethene	4	25.0	1.80E+00	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.80E+00	1.80E+00	4.20E+00	1.60E+00	6.08E+00	1.32E+01	Unknown
CG-128-70	Iron	5	100.0	5.09E+03	1.00E+03	5.09	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	4.73E+03	5.14E+03	4.90E+03	1.94E+02	5.08E+03	5.09E+03	Normal/Lognormal
CG-128-70	Manganese	5	100.0	3.22E+02	1.00E+02	3.22	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.94E+02	3.25E+02	3.10E+02	1.17E+01	3.21E+02	3.22E+02	Normal/Lognormal
CG-128-70	Methane	4	100.0	2.66E+04	--	--	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.10E+04	2.66E+04	1.81E+04	6.70E+03	2.60E+04	3.61E+04	Normal/Lognormal
CG-128-70	Methylene chloride	4	25.0	3.20E-01	4.95E+02	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.20E-01	3.20E-01	1.96E+00	1.09E+00	3.24E+00	1.47E+02	Unknown
CG-128-70	Nickel	2	100.0	3.34E+00	8.20E+00	0.41	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.39E+00	3.34E+00	2.87E+00	6.72E-01	5.86E+00	1.14E+01	Unknown
CG-128-70	Pentachlorophenol	3	33.3	3.97E-01	2.53E+00	0.16	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	3.97E-01	3.97E-01	3.01E-01	2.42E-01	7.09E-01	6.28E+10	Normal/Lognormal
CG-128-70	Vinyl chloride	4	100.0	4.93E-01	2.04E+00	0.24	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.40E-01	4.93E-01	3.27E-01	1.19E-01	4.66E-01	5.86E-01	Normal/Lognormal
CG-128-70	Zinc	2	50.0	1.37E+00	8.10E+01	0.02	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.37E+00	1.37E+00	3.19E+00	2.57E+00	1.46E+01	4.49E+10	Unknown
CG-128-WT																							
CG-128-WT	1,1-Dichloroethane	6	33.3	2.20E+00	4.70E+01	0.05	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.70E+00	2.20E+00	9.83E-01	7.65E-01	1.61E+00	2.73E+00	Unknown
CG-128-WT	1,1-Dichloroethylene	6	16.7	1.23E-02	2.50E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	1.00E+00	1.23E-02	1.23E-02	1.02E-01	1.95E-01	2.62E-01	1.84E+00	Unknown
CG-128-WT	1,2-Dichloroethane	6	16.7	3.10E-02	1.29E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E+00	3.10E-02	3.10E-02	1.22E-01	1.85E-01	2.74E-01	7.00E-01	Unknown
CG-128-WT	1,4-Dioxane	3	66.7	1.65E+00	9.49E+01	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.48E+00	1.65E+00	1.21E+00	6.20E-01	2.25E+00	7.27E+01	Normal/Lognormal
CG-128-WT	Arsenic	5	100.0	4.34E+00	5.06E-02	85.75	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.10E+00	5.01E+00	2.53E+00	1.90E+00	4.34E+00	1.16E+01	Normal
CG-128-WT	Barium	1	100.0	2.14E+00	4.00E+00	0.53	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.14E+00	2.14E+00	2.14E+00	--	N/A	N/A	Unknown
CG-128-WT	Benzo(a)anthracene	3	33.3	1.01E-02	2.00E-02	0.51	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.01E-02	1.01E-02	7.70E-03	2.56E-03	1.20E-02	2.61E-02	Normal/Lognormal
CG-128-WT	Bis(2-ethylhexyl) phthalate	3	66.7	1.40E+01	2.00E+00	7.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	7.20E-01	7.20E-01	1.81E+00	1.40E+01	5.39E+00	7.49E+00	1.80E+01	3.63E+14	Normal/Lognormal
CG-128-WT	Chloroform	6	16.7	5.23E-01	4.11E+00	0.13	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.45E-01	5.45E-01	5.08E-01	1.84E-02	5.23E-01	5.23E-01	Unknown
CG-128-WT	Chromium	2	50.0	4.75E-01	1.00E+01	0.05	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.75E-01	4.75E-01	4.88E-01	1.77E-02	5.66E-01	5.52E-01	Unknown
CG-128-WT	cis-1,2-Dichloroethylene	6	16.7	5.48E-01	7.27E+01	0.01	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.95E-01	5.95E-01	5.16E-01	3.88E-02	5.48E-01	5.48E-01	Unknown
CG-128-WT	Copper	2	100.0	1.77E+00	3.10E+00	0.57	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.58E+00	1.77E+00	1.67E+00	1.38E-01	2.29E+00	2.28E+00	Unknown
CG-128-WT	Nickel	2	100.0	4.44E+00	8.20E+00	0.54	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.14E+00	4.44E+00	3.79E+00	9.19E-01	7.89E+00	1.65E+01	Unknown
CG-128-WT	Tetrachloroethylene	5	100.0	4.97E-01	2.02E-01	2.46	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.45E-01	5.27E-01	4.19E-01	6.89E-02	4.85E-01	4.97E-01	Normal/Lognormal
CG-128-WT	Trichloroethylene	6	100.0	5.86E-01	4.04E-01	1.45	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.56E-01	5.90E-01	5.30E-01	5.95E-02	5.79E-01	5.86E-01	Normal/Lognormal
CG-128-WT	Vinyl chloride	6	83.3	1.80E-01	1.28E+00	0.14	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	4.20E-02	1.80E-01	9.85E-02	6.40E-02	1.51E-01	1.06E+00	Normal/Lognormal
CG-128-WT	Zinc	2	50.0	7.00E-01	8.10E+01	0.01	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	7.00E-01	7.00E-01	2.85E+00	3.04E+00	1.64E+01	1.11E+24	Unknown
CG-129-40																							
CG-129-40	1,2-Dichloroethane	4	100.0	1.82E-01	3.06E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.40E-01	1.82E-01	1.57E-01	1.99E-02	1.80E-01	1.85E-01	Normal/Lognormal
CG-129-40	1,4-Dioxane	3	100.0	2.39E+02	9.49E+01	2.52	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	8.20E+01	2.39E+02	1.85E+02	8.90E+01	3.35E+02	6.16E+03	Normal/Lognormal
CG-129-40	Arsenic	5	20.0	1.21E-01	5.06E-02	2.39	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	4.00E-02	6.15E-02	1.21E-01	1.21E-01	4.66E-02	4.18E-02	8.65E-02	1.62E-01	Unknown

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-129-40	Barium	1	100.0	9.94E+00	4.00E+00	2.49	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.94E+00	9.94E+00	9.94E+00	--	N/A	N/A	Unknown
CG-129-40	Benzene	4	100.0	2.40E+01	1.17E+01	2.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.14E+01	2.40E+01	2.30E+01	1.11E+00	2.43E+01	2.44E+01	Normal/Lognormal
CG-129-40	Benzo(a)anthracene	3	33.3	1.40E-02	2.00E-02	0.70	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.00E-02	1.40E-02	1.40E-02	8.00E-03	5.20E-03	1.68E-02	2.17E-01	Unknown
CG-129-40	Bis(2-ethylhexyl) phthalate	3	66.7	1.20E+00	2.00E+00	0.60	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.93E+00	1.93E+00	5.68E-01	1.20E+00	9.11E-01	3.19E-01	1.45E+00	3.68E+00	Normal/Lognormal
CG-129-40	Chloroethane	4	100.0	1.26E+02	4.61E+02	0.27	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.00E+01	1.26E+02	9.15E+01	2.42E+01	1.20E+02	1.34E+02	Normal/Lognormal
CG-129-40	Chromium	2	50.0	8.80E-01	1.00E+01	0.09	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	8.80E-01	8.80E-01	6.90E-01	2.69E-01	1.89E+00	3.93E+01	Unknown
CG-129-40	cis-1,2-Dichloroethylene	4	25.0	2.90E-01	1.65E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	2.90E-01	2.90E-01	5.73E-01	3.02E-01	9.27E-01	1.74E+00	Normal/Lognormal
CG-129-40	Copper	2	50.0	3.70E-01	3.10E+00	0.12	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.70E-01	3.70E-01	4.35E-01	9.19E-02	8.45E-01	1.37E+00	Unknown
CG-129-40	Hexavalent Chromium	1	100.0	1.00E+01	1.00E+01	1.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.00E+01	1.00E+01	1.00E+01	--	N/A	N/A	Unknown
CG-129-40	Methylene chloride	4	100.0	1.70E+01	4.95E+02	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.90E+00	1.70E+01	1.11E+01	5.15E+00	1.72E+01	3.86E+01	Normal/Lognormal
CG-129-40	Nickel	2	100.0	4.34E+00	8.20E+00	0.53	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.44E+00	4.34E+00	2.89E+00	2.05E+00	1.20E+01	6.23E+07	Unknown
CG-129-40	Phenol	3	33.3	5.90E-01	1.18E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	5.90E-01	5.90E-01	3.53E+00	2.55E+00	7.82E+00	6.72E+06	Unknown
CG-129-40	Toluene	4	25.0	1.30E-01	9.80E+00	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.30E-01	1.30E-01	5.33E-01	3.57E-01	9.53E-01	1.04E+01	Normal/Lognormal
CG-129-40	Trichloroethylene	4	25.0	6.00E-02	7.88E-01	0.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	6.00E-02	6.00E-02	2.25E-02	2.50E-02	5.19E-02	5.24E-01	Unknown
CG-129-40	Vinyl chloride	4	100.0	2.07E+00	2.04E+00	1.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.10E-01	2.07E+00	1.48E+00	6.67E-01	2.26E+00	4.59E+00	Normal/Lognormal
CG-129-40	Zinc	2	50.0	1.00E+00	8.10E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.00E+00	1.00E+00	3.00E+00	2.83E+00	1.56E+01	1.74E+16	Unknown
CG-129-WT																							
CG-129-WT	1,1-Dichloroethane	4	25.0	1.60E-01	4.70E+01	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.60E-01	1.60E-01	4.15E-01	1.70E-01	6.15E-01	1.67E+00	Unknown
CG-129-WT	1,2-Dichloroethane	4	25.0	1.20E-02	1.29E+01	0.00	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	1.20E-02	1.20E-02	4.05E-02	1.90E-02	6.29E-02	3.37E-01	Unknown
CG-129-WT	Arsenic	5	100.0	2.50E+00	5.06E-02	49.41	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.55E-01	2.50E+00	1.32E+00	8.76E-01	2.16E+00	4.46E+00	Normal/Lognormal
CG-129-WT	Barium	1	100.0	1.75E+00	4.00E+00	0.44	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.75E+00	1.75E+00	1.75E+00	--	N/A	N/A	Unknown
CG-129-WT	Bis(2-ethylhexyl) phthalate	3	66.7	8.93E+00	2.00E+00	4.47	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	2.00E+00	5.18E-01	8.93E+00	3.48E+00	4.72E+00	1.14E+01	4.18E+09	Normal/Lognormal
CG-129-WT	Chromium	2	50.0	6.90E-01	1.00E+01	0.07	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.90E-01	6.90E-01	5.95E-01	1.34E-01	1.19E+00	2.16E+00	Unknown
CG-129-WT	Copper	2	50.0	2.50E-01	3.10E+00	0.08	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.50E-01	2.50E-01	3.75E-01	1.77E-01	1.16E+00	2.19E+02	Unknown
CG-129-WT	Hexavalent Chromium	1	100.0	8.00E+00	1.00E+01	0.80	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.00E+00	8.00E+00	8.00E+00	--	N/A	N/A	Unknown
CG-129-WT	Nickel	2	50.0	1.63E+00	8.20E+00	0.20	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.63E+00	1.63E+00	1.07E+00	7.99E-01	4.63E+00	2.89E+08	Unknown
CG-129-WT	Trichloroethylene	4	100.0	4.70E-02	4.04E-01	0.12	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.10E-02	4.70E-02	3.33E-02	1.19E-02	4.72E-02	6.46E-02	Normal/Lognormal
CG-129-WT	Vinyl chloride	4	50.0	4.30E-02	1.28E+00	0.03	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.10E-02	4.30E-02	2.10E-02	1.56E-02	3.93E-02	1.54E-01	Normal/Lognormal
CG-129-WT	Zinc	2	50.0	7.90E-01	8.10E+01	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	7.90E-01	7.90E-01	2.90E+00	2.98E+00	1.62E+01	1.69E+21	Unknown
CG-130-WT																							
CG-130-WT	1,1-Dichloroethane	5	100.0	5.81E+00	4.70E+01	0.12	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.50E-01	5.81E+00	2.88E+00	2.00E+00	4.79E+00	1.51E+01	Normal/Lognormal
CG-130-WT	1,1-Dichloroethylene	5	80.0	2.05E-01	2.50E+01	0.01	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	3.10E-02	2.05E-01	8.20E-02	7.34E-02	1.52E-01	5.32E-01	Normal/Lognormal
CG-130-WT	1,2-Dichloroethane	5	60.0	2.32E-01	1.29E+01	0.02	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	4.90E-02	2.32E-01	1.00E-01	7.97E-02	1.76E-01	3.74E-01	Lognormal
CG-130-WT	1,4-Dioxane	3	33.3	3.23E+00	9.49E+01	0.03	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.23E+00	3.23E+00	1.41E+00	1.58E+00	4.07E+00	7.45E+04	Unknown
CG-130-WT	Arsenic	5	100.0	1.26E+00	5.06E-02	24.90	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.59E-01	1.26E+00	8.89E-01	3.68E-01	1.24E+00	1.70E+00	Normal/Lognormal
CG-130-WT	Benzo(a)anthracene	3	33.3	1.47E-02	2.00E-02	0.74	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.47E-02	1.47E-02	9.23E-03	4.97E-03	1.76E-02	1.42E-01	Normal/Lognormal
CG-130-WT	Benzo(b)fluoranthene	3	66.7	1.35E-02	1.94E-02	0.70	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.60E-02	1.60E-02	1.07E-02	1.35E-02	1.07E-02	2.75E-03	1.54E-02	2.18E-02	Normal/Lognormal
CG-130-WT	Benzo(k)fluoranthene	3	66.7	1.06E-02	1.80E-02	0.59	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.60E-02	1.60E-02	1.05E-02	1.06E-02	9.70E-03	1.47E-03	1.22E-02	1.37E-02	Normal/Lognormal
CG-130-WT	Bis(2-ethylhexyl) phthalate	3	33.3	1.56E+00	2.00E+00	0.78	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	6.15E-01	2.00E+00	1.56E+00	1.56E+00	9.56E-01	6.27E-01	2.01E+00	7.36E+02	Normal/Lognormal
CG-130-WT	Chrysene	3	33.3	1.18E-02	1.80E-02	0.66	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	1.18E-02	1.18E-02	8.27E-03	3.41E-03	1.40E-02	4.67E-02	Normal/Lognormal
CG-130-WT	cis-1,2-Dichloroethylene	5	100.0	3.55E+00	7.27E+01	0.05	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	9.70E-01	3.55E+00	2.21E+00	1.09E+00	3.25E+00	5.57E+00	Normal/Lognormal
CG-130-WT	Ethane	4	50.0	9.76E+01	--	--	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+01	1.64E+01	9.76E+01	2.98E+01	4.57E+01	8.36E+01	3.23E+12	Normal/Lognormal
CG-130-WT	Iron	5	80.0	9.02E+02	1.00E+03	0.90	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	3.00E+02	3.00E+02	5.86E+01	9.02E+02	4.66E+02	3.78E+02	8.26E+02	1.60E+04	Normal/Lognormal
CG-130-WT	Manganese	5	100.0	8.16E+01	1.00E+02	0.82	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.52E+01	8.44E+01	6.80E+01	1.16E+01	7.90E+01	8.16E+01	Normal/Lognormal
CG-130-WT	Methane	4	100.0	5.63E+02	--	--	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.70E+00	5.63E+02	1.88E+02	2.64E+02	4.98E+02	1.78E+14	Normal/Lognormal
CG-130-WT	Tetrachloroethylene	5	80.0	6.50E-02	2.02E-01	0.32	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	5.20E-02	6.50E-02	9.62E-02	8.61E-02	1.78E-01	3.07E-01	Unknown
CG-130-WT	Trichloroethylene	5	100.0	1.85E+00	4.04E-01	4.59	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.50E-01	1.90E+00	1.29E+00	3.91E-01	1.67E+00	1.85E+00	Normal/Lognormal
CG-130-WT	Vinyl chloride	5	80.0	1.23E+00	1.28E+00	0.96	Area 3	4	14	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	8.30E-02	1.23E+00	3.40E-01	5.05E-01	8.22E-01	8.11E+02	Lognormal
CG-131-40																							
CG-131-40	1,1-Dichloroethane	5	100.0	1.63E+01	4.70E+01	0.35	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.35E+01	1.70E+01	1.48E+01	1.50E+00	1.62E+01	1.63E+01	Normal/Lognormal
CG-131-40	1,1-Dichloroethylene	5	100.0	1.70E-01	2.50E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.20E-02	1.70E-01	1.46E-01	3.13E-02	1.76E-01	1.96E-01	Normal
CG-131-40	1,2-Dichloroethane	5	100.0	7.87E-01	3.06E+01	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.31E-01	8.00E-01	7.14E-01	6.76E-02	7.78E-01	7.87E-01	Normal/Lognormal

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-131-40	1,4-Dioxane	3	100.0	5.00E+02	9.49E+01	5.27	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.80E+02	5.00E+02	4.14E+02	1.18E+02	6.12E+02	1.09E+03	Normal/Lognormal
CG-131-40	2-Methylnaphthalene	1	100.0	8.20E-03	2.10E+00	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	8.20E-03	8.20E-03	8.20E-03	--	N/A	N/A	Unknown
CG-131-40	Arsenic	5	60.0	7.57E-02	5.06E-02	1.50	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	6.12E-02	6.13E-02	5.00E-02	7.57E-02	5.19E-02	2.18E-02	7.27E-02	9.80E-02	Normal/Lognormal
CG-131-40	Benzene	5	20.0	2.96E-01	1.17E+01	0.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	3.20E-01	3.20E-01	2.64E-01	3.13E-02	2.94E-01	2.96E-01	Unknown
CG-131-40	Bis(2-ethylhexyl) phthalate	3	33.3	1.69E+00	2.00E+00	0.85	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	8.30E-01	2.97E+00	1.69E+00	1.69E+00	1.20E+00	6.85E-01	2.35E+00	3.53E+02	Normal/Lognormal
CG-131-40	Chloroethane	5	100.0	4.21E+00	4.61E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.93E+00	4.25E+00	4.06E+00	1.51E-01	4.21E+00	4.21E+00	Normal/Lognormal
CG-131-40	Chromium	2	50.0	6.30E-01	1.00E+01	0.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.30E-01	6.30E-01	5.65E-01	9.19E-02	9.75E-01	1.20E+00	Unknown
CG-131-40	cis-1,2-Dichloroethylene	5	100.0	1.07E+01	1.65E+02	0.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.37E+00	1.10E+01	9.99E+00	6.62E-01	1.06E+01	1.07E+01	Normal/Lognormal
CG-131-40	Methylene chloride	5	20.0	3.10E-01	4.95E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.10E-01	3.10E-01	2.06E+00	9.79E-01	3.00E+00	2.20E+01	Unknown
CG-131-40	Vinyl chloride	5	100.0	1.22E+01	2.04E+00	5.98	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.90E+00	1.22E+01	9.67E+00	1.90E+00	1.15E+01	1.22E+01	Normal/Lognormal
CG-131-WT																							
CG-131-WT	1,1-Dichloroethane	6	100.0	3.61E+01	4.70E+01	0.77	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.50E+01	3.61E+01	2.65E+01	7.89E+00	3.29E+01	3.72E+01	Normal/Lognormal
CG-131-WT	1,1-Dichloroethylene	6	100.0	3.74E+00	2.50E+01	0.15	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.90E+00	3.84E+00	2.93E+00	6.78E-01	3.49E+00	3.74E+00	Normal/Lognormal
CG-131-WT	1,2-Dichloroethane	6	100.0	1.45E+00	1.29E+01	0.11	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.70E-01	1.45E+00	1.06E+00	3.57E-01	1.35E+00	1.70E+00	Normal/Lognormal
CG-131-WT	1,4-Dioxane	3	100.0	2.31E+01	9.49E+01	0.24	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.30E+00	2.31E+01	1.13E+01	1.07E+01	2.93E+01	3.51E+06	Normal/Lognormal
CG-131-WT	Arsenic	5	100.0	2.48E+00	5.06E-02	48.94	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.31E+00	2.50E+00	1.79E+00	5.00E-01	2.27E+00	2.48E+00	Normal/Lognormal
CG-131-WT	Benzene	6	100.0	2.71E+00	9.60E+00	0.28	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.20E-01	2.71E+00	1.54E+00	9.18E-01	2.30E+00	4.49E+00	Normal/Lognormal
CG-131-WT	Bis(2-ethylhexyl) phthalate	3	33.3	3.18E-01	2.00E+00	0.16	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	4.60E-01	1.60E+00	3.18E-01	3.18E-01	4.49E-01	3.07E-01	9.67E-01	2.25E+01	Normal/Lognormal
CG-131-WT	Chloroform	6	16.7	1.80E-01	4.11E+00	0.04	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	1.80E-01	1.80E-01	5.30E-01	2.63E-01	7.47E-01	1.08E+00	Normal/Lognormal
CG-131-WT	Chromium	2	50.0	4.90E-01	1.00E+01	0.05	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.90E-01	4.90E-01	4.95E-01	7.07E-03	5.27E-01	5.19E-01	Unknown
CG-131-WT	cis-1,2-Dichloroethylene	6	100.0	8.28E+01	7.27E+01	1.14	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.80E+01	8.28E+01	6.31E+01	1.86E+01	7.84E+01	8.84E+01	Normal/Lognormal
CG-131-WT	Pentachlorophenol	3	33.3	7.92E-01	2.53E+00	0.31	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	9.60E-01	7.92E-01	7.92E-01	4.32E-01	3.86E-01	1.08E+00	1.20E+14	Normal/Lognormal
CG-131-WT	trans-1,2-Dichloroethylene	6	16.7	4.60E-01	6.53E+01	0.01	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+00	4.60E-01	4.60E-01	5.77E-01	2.08E-01	7.48E-01	7.71E-01	Unknown
CG-131-WT	Trichloroethylene	6	100.0	5.09E+01	4.04E-01	125.89	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.60E+01	5.68E+01	4.32E+01	8.01E+00	4.98E+01	5.09E+01	Normal/Lognormal
CG-131-WT	Vinyl chloride	6	100.0	1.72E+01	1.28E+00	13.42	Area 3	5	15	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.70E+00	1.72E+01	1.08E+01	6.21E+00	1.59E+01	5.54E+01	Normal/Lognormal
CG-132-40																							
CG-132-40	1,4-Dioxane	3	100.0	9.09E+00	9.49E+01	0.10	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.40E+00	9.09E+00	7.55E+00	1.39E+00	9.89E+00	1.13E+01	Normal/Lognormal
CG-132-40	Arsenic	3	33.3	8.02E-02	5.06E-02	1.58	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	6.13E-02	6.13E-02	8.02E-02	8.02E-02	4.72E-02	2.86E-02	9.54E-02	8.39E-01	Unknown
CG-132-40	Benzo(a)anthracene	3	33.3	3.17E-02	2.00E-02	1.59	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.17E-02	3.17E-02	1.49E-02	1.46E-02	3.96E-02	8.43E+01	Normal/Lognormal
CG-132-40	Benzo(b)fluoranthene	3	33.3	2.73E-02	1.94E-02	1.41	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.73E-02	2.73E-02	1.34E-02	1.21E-02	3.38E-02	1.80E+01	Normal/Lognormal
CG-132-40	Benzo(k)fluoranthene	3	33.3	2.91E-02	1.80E-02	1.62	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.91E-02	2.91E-02	1.40E-02	1.31E-02	3.62E-02	3.43E+01	Normal/Lognormal
CG-132-40	Bis(2-ethylhexyl) phthalate	3	33.3	1.50E-01	2.00E+00	0.08	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	8.79E-01	1.10E+00	1.50E-01	1.50E-01	3.80E-01	2.07E-01	7.28E-01	3.58E+01	Normal/Lognormal
CG-132-40	Chrysene	3	33.3	3.38E-02	1.80E-02	1.88	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	3.38E-02	3.38E-02	1.56E-02	1.58E-02	4.23E-02	1.71E+02	Normal/Lognormal
CG-132-40	Dibenzo(a,h)anthracene	3	33.3	2.72E-02	1.62E-02	1.68	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.72E-02	2.72E-02	1.34E-02	1.20E-02	3.37E-02	1.74E+01	Normal/Lognormal
CG-132-40	Indeno(1,2,3-cd)pyrene	3	33.3	2.54E-02	2.00E-02	1.27	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-02	1.60E-02	2.54E-02	2.54E-02	1.28E-02	1.10E-02	3.14E-02	9.03E+00	Normal/Lognormal
CG-132-40	Trichloroethylene	4	75.0	5.30E-02	7.88E-01	0.07	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	8.30E-03	5.30E-02	2.51E-02	2.08E-02	4.96E-02	5.66E-01	Normal/Lognormal
CG-132-40	Vinyl chloride	4	100.0	8.09E+00	2.04E+00	3.97	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.50E+00	8.09E+00	4.46E+00	2.77E+00	7.72E+00	3.48E+01	Normal/Lognormal
CG-132-WT																							
CG-132-WT	1,1-Dichloroethylene	5	40.0	7.57E-02	2.50E+01	0.00	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	2.30E-02	7.70E-02	3.50E-02	2.35E-02	5.74E-02	7.57E-02	Unknown
CG-132-WT	Arsenic	5	100.0	1.52E+00	5.06E-02	30.08	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.21E+00	1.55E+00	1.37E+00	1.42E-01	1.50E+00	1.52E+00	Normal/Lognormal
CG-132-WT	Bis(2-ethylhexyl) phthalate	3	33.3	5.32E-01	2.00E+00	0.27	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	6.41E-01	2.00E+00	5.32E-01	5.32E-01	6.18E-01	3.48E-01	1.20E+00	1.29E+01	Normal/Lognormal
CG-132-WT	Chloroform	5	20.0	3.10E-01	4.11E+00	0.08	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.10E-01	3.10E-01	4.62E-01	8.50E-02	5.43E-01	5.90E-01	Unknown
CG-132-WT	cis-1,2-Dichloroethylene	5	20.0	4.50E-01	7.27E+01	0.01	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.50E-01	4.50E-01	4.90E-01	2.24E-02	5.11E-01	5.13E-01	Unknown
CG-132-WT	Tetrachloroethylene	5	100.0	7.47E-01	2.02E-01	3.70	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.92E-01	8.12E-01	5.28E-01	1.69E-01	6.89E-01	7.47E-01	Normal/Lognormal
CG-132-WT	Trichloroethylene	5	100.0	1.41E+01	4.04E-01	35.02	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.75E+00	1.42E+01	7.58E+00	3.88E+00	1.13E+01	1.41E+01	Normal/Lognormal
CG-132-WT	Vinyl chloride	5	40.0	1.64E-01	1.28E+00	0.13	SW Crossgrad	4.5	14.5	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	2.70E-02	1.64E-01	4.42E-02	6.74E-02	1.08E-01	1.59E+00	Unknown
CG-133-40																							
CG-133-40	1,1-Dichloroethane	5	20.0	2.00E-01	4.70E+01	0.00	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.00E-01	2.00E-01	4.40E-01	1.34E-01	5.68E-01	7.84E-01	Unknown
CG-133-40	1,2-Dichloroethane	5	20.0	2.60E-02	3.06E+01	0.00	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	2.60E-02	2.60E-02	4.52E-02	1.07E-02	5.54E-02	6.49E-02	Unknown
CG-133-40	1,4-Dioxane	3	33.3	1.13E+00	9.49E+01	0.01	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.13E+00	1.13E+00	7.10E-01	3.64E-01	1.32E+00	5.61E+00	Unknown
CG-133-40	Arsenic	2	50.0	6.44E-02	5.06E-02	1.27	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	8.00E-02	8.00E-02	6.44E-02	6.44E-02	5.22E-02	1.73E-02	1.29E-01	8.33E-01	Unknown
CG-133-40	cis-1,2-Dichloroethylene	5	20.0	1.80E-01	1.65E+02	0.00	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.80E-01	1.80E-01	4.36E-01	1.43E-01	5.72E-01	8.60E-01	Unknown

