SEMMATERIALS L.P. SPOKANE SITE REMEDIAL INVESTIGATION/ FEASIBILITY STUDY REPORT

Public Review Draft

Prepared for: SemMaterials Potentially Liable Persons Group

Project No. 090190-003-07 • January 31, 2013

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Contents

List of Tables

List of Figures

List of Appendices

Acronym and Abbreviation List

ARAR	applicable, relevant, or appropriate requirements
AST	Aboveground Storage Tank
BNSF	BNSF Railway Company
bgs	below ground surface
btoc	below top of casing
cPAHs	carcinogenic PAHs
CSCSs	Confirmed and Suspected Contaminated Sites
COPCs	Constituents of potential concern
DMP	Data Management Plan
DPCA	Disproportionate Cost Analysis
EAB	Enhanced Aerobic Biodegradation
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management (System)
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
FS	feasibility study
GIS	Geographic Information System
GMA	Growth Management Act
Golder	Golder Associates Inc.
GTI	Groundwater Technology, Inc.
HASP	Health and Safety Plan
IC	Institutional Controls
IDW	Investigation Derived Waste
ISCO	in situ chemical oxidation
Koch	Koch Materials, LLC
LUST	Leaking Underground Storage Tank
MCL	maximum contaminant level
MDL	Method Detection Limits
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation
MSL	mean sea level
MTCA	Model Toxics Control Act
NPV	net present value
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	Photo Ionization Detector
PLPs	Potentially Liable Persons
ppm	parts per million
PPP	Public Participation Plan
PQL	Practical Quantitation Limit
PVC	Poly Vinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance Quality Control
RAO	remedial action objectives
RI	remedial investigation
RL	reporting limits
SAP	Field Sampling Analysis Plan
SCS	Soil Conservation Service
SemMaterials	SemMaterials L.P.
SHA	site hazard assessment

Site	SemMaterials, LP Spokane Site
SVE	soil vapor extraction
SVRP	Spokane Valley Rathdrum Prairie
TEF	Toxicity Equivalency Factors
TPH	total petroleum hydrocarbons
µg/L	micrograms per liter
WAC	Washington Administrative Code

Executive Summary

Site History and Background

The SemMaterials L.P. Spokane Site (Site) is a 10-acre property located in the Hillyard district of Spokane, Washington. The Site has been used for a variety of asphalt- and petroleum-related activities and processes since 1955, and has contained numerous aboveground storage tanks (ASTs) in various configurations. The entire Site is fenced and access to the property is restricted to authorized personnel. The majority of the Site is unpaved, with the exception of the Northeast Tank Farm area located in the northeastern corner of the Site. The quantity and capacity of the ASTs at the Site have varied with time, and the total AST capacity at the Site has been as high as 12.5 million gallons. The ASTs in the Northeast Tank Farm area have been used to store lighter petroleum products for use in asphalt manufacturing. As added protection in the case of a possible spill, this area is both paved and surrounded by a containment wall.

The Site is located in a relatively large area zoned for industrial use, with adjacent areas zoned for mixed commercial and residential use. The closest residential area is approximately 950 feet west of the Site. Based on the industrial zoning and the characteristics described above, the Site qualifies as an industrial property under the Model Toxics Control Act (MTCA) for the purposes of developing appropriately protective cleanup levels and remedial options.

Petroleum-impacted soil was discovered beneath the Northeast Tank Farm area during the replacement of several ASTs in December 1992. No specific release was identified at that time, nor have there been other specific releases identified or reported since 1992. The Washington State Department of Ecology (Ecology) conducted an initial investigation of the Site in January 1993. Based on confirmation of the pre-1992 release in the Northeast Tank Farm area, Ecology sent Koch Materials, Inc. an early notice letter in February 1993, indicating that the facility would be listed in Ecology's hazardous sites database and a Site Hazard Assessment (SHA) would be performed. The Site was added to Ecology's Hazardous Sites List on February 21, 1995.

Remediation of the petroleum-impacted soil in the Northeast Tank Farm area was initially addressed through operation of an active bioventing system and construction of the asphalt cap. The active bioventing system was designed to enhance microbial degradation of petroleum-impacted soil, and the cap was designed to limit infiltration of surface water through the impacted soil. The bioventing system was operated as an active system from December 1996 until January 2004, and currently operates in a passive mode.

After discovery of impacted soil in the Northeast Tank Farm area, Ecology notified BNSF Railway Company, Koch Materials, LLC, Marathon Oil Company, and SemMaterials L.P. as Potentially Liable Persons (PLPs) for the Site. Agreed Order No. 5589, which was signed by the PLPs on April 18, 2008, required that a Remedial Investigation/Feasibility Study be conducted for the Site. The Remedial Investigation/ Feasibility Study was to be conducted in accordance with the Washington State Model

Toxics Control Act, as established in Chapter 173-340 of the Washington Administrative Code (WAC). Ecology-approved Remedial Investigation/Feasibility Study activities were conducted in two phases between 2008 and 2011. Remedial Investigation activities included shallow and deep soil investigations, installation of monitoring wells, and collection of seven rounds of quarterly groundwater level and water quality data.

Physical Setting, Geology, and Hydrogeology

The Site is relatively flat, with an approximate elevation of 2,037 feet above mean sea level. The Spokane River, located approximately 1.5 miles south and hydraulically upgradient of the Site, is the closest natural surface water body to the Site, although a manmade stormwater collection basin on the adjacent Dross site to the north reportedly contains water all year round.

The Site overlies the flood deposit gravels of the Spokane Valley-Rathdrum Prairie aquifer, in an area of the aquifer known as the Hillyard Trough. The Spokane Valley-Rathdrum Prairie aquifer is comprised of a stratified mixture of boulders, cobbles, gravel, and sand, with intermittent and discontinuous layers of silt and clay. Depth to groundwater at the Site generally ranges from 160 to 175 feet below grade, with the highest water levels typically present in the spring months. Groundwater flow in the Spokane Valley-Rathdrum Prairie at the Site is to the north. The Spokane Valley-Rathdrum Prairie aquifer can have extremely high groundwater flow velocities, with an average flow velocity of around 47 feet per day in the Hillyard Trough area. In comparison, a typical aquifer may have groundwater flow velocities of between ¼-inch and several feet per day.

The Spokane Valley-Rathdrum Prairie aquifer provides potable, commercial, and industrial water for more than 500,000 people in Idaho and Washington. Because it supplies water to more than 80 percent of the population living near the aquifer, the U.S. Environmental Protection Agency (EPA) designated the Spokane Valley-Rathdrum Prairie aquifer as a Sole Source Aquifer in 1978. The SemMaterials Site Remedial Investigation identified a total of 15 Spokane Valley-Rathdrum Prairie wells within a 1 mile radius of the Site. None of the identified wells located hydraulically downgradient (north) of the Site are noted as being used for potable water supply.

The Site is largely unpaved, and surface water that does not infiltrate directly on contact primarily drains to low lying areas along the perimeter of the property, where it eventually evaporates or infiltrates. Limited surface water runoff overflow may occur periodically off the Site to the south, where the topography favors some pooling in a low lying area.

Summary of Remedial Investigation Findings

Investigations completed to date have identified the presence of petroleum hydrocarbon compounds in Site soil and, to a much lesser extent in Site groundwater. The presence of these petroleum hydrocarbon contaminants is consistent with past historical petroleum storage and asphalt manufacturing operations at the Site. The identified petroleum hydrocarbon compounds include diesel- and heavy oil-range petroleum hydrocarbons, non-carcinogenic and carcinogenic polycyclic aromatic hydrocarbons, and naphthalene. These compounds comprise the contaminants of potential concern for all media at the Site.

An exposure pathway assessment was completed for the contaminants of potential concern present. Potential exposure pathways for contaminants of potential concern at the Site include direct contact soil exposure, soil to groundwater exposure, soil to air exposure, and groundwater exposure. These exposure pathways provided the basis for developing the following table of draft cleanup levels for the identified contaminants of potential concern in Site soil and groundwater.

Draft MTCA Soil Cleanup Levels		
Contaminants of Potential Concern	**Method/Pathway**	**Draft Cleanup Level**
TPH as Diesel and Oil	Method C - Direct contact	2,139 mg/kg[1]
carcinogenic polycyclic aromatic hydrocarbons	Method C - Direct contact	18 mg/kg[1]
TPH as Diesel and Oil	Method B - Groundwater protection	Empirically demonstrated through groundwater monitoring
carcinogenic polycyclic aromatic hydrocarbons	Method B - Groundwater protection	Empirically demonstrated through groundwater monitoring
Draft MTCA Groundwater Cleanup Levels		
TPH as Diesel	Method A - Drinking water	500 µg/L[2]
TPH as Oil	Method A - Drinking water	500 µg/L[2]
carcinogenic polycyclic aromatic hydrocarbons	Method A - Drinking water	0.1 µg/L[2]

Notes:
(1) milligrams/kilogram
(2) micrograms/liter

The initial investigations completed in the Northeast Tank Farm area in the 1990s documented exceedances of draft cleanup levels (2,139 mg/kg) for diesel- and oil-range TPH in the shallow soil (up to 20 feet below grade), with some limited exceedances also documented in deeper soil to at least 125 feet below grade. These investigations confirmed that releases occurred in the Northeast Tank Farm area prior to 1992. Concentrations of soil petroleum hydrocarbons in this area have likely attenuated significantly since the 1990s, due to both volatilization and natural biodegradation processes. These processes are expected to have been further enhanced by operation of the bioventing system in the Northeast Tank Farm area.

Additional remedial investigation activities completed during 2008 documented additional areas at the Site where exceedances of draft cleanup levels were present in Site soil. These include a limited area along the northern perimeter of the Site, and a somewhat larger area in the central portion of the Site. However, soil concentrations were documented to decrease with depth in both these areas, and deep migration of petroleum hydrocarbon contaminants to the water table is not indicated in either area.

Further additional deep soil investigations were conducted as part of the 2008 monitoring well installations along the northern Site perimeter. Contaminants of potential concern were not detected in the soil from the ground surface to the water table along the northern Site perimeter.

Carcinogenic polycyclic aromatic hydrocarbons constitute important risk drivers for the soil direct contact pathway, and therefore were analyzed in many of the soil samples collected as part of the RI. No carcinogenic polycyclic aromatic hydrocarbons were documented at concentrations above draft cleanup levels in any of the RI soil samples analyzed.

Groundwater sampling was completed as part of the RI over seven discrete sampling events between January 2009 and May 2011. No exceedances of draft groundwater cleanup levels were documented in any of the groundwater samples collected. The absence of documented exceedances of draft cleanup levels in groundwater, especially in light of the significant age of the release(s) and the nature of the contaminants, confirms that Site soil is not only currently protective of the soil to groundwater pathway, but should remain protective in the future. Future empirical demonstration of soil protectiveness is included as a component of the recommended preferred remedy for confirming that soil concentrations at the Site remain adequately protective of the groundwater pathway.

Remedial Alternatives Evaluation and Preferred Remedy Selection

The Feasibility Study identified remedial action objectives and evaluated them for compliance with applicable environmental regulations, and whether they provide acceptable protection of human health and the environment. Additionally, the Feasibility Study identified standard points of compliance for each media and exposure pathway. With these criteria under consideration, a broad range of potentially applicable remedial technologies were evaluated, and some technologies were eliminated from further consideration due to lack of suitability/applicability, cost, or implementability limitations. A full scope and cost for four retained remedial alternatives was then developed in detail for comparison with MTCA criteria for selection of cleanup actions. The fully evaluated alternatives included:

Alternative 1 – Completed Remedial Actions, including the existing bioventing system and asphalt cap in the Northeast Tank Farm area.

Alternative 2 – Existing Cap, Institutional Controls, and Monitored Natural Attenuation: This alternative includes maintaining the existing pavement (or equivalent low permeability material) cap in the Northeast Tank Farm area, maintaining existing site security measures, periodic groundwater sampling to confirm continued soil protectiveness and groundwater compliance, and an environmental covenant for areas with documented residual TPH-impacted soil. In addition, a soil cap will be constructed in the vicinity of soil boring GGP09 to prevent direct contact with shallow (less than 2.5 feet bgs) TPH-impacted soil that exceeded the draft cleanup level (2,139 mg/kg).

Alternative 3 – Partial Soil Excavation/Disposal, Existing Cap, Institutional Controls, and Monitored Natural Attenuation: This alternative includes removal of the upper 15 feet of impacted soil to meet direct soil contact compliance cleanup levels, construction of a replacement cap over the Northeast Tank Farm area to limit infiltration, and periodic groundwater sampling to confirm continued soil protectiveness and groundwater compliance

Alternative 4 – Complete Soil Excavation/Disposal:
This alternative addresses removal of all impacted soil above cleanup levels on the Site and is a permanent remedy. Due to depth of impacted soil in the Northeast Tank Farm area, removal of these soils would likely require a very large excavation that extends onto neighboring properties or deep shoring of the excavation.

Each of the above alternatives was assessed with regard to specific evaluation and ranking requirements specified by MTCA rules for remedy selection. A disproportionate cost analysis was then completed using the MTCA ranking data. The purpose of the disproportionate cost analysis was to quantify the cost to benefit of each alternative, and allow for elimination of alternatives that provide little or no incremental benefit at significantly higher costs when compared to the other evaluated alternatives.

The disproportionate cost analysis for the SemMaterials Site remedial alternatives confirmed that Alternative 1 – *Completed Remedial Actions*, provided the lowest cost but with the lowest ranking criteria score and was analyzed for comparative purposes only. Alternative 2 – *Existing Cap, Institutional Controls, and Monitored Natural Attenuation* had a higher ranking score and relatively low costs. Alternative 3 – *Partial Soil Excavation and Disposal, Existing Cap, Institutional Controls, and Monitored Natural Attenuation* had a ranking score lower than Alternative 2, with a cost approximately 16 times higher than Alternative 2 (for negative net incremental benefit). The lower ranking score for Alternative 3 is primarily due to a lower ranking score for short-term risk management related to potential exposures during construction, and a lower ranking score for technical and administrative implementability related to the difficulty in excavating at an operating facility. Alternative 3 also results in more public impact than Alternative 2, due to truck traffic and noise.

Alternative 4 – *Complete Soil Excavation/Disposal* had the highest ranking score, scoring approximately 25% higher in overall net benefit over Alternative 2. However, the cost of Alternative 4, estimated from $39 million (un-shored) to $75 million (shored), ranges from 190 to 370 times that of Alternative 2.

Based on the disproportionate cost analysis, Alternative 2 provides a better level of protectiveness and effectiveness than Alternative 3, and at a significantly lower cost. Alternative 4 provides some limited incremental benefit over Alternatives 2 and 3, but at a very high additional cost. The cost of Alternative 4 is considered disproportionate to the nominal incremental environmental benefit it provides over Alternative 2. Given these factors, Alternative 2 is identified within the Feasibility Study as the preferred alternative for implementation at the SemMaterials Site.

1 Introduction

The SemMaterials L.P. Spokane Site (Site) is located in the Hillyard district of Spokane, Washington. The Site has been used for a variety of asphalt- and petroleum-related activities and processes since the mid-1900s, and contains numerous aboveground storage tanks (ASTs). During or around the time of the dismantling of three ASTs in December 1992, petroleum-impacted soil was discovered beneath the ASTs (SCS, 1992). The Washington State Department of Ecology (Ecology) conducted an initial investigation of the facility on January 20, 1993. Following the initial investigation in January 1993, Ecology sent Koch Materials an early notice letter in February 1993. The letter informed Koch the facility would be listed on Ecology's hazardous sites database and a Site Hazard Assessment (SHA) would be performed. Following completion of a Site Hazard Assessment by the Spokane County Health District, the Site was added to Ecology's Hazardous Sites Listing on February 21, 1995. Ecology later determined that the BNSF Railway Company (BNSF), Koch Materials, LLC (Koch Materials), Marathon Oil Company (Marathon), and SemMaterials L.P. (SemMaterials) were Potentially Liable Persons (PLPs). Based on these determinations, Agreed Order No. 5589 (Agreed Order), which was signed by the PLPs on April 18, 2008, required that a Remedial Investigation/Feasibility Study (RI/FS) be conducted for the SemMaterials L.P. Spokane Site (Ecology, 2008). This RI/FS is being completed in accordance with the Agreed Order.

The RI/FS was conducted in accordance with the Washington State Model Toxics Control Act (MTCA), as established in Chapter 173-340 of the Washington Administrative Code (WAC). Prior to completing any remedial investigations, a Site RI/FS Work Plan (Golder, 2008) was approved by Ecology, as stipulated in the Agreed Order. Remedial investigations were conducted in two phases (Phase I and II) at the Site. Phase I included shallow soil investigations; sampling and analysis of deep soil during the drilling of monitoring wells; installation of monitoring wells; and collection of three rounds of quarterly groundwater samples. Phase II included completing four additional rounds of quarterly groundwater level monitoring and water quality sampling.

1.1 Purpose

The purpose of the RI is to assess the nature and extent of the release of hazardous substances at the Site in order to select an appropriate cleanup action under MTCA. The RI is a data gathering phase that collects, develops, and evaluates sufficient information regarding Site releases to determine the nature and extent of the hazardous substance releases and to evaluate the risk to human health and the environment. The data collected during the RI supplements the existing data collected during previous investigations.

The RI data is used to support the FS, which will evaluate applicable cleanup alternatives in accordance with WAC 173-340-350 through WAC 173-340-390. Based on the results of the RI/FS, Ecology will determine the appropriate cleanup action.

1.2 Objectives

The primary objective of the RI is to assess the nature and extent of the hazardous substance impacts to soil and groundwater from Site activities. An evaluation of exposure risks to human and ecological receptors from the release of hazardous substances is also provided. Specific objectives of the remedial investigation were documented in the Site RI/FS Work Plan (Golder, 2008) and include the following:

- Compilation of historical uses and operations at the Site and surrounding area;
- Evaluation of previous investigations and cleanup actions conducted at the Site;
- Identification of constituents of potential concern (COPCs) at the Site;
- Investigation of the regional and Site-specific geologic and hydrogeologic characteristics affecting groundwater flow beneath the Site;
- Characterization of the nature and extent of soil impacts from Site releases;
- Assessment of the nature and extent of groundwater impacts from Site releases;
- Evaluation of the potential routes of exposure to human and ecological receptors associated with Site releases; and
- Development of draft cleanup levels for the Site.

The RI establishes the nature and extent of the COPCs and evaluates the impacts of these COPCs on soil and groundwater. This information is used to develop a conceptual site model that identifies potential human health and/or environmental risks associated with exposure at the Site.

The RI provides the necessary data to support the FS evaluation of applicable cleanup alternatives for the Site. The primary objectives of the FS include the following:

- Identify remedial action objectives;
- Identify and evaluate remedial technologies that may be applicable to the Site; and
- Develop and evaluate a range of remedial action alternatives and select a preferred alternative.

1.3 Report Organization

The RI is presented in Sections 2 through 6 of this report, while the FS is presented in Sections 7 through 11. Individual sections of the RI/FS report include the following:

- **Section 1 – Introduction:** This section briefly states the purpose and objectives of the RI/FS, and outlines the organization of the RI/FS Report.
- **Section 2 – Site Setting:** This section describes the Site including the proper facility name, legal description, address, property boundary, property history, previous environmental investigations, COPCs, nearby contaminated sites, and land use and zoning.

- **Section 3 – Physical and Hydrogeologic Setting:** This section describes the Site's physical and hydrogeologic settings, including: topography, surface water occurrence, climate, soils, vegetation, wildlife, regional and local geology, and groundwater occurrence.
- **Section 4 – Site Remedial Investigation:** This section describes the activities and provides the results of the Phase I and II remedial investigations.
- **Section 5 – Evaluation of Receptors and Development of Draft Cleanup Levels:** This section discusses both human and ecological receptors at the Site and presents draft cleanup levels for both soil and groundwater exposure pathways.
- **Section 6 – Nature and Extent of Impacts to Site Media:** This section discusses the nature and extent of soil and groundwater impacts that exceed the draft cleanup levels.
- **Section 7 – Basis for Remedial Action:** This section identifies the remedial action objectives (including the COPCs, the draft cleanup levels, and the points of compliance) and estimates the areas and volumes of impacted media.
- **Section 8 – Identification and Screening of Remedial Technologies:** This section describes and evaluates the remedial technologies that are generally suitable to address the COPCs that exceed draft cleanup levels and screens out those technologies that provide no additional benefit and are generally more expensive or difficult to implement.
- **Section 9 – Development of Remedial Alternatives:** This section identifies and describes a range of remedial alternatives that combine one or more of the remedial technologies discussed in Section 8.
- **Section 10 – Evaluation of Remedial Alternatives:** This section provides an evaluation of the remedial alternatives based on overall protectiveness, compliance with cleanup standards, compliance with applicable state and federal laws, compliance monitoring, permanence, reasonable restoration timeframe, and consideration of public concerns.
- **Section 11 – Preferred Cleanup Action:** This section describes the preferred cleanup action based on the evaluation of the remedial alternatives.
- **Section 12 – References:** This section includes citations for the references used and documents reviewed to prepare this RI/FS report.

The Public Participation Plan (PPP) for this RI/FS has been developed and is implemented by Ecology with assistance from the PLPs. The PPP identifies the process for informing the public about the RI/FS process and soliciting public input. Public involvement in the RI/FS process will be important to guide decisions regarding the remedial actions and long-term land uses for the Site. The PPP identifies the methods for providing public notice, seeking and incorporating public concerns, and incorporating public meetings into the RI/FS process. The PPP is an exhibit to the Agreed Order.

2 Site Setting

The following sections describe the Site location, history of operations, the previous environmental investigations, the COPCs, the nearby contaminated sites, and the land use and zoning in the vicinity of the Site.

2.1 Site Location and Description

The SemMaterials Site, Spokane County Tax Parcel No. 35032.4402, is located at 4327 North Thor Street, in the northeast portion (Hillyard District) of Spokane, Washington, as shown on Figure 2.1. The Site encompasses approximately 10 acres, and is located within the northwest quarter of Section 3, Township 25 North, Range 43 West, of the Willamette Meridian.

The Site is owned by BNSF and is currently occupied by Blueknight Energy Partners, LP. Blueknight Energy Partners, LP is the successor to SemGroup Energy Partners, LP.

The asphalt plant located on the property is currently operated by Western States Asphalt, Inc. The facility is used for the blending, storage, and loading of various grades of asphalt cement (Radian, 1996a). The facility has been used for similar purposes since the mid-1900s, but has been operated by various entities. Blackline Asphalt Sales, Inc. operated the Site from the mid-1950s through 1974; Husky Oil Company of Delaware operated the Site from 1974 until 1982; Intermountain Asphalt Company operated the Site from 1982 until 1983; Koch Asphalt Company operated the Site from 1983 until 2005; and SemGroup Energy Partners, LP operated the Site from 2005 until filing for bankruptcy in 2008 and subsequently becoming Blueknight Energy Partners, LP. The relationship between Blueknight Energy Partners and Western States Asphalt is unknown.

As part of the historical and current asphalt plant operations, the Site consists of an office, shop, storage building, scale house, loading racks, and numerous ASTs that are used to store various asphalt and petroleum products. Figure 2.2 illustrates the historical locations of the various buildings and ASTs at the Site. Historically, the total AST capacity at the Site was about 12.5 million gallons (Golder, 2008). Table 2.1 provides the respective AST inventory that corresponds to the AST numbers on Figure 2.2. However, it is important to note that the quantity and capacity of the ASTs at the Site have varied with time. Figure 2.3 presents the most recent aerial image of the Site, depicting the property boundary, existing infrastructure, and current AST locations. The majority of the Site is unpaved, with the exception of the northeastern corner of the Site, referred to as the Northeast Tank Farm area. The ASTs in this area have contained lighter petroleum products; therefore, the area is paved and surrounded by a containment wall. The entire Site is fenced and access to the property is restricted to authorized personnel.

2.2 Site History

Select aerial photographs of the Site from 1931 through 1962 are provided in Appendix A. Information regarding the early phases of Site operations is limited; therefore, knowledge about the Site exists primarily from the information provided by the current operators and previous investigations.

The Site comprises a portion of the former Hillyard Railyard, which was acquired by the Great Northern Railroad Company in the late 1800s (GeoEngineers, 2005; Golder, 2008), of which BNSF is the successor. A 1931 aerial photograph (refer to Appendix A.1) indicates the presence of the Hillyard Railyard and Roundhouse to the north of the Site. Based on a 1950 and 1955 aerial photographs of the Site (refer to Appendix A.2), the Site was first occupied sometime in 1955 (refer to Appendix A.3). The Spokane County Parcel Information Database confirms the existence of a general office, service garage, and several ASTs at the Site in 1955. Although the Spokane County Parcel Information Database also indicates the construction of several ASTs in 1947, as the 1950 aerial photograph clearly illustrates (refer to Appendix A.2), these ASTs appear to be associated with the Black Tank Site property located immediately to the north of the Site.

Asphalt operations, including the production of asphalt cement and cutback materials, started following the initial construction of the Site facilities in 1955 and have continued at the Site through present-day (Golder, 2008). The materials and products produced have remained relatively consistent since operations began. The Site may also have been used for fuel oil usage or sales (Golder, 2008).

The 1955 aerial photograph (refer to Appendix A.3) indicates the presence of ASTs installed in the north-central portion of the Site during 1955. Based on Spokane County Parcel Information Database, additional ASTs were constructed during the 1960s and 1970s, as illustrated on the 1962 aerial photograph (refer to Appendix A.4). In addition, the construction of the maintenance shop in the south-central area, and the expansion of the office building (refer to Figure 2.2) also likely occurred during this period (Golder, 2008). Additional ASTs were later installed in the southwestern and southeastern corners of the Site, and the north-central and south-central portions of the Site.

Several ASTs (Nos. 12, 13, and 14 on Figure 2.2) were replaced at the Northeast Tank Farm area in March 1993. During dismantling of the former ASTs in December 1992, petroleum-impacted soil was discovered beneath the former ASTs. The former ASTs contained diesel fuel No. 1 (AST No. 12 and 13) and diesel fuel No. 2 (AST No. 14), and at the time of dismantling were operated by Koch Materials. The ASTs were also reported to have contained Bunker C fuel oil (SCS, 1992). The suspected release was reported to Ecology by Koch Materials personnel on December 4, 1992. The following section provides a summary of the environmental investigations performed at the Site in the vicinity of the suspected release.

2.3 Pre-RI Environmental Investigations at the Site

Following the report of the suspected release, Ecology conducted an initial investigation of the facility on January 20, 1993. In January 1995, the Spokane County Health District completed a Site Hazard Assessment (SHA) of the facility, which received a hazard ranking of three. Numerous environmental investigations were conducted at the Site to assess the release in the Northeast Tank Farm area. These pre-RI investigations were conducted independently, without Ecology oversight, and include the following:

- *Analytical Results, Koch Hillyard Station, Spokane, Washington*, SCS Engineers, February 3, 1993;
- *Additional Analytical Results, Koch Hillyard Station, Spokane, Washington*, SCS Engineers, February 4, 1993;
- *Rough Comparison of Analytical Options, Koch Hillyard Station, Spokane, Washington*, SCS Engineers, February 8, 1993;
- *Additional Work, Koch Hillyard Station, Spokane, Washington*, SCS Engineers, February 11, 1993;
- *Proposal and Cost Estimate to Evaluate Subsurface Contamination, Koch Materials Hillyard Site, Spokane, Washington*, SCS Engineers, February 24, 1993;
- *Closure of Investigation Project, Koch Materials, Spokane, Washington*, SCS Engineers, March 12, 1993;
- *Tank Farm Site Investigation Koch Materials Company, Hillyard Asphalt Plant, Spokane, Washington*, Radian International (Radian), September 1996;
- *Bioventing System and Cap Installation Work Plan, Koch Materials Company, Hillyard Asphalt Plant, Spokane, Washington*, Radian International (Radian), October 1996; and
- *Installation and Operation Report Bioventing System Koch Materials Company Hillyard Facility, Spokane, Washington*, Radian International (Radian), February 28, 1997.

Figures 2.4 and 2.5 illustrate the locations of the explorations associated with the various environmental investigations at the Site, including those investigations of the Northeast Tank Farm area noted above. Tables 2.2 and 2.3 provide a summary of the laboratory results.

On January 19, 1993, three exploratory borings (BH-1, BH-2, and BH-3) were installed to a depth of 20 feet below ground surface (bgs) in the vicinity of the suspected release identified in the Northeast Tank Farm area in 1992. (SCS Engineers, 1993a) (refer to Figure 2.5). Soil samples collected from these borings contained concentrations of both diesel-range (WTPH-D) total petroleum hydrocarbons (TPH) and heavy-chain (WTPH-418.1) total petroleum hydrocarbons compounds that exceeded the 1991 MTCA Method A soil cleanup level of 200 milligrams per kilogram (mg/kg). The soil sample exceedances occurred in all samples collected at BH-2 (to a depth of 20 feet bgs), and the shallow soil samples collected at BH-1 and BH-3 (to a depth of 5 feet bgs). Based on these results, additional heavy-chain TPH analyses were performed on archived soil samples collected at BH-1 and BH-3 in order to confirm that the petroleum-impacted soil was vertically bound at these locations (SCS Engineers, 1993b).

In February 1993, an additional soil boring (BH-4) was drilled in the vicinity of BH-2 to a depth of 125 feet bgs to vertically bound the extent of impacts, and five shallow test pits (TP-1 to TP-5) were excavated to depths of about 10 to 12 feet bgs to refine the lateral extent of impacts (SCS Engineers, 1993c, 1993d, 1993e, and 1993f). Soil samples collected from the test pits indicated elevated heavy-chain TPH concentrations that exceeded the 1991 MTCA Method A soil cleanup level in TP-1, TP-2, TP-4, and TP-5. In addition, heavy-chain TPH concentrations exceeded the 1991 MTCA Method A soil cleanup levels in BH-4 to a depth of at least 125 feet bgs (SCS Engineers, 1993e).

On January 22 and 23, 1996, an additional soil boring (BH-5) was drilled in the vicinity of BH-4 to a depth of 126 feet bgs to characterize the type of petroleum impacts, and confirm and refine the vertical extent of impacts (GTI, 1996a and 1996b) (refer to Figure 2.5). Soil samples collected from less than 125 feet bgs did not indicate the presence of heavy-chain TPH concentrations; however, a black viscous oil was reportedly observed from 125 to 125.5 feet bgs in this boring. Immediately below the black viscous oil at 125.5 feet bgs was a silty clay, which was dry with no apparent oil staining. Characterization analysis of a soil sample collected at 125 feet bgs indicated the presence of petroleum hydrocarbons representative of biodegraded heavy or residual fuel oil (No. 4, No. 5, or No. 6). The sample did not contain diesel-range hydrocarbons.

In order to further assess the lateral extent of impacted soil in the Northeast Tank Farm area, eight additional soil borings (BH-6 to BH-13) and one hand auger hole (BH-14) were drilled in 1996 (Radian, 1996a) (refer to Figure 2.5). BH-7 and BH-13 were drilled to a depth of 41 and 31 feet bgs, respectively, while the remaining soil borings were drilled to a maximum depth of 20 feet bgs. Soil samples collected from the borings indicated that heavy-chain TPH concentrations exceeded the 1991 MTCA Method A soil cleanup levels in the following borings:

- BH-7 at 41 feet bgs
- BH-8 at 19.5 feet bgs
- BH-9 at 4 feet bgs
- BH-10 at 19 feet bgs
- BH-12 at 3 feet bgs
- BH-14 at 0.75 feet bgs

Based on the results of the previous investigations, Koch Materials coordinated the installation of an active bioventing system and asphalt cap in the Northeast Tank Farm in December 1996 (Radian, 1997). The purpose of this system was to increase microbial degradation of petroleum-impacted soil and prevent the infiltration of surface water through the impacted soil. As per the *Bioventing System and Cap Installation Work Plan* (Radian, 1996b), the system was to be run continuously until microbial degradation of petroleum impacted soil ceased. Supplemental information was collected to evaluate the effectiveness of the bioventing system between January 1997 and January 2004. Based primarily on system discharge effluent data, the system was converted to passive operation on January 26, 2004.

2.4 Constituents of Potential Concern (COPCs)

The Site has been owned by BNSF and its predecessors for over a century and has been operated as an asphalt plant for many decades. Processes at the Site have consistently been associated with petroleum hydrocarbons, mainly heavy-oil residues. The lightest petroleum hydrocarbons supposedly used and/or stored at the Site include diesel and kerosene. Golder (2008) did not find documentation that identifies the use or storage of gasoline, or documentation of processes that could result in uncontrolled releases of volatile organic compounds or metals.

The petroleum hydrocarbons used as raw materials in the processing of the asphaltic products are heavy-chained petroleum compounds. In addition, polycyclic aromatic hydrocarbons (PAHs) are also associated with the asphalt products and are expected to be present. Table 830-1 of MTCA specifies that investigations for diesel- and heavy oil-range petroleum hydrocarbons should also include naphthalene as a possible constituent. Polychlorinated biphenyls (PCBs), also listed in Table 830-1 of MTCA, are not considered a COPC as per the RI/FS Work Plan (Golder, 2008).

With the exception of diesel fuel and kerosene no. 1 fuel oil, the raw materials and products involved in the asphalt production are viscous and some require heating to be made more fluid for conveyance. Diesel storage and use at the Site was primarily for trucks, boilers and possibly flushing and cleaning of heavy petroleum material from equipment. Kerosene no. 1 fuel oil has been used at the Site for production of cutback material. Currently, all functioning storage tanks and pipelines at the Site are aboveground, except for a short (~16-foot) underground pipeline at the front of the entrance gate. Some pipelines not in use today may have been underground. As discussed above, historic releases at the Site have not been documented, except for the release discovered during tank removal activities at the Northeast Tank Farm area in 1992.

Based on review of the available information and previous investigations, the COPCs for the Site, as indicated in the RI/FS Work Plan (Golder, 2008), include:

- Diesel-range petroleum hydrocarbons
- Heavy oil-range petroleum hydrocarbons
- PAHs (both non-carcinogenic and carcinogenic PAHs)
- Naphthalene

2.4.1 Physical and Chemical Properties of COPCs

The physical and chemical characteristics of COPCs for the Site vary. Solubility in water generally increases the lighter the petroleum hydrocarbon. PAHs have very low water solubility, generally in the single parts per billion range. The lighter fraction of COPCs, such as diesel-range hydrocarbons, and to a lesser extent, naphthalene, degrade at a higher rate and are more mobile than heavy oil-range petroleum hydrocarbons. PAHs are very persistent and are practically immobile by themselves, but can become more mobile when dissolved and carried within a lighter petroleum fraction.

The COPCs are not considered volatile, except for diesel-range TPH which have lighter hydrocarbon components. Although MTCA considers diesel-range TPH at concentrations above 10,000 mg/kg to be potentially volatile based on WAC 173-340-745 (5)(b)(iii)(C)(II), the age and presence of heavy oil-range TPH at the Site may cause the diesel-range TPH to be less volatile.

