Transmittal

April 6, 2021

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Subject: Supplemental Remedial Investigation Work Plan Addendum

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1	Supplemental Remedial Investigation Work Plan Addendum	1	

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Supplemental Remedial Investigation Work Plan Addendum

Former Unocal Bulk Plant 0046
Phillips 66 Site 5887 (Formerly 5826)
217 East Steuben Street
Bingen, Washington
Facility Site ID: 61834259

Phillips 66 Company

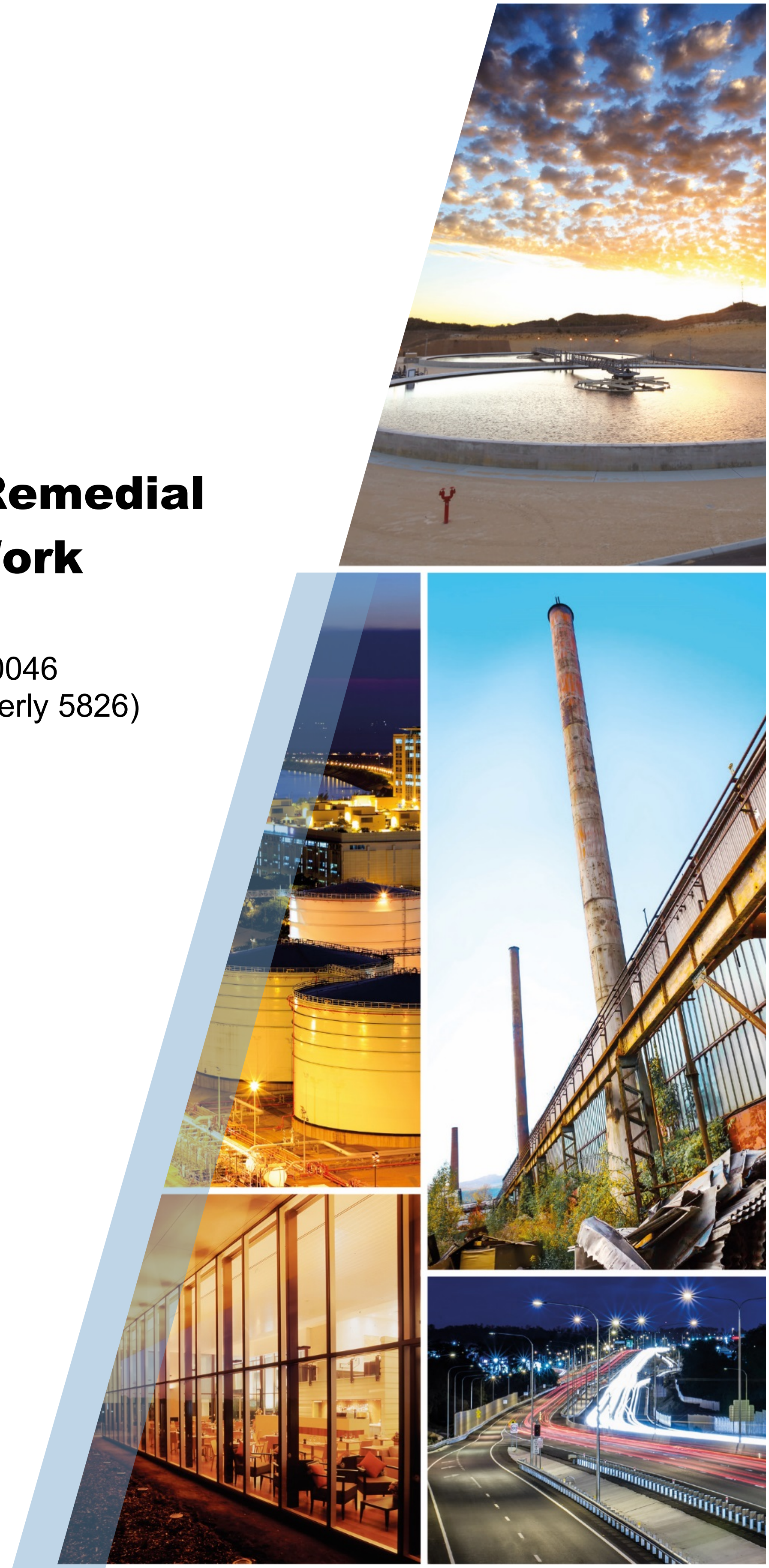


Table of Contents

1. Introduction ... 1
2. Objectives and Scope ... 1
3. Pre-field Activities ... 1
4. Investigation Activities ... 2
   - 4.1 Soil and Groundwater Assessment ... 2
   - 4.2 Soil Sampling and Logging ... 4
   - 4.3 Monitoring Well Installation and Development ... 4
   - 4.4 Investigation Derived Waste ... 5
   - 4.5 Groundwater Sampling ... 5
5. Reporting and Scheduling ... 5