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-133-40	Toluene	5	20.0	1.30E-01	9.80E+00	0.01	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.30E-01	1.30E-01	4.26E-01	1.65E-01	5.84E-01	1.24E+00	Unknown
CG-133-40	Vinyl chloride	5	100.0	5.83E+01	2.04E+00	28.59	SW Crossgrad	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.61E+00	5.83E+01	3.40E+01	2.35E+01	5.64E+01	1.19E+04	Normal/Lognormal
CG-134-40																							
CG-134-40	1,1-Dichloroethane	5	100.0	3.76E+01	4.70E+01	0.80	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.12E+01	3.92E+01	3.42E+01	3.26E+00	3.73E+01	3.76E+01	Normal/Lognormal
CG-134-40	1,1-Dichloroethylene	5	100.0	1.01E+00	2.50E+01	0.04	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	6.38E-01	1.05E+00	8.12E-01	1.61E-01	9.65E-01	1.01E+00	Normal/Lognormal
CG-134-40	1,2-Dichloroethane	5	100.0	2.55E+00	3.06E+01	0.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.10E+00	2.74E+00	2.27E+00	2.68E-01	2.53E+00	2.55E+00	Unknown
CG-134-40	1,4-Dioxane	4	100.0	3.74E+02	9.49E+01	3.94	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.90E+02	3.74E+02	2.61E+02	7.94E+01	3.54E+02	4.12E+02	Normal/Lognormal
CG-134-40	2-Methylnaphthalene	2	50.0	5.50E-03	2.10E+00	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	5.50E-03	5.50E-03	2.78E-02	3.15E-02	1.68E-01	1.61E+28	Unknown
CG-134-40	Benzene	5	20.0	2.50E-01	1.17E+01	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	2.50E-01	2.50E-01	2.50E-01	--	2.50E-01	2.50E-01	Unknown
CG-134-40	Bis(2-ethylhexyl) phthalate	3	33.3	2.97E+00	2.00E+00	1.49	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	2.00E+00	1.76E+01	2.97E+00	2.97E+00	4.26E+00	4.06E+00	1.11E+01	2.95E+05	Normal/Lognormal
CG-134-40	Chloroethane	5	80.0	2.50E+00	4.61E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.48E+00	2.50E+00	1.53E+00	7.13E-01	2.21E+00	4.36E+00	Normal/Lognormal
CG-134-40	cis-1,2-Dichloroethylene	5	100.0	3.76E+01	1.65E+02	0.23	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.26E+01	3.76E+01	3.56E+01	2.30E+00	3.78E+01	3.80E+01	Normal/Lognormal
CG-134-40	Ethane	4	100.0	4.54E+02	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.20E+02	4.54E+02	3.39E+02	9.75E+01	4.54E+02	5.61E+02	Normal/Lognormal
CG-134-40	Ethene	4	100.0	1.43E+02	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.00E+01	1.43E+02	9.93E+01	4.52E+01	1.52E+02	3.97E+02	Normal/Lognormal
CG-134-40	Iron	7	100.0	2.75E+04	1.00E+03	27.48	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.42E+04	2.88E+04	2.61E+04	1.78E+03	2.74E+04	2.75E+04	Normal/Lognormal
CG-134-40	Manganese	5	100.0	8.36E+02	1.00E+02	8.36	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	7.70E+02	8.45E+02	8.07E+02	2.96E+01	8.35E+02	8.36E+02	Normal/Lognormal
CG-134-40	Methane	4	100.0	1.01E+04	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.08E+03	1.01E+04	6.12E+03	3.64E+03	1.04E+04	4.93E+04	Normal/Lognormal
CG-134-40	Methylene chloride	5	20.0	2.00E-01	4.95E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	2.00E-01	2.00E-01	2.04E+00	1.03E+00	3.02E+00	6.27E+01	Unknown
CG-134-40	Vinyl chloride	5	100.0	1.92E+01	2.04E+00	9.42	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	9.30E+00	1.92E+01	1.51E+01	3.89E+00	1.88E+01	2.14E+01	Normal/Lognormal
CG-134-WT																							
CG-134-WT	1,1-Dichloroethane	5	20.0	3.40E-01	4.70E+01	0.01	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.40E-01	3.40E-01	4.68E-01	7.16E-02	5.36E-01	5.65E-01	Unknown
CG-134-WT	1,1-Dichloroethylene	5	40.0	5.90E-02	2.50E+01	0.00	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	1.00E-02	5.90E-02	2.88E-02	1.81E-02	4.60E-02	8.72E-02	Normal/Lognormal
CG-134-WT	Arsenic	1	100.0	1.78E+00	5.06E-02	35.18	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.78E+00	1.78E+00	1.78E+00	--	N/A	N/A	Unknown
CG-134-WT	Chromium	2	50.0	5.10E-01	1.00E+01	0.05	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	5.10E-01	5.10E-01	5.05E-01	7.07E-03	5.37E-01	5.29E-01	Unknown
CG-134-WT	cis-1,2-Dichloroethylene	5	20.0	2.70E-01	7.27E+01	0.00	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.70E-01	2.70E-01	4.54E-01	1.03E-01	5.52E-01	6.35E-01	Unknown
CG-134-WT	Iron	7	100.0	9.41E+02	1.00E+03	0.94	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.08E+02	1.34E+03	6.63E+02	3.11E+02	8.92E+02	9.41E+02	Lognormal
CG-134-WT	Manganese	5	100.0	1.17E+02	1.00E+02	1.17	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.98E+01	1.17E+02	1.07E+02	1.05E+01	1.17E+02	1.19E+02	Normal/Lognormal
CG-134-WT	Methane	4	100.0	3.69E+00	--	--	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.10E-01	3.69E+00	2.42E+00	1.43E+00	4.10E+00	4.12E+01	Normal/Lognormal
CG-134-WT	Trichloroethylene	5	80.0	5.20E-02	4.04E-01	0.13	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	4.00E-02	5.20E-02	4.10E-02	9.97E-03	5.05E-02	5.74E-02	Normal/Lognormal
CG-134-WT	Vinyl chloride	5	80.0	7.91E-01	1.28E+00	0.62	Area 3	4.33	14.33	Water Table	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	4.20E-02	7.91E-01	1.96E-01	3.34E-01	5.14E-01	8.76E+01	Lognormal
CG-135-40																							
CG-135-40	1,1-Dichloroethane	2	100.0	4.37E+00	4.70E+01	0.09	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.23E+00	4.37E+00	3.80E+00	8.06E-01	7.40E+00	1.21E+01	Unknown
CG-135-40	1,2-Dichloroethane	2	100.0	5.08E-01	3.06E+01	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.52E-01	5.08E-01	4.30E-01	1.10E-01	9.22E-01	2.20E+00	Unknown
CG-135-40	1,4-Dioxane	1	100.0	3.00E+02	9.49E+01	3.16	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.00E+02	3.00E+02	3.00E+02	--	N/A	N/A	Unknown
CG-135-40	Benzene	2	50.0	8.00E-01	1.17E+01	0.07	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	8.00E-01	8.00E-01	5.25E-01	3.89E-01	2.26E+00	7.70E+07	Unknown
CG-135-40	Chloroethane	2	100.0	5.34E+01	4.61E+02	0.12	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.61E+01	5.34E+01	4.98E+01	5.16E+00	7.28E+01	7.48E+01	Unknown
CG-135-40	cis-1,2-Dichloroethylene	2	50.0	1.14E+00	1.65E+02	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.14E+00	1.14E+00	8.20E-01	4.53E-01	2.84E+00	8.49E+03	Unknown
CG-135-40	Ethane	1	100.0	3.26E+02	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.26E+02	3.26E+02	3.26E+02	--	N/A	N/A	Unknown
CG-135-40	Ethene	1	100.0	2.24E+02	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.24E+02	2.24E+02	2.24E+02	--	N/A	N/A	Unknown
CG-135-40	Iron	3	100.0	3.79E+04	1.00E+03	37.90	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	3.35E+04	3.79E+04	3.59E+04	2.24E+03	3.97E+04	4.04E+04	Normal/Lognormal
CG-135-40	Manganese	5	100.0	1.14E+03	1.00E+02	11.37	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	1.04E+03	1.16E+03	1.09E+03	4.34E+01	1.14E+03	1.14E+03	Normal/Lognormal
CG-135-40	Methane	1	100.0	2.10E+04	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	2.10E+04	2.10E+04	2.10E+04	--	N/A	N/A	Unknown
CG-135-40	Vinyl chloride	2	100.0	7.06E+00	2.04E+00	3.46	Area 3	30	40	Shallow	FALSE	Groundwater	MW	TRUE	--	--	4.88E+00	7.06E+00	5.97E+00	1.54E+00	1.29E+01	3.12E+01	Unknown
CG-135-50																							
CG-135-50	1,1-Dichloroethane	5	100.0	5.14E+00	4.70E+01	0.11	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.10E+00	5.28E+00	3.96E+00	9.30E-01	4.85E+00	5.14E+00	Normal/Lognormal
CG-135-50	1,1-Dichloroethylene	5	20.0	1.30E-02	2.50E+01	0.00	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	1.30E-02	1.30E-02	2.26E-02	5.37E-03	2.77E-02	3.24E-02	Unknown
CG-135-50	1,2-Dichloroethane	5	100.0	7.50E-01	3.06E+01	0.02	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.22E-01	7.67E-01	4.75E-01	1.83E-01	6.49E-01	7.50E-01	Normal/Lognormal
CG-135-50	1,4-Dioxane	3	100.0	5.30E+02	9.49E+01	5.59	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.80E+02	5.30E+02	3.35E+02	1.79E+02	6.36E+02	5.16E+03	Normal/Lognormal
CG-135-50	2-Methylnaphthalene	2	50.0	8.50E-03	2.10E+00	0.00	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E-01	1.00E-01	8.50E-03	8.50E-03	2.93E-02	2.93E-02	1.60E-01	4.04E+17	Unknown
CG-135-50	Benzene	5	100.0	4.50E+00	1.17E+01	0.39	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	2.08E+00	4.50E+00	3.29E+00	9.02E-01	4.15E+00	4.69E+00	Normal/Lognormal
CG-135-50	Chloroethane	5	100.0	8.77E+01	4.61E+02	0.19	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	7.74E+01	8.99E+01	8.30E+01	4.64E+00	8.74E+01	8.77E+01	Normal/Lognormal
CG-135-50	cis-1,2-Dichloroethylene	5	100.0	2.10E+00	1.65E+02	0.01	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	1.79E+00	2.10E+00	1.95E+00	1.47E-01	2.09E+00	2.11E+00	Normal/Lognormal

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-135-50	Methylene chloride	5	20.0	3.24E+00	4.95E+02	0.01	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E+00	5.00E+00	3.60E+00	3.60E+00	2.72E+00	4.92E-01	3.19E+00	3.24E+00	Unknown
CG-135-50	trans-1,2-Dichloroethylene	5	20.0	3.00E-01	1.69E+03	0.00	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.00E-01	3.00E-01	4.60E-01	8.94E-02	5.45E-01	5.99E-01	Unknown
CG-135-50	Trichloroethylene	5	20.0	6.60E-02	7.88E-01	0.08	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	6.60E-02	6.60E-02	2.42E-02	2.43E-02	4.73E-02	1.48E-01	Lognormal
CG-135-50	Vinyl chloride	5	100.0	7.68E+00	2.04E+00	3.77	Area 3	40	50	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.90E+00	7.68E+00	5.88E+00	1.50E+00	7.31E+00	8.10E+00	Normal/Lognormal
CG-136-40																							
CG-136-40	1,1-Dichloroethane	5	100.0	6.52E+00	4.70E+01	0.14	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.92E+00	6.70E+00	5.81E+00	6.37E-01	6.42E+00	6.52E+00	Normal/Lognormal
CG-136-40	1,1-Dichloroethylene	5	20.0	1.60E-02	2.50E+01	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	5.00E-02	5.00E-02	1.60E-02	1.60E-02	2.32E-02	4.02E-03	2.70E-02	2.90E-02	Unknown
CG-136-40	1,2-Dichloroethane	5	100.0	2.51E-01	3.06E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.48E-01	2.60E-01	1.91E-01	4.67E-02	2.35E-01	2.51E-01	Normal/Lognormal
CG-136-40	1,4-Dioxane	2	100.0	8.83E+01	9.49E+01	0.93	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.20E+01	8.83E+01	6.52E+01	3.27E+01	2.11E+02	1.08E+05	Unknown
CG-136-40	Benzene	5	100.0	6.77E-01	1.17E+01	0.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.80E-01	6.80E-01	6.34E-01	4.16E-02	6.74E-01	6.77E-01	Normal/Lognormal
CG-136-40	Chloroethane	5	20.0	7.09E-01	4.61E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	8.00E-01	8.00E-01	5.60E-01	1.34E-01	6.88E-01	7.09E-01	Unknown
CG-136-40	Chromium	2	50.0	6.10E-01	1.00E+01	0.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	6.10E-01	6.10E-01	5.55E-01	7.78E-02	9.02E-01	1.02E+00	Unknown
CG-136-40	cis-1,2-Dichloroethylene	5	100.0	2.79E+00	1.65E+02	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.69E+00	2.80E+00	2.28E+00	4.04E-01	2.66E+00	2.79E+00	Normal/Lognormal
CG-136-40	Trichloroethylene	5	40.0	7.00E-02	7.88E-01	0.09	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	5.00E-02	5.50E-03	7.00E-02	2.71E-02	2.55E-02	5.14E-02	3.14E-01	Normal/Lognormal
CG-136-40	Vinyl chloride	5	100.0	4.91E+01	2.04E+00	24.08	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.70E+01	4.91E+01	3.41E+01	1.18E+01	4.53E+01	5.89E+01	Normal/Lognormal
CG-136-WT																							
CG-136-WT	1,1,1-Trichloroethane	5	20.0	4.00E-01	1.10E+01	0.04	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	2.00E+00	4.00E-01	4.00E-01	5.80E-01	2.39E-01	8.08E-01	9.05E-01	Lognormal
CG-136-WT	1,1-Dichloroethane	5	20.0	1.50E+00	4.70E+01	0.03	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	2.00E+00	1.50E+00	1.50E+00	8.00E-01	4.47E-01	1.23E+00	1.75E+00	Normal/Lognormal
CG-136-WT	1,1-Dichloroethylene	5	100.0	2.28E-01	2.50E+01	0.01	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.43E-01	2.30E-01	1.85E-01	3.52E-02	2.18E-01	2.28E-01	Normal/Lognormal
CG-136-WT	1,2-Dichloroethane	5	20.0	2.70E-02	1.29E+01	0.00	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	2.70E-02	2.70E-02	4.54E-02	1.03E-02	5.52E-02	6.35E-02	Unknown
CG-136-WT	1,4-Dioxane	2	50.0	1.30E+00	9.49E+01	0.01	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	1.30E+00	1.30E+00	9.00E-01	5.66E-01	3.43E+00	2.62E+05	Unknown
CG-136-WT	Arsenic	2	100.0	1.63E+00	5.06E-02	32.21	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.28E+00	1.63E+00	1.46E+00	2.47E-01	2.56E+00	3.26E+00	Unknown
CG-136-WT	Chromium	2	50.0	3.70E-01	1.00E+01	0.04	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	3.70E-01	3.70E-01	4.35E-01	9.19E-02	8.45E-01	1.37E+00	Unknown
CG-136-WT	cis-1,2-Dichloroethylene	5	100.0	1.49E+02	7.27E+01	2.04	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	9.62E+01	1.63E+02	1.18E+02	2.67E+01	1.43E+02	1.49E+02	Normal/Lognormal
CG-136-WT	Tetrachloroethylene	5	100.0	2.07E+00	2.02E-01	10.23	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.50E+00	2.24E+00	1.75E+00	2.90E-01	2.03E+00	2.07E+00	Normal/Lognormal
CG-136-WT	trans-1,2-Dichloroethylene	5	100.0	4.48E+00	6.53E+01	0.07	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	2.30E+00	4.66E+00	3.08E+00	1.01E+00	4.04E+00	4.48E+00	Normal/Lognormal
CG-136-WT	Trichloroethylene	5	100.0	3.13E+01	4.04E-01	77.53	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	2.34E+01	3.18E+01	2.79E+01	3.05E+00	3.08E+01	3.13E+01	Normal/Lognormal
CG-136-WT	Vinyl chloride	5	100.0	6.49E-01	1.28E+00	0.51	Area 3	4	14	Water Table	FALSE	Groundwater	MW	FALSE	--	--	2.00E-01	6.49E-01	4.69E-01	1.68E-01	6.29E-01	9.25E-01	Normal/Lognormal
CG-137-40																							
CG-137-40	1,4-Dioxane	1	100.0	3.90E+01	9.49E+01	0.41	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	3.90E+01	3.90E+01	3.90E+01	--	N/A	N/A	Unknown
CG-137-40	Naphthalene	5	100.0	2.72E+01	1.20E+01	2.27	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.10E+00	2.72E+01	1.16E+01	1.01E+01	2.12E+01	1.63E+02	Normal/Lognormal
CG-137-40	Trichloroethylene	5	40.0	5.50E-01	7.88E-01	0.70	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	5.00E-02	1.30E-02	5.50E-01	1.25E-01	2.38E-01	3.51E-01	5.66E+01	Lognormal
CG-137-40	Vinyl chloride	5	100.0	6.82E+01	2.04E+00	33.45	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.09E+01	6.82E+01	5.31E+01	1.23E+01	6.48E+01	6.92E+01	Normal/Lognormal
CG-137-WT																							
CG-137-WT	1,1-Dichloroethane	5	20.0	1.50E-01	4.70E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+01	1.50E-01	1.50E-01	1.73E+00	2.05E+00	3.68E+00	2.50E+02	Normal/Lognormal
CG-137-WT	1,1-Dichloroethylene	5	100.0	2.58E+00	2.50E+01	0.10	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.20E+00	2.58E+00	1.75E+00	5.97E-01	2.32E+00	2.67E+00	Normal/Lognormal
CG-137-WT	1,2,4-Trimethylbenzene	5	20.0	1.32E+00	1.30E+01	0.10	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+01	1.32E+00	1.32E+00	2.06E+00	1.80E+00	3.78E+00	1.55E+01	Normal/Lognormal
CG-137-WT	1,2-Dichloroethane	5	20.0	5.80E-03	1.29E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E+00	5.80E-03	5.80E-03	1.31E-01	2.07E-01	3.29E-01	6.40E+01	Lognormal
CG-137-WT	1,4-Dioxane	1	100.0	6.60E-01	9.49E+01	0.01	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	6.60E-01	6.60E-01	6.60E-01	--	N/A	N/A	Unknown
CG-137-WT	cis-1,2-Dichloroethylene	5	100.0	5.45E+01	7.27E+01	0.75	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	3.65E+01	5.74E+01	4.46E+01	8.38E+00	5.26E+01	5.45E+01	Normal/Lognormal
CG-137-WT	Naphthalene	5	40.0	5.80E+00	1.20E+01	0.48	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	5.00E-01	2.50E+00	6.30E-01	5.80E+00	1.79E+00	2.28E+00	3.96E+00	4.80E+01	Lognormal
CG-137-WT	trans-1,2-Dichloroethylene	5	80.0	5.38E+00	6.53E+01	0.08	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	3.60E+00	5.38E+00	4.74E+00	7.40E-01	5.45E+00	5.68E+00	Normal/Lognormal
CG-137-WT	Trichloroethylene	5	100.0	3.67E+02	4.04E-01	907.35	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	2.23E+02	3.86E+02	2.83E+02	6.68E+01	3.47E+02	3.67E+02	Normal/Lognormal
CG-137-WT	Vinyl chloride	5	100.0	2.59E+00	1.28E+00	2.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	7.70E-01	2.59E+00	1.71E+00	6.72E-01	2.35E+00	3.33E+00	Normal/Lognormal
CG-138-40																							
CG-138-40	1,1-Dichloroethane	5	20.0	2.90E-01	4.70E+01	0.01	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	2.90E-01	2.90E-01	4.58E-01	9.39E-02	5.48E-01	6.10E-01	Unknown
CG-138-40	1,2-Dichloroethane	5	20.0	6.60E-03	3.06E+01	0.00	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	6.60E-03	6.60E-03	4.13E-02	1.94E-02	5.98E-02	3.86E-01	Unknown
CG-138-40	Benzo(b)fluoranthene	3	33.3	1.65E-02	1.94E-02	0.85	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-02	1.60E-02	1.65E-02	1.65E-02	9.83E-03	5.97E-03	1.99E-02	2.91E-01	Normal/Lognormal
CG-138-40	Benzo(k)fluoranthene	3	33.3	3.69E-02	1.80E-02	2.05	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-02	1.60E-02	3.69E-02	3.69E-02	1.66E-02	1.76E-02	4.63E-02	4.69E+02	Normal/Lognormal
CG-138-40	Chrysene	3	33.3	1.47E-02	1.80E-02	0.82	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-02	1.60E-02	1.47E-02	1.47E-02	9.23E-03	4.97E-03	1.76E-02	1.42E-01	Normal/Lognormal
CG-138-40	Dibenzo(a,h)anthracene	3	33.3	2.91E-02	1.62E-02	1.80	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-02	1.60E-02	2.91E-02	2.91E-02	1.40E-02	1.31E-02	3.62E-02	3.43E+01	Normal/Lognormal
CG-138-40	Indeno(1,2,3-cd)pyrene	3	33.3	2.18E-02	2.00E-02	1.09	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-02	1.60E-02	2.18E-02	2.18E-02	1.16E-02	8.96E-03	2.67E-02	2.33E+00	Normal/Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-138-40	Vinyl chloride	5	20.0	1.27E-02	2.04E+00	0.01	Area 3	29.92	39.92	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	1.40E-02	1.40E-02	1.08E-02	1.79E-03	1.25E-02	1.27E-02	Unknown
CG-138-70																							
CG-138-70	1,1-Dichloroethane	5	20.0	7.65E-01	4.70E+01	0.02	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	8.70E-01	8.70E-01	5.74E-01	1.65E-01	7.32E-01	7.65E-01	Unknown
CG-138-70	1,4-Dioxane	3	100.0	1.38E+02	9.49E+01	1.45	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	--	--	9.50E+01	1.38E+02	1.13E+02	2.22E+01	1.51E+02	1.76E+02	Normal/Lognormal
CG-138-70	Arsenic	3	33.3	5.03E-01	5.06E-02	9.94	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	6.13E-02	1.40E-01	5.03E-01	5.03E-01	2.01E-01	2.62E-01	6.43E-01	5.65E+07	Normal/Lognormal
CG-138-70	Chloroethane	5	20.0	1.08E+00	4.61E+02	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	1.20E+00	1.20E+00	6.40E-01	3.13E-01	9.38E-01	1.08E+00	Unknown
CG-138-70	Methylene chloride	5	20.0	2.50E-01	4.95E+02	0.00	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	5.00E+00	5.00E+00	2.50E-01	2.50E-01	2.05E+00	1.01E+00	3.01E+00	3.58E+01	Unknown
CG-138-70	Trichloroethylene	5	20.0	2.00E-02	7.88E-01	0.03	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	2.00E-02	5.00E-02	2.00E-02	2.00E-02	1.80E-02	7.58E-03	2.52E-02	3.62E-02	Normal/Lognormal
CG-138-70	Vinyl chloride	5	100.0	4.03E+01	2.04E+00	19.77	Area 3	60	70	Intermediate	FALSE	Groundwater	MW	FALSE	--	--	6.20E+00	4.03E+01	2.17E+01	1.32E+01	3.43E+01	8.77E+01	Normal/Lognormal
CG-138-WT																							
CG-138-WT	1,1-Dichloroethane	5	20.0	5.65E-01	4.70E+01	0.01	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	6.00E-01	6.00E-01	5.20E-01	4.47E-02	5.63E-01	5.65E-01	Unknown
CG-138-WT	Arsenic	3	66.7	2.94E-01	5.06E-02	5.81	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.60E-01	1.60E-01	1.10E-01	2.94E-01	1.61E-01	1.16E-01	3.57E-01	1.20E+01	Normal/Lognormal
CG-138-WT	cis-1,2-Dichloroethylene	5	20.0	2.20E-01	7.27E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	2.20E-01	2.20E-01	4.44E-01	1.25E-01	5.63E-01	7.27E-01	Unknown
CG-138-WT	Tetrachloroethylene	5	100.0	1.11E+00	2.02E-01	5.50	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	2.70E-01	1.11E+00	4.70E-01	3.60E-01	8.13E-01	1.23E+00	Unknown
CG-138-WT	Trichloroethylene	5	100.0	6.06E-01	4.04E-01	1.50	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.86E-01	6.11E-01	2.96E-01	1.79E-01	4.67E-01	6.06E-01	Lognormal
CG-138-WT	Vinyl chloride	5	20.0	2.38E-02	1.28E+00	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	2.60E-02	2.60E-02	1.32E-02	7.16E-03	2.00E-02	2.38E-02	Unknown
CG-139-40																							
CG-139-40	1,4-Dioxane	2	100.0	1.09E+02	9.49E+01	1.15	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	6.10E+01	1.09E+02	8.50E+01	3.39E+01	2.37E+02	6.19E+03	Unknown
CG-139-40	Arsenic	3	66.7	2.20E-01	5.06E-02	4.35	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	5.80E-01	5.80E-01	1.27E-01	2.20E-01	2.12E-01	8.18E-02	3.50E-01	1.11E+00	Normal/Lognormal
CG-139-40	Bis(2-ethylhexyl) phthalate	2	50.0	7.45E-02	2.00E+00	0.04	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E+00	2.00E+00	7.45E-02	7.45E-02	5.37E-01	6.54E-01	3.46E+00	9.45E+40	Unknown
CG-139-40	Trichloroethylene	5	20.0	5.30E-03	7.88E-01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	5.00E-02	5.30E-03	5.30E-03	1.21E-02	7.51E-03	1.92E-02	2.93E-02	Lognormal
CG-139-40	Vinyl chloride	5	100.0	4.08E+01	2.04E+00	20.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.60E-01	4.08E+01	9.09E+00	1.77E+01	2.60E+01	7.41E+03	Lognormal
CG-140-30																							
CG-140-30	1,1-Dichloroethane	5	100.0	6.51E+00	4.70E+01	0.14	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.46E+00	6.60E+00	6.05E+00	4.39E-01	6.47E+00	6.51E+00	Normal/Lognormal
CG-140-30	1,2-Dichloroethane	5	20.0	3.40E-02	3.06E+01	0.00	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	3.40E-02	3.40E-02	4.68E-02	7.16E-03	5.36E-02	5.65E-02	Unknown
CG-140-30	Chloroethane	5	20.0	2.70E-01	4.61E+02	0.00	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	2.70E-01	2.70E-01	4.54E-01	1.03E-01	5.52E-01	6.35E-01	Unknown
CG-140-30	Manganese	2	100.0	4.36E+02	1.00E+02	4.36	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	--	--	3.97E+02	4.36E+02	4.17E+02	2.76E+01	5.40E+02	5.29E+02	Unknown
CG-140-30	Trichloroethylene	5	100.0	6.00E-02	7.88E-01	0.08	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	--	--	3.00E-02	6.00E-02	4.54E-02	1.41E-02	5.89E-02	6.77E-02	Normal/Lognormal
CG-140-30	Vinyl chloride	5	100.0	7.44E+01	2.04E+00	36.47	Area 3	20	30	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.04E+01	7.69E+01	6.26E+01	1.00E+01	7.22E+01	7.44E+01	Normal/Lognormal
CG-140-40																							
CG-140-40	Iron	2	100.0	6.34E+03	1.00E+03	6.34	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.16E+03	6.34E+03	5.75E+03	8.34E+02	9.48E+03	1.09E+04	Unknown
CG-140-40	Manganese	5	100.0	4.54E+02	1.00E+02	4.54	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.07E+02	4.54E+02	4.37E+02	2.09E+01	4.57E+02	4.58E+02	Normal/Lognormal
CG-140-40	Vinyl chloride	2	100.0	3.98E+00	2.04E+00	1.95	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.32E+00	3.98E+00	3.15E+00	1.17E+00	8.39E+00	1.21E+02	Unknown
CG-141-40																							
CG-141-40	1,1-Dichloroethane	5	40.0	2.30E+00	4.70E+01	0.05	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	4.00E+00	1.00E+01	2.02E+00	2.30E+00	2.66E+00	1.31E+00	3.91E+00	4.53E+00	Unknown
CG-141-40	1,4-Dioxane	1	100.0	5.40E+01	9.49E+01	0.57	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	5.40E+01	5.40E+01	5.40E+01	--	N/A	N/A	Unknown
CG-141-40	Arsenic	1	100.0	8.56E-02	5.06E-02	1.69	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	8.56E-02	8.56E-02	8.56E-02	--	N/A	N/A	Unknown
CG-141-40	Chromium	2	50.0	6.90E-01	1.00E+01	0.07	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	6.90E-01	6.90E-01	5.95E-01	1.34E-01	1.19E+00	2.16E+00	Unknown
CG-141-40	Ethane	4	100.0	3.63E+01	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.70E+01	3.63E+01	2.62E+01	9.36E+00	3.72E+01	5.08E+01	Normal/Lognormal
CG-141-40	Ethene	4	100.0	4.83E+02	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.67E+02	4.83E+02	3.64E+02	1.07E+02	4.91E+02	5.93E+02	Normal/Lognormal
CG-141-40	Hexavalent Chromium	1	100.0	1.71E+01	1.00E+01	1.71	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.71E+01	1.71E+01	1.71E+01	--	N/A	N/A	Unknown
CG-141-40	Iron	7	100.0	1.97E+04	1.00E+03	19.74	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.60E+04	2.07E+04	1.82E+04	1.94E+03	1.96E+04	1.97E+04	Normal/Lognormal
CG-141-40	Manganese	7	100.0	7.63E+02	1.00E+02	7.63	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	6.28E+02	8.05E+02	7.07E+02	6.94E+01	7.58E+02	7.63E+02	Normal/Lognormal
CG-141-40	Methane	4	100.0	6.46E+03	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.50E+03	6.46E+03	3.87E+03	1.82E+03	6.02E+03	9.07E+03	Normal/Lognormal
CG-141-40	Vinyl chloride	5	100.0	3.34E+02	2.04E+00	164.05	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.40E+02	3.62E+02	2.84E+02	4.63E+01	3.28E+02	3.34E+02	Normal/Lognormal
CG-141-40	Zinc	2	50.0	1.20E+00	8.10E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	1.20E+00	1.20E+00	3.10E+00	2.69E+00	1.51E+01	7.14E+12	Unknown
CG-141-50																							
CG-141-50	Vinyl chloride	2	100.0	4.73E+01	2.04E+00	23.20	Area 3	40	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.86E+01	4.73E+01	3.30E+01	2.03E+01	1.24E+02	5.29E+06	Unknown
CG-141-WT																							
CG-141-WT	1,1-Dichloroethane	4	25.0	2.80E+00	4.70E+01	0.06	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	2.80E+00	2.80E+00	1.08E+00	1.15E+00	2.43E+00	1.99E+01	Unknown
CG-141-WT	1,1-Dichloroethylene	4	25.0	5.40E-02	2.50E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	5.00E-02	5.00E-02	5.40E-02	5.40E-02	3.23E-02	1.45E-02	4.93E-02	6.52E-02	Unknown
CG-141-WT	1,2-Dichloroethane	4	25.0	6.90E-03	1.29E+01	0.00	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	6.90E-03	6.90E-03	3.92E-02	2.16E-02	6.46E-02	2.17E+00	Unknown