2.5 Nearby Contaminated Sites

There are several Ecology-listed Confirmed and Suspected Contaminated Sites (CSCSs) located immediately downgradient (north) of the Site that were identified based on their location as potential contributors to subsurface contamination (refer to Table 2.4). These CSCS sites, which could potentially impact groundwater quality (see Section 3.2) downgradient of the Site, include:

- Aluminum Recycling Corp (Hillyard Dross Site; Cleanup ID No. 1133)
- BNSF Railway Black Tank Property (Black Tank Site; Cleanup ID No. 3243)
- BNSF Bunker C Spill Area (Cleanup ID No. 2829)

The Hillyard Dross and Black Tank sites are located immediately downgradient of the SemMaterials Site. The locations of these sites are illustrated on Figure 2.3 and details about the sites are provided in the subsequent sections. No CSCSs or Leaking Underground Storage Tanks (LUSTs) were identified within 1 mile upgradient of the Site. Therefore, there appears to be little potential for subsurface contamination to migrate to the Site from known upgradient sources.

2.5.1 Hillyard Dross Site

The Hillyard Dross site is located to the north of the eastern portion of the SemMaterials Site. The site was used as an aluminum dross recycling and secondary facility, with approximately 65,000 cubic yards of aluminum dross remaining at the site (EMR, 1999). Aluminum dross is known to contain elevated concentrations of chloride, fluoride, ammonia, and nitrates, which are a potential concern for human health and ecological receptors.

A total of four test pits and five soil borings were excavated as part of the remedial investigations conducted at the site to determine the lateral and vertical extent of the aluminum dross and the extent of chloride, nitrite, ammonia, and metals impacts. In addition, three groundwater quality wells were installed to a depth of approximately 200 feet bgs to evaluate impacts to groundwater quality. Ecology issued a CAP for this site which has been implemented by BNSF pursuant to a Consent Decree, and routine groundwater monitoring is now being conducted by BNSF. The first 5-year review by Ecology regarding this cleanup is expected to occur in 2014.

2.5.2 Black Tank Site

The Black Tank site is located to the north of the western portion of the SemMaterials Site. The Black Tank site included a 420,000-gallon AST (so-called “black tank”) that contained asphaltic and other petroleum-based mixtures. Due to a release of petroleum hydrocarbons at the Black Tank site, remedial activities were performed beginning in September 2005.

Remedial activities at the Black Tank site included removal of remnant contents from the black tank, demolition and recycling of the black tank, and excavation of petroleum-impacted soil beneath and adjacent to the black tank (GeoEngineers, 2008). Approximately 10,270 tons of petroleum-impacted soil was removed during the remedial activities. In addition, 12 soil borings were completed on and adjacent to the Black Tank site to assess the lateral and vertical extent of petroleum-impacted soil. Only two of these soil borings had petroleum hydrocarbon concentrations that exceeded MTCA Method C site-specific cleanup criteria calculated from contaminated samples collected near/beneath the black tank.

Five groundwater monitoring wells (MW-1 to MW-5) were also installed at the Black Tank site in the Spokane Valley-Rathdrum Prairie (SVRP) aquifer in January 2008. Wells were installed to depths ranging from 169.5 to 193.0 feet bgs. Free petroleum product was observed floating on the water table in four of the five wells installed at the site, and groundwater quality samples indicated the presence of both diesel-range and heavy oil-range petroleum hydrocarbons (GeoEngineers, 2008). Ten additional groundwater monitoring wells (MW-6 to MW-15) were subsequently installed in order to better assess the extent of any groundwater impacts at the site (GeoEngineers, 2010). Ecology, BNSF and Marathon recently negotiated Agreed Order No. 9188 to complete an RI/FS at the Black Tank site (Ecology, 2012).

2.5.3 BNSF Bunker C Spill Area

The BNSF Bunker C spill area is located immediately to the northeast of the SemMaterials Site, at the intersection of North Freya Street and East Longfellow Avenue. A release was reported to have occurred at this location on August 1, 1996, which resulted in the confirmed presence of petroleum hydrocarbons in the soil. A Site Hazard Assessment hazard ranking of five was assigned to the BNSF Bunker C spill area release by Ecology. At the time of this report, the site was listed in the Ecology CSCS List database as “awaiting cleanup”.

2.6 Land Use and Zoning

Land use surrounding the Site includes the following:

- Immediately to the north of the Site are the Hillyard Dross and Black Tank sites, as discussed above. Further to the north, across East Wellesley Avenue is vacant land that was previously occupied by the Hillyard Railyard and Roundhouse, which included railroad maintenance and support facilities.
- Immediately to the west of the Site are active BNSF railroad lines. To the west of the active railroad lines is an area zoned for commercial and/or industrial uses that includes retail, education, and government buildings.
- Immediately to the south of the Site is a mix of vacant land, and various commercial and/or industrial properties. This includes a Community College of Spokane property and an AT&T Communications property.
- Immediately to the east of the Site is an area zoned for commercial and/or industrial uses that includes a vehicle repair shop, post office, and the Esmeralda Municipal Golf Course.

Figure 2.6 presents the City of Spokane zoning surrounding the Site. The Site is located in a relatively large area zoned for industrial use. To the west of the Site is an area zoned primarily for commercial use (Center and Corridor; Commercial; and Neighborhood Retail), although based on the Figure 2.6, it contains a mix of both commercial and residential use. The closest residential areas are approximately 950 feet west of the Site; 1,100 feet east of the Site, not including the Esmeralda Municipal Golf Course; and 1,400 feet south of the Site. These residential areas are primarily low density residential areas, though a few medium density and high density residential areas exist to the west of the Site.

2.6.1 Industrial Property

Under the MTCA Rules (WAC 173-340-200) industrial properties are defined as those properties characterized by, or committed to, traditional industrial uses, and that are either:

- Zoned for industrial use by a city or county conducting land use planning under RCW 36.70A (Growth Management Act); or
- For counties not planning under RCW 36.70A (Growth Management Act) and the cities within them, zoned for industrial use and adjacent to properties currently used or designated for industrial purposes.

Since Spokane County and the City of Spokane conduct land use planning under the Growth Management Act, based on the Growth Management Act (GMA) Joint Planning Interlocal Agreement, dated November 19, 2008, any property zoned for industrial use is generally considered an industrial property. In addition, as per WAC 173-340-745 (1), the following characteristics must be met to be considered an industrial property:

- There are no people living on the property and the primary potential exposure is to adult employees of businesses located on the property;
- Access to the property by the general public is generally not allowed. If access is allowed, it is highly limited and controlled due to safety or security considerations;
- Food is not normally grown or raised;
- Operations are often (but not always) characterized by the use and storage of chemicals, noise, odors, and truck traffic;
- The surface of the land is often (but not always) mostly covered by buildings or other structures, paved parking lots, paved access roads, and material storage areas – minimizing potential exposure to the soil; and
- Support facilities may be present consisting of offices, restaurants, and other facilities that are commercial in nature, but are primarily devoted to administrative functions necessary for the industrial use and/or are primarily intended to serve the industrial facility employees and not the general public.

Based on the industrial zoning and the characteristics described above, the Site can be reasonably designated as an industrial property.

3 Physical and Hydrogeologic Setting

3.1 Physical Setting

3.1.1 Topography

The Site is located at an average elevation of approximately 2,037 feet above mean sea level (MSL), and is relatively flat with about 10 feet of total relief. About 1 mile to the east of the Site, Beacon Hill rises approximately 500 feet above the Site (elevation of 2,539 feet MSL). To the north of the Site, the topography slopes between 2 and 5 percent towards the Little Spokane River, located approximately 8 miles north of the Site. To the south of the Site, the topography gently slopes between 1 and 2 percent towards the Spokane River, located approximately 1.5 miles south of the Site (refer to Figure 2.1). At the Spokane River, a steep bluff drops about 30 feet to the river below. Overall, the topography surrounding the Site ranges from 1,870 feet MSL at the Spokane River to 5,889 feet MSL at the nearby summit of Mt. Spokane, located to the east of the Site.

3.1.2 Surface Water Occurrence

The Site is located within the 6,240-square mile Spokane River watershed. The watershed includes the Little Spokane River, which is hydraulically downgradient of the Site and discharges to the Spokane River below Nine Mile Dam, approximately 10 miles northwest of the Site. The Spokane River eventually discharges to the Columbia River about 40 miles west of the City of Spokane. A further discussion of groundwater and surface water interactions will be discussed in Section 3.2.

The closest surface water feature in the vicinity of the Site is the Spokane River, which is located about 1.5 miles to the south of the Site. There are no perennial surface water features on the Site; however, the manmade stormwater collection basin on the adjacent Dross site to the north reportedly contains water all year.

3.1.3 Climate

The area is characterized by warm, moderately moist summers, and cool, snowy winters. Based on data collected at the Spokane Airport (NOAA Station No. 457938), the average monthly temperatures vary from lows of about 22 degrees Fahrenheit in January to highs of about 84 degrees Fahrenheit in July, for the period of record (1889 to present).

The average annual precipitation at the Spokane Airport is about 16 inches per year, with an average annual snowfall of about 41 inches. The greatest average monthly precipitation generally occurs in December, while the lowest average monthly precipitation occurs in July.

3.1.4 Soils

Soils in the vicinity of the Site are derived from weathered glacial till, colluvium, glaciofluvial, and glaciolacustrine sediments (Soil Conservation Service [SCS], 1992). The soils in the area are described by the SCS as deep, moderate to well-drained soils formed from glacial outwash or glacial lake sediments. The soils often have interbedded lenses of clays and silts that impede the downward movement of infiltrating water.

3.1.5 Vegetation

A formal vegetation survey has not been conducted on the Site; however, the majority of the Site is either paved or covered by compacted soil/gravel. Very little vegetation (grassy weeds and sagebrush species) is growing on or adjacent to the Site. The Site is located within a heavily urbanized industrial area of Spokane, thus the native vegetation of the area has been significantly altered.

3.1.6 Wildlife

Because of the Site's location within an industrial area, it is not likely that the Site or surrounding adjacent properties provide necessary habitat for species other than infrequent transient visitors. Osprey and Canada geese have reportedly been observed periodically on properties neighboring the Site. However, fencing surrounding the Site reduces access to the Site for most wildlife. Therefore, only a brief discussion of habitat and endangered, threatened, sensitive and other priority species is provided in the following sections.

3.1.6.1 Habitat

The Washington State Department of Fish and Wildlife (WDFW) Priority Habitat and Species Map (WDFW, 2008) indicates that one priority habitat (the area surrounding Beacon Hill) is located within approximately 1/2 mile of the Site, and that another priority habitat (the Spokane River) is located within approximately 1.5 miles from the Site.

Supporting documents to the WDFW Priority Habitat and Species Map (WDFW, 2008) indicate that the Beacon Hill habitat is considered a Biodiversity Area containing populations of white tailed deer, moose, elk, red-tailed hawk, Cooper's hawk, great horned owl, saw-whet owl, and remnant ponderosa pine surrounded by urban development.

According to the WDFW map, the Spokane River corridor is considered a riparian zone containing winter waterfowl concentration of nesting red-tailed hawk and individual occurrences of nesting osprey and wintering bald eagles.

3.1.6.2 Endangered, Threatened, Sensitive and other Priority Species

The Washington Fish and Wildlife Office website was used to determine listed endangered and threatened species, and species of concern that are known to inhabit Spokane County (http://www.fws.gov/wafwo/pdf/SpokaneCounty080111.pdf). The most recent list of noted species, as of March 5, 2012, includes the following:

- Endangered: gray wolf (Canis lupus),
- Threatened: bull trout (Salvelinus confluentus)
- Species of Concern: bald eagle (Haliaeetus leucocephalus), burrowing owl (Athene cunicularia), California floater mussel (Anodonta californiensis), ferruginous hawk (Buteo regalis), giant Columbia spire snail (Fluminicola columbiana), loggerhead shrike (Lanius ludovicianus), long-eared myotis (Myotis evotis), northern goshawk (Accipiter gentilis), olive-sided flycatcher (Contopus

cooperi), Pallid Townsend's big-eared bat (Corynorhinus townsendii pallescens), peregrine falcon (Falco peregrinus), redband trout (Oncorhynchus mykiss), sagebrush lizard (Sceloporus graciosus), and westslope cutthroat trout (Oncorhynchus clarki lewisi).

3.2 Hydrogeologic Setting

3.2.1 Regional Geology

The Site overlies the SVRP aquifer, in an area of the aquifer known as the Hillyard Trough. The SVRP aquifer consists of Quaternary glaciofluvial deposits that cover an area of about 370 square miles across Idaho and Washington (Kahle and Bartolino, 2007). During the climax of the most recent Quaternary glaciation, which occurred about 15,000 years before present during the Pleistocene Epoch, much of northern Washington and Idaho was covered by lobes of the Cordilleran ice sheet. This ice flowed southward out of Canada, overriding mountain ranges and filling the river valleys with ice. Several of the ice-filled valleys formed dams, behind which water collected and formed glacial lakes. This included Glacial Lake Missoula, which was the largest of these lakes, located in western Montana.

Over time, the water trapped behind the ice dam forming Glacial Lake Missoula eventually undermined the ice and burst through the dam, causing wide-spread flood events (outburst floods) that extended across parts of Montana, Idaho, Washington, and Oregon before reaching the Pacific Ocean (Kahle and Bartolino, 2007). Outburst floods from Glacial Lake Missoula may have occurred as many as 100 times (Atwater, 1986), as the ice continued to flow southward and the ice dams continued to reform.

The floodwater from the outbursts floods flowed south through Rathdrum Prairie and then west toward Spokane. The water scoured the ground surface along major river courses, such as the Spokane River, and picked up large quantities of sediment (older glacial deposits and/or flood deposits), ranging from boulder to clay size particles. As the energy of the flow dissipated, the floods deposited the sediments within the scoured valleys. Heavier sediments, such as boulders, cobbles and coarse gravel were deposited near the center of the valley; while fine gravel, sand, and silt were deposited along the margins (Kahle and Bartolino, 2007). Deposition of fine silts and clays also occurred within glacial lakes (glaciolacustrine deposits) that formed in the area, including Glacial Lake Spokane and later Glacial Lake Columbia, which formed in the Spokane area.

After the final draining of Glacial Lake Missoula, the climate began to warm, the continental ice-sheets retreated northwards, and the Spokane River resumed its course westward to Spokane. However, instead of flowing northwards through the Hillyard Trough (as it did before the outburst flood events), the Spokane River was redirected by the accumulated flood deposits in the Hillyard Trough area. As a result, the course of the Spokane River continued westward through what is now downtown Spokane, before turning northwards to join the Little Spokane River at the western toe of Lookout Mountain.

3.2.2 Local Geology

The primary geologic unit found at the surface in the vicinity of the Site is flood deposit gravels (Qfg), which comprise the SVRP aquifer. This unit consists of a poorly sorted, stratified mixture of boulders, cobbles, gravel, and sand (Joseph, 1990) deposited from the outburst flood events discussed above. The percentage of cobbles and boulders within this unit decreases in a westerly direction along the Spokane Valley and to the north, towards the Hillyard Trough.

In addition, intermittent layers of silt and clay are present within the flood deposit gravels, which were deposited in glacial lake environments. In the northern portion of the Hillyard Trough, a continuous silty clay and sand layer has been identified to be as thick as 200 feet in places, and found at a depth interval of 100 to 300 feet bgs. This silty clay layer divides the sand and gravel flood deposits into two zones, but becomes thin and discontinuous in the southern portion of the Hillyard Trough, where the Site is located.

Underlying the unconsolidated glaciofluvial deposits are the basalt flows of the Columbia River Basalt Group (Mv), which are interlayered with primarily silt and clay of the Latah Formation (Mcl). These geologic units are exposed at the surface to the northeast of the Site (Joseph, 1990). Underlying these units is crystalline bedrock, including the Mount Spokane Granite ($Kiat_s$) and the Newman Lake Gneiss (Kog_n). The depth to bedrock in the vicinity of the Site is generally around 500 to 600 feet bgs; however, both the Mount Spokane Granite and the Newman Lake Gneiss are exposed at the surface to the east of the Site, in the vicinity of Beacon Hill.

3.2.2.1 On-Site Geologic Findings

Results of the RI at the Site confirm the presence of the glaciofluvial deposits that comprise the SVRP aquifer. The soil boring and well construction logs from the RI are presented in Appendix B. Based on these logs, a geologic cross section of the Site is presented on Figure 3.1, with the location of the cross section presented on Figure 2.4. Based on the boring logs, the glaciofluvial deposits in the vicinity of the Site consist of loose, grey, fine to coarse gravel with cobbles, silt, and sand to depths of between 60 and 120 feet bgs. The amount of silt and sand observed generally increased with depth, with beds of fine to coarse sand encountered throughout each of the borings. Between approximately 85 and 197 feet bgs the glaciofluvial deposits generally consisted of loose, brownish-gray fine to coarse sand with silt and fine gravel. Beds of gravel were also occasionally encountered from 85 to 190 feet bgs. In borings MW-1 and MW-2, a silt lens was encountered between a depth of 172 and 174 feet bgs and a clayey silt lens was encountered at a depth of 187.0 to 187.5 feet bgs.

Previous investigations in the vicinity of the Northeast Tank Farm region of the Site (refer to Section 2.3) indicated that petroleum hydrocarbons were perched on a thin clay layer at a depth of 125 feet bgs (GTI, 1996a and 1996b). However, none of the borings drilled to the north of the Northeast Tank Farm area during the RI encountered clay at this depth. Borings MW-1 and MW-2 encountered silty sand between 124 and 125 feet bgs, with well graded sand and gravel below. In addition, soil samples collected at 125 feet bgs in borings GMW-3 and GMW-4 also did not indicate the presence of clay or indications of petroleum hydrocarbons. As indicated by Kahle and Bartolino (2007), the relatively thick and continuous glaciolacustrine deposits observed in the Hillyard Trough appear to become relatively thin and discontinuous towards the center of Spokane Valley.

3.2.3 Groundwater Occurrence

The glaciofluvial deposits in the vicinity of the Site are relatively permeable and most precipitation infiltrates into the underlying unconfined SVRP aquifer with little overland flow. Most of the recharge to the SVRP aquifer in the vicinity of the Site occurs in the winter and early spring, either from winter rains and/or snowmelt (Cline, 1969). Seasonal groundwater level fluctuations in the aquifer are generally less than 15 feet in most areas (Drost and Seitz, 1978). In the Hillyard Trough area, the relatively thick and extensive fine-grained deposits separate the SVRP aquifer into upper and lower units. However, because the fine-grained deposits are relatively thin and discontinuous in the vicinity of the Site, they likely create extremely localized perched zones with limited groundwater.

Groundwater levels were monitored at the Site during both Phase I and Phase II of the RI, and are summarized in Table 3.1 and shown on Figure 3.2. Groundwater levels in May 2011 ranged between 165.6 feet bgs (GMW-06) and 172.8 feet bgs (GMW-05). Seasonally, groundwater levels vary between 5 and 7 feet, with the highest groundwater levels generally occurring in spring (April or May) and the lowest groundwater levels generally occurring in late summer or fall (August or November).

3.2.3.1 Groundwater Flow

Regional groundwater flow within the SVRP aquifer generally reflects the ground surface topography (Kahle et al., 2005). Within the Spokane Valley, groundwater generally flows from east to west, parallel to the Spokane River. However, the Site is located within the Hillyard Trough, where groundwater flow is to the north along the ancestral course of the Spokane River, towards the Little Spokane River (Hsieh, et al., 2007; Kahle, et al., 2005).

Figure 3.3 presents a groundwater elevation contour map in the vicinity of the Site for May 2011, based on groundwater level measurements collected during Phase II of the RI. This groundwater elevation contour map confirms the northward groundwater flow direction in the vicinity of the Site. Groundwater flow directions in the vicinity of the Site remained relatively consistent during the Phase II RI quarterly groundwater level monitoring and sampling events (Aspect, 2010c; 2011a; 2011b).

Based on Figure 3.3, the groundwater gradient immediately downgradient of the Site is approximately 0.0014. This is relatively consistent with groundwater monitoring completed by CH2M Hill (1994) in the Spokane area, which indicated a hydraulic gradient within the southern portion of the Hillyard Trough of 0.004.

3.2.3.2 Groundwater/Surface Water Interactions

An inspection of surface water runoff at the Site was conducted as part of the Phase II RI (refer to Section 4.3). This inspection indicated that surface water drainage is generally outward from the topographical high at the center of the Site in the vicinity of the office (refer to Figure 3.4). Surface runoff generally pools in low lying areas along the perimeter of the property, where it eventually evaporates or infiltrates. Based on the inspection, it generally does not appear that surface water runoff exits the Site, with the exception of one area to the south of the Site where the topography favors some pooling in a low lying area that may receive overflow runoff from the Site.

As previously discussed (Section 3.1.2), the closest surface water feature in the vicinity of the Site is the Spokane River, located about 1.5 miles south of the Site (refer to Figure

2.1). Based on the groundwater flow direction beneath the Site as discussed above, the Spokane River is hydraulically upgradient of the Site, and thus could not be impacted from any releases at the Site.

The Little Spokane River is located about 8 miles north of the Site (refer to Figure 2.1), and based on the groundwater flow directions discussed above, is hydraulically downgradient of the Site. Based on stream gage data collected from the Little Spokane River (USGS Station Nos. 12431500 and 12431000), groundwater from the SVRP aquifer appears to be consistently discharging into the Little Spokane River between these two stream gage locations (Kahle, et al., 2005; and Hsieh, et al., 2007).

3.2.3.3 Aquifer Properties

Much of the SVRP aquifer is considered to be highly permeable, with most of the available data indicating that the hydraulic properties are on the upper end of values measured in the natural environment (Kahle, et al., 2005). However, in areas where relatively thick and extensive fine-grained deposits are present, the aquifer may be less permeable.

Hydraulic properties were not evaluated in the vicinity of the Site as part of this RI/FS; therefore, local groundwater flow velocities could not be estimated. However, the SVRP aquifer as a whole has an extremely high groundwater flow velocity, with an average flow velocity of 47 feet per day in the Hillyard Trough area (Drost and Seitz, 1978). In comparison, a typical aquifer has a groundwater flow velocity of between ¼ inch and several feet per day (Golder, 2008). The transmissivity of the SVRP aquifer in the vicinity of the Site, which is a calculated value indicating how much water can move through an aquifer, is estimated to be between approximately 2 and 6 square feet per second, with a specific yield of between 10 and 15 percent (Molenaar, 1988).

3.2.3.4 Groundwater Use and Potability

The SVRP aquifer provides a water source for more than 500,000 people in Idaho and Washington. Because it supplies water to more than 80 percent of the population living near the aquifer, the U.S. Environmental Protection Agency (EPA) designated the SVRP aquifer as a Sole Source Aquifer in 1978 (Kahle and Bartolino, 2007).

Groundwater supply wells within 1 mile of the Site were compiled based on Ecology's Well Log Database (http://apps.ecy.wa.gov/welllog/index.asp). Table 3.2 provides a list of the wells used for either industrial/commercial or domestic water supply, and Figure 3.5 indicates the approximate location of these wells. There are a total of 15 wells located within 1 mile of the Site; however, a majority of these wells are located either upgradient or cross gradient of the Site, and would not be affected by any groundwater impacts originating from Site. The exceptions are the following wells: T25N/R43E-3C1, T25N/R43E-3C2, T26N/R43E-34L1, T26N/R43E-34P1, T26N/R43E-34. T25N/R43E-3C2 is located immediately downgradient of the Site; however, it is associated with the Hillyard Dross site, which is currently undergoing a cleanup action with Ecology, in which the groundwater is not being used as potable water. Although T25N/R43E-3C1 is also indicated as being immediately downgradient of the Site, the presence of basalt in the well log lithology indicates that the well is likely mislocated. The remaining three water supply wells are located further downgradient of the Site in an area historically used for industrial purposes. Based on the well logs, these wells were installed by BNSF and Washington Water Power, and do not appear to be used for potable supply.

Residential areas within the vicinity of the Site are located either upgradient or cross gradient of the Site (refer to Section 2.6), and are expected to be within the City of Spokane's water service area, since they are located within City limits. The Spokane County Building and Planning Department Aquifer Susceptibility Map (Spokane County, 2009) indicates potentially how susceptible the SVRP aquifer is to groundwater contamination based on the surrounding environmental characteristics, including: soil media, aquifer hydraulic conductivity, annual recharge, depth to groundwater, and importance of the vadose zone. Based on this Aquifer Susceptibility Map, the SVRP aquifer within the vicinity of the Site and the City of Spokane generally has a low susceptibility. The nearest area with moderate susceptibility is approximately 1 mile hydraulically downgradient (north) of the Site, and the nearest area with high susceptibility includes wellhead protection areas for Department of Health Group A wells, approximately 2.5 miles downgradient (north) of the Site.

4 Site Remedial Investigation

The Remedial Investigation is the data-gathering phase of the RI/FS process, which was conducted in two phases (Phase I and II) at the Site. The intent of the RI is to adequately understand the nature and extent of COPCs associated with the Site and to evaluate the risks in accordance with MTCA. The COPCs that were analyzed as part of the remedial investigation include:

- Diesel-range petroleum hydrocarbons
- Heavy oil-range petroleum hydrocarbons
- Naphthalene
- PAHs

In addition, select soil and groundwater samples were also analyzed during Phase I of the RI for extractable petroleum hydrocarbons (EPH). EPH is an analysis of the concentration of the various aliphatic and aromatic petroleum hydrocarbons based on the number of carbon atoms. This is used for understanding the range of hydrocarbons that are present at the Site, and is necessary for evaluating the risk.

Applicable exposure points and potential receptors for the Site include:

- Human and ecological receptors via direct contact with the upper 15 feet of soil.
- Groundwater in the SVRP aquifer impacted by COPCs originating from the Site.

The remedial investigation was developed and executed such that data was gathered to address all of the potential exposure points listed above. Shallow soil investigations were focused on areas that had the highest potential for releases, such as loading/unloading racks, overflow pits, and decommissioned underground pipelines. The shallow soil investigation preceded the groundwater investigation to allow for identification of additional areas of potential risk and confirm proposed well locations downgradient of potential sources. Groundwater was assessed for potential impacts from COPCs known to be used at the Site.

Surface water samples were not collected as part of the RI because natural surface water features are not present at or adjacent to the Site. However, as previously discussed, surface water runoff can pool in low lying areas along the perimeter of the property before it eventually evaporates or infiltrates. The current Site operator reportedly has collected and continues to collect surface water samples at various locations (DP1 to DP3) along the perimeter of the property (refer to Figure 3.4) in order to satisfy the current discharge permit requirements (Permit No. WAG 507161), which has an expiration date of October 1, 2015.

4.1 Phase I Remedial Investigations

Phase I remedial investigations were conducted by Golder beginning in October 2008, pursuant to the Ecology-approved *Remedial Investigation/Feasibility Study Work Plan,* dated July 24, 2008. The Phase I investigations included: shallow (i.e., depths less than 16 feet bgs) soil investigations using a direct-push drill rig; sampling and analysis of deeper soils during drilling of monitoring wells; installation of monitoring wells; and collection of three rounds of quarterly groundwater quality samples.

A synopsis of soil and groundwater samples collected during the Phase I remedial investigations is presented in the following table:

Phase I Remedial Investigation Detections

Shallow Soil Investigations (0 to 16 ft bgs)	TPHs-Dx	Carcinogenic PAHs	Non-carcinogenic PAHs	Naphthalene	EPH
Number of Analyses	54	38	38	38	18
Number of Detections	28	5	9	6	16
Maximum Value (mg/kg)	26,000	5.2	44	158	3,800
Deep Soil Investigations (105 to 176 ft bgs)	**TPHs-Dx**	**Carcinogenic PAHs**	**Non-carcinogenic PAHs**	**Naphthalene**	**EPH**
Number of Analyses	8	8	8	8	3
Number of Detections	0	0	0	1	0
Maximum Value (mg/kg)	ND	ND	ND	0.0076	ND
Groundwater Samples	**TPHs-Dx**	**Carcinogenic PAHs**	**Non-carcinogenic PAHs**	**Naphthalene**	**EPH**
Number of Analyses	21	21	21	21	7
Number of Detections	3	6	7	0	0
Maximum Value (µg/L)	270	0.0115	0.012	ND	ND

Notes:
ND = Non-detect

The Phase I remedial investigations indicated detections of diesel- and oil-range TPH (including EPH) in the shallow Site soil, with carcinogenic PAHs (cPAHs) and PAHs (including naphthalene) detected at lesser frequencies. The deeper Phase I soil samples did not contain detectable concentrations of either TPH or carcinogenic PAHs. Groundwater samples collected during Phase I contained only limited, trace-level detections of diesel- and oil-range TPH and PAHs.

The following sections present the methods and detailed results of all Phase I remedial investigations.

4.1.1 Phase I Shallow Soil Investigation

Previous investigations indicated the presence of petroleum hydrocarbons in the shallow soil in the vicinity of the Northeast Tank Farm area. An additional soil investigation was performed as part of this RI to further refine the extent of petroleum impacts in the shallow soil at the Site. The shallow soil investigation was performed between October 6 and 8, 2008. Thirty soil borings (GGP01 to GGP30) were completed using a direct push drill rig at the locations shown on Figures 2.4 and 2.5. Soil borings were drilled to a maximum depth of 16 feet bgs. If refusal was reached at less than 16 feet bgs, the drill rig was moved within 40 feet of the original boring location and a replacement soil boring was drilled to a depth of 16 feet bgs. Nine of the soil borings had to be moved because of shallow refusal. Boring logs are provided in Appendix B.

During drilling, soil samples were collected at 2.5-foot intervals, and field screened by visual and olfactory observation and using a hand-held photoionization detector (PID). Field screening indicated potential areas of impacted soil in several borings, including: GGP01B (4 to 12 feet), GGP06 (12 to 16 feet), GGP09 (0 to 16 feet), GGP11 (12 to 16 feet), GGP12B (4 to 8 feet), GGP18 (12 to 16 feet), GGP21B (0 to 8 feet), GGP23 (8 to 12 feet), GGP24 (0 to 16 feet), and GGP30 (4 to 8 feet).

Based on the field screening, soil samples were collected for analysis from each of the borings. If field screening did not indicate the presence of impacted soil, the sample from the bottom of the boring was selected for analysis. Soil samples were submitted to Pace Analytical Laboratory in Seattle, Washington. A total of 54 shallow soil samples were analyzed for diesel- and heavy oil-range TPH by method NWTPH-Dx, and 38 samples were analyzed for PAHs (including naphthalene) by EPA Method 8270C. Select soil samples were also submitted to Analytical Resources Inc., in Seattle, Washington, where 18 samples were analyzed for extractable petroleum hydrocarbons (EPH). The laboratory analytical results are summarized in Table 4.1 and provided in Appendix C.

4.1.1.1 Analytical Results

Total Petroleum Hydrocarbons

Only about half of the soil samples analyzed (28 soil samples from 16 borings) contained detectable concentrations of diesel- and/or heavy oil-range TPH. The higher detections of TPH were generally limited to the upper 5 to 10 feet bgs, except at GGP21B and GGP24, where higher TPH concentrations were also present at the total boring depths of 12 and 15 feet bgs, respectively.

TPH concentrations (sum of the diesel- and heavy oil-range analyses) ranged from 7.2 to 26,000 mg/kg. The highest TPH concentrations were detected in borings GGP06 (3,800 mg/kg), GGP09 (9,200 mg/kg), and GGP30 (2,370 mg/kg), located near the center of the Site; GGP21B (1,830 mg/kg), located near the north side of the Site; and GGP24 (26,000 mg/kg) located northwest of the Northeast Tank Farm.

Polycyclic Aromatic Hydrocarbons

Ten of the soil samples (from eight of the thirty soil borings) had detections of PAHs. Detected naphthalene concentrations ranged from less than 2 to 158 mg/kg. In addition, several other carcinogenic (cPAH) and non-carcinogenic PAHs were detected in the soil. In all but one of the samples (GGP05), PAH detections occurred in soil samples that also had TPH detections.

Published Toxicity Equivalency Factors (TEFs) from WAC 173-340-900, Table 708-2 were used to calculate the total toxic equivalent concentration of cPAHs as benzo(a)pyrene in Site soil samples. Non-detects were used in this calculation at ½ the detection limit. Calculated benzo(a)pyrene toxic equivalent concentrations in the shallow soil samples ranged from the sum of ½ the detection limit to 5.2 mg/kg.

Extractable Petroleum Hydrocarbons

Sixteen of the soils samples had detected concentrations of EPH, including aromatic and aliphatic petroleum hydrocarbons. However, three of these samples did not have detected concentrations of TPH or PAHs (GGP-11-15, GGP-12B-2.5, and GGP-12B-7.5). Detected concentrations of aliphatic EPH ranged from 2.1 parts per million (ppm) to 960 ppm; while detected concentrations of aromatic EPH ranged from 2.1 ppm to 3,800 ppm.

4.1.2 Phase I Deep Soil Investigation

Previous soil investigations conducted in the vicinity of the Northeast Tank Farm area indicated that petroleum hydrocarbons were present in soil to a depth of 125 feet bgs (Radian, 1996a; GTI, 1996a and 1996b). The petroleum hydrocarbons appear to have been perched on a thin clay layer observed at 125.5 feet bgs. Therefore, additional soil samples were collected during the drilling and installation of monitoring wells downgradient of the Site as part of this RI to further refine the lateral and vertical extent of petroleum hydrocarbon impacts in the deep soil at the Site. The locations of these wells are illustrated on Figure 2.4 and boring logs are provided in Appendix B.

The deep soil samples were collected from the sonic drilled borings of two monitoring wells (GMW-01 and GMW-02) located to the north of the Northeast Tank Farm. Soil samples were field screened by visual and olfactory observation and by using a hand-held PID. The PID measurements were generally less than 14 ppm, except for the soil in GMW-01 at 172 feet bgs, which was measured at 108 ppm. No odors, staining, sheens, or free product were observed in the soil at depth. Four soil samples were collected from boring GMW-01 between depths of 120 and 175 feet bgs, and five soil samples were collected from boring GMW-02 between depths of 105 and 176 feet bgs (refer to Appendix B). The targeted depths included the depth at which petroleum hydrocarbons were detected (125 feet bgs), the soil above the aquifer, and the soil at the groundwater interface. The soil samples were labeled by the monitoring well number (i.e., GMW-01) followed by the depth at which the sample was collected (i.e., 120).

Soil samples were submitted to Pace Analytical Laboratory. The samples were analyzed for diesel- and heavy oil-range TPH by method NWTPH-Dx. A total of six samples (three samples from each well) were also analyzed for PAHs (including naphthalene) by EPA Method 8270C. In addition, two samples from GMW-01 and one sample from GMW-02 were submitted to Analytical Resources Inc., and analyzed for EPH. The laboratory analytical results are summarized in Table 4.2 and provided in Appendix C.