Figure Index

Figure 1 Site Location Map

Figure 2 Proposed Investigation Site Map

Table Index

Table 1 Summary of Soil Analytical Data

Table 2 Summary of Groundwater Analytical Data

Appendix Index

Appendix A Quality Assurance Project Plan

1. Introduction

GHD is submitting this *Supplemental Remedial Investigation Work Plan Addendum* on behalf of Phillips 66 Company (P66) for the purpose of collecting the additional information necessary to complete the remedial investigation in accordance with Washington Administrative Code (WAC) 173-340-350 at 217 East Steuben Street, Bingen, Klickitat County, Washington (Property; Figure 1). The Washington State Department Ecology (Ecology) has drafted an Agreed Order (AO) to facilitate remedial investigation activities at the property. The AO named P66, Chevron Environmental Management Company (CEMC), and Wilson Oil, Inc. as potentially liable parties (PLPs), and has required the PLPs to complete a Supplemental Investigation (SRI), Feasibility Study (FS), and prepare a Draft Cleanup Action Plan (DCAP) for the property.

This report is an addendum to the *Supplemental Remedial Investigation Work Plan* to collect additional soil and groundwater data based on findings from site investigation activities completed in October 2020. The scope of work presented in this report is being completed in accordance with the Washington State Department of Ecology.

For purposes of this report, the Model Toxics Control Act site (Site) is defined as all affected areas from the petroleum release associated with the Property and potentially adjacent parcels.

2. Objectives and Scope

The objectives and scope of this work plan addendum is as follows:

- Delineate soil and groundwater impacts for all appropriate compounds as outlined in WAC 173-340-900, Table 830-1, *Required Testing for Petroleum Releases*
- Evaluate the extent of impacts in the shallow zone north of MW-3 (less than 20 feet below ground surface [bgs])
- Evaluate for presence of deep impacts (greater than 30 feet bgs) south of MW-3 and in the vicinity of the former 6,000-gallon diesel underground storage tank (UST)
- Evaluate historical soil exceedance in soil south of the former 6,000-gallon diesel UST
- Continue groundwater monitoring activities on a quarterly basis at the Site

3. Pre-field Activities

GHD will complete the following pre-field activities.

Health and Safety Plan

GHD will prepare a Site-specific Health and Safety Plan (HASP) in accordance with federal regulations (Title 40, Code of Federal Regulations, Section 1910.120). The HASP will identify potential physical and chemical hazards associated with the proposed field activities and will outline safe work practices.

Underground Utility Clearance

Prior to any Site work involving soil disturbance, Washington State One Call Utility Notification Service will be called to alert the utility companies in the area of the scheduled work and to request identification of all underground utilities in the vicinity of the disturbance area. A private utility locating contractor will be retained to mark private utilities and to verify the absence of all underground utilities near each of the proposed boring locations.

To further mitigate the chances of encountering a subsurface utility, each soil boring will be hand cleared to a depth of 5 feet using a hand auger, air knife, or other appropriate method.

4. Investigation Activities

4.1 Soil and Groundwater Assessment

Seven borings will be advanced and six will be completed as permanent groundwater monitoring wells to further characterize soil and groundwater impacts at the Site. The borings will be advanced by a Washington State licensed driller using a vacuum truck / air knife and a limited access sonic drill rig. The locations of the proposed borings and monitoring well are presented on Figure 2.