ATTACHMENT A-1

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-141-WT	Arsenic	1	100.0	3.34E-01	5.06E-02	6.60	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	3.34E-01	3.34E-01	3.34E-01	--	N/A	N/A	Unknown
CG-141-WT	Chloroform	4	50.0	7.08E+00	4.11E+00	1.72	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	5.00E-01	1.00E+00	2.30E+00	7.08E+00	2.53E+00	3.17E+00	6.26E+00	2.05E+04	Normal/Lognormal
CG-141-WT	Chromium	2	50.0	6.20E-01	1.00E+01	0.06	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	6.20E-01	6.20E-01	5.60E-01	8.49E-02	9.39E-01	1.10E+00	Unknown
CG-141-WT	Ethane	4	25.0	4.80E-01	--	--	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	4.80E-01	4.80E-01	3.87E+00	2.26E+00	6.53E+00	1.06E+03	Unknown
CG-141-WT	Hexavalent Chromium	1	100.0	5.71E+00	1.00E+01	0.57	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	5.71E+00	5.71E+00	5.71E+00	--	N/A	N/A	Unknown
CG-141-WT	Iron	7	100.0	2.54E+03	1.00E+03	2.54	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	5.50E+02	2.54E+03	1.59E+03	6.73E+02	2.09E+03	2.88E+03	Normal/Lognormal
CG-141-WT	Manganese	7	100.0	1.30E+02	1.00E+02	1.30	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	3.97E+01	1.30E+02	8.87E+01	3.39E+01	1.14E+02	1.36E+02	Normal/Lognormal
CG-141-WT	Methane	4	50.0	9.70E+00	--	--	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.20E+00	1.20E+00	7.41E+00	9.70E+00	4.58E+00	4.69E+00	1.01E+01	5.50E+04	Normal/Lognormal
CG-141-WT	Trichloroethylene	4	100.0	3.97E-01	4.04E-01	0.98	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.00E-02	3.97E-01	1.31E-01	1.79E-01	3.41E-01	1.04E+03	Lognormal
CG-141-WT	Vinyl chloride	4	25.0	2.10E-01	1.28E+00	0.16	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	2.10E-01	2.10E-01	6.00E-02	1.00E-01	1.78E-01	4.54E+02	Unknown
CG-141-WT	Zinc	2	50.0	1.76E+00	8.10E+01	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	1.76E+00	1.76E+00	3.38E+00	2.29E+00	1.36E+01	1.21E+07	Unknown
CG-142-40																							
CG-142-40	1,4-Dioxane	1	100.0	6.80E-01	9.49E+01	0.01	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	6.80E-01	6.80E-01	6.80E-01	--	N/A	N/A	Unknown
CG-142-40	cis-1,2-Dichloroethylene	4	25.0	1.20E-01	1.65E+02	0.00	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	1.20E-01	1.20E-01	4.05E-01	1.90E-01	6.29E-01	3.37E+00	Unknown
CG-142-40	Manganese	2	100.0	5.03E+02	1.00E+02	5.03	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.28E+02	5.03E+02	4.66E+02	5.30E+01	7.02E+02	7.37E+02	Unknown
CG-142-40	Trichloroethylene	4	25.0	1.30E-02	7.88E-01	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	5.00E-02	1.30E-02	1.30E-02	1.45E-02	7.14E-03	2.29E-02	3.38E-02	Normal/Lognormal
CG-142-40	Vinyl chloride	4	75.0	3.80E-02	2.04E+00	0.02	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	1.10E-02	3.80E-02	2.10E-02	1.32E-02	3.66E-02	1.18E-01	Normal/Lognormal
CG-142-WT																							
CG-142-WT	Manganese	2	100.0	8.76E+02	1.00E+02	8.76	Area 3	5	15	Water Table	FALSE	Groundwater	MW	FALSE	--	--	5.27E+02	8.76E+02	7.02E+02	2.47E+02	1.80E+03	1.70E+04	Unknown
CG-142-WT	Vinyl chloride	4	25.0	3.70E-02	1.28E+00	0.03	Area 3	5	15	Water Table	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	3.70E-02	3.70E-02	1.68E-02	1.35E-02	3.26E-02	9.49E-02	Unknown
CG-143-40																							
CG-143-40	Ethane	4	25.0	1.20E+00	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	1.20E+00	1.20E+00	4.05E+00	1.90E+00	6.29E+00	3.37E+01	Unknown
CG-143-40	Iron	6	100.0	6.06E+03	1.00E+03	6.06	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	3.90E+03	7.26E+03	4.87E+03	1.25E+03	5.89E+03	6.06E+03	Normal/Lognormal
CG-143-40	Manganese	7	100.0	5.20E+02	1.00E+02	5.20	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.30E+02	5.58E+02	4.85E+02	4.36E+01	5.17E+02	5.20E+02	Normal/Lognormal
CG-143-40	Methane	4	100.0	8.90E+03	--	--	Area 3	30	40	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.20E+03	8.90E+03	6.90E+03	2.18E+03	9.47E+03	1.27E+04	Normal/Lognormal
CG-143-WT																							
CG-143-WT	Iron	1	100.0	1.55E+04	1.00E+03	15.50	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.55E+04	1.55E+04	1.55E+04	--	N/A	N/A	Unknown
CG-143-WT	Manganese	7	100.0	4.43E+02	1.00E+02	4.43	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	3.05E+02	4.43E+02	4.02E+02	5.42E+01	4.42E+02	4.52E+02	Unknown
CG-143-WT	Tetrachloroethylene	4	25.0	8.00E-02	2.02E-01	0.40	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	5.00E-02	5.00E-01	8.00E-02	8.00E-02	9.50E-02	1.07E-01	2.20E-01	1.16E+01	Normal/Lognormal
CG-143-WT	Trichloroethylene	4	100.0	1.03E-01	4.04E-01	0.25	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	--	--	1.60E-02	1.03E-01	4.48E-02	3.97E-02	9.14E-02	5.80E-01	Normal/Lognormal
CG-143-WT	Vinyl chloride	4	25.0	2.90E-02	1.28E+00	0.02	Area 3	4.5	14.5	Water Table	FALSE	Groundwater	MW	FALSE	2.00E-02	2.00E-02	2.90E-02	2.90E-02	1.48E-02	9.50E-03	2.59E-02	4.88E-02	Unknown
CG-144-35																							
CG-144-35	1,2-Dichloroethane	4	25.0	3.30E-02	3.06E+01	0.00	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	3.30E-02	3.30E-02	4.58E-02	8.50E-03	5.58E-02	6.20E-02	Unknown
CG-144-35	cis-1,2-Dichloroethylene	4	25.0	2.40E-01	1.65E+02	0.00	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	2.40E-01	2.40E-01	4.35E-01	1.30E-01	5.88E-01	8.47E-01	Unknown
CG-144-35	Ethane	4	25.0	2.00E+00	--	--	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	2.00E+00	2.00E+00	4.25E+00	1.50E+00	6.01E+00	1.10E+01	Unknown
CG-144-35	Ethene	4	25.0	1.50E+00	--	--	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+01	1.00E+01	1.50E+00	1.50E+00	4.13E+00	1.75E+00	6.18E+00	1.92E+01	Unknown
CG-144-35	Iron	6	100.0	7.98E+03	1.00E+03	7.98	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	7.02E+03	8.42E+03	7.47E+03	5.83E+02	7.95E+03	7.98E+03	Normal/Lognormal
CG-144-35	Manganese	5	100.0	5.35E+02	1.00E+02	5.35	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	3.98E+02	5.37E+02	4.76E+02	5.18E+01	5.26E+02	5.35E+02	Normal/Lognormal
CG-144-35	Methane	4	100.0	4.54E+03	--	--	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.90E+03	4.54E+03	3.48E+03	1.17E+03	4.86E+03	7.26E+03	Normal/Lognormal
CG-144-35	Vinyl chloride	4	100.0	3.20E+00	2.04E+00	1.57	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.80E-01	3.20E+00	1.89E+00	1.37E+00	3.50E+00	5.55E+01	Normal/Lognormal
CG-145-35																							
CG-145-35	1,1-Dichloroethane	4	100.0	2.00E+00	4.70E+01	0.04	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.08E+00	2.00E+00	1.41E+00	4.20E-01	1.91E+00	2.21E+00	Normal/Lognormal
CG-145-35	1,1-Dichloroethylene	4	50.0	2.00E-01	2.50E+01	0.01	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	5.00E-02	5.00E-02	5.70E-02	2.00E-01	7.68E-02	8.35E-02	1.75E-01	3.45E+00	Normal/Lognormal
CG-145-35	1,2-Dichloroethane	4	25.0	3.70E-02	3.06E+01	0.00	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	3.70E-02	3.70E-02	4.68E-02	6.50E-03	5.44E-02	5.75E-02	Unknown
CG-145-35	Chloroethane	4	25.0	6.00E-01	4.61E+02	0.00	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	6.10E-01	6.10E-01	5.28E-01	5.50E-02	5.92E-01	6.00E-01	Unknown
CG-145-35	Iron	1	100.0	1.33E+03	1.00E+03	1.33	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	1.33E+03	1.33E+03	1.33E+03	--	N/A	N/A	Unknown
CG-145-35	Manganese	7	100.0	2.82E+02	1.00E+02	2.82	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.06E+02	2.83E+02	2.56E+02	3.01E+01	2.78E+02	2.82E+02	Normal/Lognormal
CG-145-35	Vinyl chloride	4	100.0	1.96E-01	2.04E+00	0.10	Area 3	25	35	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.50E-02	1.96E-01	1.20E-01	7.26E-02	2.06E-01	3.81E+00	Normal/Lognormal
CG-149-68																							
CG-149-68	1,1-Dichloroethane	8	37.5	2.20E-01	4.70E+01	0.00	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	1.90E-01	2.20E-01	3.91E-01	1.50E-01	4.92E-01	5.90E-01	Unknown
CG-149-68	1,1-Dichloroethylene	8	37.5	5.70E-02	2.50E+01	0.00	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	5.00E-02	4.80E-03	5.70E-02	2.22E-02	1.68E-02	3.34E-02	6.67E-02	Normal/Lognormal
CG-149-68	cis-1,2-Dichloroethylene	8	62.5	1.03E+00	1.65E+02	0.01	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	6.70E-01	1.43E+00	7.50E-01	3.31E-01	9.72E-01	1.03E+00	Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility
Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-149-68	Ethylbenzene	8	12.5	2.64E+00	7.30E+00	0.36	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	1.00E+00	4.60E+00	4.60E+00	9.19E-01	1.49E+00	1.92E+00	2.64E+00	Unknown
CG-149-68	Naphthalene	8	12.5	1.22E+00	1.20E+01	0.10	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-01	2.00E+00	1.22E+00	1.22E+00	6.53E-01	4.36E-01	9.45E-01	1.60E+00	Unknown
CG-149-68	Toluene	8	12.5	4.63E+00	9.80E+00	0.47	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	1.30E-01	1.00E+00	4.63E+00	4.63E+00	8.91E-01	1.52E+00	1.91E+00	5.38E+00	Lognormal
CG-149-68	Trichloroethylene	8	62.5	1.00E-01	7.88E-01	0.13	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	5.00E-02	5.00E-02	6.80E-03	1.12E-01	3.10E-02	3.44E-02	5.41E-02	1.00E-01	Lognormal
CG-149-68	Vinyl chloride	8	100.0	3.10E-01	2.04E+00	0.15	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	--	--	3.80E-02	3.10E-01	1.84E-01	1.04E-01	2.54E-01	4.74E-01	Normal/Lognormal
CG-149-68	Xylenes (Total)	8	12.5	1.05E+01	1.41E+02	0.07	Area 1	67.8	58.2	Intermediate	FALSE	Groundwater	MW	TRUE	1.00E+00	3.00E+00	1.34E+01	1.34E+01	2.61E+00	4.39E+00	5.55E+00	1.05E+01	Unknown
CG-149-WT																							
CG-149-WT	1,1,1-Trichloroethane	8	100.0	6.68E+02	1.10E+01	60.73	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.20E+00	6.68E+02	1.93E+02	2.36E+02	3.51E+02	8.99E+03	Lognormal
CG-149-WT	1,1,2-Trichlorotrifluoroethane	5	100.0	9.60E+01	1.21E+03	0.08	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.07E+01	9.60E+01	6.19E+01	2.79E+01	8.85E+01	1.15E+02	Unknown
CG-149-WT	1,1-Dichloroethane	8	100.0	1.75E+02	4.70E+01	3.72	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.70E+01	2.47E+02	1.15E+02	5.94E+01	1.54E+02	1.75E+02	Normal/Lognormal
CG-149-WT	1,1-Dichloroethylene	8	75.0	4.31E+00	2.50E+01	0.17	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	1.00E+01	4.08E-01	4.31E+00	1.72E+00	1.83E+00	2.95E+00	5.30E+00	Lognormal
CG-149-WT	1,2,4-Trimethylbenzene	8	100.0	6.12E+01	1.30E+01	4.70	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.35E+01	7.36E+01	4.92E+01	1.41E+01	5.87E+01	6.12E+01	Normal/Lognormal
CG-149-WT	1,2-Dichlorobenzene	8	37.5	6.10E-01	1.40E+01	0.04	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	2.80E-01	6.10E-01	1.12E+00	1.58E+00	2.18E+00	2.82E+00	Unknown
CG-149-WT	1,2-Dichloroethane	8	75.0	1.08E+01	1.29E+01	0.84	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	2.00E+00	1.00E+01	5.74E-01	1.10E+01	3.18E+00	3.47E+00	5.51E+00	1.08E+01	Lognormal
CG-149-WT	1,3,5-Trimethylbenzene	8	100.0	2.09E+01	9.76E+00	2.14	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.90E+00	2.52E+01	1.43E+01	5.78E+00	1.82E+01	2.09E+01	Normal/Lognormal
CG-149-WT	Benzene	8	50.0	9.60E-01	9.60E+00	0.10	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E+00	1.80E-01	9.60E-01	7.46E-01	7.58E-01	1.25E+00	2.08E+00	Lognormal
CG-149-WT	Chloroethane	8	50.0	1.80E+00	4.61E+02	0.00	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	8.00E-01	1.80E+00	1.59E+00	1.47E+00	2.57E+00	3.67E+00	Lognormal
CG-149-WT	cis-1,2-Dichloroethylene	8	100.0	3.00E+02	7.27E+01	4.13	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.75E+01	3.00E+02	9.56E+01	9.53E+01	1.59E+02	3.41E+02	Lognormal
CG-149-WT	Cumene	3	100.0	4.90E+00	7.30E+00	0.67	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.30E+00	4.90E+00	3.80E+00	1.35E+00	6.07E+00	1.71E+01	Normal/Lognormal
CG-149-WT	Dichlorodifluoromethane	3	66.7	3.50E-01	6.36E+00	0.06	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	5.00E-01	3.40E-01	3.50E-01	3.13E-01	5.51E-02	4.06E-01	4.81E-01	Normal/Lognormal
CG-149-WT	Ethylbenzene	8	100.0	2.87E+01	7.30E+00	3.93	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.97E+00	4.17E+01	1.69E+01	1.11E+01	2.43E+01	2.87E+01	Lognormal
CG-149-WT	Methylene chloride	8	12.5	2.00E-01	3.21E+02	0.00	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	3.00E-01	5.00E+01	2.00E-01	2.00E-01	4.86E+00	8.29E+00	1.04E+01	1.82E+02	Lognormal
CG-149-WT	Naphthalene	8	100.0	1.12E+01	1.20E+01	0.93	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	3.40E+00	1.30E+01	8.07E+00	2.67E+00	9.86E+00	1.12E+01	Normal/Lognormal
CG-149-WT	p-Isopropyltoluene	4	100.0	2.14E+00	7.49E+01	0.03	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.10E-01	2.14E+00	1.64E+00	6.35E-01	2.38E+00	5.09E+00	Normal/Lognormal
CG-149-WT	Propylbenzene	4	100.0	6.78E+00	7.30E+00	0.93	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.70E+00	6.80E+00	5.25E+00	1.03E+00	6.47E+00	6.78E+00	Unknown
CG-149-WT	sec-Butylbenzene	4	100.0	3.30E+00	4.59E+00	0.72	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.50E+00	3.30E+00	2.92E+00	3.94E-01	3.38E+00	3.50E+00	Normal/Lognormal
CG-149-WT	Tetrachloroethylene	6	100.0	3.53E+00	2.02E-01	17.48	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	4.40E-01	3.53E+00	1.54E+00	1.10E+00	2.44E+00	4.41E+00	Normal/Lognormal
CG-149-WT	Toluene	8	100.0	1.24E+01	9.80E+00	1.27	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	6.70E-01	1.24E+01	4.34E+00	4.56E+00	7.39E+00	2.73E+01	Lognormal
CG-149-WT	trans-1,2-Dichloroethylene	8	62.5	6.34E+00	6.53E+01	0.10	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+01	1.11E+00	6.34E+00	2.44E+00	2.10E+00	3.85E+00	6.84E+00	Normal/Lognormal
CG-149-WT	Trichloroethylene	7	100.0	1.40E+01	4.04E-01	34.65	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.74E+00	1.40E+01	6.97E+00	4.73E+00	1.04E+01	1.58E+01	Normal/Lognormal
CG-149-WT	Vinyl chloride	8	100.0	1.40E+02	1.28E+00	109.23	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	8.16E+00	1.40E+02	3.65E+01	4.57E+01	6.71E+01	1.45E+02	Lognormal
CG-149-WT	Xylenes (Total)	8	100.0	5.04E+01	1.41E+02	0.36	Area 1	15.9	6.1	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.27E+01	6.90E+01	3.18E+01	1.77E+01	4.36E+01	5.04E+01	Normal/Lognormal
CG-151-25																							
CG-151-25	1,1-Dichloroethane	2	50.0	1.90E+00	4.70E+01	0.04	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	1.90E+00	1.90E+00	1.20E+00	9.90E-01	5.62E+00	7.59E+10	Unknown
CG-151-25	1,2-Dichloroethane	2	50.0	3.30E-02	3.06E+01	0.00	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	1.00E-01	1.00E-01	3.30E-02	3.30E-02	4.15E-02	1.20E-02	9.52E-02	3.32E-01	Unknown
CG-151-25	1,4-Dioxane	2	100.0	3.20E+00	9.49E+01	0.03	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.35E+00	3.20E+00	2.78E+00	6.01E-01	5.46E+00	9.20E+00	Unknown
CG-151-25	cis-1,2-Dichloroethylene	2	50.0	7.70E-01	1.65E+02	0.00	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	7.70E-01	7.70E-01	6.35E-01	1.91E-01	1.49E+00	6.02E+00	Unknown
CG-151-25	Manganese	2	100.0	2.75E+02	1.00E+02	2.75	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	--	--	2.38E+02	2.75E+02	2.57E+02	2.62E+01	3.73E+02	3.83E+02	Unknown
CG-151-25	trans-1,2-Dichloroethylene	2	50.0	4.40E-01	1.69E+03	0.00	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	1.00E+00	1.00E+00	4.40E-01	4.40E-01	4.70E-01	4.24E-02	6.59E-01	6.63E-01	Unknown
CG-151-25	Vinyl chloride	2	100.0	6.90E+01	2.04E+00	33.84	Area 3	15	25	Shallow	FALSE	Groundwater	MW	FALSE	--	--	4.94E+01	6.90E+01	5.92E+01	1.39E+01	1.21E+02	2.35E+02	Unknown
CG-153-79																							
CG-153-79	Toluene	7	14.3	5.79E-01	9.80E+00	0.06	Area 2	78.9	69.3	Intermediate	FALSE	Groundwater	MW	TRUE	1.70E-01	1.00E+00	6.90E-01	6.90E-01	4.32E-01	1.99E-01	5.79E-01	1.12E+00	Normal
CG-153-79	Vinyl chloride	7	42.9	1.20E-02	2.04E+00	0.01	Area 2	78.9	69.3	Intermediate	FALSE	Groundwater	MW	TRUE	2.00E-02	2.00E-02	1.10E-02	1.40E-02	1.09E-02	1.46E-03	1.19E-02	1.20E-02	Unknown
CG-153-WT																							
CG-153-WT	1,1-Dichloroethane	7	42.9	4.83E+00	4.70E+01	0.10	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	2.00E+01	1.20E-01	4.83E+00	2.75E+00	3.61E+00	5.40E+00	1.47E+02	Lognormal
CG-153-WT	1,2,4-Trimethylbenzene	7	100.0	4.50E+02	1.30E+01	34.58	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.50E+00	4.50E+02	2.05E+02	1.58E+02	3.21E+02	1.05E+04	Normal/Lognormal
CG-153-WT	1,2-Dichlorobenzene	7	100.0	3.16E+01	1.40E+01	2.26	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.20E+01	3.49E+01	2.13E+01	8.41E+00	2.75E+01	3.16E+01	Normal/Lognormal
CG-153-WT	1,2-Dichloroethane	6	66.7	6.06E-01	1.29E+01	0.05	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	4.30E-02	7.38E-01	3.80E-01	2.75E-01	6.06E-01	7.98E+00	Normal
CG-153-WT	1,3,5-Trimethylbenzene	7	100.0	1.90E+02	9.76E+00	19.46	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.30E+00	1.90E+02	8.22E+01	6.57E+01	1.30E+02	1.04E+04	Normal/Lognormal
CG-153-WT	1,4-Dichlorobenzene	5	60.0	4.50E-01	2.50E+00	0.18	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	3.27E-01	4.50E-01	4.31E-01	7.63E-02	5.04E-01	5.30E-01	Normal/Lognormal
CG-153-WT	Benzene	6	100.0	3.99E+00	9.60E+00	0.42	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.20E+00	4.14E+00	2.95E+00	9.13E-01	3.70E+00	3.99E+00	Lognormal
CG-153-WT	Chlorobenzene	7	57.1	7.70E+00	5.19E+01	0.15	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+01	2.80E+00	7.70E+00	3.96E+00	3.59E+00	6.60E+00	3.89E+01	Normal/Lognormal

Geomatrix

CLEANUP LEVEL COMPARISION - CONSTITUENTS OF CONCERN - OUTSIDE AREA

PSC Georgetown Facility

Seattle, Washington

							Sample Attribute Information								Sample Statistical Information								
Site ID	Groundwater Constituent	Number of Samples Analyzed	Frequency of Detection (%)	EPC Concentration (ug/l)	Applicable Groundwater Cleanup Level (AGWCUL) (ug/l)	Ratio of EPC to AGWCUL	Area	Top Screen (feet)	Bottom Screen (feet)	Czone	Is in Wall?	Media	Basis for Media	Is East of 4th?	Minimum Non-Detect (ug/l)	Maximum Non-Detect (ug/l)	Minimum Detected (ug/l)	Maximum Detected (ug/l)	Mean (ug/l)	Standard Deviation (ug/l)	95% Upper Confidence Limit (ug/l)	Logarithmic 95% Upper Confidence Limit (ug/l)	Goodness of Fit (5% Level of Significance)
CG-153-WT	Chloroethane	7	100.0	7.60E+01	4.61E+02	0.16	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.21E+01	7.60E+01	4.27E+01	2.03E+01	5.76E+01	8.57E+01	Normal/Lognormal
CG-153-WT	cis-1,2-Dichloroethylene	7	28.6	1.28E+00	7.27E+01	0.02	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	5.00E-01	2.00E+01	1.40E-01	1.28E+00	2.17E+00	3.55E+00	4.77E+00	4.84E+01	Lognormal
CG-153-WT	Cumene	3	100.0	1.20E+02	7.30E+00	16.44	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.60E+01	1.20E+02	7.80E+01	3.64E+01	1.39E+02	4.39E+02	Normal/Lognormal
CG-153-WT	Ethylbenzene	6	100.0	1.78E+03	7.30E+00	243.84	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	1.00E+01	1.78E+03	6.53E+02	6.47E+02	1.19E+03	5.75E+06	Normal/Lognormal
CG-153-WT	Methylene chloride	7	14.3	2.20E+00	3.21E+02	0.01	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	3.10E-01	1.00E+02	2.20E+00	2.20E+00	8.58E+00	1.83E+01	2.20E+01	1.83E+03	Lognormal
CG-153-WT	Naphthalene	7	85.7	2.01E+01	1.20E+01	1.68	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+01	1.00E+01	1.90E+00	2.20E+01	1.44E+01	7.77E+00	2.01E+01	6.46E+01	Normal
CG-153-WT	p-Isopropyltoluene	4	100.0	5.25E+00	7.49E+01	0.07	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	2.40E-01	5.25E+00	3.05E+00	2.25E+00	5.69E+00	1.12E+04	Normal/Lognormal
CG-153-WT	Propylbenzene	4	100.0	1.90E+02	7.30E+00	26.03	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	7.70E+01	1.90E+02	1.28E+02	4.76E+01	1.83E+02	2.54E+02	Normal/Lognormal
CG-153-WT	sec-Butylbenzene	4	100.0	1.00E+01	4.59E+00	2.18	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.00E+00	1.00E+01	8.21E+00	2.33E+00	1.09E+01	1.42E+01	Normal/Lognormal
CG-153-WT	Toluene	6	83.3	1.30E+03	9.80E+00	132.65	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	3.80E+00	3.80E+00	2.60E+00	1.30E+03	2.20E+02	5.29E+02	6.55E+02	6.69E+06	Unknown
CG-153-WT	trans-1,2-Dichloroethylene	7	42.9	1.68E+00	6.53E+01	0.03	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	2.00E+01	4.10E-01	1.68E+00	2.30E+00	3.49E+00	4.86E+00	1.80E+01	Lognormal
CG-153-WT	Trichloroethylene	6	66.7	7.70E-02	4.04E-01	0.19	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.00E-02	7.70E-02	1.96E-01	2.37E-01	3.90E-01	8.41E+00	Lognormal
CG-153-WT	Vinyl chloride	6	66.7	8.52E+00	1.28E+00	6.65	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	1.00E+00	1.00E+00	2.40E-01	8.52E+00	1.75E+00	3.32E+00	4.48E+00	3.07E+01	Unknown
CG-153-WT	Xylenes (Total)	7	100.0	4.65E+03	1.41E+02	33.10	Area 2	14.8	5	Water Table	FALSE	Groundwater	MW	TRUE	--	--	5.91E+00	4.65E+03	1.64E+03	2.13E+03	3.21E+03	1.40E+09	Lognormal

Geomatrix

ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - WATER TABLE SAMPLE INTERVAL
HCIM AREA

PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater CL (μg/l)	Highest Concentration	Units	Highest Hit > SWFS CL?
11-S-1	Water Table	31-Jan-00	1,1,1-Trichloroethane	Yes	1.10E+01	1.98E+03 D	ug/l	Yes
9-S-1	Water Table	22-May-00	1,1,2-Trichloroethane	No	--	1.26E+01	ug/l	--
2-S-1	Water Table	4-Feb-02	1,1,2-Trichlorotrifluoroethane	Yes	1.21E+03	2.17E+03 D	ug/l	Yes
2-S-1	Water Table	4-Feb-02	1,1-Dichloroethane	Yes	4.70E+01	2.04E+03 D	ug/l	Yes
9-S-1	Water Table	22-May-00	1,1-Dichloroethene	Yes	2.50E+01	1.06E+02 J	ug/l	Yes
6-S-1	Water Table	9-Aug-00	1,2,4-Trichlorobenzene	No	--	3.16E+00	ug/l	--
11-S-1	Water Table	4-Feb-03	1,2,4-Trimethylbenzene	Yes	1.30E+01	9.51E+02 D	ug/l	Yes
11-S-1	Water Table	31-Jan-00	1,2-Dichlorobenzene	Yes	1.40E+01	5.15E+01 D	ug/l	Yes
11-S-1	Water Table	2-Nov-00	1,2-Dichloroethane	Yes	1.29E+01	1.10E+03 J	ug/l	Yes
11-S-1	Water Table	1-Mar-01	1,2-Dichloropropane	No	--	2.98E+00 J	ug/l	--
8-S-1	Water Table	19-May-00	1,3,5-Trimethylbenzene	Yes	9.76E+00	7.55E+02 D	ug/l	Yes
CG-150-WT	Water Table	15-Nov-05	1,3-Dichlorobenzene	No	--	3.30E+00 D	ug/l	--
CG-150-WT	Water Table	16-Nov-04	1,4-Dichlorobenzene	Yes	2.50E+00	2.50E+01 D	ug/l	Yes
CG-150-WT	Water Table	16-Nov-04	1,4-Dioxane	Yes	9.49E+01	2.07E+02 D	ug/l	Yes
1-S-1	Water Table	20-Oct-03	1-Methyl naphthalene	Yes	2.10E+00	2.82E+00 J	ug/l	Yes
CG-150-WT	Water Table	15-Nov-05	2,4,5-Trichlorophenol	No	--	2.00E-01 J	ug/l	--
1-S-1	Water Table	20-Oct-03	2,4,6-Trichlorophenol	No	--	5.32E-02 J	ug/l	--
11-S-1	Water Table	4-Feb-03	2,4-Dimethylphenol	Yes	2.85E+01	9.21E+02 D	ug/l	Yes
1-S-1	Water Table	26-Oct-00	2,4-Dinitrophenol	No	--	2.72E+01	ug/l	--
11-S-1	Water Table	10-Aug-00	2-Butanone	No	--	2.25E+03 J	ug/l	--
9-S-1	Water Table	1-Nov-00	2-Hexanone	Yes	9.90E+01	5.23E+02	ug/l	Yes
8-S-1	Water Table	8-Aug-01	2-Methylnaphthalene	Yes	2.10E+00	2.17E+01	ug/l	Yes
11-S-1	Water Table	2-Nov-00	2-Methylphenol	Yes		2.82E+02 D	ug/l	Yes
11-S-1	Water Table	2-Nov-00	4-Methylphenol	Yes	1.08E+02	1.93E+03 D	ug/l	Yes
1-S-1	Water Table	20-Oct-03	4-Nitroaniline	No	--	3.08E+01 J	ug/l	--
8-S-1	Water Table	2-Mar-01	Acenaphthene	No	--	1.13E+00 D	ug/l	--
D16	Water Table	26-Oct-00	Acetone	No	--	4.10E+02	ug/l	--
9-S-1	Water Table	13-Nov-01	Acetophenone	No	--	6.13E+01	ug/l	--
11-S-1	Water Table	21-May-02	Ammonia (as N)	No	--	3.33E+00	ug/l	--
1-S-1	Water Table	20-Oct-03	Aniline	No	--	1.86E+01	ug/l	--
CG-150-WT	Water Table	15-Nov-05	Anthracene	No	--	3.40E-02 D	ug/l	--
9-S-1	Water Table	4-Feb-02	Aroclor 1016	Yes	5.00E-03	1.54E+01 DJ	ug/l	Yes
9-S-1	Water Table	22-May-00	Aroclor 1232	Yes	5.00E-03	2.59E+01 D	ug/l	Yes
1-S-1	Water Table	3-Feb-03	Aroclor 1242	No	--	2.45E+00	ug/l	--
11-S-1	Water Table	24-May-00	Arsenic	Yes	5.06E-02	1.67E+01	ug/l	Yes
11-S-1	Water Table	2-Nov-00	Barium	Yes	4.00E+00	3.29E+01	ug/l	Yes
9-S-1	Water Table	11-Aug-00	Benzene	Yes	9.60E+00	1.03E+02	ug/l	Yes
1-S-1	Water Table	16-Nov-04	Benzo(a)anthracene	Yes	2.00E-02	2.12E-02 J	ug/l	Yes
1-S-1	Water Table	4-Feb-02	Benzo(a)pyrene	No	--	1.38E-02	ug/l	--
1-S-1	Water Table	4-Feb-02	Benzo(b)fluoranthene	Yes	1.94E-02	4.17E-02 J	ug/l	Yes
1-S-1	Water Table	15-Nov-05	Benzo(ghi)perylene	No	--	8.30E-03	ug/l	--
10-S-1	Water Table	20-Oct-03	Benzo(k)fluoranthene	Yes	1.80E-02	9.38E-02 J	ug/l	Yes

Geomatrix

ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - WATER TABLE SAMPLE INTERVAL
HCIM AREA
PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater CL (μg/l)	Highest Concentration	Units	Highest Hit > SWFS CL?
11-S-1	Water Table	4-Feb-02	Benzoic acid	Yes	4.20E+01	6.49E+02 D	ug/l	Yes
1-S-1	Water Table	16-Nov-04	Benzyl alcohol	No	--	5.54E+01 J	ug/l	--
1-S-1	Water Table	20-Oct-03	Bis(2-ethylhexyl)phthalate (BEHP)	Yes	2.00E+00	4.96E-01	ug/l	No
9-S-1	Water Table	6-Mar-01	Bromodichloromethane	No	--	1.27E+01	ug/l	--
11-S-1	Water Table	4-Feb-03	C10-C12 (EPH) Aromatics	Yes	5.00E+01	2.16E+03	ug/l	Yes
10-S-1	Water Table	21-May-03	C10-C12 (VPH) Aromatics	No	--	1.11E+02	ug/l	--
11-S-1	Water Table	21-May-03	C12-C16 (EPH) Aromatics	No	--	1.49E+02 J	ug/l	--
9-S-1	Water Table	4-Feb-03	C8-C10 (EPH) Aliphatics	Yes	5.00E+01	2.36E+03	ug/l	Yes
11-S-1	Water Table	21-May-03	C8-C10 (EPH) Aromatic	Yes	2.75E+02	1.17E+04 J	ug/l	Yes
11-S-1	Water Table	4-Feb-03	C8-C10 (VPH) Aromatics	Yes	2.75E+02	2.86E+04 D	ug/l	Yes
1-S-1	Water Table	20-Oct-03	Carbazole	No	--	1.58E+00	ug/l	--
D19	Water Table	27-Nov-00	Carbon Dioxide	No	--	3.07E+05	ug/l	--
9-S-1	Water Table	16-May-01	Carbon disulfide	Yes	9.20E-01	9.76E+00	ug/l	Yes
9-S-1	Water Table	11-Aug-00	Chloride	No	--	5.09E+01 D	ug/l	--
D1	Water Table	9-Oct-00	Chlorobenzene	No	5.19E+01	1.92E+01	ug/l	--
CG-150-WT	Water Table	15-Nov-05	Chloroethane	Yes	4.61E+02	1.40E+03 D	ug/l	Yes
11-S-1	Water Table	31-Jan-00	Chloroform	Yes	4.11E+00	8.20E+01 D	ug/l	Yes
SA-D7	Water Table	10-Oct-00	Chloromethane	No	--	1.27E+01	ug/l	--
11-S-1	Water Table	2-Nov-00	Chromium	Yes	1.00E+01	1.25E+01	ug/l	Yes
1-S-1	Water Table	20-Oct-03	Chrysene	Yes	1.80E-02	7.41E-02	ug/l	Yes
11-S-1	Water Table	2-Nov-00	cis-1,2-Dichloroethylene	Yes	7.27E+01	1.45E+04	ug/l	Yes
11-S-1	Water Table	2-Nov-00	Copper	Yes	3.10E+00	7.35E+00	ug/l	Yes
11-S-1	Water Table	10-Aug-00	Cumene	Yes	7.30E+00	7.60E+01	ug/l	Yes
9-S-1	Water Table	4-Feb-02	Cyanide	Yes	1.00E+01	4.89E+01	ug/l	Yes
1-S-1	Water Table	20-Oct-03	Dibenzo(a,h)anthracene	Yes	1.62E-02	7.76E+01 J	ug/l	Yes
1-S-1	Water Table	15-Nov-05	Dibenzofuran	No	--	2.30E-01 D	ug/l	--
11-S-1	Water Table	1-Mar-01	Dichloro-difluoro-methane	Yes	6.36E+00	1.50E+01 J	ug/l	Yes
11-S-1	Water Table	24-May-00	Diesel	Yes	5.00E+02	2.24E+05	ug/l	Yes
D5	Water Table	28-Nov-00	Ethane	Yes	--	2.37E+02	ug/l	No
9-S-1	Water Table	16-May-01	Ethylbenzene	Yes	7.30E+00	2.19E+04	ug/l	Yes
D16	Water Table	26-Oct-00	Ethylene	Yes	--	4.35E+02	ug/l	No
1-S-1	Water Table	15-Nov-05	Fluoranthene	No	--	8.40E-02 D	ug/l	--
7-S-1	Water Table	27-Feb-01	Fluorene	No	--	9.12E-01	ug/l	--
11-S-1	Water Table	10-Aug-00	Gasoline	Yes	8.00E+02	1.61E+05 D	ug/l	Yes
1-S-1	Water Table	26-Oct-00	Hexachlorocyclopentadiene	No	1.00E+01	1.15E+01	ug/l	--
1-S-1	Water Table	20-Oct-03	Indeno(1,2,3-cd)pyrene	Yes	2.00E-02	5.92E-02	ug/l	Yes
D16	Water Table	26-Oct-00	Iron	Yes	1.00E+03	7.80E+01 D	ug/l	No
11-S-1	Water Table	4-Feb-03	Isophorone	No	--	2.89E+01	ug/l	--
11-S-1	Water Table	2-Nov-00	Lead	Yes	2.50E+00	1.01E+01	ug/l	Yes
11-S-1	Water Table	15-May-01	Lube Oil	Yes	5.00E+02	1.49E+03	ug/l	Yes
11-S-1	Water Table	21-May-02	Magnesium	No	--	4.34E+00	ug/l	--

ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - WATER TABLE SAMPLE INTERVAL
HCIM AREA

PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater CL (μg/l)	Highest Concentration	Units	Highest Hit > SWFS CL?
11-S-1	Water Table	24-May-00	Manganese	Yes	1.00E+02	1.99E+00 DB	ug/l	No
D19	Water Table	27-Nov-00	Methane	Yes	--	9.98E+03	ug/l	No
11-S-1	Water Table	2-Nov-00	Methyl isobutyl ketone (MIBK)	Yes	1.70E+02	2.27E+02 D	ug/l	Yes
11-S-1	Water Table	10-Aug-00	Methylene chloride	Yes	3.21E+02	2.36E+02 J	ug/l	No
11-S-1	Water Table	4-Feb-03	Methylphenol	Yes	1.65E+03	2.68E+03 D	ug/l	Yes
8-S-1	Water Table	19-May-00	Naphthalene	Yes	1.20E+01	3.62E+02 D	ug/l	Yes
7-S-1	Water Table	9-Aug-00	n-Butylbenzene	No	--	1.12E+01	ug/l	--
1-S-1	Water Table	3-Feb-03	n-Hexane	Yes	1.00E+00	4.21E+00	ug/l	Yes
9-S-1	Water Table	1-Nov-00	Nickel	Yes	8.20E+00	9.14E+00	ug/l	Yes
D2	Water Table	17-Oct-00	Nitrate(as N)	No	--	4.85E+03	ug/l	--
11-S-1	Water Table	4-Feb-02	Nitrite (as N)	No	--	2.19E+02	ug/l	--
1-S-1	Water Table	20-Oct-03	Nitrobenzene	No	--	7.52E-01 J	ug/l	--
11-S-1	Water Table	4-Feb-03	Pentachlorophenol	Yes	2.53E+00	4.87E+01	ug/l	Yes
7-S-1	Water Table	27-Feb-01	Phenanthrene	No	--	3.04E-01	ug/l	--
11-S-1	Water Table	4-Feb-03	Phenol	Yes	1.18E+02	6.63E+03 D	ug/l	Yes
8-S-1	Water Table	11-Aug-00	p-Isopropyltoluene	Yes	7.49E+01	5.81E+01	ug/l	No
11-S-1	Water Table	21-May-02	Potassium	No	--	4.00E+01	ug/l	--
11-S-1	Water Table	10-Aug-00	Propylbenzene	Yes	7.30E+00	1.72E+02 J	ug/l	Yes
10-S-1	Water Table	27-Feb-01	Pyrene	No	--	1.89E-01	ug/l	--
9-S-1	Water Table	22-May-00	sec-Butylbenzene	Yes	4.59E+00	2.02E+02 J	ug/l	Yes
11-S-1	Water Table	7-Nov-01	Selenium	Yes	5.00E+00	1.01E+00	ug/l	No
11-S-1	Water Table	21-May-02	Sodium	No	--	4.79E+01	ug/l	--
9-S-1	Water Table	11-Aug-00	Styrene	Yes	5.00E-01	4.74E+01	ug/l	Yes
D2	Water Table	17-Oct-00	Sulfate	No	--	2.69E+01 D	ug/l	--
2-S-1	Water Table	4-Feb-02	Tetrachloroethene	Yes	2.02E-01	2.82E+02 D	ug/l	Yes
11-S-1	Water Table	2-Nov-00	Toluene	Yes	9.80E+00	6.69E+04 J	ug/l	Yes
11-S-1	Water Table	21-May-03	TotalExtractablePetroleum HC	Yes	--	1.44E+04 J	ug/l	No
11-S-1	Water Table	4-Feb-03	TotalVolatilePetroleum HC	Yes	--	2.86E+04	ug/l	No
9-S-1	Water Table	22-May-00	trans-1,2-Dichloroethene	Yes	6.53E+01	7.12E+03 D	ug/l	Yes
2-S-1	Water Table	4-Feb-02	Trichloroethene	Yes	4.04E-01	6.12E+02 D	ug/l	Yes
11-S-1	Water Table	7-Aug-01	Trichlorofluoromethane	No	--	6.89E+02 D	ug/l	--
1-S-1	Water Table	4-Feb-02	Vanadium	Yes	2.00E+01	1.04E+01	ug/l	No
CG-149-WT	Water Table	17-May-05	Vinyl acetate	No	--	1.80E+00 J	ug/l	--
D12	Water Table	3-Nov-00	Vinyl chloride	Yes	1.28E+00	8.71E+03 D	ug/l	Yes
11-S-1	Water Table	4-Feb-03	Xylenes (Total)	Yes	1.41E+02	1.59E+04 D	ug/l	Yes
1-S-1	Water Table	7-Nov-01	Zinc	Yes	8.10E+01	2.83E+01	ug/l	No

Notes:

D = The reported result is from a dilution.

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

N = The anlayte was tentatively identified.

B = The analyte was found in an associated blank.

Geomatrix

ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - SHALLOW SAMPLE INTERVAL
HCIM AREA

PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater Cleanup Level (μg/l)	Concentration	Units	Highest Hit > SWFS CL?
SA-D10	Shallow	03-Nov-00	1,1,1-Tri-chloroethane	Yes	1.10E+01	4.46E+02	ug/l	Yes
D2	Shallow	17-Oct-00	1,1,2-Tri-chloroethane	No	--	2.97E+00	ug/l	--
D20	Shallow	07-Nov-00	1,1,2-Trichlorotrifluoroethane	Yes	1.10E+04	1.68E+02 D	ug/l	No
SA-D10	Shallow	03-Nov-00	1,1-Dichloroethane	Yes	4.70E+01	1.56E+03 D	ug/l	Yes
SA-D10	Shallow	03-Nov-00	1,1-Dichloroethene	Yes	2.50E+01	1.96E+01	ug/l	No
D23	Shallow	02-Nov-00	1,2-Dichloroethane	Yes	3.06E+01	3.72E+01	ug/l	Yes
D19	Shallow	27-Nov-00	2-Butanone	No	--	1.03E+02	ug/l	--
D21	Shallow	08-Nov-00	2-Hexanone	Yes	9.90E+01	3.05E+02 D	ug/l	Yes
D23	Shallow	02-Nov-00	4-Methyl-2-pentanone (MIBK)	Yes	1.70E+02	8.06E+02	ug/l	Yes
D23	Shallow	02-Nov-00	Acetone	No	--	2.32E+02	ug/l	--
D2	Shallow	17-Oct-00	Benzene	Yes	1.17E+01	5.30E+01	ug/l	Yes
SA-D13	Shallow	06-Nov-00	Carbon Dioxide	No	--	2.42E+05	ug/l	--
D18	Shallow	23-Oct-00	Carbon disulfide	Yes	9.20E-01	5.42E+00	ug/l	Yes
SA-D13	Shallow	06-Nov-00	Chloride	No	--	1.24E+05 DBB	ug/l	--
D26	Shallow	30-Nov-00	Chlorobenzene	No	--	4.13E+00	ug/l	--
D22	Shallow	24-Oct-00	Chloroethane	Yes	4.61E+02	1.53E+03 D	ug/l	Yes
D37	Shallow	15-Dec-00	Chloroform	Yes	2.80E+01	4.57E+00 D	ug/l	No
SA-D3	Shallow	19-Oct-00	cis-1,2-Dichloroethylene	Yes	1.65E+02	1.04E+04 D	ug/l	Yes
D2	Shallow	17-Oct-00	Cyanide	Yes	1.00E+01	1.16E+01	ug/l	Yes
D5	Shallow	28-Nov-00	Ethane	Yes	--	4.17E+02	ug/l	No
D2	Shallow	17-Oct-00	Ethylbenzene	Yes	7.30E+00	8.89E+03 D	ug/l	Yes
D2	Shallow	17-Oct-00	Ethylene	Yes	--	1.19E+03	ug/l	No
D4	Shallow	23-Oct-00	Iron	Yes	1.00E+03	7.94E+04 D	ug/l	Yes
D19	Shallow	27-Nov-00	Xylenes (Total)	Yes	1.41E+02	4.41E+03 D	ug/l	Yes
SA-D13	Shallow	06-Nov-00	Methane	Yes	--	1.07E+04	ug/l	No
D23	Shallow	02-Nov-00	Methylene chloride	Yes	4.95E+02	3.98E+01	ug/l	No
D5	Shallow	28-Nov-00	Nitrate(as N)	No	--	2.82E+03	ug/l	--
SA-D10	Shallow	03-Nov-00	Sulfate	No	--	1.18E+04	ug/l	--
D2	Shallow	17-Oct-00	Tetrachloroethene	Yes	2.02E-01	2.83E+00	ug/l	Yes
D23	Shallow	02-Nov-00	Toluene	Yes	9.80E+00	1.31E+04 D	ug/l	Yes
SA-D10	Shallow	03-Nov-00	trans-1,2-Dichloroethene	Yes	1.69E+03	4.29E+01	ug/l	No
SA-D10	Shallow	03-Nov-00	Trichloroethene	Yes	7.88E-01	3.78E+00	ug/l	Yes
D23	Shallow	02-Nov-00	Trichlorofluoromethane	No	--	3.27E+00	ug/l	--
SA-D3	Shallow	19-Oct-00	Vinyl chloride	Yes	2.04E+00	1.54E+04 D	ug/l	Yes

Notes:

D = The reported result is from a dilution.

B = The analyte was found in an associated blank.

Geomatrix

ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - INTERMEDIATE SAMPLE INTERVAL
HCIM AREA

PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater Cleanup Level (µg/l)	Concentration	Units	Highest Hit > SWFS CL?
2-I	Intermediate	14-Aug-00	1,1,1-Trichloroethane	Yes	1.10E+01	1.65E+01	ug/l	Yes
D16	Intermediate	27-Oct-00	1,1,2,2,-Tetrachloroethane	No	--	61.3 D	ug/l	--
12-I	Intermediate	6-Nov-01	1,1,2-Tri-chloroethane	No	--	3.22	ug/l	--
D20	Intermediate	7-Nov-00	1,1,2-Trichlorotrifluoroethane	Yes	1.10E+04	5.08E+01	ug/l	No
D9	Intermediate	31-Oct-00	1,1-Dichloroethane	Yes	4.70E+01	1.04E+03 D	ug/l	Yes
D20	Intermediate	8-Nov-00	1,1-Dichloroethene	Yes	2.50E+01	1.38E+03 D	ug/l	Yes
2-I	Intermediate	16-May-01	1,2,4-Trimethylbenzene	Yes	7.77E+01	4.75E+02 D	ug/l	Yes
12-I	Intermediate	10-Feb-00	1,2-Dichlorobenzene	Yes	1.40E+01	1.97E+02	ug/l	Yes
D2	Intermediate	17-Oct-00	1,2-Dichloroethane	Yes	3.06E+01	1.29E+01	ug/l	No
D22	Intermediate	25-Oct-00	1,2-Dichloropropane	No	--	321	ug/l	--
9-I	Intermediate	19-May-00	1,3,5-Trimethylbenzene	Yes	5.57E+01	1.68E+00	ug/l	No
12-I	Intermediate	10-Feb-00	1,4-Dichlorobenzene	Yes	2.50E+00	1.06E+00	ug/l	No
11-I	Intermediate	2-Nov-00	2,4-Dimethylphenol	Yes	2.85E+01	4.44E+02 D	ug/l	Yes
D14	Intermediate	1-Nov-00	2-Butanone	No	--	327	ug/l	--
D32	Intermediate	1-Dec-00	2-Hexanone	Yes	9.90E+01	6.57E+01	ug/l	No
11-I	Intermediate	2-Nov-00	2-Methylphenol	Yes	1.30E+01	3.02E+02 D	ug/l	Yes
D14	Intermediate	1-Nov-00	Methyl isobutyl ketone (MIBK)	Yes	1.70E+02	1.17E+01	ug/l	No
11-I	Intermediate	2-Nov-00	4-Methylphenol	Yes	1.08E+02	2.23E+03 D	ug/l	Yes
12-I	Intermediate	5-Mar-01	Acenaphthene	No	--	0.487	ug/l	--
1-I	Intermediate	15-Nov-05	Acenaphthylene	No	--	0.0055 JD[J]	ug/l	--
12-I	Intermediate	10-Feb-00	Acetone	No	--	370	ug/l	--
12-I	Intermediate	30-Oct-00	Arsenic	Yes	5.06E-02	1.78E+01	ug/l	Yes
12-I	Intermediate	30-Oct-00	Barium	Yes	4.00E+00	6.40E+01	ug/l	Yes
D22	Intermediate	25-Oct-00	Benzene	Yes	1.17E+01	7.36E+01	ug/l	Yes
D13	Intermediate	7-Nov-00	Carbon Dioxide	No	--	211000	ug/l	--
D12	Intermediate	6-Nov-00	Carbon disulfide	Yes	9.20E-01	4.66E+01	ug/l	Yes
D22	Intermediate	25-Oct-00	Chlorobenzene	No	--	11	ug/l	--
D2	Intermediate	17-Oct-00	Chloroethane	Yes	4.61E+02	1.96E+02 D	ug/l	No
D33	Intermediate	13-Dec-00	Chloroform	Yes	2.80E+01	1.36E+01 D	ug/l	No
D15	Intermediate	26-Oct-00	Chloromethane	No	--	51.6	ug/l	--
9-I	Intermediate	2-Nov-00	Chromium	Yes	1.00E+01	7.60E+01	ug/l	Yes
D9	Intermediate	31-Oct-00	cis-1,2-Dichloroethylene	Yes	1.65E+02	8.54E+04 D	ug/l	Yes
11-I	Intermediate	2-Nov-00	Copper	Yes	3.10E+00	2.53E+01	ug/l	Yes
D5	Intermediate	28-Nov-00	Cyanide	Yes	1.00E+01	6.49E+01	ug/l	Yes
12-I	Intermediate	30-Oct-00	Diesel	Yes	5.00E+02	1.50E+03	ug/l	Yes
D2	Intermediate	17-Oct-00	Ethane	Yes	--	5.85E+02	ug/l	No
D2	Intermediate	17-Oct-00	Ethylbenzene	Yes	7.30E+00	2.20E+03 D	ug/l	Yes
SA-D3	Intermediate	19-Oct-00	Ethylene	Yes	--	2.32E+03	ug/l	No
12-I	Intermediate	5-Mar-01	Fluorene	No	--	0.195	ug/l	--

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ATTACHMENT A-2

CLEANUP LEVEL COMPARISON - INTERMEDIATE SAMPLE INTERVAL
HCIM AREA

PSC Georgetown Facility

Site ID	Zone	Sample Date	Constituent	RI CL exists?	SWFS Groundwater Cleanup Level (μg/l)	Concentration	Units	Highest Hit > SWFS CL?
12-I	Intermediate	30-Oct-00	Gasoline	Yes	8.00E+02	2.28E+02	ug/l	No
D4	Intermediate	23-Oct-00	Iron	Yes	1.00E+03	7.50E+04 D	ug/l	Yes
12-I	Intermediate	30-Oct-00	Lead	Yes	2.50E+00	7.13E+00	ug/l	Yes
12-I	Intermediate	30-Oct-00	Lube Oil	Yes	5.00E+02	5.16E+02	ug/l	Yes
11-I	Intermediate	24-May-00	Manganese	Yes	1.00E+02	2.68E+02	ug/l	Yes
12-I	Intermediate	8-Aug-01	Methane	Yes	--	4.15E+04	ug/l	No
D33	Intermediate	13-Dec-00	Methylene chloride	Yes	4.95E+02	1.28E+02 D	ug/l	No
12-I	Intermediate	10-Feb-00	Naphthalene	Yes	1.20E+01	3.76E+00	ug/l	No
9-I	Intermediate	2-Nov-00	Nickel	Yes	8.20E+00	6.72E+01	ug/l	Yes
9-I	Intermediate	10-Feb-00	Nitrite (as N)	No	--	96.5 D	ug/l	--
12-I	Intermediate	5-Mar-01	Phenanthrene	No	--	0.156	ug/l	--
11-I	Intermediate	2-Nov-00	Phenol	Yes	1.18E+02	4.67E+03 D	ug/l	Yes
12-I	Intermediate	6-Nov-01	Selenium	Yes	5.00E+00	1.64E+00	ug/l	No
D14	Intermediate	1-Nov-00	Styrene	Yes	5.00E-01	6.06E+00	ug/l	Yes
D5	Intermediate	28-Nov-00	Sulfate	No	--	28700 D	ug/l	--
D22	Intermediate	25-Oct-00	Tetrachloroethene	Yes	2.02E-01	4.03E+01	ug/l	Yes
D2	Intermediate	17-Oct-00	Toluene	Yes	9.80E+00	3.52E+03 D	ug/l	Yes
D9	Intermediate	31-Oct-00	trans-1,2-Dichloroethene	Yes	1.69E+03	1.28E+04 D	ug/l	Yes
D22	Intermediate	25-Oct-00	Trichloro-ethene	Yes	7.88E-01	1.43E+05 D	ug/l	Yes
11-I	Intermediate	15-May-01	Vanadium	Yes	2.00E+01	4.10E+01	ug/l	Yes
D9	Intermediate	31-Oct-00	Vinyl chloride	Yes	2.04E+00	6.72E+04 D	ug/l	Yes
D2	Intermediate	17-Oct-00	Xylenes (Total)	Yes	1.41E+02	8.84E+02 D	ug/l	Yes
12-I	Intermediate	30-Oct-00	Zinc	Yes	8.10E+01	6.40E+01	ug/l	No

Notes:

D = The reported result is from a dilution.

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

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ATTACHMENT B

Estimation of Chlorinated VOC Biodegradation Rates

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENT B
ESTIMATION OF CHLORINATED VOC BIODEGRADATION RATES

PSC Georgetown
Seattle, Washington

1.0 INTRODUCTION

This attachment describes the estimation of chlorinated ethene biodegradation rates at the Philip Services Corporation (PSC) former dangerous waste treatment and storage facility (Facility).

2.0 HYDROGEOLOGIC CONDITIONS

This section summarizes hydrogeologic conditions based on boring logs, water level measurements, and hydraulic conductivity tests presented in the RI Report (PSC, 2003) and boring logs of monitoring wells installed as part of the barrier wall performance mentoring network (Geomatrix, 2004). The investigations reported in the RI identified five hydrogeologic units that occur with increasing depths. These hydrogeologic units are described below:

- The shallow sand unit (including fill) consists of poorly graded, fine to medium sand with fine gravel and varies from approximately 20 to 65 feet in thickness. This unit generally corresponds to water table and shallow depth intervals referred to in the RI and elsewhere. The upper portions of the unit may be composed of fill including material dredged from the Duwamish Waterway. The shallow sand unit grades into the intermediate sand and silt unit. An average hydraulic conductivity of 3.2×10^{-2} centimeter per second (cm/sec) for the shallow sand unit based on grain size, slug test, and pumping test data was presented in the RI Report.

- The intermediate sand and silt unit consists of discontinuous interbedded silty sand and sandy silt lenses with shell fragments. This unit generally corresponds to intermediate depth intervals referred to in the RI and elsewhere. The unit ranges in thickness from 13 to 68 feet. Near the facility, the shallow sand unit is quite distinct from the intermediate sand and silt unit. Downgradient from the facility the intermediate sand and silt unit becomes much sandier, with fewer silt layers, suggesting that by East Marginal Way South, the shallow sand and the intermediate sand and silt units may be acting as a single hydrogeologic unit. An average hydraulic conductivity of 5.1×10^{-3} cm/sec for the intermediate sand and silt unit based on grain size, slug test, and pumping test data was presented in the RI Report. The lower hydraulic conductivity as compared to the overlying shallow sand unit is consistent with the finer-grained nature of the intermediate unit in the vicinity of the facility.

- The silt unit, which represents the aquitard separating the shallower aquifers from the deep sand and silt unit, consists predominately of silt and very fine sand ranging in thickness from 11 to 50 feet. Clam shells and shell fragments are commonly present. Some borings encountered worm burrows, mud cracks, and occasional fine laminations. Laboratory tests indicated a vertical hydraulic conductivity of 1×10^{-7} cm/sec to 5×10^{-6} cm/sec.

- The deep sand and silt unit consists of sandy silt, fine sand and interbedded, lenses of silty sand. The top of the unit lies at depths of between approximately 84 and 128 feet. The RI presents a hydraulic conductivity estimate of 3×10^{-3} cm/sec for the deep sand and silt unit based on grain size, slug test, and pumping test data.

- The bedrock consists of consolidated sedimentary sandstone and siltstone. In a boring upgradient from the facility, bedrock was encountered at a depth of approximately 56 feet bgs. The depth to bedrock likely increases to a maximum depth of about 330 to 660 feet near the Duwamish Waterway.

For the purposes of this evaluation, only the upper sand unit and the intermediate sand and silt unit were considered in developing the groundwater flow conceptual model and estimating contaminant mass and biodegradation rates. These hydrogeologic units encompass the water table, shallow, and intermediate depth intervals from the RI Report, which were defined to evaluate water quality data based on depth below ground surface, rather than hydrogeologic units. The water table and shallow depth intervals generally correspond to samples from the upper sand unit, and the intermediate depth interval generally corresponds to samples from the intermediate sand and silt unit.

Based on contoured water level data from the upper sand unit and the intermediate sand and silt unit, groundwater flow directions near the facility are generally to the west and southwest, with a hydraulic gradient of approximately 0.0017. Assuming an effective porosity of 0.30, estimated horizontal groundwater velocities for the upper sand and the intermediate units are approximately 190 and 30 feet per year (ft/yr), respectively. Vertical hydraulic gradients measured between these units are generally flat to slightly upward and range from 0 to 0.004, with the stronger upward gradients in the vicinity of the facility. Given that these vertical hydraulic gradients are similar to the horizontal hydraulic gradients, and that vertical hydraulic conductivity is likely at least an order-of-magnitude lower than the measured horizontal hydraulic conductivities, it is assumed for the purposes of this evaluation that vertical groundwater flow between the shallow sand and intermediate sand and silt units is negligible. In reality, there is likely some upward component of flow near the facility.

Hydrogeologic cross sections depicting these units and the associated tetrachlorethene (PCE), trichloroethene (TCE), cis-1,2-dichloroehtene (cis-1,2-DCE), and vinyl chloride (VC) concentrations, were developed at the locations shown on Figure B-1 using lithologic data from soil borings and monitoring well installations. Hydrogeologic cross-sections are presented on Figures B-2a through B-2d and B-3a through B-3d. The cross sections were oriented approximately perpendicular to groundwater flow. Cross section A-A' spans the facility through the source area now contained by the barrier wall. Cross section B-B' is located approximately 800 feet downgradient from the facility and immediately upgradient from where other suspected sources of chlorinated VOCs are thought to exist.

As shown on the hydrogeologic cross sections, the water table is encountered in the shallow sand unit at an elevation of approximately 10 feet (NAVD 88). In cross section A-A' the base of the shallow sand unit and the top of the intermediate sand and silt unit occurs at elevations of approximately -47 to -31 feet. In cross section B-B', the top of the intermediate sand and silt unit occurs at elevations of approximately -25 to -15 feet.

3.0 CONTAMINANT FATE AND TRANSPORT

The primary fate and transport issue for chlorinated VOCs is natural attenuation in groundwater through biodegradation. The generally anaerobic conditions observed in the shallow sand unit and the intermediate sand and silt unit are conducive to biodegradation of the chlorinated VOCs by reductive dechlorination (PSC, 2003). Under anaerobic conditions, chlorinated ethenes biodegrade as follows:

- PCE → TCE → cis-1,2-dichloroethene (cis-1,2-DCE) → VC → ethene → ethane

VC can also degrade under aerobic conditions by direct aerobic oxidation to carbon dioxide. The more highly chlorinated VOCs generally degrade more readily under anaerobic conditions, while the lesser chlorinated VOCs such as VC generally degrade more quickly under aerobic conditions. Biodegradation appears to be limiting the downgradient migration of PCE and TCE and their breakdown products, cis-1,2-DCE and VC.

The remainder of this section presents an overview of chlorinated VOC distribution between the facility and Sixth Avenue South, based on groundwater reconnaissance samples from the RI collected between 2000 and 2001 and groundwater monitoring well data collected in May 2002. These data sets were selected as they provide the most complete data sets of the chlorinated VOC distribution prior to installation of the barrier wall. Using the contaminant distribution and the understanding of hydrogeologic conditions, a contaminant transport conceptual site model is developed, and contaminant mass at each cross section is estimated.

3.1 CONTAMINANT DISTRIBUTION

PCE, TCE, cis-1,2-DCE, and VC data were posted on the hydrogeologic cross sections and isoconcentration contours were developed, as shown on Figures B-2a through B-2d and B-3a through B-3d.

VC and cis-1,2-DCE concentrations and distributions are similar in cross section A-A', with relatively broad distribution of concentrations greater than 1 μg/L in the shallow sand unit. Higher concentration areas, represented by the 1,000 μg/L contours on these sections, are also similar in location and extent. The highest cis-1,2-DCE and VC concentrations occur near the north end of cross section A-A', spanning the interface between the shallow sand unit and the intermediate sand and silt unit. TCE and PCE concentrations are generally much lower and less wide-spread in the shallow sand unit than cis-1,2-DCE and VC concentrations. The highest TCE concentrations (up to 82,900 μg/L) occur at the interface between the shallow sand unit and the intermediate sand and silt unit, in the same general locations as the highest cis-1,2-DCE and VC concentrations. Detectable concentrations of PCE are generally limited to the upper 10 feet of the shallow sand unit, with two relatively low concentration detections at the interface between the shallow sand unit and the intermediate sand and silt unit.

The chlorinated VOC concentrations and distributions observed in cross section A-A' are significantly different than those of downgradient cross section B-B'. Chlorinated VOCs were not detected in the intermediate sand and silt unit in the downgradient cross section. The highest VOC concentrations are limited to the upper 30 feet of the shallow sand unit in cross section B-B'. The very high concentrations detected at the interface between the upper sand unit and the intermediate sand and silt unit in cross section A-A' do not appear to have migrated to the downgradient cross section B-B'.

VC and cis-1,2-DCE concentrations continue to be co-located at downgradient cross section B-B', with TCE and PCE showing a different distribution. PCE is virtually absent at cross section B-B'. Maximum concentrations of PCE, cis-1,2-DCE, and VC decrease in the downgradient direction between the cross sections, reflecting the effects of biodegradation and dispersion. TCE concentrations remain relatively unchanged, possibly in part due to biodegradation of PCE to TCE.

3.2 CONTAMINANT TRANSPORT CONCEPTUAL MODEL

Based on the understanding of local hydrogeologic conditions and contaminant distribution, the following contaminant transport conceptual model was developed:

- Prior to construction of the barrier wall, groundwater flowed to the west and southwest through chlorinated VOC source areas at the facility. Dissolved phase PCE, TCE, cis-1,2-DCE, and VC migrated downgradient from the facility to the west and southwest. Although an exact release date is unknown, for the purposes of this conceptual model an initial release date of sometime in the1970s is assumed. Given this, it is further assumed that the plume had achieved steady state conditions at the locations of the two cross sections at the time the data presented in the RI were collected. For the purposes of this conceptual model it is also assumed that dissolved phase chlorinated VOC concentrations exiting the facility with groundwater flow have not changed over time, such that concentrations observed downgradient of the facility are the result of historical concentrations similar to what were observed in the RI data.

- No known sources of chlorinated VOCs other than at the facility are present at or upgradient of cross section B-B'. Changes in chlorinated VOC concentrations between the facility and Sixth Avenue South occur only due to biodegradation and hydrodynamic dispersion.

- Groundwater flow rates in the shallow sand unit are approximately an order-of-magnitude higher than groundwater flow rates in the intermediate sand and silt unit.

- Groundwater with high chlorinated ethene concentrations is observed at the base of the shallow sand unit in cross-section A-A'. Similar concentrations at the same depths in cross-section B-B' have not been observed. The high concentration area in cross-section A-A' was not considered in estimating biodegradation rates. This exclusion is conservative in estimating the degradation rates because less source mass results in less degradation in the modeling process. In addition, excluding this potion of the chlorinated ethene mass results in more reasonable biodegradation rates for TCE, cis-1,2-DCE, and VC.

- Horizontal groundwater flow rates in the vicinity of the facility are much greater than vertical flow rates. As such, horizontal flow within each hydrogeologic unit can be assumed and flow and contaminant transport between the shallow sand unit and intermediate sand and silt unit can, for the purposes of this analysis, be ignored.

- For the purposes of this conceptual model it is assumed that groundwater flow rates at and between each cross section are uniform, with a seepage velocity within the shallow sand unit (the water table and shallow depth interval) of approximately 190 ft/yr.

This conceptual model forms the basis for estimating contaminant mass presented in the following section and interpreting the results.

3.3 CONTAMINANT MASS

Mass balance and mass flux approaches can be used to indicate whether biodegradation is occurring and to estimate biodegradation rates (e.g., King et al., 1999; Devlin et al., 2002). One advantage of a mass-based approach is that the effects of dilution or dispersion, which can complicate interpretation of concentration data, do not change the total mass. For this evaluation, a mass balance (based on mass flux) was calculated at the two cross sections, allowing for a direct comparison of changes in plume composition over a given travel distance.