4.1.2.1 Analytical Results

No TPH were detected in any of the deep soil samples collected for either boring GMW-01 or GMW-02. One sample (GMW-01-174.5) had a detection of 2-Methylnapthalene, a non-carcinogenic PAH, at 0.0076 mg/kg. No other PAHs were detected in any of the soil samples. Results of the EPH analyses indicated that no aromatic hydrocarbons were detected. A detection of aliphatic hydrocarbons, in the C21-C34 range, was reported in the sample GMW-02-176.

4.1.3 Phase I Groundwater Investigations

Previous site investigations included the installation of relatively deep borings at or adjacent to the Site, but did not include investigations of groundwater from the SVRP aquifer. In addition, no monitoring wells existed at the Site prior to this RI, nor were any previous groundwater investigations conducted.

The Phase I RI evaluated the groundwater quality of the SVRP aquifer immediately downgradient of the Site. In October and November 2008, Golder oversaw the installation of six monitoring wells at the Site. Five wells (GMW-01 to GMW-05) were installed along an east-west line near the northern property boundary of the Site in October 2008. These wells are located in positions hydraulically downgradient of the main processing and storage areas at the Site, including the Northeast Tank Farm area. A sixth well (GMW-06) was installed near the northwest corner of the Site, downgradient of the northernmost asphalt cement AST and upgradient of the adjacent Black Tank site (see Section 2.5). The locations of GMW-01 to GMW-06; an off-site monitoring well (UDCMW-4), installed as part of the adjacent Dross Site investigation; and monitoring wells at the adjacent Black Tank site, designated with the prefix GEO-BTMW, are shown on Figure 2.4. Appendix B provides the soil boring and Site monitoring well construction logs.

4.1.3.1 Monitoring Well Drilling

Monitoring wells GMW-01 and GMW-02 were drilled using sonic drilling techniques. These techniques were used in order to obtain continuous soil samples for stratigraphic interpretation, and to facilitate detection of any perched groundwater zones in the vicinity of the Northeast Tank Farm area, where deep soil impacts were previously observed. The soil borings were advanced using continuous 8-inch-diameter casing and a 4-inch-diameter sample barrel to drill from ground surface to approximately 15 feet below the static water level.

The four remaining monitoring wells (GMW-03 to GMW-06) were drilled using air-rotary drilling techniques. Soil boring samples were collected using a split-spoon drive sampler to confirm local lithology at targeted depths within each boring. The borings were advanced using continuous 8-inch-diameter casing with a 4-inch-diameter Tubex overdrive bit from ground surface to 58 feet bgs. At 58 feet bgs, the boreholes were reduced to a 6-inch-diameter casing and a 3-inch-diameter Tubex bit to drill to the total depth of each borehole at approximately 15 feet below the static water level.

No perched groundwater was identified during the drilling of the monitoring well borings. The total depths ranged from 190 to 197 feet bgs.

4.1.3.2 Monitoring Well Construction and Development

Monitoring wells were constructed using 2-inch-diameter, schedule 80 polyvinyl chloride (PVC) casing with stainless steel centralizers placed at 40-foot intervals. The well screens also consisted of 2-inch-diameter, schedule 80 PVC, with the exception of GMW-02, which consisted of stainless steel. All of the monitoring wells were constructed to intersect the water table and had 20-foot screen intervals, with the exception of GMW-06, which had a 25-foot screen interval. Installation details for the monitoring wells are presented in Table 3.1, and the well construction logs are present in Appendix B.

At the surface, GMW-01 to GMW-04 were completed with above ground monuments, while GMW-05 and GMW-06 were completed with flush-mount monuments. All monitoring wells were completed with concrete pads and protective steel monuments with lockable lids. After installation of the monitoring wells was completed, the wells were developed. Well development consisted of bailing and swabbing the monitoring well with the drill rig. Wells were further developed using a submersible Grundfos pump to purge a minimum of 50 gallons of water from each well to remove fine-grained particles from the well screen and water column.

Each well was equipped with a dedicated Well Wizard® MicroPurge T1200M bladder pump that was 3.4 feet long. The pump has a maximum volume of 495 milliliters and a maximum lift of 300 feet. The pump intakes were initially set approximately 2 feet above the bottom of the screen interval, but were later modified during the Phase II groundwater quality sampling to be about 5 feet below the lowest observed water level. Table 4.3 provides the initial and modified pump settings for the monitoring wells.

4.1.3.3 Groundwater Sampling Activities and Methods

Based on the Work Plan (Golder, 2008), two groundwater sampling events were initially to be conducted to identify temporal changes to the groundwater chemistry in the SVRP aquifer. The first groundwater sampling event was to be conducted in December 2008; however, because of inclement weather, only water level measurements were collected at that time. The first groundwater sampling event was instead completed on January 13-14, 2009. Groundwater samples were collected from the new Site wells (GMW-01 to GMW-06) and the pre-existing Hillyard Dross site well (GEO-DCMW-4), which was renamed UDCMW-4 for the purposes of this report. The second groundwater sampling event took place on April 30 and May 1, 2009. Due to the detection of PAHs during the second groundwater sampling event that may have been erroneous, a third groundwater sampling event was conducted in August 2009.

The third groundwater sampling event included additional QC steps to evaluate representativeness of the samples and ensure the quality of the data. This included analysis of split samples sent to a second laboratory (Test America Laboratories) in order to evaluate laboratory quality control. In addition, field, office, and bottle blanks were prepared using high-quality deionized/distilled water (triple distilled) from the respective laboratory. Field blanks were prepared at the wells (open to the atmosphere), while additional office blanks were prepared in a controlled environment, away from potential ambient impacts. A bottle blank was also transported with the sample bottles received from the laboratories in order to determine if COPCs were being picked up as residue from the sample bottles, since the bottles were not certified for low-level SIM analyses. The laboratories also performed laboratory method blanks to help determine the source of the previously detected PAHs.

All groundwater sampling activities were conducted in accordance with QA protocols and procedures specified in the relevant technical procedures of the QAPP (Golder, 2008). Prior to collecting the groundwater samples, water levels were measured using a product/water level indicator to identify if free product was present in any of the wells. In addition, a clear, disposable bailer was also used to confirm the presence/absence of free product. Free product was not identified in any of the Site wells (GMW-01 to GMW-06). Groundwater levels were also monitored in the off-site monitoring wells during the first two sampling events. This included GEO-BTMW-01 to GEO-BTMW-09, which are on the adjacent Black Tank site (GeoEngineers, 2008), and UDCMW-4 which is on the adjacent BNSF property. Table 3.1 provides a summary of these water levels.

Low flow sampling techniques were used for the collection of the groundwater quality samples, which included allowing the field parameters to stabilize prior to sampling. Field parameters from the groundwater sampling events are presented in Appendix D. Groundwater samples were collected using the dedicated pumps discussed above. Groundwater samples collected during the first sampling event were collected from approximately 2 feet above the bottom of the screen interval, at the elevations listed in Table 4.3. However, as requested by Ecology, during subsequent sampling events groundwater samples were collected as near to the current water level as possible.

Groundwater samples were submitted to Pace Analytical Laboratory and also to Test America Laboratory, during the third groundwater sampling event. Groundwater samples were analyzed for diesel- and heavy oil-range TPH by method NWTPH-Dx, and PAHs (including naphthalene). In addition, select samples were submitted to Analytical Resources Inc., and analyzed for EPH. The laboratory analytical results are summarized in Table 4.4 and provided in Appendix E.

4.1.3.4 Analytical Results

Total Petroleum Hydrocarbons

Low concentrations of diesel- and/or heavy oil-range TPH were detected in monitoring wells UDCMW-4, GMW-04, and GMW-05 during the August 2009 sampling event. Detected concentrations ranged from 27 to 270 micrograms per liter (µg/L). However, TPH were not detected in any of the other groundwater samples collected in 2009.

Polycyclic Aromatic Hydrocarbons

Low concentrations of PAHs, including cPAHs, were initially reported in samples collected from several wells during the 2009 Phase I sampling. However, a number of these detections were subsequently qualified or rejected after data validation indicated field quality control and/or laboratory quality control problems (Aspect, 2010a). Rejected results are shown with an “R” flag in Table 4.4. Therefore, valid detections of PAHs only occurred in January 2009 at UDCMW-4, in May 2009 at GMW-01 to GMW-02 and GMW-04 to GMW-06, and in August 2009 at UDCMW-4.

Published TEFs from WAC 173-340-900, Table 708-2 were used to calculate the total TEF concentration of cPAHs as benzo(a)pyrene in the 2009 groundwater samples using data that were not rejected. Half of the detection limit was used for cPAHs that were non-detect. The highest calculated benzo(a)pyrene TEF concentration in the valid ground-water samples collected during the 2009 Phase I sampling events was 0.012 µg/L.

Results from the field blank, bottle blank, and method blanks confirmed the possibility of external impacts or false laboratory detections in the third groundwater sampling event. Since the field blanks prepared at the wells revealed detections of some PAHs, it is believed that ambient air is a potential source. Alternatively, it is possible that the low detection limits for these analyses triggered false positive results from the laboratory equipment. Therefore, additional QA/QC controls were used during subsequent Phase II groundwater sampling events.

4.1.4 Surveying

Geoprobe boring locations and control points were recorded using a handheld GPS. The new monitoring wells at the Site (GMW-01 to GMW-06) and UDCMW-4 were surveyed for geodetic x,y,z coordinates by Benthin Associates, a licensed land surveying company. In addition to the monitoring wells, control points were also surveyed in order to check the accuracy of the handheld GPS used to record the geoprobe boring locations. Both data sets were uploaded into a GIS system and found to be accurate and comparable. The ground surface elevation at each monitoring well and the north side of the top of the well casing (where groundwater level readings are collected from) were also surveyed. The surveyed locations, the ground surface elevations, and the top of casing elevations for each of the monitoring wells are provided in Table 3.1. The surveyed geodetic x,y,z coordinates and the GPS coordinates are provided in Appendix F.

4.2 Phase II Remedial Investigation

The Phase II remedial investigation was conducted by Aspect beginning in August 2010. This investigation, conducted in accordance with the Ecology-approved *Remedial Investigation/Feasibility Study Phase II Work Plan* (Aspect, 2010b), included completing four additional rounds of quarterly groundwater level monitoring and sampling. The sampling included modification of the field sample collection methods to address the previous field and/or laboratory quality control problems discussed above.

A synopsis of the groundwater samples collected during the Phase II remedial investigation is presented in the following table:

Phase II Remedial Investigations

Groundwater Samples	TPHs-Dx	Carcinogenic PAHs	Non-carcinogenic PAHs	Naphthalene
Number of Analyses	28	28	28	28
Number of Detections	6	2	3	0
Maximum Value (µg/L)	400	0.0107	0.04	ND

The Phase II remedial investigations revealed only a very few trace-level detections of diesel- and oil-range TPH, PAHs and cPAHs in Site groundwater. The methods and detailed results of the Phase I groundwater investigations are summarized in a previous technical memorandum (Aspect, 2011c), and the following sections of this report.

4.2.1 Groundwater Sampling Activities and Methods

Groundwater samples were collected from wells GMW-01 to GMW-06 and UDCMW-4 in August and November 2010, and February and May of 2011. In accordance with the *RI/FS Phase II Work Plan* (Aspect, 2010b), pump tubing lengths were adjusted during the initial (August 2010) quarterly groundwater level monitoring and groundwater quality sampling event. The dedicated QED bladder pump tubings were retrofitted so that the pump intakes were within about 5 feet of the lowest groundwater level measurements (as recorded in August 2009), in order to facilitate the collection of groundwater quality samples that are fully representative of the uppermost portion of the SVRP aquifer.

During subsequent quarterly groundwater quality sampling events, the dedicated pump intakes were to be temporarily set at approximately 2 feet below the measured depth to water. However, because the Well Wizard T1200M bladder pumps require approximately 3 feet of water above the pump intake to function properly, the dedicated bladder pumps were instead set at approximately 3 feet below the measured depth of water at each well. Table 4.3 provides a summary of both the initial, permanent pump settings and the temporary pump settings used for the collection of the Phase II groundwater quality samples.

After temporarily re-setting the pump intakes, groundwater quality samples were collected using low flow sampling techniques in conjunction with "Clean Hands/Dirty Hands (CH/DH)" sampling protocols (EPA, 1996). Due to previous low level detections of cPAHs in both the groundwater quality samples and the field blanks and/or laboratory method blanks, CH/DH sampling protocols were used in order to minimize the potential for field quality assurance (QA) issues. In addition, each wellhead was isolated from potential airborne COPCs by use of a tent during the collection of the groundwater quality samples. Field forms from the groundwater sampling are provided in Appendix D.

Groundwater samples were collected in laboratory-certified bottles and double-bagged in order to further minimize the potential for contamination during transport. All samples collected by Aspect were analyzed for diesel- and heavy oil-range TPH by Method NWTPH-Dx and PAHs by EPA Method 8270D by Friedman & Bruya, Inc., in Seattle, Washington. Data validation was performed by Pyron Environmental. The validated laboratory analytical results are summarized in Table 4.4 and provided in Appendix E. Data validation reports are provided in Appendix G. In order to meet the laboratory Reporting Limits (RLs) previously established in Phase I (Golder, 2008), Friedman & Bruya reported PAHs down to the Method Detection Limits (MDLs). PAH concentrations that were less than the RL, but greater than the MDL, were qualified with an estimated (j) flag.

4.2.2 Analytical Results

Total Petroleum Hydrocarbons

The Phase II groundwater investigation results for TPH were comparable to the Phase I results. With the exception of well UDCMW-4, there were only sporadic detections of diesel-range TPH in GMW-02 and GMW-05, which occurred at relatively low concentrations. The maximum diesel-range TPH concentration detected during Phase II occurred in UDCMW-4 (230 µg/L) in February 2011. Heavy oil-range TPH were only detected in UDCMW-4 during Phase II, with the maximum concentration (400 µg/L) also occurring in February 2011.

Polycyclic Aromatic Hydrocarbons

During the August 2010 sampling event, no valid detections of PAHs were noted in the Site wells. Both benzo(a)pyrene and phenanthrene were detected in the field blank, and benzo(a)pyrene was initially also reported in the sample from GMW-01. However, given the presence of benzo(a)pyrene in the field blank, Pyron Environmental qualified the result for benzo(a)pyrene in GMW-01 as a non-detect (U) at the RL of 0.1 µg/L.

During the November 2010 sampling event, there were no detections of PAHs in the groundwater samples, the field blank, or the laboratory method blank.

During the February 2011 sampling event, there were valid detections of PAHs that included benzo(a)anthracene (0.020 µg/L) in monitoring well GMW-04, and benzo(b)fluoranthene (0.023 µg/L) and indeno(1,2,3-cd)pyrene (0.027 µg/L) in monitoring well GMW-06. In addition, chrysene (0.021 µg/L) and phenanthrene (0.021 µg/L) were also detected in the field blank, and benzo(g,h,i)-perylene (0.022 µg/L) was detected in the method blank. Since no chrysene, phenanthrene, or benzo(g,h,i)perylene were reported in any of the primary groundwater samples, none of the groundwater sample results were qualified for this event.

During the May 2011 sampling event, there were reported detections of PAHs that included acenaphthene in well UDCMW-4 (0.021 µg/L) and GMW-01 (0.04 µg/L), and benzo(g,h,i)perylene in well GMW-06 (0.024 µg/L). Since each of these results was below the normal RLs, the results were qualified as estimated (j).

For each of the Phase II sampling events, the benzo(a)pyrene toxic equivalent cPAH concentrations were calculated using the TEFs from WAC 173-340-900, Table 708-2. A conservative approach was used that applies the full non-detected value (MDL) rather than half the non-detected value in the calculation. Calculated benzo(a)pyrene TEF concentrations for all the Phase II groundwater results are provided in Table 4.4. The maximum benzo(a)pyrene TEF concentration was 0.0525 µg/L, which occurred in the August 2010 sample from well GMW-01. It is important to note that the elevated TEF concentration for this sample is largely due to an elevated benzo(a)pyrene RL resulting from the documented contamination of the field blank. The next highest benzo(a)pyrene TEF concentration for the Phase II groundwater sampling was 0.0107 µg/L. This result was for the February 2011 sample from well GMW-06.

4.3 Surface Water Runoff Inspection

A surface water runoff inspection was completed by Aspect Consulting on December 30, 2011 (refer to Appendix H). The inspection was completed after approximately ½-inch of rain was recorded locally over the previous four days. Based on the inspection and a personal interview with the facility manager, it was confirmed that no formal drainage system (inlets, conveyance piping, drywells, etc.) exists at the Site. With the exception of the Northeast Tank Farm area, which is capped with concrete and asphalt, the Site is generally semi-pervious and covered with gravel. There is a small pervious area covered with grass adjacent to the scale house which is estimated to be less than 1 percent of the overall surface area of the Site.

Surface water drainage at the Site is generally outward from the topographical high in the vicinity of the office (refer to Figure 3.4). The water generally pools in low lying areas along the perimeter of the property, where it eventually evaporates or infiltrates. Based on the inspection, it does not generally appear that surface water runoff exits the Site, with the exception of one area to the south of the Site. In this area, the topography favors some pooling in a low lying area that may receive overflow runoff from the Site.

The current Site operator reportedly has collected and continues to collect surface water samples at three locations (DP1 to DP3) along the perimeter of the property in order to satisfy the current discharge permit requirements (Permit No. WAG 507161). These sample locations reportedly include:

- **Sample Location No. 1 (DP1):** Located in a low lying area along the northern perimeter of the property, immediately east of the main vehicular access point. The contributory area to this sample location comprises less than ⅙ of the Site, and is bounded by a berm to the north, main vehicular access to the west, and railroad lines to the south.
- **Sample Location No. 2 (DP2):** Located in a low lying area in the southeast corner of the Site in the vicinity of two large steel tanks. The contributory area to this sample location comprises a significant portion of the Site (up to ½ of the total area), and is bounded by railroad lines to the north, a berm (ecology block walls) to the east and south, and a topographic divide to the west.
- **Sample Location No. 3 (DP3):** Located in a low lying area near the midpoint of the southern perimeter of the Site, immediately west of the shop building. The contributory area to this sample location comprises more than ⅙ of the Site, and is bounded by topographic divides to the east and west, railroad lines to the north, and a berm (ecology block wall) to the south.

The discharge permit requires that surface water samples be analyzed for pH, oil & grease, and turbidity. However, only limited oil & grease and turbidity analyses have been performed due to periods of little to no discharge. Based on Ecology's Water Quality Permitting and Reporting Information System (PARIS), no violations of the permit requirements have been reported since 2005, when benchmark exceedances occurred due to the required analyses not being completed.

4.4 Interim Remedial Actions

4.4.1 Operation

Koch Materials coordinated the installation of an active bioventing system (Figure 2.2) and asphalt cap in the Northeast Tank Farm area in December 1996 (Radian, 1997). The purpose of this interim remedial system was to increase microbial degradation of petroleum-impacted soil and prevent the infiltration of surface water through the impacted soil. Supplemental information was collected to evaluate the effectiveness of the bioventing system between January 1997 and January 2004. Based primarily on system discharge effluent data, the system was converted to passive operation on January 26, 2004.

4.4.2 Inspection

The asphalt cap in the Northeast Tank Farm area was inspected in both 2010 and 2011 to confirm the integrity of the asphalt cap. At both times, the cap appeared to be in good condition. Photos documenting the inspection and cap condition are provided in Appendix I.

5 Evaluation of Receptors and Development of Draft Cleanup Levels

This section presents an evaluation of receptors and exposure pathways that potentially exist based on current land use and Site conditions. Identified potential receptors and exposure pathways are then used to develop cleanup level methodologies, and draft numerical cleanup levels for COPCs (TPH and cPAHs) in the Site soil and groundwater.

As discussed in Section 2.6, the Site is currently designated as an industrial property, with the operational history of the Site dating back to the early 20th Century. Storage and production of asphaltic materials has occurred at the Site since the 1950s, and it is expected that current or similar Site uses for asphaltic material production or other industrial uses will continue for the foreseeable future. Therefore, industrial land use represents the reasonable maximum exposure scenario for the Site.

Based on an industrial land use exposure scenario, the following potential receptors were considered in the conceptual model:

Human receptors

- Current and future on-Site industrial/commercial workers
- Current and future trespassers and recreationalists
- Future off-Site human exposure

Ecological receptors

- Terrestrial wildlife and plants
- Aquatic life

Each of these potential receptors is further discussed in the following sections.

5.1 Receptors

5.1.1 Human Receptors

5.1.1.1 Current and Future On-Site Industrial/Commercial Worker

On-Site workers represent the most likely potential for exposure based on the proximity to potential exposure pathways at the Site. Current and future industrial workers include operational employees and future construction workers. Potential exposure pathways are direct soil contact and potential future use of groundwater. Although groundwater at the Site is not currently used for any domestic or industrial purposes, future use of groundwater at the Site is considered a potential exposure pathway. The direct soil contact exposure pathway and the groundwater exposure pathway are further discussed in the context of soil and groundwater cleanup level development in Sections 5.2.1 and 5.2.2, respectively.

5.1.1.2 Current and Future Trespassers and Recreational Users

The occurrence of trespassers or recreational users inadvertently entering the Site is considered remote based on the industrial setting of the Site and the adjacent areas. The Site is currently operational and fenced, with restricted and controlled access. As discussed in Section 2.6, the closest residential areas are approximately 950 feet from the Site. Therefore, current and future trespassers and recreationalists are not considered further as receptors.

5.1.1.3 Future off-Site Drinking Water

The only off-Site human exposure that could occur from potential releases from the Site is from groundwater consumption. Groundwater data collected to date demonstrate that although some impact to groundwater has occurred, no detections have exceeded the proposed drinking water-based cleanup levels. The groundwater pathway would only be complete if the off-Site aquifer becomes impacted by TPH or cPAHs at concentrations exceeding the proposed cleanup levels. As discussed further in the following sections, Site groundwater is currently in compliance with cleanup levels that are protective of groundwater consumption. Nonetheless, because of the SVRP's status as a sole source aquifer and other factors, off-Site drinking water is considered in the development of groundwater cleanup levels in Section 5.2.2.

5.1.2 Ecological Receptors

The potential exposure pathway for wildlife is direct soil contact. The Site is potentially accessible to terrestrial wildlife, with perimeter fencing being the only restriction to access. However, the Site offers no vegetation or other features that would attract wildlife. Therefore, wildlife is not considered a potential receptor.

No surface water exists on or near the Site (refer to Section 3.1.2). The nearest surface water is the Spokane River, located approximately 1.5 miles to the south, and hydraulically upgradient of the Site. Although the Little Spokane River is hydraulically downgradient of the Site, it is located approximately 8 miles to the north. Based on the lack of perennial surface water at the Site and the relatively large distance to off-Site surface water, aquatic wildlife and users of surface water are not considered potential receptors.

A Simplified Terrestrial Ecological Evaluation (Table 749-1 in WAC 173-340-900) was prepared to evaluate whether substantial wildlife exposure to Site COPCs is likely. Appendix J includes the completed Table 749-1 Simplified Terrestrial Ecological Evaluation. Based on the results of this numerical evaluation, land use at the Site and the surrounding area makes substantial wildlife exposure unlikely, and this pathway does not warrant further consideration.

5.2 Development of Draft Cleanup Levels

Based on the above evaluation of exposure pathways, the following are considered potentially complete exposure pathways at the Site:

Soil Exposure Pathways

- Soil direct contact exposure pathway to current and future on-Site industrial/commercial workers.
- Soil to groundwater exposure pathway.
- Soil to air exposure pathway.

Groundwater Exposure Pathways

- Groundwater exposure pathway to future on-Site industrial/commercial workers.
- Groundwater exposure pathway to off-Site human receptors.

These exposure pathways are further considered in developing draft cleanup levels for Site soil and groundwater. The exposure pathways and rationale for draft cleanup level selection are presented in the following sections. Numerical calculations for site-specific Method B and C analyses are summarized in Table 5.1, and draft cleanup levels for Site soil and groundwater are summarized in Table 5.2.

5.2.1 Soil Exposure Pathways

5.2.1.1 Soil Direct Contact Pathway

As previously discussed (refer to Section 2.6), the Site is considered an industrial property and industrial land use represents the reasonable maximum human direct contact exposure for the Site. MTCA Method C cleanup levels for soil direct contact exposure are considered currently applicable for the Site. Method C direct contact cleanup levels for TPH were calculated using Ecology’s MTCATPH 11.1 spreadsheet with PAH (including naphthalene) and EPH data from six soil samples. The MTCATPH 11.1 calculations are provided in Appendix K.

Sample-specific TPH concentrations calculated to be protective of direct human exposure in an industrial setting ranged from 2,139 to 6,731 mg/kg. These results are summarized in Table 5.1. The lowest calculated value of 2,139 mg/kg is used for evaluating direct human exposure protection for TPH in Site soil within the upper 15 feet of the soil column, the standard point of compliance for direct contact with soil under MTCA (WAC 173-340-740 (6)(d)). The Method C formula value of 18 mg/kg for direct contact with cPAHs, evaluated as the benzo(a)pyrene toxic equivalent concentration, is used for evaluating direct human exposure protection for cPAHs in Site soil within the upper 15 feet of the soil column. The numeric cleanup levels (Table 5.2) for TPH (2,139 mg/kg) and cPAHs (18 mg/kg), calculated in accordance with Method C for an industrial land use scenario, are adequately protective for direct soil contact at the Site.

5.2.1.2 Soil to Groundwater Pathway

The most common method of confirming soil protectiveness for the groundwater pathway under MTCA is by direct comparison of soil concentrations to numerical cleanup levels. Soil concentrations adequately protective of leaching TPH constituent mixtures (including cPAHs) to groundwater were calculated using the MTCATPH 11.1 spreadsheet. Calculated MTCA Method B soil concentrations adequately protective of the groundwater pathway are presented in Table 5.1, and the MTCATPH 11.1 calculations are included in Appendix K.

The petroleum hydrocarbons documented at the Site are predominantly the relatively immobile heavier aromatics, although cutback fluids appear to have been used at the site. These immobile heavier aromatics compounds generally have a low potential for leaching. Calculation of Method B cleanup levels for protection of groundwater using four of the six soil samples analyzed for EPHs resulted in protective concentrations equivalent to complete saturation of soil with product (refer to Table 5.1). This confirms that for some of the petroleum hydrocarbons present, leaching from soil does not represent a risk to groundwater at any soil concentration. For the other two samples analyzed for EPHs, the calculated Method B soil concentrations adequately protective of the groundwater pathway were 1,923 mg/kg, and greater than 11,000 mg/kg.

Development of numeric TPH concentrations protective of groundwater also requires an evaluation of soil concentrations that will prevent accumulation of free product on the groundwater surface. The MTCA Method A cleanup level of 2,000 mg/kg for TPH as diesel and heavy oil is a conservative level established based on preventing accumulation of free product for diesel- and heavy oil-range petroleum hydrocarbons under any soil conditions. Since the calculated Method B site-specific concentration of 1,923 mg/kg for protection of leaching to groundwater is less than the Method A value, 1,923 mg/kg is considered adequately protective of free product accumulation at the Site.

MTCA allows alternatives to direct numerical comparison for demonstrating that soil concentrations at a Site will not cause an exceedance of the applicable groundwater cleanup level, or cause an accumulation of non-aqueous phase liquid on or in the groundwater (WAC 173 340-747(2)). Specifically, MTCA provides a method for developing an empirical demonstration, through groundwater monitoring, that soil concentrations measured at a Site as a whole are protective and do not cause an exceedance of the groundwater cleanup level (WAC 173 340-747(9)(a)). Criteria necessary to establish the defensibility of this empirical approach are summarized in WAC 173-340-747(b), and include:

i. Groundwater concentrations must be less than or equal to the applicable groundwater cleanup level.

ii. The measured soil concentrations will not cause a future exceedance of the applicable groundwater cleanup level.

Additionally, the evaluation criteria for the empirical demonstration has to be based on methods approved by Ecology (WAC 173-340-747(9)(c)). The methods must comply with the requirements of WAC 173-340-702 (14-16) to Ecology's satisfaction, including meeting the burden of proof and providing data of adequate quality.

As further discussed in Section 6.2 below, most groundwater samples collected to date have not contained detectable concentrations of either TPH or cPAHs. Trace concentrations of both TPH and individual cPAHs have been detected periodically, but no exceedances of the draft groundwater cleanup levels have been documented to date. The absence of cleanup level exceedances for TPH and cPAHs in groundwater confirms that Site soil, as a whole, is currently protective of the soil to groundwater pathway. An empirical demonstration of soil protectiveness is therefore considered an appropriate approach for confirming that soil concentrations at the Site are, and will remain, adequately protective of the soil to groundwater pathway.

5.2.1.3 Soil to Air Pathway

The soil to air exposure pathway is not considered further in the development of cleanup levels because of the following:

- The detected TPH and cPAHs in soil are at relatively low concentrations, and have a low volatility.
- Only one soil sample (GGP 24 at 2.5 feet) out of the more than 50 soil samples analyzed had a diesel-range TPH concentration above the 10,000 mg/kg MTCA threshold for consideration of diesel-range TPH as a potential risk to air. WAC 173-340-745(5)(b)(iii)(C).
- The human occupancy at the Site consists of industrial workers.
- Current operations at the site involve the processing and storage of petroleum products that results in elevated concentrations of petroleum constituents in ambient air.

5.2.2 Groundwater Exposure Pathways

Based on the potential future use of groundwater beneath the Site as drinking water, and the Federal classification of the SVRP aquifer as a Sole Source Aquifer (Kahle and Bartolino, 2007), the MTCA Method A groundwater cleanup levels for TPH and cPAHs are used as Site cleanup levels for groundwater. The MTCA Method A cleanup level for diesel- and heavy oil-range TPH in groundwater is 500 µg/L, and the Method A cleanup level for cPAHs, as the benzo(a)pyrene TEF concentration, is 0.1 µg/L.

No surface water exists on or near the Site. The Spokane River is located approximately 1.5 miles to the south, but is hydraulically upgradient of the Site. Although the Little Spokane River is located hydraulically downgradient of the Site, it is located approximately 8 miles to the north. Based on this information, the groundwater to surface water exposure pathway is eliminated from further consideration in the development of cleanup levels.

6 Nature and Extent of Impacts to Site Media

This section provides a synopsis of RI findings as they relate to impacts to various Site media. It also provides a conceptual Site model that summarizes the origin and current occurrence of COPCs in soil and groundwater at the Site, describes the fate and transport of the COPCs, and presents a comparison of the COPCs to the respective draft Site cleanup levels developed in Section 5 above.

A tabulated synopsis of all pre-RI and RI soil and groundwater samples collected, and documented draft cleanup level exceedances for each media, is presented in the following table:

	Diesel- and Oil-range TPHs			Carcinogenic PAHs		
	Analyses	Detections	Cleanup Level Exceedances	Analyses	Detections	Cleanup Level Exceedances
Historic Soil Investigations	64	60	36	NA	NA	NA
Phase I Shallow Soil Investigations	54	28	6	38	5	0
Phase I Deep Soil Investigations	8	0	0	8	0	0
Phase I and II Groundwater Investigations	49	9	0	49	8	0

Notes:
NA = Not Analyzed

Investigations conducted at the Site following the detection of petroleum impacted soil in December 1992 confirmed detections and exceedances of the draft cleanup levels for diesel- and oil-range TPH occurred in the shallow (up to 20 feet bgs) and deep (up to 125 feet bgs) soil in the immediate vicinity of the Northeast Tank Farm. The full nature and age of the release(s) in the Northeast Tank Farm area are not known, though the release(s) in this area pre-date at least 1992. Given the pre-1992 date for release(s) in the Northeast Tank Farm area, concentrations of petroleum hydrocarbons in soil in this area have likely attenuated significantly over time due to both volatilization and natural biodegradation processes. These processes are expected to have been further enhanced by operation of the bioventing system in the Northeast Tank Farm area.

Shallow soil investigations conducted across the entirety of the Site as part of the Phase I RI confirmed the presence of detectable diesel- and oil-range TPH at many locations, but defined only limited areas with exceedances of draft cleanup levels. In addition, deep migration of contaminants to depths at or near the water table was not confirmed in any area of the Site, except in the vicinity of the Northeast Tank Farm area, during the drilling completed in 1993 (SCS Engineers, 1993e) and 1996 (GTI, 1996a). Soil investigations completed to date have not documented any exceedances of draft cleanup levels for cPAHs in soil across the entirety of the Site.

Overall, the extent of soil with concentrations of COPCs above draft cleanup levels is limited to within the immediate footprint of the Northeast Tank Farm area, a small area along the northern perimeter of the Site northwest of the Northeast Tank Farm area, and an additional area within the south-central portion of the Site. These areas are depicted on Figure 6.1. Soil investigations conducted as part of monitoring well installations during the Phase I RI confirmed that no TPH or cPAHs are present in the soil along the immediate northern perimeter of the Site. However, considering the location of the monitoring wells and the previous investigation results within the Northeast Tank Farm, soil impacts were not anticipated to be encountered at the monitoring well locations.

Groundwater sampling conducted over seven events as part of the Phase I and Phase II remedial investigations confirmed that groundwater along the northern Site perimeter is not impacted by COPCs at concentrations above draft cleanup levels. These data confirm that though COPCs remain in Site soil within the footprint of the facility, Site soil quality, as a whole, is currently protective of the soil to groundwater pathway.

In summarizing the working conceptual Site model, the Site is characterized by a relatively old (prior to December 1992) release(s) of petroleum hydrocarbons within the footprint of the Northeast Tank Farm area. This release(s) migrated to depths in excess of 125 feet bgs. Other releases of unknown origin and age have impacted shallow soil in several other areas of the Site, but these impacts are generally limited to shallow soil and deep migration of COPCs is not indicated in these areas. Concentrations of soil COPCs at the Site have likely attenuated since release due to both volatilization and natural biodegradation processes, and these natural attenuation processes are expected to continue in the future. A remedial action, in the form of a bioventing system and asphalt cap, was implemented to address the release(s) in the Northeast Tank Farm area. The operation of the bioventing system enhanced the active natural attenuation processes of volatilization and biodegradation, and the asphalt cap limits infiltration through the impacted soil. The documented absence of cleanup level exceedances for both TPH and cPAHs in groundwater immediately downgradient of the Site over seven consecutive quarterly sampling events confirms that contaminants in Site soil, as a whole, are not adversely impacting groundwater.

The following section provides detailed descriptions of the nature and extent of COPCs in soil and groundwater at the Site.

6.1 Soil

6.1.1 Total Petroleum Hydrocarbons

Shallow soil with TPH concentrations exceeding the cleanup level for direct contact protection (42 exceedances for 126 analyses) are present in several non-contiguous areas of the Site, as shown on Figure 6.1. These include two areas approximately one-quarter of an acre in size located in the central and northeastern portions of the facility (referred to hereafter as the Central and Northeast Tank Farm Areas), and one smaller isolated area along the northern perimeter of the facility (referred to as the North Area).