Locations A through F will be installed as permanent monitoring wells at the Site. Locations A through D are proposed to the north, south, east and west of monitoring well MW-3 and will be advanced to a depth of 20 feet bgs to evaluate soil impacts in the shallow zone, and to delineate the extent of groundwater impacts surrounding MW-3. Location E will be installed to the immediate south of MW-3 and will be advanced to a depth of 40 feet bgs to evaluate the presence of any deeper impacts in soil and groundwater. Location F will be installed in the vicinity of the former 6,000-gallon diesel UST to a depth of 40 feet bgs to evaluate the presence of deeper impacts in soil and groundwater at the Site. Location G will be advanced to the south of the former 6,000-gallon diesel UST to evaluate a historical soil exceedance at former sample location 3.

The table below outlines sample location, sample depth, proposed well depths, purpose, and selected analysis per boring location.

Table 4.1 Soil Boring Plan

Proposed Boring	Anticipated Soil Samples Per Boring	Anticipated Total Depth / Well Details	Purpose	Soil Analysis
A - D	Up to 3 samples 1 sample in the vadose zone based on field screening 1 sample at the water table 1 sample for vertical delineation, if impacts present	Advanced to 20 ft bgs Well screened from 5-20 ft bgs	Evaluate soil conditions and define extent of groundwater impacts in the shallow zone surrounding MW-3	TPHg, TPHd, TPHo BTEX; Contingency Analyses: cPAHs, Naphthalenes, and Additives (If impacts indicated by field screening or, if initial analytes exceed Method A)
E and F	Up to 3 samples 1 sample in the vadose zone based on field screening 1 sample at the water table 1 sample for vertical delineation, if impacts present	Advance to 40 ft bgs Well screened from 20-40 ft bgs	Evaluate soil conditions and deep impacts to the south of MW-3 and within the vicinity of the former 6,000-gallon diesel UST	TPHg, TPHd, TPHo, BTEX; Contingency Analyses: cPAHs, Naphthalenes, and Additives (based on field screening, or if initial analytes exceed Method A) 1 sample from each boring for EPH/VPH 1 sample from each boring for HVOCs and PCBs
G	1 sample at 1 ft bgs	Up to 2 ft bgs using air knife/vactor truck	Evaluate historical soil exceedance along south extent of former 6,000-gallon diesel UST	TPHg, TPHd, TPHo, BTEX; Contingency Analyses: cPAHs, Naphthalenes, and Additives (select samples, only if initial analytes exceed Method A)

Notes:
fbg = feet below ground
TPHg = Gasoline range organics per Method Northwest Total Petroleum Hydrocarbon Identification (NWTPH) Gx
TPHd = Diesel range organics per Method Northwest Total Petroleum Hydrocarbon Identification (NWTPH) Dx
TPHo = Oil range organics per Method Northwest Total Petroleum Hydrocarbon Identification (NWTPH) Dx
BTEX = Benzene, Toluene, Ethylbenzene and Xylenes per EPA Method 8260B
cPAHs = Carcinogenic Polycyclic aromatic hydrocarbons per EPA Method 8270
Naphthalenes = 1-methyl naphthalene, 2-methyl naphthalene, and naphthalene per EPA Method 8270
Additives = Methyl T Butyl Ether (MTBE), Dibromoethane (EDB), and Dichloroethane (EDC), per EPA Method 8260B, and Total Lead per EPA Method 6020.
EPH = Extractable Petroleum Hydrocarbons per NWTPH EPH
VPH = Volatile Petroleum Hydrocarbons per NWTPH VPH

n hexane per EPA Method 8260B
Contingency analysis for cPAHs and naphthalenes will be completed if TPHd and TPHo analysis indicates an exceedance of MTCA Method A Cleanup levels
Contingency analysis for naphthalenes and additives will be completed if TPHg analysis indicates an exceedance of MTCA Method A Cleanup levels

4.2 Soil Sampling and Logging

The first 5 feet of all borings will be advanced using a 3.25-inch diameter hand auger or air knife and vacuum truck in order to further mitigate contact and damage to potential subsurface utility lines. Borings A through F will be further advanced with a limited access sonic drill rig to the depths noted above. Soil samples will be collected in the sonic core barrel and extruded into plastic liners for field screening and soil logging.

Soil will be continuously logged using the modified Unified Soil Classification System. Soil samples will be continuously screened in the field for total volatile organic vapors using a photo ionization detector (PID). Each soil sample will be placed in a resealable plastic bag and allowed to equilibrate. The PID sensor probe will then be inserted into the bag to get a measurement of total volatized organic vapors in the headspace above the soil. A visual inspection for potential staining will be completed and any olfactory observations will be noted in the soil logs.