Contaminant concentration data between the cross sections are affected by transformation due to biodegradation and dispersion. Due to the effects of dispersion, the decline in contaminant concentrations between the cross sections does not necessarily indicate that biodegradation is reducing contaminant mass. Similarly, because biodegradation successively transforms PCE to TCE to cis-1,2-DCE to VC, which ultimately degrades to ethene, stable or increasing TCE, cis-1,2-DCE and VC concentrations between cross sections can occur even if VOCs are undergoing significant biodegradation. To provide a better understanding of potential biodegradation and to remove the effects of dispersion, total mass of PCE, TCE, cis-1,2-DCE, and VC, both in milligrams and moles, were calculated at each cross section. The contaminant transport model calibrated to estimate biodegradation rates, as discussed in Section 4, requires contaminant concentrations. Average concentrations of PCE, TCE, cis-1,2-DCE, and VC were also calculated for use in the model.

Contaminant mass and average concentration for each constituent at each cross section was calculated using the following procedure:

- The areas between successive contour intervals (e.g., between the 1 and 10 μg/L contours, 10 and 100 μg/L contours, etc.) were calculated using ArcView GIS software. These areas were converted to aquifer volumes using an arbitrary aquifer thickness perpendicular to the cross section of 1 foot.
- The aquifer volumes were converted to groundwater volumes by multiplying by a porosity of 0.3.
- The mass in milligrams between each contour interval was calculated by multiplying the water volume by the average concentration within that contour interval. The average concentration was calculated as the linear average between contour intervals (e.g., 5.5 μg/L was used between the 1 and 10 μg/L contours). For

areas not falling between two contour intervals, the average concentration was calculated by taking the linear average between the contoured concentration and the maximum concentration within that interval. For example, the highest concentration enclosed by the 10 μg/L PCE contour interval on Figure B-2a is 15.7 μg/L. The average concentration inside this contour was calculated as the average of 10 and 15.7 μg/L, or 12.85 μg/L. The total mass for each constituent was then calculated by summing the masses between each contour interval.

- The mass in moles for each constituent was calculated by dividing the total mass in each cross section by the molecular weight.

- The average concentration of each constituent was calculated by dividing the total mass in milligrams by the volume of water bounded by the 1 μg/L contour. The volume of water was calculated using the same assumptions of a 1 foot aquifer thickness and porosity of 0.30 described above.

Mass calculations were limited to the shallow sand unit. Based on the conceptual model, all mass within the shallow sand unit stays within this unit as it migrates downgradient, such that changes in mass between cross sections are only due to the effects of biodegradation. Two sets of mass calculations were performed for cross section A-A', one including the high concentrations area at the base of the shallow sand unit and one excluding this area. Results are summarized in Tables B-1 and B-2.

In cross section A-A', when the high concentration area at the base of the upper sand unit is included, the total chlorinated VOC mass is approximately 14.7 moles, of which approximately 66 percent is VC, 31 percent is cis-1,2-DCE, 3 percent is TCE, and less than 1 percent is PCE. When the high concentration area at the base of the upper sand unit is excluded, the total chlorinated VOC mass is approximately 10.1 moles, of which approximately 63 percent is VC, 37 percent is cis-1,2-DCE, and less than 1 percent is PCE and TCE. In cross section B-B', the total chlorinated VOC mass is approximately 0.6 moles, of which approximately 89 percent is VC, 10 percent is cis-1,2-DCE, 1 percent is TCE, and less than 1 percent is PCE.

Excluding the high concentration area at the base of the upper sand unit at cross section A-A', there is approximately a 94 percent reduction in total moles of chlorinated VOCs between cross sections A-A' and B-B'. Total moles of PCE decrease from 0.0027 to 0.0001, total moles of TCE decrease from 0.0084 to 0.0073, total moles of cis-1,2-DCE decrease from 3.7 to 0.06, and total moles of VC decrease from 6.4 to 0.5.

The molar mass estimates track changes in total plume mass and, therefore, are not affected by dispersion. The decreases in both total moles of chlorinated VOCs and moles of each individual constituent provide strong, compelling evidence that biodegradation is reducing contaminant concentrations between the facility and Sixth Avenue South.

The areas bounded by the 1 μg/L contour for each constituent (except PCE) are relatively unchanged between cross section A-A' and B-B' (Tables B-1 and B-2), with the contoured downgradient areas within about 10 to 15 percent of the contoured upgradient areas. The cross sectional area of the PCE plume is reduced by approximately 80 percent downgradient of the facility, likely due to reduction of the low initial PCE concentrations to below the laboratory detection limits. The relatively unchanged plume dimensions at the two cross sections indicate that transverse dispersion is not significantly affecting the plume between the facility and Sixth Avenue South, such that changes in average concentration (as shown on Table B-2) between these locations are primarily due to biodegradation.

4.0 ESTIMATION OF BIODEGRADATION RATES

Biodegradation rates were estimated by calibration of a BIOCHLOR model using the average contaminant concentrations at cross sections A-A' and B-B'. BIOCHLOR will also be used for the fate and transport modeling in the SWFS (see Appendix B). The BIOCHLOR (ver. 2.2) software was developed on behalf of the U.S. Air Force Center for Environmental Excellence by Groundwater Services, Inc. to assess natural attenuation of chlorinated solvents in groundwater. BIOCHLOR simulates the degradation of chlorinated solvent compounds in groundwater systems. BIOCHLOR is a Microsoft Excel programmed spreadsheet that simulates 1-D advection, 3-D dispersion, linear adsorption, and biotransformation via reductive dechlorination for chlorinated solvents.

4.1 DEGRADATION RATE ESTIMATE METHODS

Biodegradation rates were estimated by calibration of a BIOCHLOR model for the area between cross sections A-A' and B-B', using average concentrations at these locations. Values for most model input parameters were selected based on comments received from Ecology on previous modeling presented in the Draft RI Report and the physical dimensions of the area being modeled. These model input parameters and sources of the values are summarized in Table B-3.

Source area width and depth were selected as the plume width and depth measured at cross section A-A'. Source concentrations were selected as the average concentrations at cross section A-A', calculated by dividing the total mass for each constituent by the total groundwater volume within the 1 μg/L contour as determined in the contaminant mass estimates. The high concentration area at the base of the shallow sand unit was not included in this calculation, thereby reducing the source area concentrations used in the model. This has the conservative effect of producing lower biodegradation rates (longer half lives) from model calibration. The target model output concentrations for calibration were based on the average concentrations at cross section B-B'.

Biodegradation rates were estimated by calibrating the model output to the average concentrations at cross section B-B'. The PCE biodegradation rate was estimated by varying the PCE half life until the model predicted concentration equaled the average concentration at cross section B-B'. Then, keeping the PCE half life constant, the TCE biodegradation rate was estimated by varying the TCE half life until the predicted average concentration equaled the average concentration at cross section B-B'. This same procedure was followed for cis-1,2-DCE and VC. In all cases the generation of daughter products from the biodegradation of more highly chlorinated parent products was incorporated into the calibration, as is standard for BIOCHLOR model simulations.

4.2 ESTIMATED DEGRADATION RATES

Table B-4 presents the calibration targets, calibrated biodegradations rates, and model output. Calibrated half lives for PCE, TCE, cis-1,2-DCE, and VC of 1.2, 3.0, 0.65 and 0.82 years, respectively, produced the best fit to average concentrations at cross section B-B'. These half lives are within the range of commonly cited literature values for biodegradation of chlorinated VOCs under anaerobic conditions similar to conditions at the site shown on Table B-5 (e.g., Wiedemeier et al., 1999). The TCE and cis-1,2-DCE biodegradation rates are also generally similar to the rates estimated in the RI and used in modeling for the Downgradient FS (Geomatrix, 2005), while the estimated VC biodegradation rate is considerably faster than what was used in the Downgradient FS.

5.0 SENSITIVITY ANALYSIS

Two sets of sensitivity analyses were performed. The first sensitivity analysis evaluated the sensitivity of model output (contaminant concentration predictions at cross section B-B') to model inputs. This sensitivity analysis was limited to transverse dispersivity and biodegradation half lives. The second sensitivity analysis evaluated the sensitivity of estimated biodegradation rates on model input parameters. This sensitivity analysis considered different approaches to estimate contaminant mass and concentrations, and considered sensitivity to dispersivity and groundwater flow rate.

5.1 SENSITIVITY OF CONCENTRATION PREDICTIONS

Transverse dispersivity (α_y) was set to zero in calibrating the model, based on the observation that the cross sectional area of the plume had not significantly increased between the facility and Sixth Avenue South. In reality, horizontal dispersion perpendicular to the direction of flow is likely resulting in some reduction in contaminant concentrations. To evaluate the effects of including transverse dispersion, the calibrated model was run with a transverse dispersivity set equal to 0.1 times the longitudinal dispersivity (α_x). As shown on Table B-5, the modeled concentrations with transverse dispersivity included are virtually identical to the calibrated concentrations with no transverse dispersivity. This is due to the large width of the plume in the source area (650 feet) relative to the modeled flow path length (800 feet) and transverse dispersivity used (2.3 feet).

Model sensitivity to three sets of alternate biodegradation half lives was also evaluated. The first set of half lives used is from fate and transport modeling for areas downgradient of the facility that was previously performed for the Downgradient FS (Geomatrix, 2005). These biodegradation rates were selected based on comments received from the Washington State Department of Ecology (Ecology) on previous modeling presented in the Draft RI Report. The other two sets of half lives are literature values representing the high and low range of estimated biodegradation rates selected from Tables 6.6 and 6.7 of Wiedemeier et al. (1999). Biodegradation rates that were evaluated and resulting modeled concentrations are shown on Table B-5.

Using the biodegradation rates from the Downgradient FS slightly underestimates the average TCE concentrations, and overestimates the average cis-1,2-DCE and VC concentrations by factors of about 5 and 12 times, respectively. Using the low degradation rates from the literature overestimates the average concentrations, especially PCE, cis-1,2-DCE, and VC. Similarly, the high degradation rates underestimate the average measured concentrations.

Based on these results, the calibrated biodegradation rates, when used with the advection and adsorption parameters in Table B-3, most accurately simulate natural attenuation of chlorinated VOCs downgradient of the facility. Additionally, model results, at least over the area for which the calibrated model was developed, are not sensitive to inclusion of transverse dispersivity.

5.2 Sensitivity of Biodegradation Rates Estimates

The sensitivity of estimated biodegradation rates to estimates of contaminant concentrations, assumed groundwater flow rates, and assumed dispersivity was evaluated. Several alternate approaches to estimating upgradient and downgradient contaminant concentrations at the two cross sections were used, including:

- Using well data only at cross section locations A-A' and B-B'. Cross sections with chemical contours based only on well data are shown on Figures B-4a through B-4d and B-5a through B-5d. Several wells shown on these cross sections were not used in Figures B-2a through B-2d and B-3a through B-3d, because they were considered too far upgradient or downgradient of the cross section locations. These additional wells were included in these cross sections to help fill data gaps and provide better coverage of the width and depth of the plume that were previously defined by probe data.

- Using the same well and probe data as were originally used at cross section location A-A' (Figures B-2a through B-2d) and adding additional wells to cross section B-B'. Revised cross sections at B-B' with chemical contours based on probe and well data are shown on Figures B-6a through B-6d.

- Constructing a new cross section at location C-C' using well data only and comparing to results at B-B' constructed using well data only (Figures B-3a through B-3d). New cross sections at C-C' with chemical contours based on well data are shown on Figures B-7a through B-7d.

Contaminant mass and average concentrations were calculated for these new cross sections, and biodegradation rates were estimated following the same approach discussed in Sections 3 and 4. Table B-6 presents the results of these analyses. In general, the revised mass calculation approaches result in little variability for estimated PCE, cis-1,2-DCE, and VC biodegradation rates. Estimated PCE biodegradation rates range from 1.1 to 1.7 years compared to a base case estimate of 1.2 years, cis-1,2-DCE biodegradation rates range from 0.46 to 1.7 years compared to a base case estimate of 0.65 years, and VC biodegradation rates range from 0.17 to 1.1 years compared to a base case estimate of 0.82 years.

Estimated biodegradation rate sensitivity to groundwater flow rate and dispersivity was also evaluated. Applying same input parameters as were used in estimating biodegradation rates in Section 4.2, the assumed groundwater flow rate was varied by a factor of two. The estimated biodegradation rate varies inversely with the flow rate, approximately doubling when the flow rate is halved, and getting halved when the flow rate is doubled. Similarly, sensitivity to dispersivity was evaluated by varying the dispersivity between 8 and 80 feet, versus the value originally used of 22.6 feet. Estimated biodegradation rates were relatively insensitive to changes in dispersivity, with marginal increases due to increased dispersivity, and virtually no decrease due to decreased dispersivity.

6.0 COMPARISON OF MODELED TO MEASURED POINT DATA

An additional evaluation of the validity of the estimated biodegradation rates was performed by comparing model predicted concentrations to measured point concentrations in wells downgradient of the facility. Biodegradation rates estimated in Section 4.2 were used with two sets of initial concentrations and compared to concentrations in downgradient wells. The first set of initial concentrations was the average concentrations calculated inside the wall in Section 4.2 and shown for cross section A-A' in Table 4-2. The second set of initial concentrations were taken as the exposure point concentrations (EPCs) at monitoring well CG-124-WT which has generally the highest concentrations of chlorinated ethenes in water table and shallow depth interval wells located between the barrier wall and Denver Avenue South. The EPC concentrations were calculated in Section 3 of the main report, and are either the upper 95% upper confidence limit on the means concentrations at each well or the maximum concentration at that well.

Modeled results are compared to EPC concentrations at water table and shallow depth interval monitoring wells CG-124-WT, CG-124-40, CG-125-40, CG-126-WT, CG-127-WT, CG-127-40, CG-131-WT, CG-131-40, CG-134-WT, and CG-134-40. These wells are generally located along a likely flow path from the facility to Fourth Avenue South. Model results and EPC values for these well are shown on Table B-8.

Using the average concentration inside the wall, the model under predicts PCE and TCE concentrations in the water table depth interval, primarily because the average initial concentrations used are lower than the downgradient point concentrations. The model over predicts PCE and TCE concentrations in the shallow depth interval. For cis-1,2-DCE and VC the model either greatly over predicts or shows reasonably close agreement with the downgradient concentrations in both the water table and shallow intervals, until the water table sample at CG-131 and the shallow sample at CG-134 located near Fourth Avenue South, where the well data show a sudden increase in cis-1,2-DCE and VC, as well as TCE at CG-131. The

TCE and cis1,2-DCE concentrations at CG-131-WT are higher than any source are concentrations near the facility, implying a potential off site source in this area.

Using the EPC data from well CG-124-WT as the initial concentration, the model predictions show very close agreement with well data to at least 900 feet downgradient at well CG-127. At CG-131 and CG-134 the model again under predicts the well data, due to the sudden increase in TCE, cis-1,2-DCE, and VC at these wells.

7.0 SUMMARY

Total mass in milligrams and moles, plume areas perpendicular to flow, and average concentrations were estimated at two cross sections located near the facility. Mass balance results indicate that biodegradation of chlorinated ethenes is occurring between the facility and Sixth Avenue South, with approximately 94 percent of the total moles of PCE, TCE, cis-1,2-DCE, and VC attenuated between these locations. The relatively unchanged plume dimensions between these locations indicate that dispersion is not significantly affecting the plume, and that changes in average concentration are primarily due to biodegradation.

Biodegradation rates were estimated by calibrating a contaminant transport model using the average concentrations at the cross sections. Estimated biodegradation rates are within the range of commonly cited literature values. Predicted concentrations from the calibrated model were compared to predicted concentrations using a range of biodegradation rates, including rates previously used in the Downgradient FS. The biodegradation rates from the calibrated model provided the best fit to the concentration data, while the alternate biodegradation rates significantly overestimated or underestimated average measured concentrations.

Sensitivity analyses were performed to evaluate the sensitivity of estimated biodegradation rates to various other estimates of average chlorinated ethene concentrations at the cross sections. Estimated biodegradation rates were relatively insensitive to the alternative concentration estimates, and no strong bias in using well data versus probe data could be determined.

Model results using average concentrations inside the wall as well as concentrations from well CG-124-WT as the initial concentration resulting in either over predictions or a reasonable fit to point data from wells. The model underestimated well data at two locations near Fourth Avenue South, where chlorinated ethene concentrations increase rapidly, and TCE and cis-1,2-DCE were higher than the source concentrations used in the model.

In conclusion, the estimated biodegradation rates for PCE, TCE, cis-1,2-DCE, and VC of 1.2, 3, 0.65, and 0.82 years, respectively, provide the most reasonable fit of model results to field data and are suitable for use in predictive biodegradation modeling.

8.0 REFERENCES

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TABLE B-1

SUMMARY OF PLUME CHARACTERISTICS, INCLUDING HIGH CONCENTRATION AREA IN CROSS SECTION A-A'

PSC Georgetown
Seattle, Washington

Cross Sectional Area	Cross Section	
Plume area at Section (ft^2)	A-A'	B-B'
PCE	3,425	690
TCE	9,500	9,500
DCE	24,000	21,000
VC	24,000	20,000

Mass	Cross Section	
Total Mass at Section (in mg)	A-A'	B-B'
PCE	480	9
TCE	52,000	960
DCE	440,000	6,100
VC	610,000	34,000
Change in Mass (in mg)		
PCE	-470	
TCE	-51,000	
DCE	-430,000	
VC	-580,000	

Moles	Cross Section	
Total Moles at Section	A-A'	B-B'
PCE	0.0029	0.0001
TCE	0.4	0.0073
DCE	4.5	0.06
VC	9.8	0.54
Total	14.7	0.6
Change in Moles		
PCE	-0.0028	
TCE	-0.3884	
DCE	-4.48	
VC	-9.22	
Total	-14.0851	

Concentration	Cross Section	
Average Concentration (µg/L)	A-A'	B-B'
PCE	6.6	0.6
TCE	256	4.8
DCE	888	14
VC	1,182	81
Change in Concentration (µg/L)		
PCE	-6.0	
TCE	-252	
DCE	-874	
VC	-1,101	

Notes:
1. Mass and mole totals are for a 1-foot thick volume of aquifer along each section. Negative values indicate a decrease in mass or concentration.

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TABLE B-2

SUMMARY OF PLUME CHARACTERISTICS,
NOT INCLUDING HIGH CONCENTRATION AREA IN CROSS SECTION A-A'

PSC Georgetown
Seattle, Washington

Cross Sectional Area	Cross Section	
Plume area at Section (ft^2)	A-A'	B-B'
PCE	3,300	690
TCE	8,200	9,500
DCE	22,000	21,000
VC	22,000	20,000

Mass	Cross Section	
Total Mass at Section (in mg)	A-A'	B-B'
PCE	440	9
TCE	1,100	960
DCE	360,000	6,100
VC	400,000	34,000
Change in Mass (in mg)		
PCE	-430	
TCE	-140	
DCE	-350,000	
VC	-370,000	

Moles	Cross Section	
Total Moles at Section	A-A'	B-B'
PCE	0.0027	0.0001
TCE	0.0084	0.0073
DCE	3.7	0.06
VC	6.4	0.5
Total	10.1	0.6
Change in Moles		
PCE	-0.0026	
TCE	-0.0011	
DCE	-3.65	
VC	-5.86	
Total	-9.5119	

Concentration	Cross Section	
Average Concentration (µg/L)	A-A'	B-B'
PCE	6.4	0.6
TCE	6.1	4.8
DCE	774	14
VC	856	81
Change in Concentration (µg/L)		
PCE	-5.8	
TCE	-1.3	
DCE	-760	
VC	-776	

Notes:
1. Mass and mole totals are for a 1-foot-thick volume of aquifer along each section.
   Negative values indicate a decrease in mass or concentration.

TABLE B-3

BIOCHLOR INPUT PARAMETERS FOR MODEL CALIBRATION

PSC Georgetown
Seattle, Washington

Parameter	Value	Units	Source
Advection			
Hydraulic Conductivity	0.032	cm/s	Geometric mean of shallow sand unit hydraulic conductivity values
Hydraulic Gradient	0.0017	ft/ft	Site-wide average from the Draft RI report
Effective Porosity	0.3	unitless	Ecology default value
Seepage Velocity	187.6	ft/yr	Calculated
Dispersion			
α_x	22.6	Feet	Calculated using modified Xu and Ekstein equation
α_y	0	Feet	No transverse dispersion, minimal change in plume area observed between cross sections
α_z	0	Feet	No vertical dispersion into intermediate unit assumed
Adsorption			
Soil Bulk Density	1.51	kg/L	Ecology default value
Fraction Organic Carbon	0.001	unitless	Ecology default value
PCE Partition Coefficient	265	L/kg	Ecology default value
TCE Partition Coefficient	94	L/kg	Ecology default value
DCE Partition Coefficient	35.5	L/kg	Ecology default value
VC Partition Coefficient	18.6	L/kg	Ecology default value
Model Dimensions			
Model Length	800	Feet	Distance between cross section A-A' and B-B'
Model Width	1500	Feet	Sufficiently wide to define downgradient plume
Source Area Width	650	Feet	Plume width at cross section A-A'
Source Area Depth	50	Feet	Average plume thickness at cross section A-A'
Simulation Time	30	Years	Sufficient time to reach steady state conditions
Source Data			
PCE Concentration	6.4	µg/L	Average concentration at cross section A-A'
TCE Concentration	6.1	µg/L	Average concentration at cross section A-A'
DCE Concentration	774	µg/L	Average concentration at cross section A-A'
VC Concentration	856	µg/L	Average concentration at cross section A-A'
Source Type	Continuous, single planar		Constant source assumed

TABLE B-4

BIOCHLOR CALIBRATION TARGETS AND RESULTS

PSC Georgetown

Seattle, Washington

Parameter	Value	Units	Source
Calibration Targets			
PCE Concentration	0.6	µg/L	Average concentration at cross section B-B'
TCE Concentration	4.8	µg/L	Average concentration at cross section B-B'
DCE Concentration	14	µg/L	Average concentration at cross section B-B'
VC Concentration	81	µg/L	Average concentration at cross section B-B'
Biodegradation - 1st Order Decay Half Life			
PCE to TCE	1.2	Years	Model calibration
TCE to DCE	3.0	Years	Model calibration
DCE to VC	0.65	Years	Model calibration
VC to Ethene	0.82	Years	Model calibration
Calibrated Output			
PCE Concentration	0.6	µg/L	Model output
TCE Concentration	4.8	µg/L	Model output
DCE Concentration	14	µg/L	Model output
VC Concentration	81	µg/L	Model output

TABLE B-5

COMPARISON OF ALTERNATE DEGRADATION RATES

PSC Georgetown
Seattle, Washington

Biodegradation Half Lives in Years

	Calibrated Rates	Calibrated Rates with Transverse Dispersion	Downgradient FS Rates (1)	Literature Values - Low Rates (2)	Literature Values - High Rates (2)
PCE to TCE	1.2	1.2	1.2	10	0.58
TCE to DCE	3.0	3.0	2.14	14	0.76
DCE to VC	0.65	0.65	1.12	5.0	0.22
VC to Ethene	0.82	0.82	8.21	5.8	0.26

Modeled Concentration at Cross Section B-B' in µg/L

	Calibrated Rates	Calibrated Rates with Transverse Dispersion	Downgradient FS Rates (1)	Literature Values - Low Rates (2)	Literature Values - High Rates (2)	Average Measured Concentrations
PCE	0.6	0.6	0.6	4.8	0.1	0.6
TCE	4.8	4.7	3.5	6.1	0.6	4.8
DCE	14	14	67	433	0.2	14
VC	81	81	957	682	0.6	81

Notes:

1. Half lives are from the Downgradient FS (Geomatrix, 2005). PCE half life was not used in the Downgradient FS. The calibrated PCE half life developed in this appendix is used instead.
2. Literature values are from Tables 6.6 and 6.7 of Wiedemeier, et al., 1999.

TABLE B-6

BIODEGRADATION RATE ESTIMATE SENSITIVITY TO CONCENTRATION CALCULATIONS

PSC Georgetown
Seattle, Washington

	Concentration (μg/L)		Mass (mg)		Estimated Half Life
	A-A'	B-B'	A-A'	B-B'	(Years)
Base Case - Wells and Probes (Figures A-2 and A-3)					
PCE	6.4	0.6	441	9	1.2
TCE	6.1	4.8	1,056	962	3
DCE	774	14	357,232	6,108	0.65
VC	856	81	396,396	33,704	0.82
Wells Only, Added Wells at A-A' and B-B' (Figures A-4 and A-5)					
PCE	9.6	0.7	526	14	1.1
TCE	8.5	9.6	462	681	5.2
DCE	885	4.1	214,650	1,146	0.46
VC	91	1.5	23,805	956	0.17
Wells and Probes, Added Wells at B-B' (Figures A-2 and A-6)					
PCE	6.4	0.8	441	12	1.2
TCE	6.1	4.8	1,056	962	3
DCE	774	14	357,232	6,190	0.65
VC	856	55	396,396	34,872	0.7
C-C' at Denver Avenue, wells only (Figures A-7 and A-5)					
PCE	7.1	0.7	870	14	1.2
TCE	5.8	9.6	1,499	681	20
DCE	19	4.1	5,073	1,146	1.7
VC	31	1.5	6,250	956	0.6
Wells and Probes (Figures A-2 and A-3), Double Concentration at B-B'					
PCE	6.4	1.2	441	18	1.7
TCE	6.1	9.5	1,056	1,925	35
DCE	774	28	357,232	12,216	0.83
VC	856	161	396,396	67,408	1.1

TABLE B-7

ADDITIONAL BIODEGRADATION RATE ESTIMATE SENSITIVITY

PSC Georgetown

Seattle, Washington

Estimated Biodegradation Rates (Years)

Constituent	Base Case	Flow Rate		Longitudinal Dispersivity	
		x 2	x 0.5	80 ft	8 ft
PCE	1.2	0.60	2.4	1.0	1.2
TCE	3.0	1.5	6.1	2.9	3.0
DCE	0.65	0.33	1.3	0.51	0.69
VC	0.82	0.41	1.7	0.7	0.86

TABLE B-8

COMPARISON OF MODEL PREDICTIONS TO MEASURED WELL DATA
PSC Georgetown
Seattle, Washington

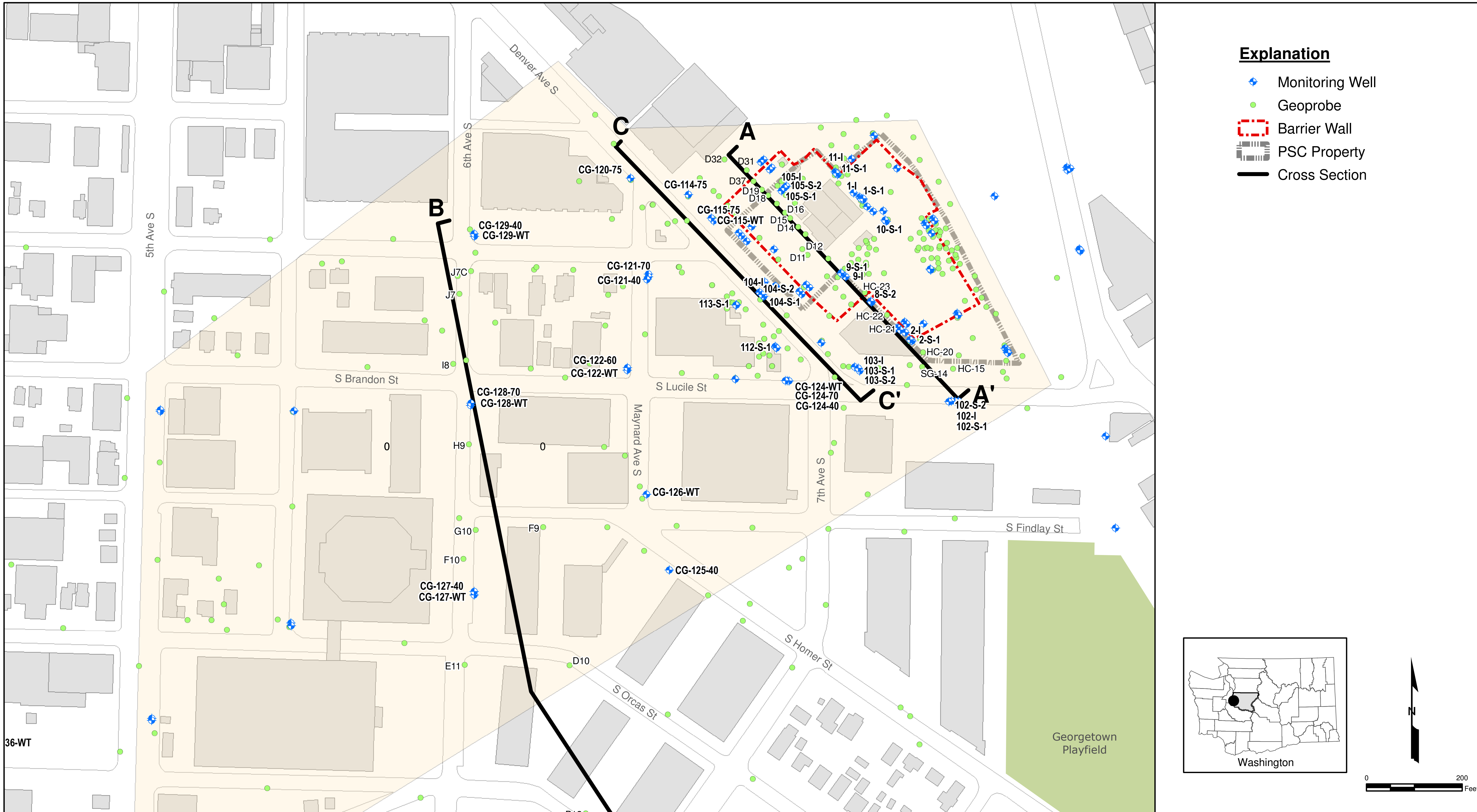
Average Concentration Inside Wall

Distance Downgradient	Location	Modeled PCE	Modeled TCE	Modeled DCE	Modeled VC	Measured - Water Table Interval PCE	Measured - Water Table Interval TCE	Measured - Water Table Interval DCE	Measured - Water Table Interval VC	Measured - Shallow Interval PCE	Measured - Shallow Interval TCE	Measured - Shallow Interval DCE	Measured - Shallow Interval VC
0		6.4	6.1	774	856								
100	CG-124	4.8	6.6	472	716	8.40	26.6	72.8	24.2	<0.01	1.91	2.58	5.32
600	CG-126/CG-125	1.2	5.6	41	170	1.86	19.1	11	2.5	<0.01	0.037	2.44	10.8
1000	CG-127	0.4	3.9	6.2	42	0.432	12.1	2.98	0.667	<0.05	0.03	5.17	12.6
1300	CG-131	0.2	2.9	1.8	14	<0.05	50.9	82.8	17.2	<0.05	<0.02	11	12.2
1600	CG-134	0.1	2.1	0.7	4.8	<0.05	0.052	0.27	0.791	<0.05	<0.02	37.6	19.2

Maximum Concentration at CG-124-WT

Distance Downgradient	Location	Modeled PCE	Modeled TCE	Modeled DCE	Modeled VC	Measured - Water Table Interval PCE	Measured - Water Table Interval TCE	Measured - Water Table Interval DCE	Measured - Water Table Interval VC	Measured - Shallow Interval PCE	Measured - Shallow Interval TCE	Measured - Shallow Interval DCE	Measured - Shallow Interval VC
0	CG-124	8.4	26.6	72.8	24.2	8.40	26.6	72.8	24.2	<0.01	1.91	2.58	5.32
500	CG-126/CG-125	2.0	18.1	9.1	16.5	1.86	19.1	11	2.5	<0.01	0.037	2.44	10.8
900	CG-127	0.7	12.1	3.1	6.1	0.432	12.1	2.98	0.667	<0.05	0.03	5.17	12.6
1200	CG-131	0.3	8.7	1.9	3.1	<0.05	50.9	82.8	17.2	<0.05	<0.02	11	12.2
1500	CG-134	0.1	6.2	1.3	1.8	<0.05	0.052	0.27	0.791	<0.05	<0.02	37.6	19.2

Notes:
1. Modeled and measured concentrations are in mg/L.