The Central Area of impacted soil is defined by borings GGP06, GGP09, and GGP30. In this area, soils in the upper 5 to 10 feet bgs contain diesel- and heavy oil-range TPH concentrations of up to 9,200 mg/kg. Concentrations of TPH were either non-detect, or were well below cleanup levels in soil samples collected in these borings from depths of 15 or 16 feet bgs, indicating that the vertical extent of TPH in this area is adequately defined.

Soil samples collected from shallow soil within the Northeast Tank Farm Area in 1993 indicated TPH concentrations of up to 31,100 mg/kg at that time. Figures 6.2 and 6.3 provide cross sections through the Site depicting soil TPH concentrations with depth, based on the results provided in Tables 2.2, 2.3, and 4.1. As shown on these cross sections, TPH concentrations exceeding the cleanup level for direct contact protection extends to depths of 115 feet bgs in boring BH-4, and 126 feet bgs in boring BH-5, where evidence of product in soil was noted during drilling. Natural attenuation of TPH through volatilization and biodegradation has undoubtedly occurred in Site soils since December 1992, and present-day concentrations of TPH in the Northeast Tank Farm area are likely lower than the originally detected concentrations depicted on Figures 6.2 and 6.3. The Northeast Tank Farm cap contributes to protecting groundwater by reducing infiltration through these residual impacted soils.

The North Area is defined by boring GGP24, which had a TPH concentration of 26,000 mg/kg. Based on data from adjacent borings, the lateral extent of this area appears to be significantly less than the Central and Northeast Tank Farm Areas.

6.1.2 Polycyclic Aromatic Hydrocarbons

There were only limited detections of cPAHs in the soil at the Site (5 detections for 46 analyses). These constituents were typically co-detected with diesel- and/or oil-range TPH. None of the cPAH detections exceeded the cleanup level of 18 mg/kg, established based on direct contact protection under the current industrial land use scenario.

As noted in Section 5.2 above, most groundwater samples collected to date have not contained detectable concentrations of either TPH or cPAHs, and there have been no exceedances of Site groundwater cleanup levels. The absence of cleanup level exceedances for TPH and cPAHs in groundwater (see next section) confirms that Site soil, as a whole, is currently protective of the soil to groundwater pathway. Since soil protectiveness for the groundwater pathway is to be demonstrated empirically, comparisons of soil concentrations to groundwater protection-based numeric standards are not discussed further in this report.

6.2 Groundwater

Sampling completed periodically since 2009 confirms that a majority of the groundwater samples collected to date have not contained detectable concentrations of TPH or cPAHs. Detections have been both temporally sporadic, and typically significantly below MTCA Method A cleanup levels, which are proposed herein as the draft cleanup levels for the Site.

6.2.1 Total Petroleum Hydrocarbons

Of the limited detections of TPH in groundwater (9 detection for 49 analyses), the maximum detected TPH concentration to date was 400 µg/L in February 2011. This detection occurred in well UDCMW-4, located in the northeast corner of the Site. This detection was less than the draft cleanup level of 500 µg/L. With the exception of the February 2011 sample in well UDCMW-4, the detections of TPH in groundwater samples for all wells, including UDCMW-4, were significantly below the draft cleanup level.

6.2.2 Polycyclic Aromatic Hydrocarbons

Only limited detections of cPAHs were recorded in groundwater. Of the 49 groundwater samples collected, only 8 detections of cPAHs were documented. The maximum detected TEF-adjusted cPAH concentration in groundwater was 0.0525 µg/L in the August 2010 sample from well GMW-01. This result is approximately one-half the draft cleanup level of 0.1 µg/L. In addition, as previously discussed (Section 4.2), this value is likely artificially high due to an elevated benzo(a)pyrene RL. The next highest detected TEF-adjusted cPAH concentration in Site groundwater was 0.0107 µg/L, which occurred in the February 2011 sample from well GMW-06. This concentration is approximately one order of magnitude below the cleanup level of 0.1 µg/L. In summary, detections of cPAHs in groundwater were relatively limited and sporadic, and all detections were significantly below the draft cleanup level.

6.3 Conceptual Model of Soil and Groundwater Impacts, Fate, and Transport

Data collected from earlier investigations and the RI have allowed for development of the following working conceptual Site model that characterizes the origin, current distribution, and fate and transport of COPCs at or from the Site.

The SemMaterials Site is characterized by a relatively old (pre-December 1992) release(s) of petroleum hydrocarbons within the footprint of the Northeast Tank Farm. This release(s) appears to have migrated to depths of up to 125 feet bgs beneath the Northeast Tank Farm area. Other releases of unknown age have impacted shallow soil in several other areas (the North and Central Areas) of the Site, but these impacts are generally limited to shallow soil, and deep migration of COPCs to the water table has not likely occurred in these areas. Deep soil investigations completed along the northern Site perimeter have also confirmed that COPCs are not present in soil from the ground surface to the water table along the northern perimeter of the SemMaterials facility.

The primary COPCs confirmed in Site soil are diesel- and heavy-oil range petroleum hydrocarbons and associated PAHs, both of which are relatively insoluble in water. The heavier-range petroleum hydrocarbons are also typically not highly mobile in soil.

Concentrations of soil COPCs at the Site, originating as releases that occurred two or more decades ago, have likely attenuated significantly due to both volatilization and natural biodegradation processes, and these natural attenuation processes are expected to continue in the future. A completed remedial action, in the form of a bioventing system and asphalt cap, was implemented to address the release(s) in the Northeast Tank Farm area. The operation of the bioventing system is expected to have enhanced the active natural attenuation processes of volatilization and biodegradation, and the asphalt cap limits infiltration through the impacted soil. The current concentrations of CPOCs in soil do not present a risk to air quality.

COPCs have been sporadically detected in groundwater samples from Site monitoring wells, but no samples have ever contained concentrations above draft cleanup levels. The origin of the COPCs in groundwater is unclear, as there is generally no consistent pattern in the groundwater detections as they related to potential upgradient sources of COPCs in Site soil. One potential exception to this is the low level detections of TPH in

UDCMW-4, which could correlate with hydraulically upgradient sources of COPCs in soil beneath the Northeast Tank Farm area.

Groundwater sampling completed over seven consecutive quarterly sampling events has confirmed that Site groundwater in all monitoring wells is in compliance with draft cleanup levels for all COPCs. These water quality data provide confirmation that Site soil, as a whole, is currently protective of the soil to groundwater pathway. Maintenance of the completed remedial action and continued natural attenuation should contribute to continued reductions in soil COPCs. Site soil, which has been demonstrated empirically to be protective of the soil to groundwater pathway, should therefore remain protective of that pathway into the future. The current concentrations of CPOCs in soil and groundwater do not present a risk to air quality.

7 Basis for Remedial Action

7.1 Remedial Action Objectives

Remedial action objectives (RAOs) for the subject property are intended to comply with applicable environmental regulations and protect human health and the environment. Site specific RAOs include:

- Protection from direct contact and ingestion of impacted soil.
- Protection of groundwater for drinking water use.

COPCs, appropriate cleanup levels, points of compliance, and areas and volumes that will require remediation to meet these RAOs are identified below.

7.1.1 Constituents of Potential Concern

The following COPCs have been identified for the Site:

- **Soil:**
    - TPH as diesel and oil.
    - cPAHs.
- **Groundwater**:
    - TPH as diesel and oil.
    - cPAHs.

7.1.2 Draft Cleanup Levels

Draft cleanup levels are provided for the following media/pathway:

- Direct contact with and ingestion of soil.
- Soil protectiveness of groundwater.
- Groundwater.

Draft cleanup levels for COPCs detected in soil and groundwater at the Site are developed in Section 5.2 and summarized in Table 5.2.

7.1.3 Points of Compliance

The standard points of compliance for each media and exposure pathway are as follows:

- **Soil *for protection from direct contact*:** ground surface to a depth of 15 feet.
- **Soil *for protection of groundwater*:** throughout the Site, to be demonstrated empirically through groundwater monitoring.
- **Groundwater *for protection of drinking water*:** extending vertically from the uppermost level of the saturated zone to the lowest most depth potentially affected.

7.2 Areas and Volumes Potentially Requiring Remediation

This section provides quantifications of the area and volume of impacted soil and groundwater potentially requiring remediation at the Site.

7.2.1 Soil

Shallow soil with TPH concentrations exceeding the draft cleanup level for direct contact protection (2,139 mg/kg) is present in several non-contiguous areas of the Site, as shown on Figure 6.1. These areas are defined as follows:

- The Central Area of TPH impacts in the vicinity of GGP06, GGP09, and GGP30.
- The Northeast Tank Farm Area of TPH impacts defined by TP-4, TP-2, BH-7, BH-8, BH-3, and BH-1.
- The North Area of TPH impacts in the vicinity of GGP24.

Each area is discussed below:

Central Area of TPH Impacts: The area of TPH-impacted soil above the draft cleanup level for direct contact protection (2,139 mg/kg) in the central area of the facility is defined by borings GGP06, GGP09, and GGP30. Estimated dimensions for this area are 100 feet by 100 feet and 15 feet deep (5,600 cubic yards). In this area, soils in the upper 5 to 10 feet bgs contain diesel- and oil-range TPH concentrations of up to 9,200 mg/kg, with an average concentration of 2,800 mg/kg. Concentrations of TPH were either non-detectable or were well below draft cleanup levels in soil samples collected from depths of 15 or 16 feet bgs, indicating that the vertical extent of TPH in this area is adequately defined.

Northeast Tank Farm Area of TPH Impacts: A comparably-sized area of TPH-impacted soil above the draft cleanup level for direct contact protection (2,139 mg/kg) is present within the Northeast Tank Farm Area. Estimated dimensions for the TPH-impacted soil are 150 feet by 80 feet and 170 feet deep (76,000 cubic yards).

Soil samples collected from this area in 1993 indicate TPH concentrations within this area of up to 31,100 mg/kg and an average concentration of 6,400 mg/kg at that time. Figures 6.2 and 6.3 depict cross sections through the Site, with depths of selected explorations and soil TPH concentrations annotated on each section. As shown on these cross sections, TPH exceeding the draft cleanup level for direct contact protection extends to depths of 115 feet bgs in boring BH-4, and 126 feet bgs in boring BH-5, where evidence of product in soil was noted during drilling. Elimination of sources of TPH releases, natural attenuation processes, and operation of the active bioventing system in the Northeast Tank Farm area between December 1996 and January 2004 have all likely contributed to reducing concentrations of TPH in this area. In addition, installation of the asphalt cap limits infiltration of surface water through the residual impacted soil.

North Area of TPH Impacts: The area of TPH-impacted soil above the draft cleanup level for direct contact protection (2,139 mg/kg) along the northern perimeter of the facility is defined by boring GGP24. Soil samples collected from this area in 2008 indicate TPH concentrations in shallow soil within this area of up to 31,100 mg/kg and an average concentration of 11,700 mg/kg at that time. The circular area shown on Figure 6.1 has a diameter of approximately 40 feet. In addition, TPH is still present above the cleanup level at the bottom of the boring at 15 feet. For costing purposes, we have assumed that the COPC-impacted soil extends to 50 feet, providing a volume estimate of 3,000 cubic yards.

cPAHs: cPAHs were documented in soil at various locations on the Site. These constituents were typically co-detected with TPH as diesel and/or oil. None of the cPAH detections in soil exceeded the draft cleanup level of 18 mg/kg established based on direct contact protection under the current industrial land use scenario.

7.2.2 Groundwater

Sampling completed over seven events since 2009 confirms that most groundwater samples collected to date have not contained detectable concentrations of TPH or cPAHs. No detected concentrations of either TPH or cPAHs have exceeded the draft (MTCA Method A) cleanup levels. The maximum detected TPH concentration in groundwater was 400 µg/L in well UDCMW-4 in February 2011. This detection was less than the draft cleanup level of 500 µg/L. Other samples from this well either did not have detectable concentrations of TPH, or the detected concentrations were only slightly above the RLs.

The maximum detected TEF-adjusted cPAH concentration detected in groundwater was 0.0525 µg/L in the August 2010 sample from well GMW-01. This result is approximately one-half the draft cleanup level of 0.1 µg/L. Additionally, as discussed previously, this calculated maximum cPAH concentration is likely artificially high due to an elevated benzo(a)pyrene RL. The next highest detected TEF-adjusted cPAH concentration in Site groundwater was 0.0107 µg/l, which occurred in the February 2011 sample from well GMW-06. This concentration is approximately one order of magnitude below the draft cleanup level of 0.1 µg/L.

Although earlier investigations did not include groundwater sample collection, the evaluation performed as part of this RI revealed no exceedances of the draft cleanup levels in groundwater over seven sampling events. Based on these empirical data, no groundwater remediation is required.

8 Identification and Screening of Remedial Technologies

8.1 Potential Remedial Technologies

Potential applicable remedial technologies for addressing the COPCs in soil at the Site include:

- **Institutional Controls (IC).** Measures to prevent exposure to COPCs in place, such as deed restrictions;
- **Monitored Natural Attenuation (MNA).** Monitoring the removal of COPCs by natural processes, such as volatilization and biodegradation;
- **Capping.** Covering the waste with concrete, asphalt, clay or other barriers that prevent direct exposure and significantly reduces the rate of infiltration through the waste;
- **Soil Excavation.** Removal of impacted soil, followed by off-site disposal or treatment;
- **Enhanced Aerobic Biodegradation (EAB).** Injecting an oxygen source and (if necessary) bacteria to stimulate microbial biodegradation of COPCs;
- **In-Situ Chemical Oxidation (ISCO) using Dissolved Oxidant.** Injecting dissolved oxidant, such as potassium permanganate or sodium persulfate, that reacts with and destroys COPCs;
- **In-Situ Chemical Oxidation (ISCO) using Ozone.** Injecting gaseous ozone that reacts with and destroys COPCs; and
- **In Situ Solidification/Stabilization of Soil**. Solidification of soil using grout injection.

8.2 Screening of Remedial Technologies

Appendix L provides a detailed description and evaluation of each technology and its applicability to the Site.

Preliminary screening of the potential remedial technologies based on effectiveness, implementability, and comparative costs is shown in Table 8.1. The standard screening criteria do not address potential risk of using various technologies. One of the potential risks with ISCO and EAB is that they involve injection of oxidants or an oxygen source (dissolved in solution) into the vadose (unsaturated) zone. This oxidant-bearing solution would be expected to migrate vertically and in the process could carry TPH impacts into the saturated zone. For this reason, an additional criterion, "Risk", is added to the table. All criteria are scored on a scale of 1 to 3 (higher is better).

ISCO, EAB, and solidification/stabilization score the lowest on the screening criteria (6.5 to 8) and are eliminated from further consideration. The primary concern with these technologies is that they offer minimal benefit compared with the other technologies at a higher cost and with implementation challenges and, in some cases, the potential to flush COPCs to groundwater. All of the other technologies score between 10 and 11 and are retained for further consideration.

9 Development of Remedial Alternatives

Four remedial alternatives were developed for comparison with MTCA criteria for cleanup actions (WAC 173-340-350(8)). These alternatives provide a range of aggressiveness and include two alternatives that do not include institutional controls. The remedial alternatives are as follows:

- Alternative 1 – Completed Remedial Actions;
- Alternative 2 – Existing Cap, Institutional Controls, and Monitored Natural Attenuation;
- Alternative 3 – Partial Soil Excavation/Disposal, Existing Cap, Institutional Controls, and Monitored Natural Attenuation; and
- Alternative 4 – Complete Soil Excavation/Disposal.

Each alternative is described in the following sections. FS-level (+50/-30 percent) cost estimates for each alternative were calculated in accordance with EPA cost estimating guidance (EPA, 2000) and professional experience with similar projects. The cost for monitoring and cap maintenance was calculated as net present value (NPV) assuming a discount rate of 4 percent for a 30-year period. If long-term monitoring were to extend past this period, the NPV costs for monitoring after 30 years would be negligible.

9.1 Alternative 1 – Completed Remedial Actions

The purpose of this alternative is to illustrate the results of the remedial actions completed to date, with no further remedial action at the Site. Elimination of the sources of TPH releases and operation of the active bioventing system in the Northeast Tank Farm Area between December 1996 and January 2004 have likely reduced the concentrations of TPH in this area. In addition, installation of the asphalt cap in the Northeast Tank Farm Area provides protection from direct exposure and minimizes infiltration at the Site. This condition has been demonstrated empirically to be protective of the Site groundwater quality. However, without institutional controls, it is possible that the cover could be damaged or removed, thereby removing the protection offered by the existing conditions. Even if no further remedial actions are completed at the Site, it is expected that the concentrations of COPCs will decrease over time due to volatilization and biodegradation.

For cost estimating purposes, the total duration of this alternative is assumed to be 0 years. Since all remedial costs have already been incurred, the future cost of this alternative is $0.

9.2 Alternative 2 – Existing Cap, Institutional Controls, and Monitored Natural Attenuation

The purpose of this alternative is to maintain the protection offered by the existing cap while volatilization and biodegradation reduce the concentration of COPCs in soil at the Site. This alternative involves the following elements:

- Construct an approximate 800-square foot cap in the vicinity of soil boring GGP09 to prevent direct contact with a limited area of shallow TPH-impacted soil (less than 2.5 feet bgs) that exceeds the draft cleanup level of 2,139 mg/kg. The cap will consist of either clean imported fill, asphalt, or concrete. The capping method will be finalized in the future Site Cleanup Action Plan (CAP). The cost for the installation of a concrete cap is used for the disproportionate cost analysis in Section 10.6 of this FS.
- Maintaining the existing pavement cap (or equivalent) in the Northeast Tank Farm Area at the Site as an institutional control, effectively capping and preventing contact with shallow TPH-impacted soil, and preventing infiltration into the area of TPH-impacted soil;
- Maintaining the cap in the vicinity of soil boring GGP09 as an institutional control to prevent direct contact with shallow TPH-impacted soil;
- Maintain existing site security measures to limit trespassing and unauthorized access;
- Periodic groundwater sampling and analysis over a future 5-year period to confirm continued groundwater compliance; and
- Placing an environmental covenant on the Property to limit certain types of subsurface disturbances and/or activities in areas with documented TPH-impacted soil and to prohibit non-industrial use unless additional analysis and cleanup actions are completed.

For cost estimating purposes, the total duration of this alternative is assumed to be 30 years. The estimated cost for this alternative is $200,000 (Table 9.1).

9.3 Alternative 3 – Partial Soil Excavation/Disposal, Existing Cap, Institutional Controls, and Monitored Natural Attenuation

The purpose of this alternative is to eliminate the potential for direct exposure by removal of the upper 15 feet of impacted soil with COPCs above cleanup levels. Since some existing facilities will need to be removed to allow soil excavation, a replacement cap would be constructed over the Northeast Tank Farm area to prevent infiltration through TPH-impacted soil while volatilization and biodegradation continue to reduce the concentration of COPCs in soil at the Site. This alternative involves the following elements:

- Demolition, removal, and disposal of the existing facilities and pavement to facilitate excavation of impacted soil;

- Excavate soil impacted with COPCs above cleanup levels to a depth of 15 feet. The excavated soil would be disposed at a licensed petroleum disposal/treatment facility. Based on existing information regarding the depth of constituent concentrations, this action would eliminate the soil impacts in the Central Area but constituent concentrations above cleanup levels would remain in the Northeast Tank Farm and North Areas at depths greater than 15 feet;
- Replace the Northeast Tank Farm Area asphalt cap with an equivalent low permeability cap to prevent stormwater infiltration and minimize the potential for residual COPCs in soil to migrate into groundwater;
- Construct a low permeability cap over the portion of the North Area that still contains COPCs above cleanup levels to prevent stormwater infiltration and minimize the potential for residual COPCs in soil to migrate to groundwater;
- Maintain existing site security measures to limit trespassing and unauthorized access;
- Periodic groundwater sampling and analysis over a future 5-year period to confirm continued groundwater compliance; and
- Placing an environmental covenant on the Property to maintain the integrity of the low permeability cap.

For cost estimating purposes, the duration of this alternative is assumed to be 30 years. The estimated cost for this alternative is $3,300,000 (Table 9.2), which does not include demolition or any facility capital replacement costs.

9.4 Alternative 4 – Complete Soil Excavation/Disposal

The purpose of this alternative is to physically remove impacted soil with concentrations of COPCs above cleanup levels on the Site, providing the most permanent remedial solution in the shortest amount of time. This alternative eliminates the need for long-term monitoring and/or institutional controls and involves the following elements:

- Demolition, removal, and disposal of the existing facilities to allow excavation of impacted soil;
- **Central Area:** Excavation of COPC-impacted soils as well as sufficient clean soils to provide stable side walls. In order to provide sufficient slope stability, the excavation sidewalls would be laid back at approximately 1.5 to 1 (horizontal to vertical). Since COPC-impacted soils are expected to be relatively shallow (within 15 feet of the ground surface), no shoring is expected to be used for this area.
- **Northeast Tank Farm Area:** Due to the greater depth of COPC-impacted soils (170 feet) in this area, an un-shored excavation would cover approximately 9 acres (extending several hundred feet onto neighboring properties to the north and east) and require removal of all the facilities on the eastern half of the SemMaterials property. In addition, this approach would require stockpiling approximately 950,000 cubic yards of clean soils on or near the Site, which would require approximately 10 acres of additional space (the SemMaterials property is approximately 10 acres in size.) This approach would require either

purchase of neighboring parcels or obtaining a temporary easement to excavate on the property, both of which could be infeasible.

- An alternate approach would be to shore the excavation sidewalls to a depth of 170 feet. Shoring would prevent off-site construction impacts and reduce the amount of clean soil to handle. Given the coarse, unconsolidated nature of the Site soils, constructing a shored excavation to this depth would require use of relatively innovative and expensive shoring technology. Possible approaches include: 1) a cantilevered wall with tiebacks extending onto neighboring properties (requiring an easement from neighboring property owners), and 2) a series of overlapping large-diameter shafts (50 to 100 feet in diameter) that are excavated to the water table and supported with a stack of concentric shoring rings. The shoring rings are removed as each excavation is backfilled with clean material;
- **North Area:** Due to the greater depth of COPC-impacted soils (50 feet), this area could also be remediated with either a shored or un-shored excavation using approaches discussed above for the Northeast Tank Farm area. The un-shored excavation would extend onto neighboring properties and would require either purchase of the property, or a temporary easement;
- Off-site disposal of COPC-impacted soil;
- Confirmation soil sampling and analysis during the excavation; and
- Restoration of the property including backfilling with imported clean material and stockpiled clean soils.

The estimated time to complete this alternative is approximately 1 year. The estimated cost for this alternative with no shoring is $38.8 million (Table 9.3a) and $74.8 million with shoring (Table 9.3b). Neither cost scenario includes demolition of the existing facilities nor any facility capital replacement costs.

10 Evaluation of Remedial Alternatives

10.1 Evaluation Criteria

MTCA requires that any remedial alternative selected for a Site meet certain minimum requirements [WAC 173-240-360(2)]. These requirements fall into two categories: "threshold" requirements and "other" requirements.

The threshold requirements are:

- Protect human health and the environment;
- Comply with cleanup standards;
- Comply with applicable state and federal laws; and
- Provide for compliance monitoring.

The other requirements are:

- Use of permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration timeframe; and
- Consider public concerns.

In order to select a remedial action that uses permanent solutions to the maximum extent practicable, MTCA requires consideration of cost in selecting among competing remedial alternatives [WAC 173-240-360(3)(e)], including at least one alternative that is permanent, or has the highest degree of permanence practically achievable. If the cost of one alternative is disproportionately higher than another when compared to the benefits afforded by each alternative, then the lower cost alternative can be selected even though it may be less permanent than a more costly alternative. The test for making this determination is stated in MTCA as follows: "Costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over the other lower cost alternative." MTCA requires evaluation of the following criteria when conducting a disproportionate cost analysis:

- Protectiveness;
- Permanence;
- Effectiveness over the long term;
- Management of short-term risks;
- Technical and administrative implementability; and
- Consideration of public concerns.

For comparison, the evaluation of each alternative relative to the minimum requirements and disproportionate cost analysis criteria is provided in Table 10.1. Other than Alternative 1 – Completed Remedial Actions, all the alternatives meet the threshold requirements listed above. A brief discussion of each alternative is provided in the following sections.

10.2 Alternative 1 – Completed Remedial Actions

Alternative 1, Completed Remedial Actions, does not involve any activities or monitoring. Although the current exposure risk is low due to the existing cap over the Northeast Tank Farm and the absence of impacts to groundwater, it is possible that the cap could lose its effectiveness without inspection and maintenance. In addition, since groundwater would not be monitored, there is no way to confirm that Site soil remains protective of groundwater quality.

The purpose of this alternative is to provide a contrast with the other alternatives. It is not considered to meet all of the threshold criteria and is not considered protective over the long- or short-term. It has the lowest weighted benefit ranking score (0.8) for all the alternatives (Table 10.1), and no future cost.

10.3 Alternative 2 – Existing Cap, Institutional Controls, and Monitored Natural Attenuation

Alternative 2 includes inspection and maintenance of the existing cap over the Northeast Tank Farm, installation of a soil cap in the vicinity of soil boring GGP09 to prevent direct exposure to shallow impacted soil, institutional controls, and monitored natural attenuation (volatilization and biodegradation). As long as the integrity of the cap is maintained and groundwater monitoring is conducted, this alternative meets most threshold criteria and scores in the middle on protectiveness, permanence, and long-term effectiveness. Although this alternative does not fully meet cleanup standards for soil direct contact in limited areas of the Site, exposure to any soil exceeding industrial land use direct contact cleanup levels is effectively prevented through a combination of capping and institutional controls.

Due to the limited required construction activities, Alternative 2 scores the highest on short-term risk management and implementability. It is expected that this alternative would have the least impact on the public. As shown in Table 10.1, Alternative 2 has the second highest weighted benefit ranking score (6.3) of all alternatives, and has a future cost of $200,000.

10.4 Alternative 3 – Partial Excavation and Disposal, Existing Cap, Institutional Controls, and Monitored Natural Attenuation

Alternative 3 is the same as Alternative 2 except the upper 15 feet of COPC-impacted soil is excavated and disposed off-site. Removal of the upper 15 feet of soil eliminates the direct contact pathway and thus this alternative scores slightly higher on protectiveness, permanence, and long-term effectiveness. Due to the need to remove portions of the existing facilities, and the associated significant construction activities which involve handling contaminated soil, Alternative 3 also scores lower on short- term risk management and implementability. It is expected that this alternative would also have a moderate impact on the public due to truck traffic and noise. Alternative 3 would be delayed until the owner decides to remove portions of the existing facilities from the Site. As shown in Table 10.1, Alternative 3 has a weighted benefit ranking score 6.0, which is lower than the Alternative 2 benefit ranking score of 6.3. Alternative 3 has a future cost of $3,300,000, which is approximately 16 times the future cost of Alternative 2.

10.5 Alternative 4 – Complete Excavation and Off-Site Disposal

Alternative 4 includes removal of all COPC-impacted soil from the Site, and is a permanent remedy. As a result, this alternative scores the highest on protectiveness, permanence, and long-term effectiveness. It should be noted that the Spokane area does not currently have a treatment facility for COPC-impacted soils and disposal at a landfill is the only viable option at this time. Treatment would score higher than disposal in terms of permanence but this difference has not been addressed in this evaluation due to the lack of a viable local treatment option.

Alternative 4 presents significant implementability challenges. If the less expensive, un-shored approach is pursued, it would require encroachment on neighboring parcels to accommodate the size of the excavation and the large quantity of clean stockpiled soils. This means either purchasing neighboring properties or obtaining a temporary easement, both of which may be infeasible. The shored approach doesn't require as much space but it may require an easement for tiebacks if a cantilevered wall approach is used. In addition, the technical challenges associated with constructing a shored excavation to 170 feet in these coarse soils are significant. This alternative therefore scores the lowest on implementability.

This alternative also requires the largest amount of construction activities and presents the greatest short-term risk to workers. It therefore also scores the lowest on short-term risk management. It is expected that this alternative will also have a significant impact on the public due to truck traffic and noise.

Alternative 4 would be delayed until the owner decides to remove all existing facilities from the Site. As such, cap inspection and maintenance, and periodic groundwater monitoring, would be required until the facilities are demolished.

As shown in Table 10.1, Alternative 4 has the highest overall weighted benefit score, and also the highest cost. Alternative 4a, the unshored option, has a future cost of $38,800,000. Alternative 4b, the shored option, has a future cost of $74,800,000.

10.6 Disproportionate Cost Analysis

A disproportionate cost analysis (DPCA) was completed, as allowed under and in accordance with WAC 173-340-360. The DPCA provides a means to balance the cost to benefit associated with an alternative and allows for elimination of alternatives for which the incremental costs are disproportionate relative to the benefits. The DPCA for the retained four alternatives is presented in Table 10.1. Figure 10.1 provides a graphical presentation of the cost benefit comparison for each of the four alternatives.

As shown on Figure 10.1, Alternative 2 provides a better overall ranking score as compared to Alternative 3, and for only 6% of the cost of Alternative 3. Under Alternative 2, potential exposure to Site soil that does not meet direct contact cleanup levels is effectively prevented by a combination of capping and institutional controls. Alternative 4 provides the best overall ranking score, scoring approximately 25% higher than Alternative 2. However, the cost to implement Alternative 4 ranges from 190 to 370 times the cost for implementation of Alternative 2, depending on whether Alternative 4a or 4b is implemented. The additional net 25% incremental benefit provided by Alternative 4 is considered disproportionate to the overall much higher cost of Alternative 4 relative to the other alternatives. Based on the protectiveness and effectiveness provided by Alternative 2, and disproportionate cost of the incremental benefits potentially provided by either Alternatives 3 or 4 over Alternative 2, Alternative 2 is identified as the preferred alternative.

11 Preferred Cleanup Action

Based on the evaluation of alternatives in Section 10, Alternative 2 is recommended as the cleanup action for this Site. The implementation of Alternative 2 includes the following elements:

- Construct a soil cap in the vicinity of soil boring GGP09 to prevent direct contact with shallow (less than 2.5 feet bgs) TPH-impacted soil.
- Maintaining existing pavement cap (or equivalent low permeability cap) in the Northeast Tank Farm Area at the Site as an institutional control, effectively capping and preventing contact with shallow TPH-impacted soil, and preventing infiltration into the area of TPH-impacted soil;
- Periodic groundwater sampling and analysis over a future 5-year period to confirm continued groundwater compliance; and
- Placing an environmental covenant on the property to limit certain types of subsurface disturbances and/or activities in areas with documented TPH-impacted soil and to prohibit non-industrial land use unless additional analysis and cleanup actions are completed.

11.1 Cap Inspection and Maintenance

The areas with COPC concentrations above cleanup levels are shown on Figure 6.1. COPC-impacted soil in the Northeast Tank Farm Area is already covered with a cap, consisting of existing pavement and other facilities. The integrity of the existing cap in the Northeast Tank Farm Area and the new cap in the vicinity of soil boring GGP09 would be inspected annually. The Northeast Tank Farm Area cap would be inspected to ensure that it is free of cracks or other defects that would allow surface water to infiltrate into the subsurface. Any cracks or other defects would be sealed or patched to restore the protective function of the cap. The new cap in the vicinity of soil boring GGP09 would be inspected to ensure that it remains intact and capable of prevent direct contact with underlying impacted soil. If substantial future facility changes or construction result in removal of an existing cap, the cap in question would be replaced with a cap of equivalent functionality.

11.2 Groundwater Monitoring

The conceptual groundwater monitoring program would include sampling of the six existing wells and analysis for TPH. Sampling will be conducted semi-annually for the first year, and then annually for the next 4 years, followed by a 5-year Ecology review. As part of remedial design, a response plan will be developed to identify actions if COPC concentrations in groundwater exceed the final Site cleanup levels. Given the age of the hydrocarbon impacts at the Site and the current record of groundwater compliance, for costing purposes it is assumed that Ecology will allow termination of the groundwater monitoring after the 5-year period.

11.3 Institutional Controls

Institutional controls would consist of an environmental covenant on the Property to restrict certain activities that could cause exposure to impacted soils or result in unacceptable mobilization of subsurface COPCs. The covenant would require maintenance of the cap in the Northeast Tank Farm Area and the cap in the vicinity of soil boring GGP09. The covenant would include a groundwater sampling plan addressing implementation of the groundwater sampling program required prior to the 5-year Ecology review. Non-industrial land uses would also be prohibited by the covenant unless and until a new analysis of remedial alternatives is prepared and Ecology approves additional cleanup actions designed to protect public health and the environmental under non-industrial land use scenarios.

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TABLES

Table 2.1 - AST Inventory

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Tank Number	Dia. (ft)	Ht. (ft)	Maximum Capacity (gal)	Year Installed	Position & Type
1	18.3	17.0	33,448	1950	V,FX,STL
2	22.3	16.0	46,537	1950	V,FX,STL
3	22.3	16.0	46,537	1950	V,FX,STL
5	27.3	16.0	69,803	1950	V,FX,STL
6	27.3	16.0	69,803	1950	V,FX,STL
7	22.3	16.0	46,537	1950	V,FX,STL
8	22.0	16.0	45,497	1950	V,FX,STL
9	14.0	26.0	29,940	1950	V,FX,STL
10	27.3	19.5	85,072	1950	V,FX,STL
12	11.0	30.0	21,327	1993	V,FX,STL
13	11.0	30.0	21,327	1993	V,FX,STL
14	11.0	30.0	21,327	1993	V,FX,STL
15	15.0	38.0	50,233	1998	V,FX,STL
16A	15.0	38.0	50,233	1998	V,FX,STL
16B	15.0	38.0	50,233	1998	V,FX,STL
17	29.3	56.0	282,451	1960	V,FX,STL
18	22.8	28.0	85,516	1960	V,FX,STL
19	22.4	33.0	97,455	1960	V,FX,STL
20	28.8	24.6	119,781	1960	V,FX,STL
21	35.0	24.6	176,904	1960	V,FX,STL
23	38.0	49.3	418,249	1950	V,FX,STL
24	67.0	40.0	1,054,946	1974	V,FX,STL
25	67.0	40.0	1,054,946	1974	V,FX,STL
26	65.8	39.1	994,093	1987	V,FX,STL
27	47.9	52.0	700,963	1987	V,FX,STL
28	8.5	35.0	14,857	1984	V,FX,STL
30	67.0	40.0	1,054,946	1987	V,FX,STL
31	67.0	40.0	1,054,946	1987	V,FX,STL
32	67.0	40.0	1,054,946	1994	V,FX,STL
33	67.0	40.0	1,054,946	1994	V,FX,STL
34	100.0	40.0	2,350,068	1994	V,FX,STL
37	19.3	25.0	54,711	1950	V,FX,STL
38	19.3	25.0	54,711	1950	V,FX,STL
39	19.3	25.0	54,711	1950	V,FX,STL
41	11.0	22.0	15,640	1984	V,FX,STL
42	12.3	24.0	21 159	1984	V,FX,STL
45	8.0	9.0	3,384	1984	V,FX,STL
46	11.3	18.9	14,054	1984	V,FX,STL
47	11.3	24.0	17,846	1984	V,FX,STL
48	11.3	24.3	18,069	1984	V,FX,STL
49	11.3	24.3	18,069	1984	V,FX,STL
50	20.0	24.0	56,402	1986	V,FX,STL
51	20.0	24.0	56,402	1986	V,FX,STL
52	8.0	16.0	6,016	1998	V,FX,STL
52b	12.0	19.0	16,074	1984	V,FX,FB
53	10.0	11.0	6,463	1950	V,FX,STL
54	12.0	35.9	30,372	1993	V,FX,STL
55	8.0	14.0	5,264	2002	V,FX,STL

Notes:

Maximum capacity is based on shell dimensions

Tank Position	Type of Construction
V - Vertical	STL - Steel
H - Horizontal	FB - Fiberglass
FX - Fixed Roof	

Table 2.2 - 1993 Borehole Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	Units	Cleanup Level	BH-1			BH-2			BH-3		
				Depth (ft bgs)	5	10	15	10	15	20	5	10	15
				Date	1993	1993	1993	1993	1993	1993	1993	1993	1993
TPH	Diesel Range	WTPH-D	mg/kg		2350		5	232		635	20600		5
TPH	Diesel-extended Range	WTPH-418.1	mg/kg		5000	30	<10	1090	3440	7740	31100	12	13
TPH	TPH-Dx (total)		mg/kg	2139	**7350**	30	10	1322	**3440**	**8375**	**51700**	12	18
Hydrocarbon Scan	< C12												
Hydrocarbon Scan	C12 - C24												
Hydrocarbon Scan	> C24												
Hydrocarbon Scan	Unknown												
Hydrocarbon Scan	Paraffins												
Hydrocarbon Scan	Isoparaffins												
Hydrocarbon Scan	Naphthenes												
Hydrocarbon Scan	Aromatics												
Hydrocarbon Scan	Olefins												
Hydrocarbon Scan	C26												
Hydrocarbon Scan	Unknown												

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is the sum of detected results and half of non-detected results.
TPH-Dx (total) for sample at BH-5 (125 ft bgs) is estimated based on description.