Soil samples will be collected in accordance with Table 6.1 above, and in accordance with Ecology's Implementation Memorandum #5 (Method 5035B) concerning procedures for collecting and preparing soil samples for VOC analysis and GHD's Standard Operating Procedures. Once each boring has been advanced and samples collected, the boring will be backfilled with hydrated bentonite chips and finished to grade to match the surrounding surface or completed as a permanent monitoring well as noted in Table 4.1. Soil samples submitted for chemical analyses will be labeled, entered onto a chain of custody form, packed on ice, and sent to an Ecology certified laboratory.

A Quality Assurance Project Plan (QAPP) detailing the data quality objectives, sampling design, field procedures, laboratory procedures, and quality control measures is included as Appendix B.

4.3 Monitoring Well Installation and Development

Soil borings A through F will be completed as permanent monitoring wells (MW-9 through MW-14) to a final estimated depth of 20 to 40 feet bgs. Each will be installed with 15 to 20 feet of screen as noted in the table above. Each well will be constructed with 2-inch Schedule 40 PVC, 0.010-inch slot screen, flush threaded with PVC blank well casing from the top of the screen to the top of the well. The well annulus will be backfilled with a 12/20 silica sand pack to a minimum of 1 foot above the top of the screen and sealed with a minimum of 2 feet of hydrated bentonite chips above the filter pack. The surface of the well will be completed with a flush mount, traffic rated well box set in a concrete surface seal.

The well will be developed following installation by surging the well screen with a surge block for 5-10 minutes followed by pumping on the well with a monsoon-style down-hole pump. Grab samples will be collected and analyzed for turbidity with a calibrated field turbidity meter after each well volume. Well development will be considered complete when turbidity is below 100 NTU or when the well has pumped dry.

The new well and existing Site wells will be surveyed by a licensed surveyor to determine the horizontal coordinates and vertical elevation of the top of well casing.

4.4 Investigation Derived Waste

Investigation Derived Waste (IDW) will include decontamination fluids, soil from borings and purged well water. All IDW will be placed in properly labeled 55-gallon drums and stored on-site pending analyses. All IDW will be disposed of according to P66 procedures and applicable regulatory requirements.

4.5 Groundwater Sampling

All newly installed monitoring wells will be included in the quarterly groundwater monitoring program will be implemented for the monitoring well network. The newly installed and existing monitoring wells will be gauged and sampled a minimum of four consecutive quarters if analytes are detected but below MTCA Method A screening levels.

The groundwater samples will be collected using a peristaltic pump and will be purged at a rate less than 200 milliliters per minute. Depth to water will be monitored every 3 minutes and if depth to water increases by more than 0.2 foot, then the purge rate will be decreased to prevent further water level drawdown.

Parameters including pH, specific conductance, oxidation-reduction potential, dissolved oxygen, temperature, salinity, turbidity and visual water quality will be measured and recorded on field data sheets every 3 minutes. Stabilization will be considered to be achieved and purging complete after three consecutive readings are within the following limits:

1. pH-0.1 unit
2. Temperature - 3 percent
3. Specific Conductance - 3 percent
4. Dissolved Oxygen - 10 percent
5. Oxidation-Reduction Potential - 10 percent
6. Water level ±0.2 foot

If stabilization does not occur within 1 hour, the sample will be collected and field parameters will be recorded. Groundwater samples submitted for chemical analyses will be labeled, entered onto a chain of custody form, packed on ice, and sent to an Ecology certified laboratory. The samples will be analyzed for the same constituents listed above for soil. Refer to the QAPP in Appendix B for further details.

5. Reporting and Scheduling

Following completion of the above activities and validation of the laboratory analytical data, GHD will prepare a supplemental investigation report (SRI) that will include the following:

- A summary of soil boring and well installation activities

- Boring logs with well completion details
- Well survey results
- Tabulated analytical results for soil and groundwater samples
- Laboratory analytical reports and chain of custody forms for soil samples
- Summary of waste disposal
- Updated Conceptual Site Model
- GHD's conclusions and recommendations

GHD will begin this proposed scope of work upon receipt of Ecology approval of this work plan. As prescribed in the draft AO, the field work will be completed within 120 days of Ecology approval of this work plan addendum and a draft SRI will be submitted within 90 days following receipt of all final analytical data.