CROSS SECTION LOCATION
PSC Georgetown
Seattle, Washington

By: klb	Date: 2/17/2006	Project No. 8770
Geomatrix		Figure B-1

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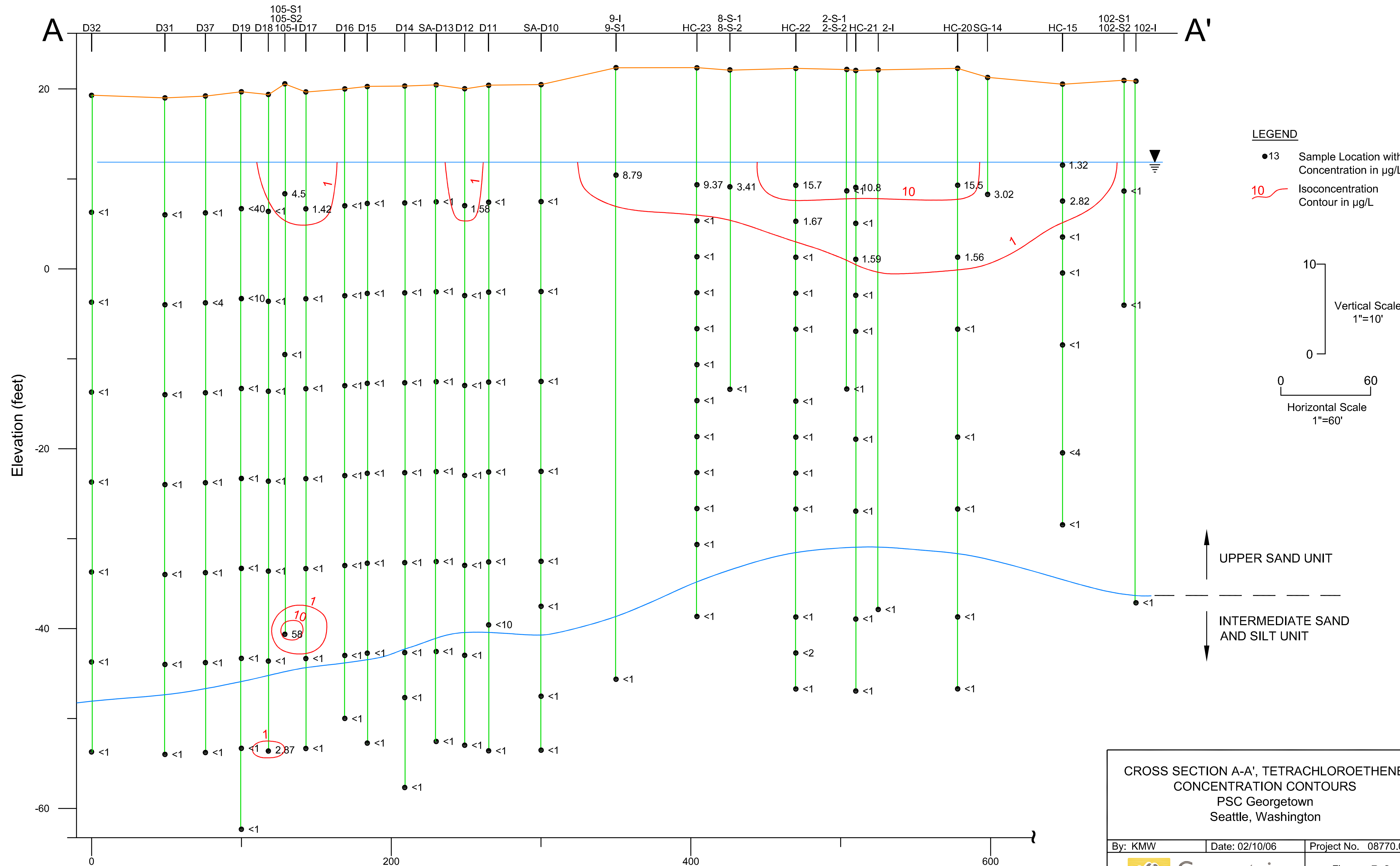

CROSS SECTION A-A', TETRACHLOROETHENE CONCENTRATION CONTOURS
PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/10/06 | Project No. 08770.005

Geomatrix

Figure B-2a

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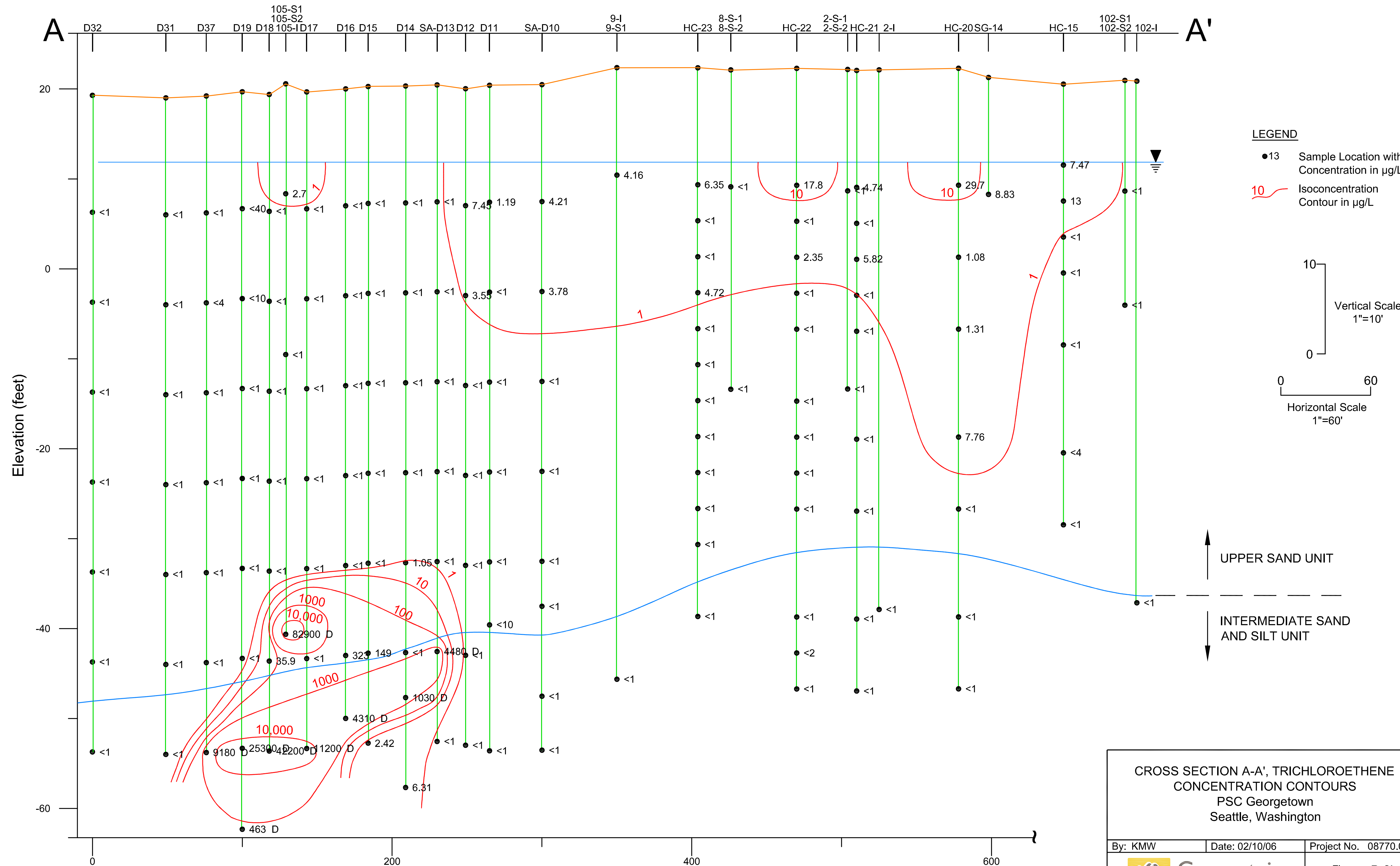

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PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/10/06	Project No. 08770.005
Geomatrix		Figure B-2b

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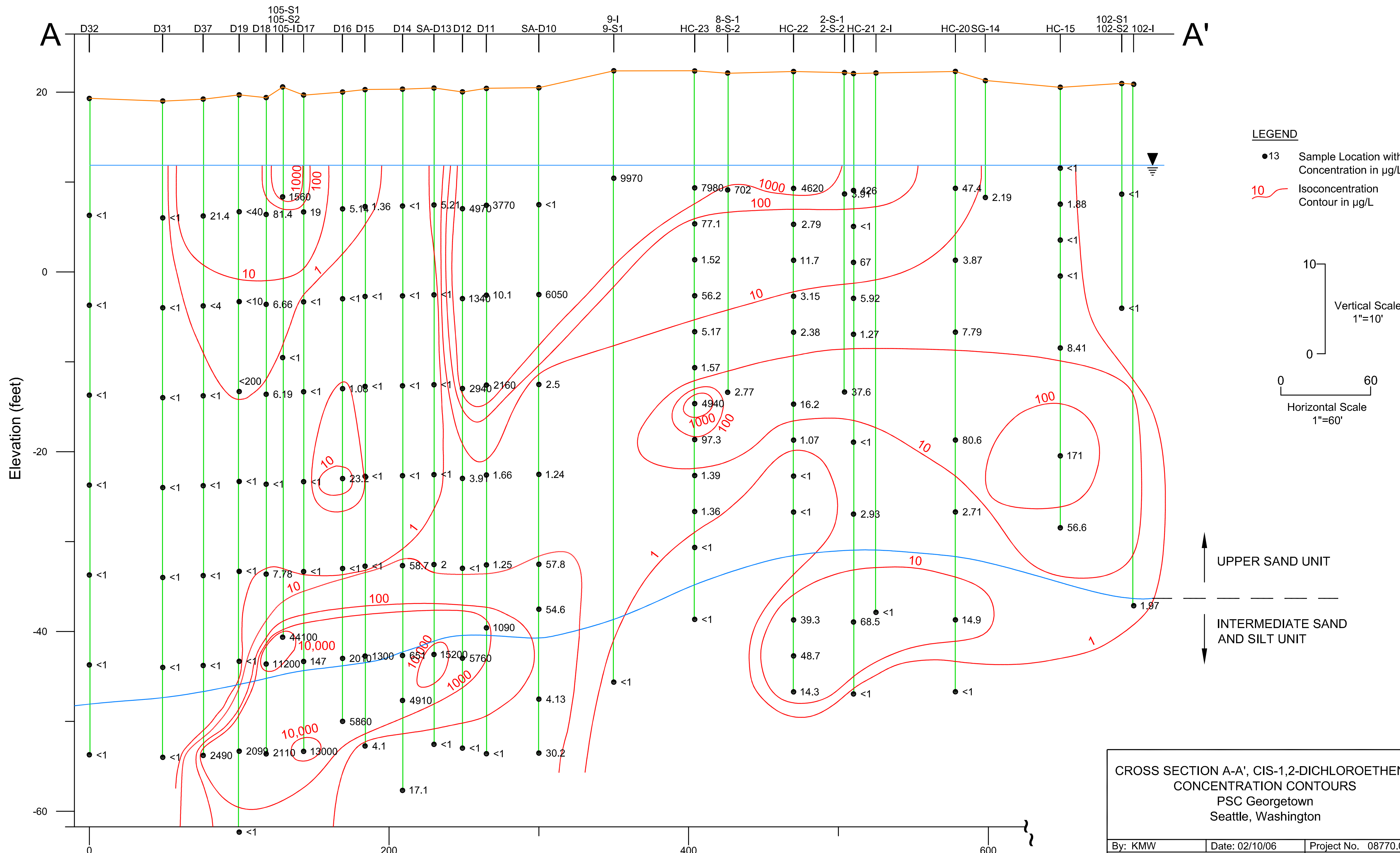

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PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/10/06 | Project No. 08770.005

Geomatrix

Figure B-2c

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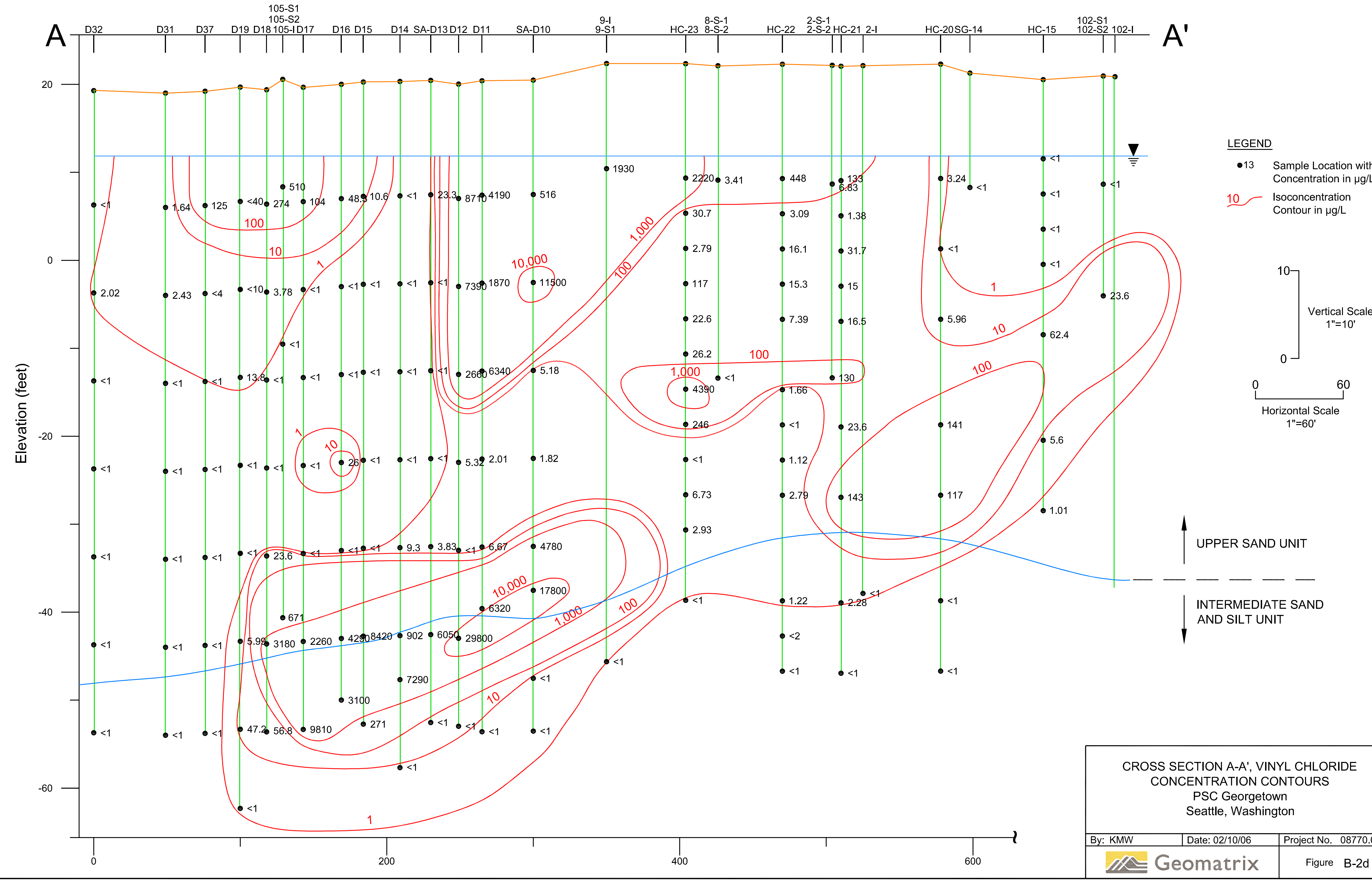

CROSS SECTION A-A', VINYL CHLORIDE CONCENTRATION CONTOURS
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/10/06	Project No. 08770.005
Geomatrix		Figure B-2d

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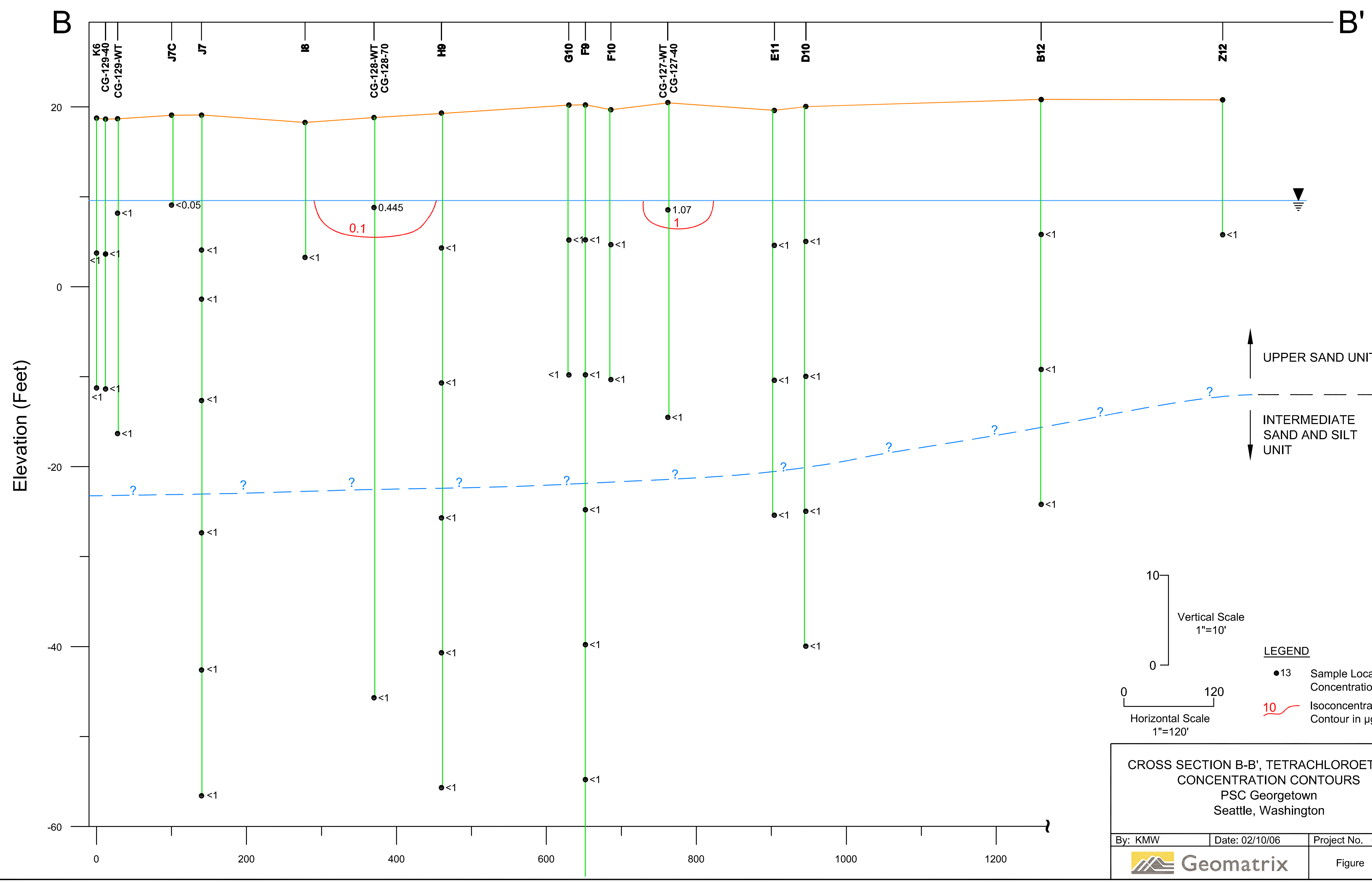

CROSS SECTION B-B', TETRACHLOROETHENE CONCENTRATION CONTOURS
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/10/06	Project No. 08770.005
Geomatrix		Figure B-3a

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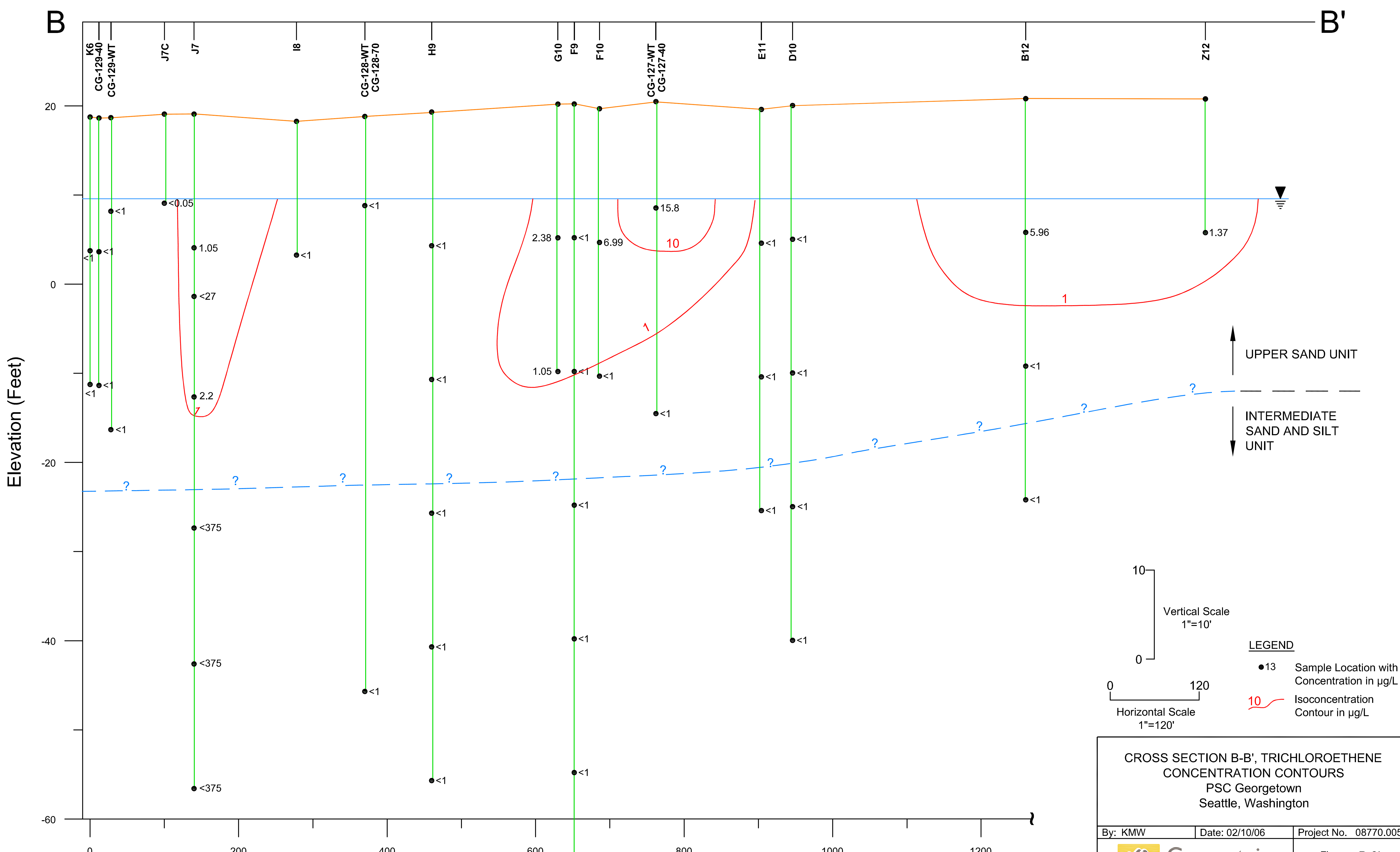

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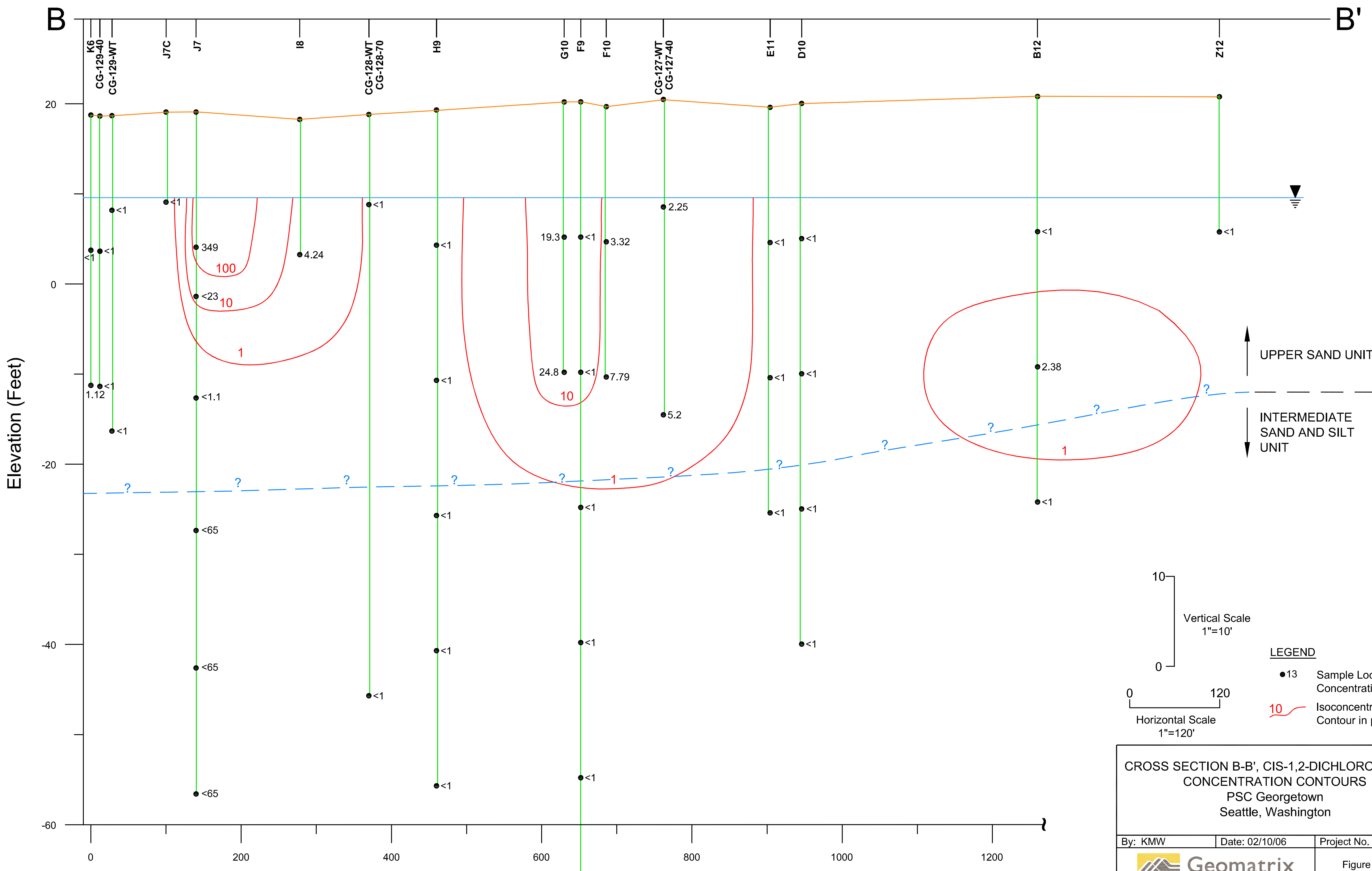
PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/10/06 | Project No. 08770.005

Geomatrix

Figure B-3b



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PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/10/06 | Project No. 08770.005

Geomatrix

Figure B-3c

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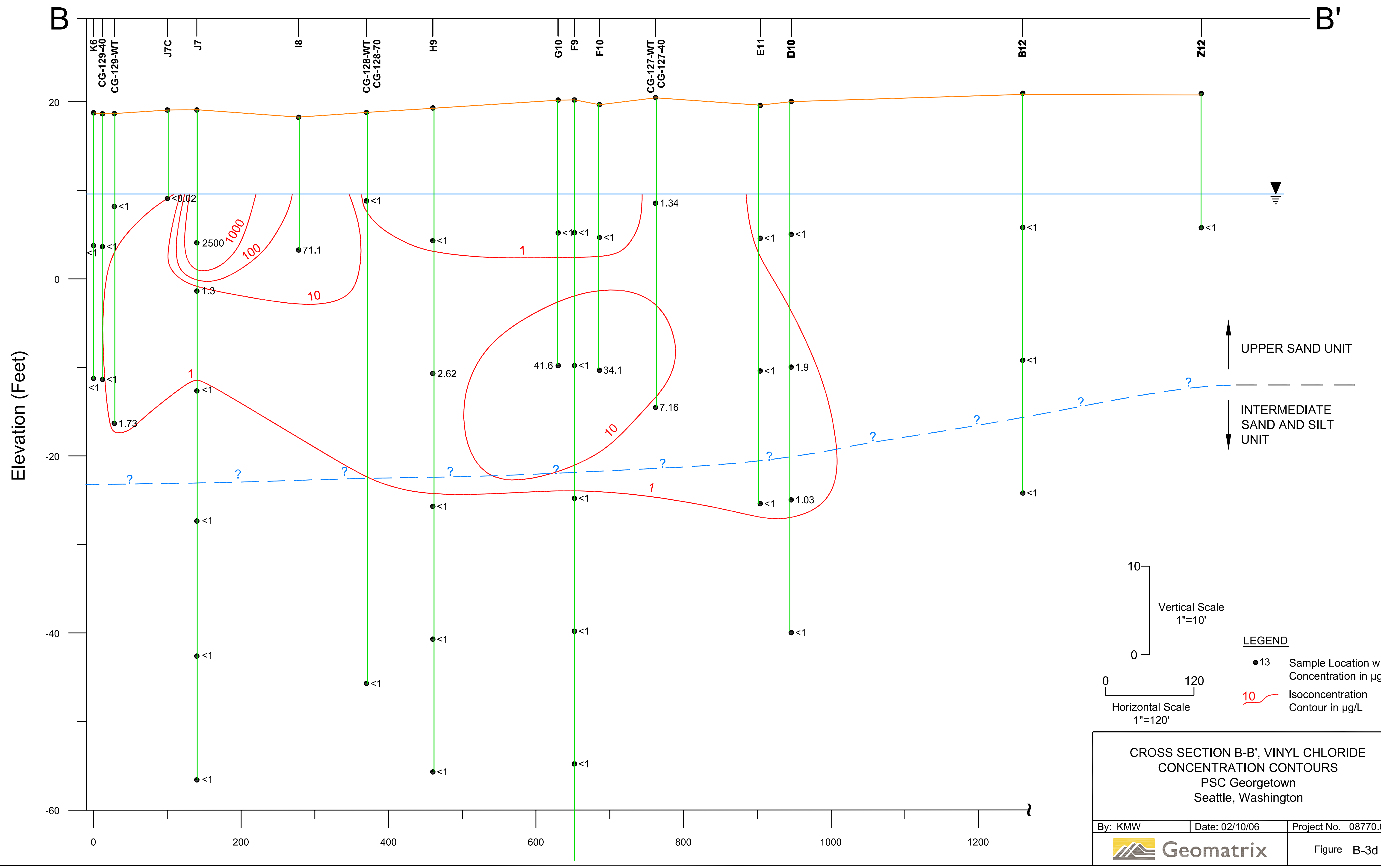