Table 2.2 - 1993 Borehole Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	Units	Cleanup Level	BH-4										
				Depth (ft bgs)	20	25	30	30	35	40	45	50	55	60	65
				Date	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
								duplicate							
TPH	Diesel Range	WTPH-D	mg/kg		<10	<10								5000	
TPH	Diesel-extended Range	WTPH-418.1	mg/kg		4250	422	10620	11750	2830	6370	15240	4760	6300	10100	4170
TPH	TPH-Dx (total)		mg/kg	2139	**4255**	427	**10620**	**11750**	**2830**	**6370**	**15240**	**4760**	**6300**	**15100**	**4170**
Hydrocarbon Scan	< C12														
Hydrocarbon Scan	C12 - C24														
Hydrocarbon Scan	> C24														
Hydrocarbon Scan	Unknown														
Hydrocarbon Scan	Paraffins														
Hydrocarbon Scan	Isoparaffins														
Hydrocarbon Scan	Naphthenes														
Hydrocarbon Scan	Aromatics														
Hydrocarbon Scan	Olefins														
Hydrocarbon Scan	C26														
Hydrocarbon Scan	Unknown														

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is the sum of detected results and half of non-detected results.
TPH-Dx (total) for sample at BH-5 (125 ft bgs) is estimated based on description.

Table 2.2 - 1993 Borehole Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

				Location	BH-4										
				Depth (ft bgs)	70	70	75	80	85	90	95	100	105	115	125
				Date	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Type	Analyte	Method	Units	Cleanup Level		duplicate									
TPH	Diesel Range	WTPH-D	mg/kg												
TPH	Diesel-extended Range	WTPH-418.1	mg/kg		19200	24500	375	7920	3670	9800	9170	8980	12480	10320	263
TPH	TPH-Dx (total)		mg/kg	2139	**19200**	**24500**	375	**7920**	**3670**	**9800**	**9170**	**8980**	**12480**	**10320**	263
Hydrocarbon Scan	< C12														
Hydrocarbon Scan	C12 - C24														
Hydrocarbon Scan	> C24														
Hydrocarbon Scan	Unknown														
Hydrocarbon Scan	Paraffins														
Hydrocarbon Scan	Isoparaffins														
Hydrocarbon Scan	Naphthenes														
Hydrocarbon Scan	Aromatics														
Hydrocarbon Scan	Olefins														
Hydrocarbon Scan	C26														
Hydrocarbon Scan	Unknown														

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is the sum of detected results and half of non-detected results.
TPH-Dx (total) for sample at BH-5 (125 ft bgs) is estimated based on description.

Table 2.2 - 1993 Borehole Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

				Location	BH-5				BH-6		BH-7			BH-8	
				Depth (ft bgs)	15	25	120	125	9	19	14	26	41	3	19.5
				Date	1993	1993	1993	1993	6/5/1996	6/5/1996	6/5/1996	6/5/1996	6/5/1996	6/6/1996	6/6/1996
Type	Analyte	Method	Units	Cleanup Level				estimated							
TPH	Diesel Range	WTPH-D	mg/kg						9.5	<40	2500	3400	1400	<800	1000
TPH	Diesel-extended Range	WTPH-418.1	mg/kg		<100	<100	<100		65	360	2000	6300	3700	3100	1900
TPH	TPH-Dx (total)		mg/kg	2139	50	50	50	**10000**	74.5	380	**4500**	**9700**	**5100**	**3500**	**2900**
Hydrocarbon Scan	< C12										5.05%				
Hydrocarbon Scan	C12 - C24										86.57%				
Hydrocarbon Scan	> C24										0.00%				
Hydrocarbon Scan	Unknown										8.37%				
Hydrocarbon Scan	Paraffins										79.27%				
Hydrocarbon Scan	Isoparaffins										4.32%				
Hydrocarbon Scan	Naphthenes										0.00%				
Hydrocarbon Scan	Aromatics										8.04%				
Hydrocarbon Scan	Olefins										0.00%				
Hydrocarbon Scan	C26										0.00%				
Hydrocarbon Scan	Unknown										8.37%				

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is the sum of detected results and half of non-detected results.
TPH-Dx (total) for sample at BH-5 (125 ft bgs) is estimated based on description.

Table 2.2 - 1993 Borehole Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

				Location	BH-9			BH-10		BH-11		BH-12		BH-13	
				Depth (ft bgs)	0.5	4	16	2	19	3	16	3	19	10	30
				Date	6/6/1996	6/6/1996	6/6/1996	6/6/1996	6/6/1996	6/6/1996	6/6/1996	6/7/1996	6/7/1996	6/7/1996	6/7/1996
Type	Analyte	Method	Units	Cleanup Level											
TPH	Diesel Range	WTPH-D	mg/kg		6300	<800	<4	11000	4500	<4	<4	260	<4	<4	4.9
TPH	Diesel-extended Range	WTPH-418.1	mg/kg		5600	8000	28	6300	5000	56	16	1600	23	25	33
TPH	TPH-Dx (total)		mg/kg	2139	**11900**	**8400**	30	**17300**	**9500**	58	18	1860	25	27	37.9
Hydrocarbon Scan	< C12					2.49%									
Hydrocarbon Scan	C12 - C24					79.78%									
Hydrocarbon Scan	> C24					14.49%									
Hydrocarbon Scan	Unknown					3.24%									
Hydrocarbon Scan	Paraffins					88.24%									
Hydrocarbon Scan	Isoparaffins					1.41%									
Hydrocarbon Scan	Naphthenes					0.00%									
Hydrocarbon Scan	Aromatics					3.18%									
Hydrocarbon Scan	Olefins					0.00%									
Hydrocarbon Scan	C26					3.94%									
Hydrocarbon Scan	Unknown					3.24%									

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is the sum of detected results and half of non-detected results.
TPH-Dx (total) for sample at BH-5 (125 ft bgs) is estimated based on description.

Table 2.3 - 1993 Test Pit Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

				Location	TP-1					TP-2	
				Depth (ft bgs)	5	5	10	10	12	5	10
				Date	1993	1993	1993	1993	1993	1993	1993
Type	Analyte	Method	Units	Cleanup Level		duplicate		duplicate			
TPH	Diesel Range	WTPH-D	mg/kg		210		<10	<10			97
TPH		WTPH-418.1	mg/kg		776	690	93		<100	2630	520
TPH	TPH-Dx (total)		mg/kg	2139	986	690	98	5	50	**2630**	617

				Location	TP-3			TP-4				
				Depth (ft bgs)	5	5	10	5	5F	5F	10	SF
				Date	1993	1993	1993	1993	1993	1993	1993	1993
Type	Analyte	Method	Units	Cleanup Level		duplicate				duplicate		
TPH	Diesel Range	WTPH-D	mg/kg					293	5370			
TPH		WTPH-418.1	mg/kg		97	86	23	2680	26260	25340	12440	10600
TPH	TPH-Dx (total)		mg/kg	2139	97	86	23	**2973**	**31630**	**25340**	**12440**	**10600**

				Location	TP-5		
				Depth (ft bgs)	5	10	10
				Date	1993	1993	1993
Type	Analyte	Method	Units	Cleanup Level			duplicate
TPH	Diesel Range	WTPH-D	mg/kg				
TPH		WTPH-418.1	mg/kg		391	1600	1480
TPH	TPH-Dx (total)		mg/kg	2139	391	1600	1480

Notes:

Data shown is as reported by the laboratory.

Blank cells indicate analyte not analyzed.

"<" indicates non-detect result at laboratory reporting limit.

Gray-shaded values indicate exceedance of cleanup level.

TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.

Table 2.4 - Ecology Listed Confirmed and Suspected Contaminated Sites in the Vicinity of the Site

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Facility Site Id	Cleanup Site Id	Cleanup Site Name	Address	SiteStatus	WARM Rank	Contaminant Name	Groundwater	Surface Water	Soil
16655424	3229	Sem Materials LP Spokane	4327 N THOR ST	Cleanup Started	3	Petroleum Products-Unspecified	S		C
627	1133	Aluminum Recycling Corp	3412 E WELLESLEY	Construction Complete-Performance Monitoring	2	Conventional Contaminants, Inorganic	C		C
627	1133	Aluminum Recycling Corp	3412 E WELLESLEY	Construction Complete-Performance Monitoring	2	Metals - Other			C
98615712	3243	BNSF Railway Black Tank Property	3202 E WELLESLEY	Awaiting Cleanup	3	Petroleum Products-Unspecified	S		C
98615712	3243	BNSF Railway Black Tank Property	3202 E WELLESLEY	Awaiting Cleanup	3	Polynuclear Aromatic Hydrocarbons	S		C
20894	2829	BN SF RR BUNKER C SPILL AREA	FREYA & E LONGFELLOW	Awaiting Cleanup	5	Petroleum Products-Unspecified	S		C

Note:

Compiled from the Washington State Department of Ecology's Integrated Site Information System in April 2012.

Table 3.1 - Remedial Investigation Monitoring Well Completion Summary and Groundwater Elevation Data

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Groundwater Level Monitoring and Groundwater Quality Sampling

Well	SemMaterials L.P. Spokane Site Monitoring Wells													
	GMW-01		GMW-02		GMW-03		GMW-04		GMW-05		GMW-06		UDCMW-4	
Coordinates (Easting, Northing)	2495610.0	274056.9	2495535.3	274043.4	2495439.2	274049.2	2495303.0	274032.9	2495137.6	274055.9	2494996.9	273836.5	2495692.0	274060.7
Ground Surface Elevation (NAVD 88)[1]	2036.65		2038.85		2037.89		2038.99		2039.87		2036.03		2036.42	
Top of PVC Casing Elevation (NAVD 88)[1]	2039.39		2041.33		2040.18		2041.45		2042.47		2035.68		2039.42	
Well Depth (ft bTOC)	199.74		193.48		192.29		195.46		195.60		192.65		--	
Well Depth (ft bgs)	197.00		191.00		190.00		193.00		193.00		193.00		--	
Screen Depth Range (ft bgs)	173.0	193.0	167.0	187.0	168.0	188.0	170.0	190.0	172.0	192.0	164.0	189.0	175.0	195.0
Screen Elevation Range (ft MSL)	1863.65	1843.65	1871.85	1851.85	1869.89	1849.89	1868.99	1848.99	1867.87	1847.87	1872.03	1847.03	1861.42	1841.42
Date	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation
2/1999														
10/29/2008	173.45	1865.94	175.62	1865.71	174.48	1865.70	175.7	1865.75	176.7	1865.77				
12/17/2008	175.44	1863.95	177.52	1863.81	176.21	1863.97	177.53	1863.92	178.61	1863.86	171.47	1864.21	174.97	1864.45
1/15/2009	174.81	1864.58	176.89	1864.44	175.63	1864.55	176.94	1864.51	178.03	1864.44	170.89	1864.79	174.84	1864.58
4/28/2009	170.75	1868.64	172.82	1868.51	171.57	1868.61	172.88	1868.57	173.97	1868.50	166.72	1868.96	170.61	1868.81
8/6/2009	175.88	1863.51	177.96	1863.37	176.68	1863.5	177.97	1863.48	179.03	1863.44	171.92	1863.76	175.91	1863.51
8/11/2010	175.95	1863.44	178.02	1863.31	176.75	1863.43	178.02	1863.43	179.08	1863.39	172.00	1863.68	176.04	1863.38
11/8/2010	176.27	1863.12	178.34	1862.99	177.07	1863.11	178.35	1863.10	179.45	1863.02	172.33	1863.35	176.31	1863.11
2/14/2011	171.17	1868.22	173.20	1868.13	171.93	1868.25	173.11	1868.34	174.22	1868.25	167.09	1868.59	171.20	1868.22
5/10/2011	169.57	1869.82	171.63	1869.7	170.38	1869.8	171.65	1869.80	172.77	1869.70	165.60	1870.08	169.59	1869.83

Off Site Groundwater Level Monitoring

Well	Black Tank Site																		Hillyard Dross Site Monitoring Wells			
	GEO-BTMW-01		GEO-BTMW-02		GEO-BTMW-03		GEO-BTMW-04		GEO-BTMW-05		GEO-BTMW-06		GEO-BTMW-07		GEO-BTMW-08		GEO-BTMW-09		DCMW-3		DCMW-5	
Top of PVC Casing Elevation (NAVD 88)[1]	2036.08		2037.10		2040.92		2033.62		2041.00		2029.49		2036.04		2040.79		2040.63		2039.01		2041.80	
Date	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation	Feet below TOC	Relative Elevation
2/1999																			174.37	1864.64	177.00	1864.80
10/29/2008																						
12/17/2008																						
1/15/2009	171.22	1864.86	172.48	1864.62	169.73	1871.19	162.13	1871.49	169.57	1871.43	163.93	1865.56			169.66	1871.13	176.77	1863.86				
4/28/2009					171.43	1869.49	170.61	1863.01	174.12	1866.88			172.71	1863.33								
8/6/2009																						
8/11/2010											165.29	1864.20							176.40	1862.61	179.16	1862.64
11/8/2010											165.50	1863.99							Dry	Dry	179.54	1862.26
2/14/2011											160.20	1869.29							171.68	1867.33	174.43	1867.37
5/10/2011											158.68	1870.81							170.22	1868.79	172.94	1868.86

Notes:

[1] Survey elevations from Benthin & Associates in NAVD 88 (12/8/08).

Gray-shaded values indicate the presence of floating product.

ft bTOC = "below top of riser casing" measured in feet.

ft MSL = "above mean sea level" measured in feet.

ft bgs = "below ground surface" measured in feet.

Table 3.2 - Water Supply Wells in the Vicinity of the Site

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Well Log ID	Well Label	Type of Water Supply	Location	Well Owner Name	Depth (ft bgs)	Dia. (in)	Date	Easting (SPS 83)	Northing (SPS 83)
158553	T25N/R43E-2C1	Domestic	Cross-gradient	RON JESSICK	85	6	9/13/1994	2418771	878183
157159	T25N/R43E-2D1	Domestic	Cross-gradient	O. J. RHODES	93	6	10/26/1989	2417447	878150
151236	T25N/R43E-2F1	Domestic	Cross-gradient	DAVE BILLUPS	203	6	8/28/1981	2418823	876890
157417	T25N/R43E-2E1	Domestic	Cross-gradient	PAUL SANDIFUR	123	6	5/8/1984	2417498	876864
158560	T25N/R43E-2SW	Domestic	Cross-gradient	RON LA FLEUY	80	6	12/6/1989	2418241	874941
156736	T25N/R43E-2N1	Domestic	Cross-gradient	MIKE LEMON	600	6	8/21/1987	2417601	874286
153139	T25N/R43E-3C1	Well is Mislocated	Downgradient	GEORGE GOLDMAN	85	6	8/5/1973	2413501	878023
292968	T25N/R43E-3C2	Industrial/Commercial	Downgradient	HILLYARD PROCESSING CO.	231	10	-	2413501	878023
149700	T25N/R43E-3J1	Domestic	Cross-gradient	BILL BULLOUGH	152	6	12/22/1982	2416224	875535
160211	T25N/R43E-4G1	Industrial/Commercial	Cross-gradient	WASHINGTON WATER POWER	380	10	1/28/1993	2409596	876585
149364	T26N/R43E-33K1	Domestic	Cross-gradient	ALLEN MAGGARD	210	6	5/1/1979	2409438	880512
160216	T26N/R43E-34L1	Industrial/Commercial	Downgradient	WASHINGTON WATER POWER	400	10	11/12/1993	2413400	880649
292954	T26N/R43E-34P1	Industrial/Commercial	Downgradient	GREAT NORTHERN RAILWAY COMPANY	210	72	-	2413453	879332
153382	T26N/R43E-34	Industrial/Commercial	Downgradient	GREAT NORTHERN ICING CO.	190	5	3/1/1922	2414031	881330
155402	T26N/R43E-35P1	Domestic	Cross-gradient	KEN JOHNKE	174	6	8/9/1973	2418719	879498

Table 4.1 - 2008 Direct-Push Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location	GGP01B	GGP02	GGP03			GGP04			GGP05	GGP06		
					Depth (ft bgs)	12.5	15	2.5	7.5	15	2.5	10	15	15	2.5	5	15
					Date	10/8/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/8/2008	10/8/2008	10/8/2008
					Units												
TPH	Diesel Range	NWTPH-Dx			mg/Kg	<26	5.1	71	26	7.2	<26	<5.4	<5.0	<5.0	34	1100	57
TPH	Heavy Oils	NWTPH-Dx			mg/kg	<100	20	210	100	49	<100	<22	<20	<20	<110	2700	130
TPH	TPH-Dx (total)			2139	mg/kg	63	25.1	281	126	56.2	63	13.7	12.5	12.5	55	3800	187
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			mg/kg								<2.0				4.5
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			mg/kg								<2.0				<2.0
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			mg/kg								<2.0				2.1
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			mg/kg								<2.0				13
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Benzo(b)fluoranthene	8270C	0.1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Benzo(k)fluoranthene	8270C	0.1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Benzo(a)pyrene	8270C	1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Chrysene	8270C	0.01		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Carcinogenic PAHs	cPAH based on TEF			18	mg/kg	0.0051	0.0052			0.21			0.0052	0.0051			0.11
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Acenaphthylene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Anthracene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Benzo(g,h,i)perylene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Fluoranthene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Fluorene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Phenanthrene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Non- Carcinogenic PAHs	Pyrene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Naph-thalenes	Naphthalene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Naph-thalenes	1-Methylnaphthalene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	<0.0068			<0.14
Naph-thalenes	2-Methylnaphthalene	8270C			mg/kg	<0.0068	<0.0069			<0.28			<0.0069	0.0071			<0.14
Naph-thalenes	Naphthalenes (total)				mg/kg	0.0102	0.01035			0.42			0.01035	0.0139			0.21

Notes:

Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.
cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.
Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.1 - 2008 Direct-Push Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location	GGP07	GGP08			GGP09			GGP10		GGP11		
					Depth (ft bgs)	15	2.5	7.5	15	2.5	10	15	2	15	2.5	12	15
					Date	10/8/2008	10/8/2008	10/8/2008	10/8/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008	10/7/2008
Type	Analyte	Method	TEF	Cleanup Level	Units												
TPH	Diesel Range	NWTPH-Dx			mg/Kg	95	93	<5.1	<26	3700	800	<5.0	12	<4.9	190	<5.3	<5.1
TPH	Heavy Oils	NWTPH-Dx			mg/kg	300	140	<21	<100	5500	1300	<20	64	<20	490	<21	<20
TPH	TPH-Dx (total)			2139	mg/kg	395	233	13.05	63	9200	2100	12.5	76	12.45	680	13.15	12.55
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg		<2.1			<100		<1.9	<40				<2.0
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			mg/kg		<2.1			<100		<1.9	<40				<2.0
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			mg/kg		<2.1			<100		<1.9	<40				<2.0
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			mg/kg		4.6			<100		<1.9	<40				<2.0
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			mg/kg		420			400		<1.9	120				2.1
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			mg/kg		<2.1			<100		<1.9	<10				<2.0
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			mg/kg		<2.1			<100		<1.9	<10				<2.0
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			mg/kg		4.4			<100		<1.9	<10				<2.0
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			mg/kg		18			430		<1.9	110				<2.0
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			mg/kg		94			1400		<1.9	400				<2.0
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg	<0.14	<0.13		<0.007	5.7		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Benzo(b)fluoranthene	8270C	0.1		mg/kg	<0.14	<0.13		<0.007	3.2		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Benzo(k)fluoranthene	8270C	0.1		mg/kg	<0.14	<0.13		<0.007	0.8		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Benzo(a)pyrene	8270C	1		mg/kg	<0.14	<0.13		<0.007	4		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Chrysene	8270C	0.01		mg/kg	<0.14	<0.13		<0.007	13		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg	<0.14	<0.13		<0.007	<0.8		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg	<0.14	<0.13		<0.007	<0.8		<0.0065	<0.250				<0.0064
Carcinogenic PAHs	cPAH based on TEF			18	mg/kg	0.11	0.10		0.005	5.2		0.0049	0.189				0.0048
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg	<0.14	<0.13		<0.007	4.2		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Acenaphthylene	8270C			mg/kg	<0.14	<0.13		<0.007	<0.8		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Anthracene	8270C			mg/kg	<0.14	<0.13		<0.007	1.4		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Benzo(g,h,i)perylene	8270C			mg/kg	<0.14	<0.13		<0.007	1.5		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Fluoranthene	8270C			mg/kg	<0.14	<0.13		<0.007	1.8		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Fluorene	8270C			mg/kg	<0.14	<0.13		<0.007	3.5		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Phenanthrene	8270C			mg/kg	<0.14	0.45		<0.007	5.9		<0.0065	<0.250				<0.0064
Non- Carcinogenic PAHs	Pyrene	8270C			mg/kg	0.16	<0.13		<0.007	10		<0.0065	<0.250				<0.0064
Naph-thalenes	Naphthalene	8270C			mg/kg	<0.14	0.22		<0.007	2.3		<0.0065	<0.250				<0.0064
Naph-thalenes	1-Methylnaphthalene	8270C			mg/kg	<0.14	0.43		<0.007	20		<0.0065	<0.250				<0.0064
Naph-thalenes	2-Methylnaphthalene	8270C			mg/kg	<0.14	0.71		<0.007	30		<0.0065	<0.250				<0.0064
Naph-thalenes	Naphthalenes (total)				mg/kg	0.21	1.36		0.0105	52		0.0098	0.375				0.0096

Notes:
Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.
cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.
Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.1 - 2008 Direct-Push Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location / Depth (ft bgs) / Date / Units	GGP12B 2.5 10/8/2008	GGP12B 7.5 10/8/2008	GGP12B 15 10/8/2008	GGP13 15 10/7/2008	GGP14 2.5 10/7/2008	GGP14 10 10/7/2008	GGP14 15 10/7/2008	GGP15B 15 10/7/2008	GGP16 15 10/7/2008	GGP17 15 10/7/2008	GGP18 15 10/7/2008
TPH	Diesel Range	NWTPH-Dx			mg/Kg	<5.4	<5.2	<5.1	<4.7	54	20	<4.9	<26	<25	<4.7	<5.3
TPH	Heavy Oils	NWTPH-Dx			mg/kg	<21	<21	<20	<19	270	100	<20	<110	<100	<19	<21
TPH	TPH-Dx (total)			2139	mg/kg	13.2	13.1	12.55	11.85	324	120	12.45	68	62.5	11.85	13.15
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			mg/kg	4.6	2.2				6.4					
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			mg/kg	<2.3	<2.0				<2.1					
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			mg/kg	<2.3	<2.0				11					
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Benzo(b)fluoranthene	8270C	0.1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Benzo(k)fluoranthene	8270C	0.1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Benzo(a)pyrene	8270C	1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Chrysene	8270C	0.01		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Carcinogenic PAHs	cPAH based on TEF			18	mg/kg		0.0054		0.0048		0.22		0.0052	0.0051	0.0051	0.0048
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Acenaphthylene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Anthracene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Benzo(g,h,i)perylene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Fluoranthene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Fluorene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Phenanthrene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Non- Carcinogenic PAHs	Pyrene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Naph-thalenes	Naphthalene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Naph-thalenes	1-Methylnaphthalene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Naph-thalenes	2-Methylnaphthalene	8270C			mg/kg		<0.0071		<0.0064		<0.29		<0.0069	<0.0068	<0.0067	<0.0063
Naph-thalenes	Naphthalenes (total)				mg/kg		0.01065		0.0096		0.435		0.01035	0.0102	0.01005	0.00945

Notes:

Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.
cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.
Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.1 - 2008 Direct-Push Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location	GGP19	GGP20	GGP21B			GGP22		GGP23		GGP24		
					Depth (ft bgs)	15	15	2	7.5	12	2.5	7	2.5	15	2.5	10	15
					Date	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008	10/6/2008
					Units												
TPH	Diesel Range	NWTPH-Dx			mg/Kg	<5.1	24	270	530	280	8.7	15	130	9.8	13000	600	2200
TPH	Heavy Oils	NWTPH-Dx			mg/kg	<21	150	1200	1300	1200	62	110	1000	100	13000	3000	3100
TPH	TPH-Dx (total)			2139	mg/kg	13.05	174	1470	1830	1480	70.7	125	1130	109.8	**26000**	**3600**	**5300**
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg			<2.0	<100	<43	<2.1	<2.1	<100	<2.0	<110		
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			mg/kg			<2.0	<100	<43	<2.1	<2.1	<100	<2.0	<110		
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			mg/kg			<2.0	<100	<43	<2.1	<2.1	<100	<2.0	260		
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			mg/kg			<2.0	<100	<43	<2.1	<2.1	<100	<2.0	320		
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			mg/kg			130	620	100	9.9	5.9	110	2.7	960		
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			mg/kg			<2.0	<100	<22	<2.1	<2.1	<42	<2.0	<110		
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			mg/kg			<2.0	<100	<22	<2.1	<2.1	<42	<2.0	<110		
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			mg/kg			<2.0	<100	<22	<2.1	<2.1	<42	<2.0	770		
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			mg/kg			2.6	380	<22	<2.1	<2.1	<42	<2.0	2300		
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			mg/kg			32	2400	23	20	3.8	240	<2.0	3800		
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg	<0.0069	<0.07	<0.29	6.2	<0.58	<0.069	<0.072	<0.85	<0.07	9.5	<0.58	1.6
Carcinogenic PAHs	Benzo(b)fluoranthene	8270C	0.1		mg/kg	<0.0069	<0.07	<0.29	2.8	<0.58	<0.069	<0.072	<0.85	<0.07	2.7	<0.58	0.89
Carcinogenic PAHs	Benzo(k)fluoranthene	8270C	0.1		mg/kg	<0.0069	<0.07	<0.29	4	<0.58	<0.069	<0.072	<0.85	<0.07	<1.2	<0.58	0.71
Carcinogenic PAHs	Benzo(a)pyrene	8270C	1		mg/kg	<0.0069	<0.07	<0.29	3.1	<0.58	<0.069	<0.072	<0.85	<0.07	3.8	<0.58	<0.34
Carcinogenic PAHs	Chrysene	8270C	0.01		mg/kg	<0.0069	<0.07	<0.29	6.7	<0.58	<0.069	<0.072	<0.85	<0.07	16	1.5	3.3
Carcinogenic PAHs	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg	<0.0069	<0.07	<0.29	<0.65	<0.58	<0.069	<0.072	<0.85	<0.07	<1.2	<0.58	<0.34
Carcinogenic PAHs	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg	<0.0069	<0.07	<0.29	1.3	<0.58	<0.069	<0.072	<0.85	<0.07	<1.2	<0.58	<0.34
Carcinogenic PAHs	cPAH based on TEF			18	mg/kg	0.0052	0.05	0.22	4.6	0.44	0.052	0.054	0.64	0.05	4.2	0.45	0.56
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg	<0.0069	<0.07	<0.29	2.6	<0.58	<0.069	<0.072	<0.85	<0.07	10	<0.58	1.2
Non- Carcinogenic PAHs	Acenaphthylene	8270C			mg/kg	<0.0069	<0.07	<0.29	<0.65	<0.58	<0.069	<0.072	<0.85	<0.07	2	<0.58	<0.34
Non- Carcinogenic PAHs	Anthracene	8270C			mg/kg	<0.0069	<0.07	<0.29	3.6	<0.58	<0.069	<0.072	<0.85	<0.07	6	<0.58	0.8
Non- Carcinogenic PAHs	Benzo(g,h,i)perylene	8270C			mg/kg	<0.0069	0.1	<0.29	0.95	<0.58	<0.069	<0.072	<0.85	<0.07	1.2	2	0.54
Non- Carcinogenic PAHs	Fluoranthene	8270C			mg/kg	<0.0069	<0.07	<0.29	27	<0.58	<0.069	<0.072	<0.85	<0.07	3.6	<0.58	0.51
Non- Carcinogenic PAHs	Fluorene	8270C			mg/kg	<0.0069	<0.07	<0.29	2.8	<0.58	<0.069	<0.072	<0.85	<0.07	13	<0.58	1.5
Non- Carcinogenic PAHs	Phenanthrene	8270C			mg/kg	<0.0069	<0.07	<0.29	21	<0.58	<0.069	<0.072	<0.85	<0.07	44	<0.58	5.5
Non- Carcinogenic PAHs	Pyrene	8270C			mg/kg	<0.0069	<0.07	<0.29	19	<0.58	<0.069	<0.072	<0.85	<0.07	17	<0.58	3.5
Naph-thalenes	Naphthalene	8270C			mg/kg	<0.0069	<0.07	<0.29	<0.65	<0.58	<0.069	<0.072	<0.85	<0.07	9.3	<0.58	1.2
Naph-thalenes	1-Methylnaphthalene	8270C			mg/kg	<0.0069	<0.07	<0.29	<0.65	<0.58	<0.069	<0.072	<0.85	<0.07	63	0.76	7.5
Naph-thalenes	2-Methylnaphthalene	8270C			mg/kg	<0.0069	<0.07	<0.29	<0.65	<0.58	<0.069	<0.072	<0.85	<0.07	86	0.85	9.3
Naph-thalenes	Naphthalenes (total)				mg/kg	0.01035	0.105	0.435	0.975	0.87	0.104	0.108	1.28	0.11	158	1.90	18.0

Notes:

Data shown is as reported by the laboratory.

Blank cells indicate analyte not analyzed.

"<" indicates non-detect result at laboratory reporting limit.

Gray-shaded values indicate exceedance of cleanup level.

TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.

cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.

Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.1 - 2008 Direct-Push Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location	GGP25	GGP26	GGP27	GGP28	GGP29	GGP30	
					Depth (ft bgs)	15	16	16	16	16	5	16
					Date	10/6/2008	10/8/2008	10/8/2008	10/8/2008	10/8/2008	10/8/2008	10/8/2008
					Units							
TPH	Diesel Range	NWTPH-Dx			mg/Kg	48	<25	<26	<25	<26	470	<26
TPH	Heavy Oils	NWTPH-Dx			mg/kg	170	<100	<100	<100	<110	1900	<110
TPH	TPH-Dx (total)			2139	mg/kg	218	62.5	63	62.5	68	**2370**	68
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			mg/kg							
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			mg/kg							
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Benzo(b)fluoranthene	8270C	0.1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Benzo(k)fluoranthene	8270C	0.1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Benzo(a)pyrene	8270C	1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Chrysene	8270C	0.01		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Carcinogenic PAHs	cPAH based on TEF			18	mg/kg	0.051	0.0052	0.021	0.0051	0.005		0.005
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Acenaphthylene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Anthracene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Benzo(g,h,i)perylene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Fluoranthene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Fluorene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Phenanthrene	8270C			mg/kg	0.073	<0.0069	<0.028	<0.0068	<0.007		<0.007
Non- Carcinogenic PAHs	Pyrene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Naph-thalenes	Naphthalene	8270C			mg/kg	<0.067	<0.0069	<0.028	<0.0068	<0.007		<0.007
Naph-thalenes	1-Methylnaphthalene	8270C			mg/kg	0.073	<0.0069	<0.028	<0.0068	<0.007		<0.007
Naph-thalenes	2-Methylnaphthalene	8270C			mg/kg	0.17	<0.0069	<0.028	<0.0068	<0.007		<0.007
Naph-thalenes	Naphthalenes (total)				mg/kg	0.28	0.01035	0.042	0.0102	0.011		0.011

Notes:

Data shown is as reported by the laboratory.
Blank cells indicate analyte not analyzed.
"<" indicates non-detect result at laboratory reporting limit.
Gray-shaded values indicate exceedance of cleanup level.
TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.
cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.
Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.2 - 2008 Monitoring Well Boring Soil Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analyte	Method	TEF	Cleanup Level	Location	GMW-01				GMW-02				
					Depth (ft bgs)	120	125	170.5	174.5	105	125	128	174.5	176
					Date	10/15/2008	10/15/2008	10/15/2008	10/15/2008	10/17/2008	10/17/2008	10/17/2008	10/17/2008	10/17/2008
					Units									
	Diesel Range	NWTPH-Dx			mg/kg	<26	<27	<28	<29	<25	<28	<26	<25	<26
	Heavy Oils	NWTPH-Dx			mg/kg	<110	<110	<110	<110	<100	<110	<100	<100	<100
	TPH-Dx (total)			2139	mg/kg	68	68.5	69	69.5	62.5	69	63	62.5	63
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C10 - C12 Aliphatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C12 - C16 Aliphatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C16 - C21 Aliphatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C21 - C34 Aliphatics	EPH			mg/kg	<2.1			<2.0					2.2
	C8 - C10 Aromatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C10 - C12 Aromatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C12 - C16 Aromatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C16 - C21 Aromatics	EPH			mg/kg	<2.1			<2.0					<2.1
	C21 - C34 Aromatics	EPH			mg/kg	<2.1			<2.0					<2.1
Carcinogenic PAHs	Benzo(a)anthracene	8270C	0.1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Benzo(b)fluoranthene	8270C	0.1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Benzo(k)fluoranthene	8270C	0.1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Benzo(a)pyrene	8270C	1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Chrysene	8270C	0.01		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Dibenzo(a,h)anthracene	8270C	0.1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Indeno(1,2,3-cd)pyrene	8270C	0.1		mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	cPAH based on TEF			18	mg/kg	0.0055	0.0055		0.0057		0.0058	0.0053		0.0053
Non- Carcinogenic PAHs	Acenaphthene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Acenaphthylene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Anthracene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Benzo(g,h,i)perylene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Fluoranthene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Fluorene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Phenanthrene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	Pyrene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
Naph-thalenes	Naphthalene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	1-Methylnaphthalene	8270C			mg/kg	<0.0073	<0.0073		<0.0076		<0.0077	<0.0070		<0.0070
	2-Methylnaphthalene	8270C			mg/kg	<0.0073	<0.0073		0.0076		<0.0077	<0.0070		<0.0070
	Naphthalenes (total)				mg/kg	0.01095	0.01095		0.0152		0.01155	0.0105		0.0105

Notes:

Data shown is as reported by the laboratory.