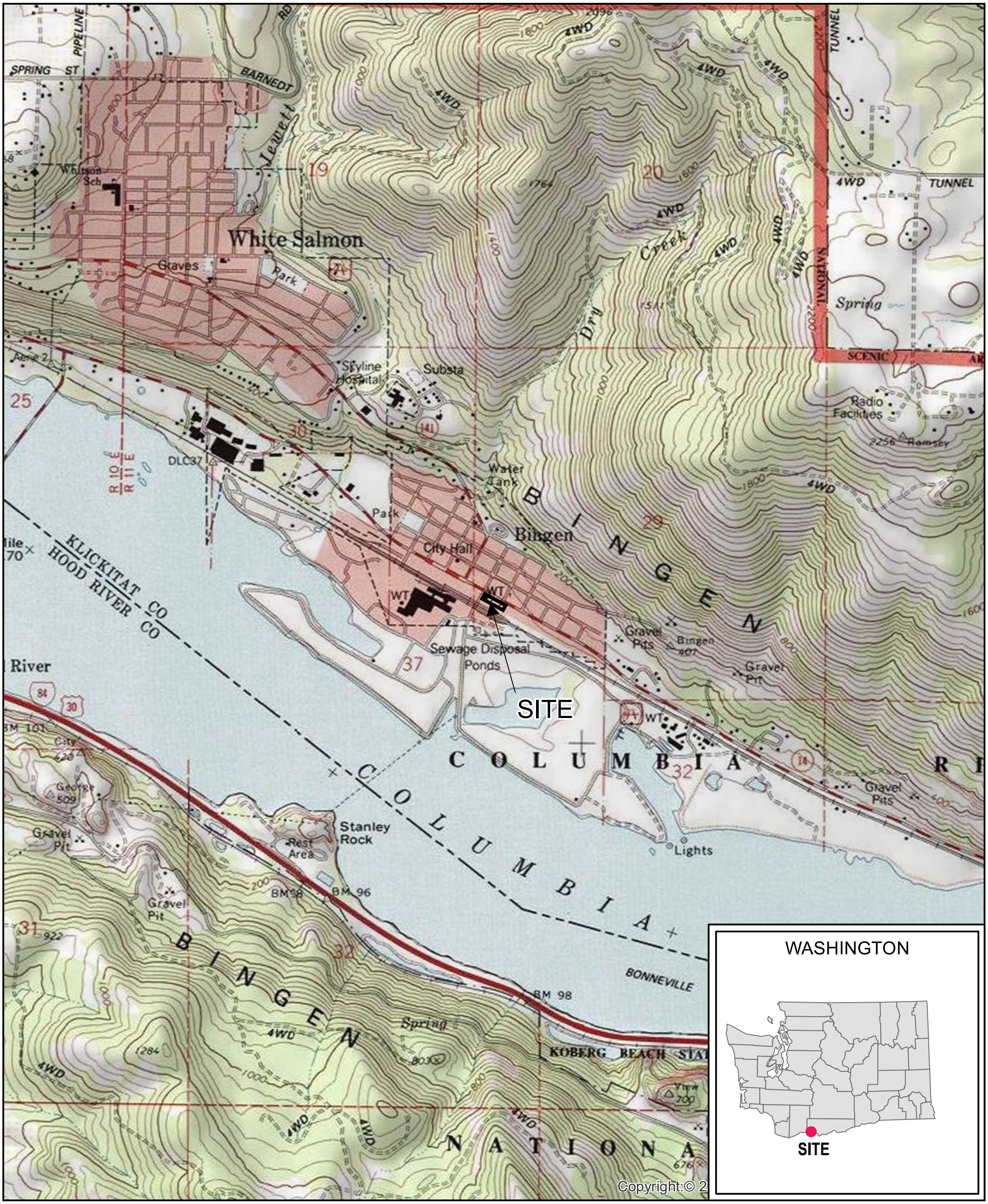
All of Which is Respectfully Submitted,

GHD

Arthur Clauss, GIT

Matthew Davis, LG

Figures



Paper Size ANSI A

0 170 340 510 680

Meters

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Washington South FIPS 4602 Feet