CROSS SECTION B-B', VINYL CHLORIDE CONCENTRATION CONTOURS
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/10/06	Project No. 08770.005
Geomatrix		Figure B-3d

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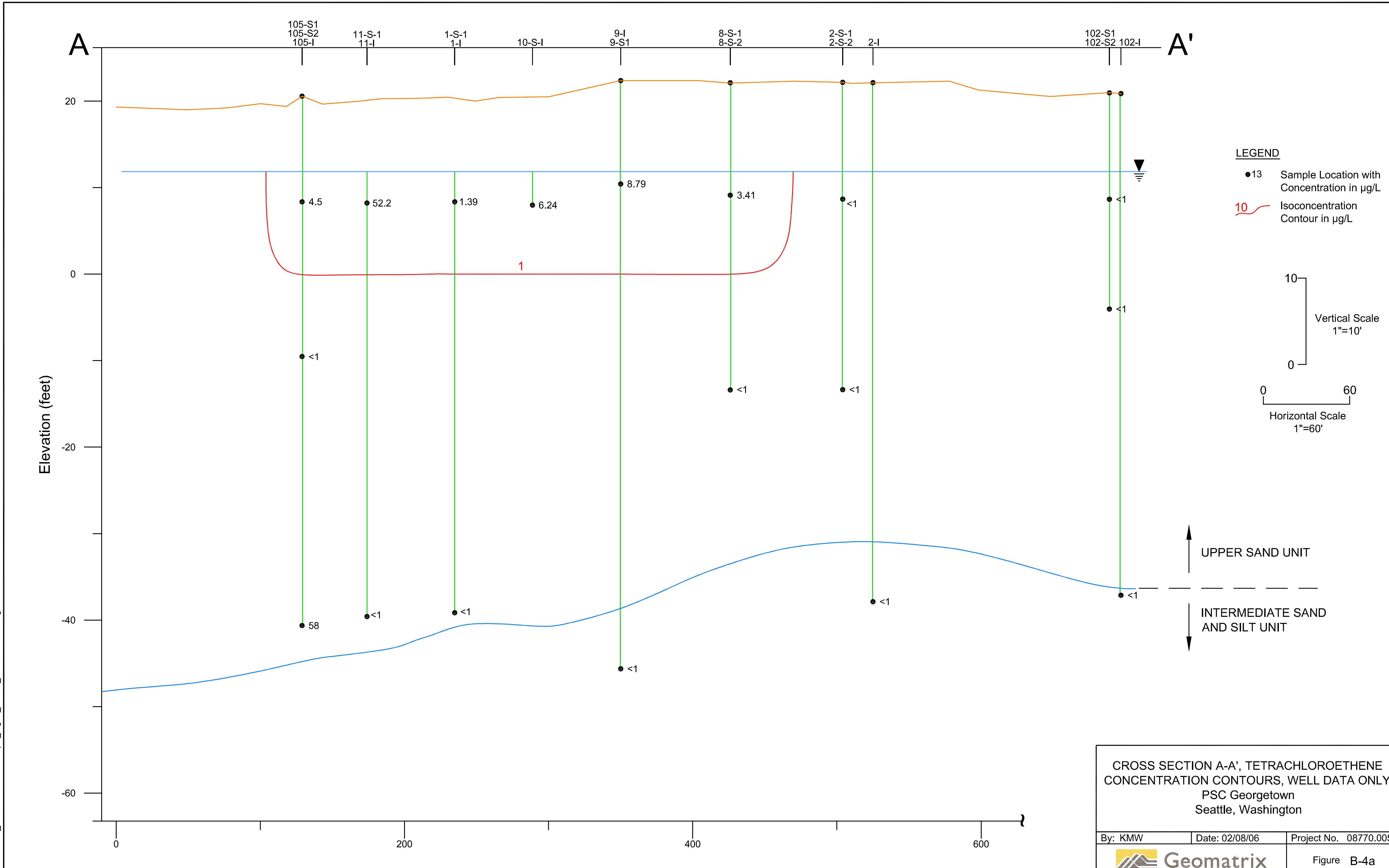
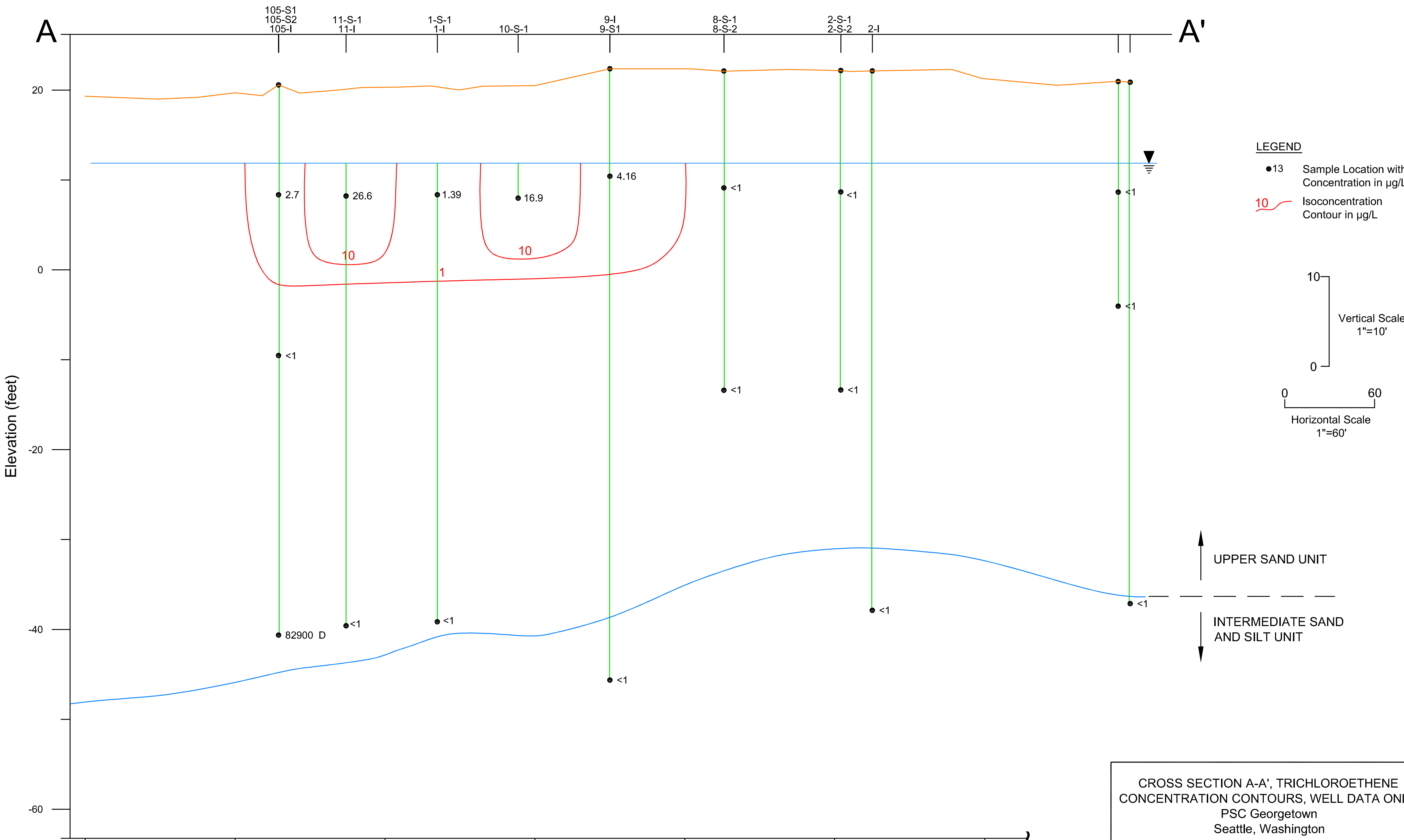


CROSS SECTION A-A', TETRACHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-4a



CROSS SECTION A-A', TRICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-4b

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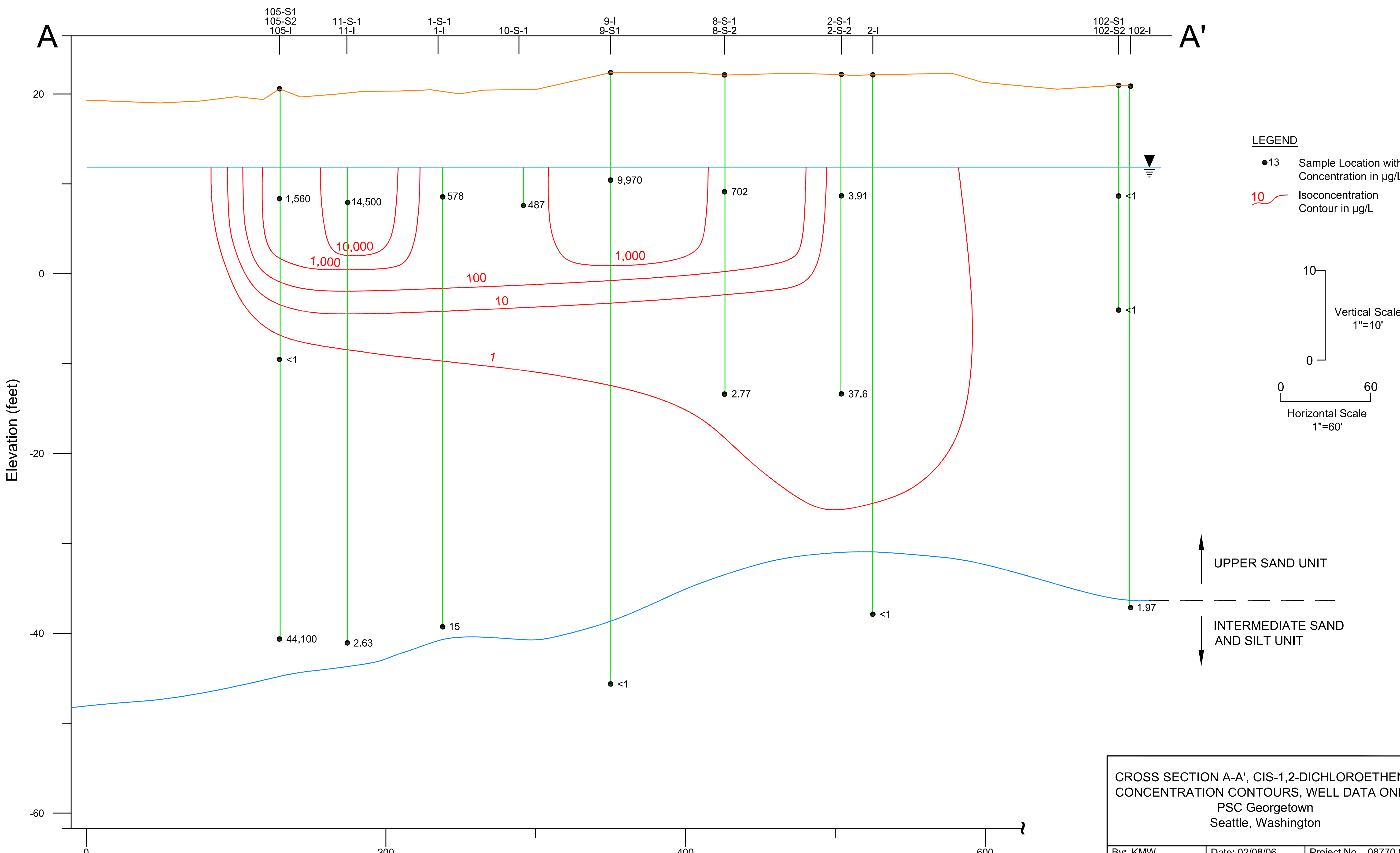

CROSS SECTION A-A', CIS-1,2-DICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/08/06 | Project No. 08770.005

Geomatrix | Figure B-4c

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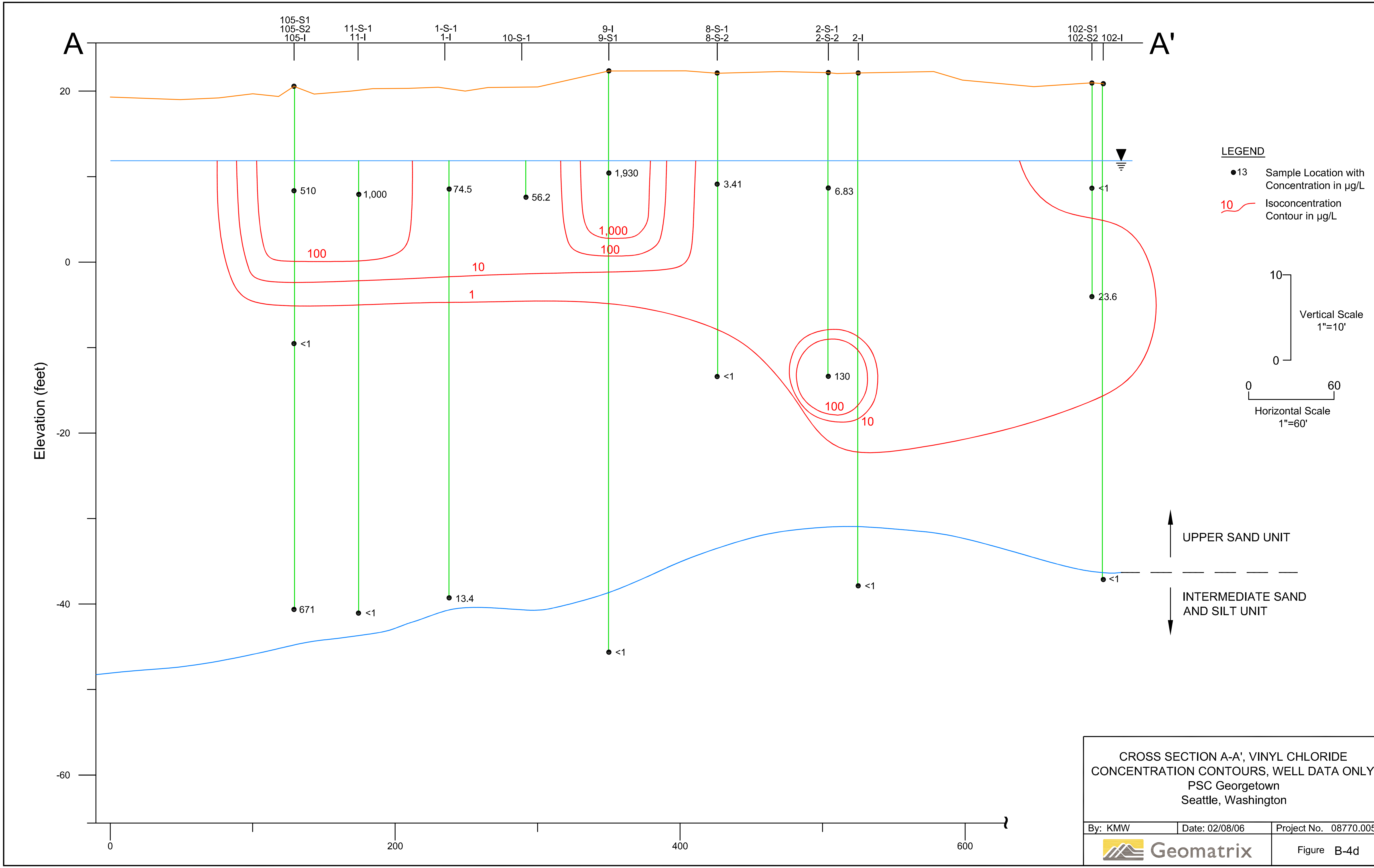

CROSS SECTION A-A', VINYL CHLORIDE CONCENTRATION CONTOURS, WELL DATA ONLY
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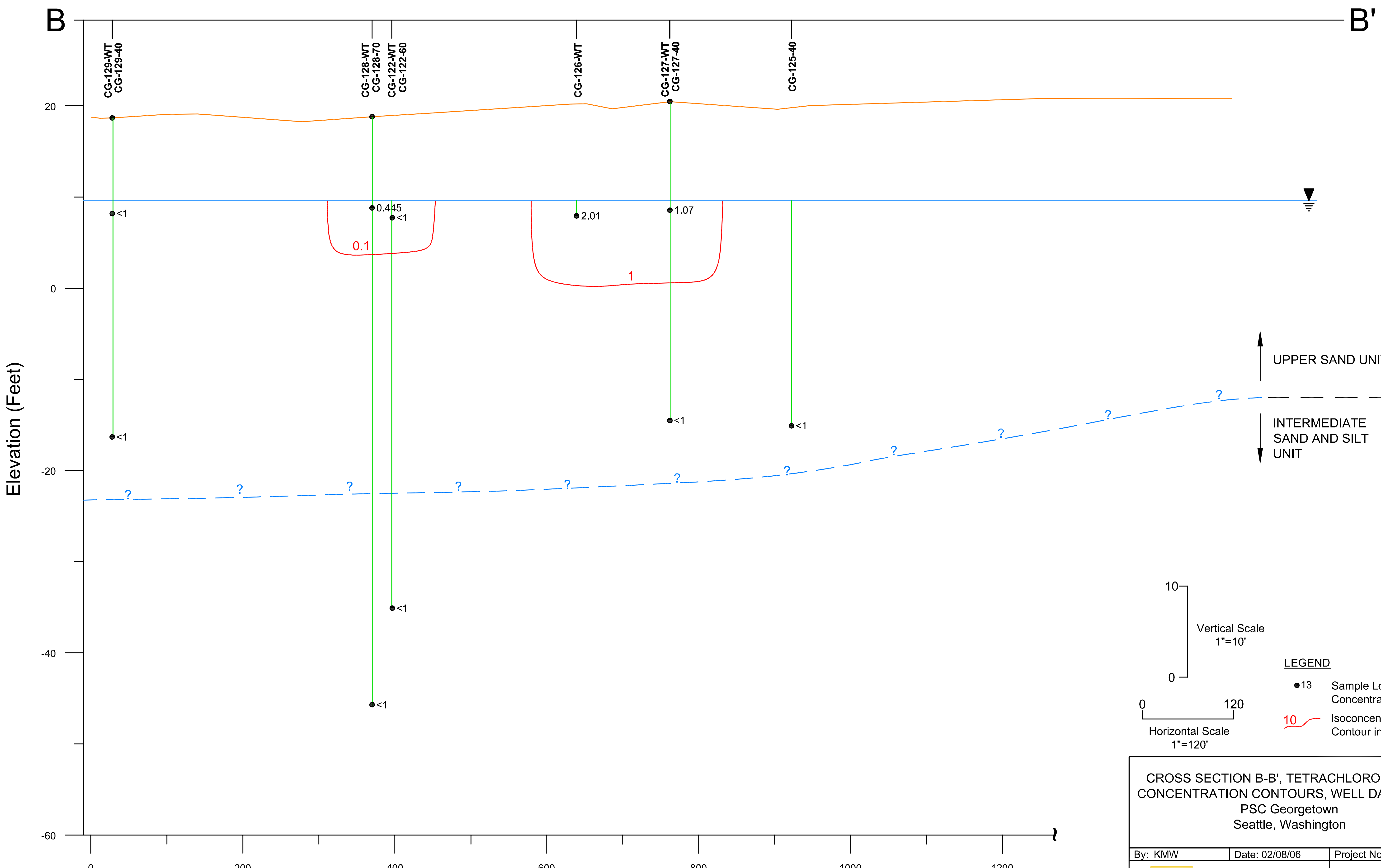
Geomatrix | Figure B-4d



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PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-5a

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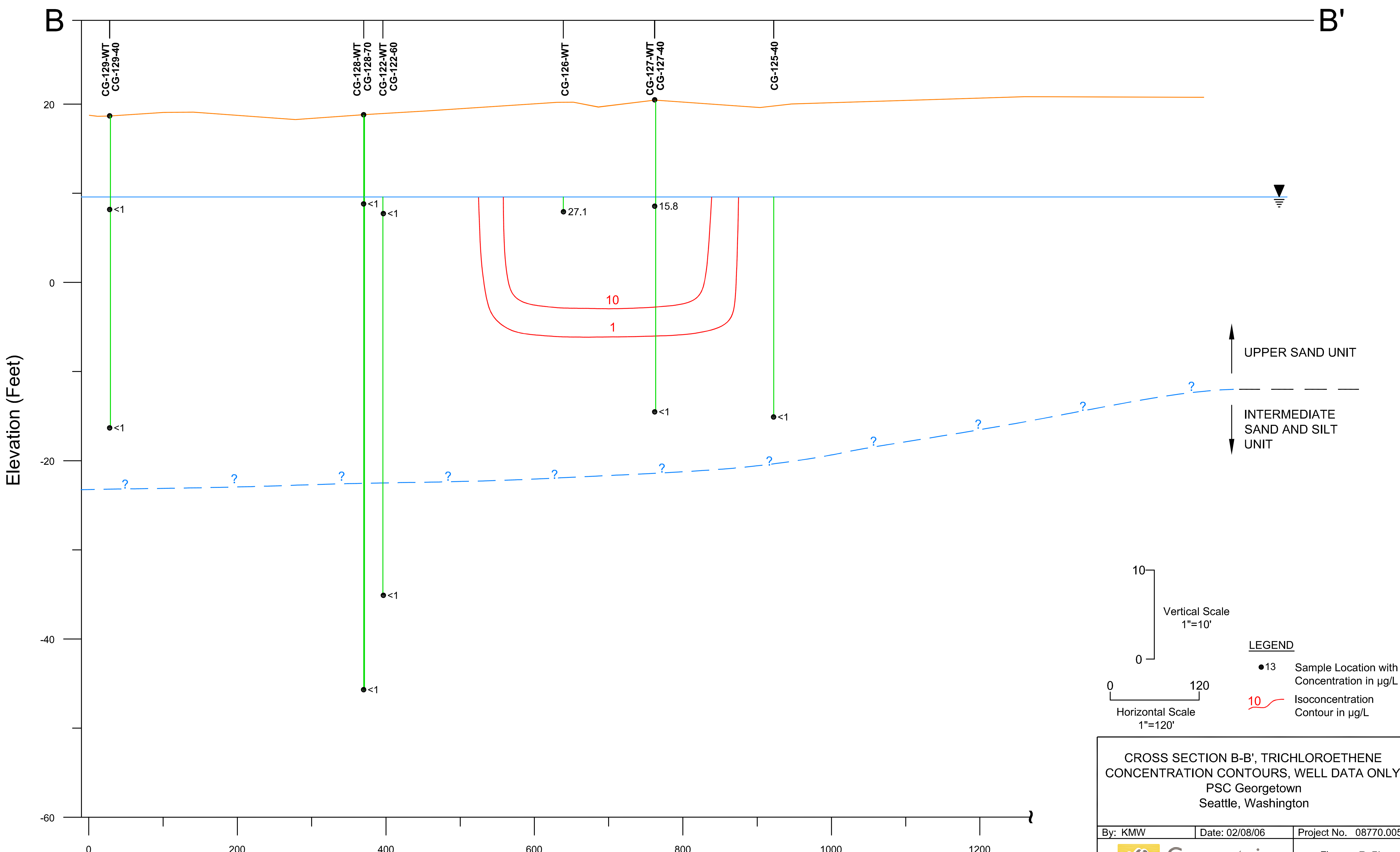

CROSS SECTION B-B', TRICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
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By: KMW | Date: 02/08/06 | Project No. 08770.005

Geomatrix

Figure B-5b

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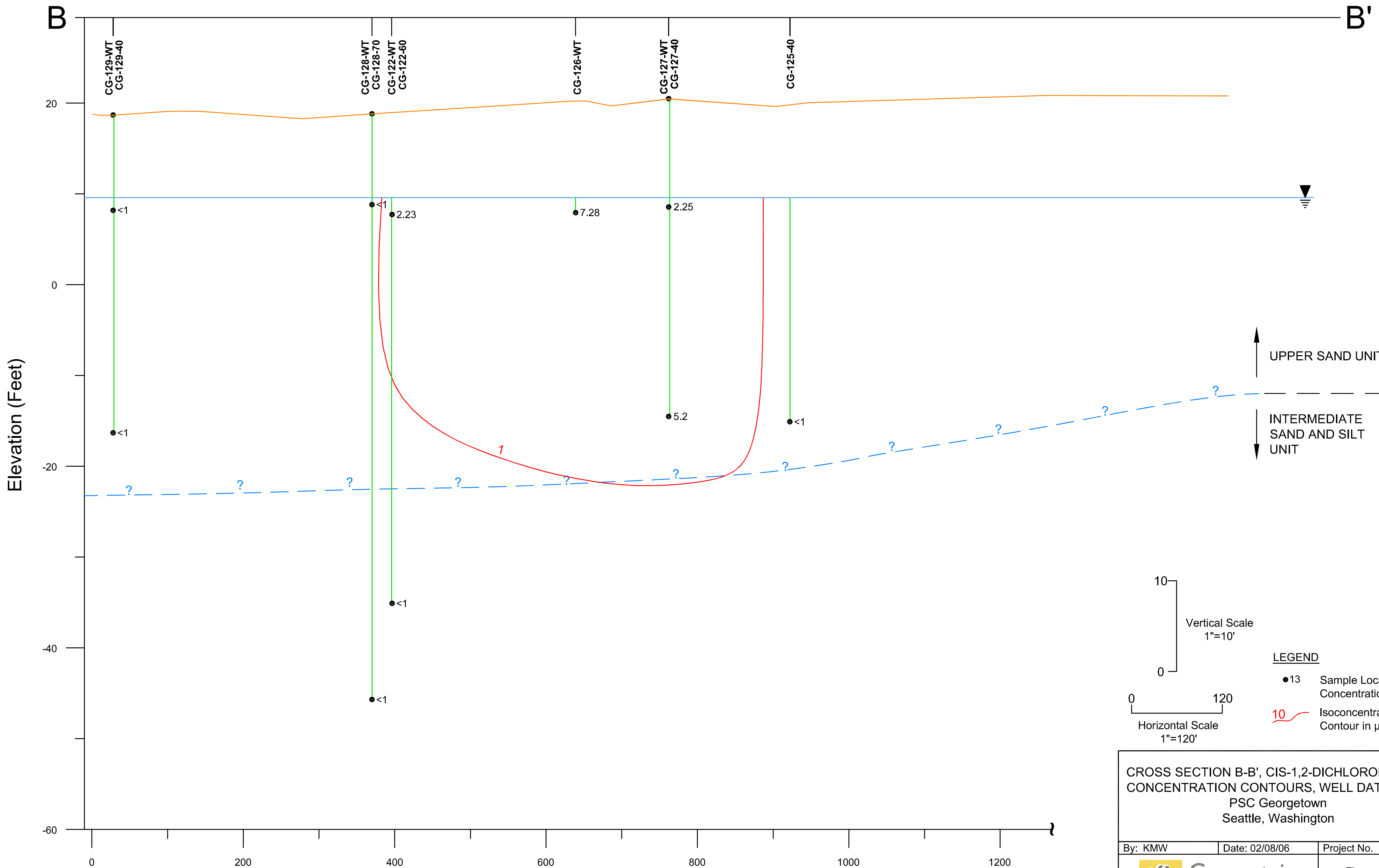

CROSS SECTION B-B', CIS-1,2-DICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-5c

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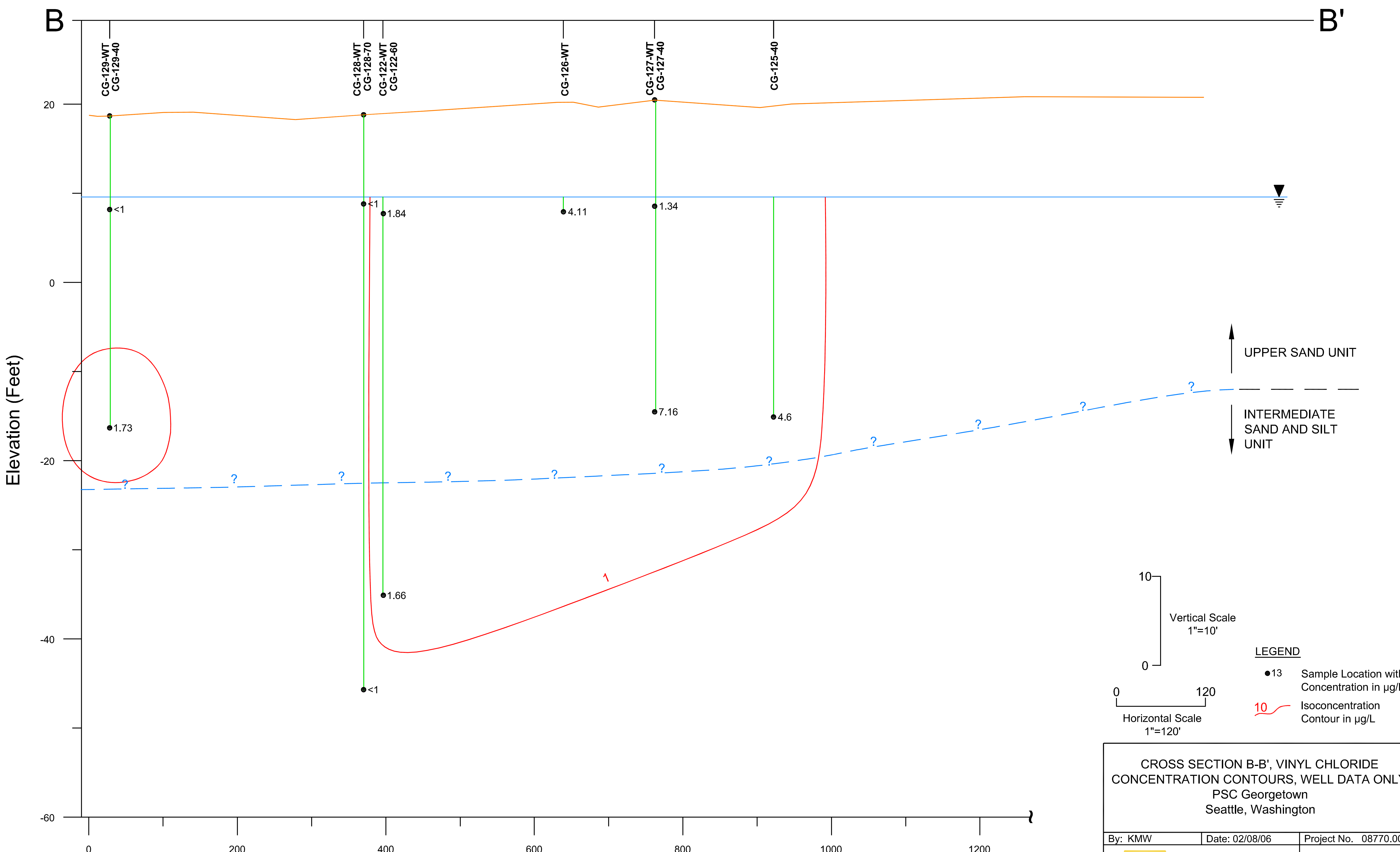

CROSS SECTION B-B', VINYL CHLORIDE CONCENTRATION CONTOURS, WELL DATA ONLY
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Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-5d