Blank cells indicate analyte not analyzed.

"<" indicates non-detect result at laboratory reporting limit.

Gray-shaded values indicate exceedance of cleanup level.

TPH-Dx (total) is calculated as sum of detected results and half of non-detected results.

cPAH based on TEF is sum of detected results and half of non-detected results multiplied by TEF.

Naphthalenes (total) is calculated as sum of detected results and half of non-detected results.

Table 4.3 - Initial and Modified Monitoring Well Pump Settings

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Phase I Remedial Investigation Initial Pump Settings

Well ID	High Water Level April 2009 (ft bTOC)	Low Water Level Aug. 2009 (ft bTOC)	Approximate Water Level Variation (ft bTOC)	Reported Pump Intake (ft bTOC)	Measured Top of Pump Aug. 2010 (ft bTOC)	Measured Pump Intake[1] Aug. 2010 (ft bTOC)	Pump Intake Minus Low Water Level (ft)	Initial Change in Pump Setting[2] Aug. 2010 (ft)	Modified Pump Intake Setting (ft bTOC)	Amount of Water Above the Pump Intake at Low Water Level (ft)
GMW-01	170.75	175.88	5.13	191.90	189.04	192.54	16.02	11.54	181.0	5.12
GMW-02	172.82	177.96	5.14	185.30	182.04	185.54	7.34	1.30	184.0	6.04
GMW-03	171.57	176.68	5.11	186.50	183.72	187.22	9.82	4.22	183.0	6.32
GMW-04	172.88	177.97	5.09	187.80	185.12	188.62	9.83	4.62	184.0	6.03
GMW-05	173.97	179.03	5.06	190.80	187.70	191.20	11.77	5.80	185.0	5.97
GMW-06	166.72	171.92	5.20	185.30	181.90	185.40	13.38	7.30	178.0	6.08
UDCMW-4	170.61	175.91	5.30	193.60	190.10	193.60	17.69	11.6	182.0	6.09

Notes:

[1] Assumed to be 3.5 feet below the measured top the of pump, based on specifications for the T1200M QED Bladder Pump.

[2] Calculated based on the reported pump intake, unless the difference between the reported and measured pump intake was more than 0.5 feet.

Phase II Remedial Investigation Quarterly Pump Settings

Well ID	August 2010			November 2010			February 2011			May 2011		
	Groundwater Level (ft bTOC)	Pump Setting (ft bTOC)	Amount of Water Above the Pump Intake (ft)	Groundwater Level (ft bTOC)	Pump Setting (ft bTOC)	Amount of Water Above the Pump Intake (ft)	Groundwater Level (ft bTOC)	Pump Setting (ft bTOC)	Amount of Water Above the Pump Intake (ft)	Groundwater Level (ft bTOC)	Pump Setting (ft bTOC)	Amount of Water Above the Pump Intake (ft)
GMW-01	175.95	179	3.05	176.27	179.3	3.03	171.17	174.25	3.08	169.57	~172.5	~3.00
GMW-02	178.02	181	2.98	178.34	181.5	3.16	173.20	176.20	3.00	171.63	174.5	2.87
GMW-03	176.75	180	3.25	177.07	180.0	2.93	171.93	175.00	3.07	170.38	173.5	3.12
GMW-04	178.02	181	2.98	178.35	181.5	3.15	173.11	176.11	3.00	171.65	175.0	3.35
GMW-05	179.08	183	3.92	179.45	182.5	3.05	174.22	177.22	3.00	172.77	176.0	3.23
GMW-06	172.00	175	3.00	172.33	175.3	2.97	167.09	170.09	3.00	165.60	168.5	2.90
UDCMW-4	176.04	179	2.96	176.31	179.3	2.99	171.20	174.20	3.00	169.59	172.5	2.91

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI				Phase II RI							
						UDCMW-4	UDCMW-4	UDCMW-4	UDCMW-4	UDCMW-4	UDCMW-4D	UDCMW-4	UDCMW-4D	UDCMW-4	UDCMW-4D	UDCMW-4	UDCMW-4D
						1/14/2009	5/1/2009	8/4/2009 PAS	8/4/2009 TAL	8/12/2010	8/12/2010 (dup)	11/9/2010	11/9/2010 (dup)	2/15/2011	2/15/2011 (dup)	5/10/2011	5/10/2011 (dup)
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82	<76 UJ	270	190 x	210 x	<50	<50	210 x	230 x	74	79
TPHs	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<410	<380 UJ	240	<250	260 x	<250	<250	350	400	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			µg/L	<40											
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			µg/L	<40											
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0095	<0.0096	<0.0095	<0.0094	<0.0042	<0.0042	<0.0042	<0.0042	<0.0042	<0.0042	<0.0038	<0.0038
Carcinogenic PAH	Benzo(a)pyrene	8270D	1		µg/L	<0.0095	<0.0096	<0.0095	<0.0190	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041	<0.004	<0.004
Carcinogenic PAH	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0096	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0038	<0.0038
Carcinogenic PAH	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0096	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0051	<0.0051
Carcinogenic PAH	Chrysene	8270D	0.01		µg/L	0.0140	<0.0096	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0024	<0.0024
Carcinogenic PAH	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0095	<0.0096	<0.0095	<0.0094	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0072	<0.0072
Carcinogenic PAH	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	0.0095	<0.0096	<0.0095	<0.0094	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0062	<0.0062
Carcinogenic PAH	*cPAH based on TEF (not incl R results)*			*0.1*	*µg/L*	*0.0077*	*0.0072*	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0066*	*0.0066*	*0.0066*	*0.0066*	*0.0066*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0095	<0.096	<0.0095	<0.0094	<0.0048	<0.0048	<0.0048	<0.0048	<0.0031	<0.0048	0.021 j	<0.0031
Non- Carcinogenic PAH	Acenaphthylene	8270D			µg/L	<0.0095	<0.096	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0031	<0.0064	<0.0031	<0.0064	<0.0064
Non- Carcinogenic PAH	Anthracene	8270D			µg/L	<0.0095	<0.096	<0.0095	0.012	<0.0049	<0.0049	<0.0049	<0.0049	<0.0059	<0.0049	<0.0059	<0.0059
Non- Carcinogenic PAH	Benzo(g,h,i)perylene	8270D			µg/L	0.0095	<0.0096	<0.0095	<0.0094	<0.0052	<0.0052	<0.0052	<0.0052	<0.0073	<0.0073	<0.0073	<0.0073
Non- Carcinogenic PAH	Fluoranthene	8270D			µg/L	<0.0095	<0.096	<0.0095	<0.0094	<0.0033	<0.0033	<0.0033	<0.0033	<0.0034	<0.0033	<0.0034	<0.0034
Non- Carcinogenic PAH	Fluorene	8270D			µg/L	<0.0095	<0.096	<0.0095	<0.0094	<0.0040	<0.0040	<0.0040	<0.0040	<0.015	<0.004	<0.015	<0.015
Non- Carcinogenic PAH	Naphthalene	8270D			µg/L	<0.0095	<0.0096	<0.0095	<0.0094	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0022	<0.0022
Non- Carcinogenic PAH	Phenanthrene	8270D			µg/L	<0.0095	<0.096	<0.016	<0.0094	<0.0049	<0.0049	<0.0049	<0.0049	<0.0028	<0.0049	<0.0028	<0.0028
Non- Carcinogenic PAH	Pyrene	8270D			µg/L	<0.0095	<0.096	<0.0095	<0.0094	<0.0037	<0.0037	<0.0037	<0.0037	<0.0036	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI						Phase II RI			
						GMW-01	GMW-01	GMW-01-1	GMW-01-2	GMW-01-1	GMW-01-2	GMW-01	GMW-01	GMW-01	GMW-01
						1/14/2009	4/30/2009	8/5/2009 PAS	8/5/2009 PAS (dup)	8/5/2009 TAL	8/5/2009 TAL (dup)	8/11/2010	11/9/2010	2/15/2011	5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82	<75 UJ	<76 UJ	<120	<120	<50	<50	<50	<50
	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<410	<380 UJ	<380 UJ	<240	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40									
	C10 - C12 Aliphatics	EPH			µg/L	<40									
	C12 - C16 Aliphatics	EPH			µg/L	<40									
	C16 - C21 Aliphatics	EPH			µg/L	<40									
	C21 - C34 Aliphatics	EPH			µg/L	<40									
	C8 - C10 Aromatics	EPH			µg/L	<40									
	C10 - C12 Aromatics	EPH			µg/L	<40									
	C12 - C16 Aromatics	EPH			µg/L	<40									
	C16 - C21 Aromatics	EPH			µg/L	<40									
	C21 - C34 Aromatics	EPH			µg/L	<40									
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0095	0.054	<0.0095	<0.0095	<0.0094	<0.0094	<0.0042	<0.0042	<0.0042	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.019	<0.019	<0.1 U	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0031	<0.0031	<0.0031	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0095	0.042	<0.0095	<0.0095	<0.0094	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0095	0.15 R	<0.0095	<0.0095	<0.0094	<0.0094	<0.0080 UJ	<0.0080 UJ	<0.0080 UJ	<0.0072 UJ
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0095	0.11 R	<0.0095	<0.0095	<0.0094	<0.0094	<0.0056 UJ	<0.0056 UJ	<0.0056	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0115*	*0.0072*	*0.0072*	*0.0119*	*0.0119*	*0.0525*	*0.0066*	*0.0066*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0048	<0.0048	<0.0031	0.04 j
	Acenaphthylene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0095	0.11 R	<0.0095	<0.0095	<0.0094	<0.0094	<0.0052 UJ	<0.0052 UJ	<0.0073 UJ	<0.0073 UJ
	Fluoranthene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0095	<0.0048	0.022 R	0.02 R	<0.0094	<0.0094	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0095	<0.0094	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI GMW-02 1/14/2009	GMW-22 1/14/2009 (dup)	GMW-02 4/30/2009	GMW-02 8/6/2009 PAS	GMW-02 8/6/2009 TAL	Phase II RI GMW-02 8/11/2010	GMW-02 11/9/2010	GMW-02 2/15/2011	GMW-02 5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<100	<82	<75 UJ	<120	<50	<50	<50	81
	Heavy Oils	NWTPH-Dx		500	µg/L	<500	<500	<410	<380 UJ	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40	<40							
	C10 - C12 Aliphatics	EPH			µg/L	<40	<40							
	C12 - C16 Aliphatics	EPH			µg/L	<40	<40							
	C16 - C21 Aliphatics	EPH			µg/L	<40	<40							
	C21 - C34 Aliphatics	EPH			µg/L	<40	<40							
	C8 - C10 Aromatics	EPH			µg/L	<40	<40							
	C10 - C12 Aromatics	EPH			µg/L	<40	<40							
	C12 - C16 Aromatics	EPH			µg/L	<40	<40							
	C16 - C21 Aromatics	EPH			µg/L	<40	<40							
	C21 - C34 Aromatics	EPH			µg/L	<40	<40							
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0095	<0.0095	0.015	<0.0095	<0.0094	<0.0042	<0.0042	<0.0042	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.019	<0.0041	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0095	<0.0095	0.016	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0095	<0.0095	0.14 R	<0.0095	<0.0094	<0.0080	<0.0080	<0.0080	<0.0072
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0095	<0.0095	0.085 R	<0.0095	<0.0094	<0.0056	<0.0056	<0.0056	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0072*	0.0074	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0066*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0048	<0.0048	<0.0031	<0.0031
	Acenaphthylene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0095	<0.0095	0.087 R	<0.0095	<0.0094	<0.0052	<0.0052	<0.0073	<0.0073
	Fluoranthene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0095	<0.0095	<0.0048	0.023 R	0.013 R	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0095	<0.0095	<0.095	<0.0095	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI GMW-03 1/14/2009	Phase I RI GMW-03 4/30/2009	Phase I RI GMW-03 8/6/2009 PAS	Phase I RI GMW-03 8/6/2009 TAL	Phase II RI GMW-03 8/11/2010	Phase II RI GMW-03 11/9/2010	Phase II RI GMW-03 2/15/2011	Phase II RI GMW-03 5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82	<80 UJ	<120	<50	<50	<50	<50
TPHs	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<410	<400 UJ	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40							
	C10 - C12 Aliphatics	EPH			µg/L	<40							
	C12 - C16 Aliphatics	EPH			µg/L	<40							
	C16 - C21 Aliphatics	EPH			µg/L	<40							
	C21 - C34 Aliphatics	EPH			µg/L	<40							
	C8 - C10 Aromatics	EPH			µg/L	<40							
	C10 - C12 Aromatics	EPH			µg/L	<40							
	C12 - C16 Aromatics	EPH			µg/L	<40							
	C16 - C21 Aromatics	EPH			µg/L	<40							
	C21 - C34 Aromatics	EPH			µg/L	<40							
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0042	<0.0042	<0.0042	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0096	<0.0095	<0.0095	<0.019	<0.0041	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0096	0.13 R	<0.0095	<0.0094	<0.0080	<0.0080	<0.0080	<0.0072
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0096	0.078 R	<0.0095	<0.0094	<0.0056	<0.0056	<0.0056	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0062*	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0066*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0048	<0.0048	<0.0031	<0.0031
	Acenaphthylene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0096	0.078 R	<0.0095	<0.0094	<0.0052	<0.0052	<0.0073	<0.0073
	Fluoranthene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:

Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:

- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI GMW-04 1/13/2009	GMW-04 4/30/2009	GMW-04 8/10/2009 PAS	GMW-04 7/30/2009 TAL	Phase II RI GMW-04 8/11/2010	GMW-04 11/9/2010	GMW-04 2/14/2011	GMW-04 5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<84	27	<120	<50	<50	<50	<50
	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<420	<47	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40							
	C10 - C12 Aliphatics	EPH			µg/L	<40							
	C12 - C16 Aliphatics	EPH			µg/L	<40							
	C16 - C21 Aliphatics	EPH			µg/L	<40							
	C21 - C34 Aliphatics	EPH			µg/L	<40							
	C8 - C10 Aromatics	EPH			µg/L	<40							
	C10 - C12 Aromatics	EPH			µg/L	<40							
	C12 - C16 Aromatics	EPH			µg/L	<40							
	C16 - C21 Aromatics	EPH			µg/L	<40							
	C21 - C34 Aromatics	EPH			µg/L	<40							
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0042	<0.0042	0.020 j	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0096	<0.0095	<0.0095	<0.019	<0.0041	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0096	0.011	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0096	0.14 R	<0.0095	<0.0094	<0.0080	<0.0080	<0.0080	<0.0072
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0096	0.084 R	<0.0095	<0.0094	<0.0056	<0.0056	<0.0056	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0063*	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0082*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0048	<0.0048	<0.0031	<0.0031
	Acenaphthylene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0096	0.086 R	<0.0095	<0.0094	<0.0052	<0.0052	<0.0073	<0.0073
	Fluoranthene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0096	<0.0095	<0.0095	0.012 R	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0096	<0.095	<0.0095	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI GMW-05 1/13/2009	GMW-05 4/30/2009	1-GMW-05 4/30/2009 (dup)	GMW-05 8/10/2009 PAS	GMW-05 7/30/2009 TAL	Phase II RI GMW-05 8/11/2010	GMW-05 11/8/2010	GMW-05 2/14/2011	GMW-05 5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82	<82	41	<120	<50	<50	50 x	64
	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<410	<410	<47	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40								
	C10 - C12 Aliphatics	EPH			µg/L	<40								
	C12 - C16 Aliphatics	EPH			µg/L	<40								
	C16 - C21 Aliphatics	EPH			µg/L	<40								
	C21 - C34 Aliphatics	EPH			µg/L	<40								
	C8 - C10 Aromatics	EPH			µg/L	<40								
	C10 - C12 Aromatics	EPH			µg/L	<40								
	C12 - C16 Aromatics	EPH			µg/L	<40								
	C16 - C21 Aromatics	EPH			µg/L	<40								
	C21 - C34 Aromatics	EPH			µg/L	<40								
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0096	<0.0095	0.012	<0.0095	<0.0094	<0.0042	<0.0042	<0.0042	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0096	<0.0095	<0.0095	<0.0095	<0.019	<0.0041	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0031	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0095	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0096	0.012	0.013	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0096	0.14 R	0.13 R	<0.0095	<0.0094	<0.0080	<0.0080	<0.0080	<0.0072
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0096	0.086 R	0.084 R	<0.0095	<0.0094	<0.0056	<0.0056	<0.0056	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0063*	*0.0070*	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0066*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0048	<0.0048	<0.0031	<0.0031
	Acenaphthylene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0096	0.087 R	0.084 R	<0.0095	<0.0094	<0.0052	<0.0052	<0.0073	<0.0073
	Fluoranthene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0096	<0.0095	<0.0095	<0.0095	<0.0094	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0096	<0.095	<0.095	0.014 R	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0096	<0.095	<0.095	<0.0095	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary
SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI GMW-06 1/13/2009	Phase I RI GMW-06 5/1/2009	Phase I RI GMW-06 7/31/2009 TAL	Phase II RI GMW-06 8/11/2010	Phase II RI GMW-06 11/8/2010	Phase II RI GMW-06 2/14/2011	Phase II RI GMW-06 5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82	<120	<50	<50	<50	<50
	Heavy Oils	NWTPH-Dx		500	µg/L	<510	<410	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40						
	C10 - C12 Aliphatics	EPH			µg/L	<40						
	C12 - C16 Aliphatics	EPH			µg/L	<40						
	C16 - C21 Aliphatics	EPH			µg/L	<40						
	C21 - C34 Aliphatics	EPH			µg/L	<40						
	C8 - C10 Aromatics	EPH			µg/L	<40						
	C10 - C12 Aromatics	EPH			µg/L	<40						
	C12 - C16 Aromatics	EPH			µg/L	<40						
	C16 - C21 Aromatics	EPH			µg/L	<40						
	C21 - C34 Aromatics	EPH			µg/L	<40						
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0096	0.015	<0.0094	<0.0042	<0.0042	<0.0042	<0.0038
	Benzo(a)pyrene	8270D	1		µg/L	<0.0096	<0.0095	<0.019	<0.0041	<0.0041	<0.0041	<0.004
	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0094	<0.0031	<0.0031	0.023 j	<0.0038
	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0096	<0.0095	<0.0094	<0.0036	<0.0036	<0.0036	<0.0051
	Chrysene	8270D	0.01		µg/L	<0.0096	<0.0095	<0.0094	<0.0047	<0.0047	<0.0047	<0.0024
	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0096	0.13 R	<0.0094	<0.0080	<0.0080	<0.0080	<0.0072
	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0096	0.081 R	<0.0094	<0.0056	<0.0056	0.027 j	<0.0062
	cPAH based on TEF (not incl R results)			*0.1*	*µg/L*	*0.0072*	*0.0072*	*0.0119*	*0.0066*	*0.0066*	*0.0107*	*0.0066*
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0048	<0.0048	<0.0031	<0.0031
	Acenaphthylene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0031	<0.0031	<0.0064	<0.0064
	Anthracene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0049	<0.0049	<0.0059	<0.0059
	Benzo(g,h,i)perylene	8270D			µg/L	<0.0096	0.083 R	<0.0094	<0.0052	<0.0052	<0.0073	0.024 j
	Fluoranthene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0033	<0.0033	<0.0034	<0.0034
	Fluorene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0040	<0.0040	<0.015	<0.015
	Naphthalene	8270D			µg/L	<0.0096	<0.0095	<0.0094	<0.0026	<0.0026	<0.0026	<0.0022
	Phenanthrene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0049	<0.0049	<0.0028	<0.0028
	Pyrene	8270D			µg/L	<0.0096	<0.095	<0.0094	<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI						Phase II RI			
						GMW-27 (Field Blank)	GMW-FB	Field Blank	Field Blank	Field Blank-2	Field Blank-2	FB	FB	FB	FB
						1/14/2009	4/30/2009	8/5/2009 PAS	8/5/2009 TAL	8/6/2009 PAS	8/6/2009 TAL	8/11/2010	11/9/2010	2/15/2011	5/10/2011
TPHs	Diesel Range	NWTPH-Dx		500	µg/L	<100	<82			<76 UJ	<120	<50	<50	<50	<50
TPHs	Heavy Oils	NWTPH-Dx		500	µg/L	<500	<410			<380 UJ	<240	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			µg/L	<40									
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			µg/L	<40									
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0094			<0.0042	<0.0042	<0.0042	<0.0038
Carcinogenic PAH	Benzo(a)pyrene	8270D	1		µg/L	<0.0095	<0.0095	<0.0095	<0.019			0.023 j	<0.0041	<0.0041	<0.004
Carcinogenic PAH	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0094			<0.0031	<0.0031	<0.0031	<0.0038
Carcinogenic PAH	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0095	<0.0095	<0.0094			<0.0036	<0.0036	<0.0036	<0.0051
Carcinogenic PAH	Chrysene	8270D	0.01		µg/L	<0.0095	<0.0095	<0.0095	<0.0094			<0.0047	<0.0047	0.021 j	<0.0024
Carcinogenic PAH	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0095	0.13	<0.0095	<0.0094			<0.0080	<0.0080	<0.0080	<0.0072
Carcinogenic PAH	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0095	0.077	<0.0095	<0.0094			<0.0056	<0.0056	<0.0056	<0.0062
Carcinogenic PAH	*cPAH based on TEF (not incl R results)*			*0.1*	*µg/L*										
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0094			<0.0048	<0.0048	<0.0031	<0.0031
Non- Carcinogenic PAH	Acenaphthylene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0094			<0.0031	<0.0031	<0.0064	<0.0064
Non- Carcinogenic PAH	Anthracene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0094			<0.0049	<0.0049	<0.0059	<0.0059
Non- Carcinogenic PAH	Benzo(g,h,i)perylene	8270D			µg/L	<0.0095	0.079	<0.0095	<0.0094			<0.0052	<0.0052	<0.0073	<0.0073
Non- Carcinogenic PAH	Fluoranthene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0094			<0.0033	<0.0033	<0.0034	<0.0034
Non- Carcinogenic PAH	Fluorene	8270D			µg/L	<0.0095	<0.095	<0.0095	<0.0094			<0.0040	<0.0040	<0.015	<0.015
Non- Carcinogenic PAH	Naphthalene	8270D			µg/L	<0.0095	<0.0095	0.014	0.030			<0.0026	<0.0026	<0.0026	<0.0022
Non- Carcinogenic PAH	Phenanthrene	8270D			µg/L	<0.0095	<0.095	<0.0095	0.0095			<0.1 U	<0.0049	0.021 j	<0.0028
Non- Carcinogenic PAH	Pyrene	8270D			µg/L	<0.0095	<0.095	<0.0095	0.011			<0.0037	<0.0037	<0.0036	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 4.4 - Groundwater Quality Results Summary

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Type	Analytes	Method	TEF	Cleanup Level	Units	Phase I RI							Phase II RI			
						Office Blank	Office Blank	Bottle Blank	Bottle Blank	Laboratory Method Blank #8823	Laboratory Method Blank #8638 & 8832	Laboratory Method Blank #47910/1-A	Laboratory Method Blank	Laboratory Method Blank	Laboratory Method Blank	Laboratory Method Blank
						8/6/2009	8/6/2009	8/6/2009	8/6/2009	8/17/2009	8/17/2009	8/15/2009	8/11/2010	11/9/2010	2/15/2011	5/10/2011
						PAS	TAL	PAS	TAL	PAS	PAS	TAL				
TPHs	Diesel Range	NWTPH-Dx		500	µg/L						<80	<120	<50	<50	<50	<50
TPHs	Heavy Oils	NWTPH-Dx		500	µg/L						<400	<250	<250	<250	<250	<250
Extractable Petroleum Hydrocarbons	C8 - C10 Aliphatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C10 - C12 Aliphatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C12 - C16 Aliphatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C16 - C21 Aliphatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C21 - C34 Aliphatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C8 - C10 Aromatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C10 - C12 Aromatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C12 - C16 Aromatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C16 - C21 Aromatics	EPH			µg/L											
Extractable Petroleum Hydrocarbons	C21 - C34 Aromatics	EPH			µg/L											
Carcinogenic PAH	Benzo(a)anthracene	8270D	0.1		µg/L	<0.0095	<0.0094	<0.016	<0.0094	0.014	<0.010	<0.010	<0.0042	<0.0042	<0.0042	<0.0038
Carcinogenic PAH	Benzo(a)pyrene	8270D	1		µg/L	<0.0095	<0.019	<0.0094	<0.019	<0.010	<0.010	<0.020	<0.0041	<0.0041	<0.0041	<0.004
Carcinogenic PAH	Benzo(b)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0094	<0.0096	<0.0094	0.051	<0.010	<0.010	<0.0031	<0.0031	<0.0031	<0.0038
Carcinogenic PAH	Benzo(k)fluoranthene	8270D	0.1		µg/L	<0.0095	<0.0094	<0.012	<0.0094	0.011	<0.010	<0.010	<0.0036	<0.0036	<0.0036	<0.0051
Carcinogenic PAH	Chrysene	8270D	0.01		µg/L	<0.0095	<0.0094	<0.017	<0.0094	<0.010	<0.010	<0.010	<0.0047	<0.0047	<0.0047	<0.0024
Carcinogenic PAH	Dibenzo(a,h)anthracene	8270D	0.1		µg/L	<0.0095	<0.0094	<0.015	<0.0094	<0.010	<0.010	<0.010	<0.0080	<0.0080	<0.0080	<0.0072
Carcinogenic PAH	Indeno(1,2,3-cd)pyrene	8270D	0.1		µg/L	<0.0095	<0.0094	<0.019	<0.0094	0.022	<0.010	<0.010	<0.0056	<0.0056	<0.0056	<0.0062
Carcinogenic PAH	*cPAH based on TEF (not incl R results)*			*0.1*	*µg/L*											
Non- Carcinogenic PAH	Acenaphthene	8270D			µg/L	<0.0095	<0.0094	<0.0033	<0.0094	<0.010	<0.010	<0.010	<0.0048	<0.0048	<0.0048	<0.0031
Non- Carcinogenic PAH	Acenaphthylene	8270D			µg/L	<0.0095	<0.0094	<0.0075	<0.0094	<0.010	<0.010	<0.010	<0.0031	<0.0031	<0.0031	<0.0064
Non- Carcinogenic PAH	Anthracene	8270D			µg/L	<0.0095	<0.0094	<0.0037	<0.0094	<0.010	<0.010	<0.010	<0.0049	<0.0049	<0.0049	<0.0059
Non- Carcinogenic PAH	Benzo(g,h,i)perylene	8270D			µg/L	<0.0095	<0.0094	<0.016	<0.0094	<0.010	<0.010	<0.010	<0.0052	<0.0052	0.022 lc j	<0.0073
Non- Carcinogenic PAH	Fluoranthene	8270D			µg/L	<0.0095	<0.0094	<0.0069	<0.0094	<0.010	<0.010	<0.010	<0.0033	<0.0033	<0.0033	<0.0034
Non- Carcinogenic PAH	Fluorene	8270D			µg/L	<0.0095	<0.0094	<0.0037	<0.0094	<0.010	<0.010	<0.010	<0.0040	<0.0040	<0.0040	<0.015
Non- Carcinogenic PAH	Naphthalene	8270D			µg/L	0.018	<0.0094	<0.019	<0.0094	<0.010	<0.010	<0.010	<0.0026	<0.0026	<0.0026	<0.0022
Non- Carcinogenic PAH	Phenanthrene	8270D			µg/L	<0.016	<0.0094	<0.0048	<0.0094	<0.010	0.016	<0.010	0.023 lc j	<0.0049	<0.0049	<0.0028
Non- Carcinogenic PAH	Pyrene	8270D			µg/L	<0.0095	<0.0094	<0.0058	<0.0094	<0.010	<0.010	<0.010	<0.0037	<0.0037	<0.0037	<0.0036

Notes:
Phase II groundwater quality data analyzed by Friedman & Bruya.
Phase II data validated by Pyron Environmental. Phase I data validated by Aspect Consulting.
Blank cells indicate analyte not analyzed.
Gray-shaded values indicated exceedance of cleanup level.
"<" indicates non-detect result at laboratory reporting limit (Phase I) or the method detection limit (Phase II).
"U" not considered detected at the reported value; one-half of the non-detected value is used for TEF calculations.
"UJ" indicates non-detect result estimated due to laboratory QA/QC.
"j" indicates the value is below normal reporting limits. The value reported is an estimate.
"R" indicates result rejected due to laboratory QA/QC and/or field QA/QC.
"fb" indicates analyte present in the blank and the sample.
"lc" the presence of the compound indicated is likely due to laboratory contamination.
"x" indicates the sample chromatographic pattern does not resemble the fuel standard used for quantification.
cPAH based on TEF is calculated as the sum of the following:
- detected values multiplied by the TEF, and
- one-half of the non-detected value (Phase I) or the non-detected value (Phase II) multiplied by the TEF.

Table 5.1 - Calculated Sample-Specific TPH Soil Cleanup Levels[1]

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Calculated Method B and C Numeric Soil Cleanup Levels		
Sample Number	**Method C Direct Contact - Ingestion (mg/kg)**	**Method B Groundwater Protection (mg/kg)**
GGP-09 (2.5 feet)	2,139	1,923
GGP-21B (2 feet)	3,300	(2)
GGP-21B (7.5 feet)	3,593	(2)
GGP-21B (12 feet)	2,440	11,294
GGP-23 (2.5 feet)	4,152	(2)
GGP-24 (2.5 feet)	6,731	(2)

Notes:

(1) Cleanup levels calculated using MTCATPH 11.1 Worksheet with EPH data, applicable naphthalene and PAH data, and default hydrogeologic data input.

(2) TPH soil cleanup level exceeds theoretical maximum that would be reached if all pore spaces were filled with free product. Leaching from soil to groundwater is not a critical pathway for these samples.

Table 5.2 - Site-Specific Cleanup Levels for Soil and Groundwater

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Soil Exposure Pathways

Media	Contaminant of Concern	Method/Pathway	Cleanup Level
Soil	TPHs as Diesel and Oil (mixture including cPAHs and naphthalene)	Method C - Direct contact within upper 15 feet of soil	2,139 mg/kg[1]
Soil	cPAHs	Method C - Direct contact within upper 15 feet of soil	18 mg/kg[1]
Soil	TPHs as Diesel and Oil (mixture including cPAHs and naphthalene)	Method B - Groundwater protection	Soil protectiveness empirically demonstrated through groundwater monitoring, per WAC 173 340-747(9)
Soil	cPAHs	Method B - Groundwater protection	Soil protectiveness empirically demonstrated through groundwater monitoring, per WAC 173 340-747(9)

Groundwater Exposure Pathways

Media	Contaminant of Concern	Method/Pathway	Cleanup Level
Groundwater	TPHs as Diesel	Method A - Drinking water	500 µg/L[2]
Groundwater	TPHs as Oil	Method A - Drinking water	500 µg/L[2]
Groundwater	cPAHs	Method A - Drinking water	0.1 µg/L[2]

Notes:

(1) milligrams/kilogram

(2) micrograms/liter

Table 8.1 - Preliminary Screening of Remedial Technologies

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Remedial Technology	Effectiveness	Implementability	Comparative Cost	Risk	Screening Result
Institutional Controls	low (1)	good (3)	low (3)	low (3)	Retained (10)
Monitored Natural Attenuation	low (1)	good (3)	low (3)	low (3)	Retained (10)
Capping	medium (2)	good (3)	low (3)	low (3)	Retained (11)
Partial Excavation and Offsite Disposal	medium (2)	good (3)	medium (2)	low (3)	Retained (10)
Complete Excavation and Offsite Disposal	high (3)	medium (2)	High (2)	low (3)	Retained (10)
Enhanced Aerobic Biodegradation	medium (2)	medium (2)	medium (2)	high (1)	Screened out (7)
In-Situ Chemical Oxidation (liquid oxidant)	medium (2)	low-medium (1.5)	medium (2)	high (1)	Screened out (6.5)
In-Situ Chemical Oxidation (ozone)	medium (2)	low-medium (1.5)	medium (2)	moderate (2)	Screened out (7.5)
Solidification/Stabilization	medium (2)	low (1)	medium (2)	low (3)	Screened out (8)

Notes:
All of the criteria are scored on a scale of 1 to 3.

Table 9.1 - Alternative 2 Cost Estimate - Capping and Institutional Controls

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Site:	SemMaterials							
Remedial Action Description:	Capping, Institutional Controls, and Monitored Natural Attenuation							
Cost Estimate Accuracy:	Feasibility Level (+50/-30 percent)							
Key Assumptions:	Vicinity of GGP09 = 20 ft x 40 ft x 1 ft = (yds) 30							
	Discount Rate = 4%							
Item	**Quantity**	**Unit**		**Unit Cost**		**Total Cost**	**Notes**	
Professional Services								
project mgmt	30	yr	$	2,500	$	43,230	planning and reporting	
5-year review	1	ls	$	10,000	$	8,219	Net present value assuming interest rate of 4%	
remedial design	1	ls	$	20,000	$	20,000	develop monitoring plan, get Ecology approval	
Subtotal					*$*	*71,449*		
Cap Construction								
mobilization/demobilization	5%		$	12,372	*$*	*619*		
excavation and disposal of contaminated soil	50	tons	$	130	$	6,500	recent project experience	
place crushed rock 3-inch deep	800	sf	$	0.55	$	440	rsmeans base coarse layer for drainage, crushed 3/4" stone base	
reinforcing steel bar	800	sf	$	1.60	$	1,280	rsmeans reinforcing steel for rigid paving, 18 lb./S.Y.	
place asphalt 4-inch deep	800	sf	$	4.19	$	3,352	rsmeans plain cement concrete for airports, 4500 PSI	
stormwater management	800	sf	$	1.00	$	800	estimate	
Subtotal					*$*	*12,991*		
Monitoring and Cap Maintenance								
groundwater monitoring	6	event	$	4,200	$	22,017	6 wells - Semi-annual first year, 4 subsequent annual events	
cap inspection and maintenance	30	yr	$	4,000	$	69,168	Annual inspection and patching	
Subtotal					*$*	*91,185*		
Contingency	15%				*$*	*26,344*	15% scope contingency	
Total Estimated Cost					**$**	**200,000**	(rounded to the nearest $10,000)	

Notes:
No adjustment of future excavation costs.
Monitoring costs are adjusted to present value using a discount rate of 4%.