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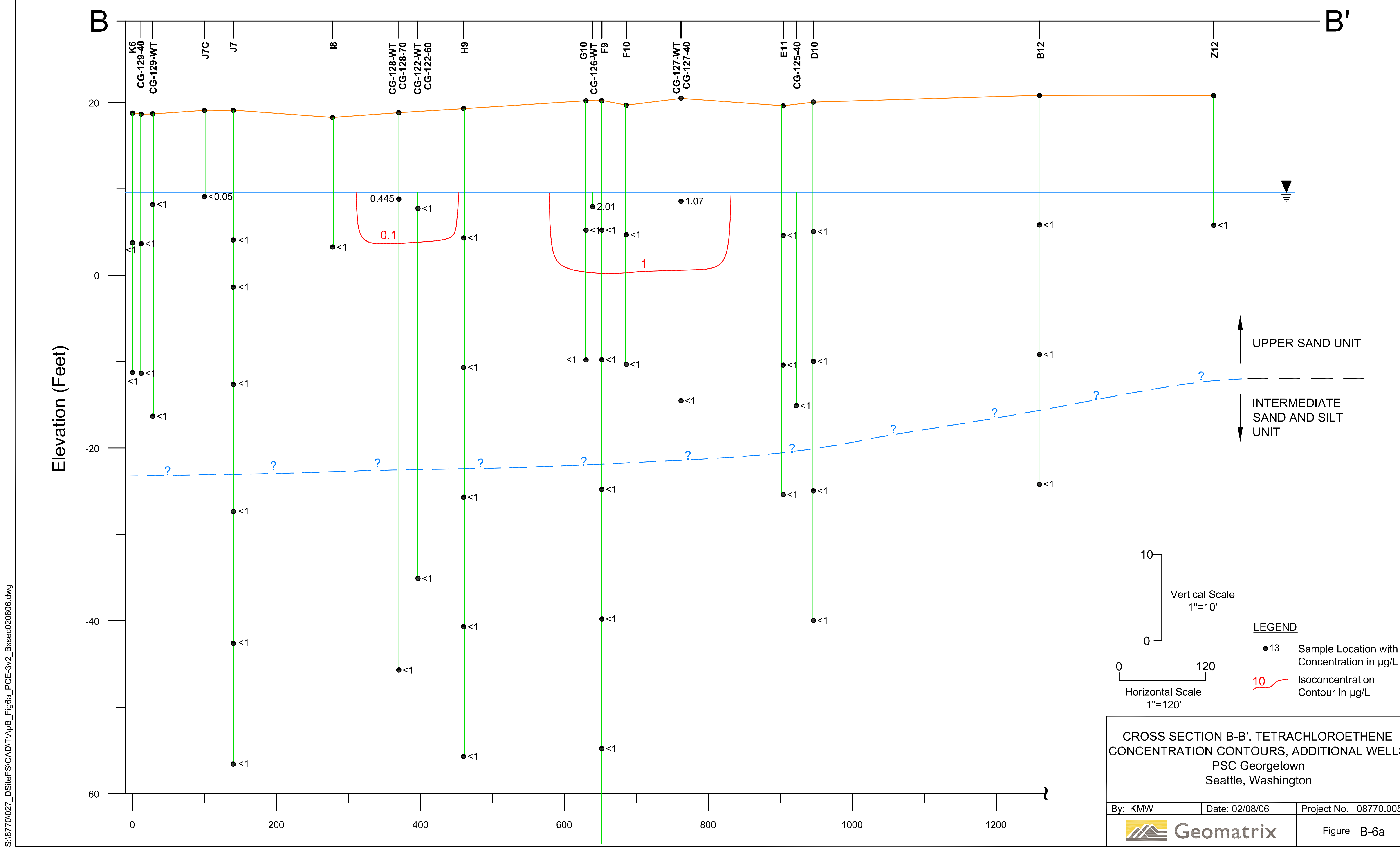
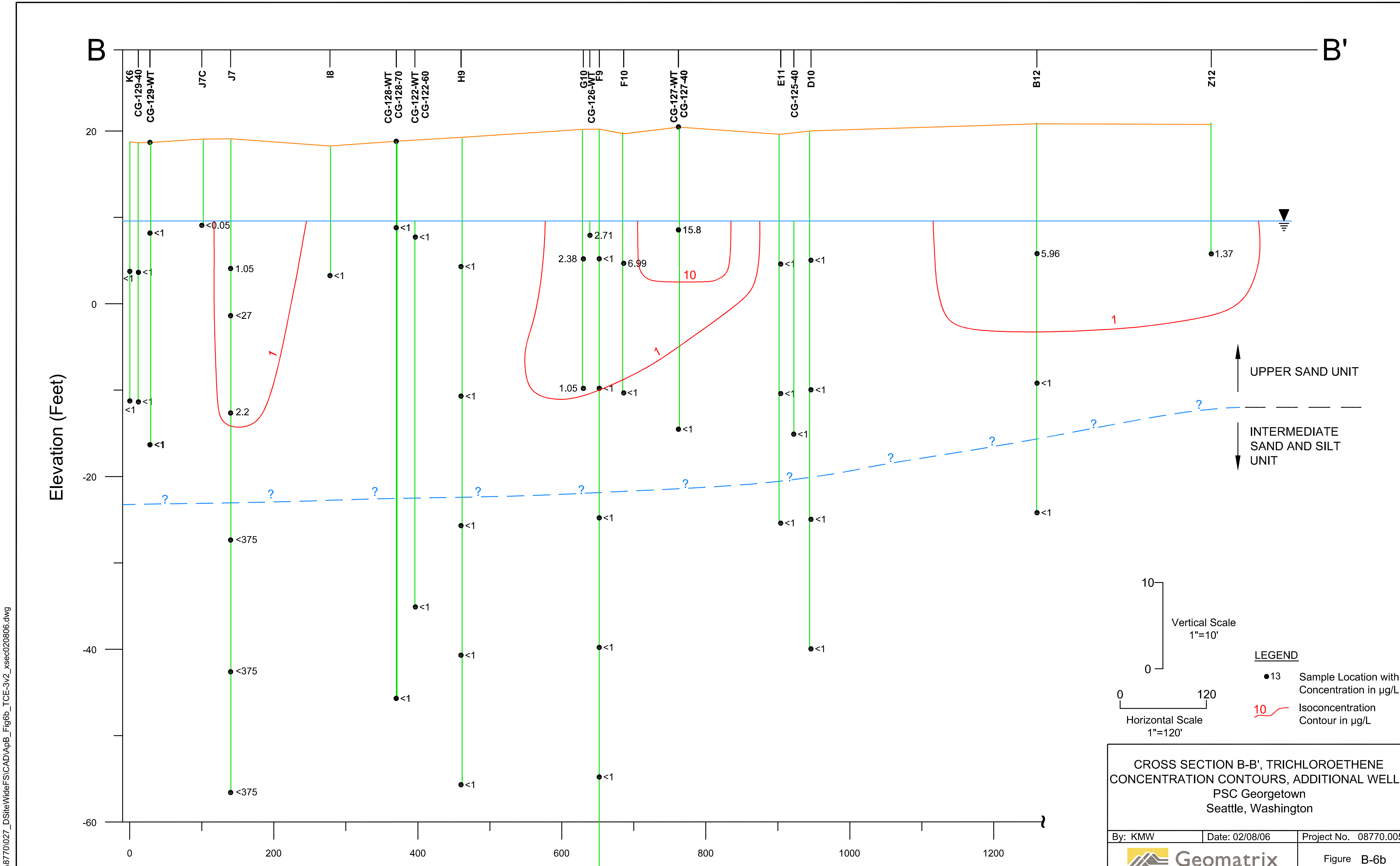


CROSS SECTION B-B', TETRACHLOROETHENE CONCENTRATION CONTOURS, ADDITIONAL WELLS
PSC Georgetown
Seattle, Washington

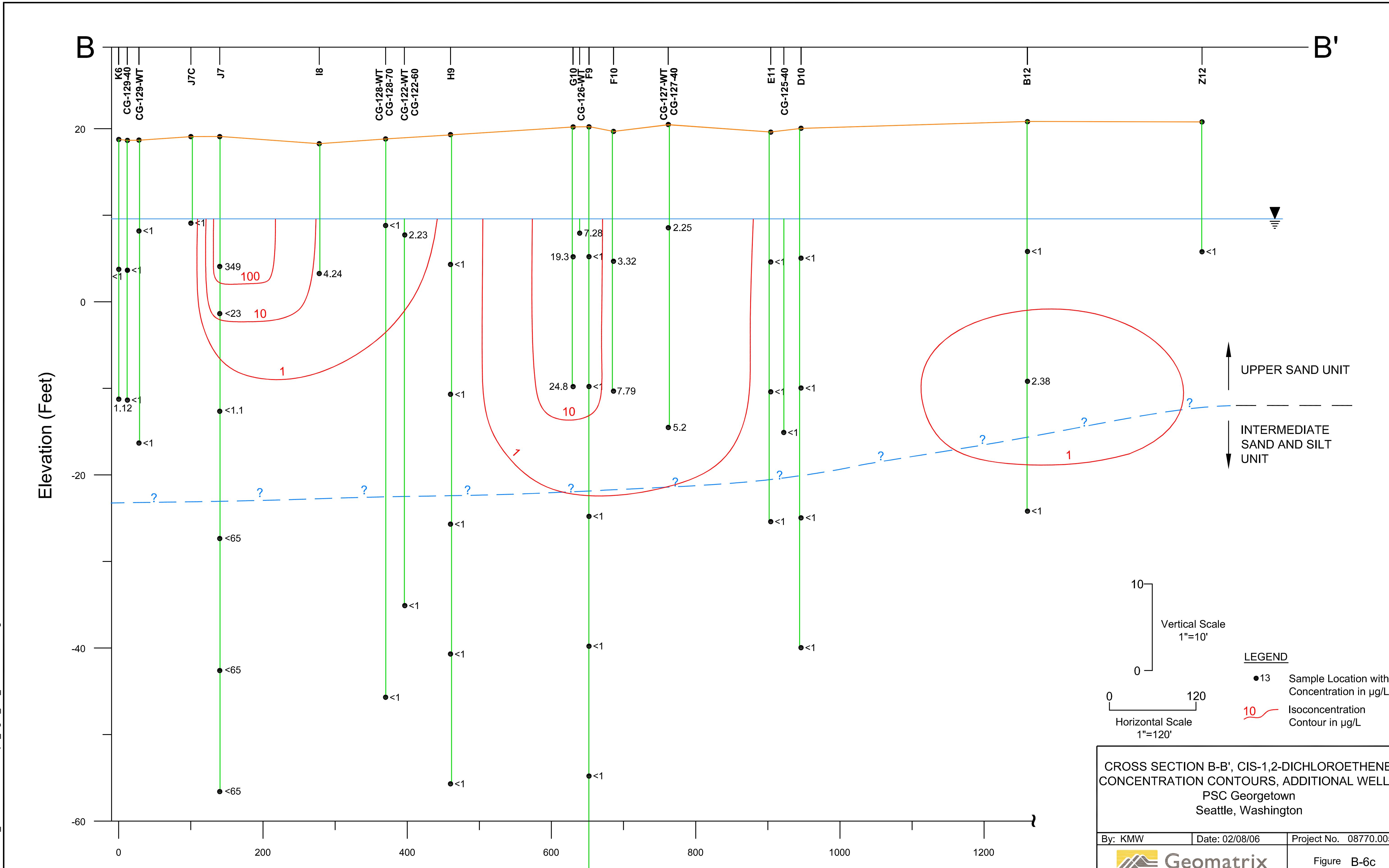
By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-6a



CROSS SECTION B-B', TRICHLOROETHENE CONCENTRATION CONTOURS, ADDITIONAL WELLS
PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/08/06 | Project No. 08770.005

Geomatrix | Figure B-6b



CROSS SECTION B-B', CIS-1,2-DICHLOROETHENE CONCENTRATION CONTOURS, ADDITIONAL WELLS
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-6c

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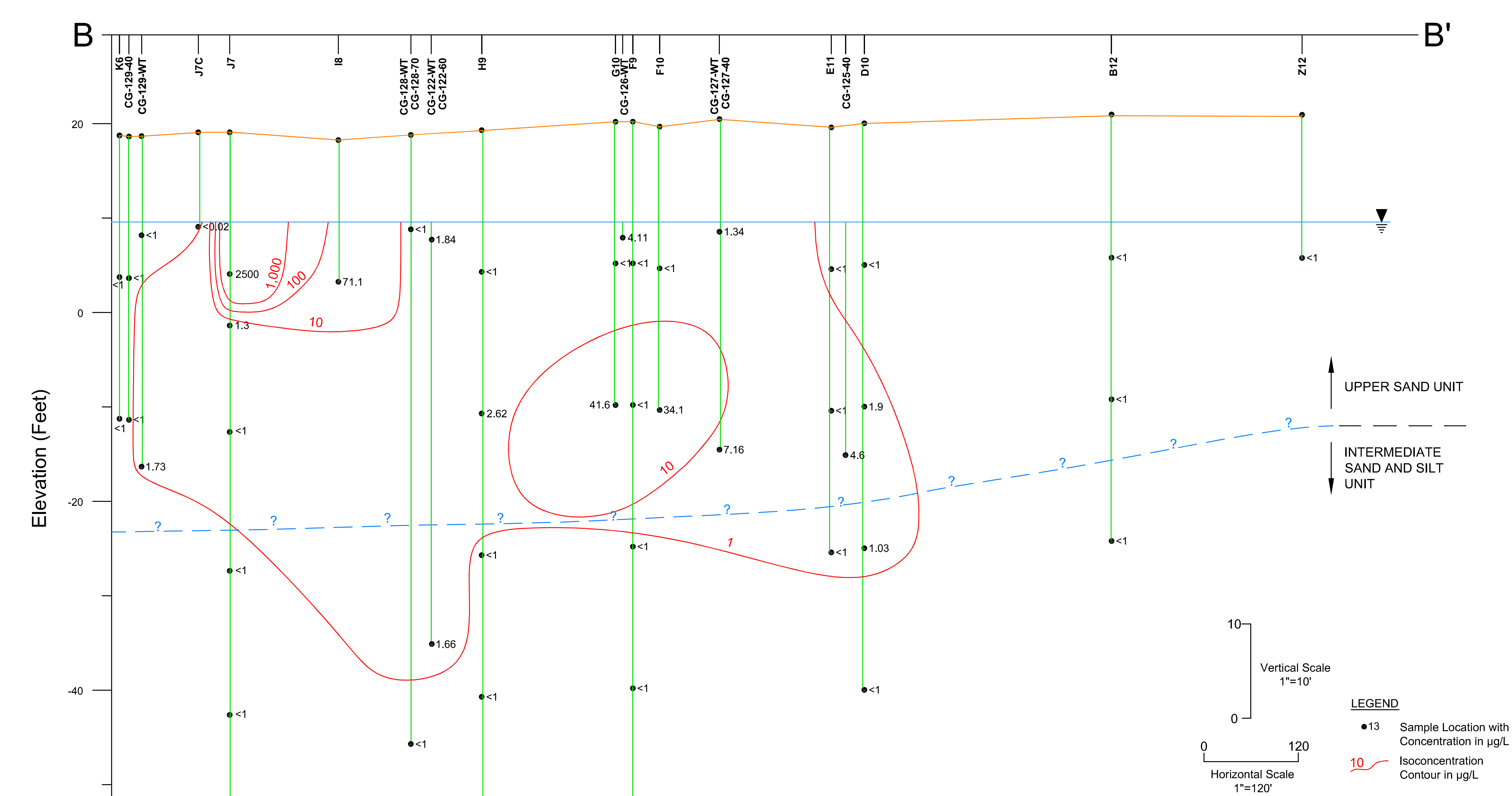

CROSS SECTION B-B', VINYL CHLORIDE CONCENTRATION CONTOURS, ADDITIONAL WELLS
PSC Georgetown
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By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-6d

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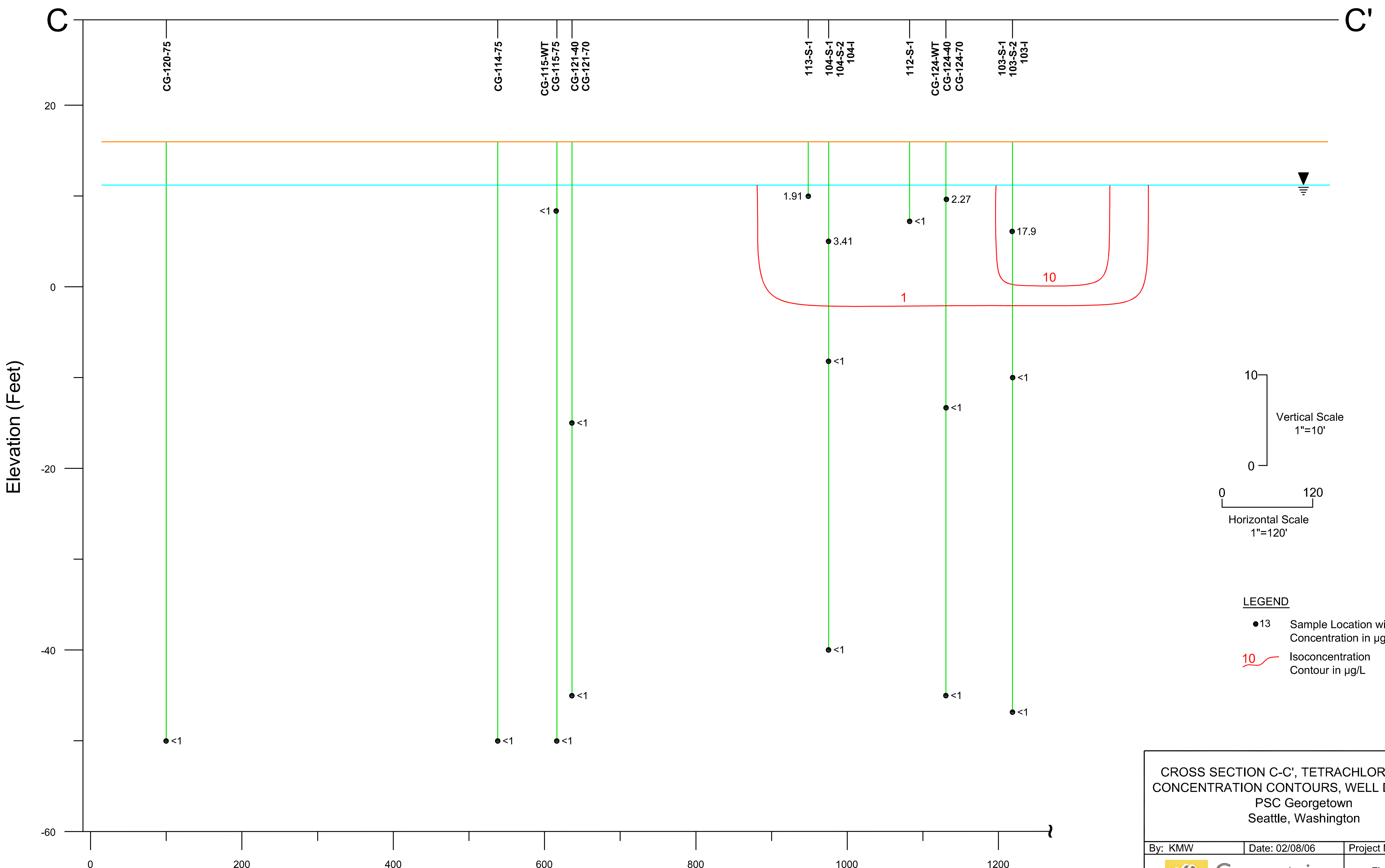

CROSS SECTION C-C', TETRACHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW | Date: 02/08/06 | Project No. 08770.005

Geomatrix | Figure B-7a

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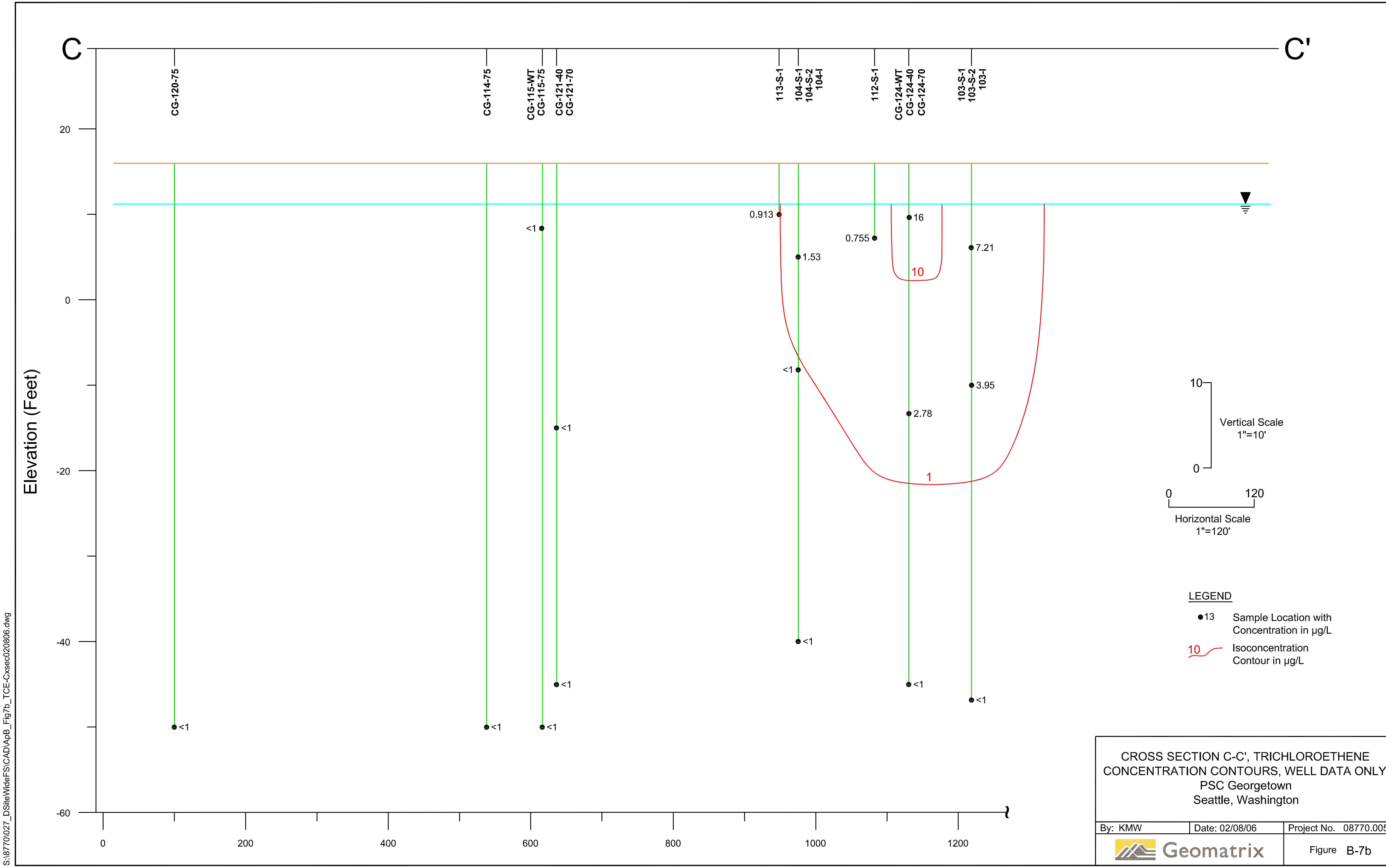
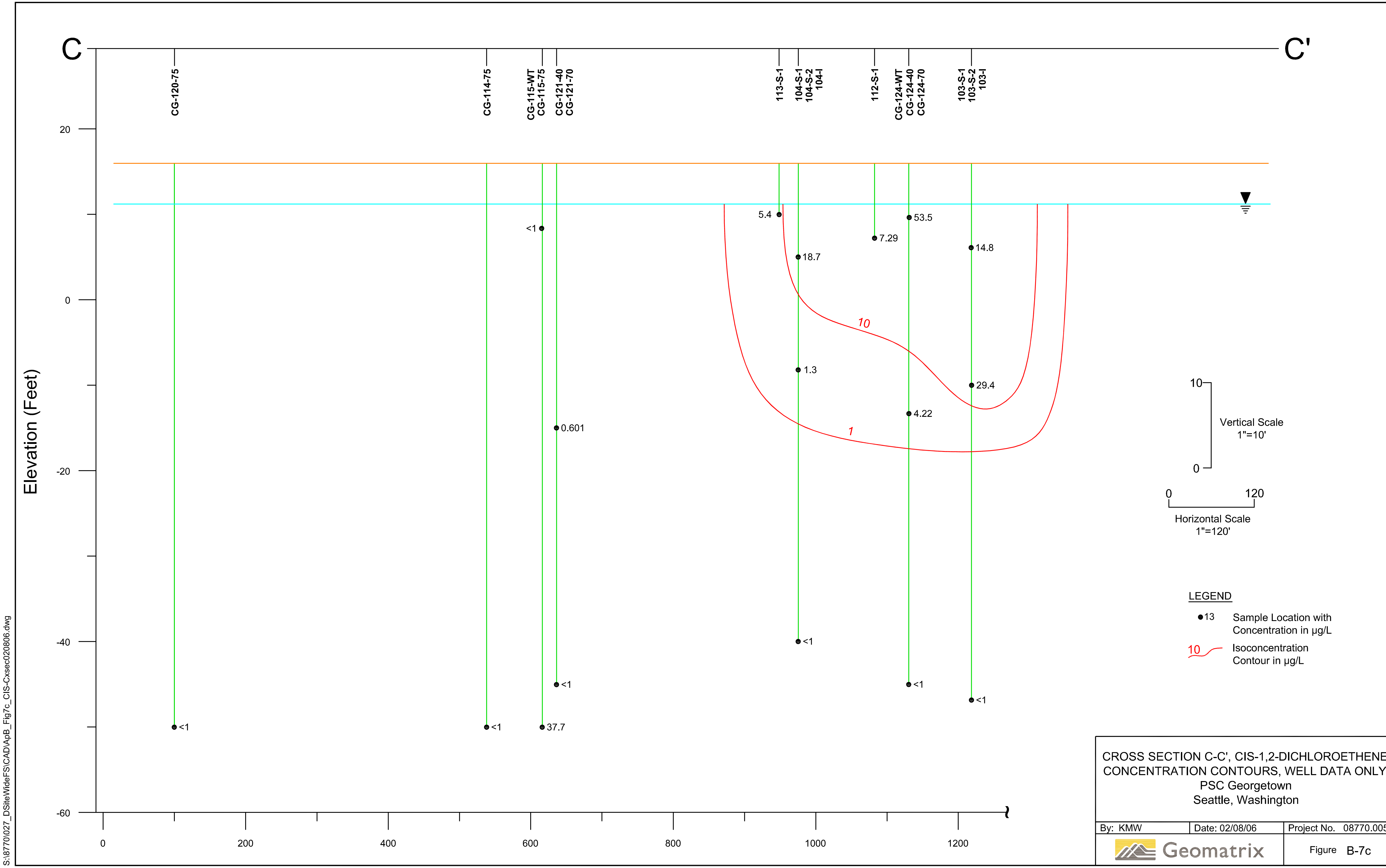


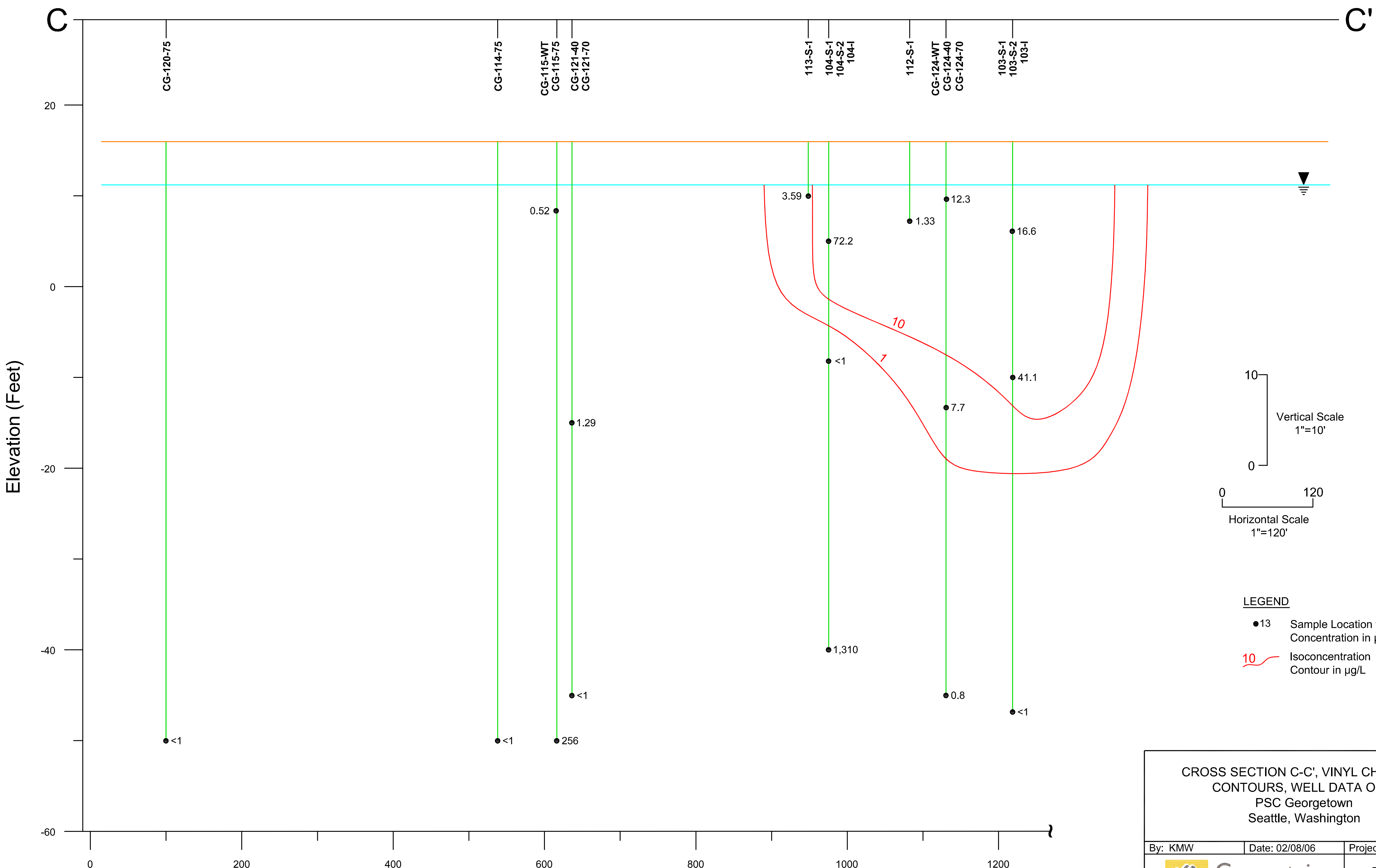
CROSS SECTION C-C', TRICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-7b



CROSS SECTION C-C', CIS-1,2-DICHLOROETHENE CONCENTRATION CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-7c



CROSS SECTION C-C', VINYL CHLORIDE CONTOURS, WELL DATA ONLY
PSC Georgetown
Seattle, Washington

By: KMW	Date: 02/08/06	Project No. 08770.005
Geomatrix		Figure B-7d

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ATTACHMENT C

Average Redox Measurements Data

TITLE:

Redox Measurement Map
Water Table Sample Interval
PSC Georgetown Facility Remedial Investigation Study Area

DWN:	DES:	PROJECT NO.:
QDD		RI2003
CHKD: AS	APPD:	FIGURE NO.:
DATE: 11/6/03	REV.:	9C-3

TITLE:

Redox Measurement Map
Shallow Sample Interval
PSC Georgetown Facility Remedial Investigation Study Area

DWN: QDD	DES.:	PROJECT NO.: RI2003	
CHKD: AS	APPD:	FIGURE NO.: 9C-11	
DATE: 11/6/03	REV.:		

TITLE:

Redox Measurement Map
Intermediate Sample Interval
PSC Georgetown Facility Remedial Investigation Study Area

DWN: QDD	DES.:	PROJECT NO.: RI2003
CHKD: AS	APPD:	FIGURE NO.: 9C-19
DATE: 11/6/03	REV.:	