Table 9.2 - Alternative 3 Cost Estimate - Partial Excavation/Disposal

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Site:	SemMaterials				
Remedial Action Description:	Partial Excavation/Disposal, Capping, Institutional Controls, and Monitored Natural Attenuation				
Cost Estimate Accuracy:	Feasibility Level (+50/-30 percent)				
Key Assumptions:	Central area = 100 ft x 100 ft x 15 ft = (yds)				6,000
	Northeast area = 150 ft x 80 ft x 15 ft = (yds)				7,000
	North Area = 40 ft x 40 ft x 15 ft = (yds)				900
	Discount Rate = 4%				

Item	Quantity	Unit	Unit Cost	Total Cost	Notes
Professional Services					
project mgmt	5%		$ 2,081,073	$ 104,054	percentage of capital and monitoring costs
5-year review	1	ls	$ 10,000	$ 8,219	Net present value assuming interest rate of 4%
remedial design	2%		$ 1,986,705	$ 39,734	percentage of capital costs
construction mgmt	6%		$ 1,986,705	$ 119,202	percentage of capital costs
Subtotal				*$ 271,209*	
Soil Excavation					
mobilization/demobilization	5%		$ 1,892,100	$ 94,605	
concrete demo, load, haul, disposal	440	lcy	$ 40	$ 17,600	recent project experience
overburden excavation and stockpile	7,500	bcy	$ 8	$ 60,000	rsmeans for bulk excavation, doubled for onsite handling
PCS excavation and loading	13,900	bcy	$ 5	$ 69,500	rsmeans for bulk excavation and loading
PCS hauling and disposal	23,000	ton	$ 40	$ 920,000	Estimate from Waste Management
purchase and import clean backfill	23,000	ton	$ 30	$ 690,000	recent project experience
place and compact clean backfill	27,000	lcy	$ 5	$ 135,000	rsmeans for backfill plus compaction
Subtotal				*$ 1,986,705*	
Cap Construction					
mobilization/demobilization	5%		$ 79,000	$ 3,950	
place crushed rock 6 inch deep	300	yd	$ 50	$ 15,000	
place asphalt 4-inch deep	16,000	sf	$ 3	$ 48,000	
stormwater management	16,000	sf	$ 1	$ 16,000	estimate
Subtotal				*$ 82,950*	
Monitoring and Cap Maintenance					
groundwater monitoring	6	event	$ 4,200	$ 25,200	6 wells - Semi-annual first year, 4 subsequent annual events
cap inspection and maintenance	30	yr	$ 4,000	$ 69,168	Annual inspection and patching
Subtotal				*$ 94,368*	
Tax	9.5%			*$ 196,617*	Washington Sales Tax (applied to capital costs)
Contingency	25%			$ 657,962	10% bid + 15% scope contingency
Total Estimated Cost				**$ 3,300,000**	(rounded to the nearest $100,000)

Notes:
No present value adjustment for future excavation costs (due to uncertainty in timing).

Table 9.3a - Alternative 4a Cost Estimate - Complete Excavation and Off-Site Disposal - No Shoring

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Site:	SemMaterials					
Remedial Action Description:	Complete Excavation/Disposal without Shoring					
Cost Estimate Accuracy:	Feasibility Level (+50/-30 percent)					
						Volume of PCS
Key Assumptions:	Central area = 100 ft x 100 ft x 15 ft = (yds)					5,556
	Northeast area = 150 ft x 80 ft x 170 ft = (yds)					75,556
	North Area = 40 ft x 40 ft x 50 = (yds)					2,963
	Discount Rate = 4%					
Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**		**Notes**
Professional Services						
project mgmt	5%		$ 25,362,200	$	1,268,000	percentage of capital and monitoring costs
5-year review	1	ls	$ 10,000	$	8,000	Net present value assuming interest rate of 4%
remedial design	2%		$ 25,337,000	$	507,000	percentage of capital costs
construction mgmt	6%		$ 25,337,000	$	1,520,000	percentage of capital costs
Subtotal				*$*	*3,303,000*	
Soil Excavation						
mobilization/demobilization	5%		$ 24,130,000	$	1,207,000	
concrete demo, load, haul, disposal	400	lcy	$ 40	$	16,000	recent project experience
Clean excavation and stockpile	943,000	bcy	$ 8	$	7,544,000	rsmeans for bulk excavation, doubled for onsite handling
PCS excavation and loading	84,000	bcy	$ 5	$	420,000	rsmeans for bulk excavation and loading
PCS hauling and disposal	139,000	ton	$ 40	$	5,560,000	Estimate from Waste Management
purchase and import clean backfill	139,000	ton	$ 30	$	4,170,000	recent project experience
place and compact clean backfill	1,284,000	lcy	$ 5	$	6,420,000	rsmeans for backfill plus compaction
Subtotal				*$*	*25,337,000*	
Monitoring						
groundwater monitoring	6	event	$ 4,200	$	25,200	6 wells - Semi-annual first year, 4 subsequent annual events
Subtotal				*$*	*25,200*	
Tax	9.5%			*$*	*2,407,000*	Washington Sales Tax (applied to capital costs)
Contingency	25%			$	7,768,000	10% bid + 15% scope contingency
Total Estimated Cost				**$**	**38,800,000**	(rounded to the nearest $100,000)

Notes:
No present value adjustment for future excavation costs (due to uncertainty in timing).

Table 9.3b - Alternative 4b Cost Estimate - Complete Excavation and Off-Site Disposal with Shoring

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Site:	SemMaterials				
Remedial Action Description:	Complete Excavation/Disposal with Shoring				
Cost Estimate Accuracy:	Feasibility Level (+50/-30 percent)				
					Volume of PCS
Key Assumptions:	Central area = 100 ft x 100 ft x 15 ft = (yds)				5,600
	Northeast area = 150 ft x 80 ft x 170 ft = (yds)				76,000
	North Area = 40 ft x 40 ft x 50 ft = (yds)				3,000
					Area of Shoring
	Northeast area = 190 ft x 120 ft x 170 ft = (sf)				105,000
	North Area = 60 ft x 60 ft x 50 ft = (sf)				12,000
	Discount Rate = 4%				

Item	Quantity	Unit	Unit Cost	Total Cost	Notes
Professional Services					
project mgmt	5%		$ 48,831,600	$ 2,442,000	percentage of capital and monitoring costs
5-year review	1	ls	$ 10,000	$ 8,000	Net present value assuming interest rate of 4%
remedial design	2%		$ 48,806,400	$ 976,000	percentage of capital costs
construction mgmt	6%		$ 48,806,400	$ 2,928,000	percentage of capital costs
Subtotal				*$ 6,354,000*	
Soil Excavation and Shoring					
mobilization/demobilization	5%		$ 46,482,400	$ 2,324,000	
shoring	117,000	sf	$ 300	$ 35,100,000	
concrete demo, load, haul, disposal	440	lcy	$ 40	$ 17,600	recent project experience
clean excavation and stockpile (Central)	2,900	bcy	$ 8	$ 23,200	rsmeans for bulk excavation, doubled for onsite handling
clean excavation and stockpile (North)	3,700	bcy	$ 8	$ 29,600	rsmeans for bulk excavation, doubled for onsite handling
clean excavation and stockpile (Northeast)	68,000	bcy	$ 8	$ 544,000	rsmeans for bulk excavation, doubled for onsite handling
PCS excavation and loading	84,600	bcy	$ 5	$ 423,000	rsmeans for bulk excavation and loading
PCS hauling and disposal	140,000	ton	$ 40	$ 5,600,000	Estimate from Waste Management
purchase and import clean backfill	140,000	ton	$ 30	$ 4,200,000	recent project experience
place and compact clean backfil	109,000	lcy	$ 5	$ 545,000	rsmeans for backfill plus compaction
Subtotal				*$ 48,806,400*	
Monitoring					
groundwater monitoring	6	event	$ 4,200	$ 25,200	6 wells - Semi-annual first year, 4 subsequent annual events
Subtotal				*$ 25,200*	
Tax	9.5%			*$ 4,637,000*	Washington Sales Tax (applied to capital costs)
Contingency	25%			$ 14,956,000	10% bid + 15% scope contingency
Total Estimated Cost				**$ 74,800,000**	(rounded to the nearest $100,000)

Notes:
No present value adjustment for future excavation costs (due to uncertainty in timing).
Does not include costs for demolition of existing facilities.

Table 10.1 - Summary of Disproportionate Cost Analysis

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Cleanup Alternatives	Alternative 1	Alternative 2	Alternative 3	Alternative 4a	Alternative 4b
Description	Completed Remedial Actions	Capping, Institutional Controls, and Monitored Natural Attenuation	Partial Excavation/Disposal, Capping, Institutional Controls, and Monitored Natural Attenuation	Complete Excavation/Disposal without Shoring	Complete Excavation/Disposal with Shoring
Amount of Soil Removal (cubic yards)	**0**	**0**	**13,900**	**84,000**	**84,600**
Overall MTCA Benefit Ranking Score	**0.8**	**6.3**	**6.0**	**7.8**	**7.9**
Cost[1]	**$0**	**$200,000**	**$3,300,000**	**$38,800,000**	**$74,800,000**

COMPLIANCE WITH MTCA THRESHOLD CRITERIA

Criterion	Alternative 1		Alternative 2		Alternative 3		Alternative 4a		Alternative 4b	
Protective of Human Health and the Environment	Does not protect human health and the environment.	**No**	Provides for protection of human health and the environment because the caps would be inspected and maintained and groundwater would be monitored.	**Yes**	Provides for protection of human health and the environment because the Northeast Tank Farm cap would be inspected and maintained and groundwater would be monitored.	**Yes**	Protects human health and the environment to the maximum extent practicable because all soil exceeding applicable cleanup levels is removed from the Site.	**Yes**	Protects human health and the environment to the maximum extent practicable because all soil exceeding applicable cleanup levels is removed from the Site.	**Yes**
Complies with Cleanup Standards	No remedial measures are employed for soil that does not comply with cleanup standards.	**No**	Soil with cleanup level exceedances remains at the Site. Institutional and engineering controls are required to prevent exposure.	**Yes**	Soil with cleanup level exceedances remains at the Site below 15 feet. Institutional and engineering controls are required to prevent potential impacts to groundwater.	**Yes**	Complies with cleanup standards because all soil exceeding applicable cleanup levels is removed from the Site.	**Yes**	Complies with cleanup standards because all soil exceeding applicable cleanup levels is removed from the Site.	**Yes**
Complies with Applicable State and Federal Laws	Does not comply with applicable laws.	**No**	Complies with applicable laws assuming the Site is properly characterized; the cap in the area of boring GGP09 is properly designed, constructed and maintained, and the Northeast Tank Farm cap is properly maintained.	**Yes**	Complies with applicable laws assuming the Site is properly characterized; and the Northeast Tank Farm cap is properly maintained.	**Yes**	Complies with applicable laws.	**Yes**	Complies with applicable laws.	**Yes**
Provides for Compliance Monitoring	Does not provide for compliance monitoring.	**No**	Provisions for compliance monitoring of groundwater.	**Yes**	Provisions for compliance monitoring of groundwater.	**Yes**	Provides for compliance monitoring until the removal action is implemented.	**Yes**	Provides for compliance monitoring until the removal action is implemented.	**Yes**

OTHER REQUIREMENTS

Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4a	Alternative 4b
Uses Permanent Solution(s) to the Maximum Extent Practicable	See below	See below	See below	See below	See below
Provides for a Reasonable Restoration Time-Frame	Restoration time frame is undefined.	>30 years, depends on rate of natural attenuation	>30 years, depends on rate of natural attenuation	1-50 years, depending on demolition of existing facilities	1-50 years, depending on demolition of existing facilities
Considers Public Concerns	Public notice and comment period will be included.	Public notice and comment period will be included.	Public notice and comment period will be included.	Public notice and comment period will be included.	Public notice and comment period will be included.

Evaluation of Permanence to the Maximum Extent Practicable

Evaluation Criteria	Weighted Factor	Alt. 1 Evaluation	Ranking (0-10)	Normalized Ranking	Alt. 2 Evaluation	Ranking (0-10)	Normalized Ranking	Alt. 3 Evaluation	Ranking (0-10)	Normalized Ranking	Alt. 4a Evaluation	Ranking (0-10)	Normalized Ranking	Alt. 4b Evaluation	Ranking (0-10)	Normalized Ranking
Protectiveness[2]	30%	Not protective because it does not prevent direct exposure and does not include groundwater monitoring.	0	0.0	Eliminates the exposure pathways and relies on natural attenuation to eliminate COPC-impacted soil. Thus, the restoration time frame is likely to take decades.	6	1.8	Eliminates the exposure pathways and relies on natural attenuation to eliminate COPC-impacted soil below 15 feet. Thus, the restoration time frame is likely to take decades.	7	2.1	The Alternative provides for maximum practicable protectiveness because it minimizes the restoration time frame.	10	3.0	The Alternative provides for maximum practicable protectiveness because it minimizes the restoration time frame.	10	3.0
Permanence[3]	20%	Not permanent because the potential for direct exposure currently exists.	0	0.0	Relies on engineering and institutional controls as well as long-term compliance monitoring to prevent potential future exposure until natural attenuation eliminates COPC-impacted soil.	5	1.0	Relies on engineering and institutional controls as well as long-term compliance monitoring to prevent potential groundwater impacts until natural attenuation eliminates COPC-impacted soil.	6	1.2	The Alternative provides for maximum permanence because the source material is eliminated from the Site.	10	2.0	The Alternative provides for maximum permanence because the source material is eliminated from the Site.	10	2.0
Effectiveness Over the Long-Term[4]	20%	Does not provide for long-term effectiveness because the potential for direct exposure exists.	0	0.0	Long-term effectiveness is predicated on compliance with engineering and institutional controls until natural attenuation eliminates COPC-impacted soil.	5	1.0	Long-term effectiveness is predicated on compliance with engineering and institutional controls until natural attenuation eliminates COPC-impacted soil below 15 feet.	6	1.2	The Alternative provides for maximum effectiveness over the long-term because the source material is eliminated from the Site once the existing facilities are removed.	10	2.0	The Alternative provides for maximum effectiveness over the long-term because the source material is eliminated from the Site once the existing facilities are removed.	10	2.0
Management of Short-Term Risks[5]	10%	Since some of the impacted soils are not capped there is the potential for direct exposure.	3	0.3	Very low potential for short-term risks of worker exposure to impacted soils during cap construction and maintenance.	10	1.0	Moderate short-term risks during soil removal and cap construction, including some potential worker exposure to impacted soils.	7	0.7	Significant short-term risks during soil removal, including potential worker exposure to impacted soils.	3	0.3	Significant short-term risks during soil removal and shoring, including potential worker exposure to impacted soils.	3	0.3
Technical and Administrative Implementability[6]	10%	Easiest to implement but does not meet regulatory MTCA requirements.	5	0.5	Easy to implement but would require continued technical and administrative actions to maintain institutional and engineering controls.	10	1.0	No significant technical challenges. Administrative challenges include excavating in operating portions of the existing facility, and associated delays in implementation. Also requires continued technical and administrative actions to maintain institutional and engineering controls.	3	0.3	Technical challenges associated with completing a large open excavation in gravelly soils. Significant administrative challenges associated with the need to obtain easements from neighboring properties for excavation.	0	0.0	Technical challenges associated with installation of shoring to 170 feet in gravelly soils. Potential administrative challenges related to acquiring easements from neighboring properties for installation of tie-backs.	1	0.1
Consideration of Public Concerns[7]	10%	Public concerns are ranked the same for all alternatives since there has been no formal public input.	5	0.5	Public concerns are ranked the same for all alternatives since there has been no formal public input.	5	0.5	Public concerns are ranked the same for all alternatives since there has been no formal public input.	5	0.5	Public concerns are ranked the same for all alternatives since there has been no formal public input.	5	0.5	Public concerns are ranked the same for all alternatives since there has been no formal public input.	5	0.5

Notes:
Disproportionate cost analysis is based on the Ecology Northwest Region Guidance Document, dated June 200

MTCA = Model Toxics Control Act

[1]The cost to implement the alternative including the cost of construction, the net present value of long-term costs, and recoverable agency oversight costs. Long-term costs include operation and maintenance costs, monitoring costs, equipment replacement costs, and the cost of maintaining institutional controls.

[2]Overall protectiveness of human health and the environment including the degree to which existing risks are reduced, time required to reduce risk at the Site and meet the cleanup standards, on-Site and off-Site risks resulting from implementation of the alternative, and improvement of overall environmental quality.

[3]The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.

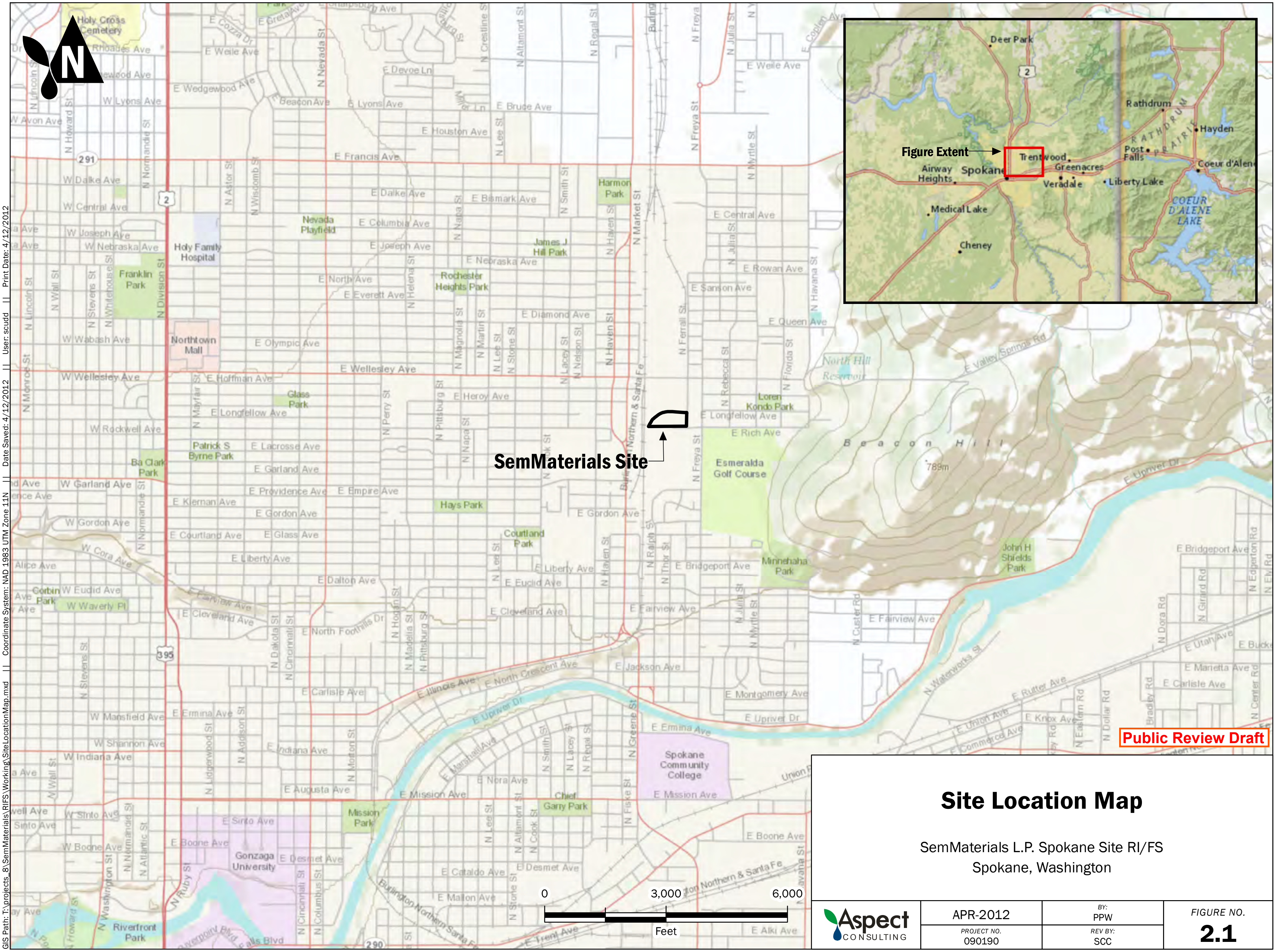
[4]Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-Site at concentrat that exceed the applicable cleanup levels, the magnitude of residual risk with the alternative in-place, and the effectiveness of controls required to manage treatment residues or remaining wastes.

[5]The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks.

[6]Ability to be implemented including consideration of whether the alternative is technically possible, availability of necessary off-Site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions.

[7]Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns.

FIGURES

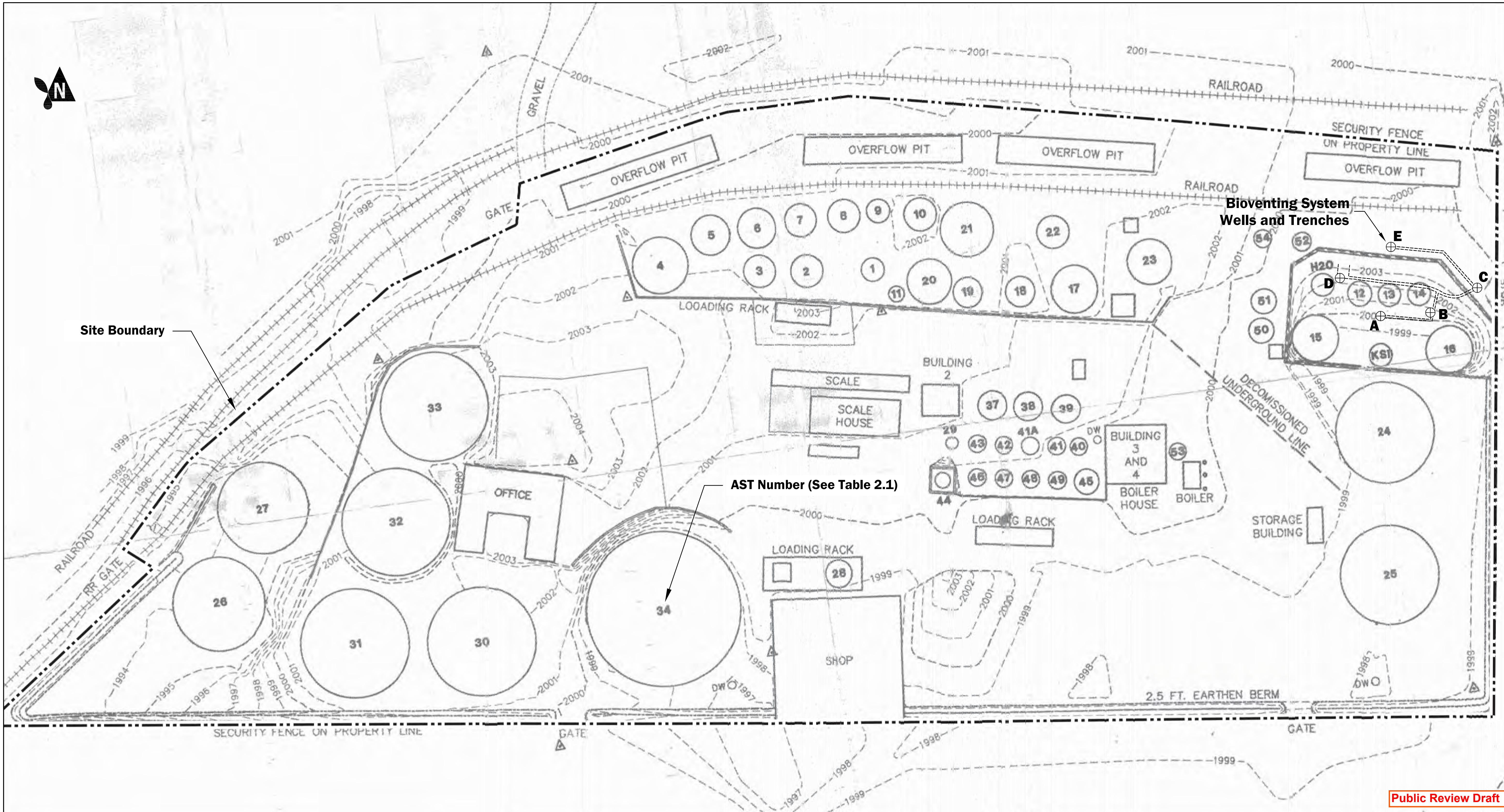


Site Location Map

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012	BY: PPW	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	2.1

GIS Path: T:\projects_8\SemMaterials\RIFS\Working\SiteLocationMap.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 4/12/2012 || User: scudd || Print Date: 4/12/2012



Sources:
Figure 1-2, Facility Layout Map,
Draft SemMaterials RI/FS (Golder 2008)

Figure 2-2, Site Plan-Trench Locations, Koch
Materials Company (Radian International 1997)

0 60 120
Feet

DRAFT

Historical AST Locations

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING

AUG-2012	BY: JMS/SCC	FIGURE NO.	
PROJECT NO. 090190	REV BY: SCC	2.2	

CAD Path: T:\projects_8\SemMaterials\RIFS\Working\Historical AST Locations\UTM_wbioventing.dwg 11x17 Landscape || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Aug 08, 2012 4:43pm || User: scudd

GIS Path: T:\projects_8\SemMaterials\RIFS\Working\SitePlan-Current.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 4/19/2012 || User: scudd || Print Date: 4/24/2012

LEGEND

Site Boundary

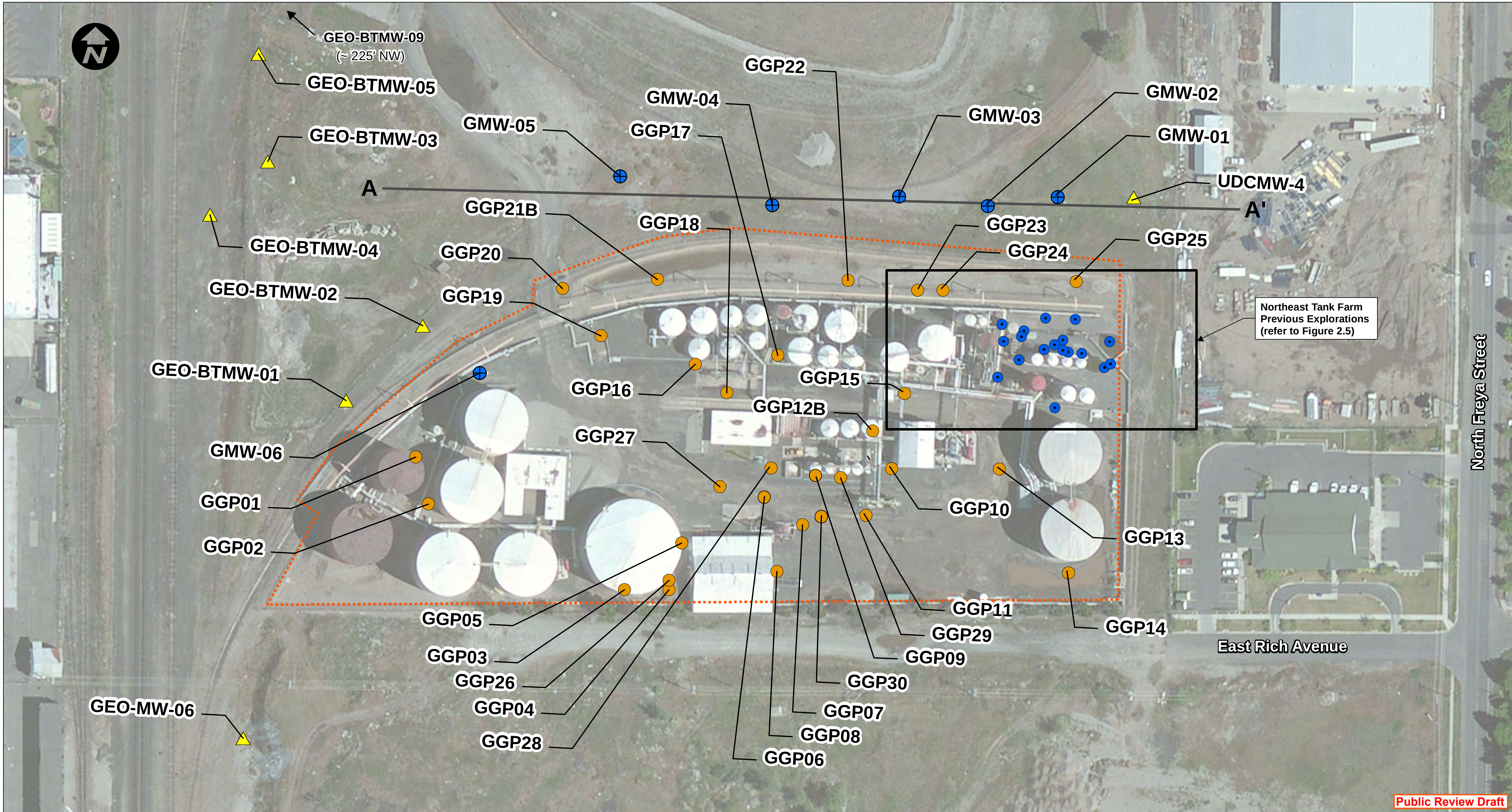
DRAFT

0 100 200 400
Feet

Current Site Plan

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012 / PROJECT NO. 090190	BY: JMS/PMB / REV BY: SCC	FIGURE NO. **2.3**



GIS Path: T:\projects_8\SemMaterials\RIFS\Working\PreviousExplorations-SiteWide.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 4/20/2012 || User: scudd || Print Date: 4/24/2012

LEGEND

- 2009 Direct-Push Boring
- Site Monitoring Well
- Off-Site Monitoring Well
- Pre-2009 Soil Sample Location
- Geologic Cross Section
- Site Boundary

0 50 100 200

Feet

DRAFT

Site-wide Previous Explorations

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012	BY: JMS/PMB	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	2.4

GIS Path: T:\projects_8\SemMaterials\RIFS\Working\PreviousExplorations-NE_TankFarm.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 4/20/2012 || User: scudd || Print Date: 4/20/2012

LEGEND

- 2009 Direct-Push Boring
- Pre-2009 Soil Sample Location
- Site Boundary

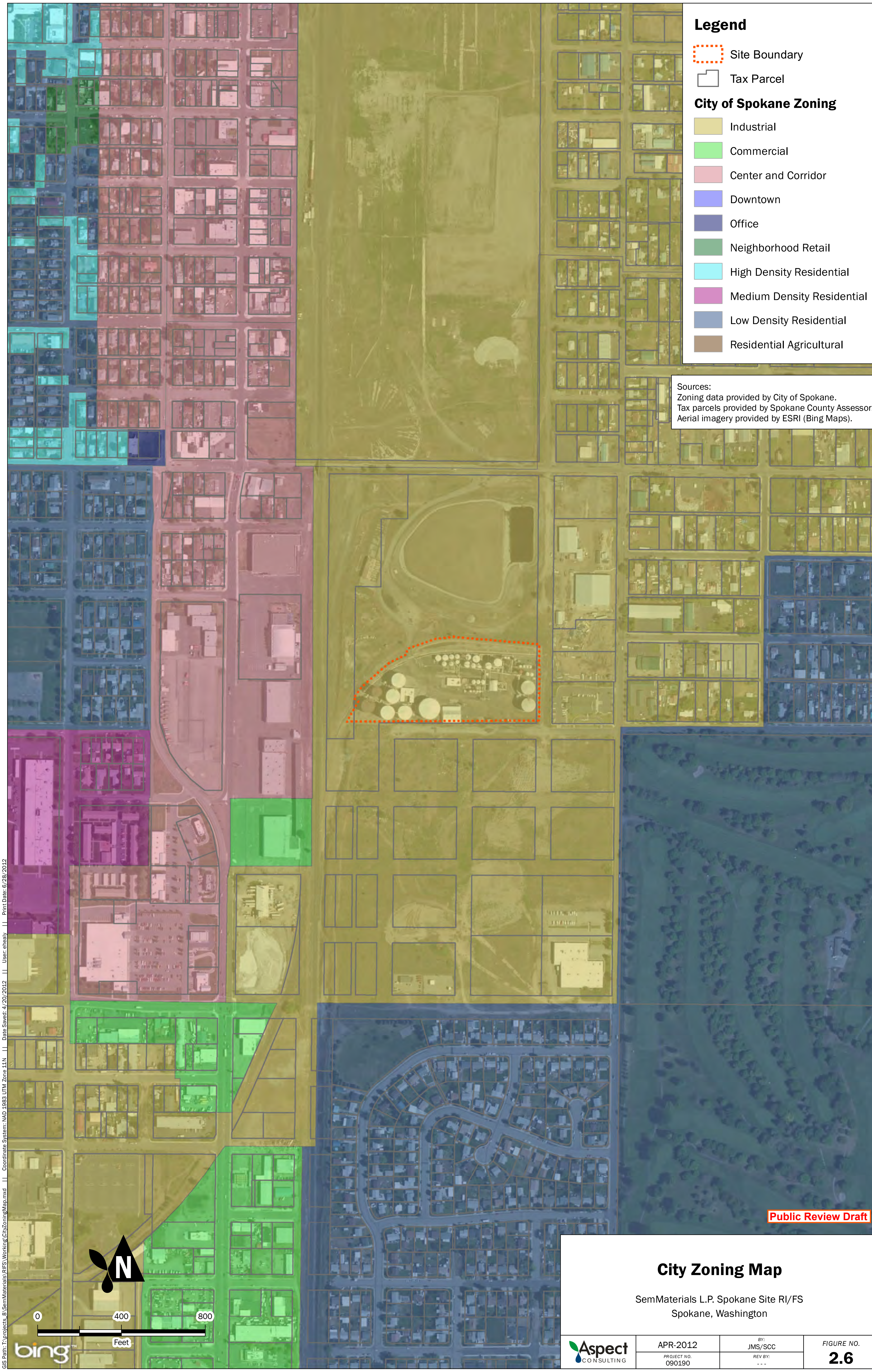
0 10 20 40
Feet

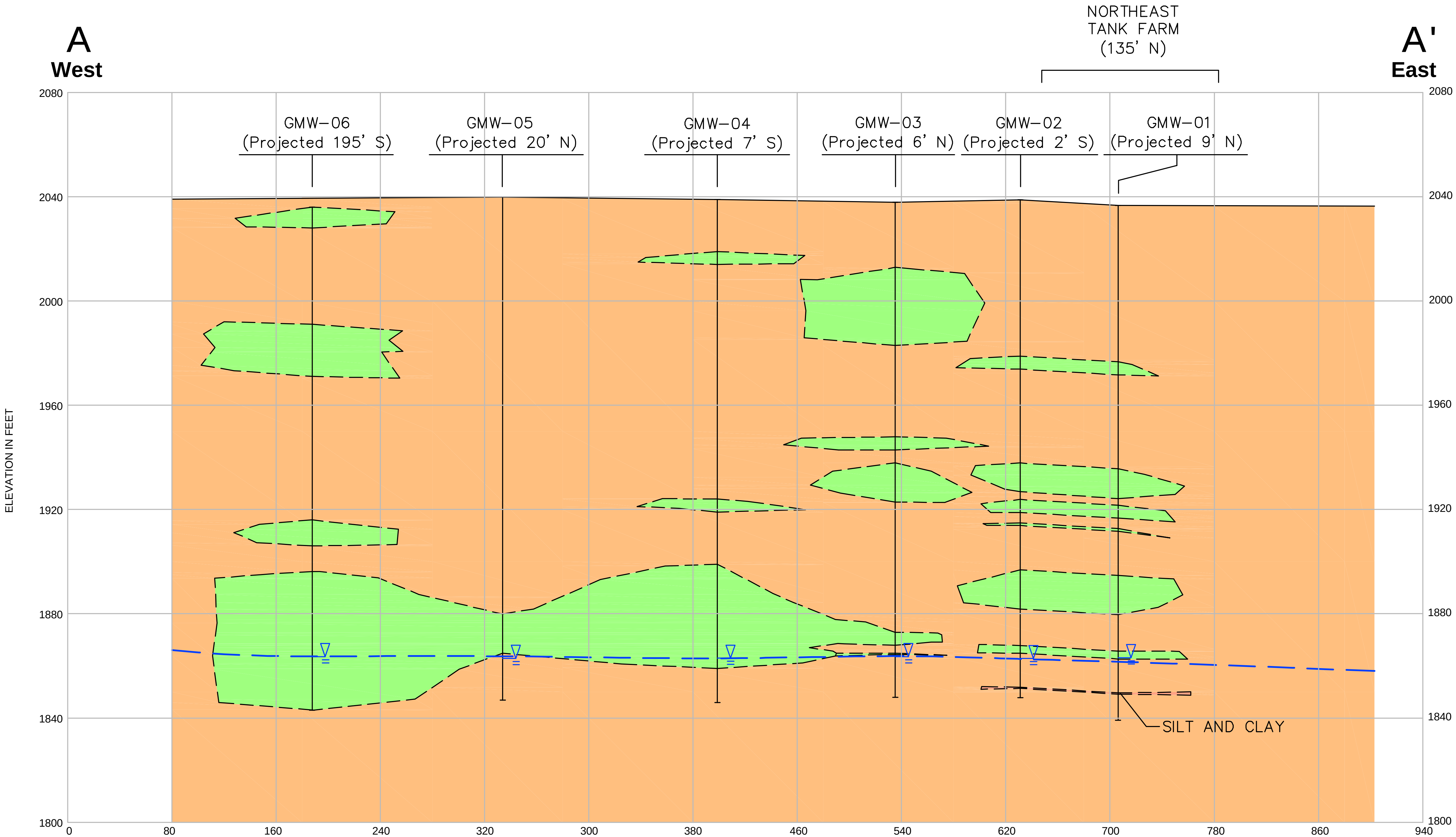
DRAFT

Northeast Tank Farm
Previous Explorations

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012	BY: JMS/PMB	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	**2.5**


Legend
Site Boundary
Tax Parcel
City of Spokane Zoning
Industrial
Commercial
Center and Corridor
Downtown
Office
Neighborhood Retail
High Density Residential
Medium Density Residential
Low Density Residential
Residential Agricultural
Sources:
Zoning data provided by City of Spokane.
Tax parcels provided by Spokane County Assessor.
Aerial imagery provided by ESRI (Bing Maps).
Public Review Draft
N
0
400
800
Feet
bing
City Zoning Map
SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington
Aspect CONSULTING
APR-2012
PROJECT NO. 090190
BY: JMS/SCC
REV BY: - - -
FIGURE NO. 2.6
GIS Path: T:\projects_8\SemMaterials\RIFS\Working\CityZoningMap.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 4/20/2012 || User: ehealy || Print Date: 6/28/2012



LEGEND

FLOOD DEPOSIT GRAVELS (Qfg)

SAND AND GRAVEL (SP)

SAND AND GRAVEL WITH SILT (GM–SM)

SILT AND CLAY (ML–CL)

INFERRED UNIT CONTACTS

GMW–06 (195' S) — MONITORING WELL PROJECTION NORTH OR SOUTH OF CROSS–SECTION

— WATER LEVEL AT TIME OF DRILLING

— BOTTOM OF BORING

— WATER TABLE

Reference: Geologic Cross Section A-A' Figure 4-3 by Golder Associates dated 10/29/2009
Modified by Aspect Consulting LLC April 2012

Public Review Draft

0 80 160
Feet

1" = 80' Horizontal
1" = 40' Vertical
Vertical Exaggeration 2X

Geologic Cross Section A-A'

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012	BY: JMS	FIGURE NO.
	PROJECT NO. 090190	REV BY: JMS JUNE 2012	3.1

CAD Path: Q:\SemMaterials\2012-06\090190-AA.dwg Figure 2.7 (11x17) || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Jun 28, 2012 2:21pm || User: pbaker

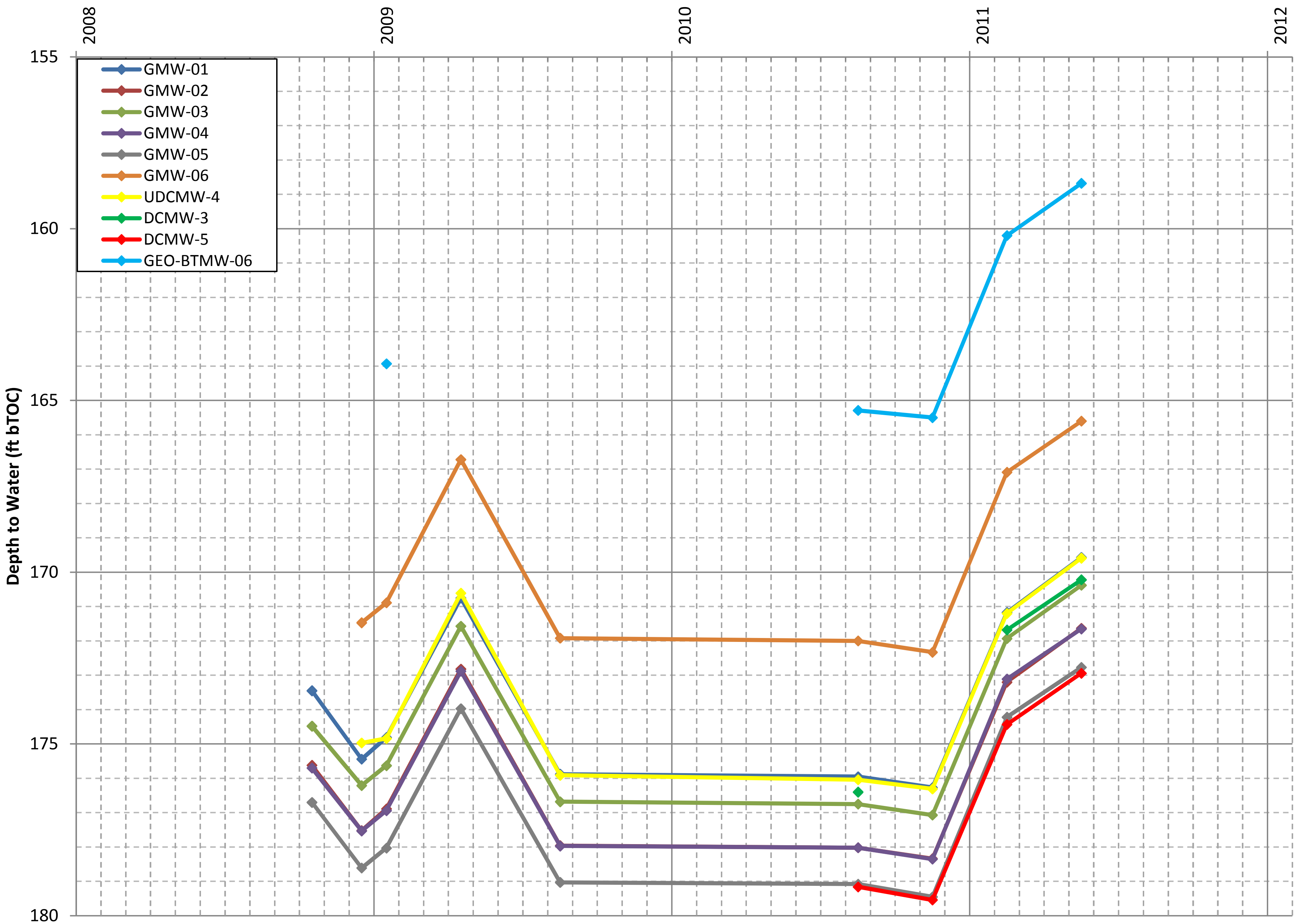


Figure 3.2
Groundwater Hydrographs
SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect Consulting
1/31/2013
P:\SemMaterials\Report Drafts\RI-FS\Tables\Groundwater Elevation Data.xls

Legend

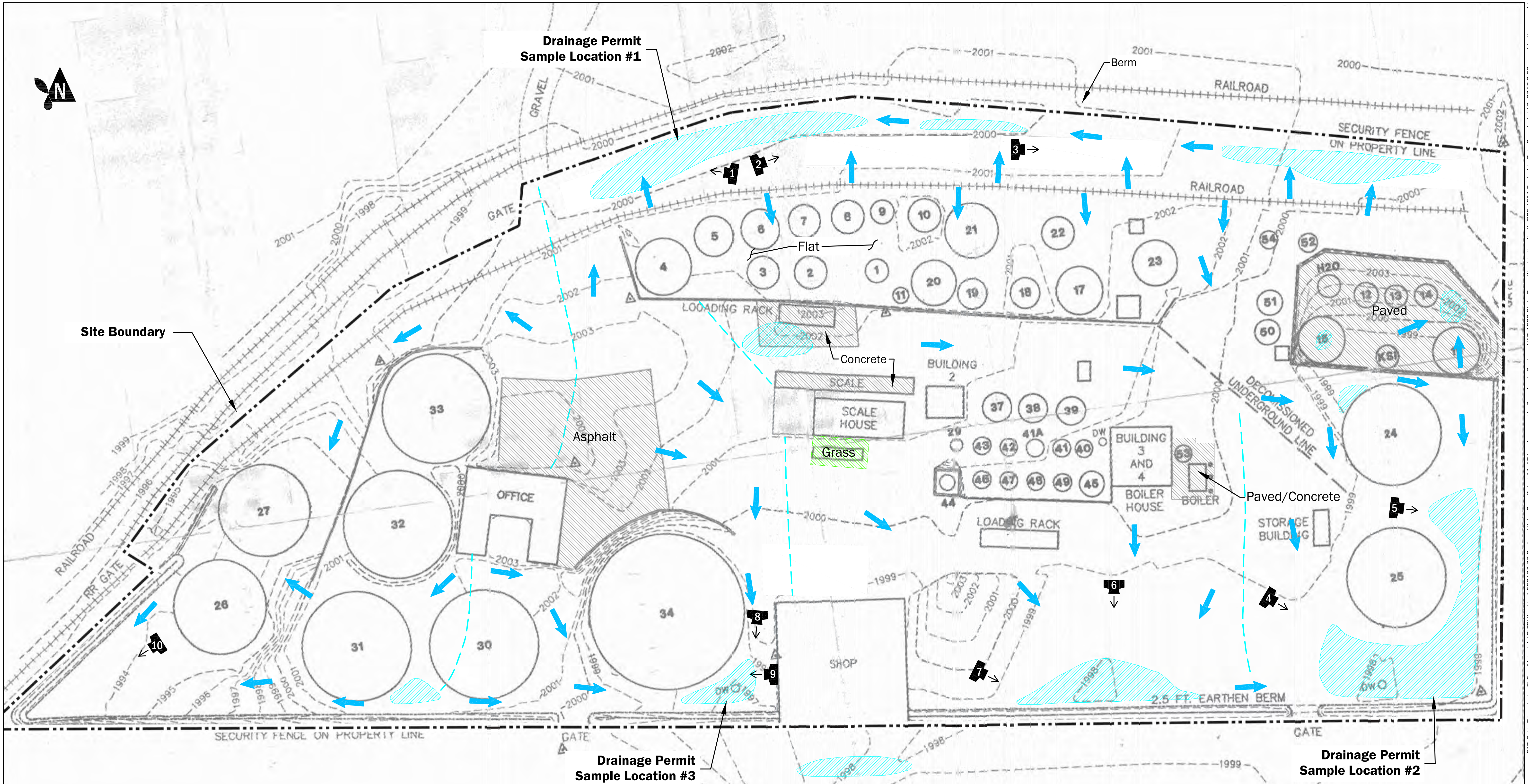
- Site Boundary
- Phase I RI Monitoring Well
- Monitoring Well Installed by Others
- Groundwater Elevation Contour (May 2011)
- *1870.81* Groundwater Elevation (May 2011)
- Inferred Groundwater Flow Direction

May 2011
Groundwater Elevation Contours

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING	APR-2012	BY: JMS/SCC	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	3.3

GIS Path: T:\projects_8\SemMaterials\RIFS\Working\GWContours-2011-05.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 4/20/2012 || User: scudd || Print Date: 4/24/2012



Surface Water Runoff Directions

Pooled Water

Impervious Areas (Asphalt/Concrete)

Pervious Areas (Grass)

Photo Location and Direction

Information based on a surface water drainage inspection conducted by Aspect Consulting personnel on December 30, 2011 (refer to Appendix H).

Notes:
No drywells or inlets on site.
All drainage pools infiltrate at surface or otherwise evaporate.

Basemap Source:
Figure 1-2, Facility Layout Map,
Draft SemMaterials RI/FS (Golder 2008)

0 60 120
Feet

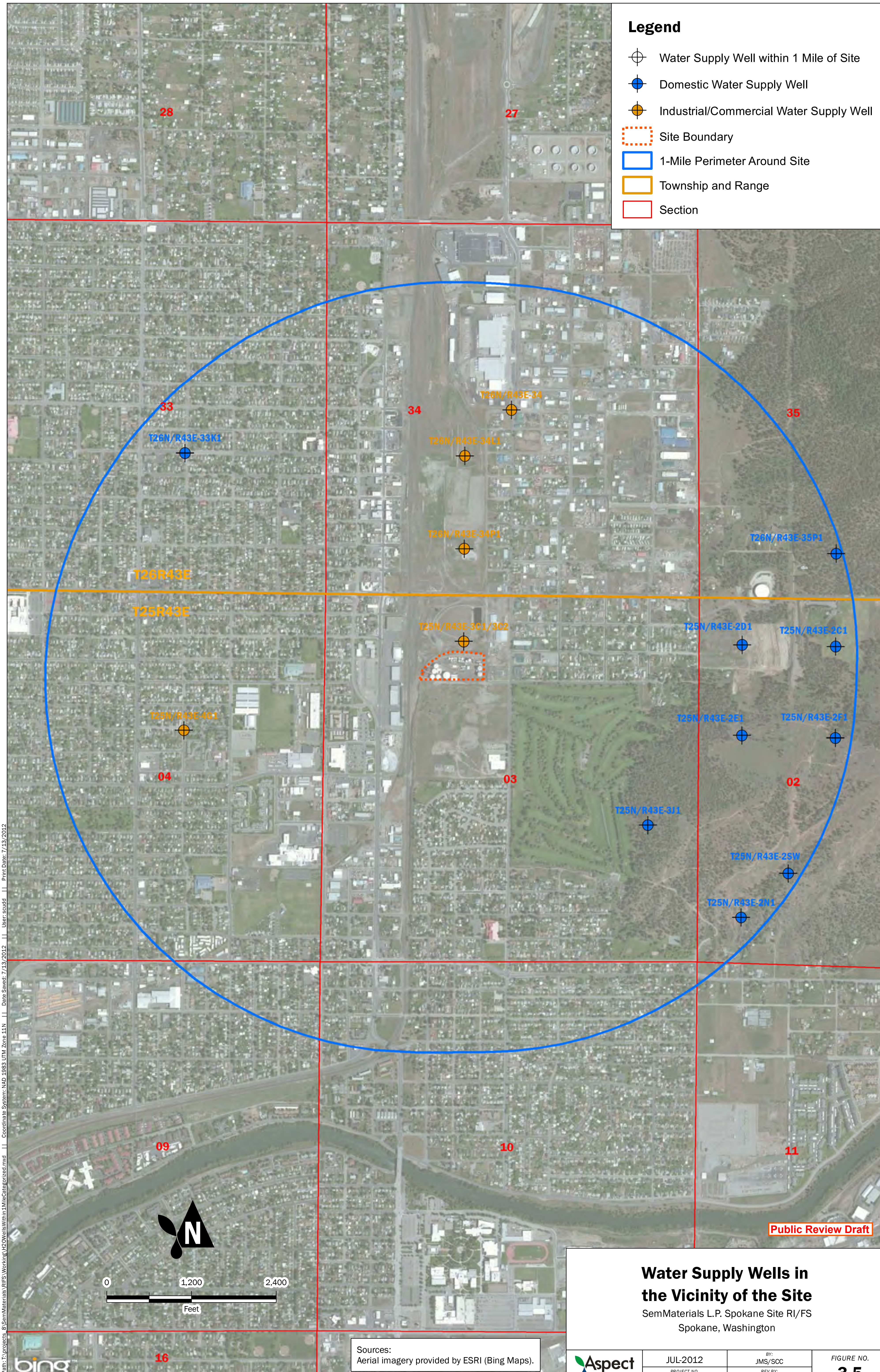
DRAFT

Surface Water Runoff Drainage Patterns

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING

APR-2012	BY: JMS/SCC	FIGURE NO.
PROJECT NO. 090190	REV BY: -	3.4

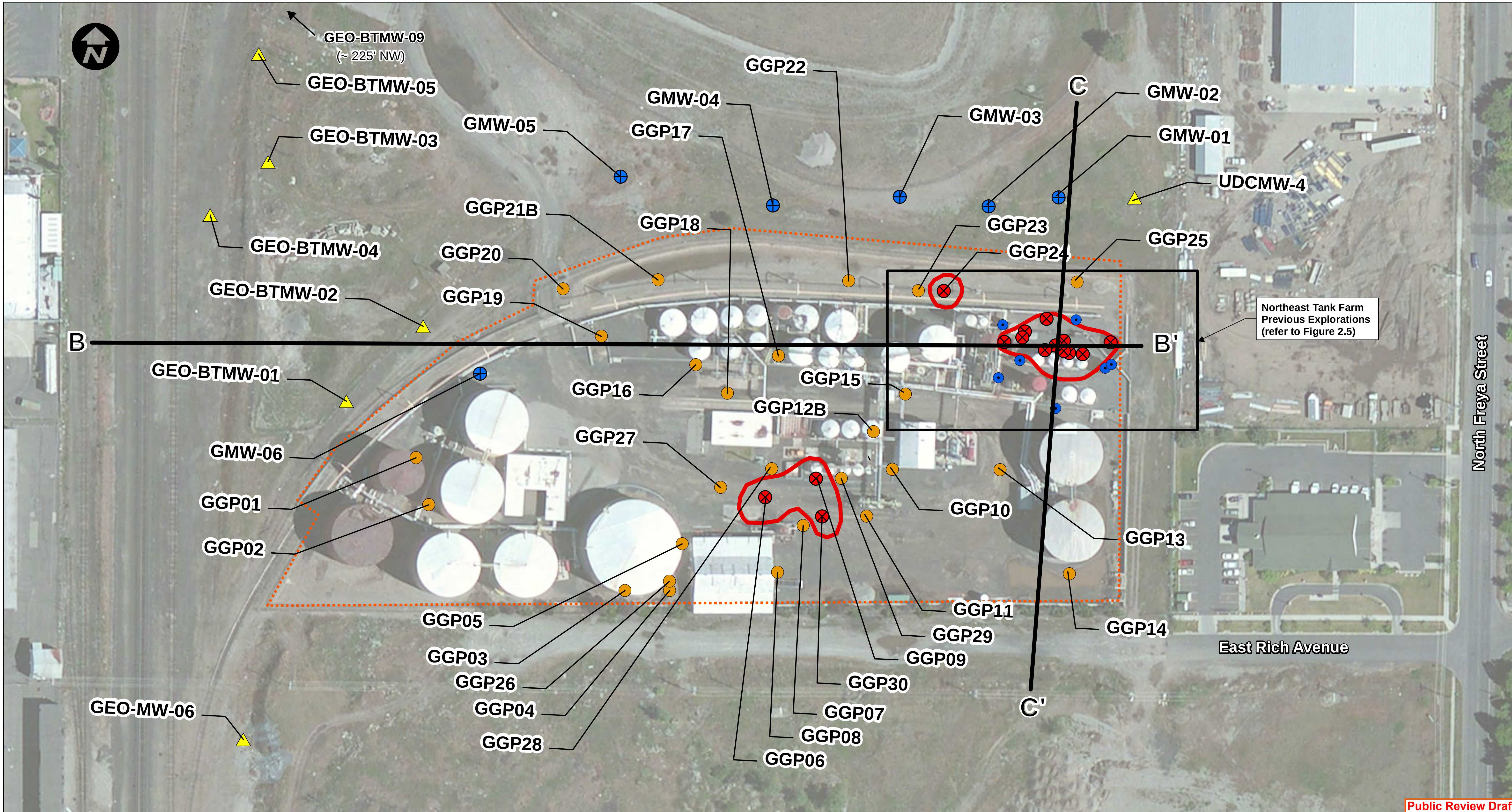


Water Supply Wells in the Vicinity of the Site

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING | JUL-2012 | BY: JMS/SCC | FIGURE NO. 3.5
PROJECT NO. 090190 | REV BY: - - -

GIS Path: T:\projects_8\SemMaterials\RIFS\Working\H2OWellsWithin1MileCategorized.mxd || Coordinate System: NAD 1983 UTM Zone 11N || Date Saved: 7/13/2012 || User: scudd || Print Date: 7/13/2012



LEGEND

- 2009 Direct-Push Boring
- Site Monitoring Well
- Off-Site Monitoring Well
- Pre-2009 Soil Sample Location
- Soil Sample Location with concentration of TPH greater than 2,139 mg/kg
- Approximate extent of soil with TPH concentration greater than the proposed 2,139 mg/kg soil cleanup level for direct contact protection
- Site Boundary

0 50 100 200

Feet

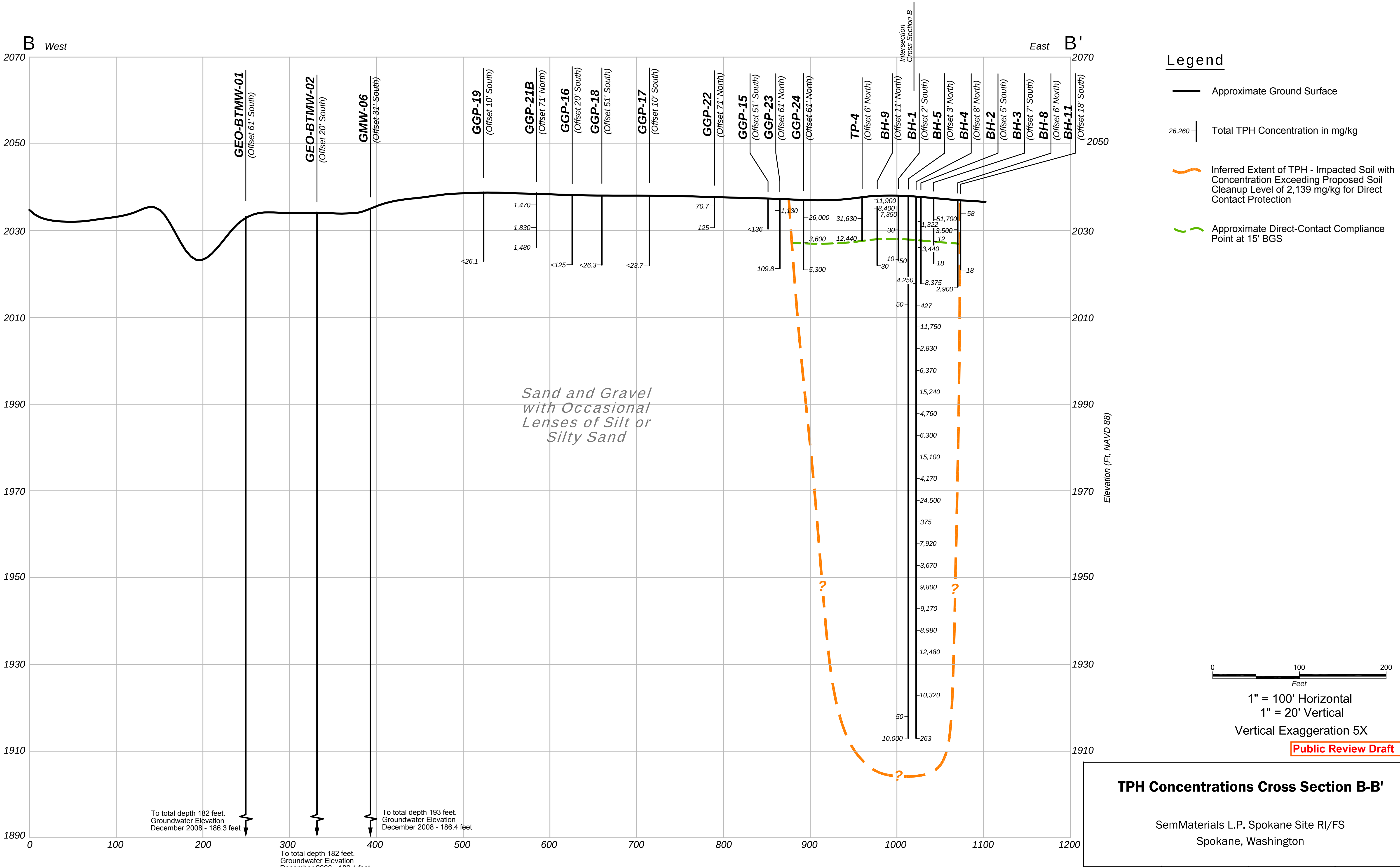
DRAFT

Extent of Soil with TPH Concentrations Exceeding the Cleanup Level

SemMaterials L.P. Spokane Site RI/FS

Spokane, Washington

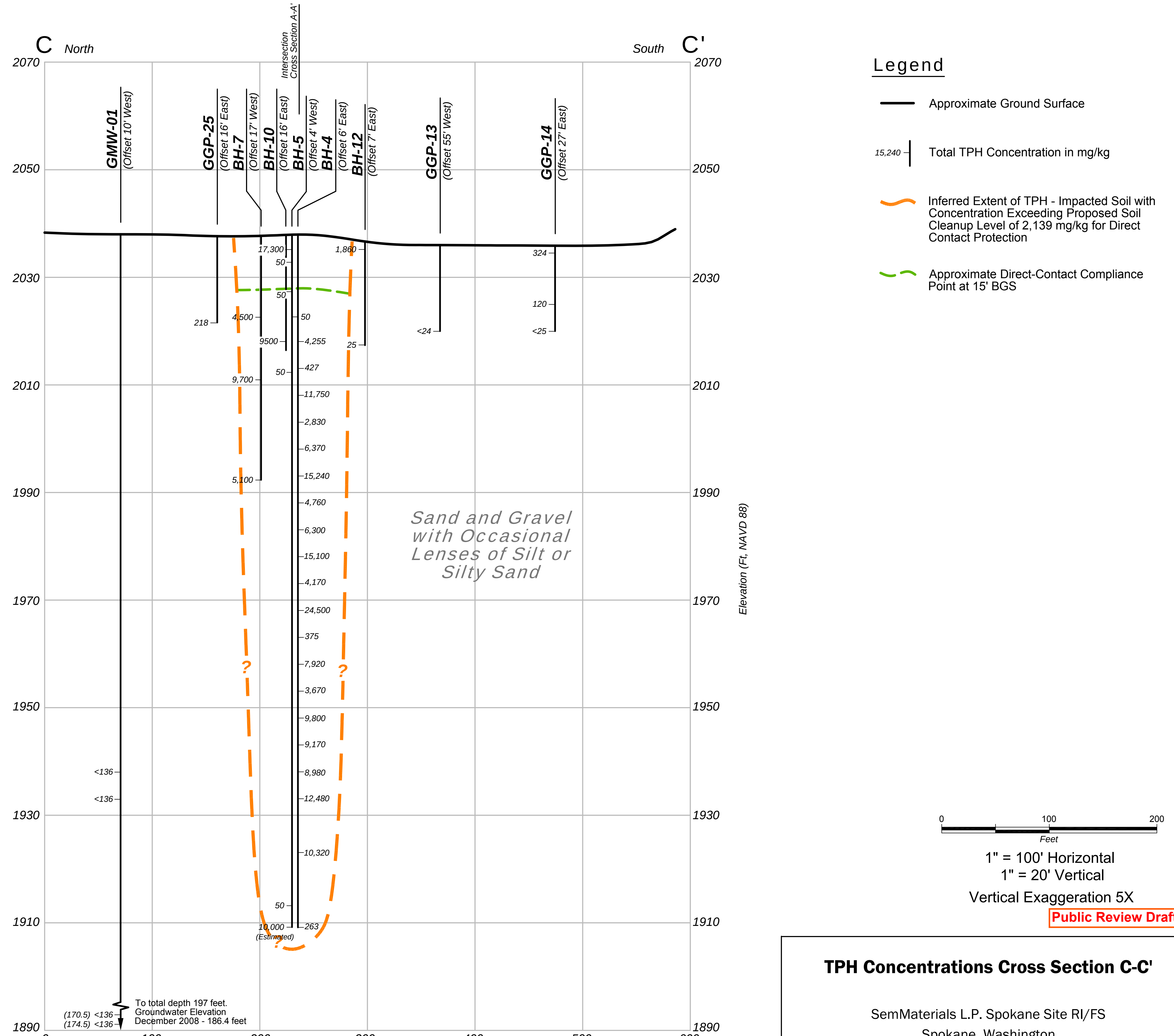
Aspect CONSULTING	APR-2012	BY: JMS/PMB	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	6.1



TPH Concentrations Cross Section B-B'

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect CONSULTING | APR-2012 | BY: JM/PMB | FIGURE NO. 6.2
PROJECT NO. 090190 | REV BY: SCC



Public Review Draft

TPH Concentrations Cross Section C-C'

SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

Aspect Consulting	APR-2012	BY: JM/PMB	FIGURE NO.
	PROJECT NO. 090190	REV BY: SCC	6.3

CAD Path: R:\SemMaterials\2012-04\090190-CC.dwg Figure 6 (11x17) || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Apr 24, 2012 2:27pm || User: scudd

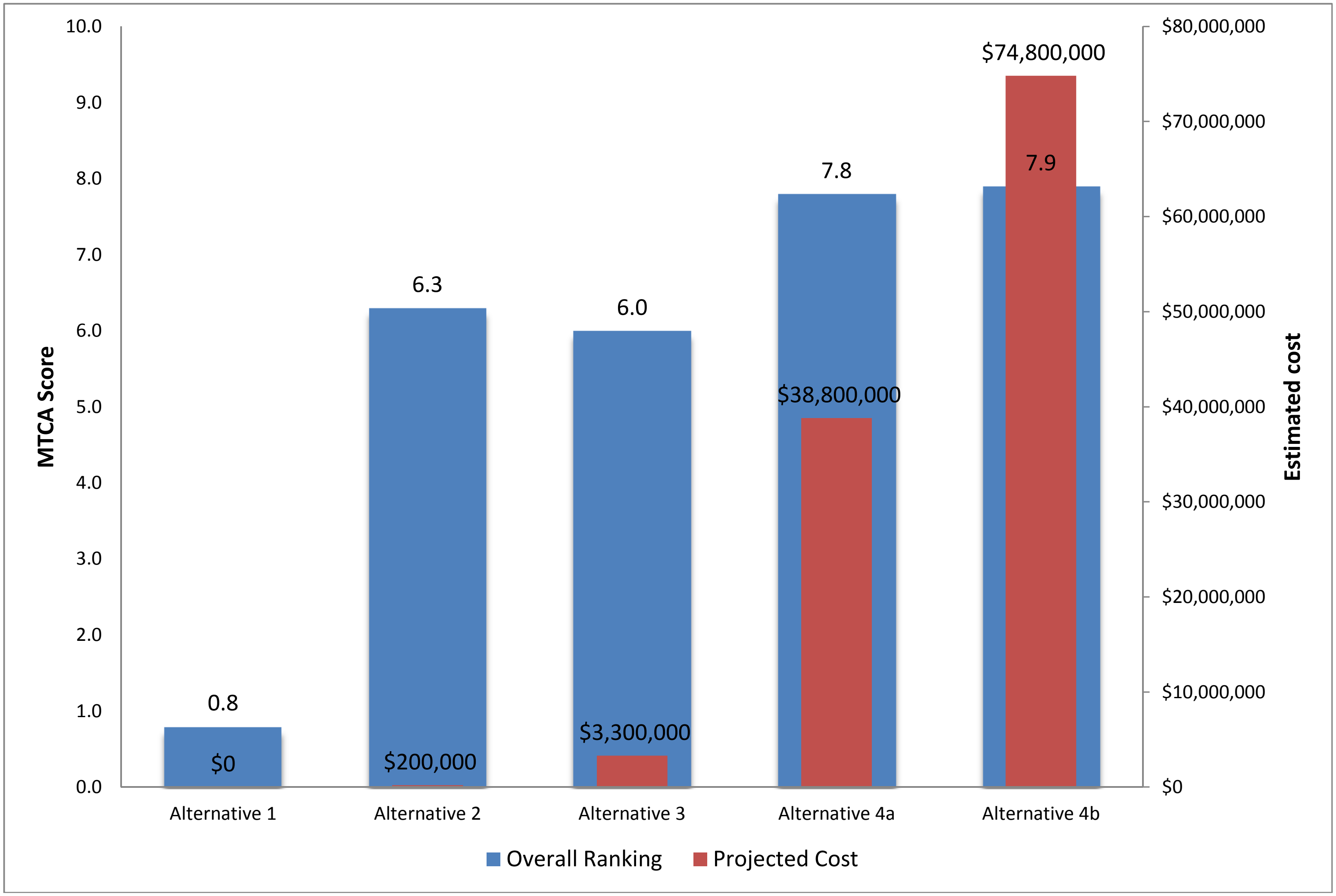


Figure 10.1 - Disproportionate Cost Analysis
SemMaterials L.P. Spokane Site RI/FS
Spokane, Washington

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