PHILLIPS 66 BINGEN (AOC 5826)
217 E STUEBEN STREET, BINGEN, WA
SITE INVESTIGATION WORK PLAN

SITE LOCATION MAP

Project No. **11190941**
Revision No. **-**
Date **Mar 9, 2021**

FIGURE 1

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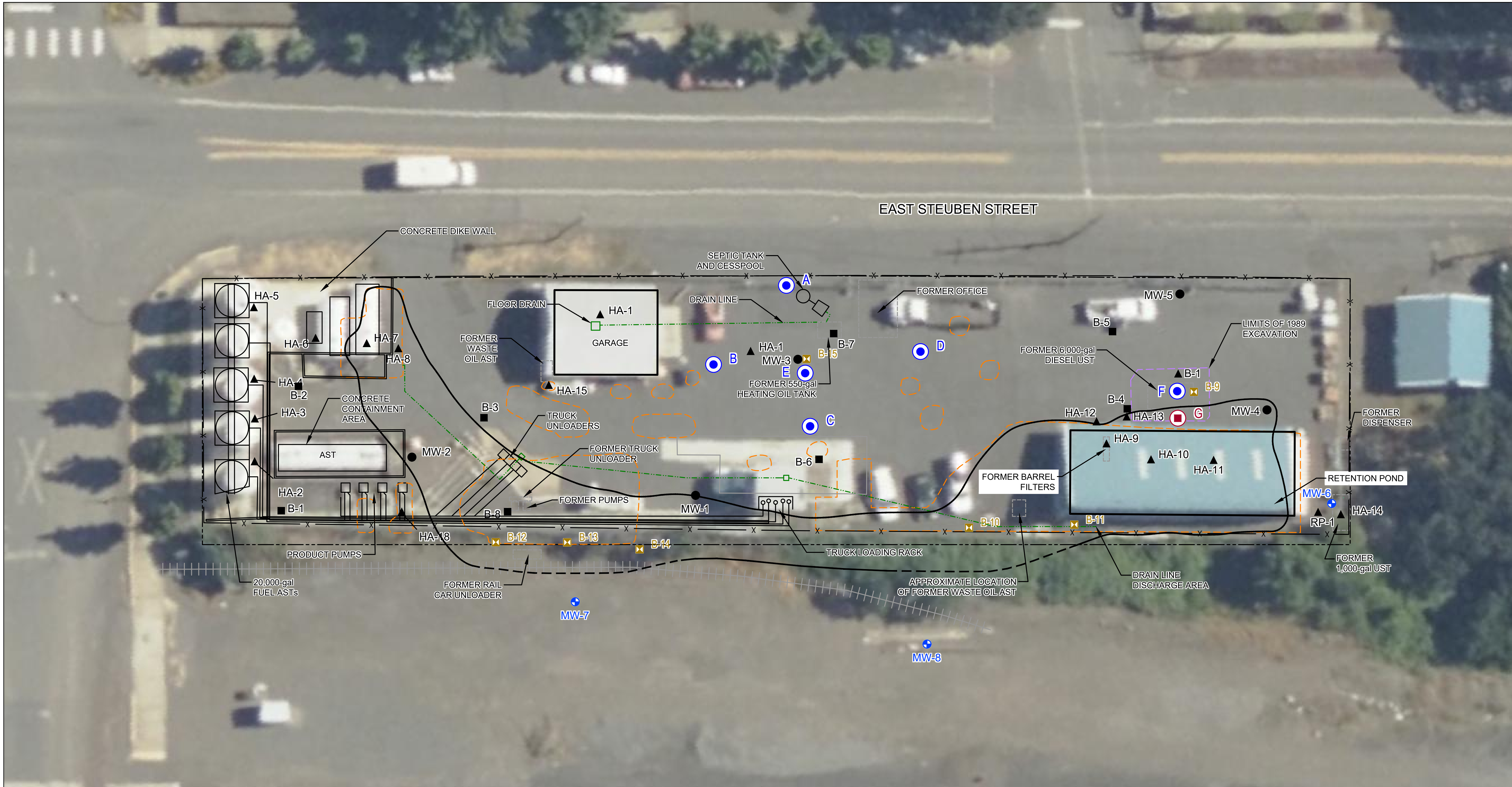
Print date: 09 Mar 2021 - 14:07

Data source: MNRF NRVIS, 2018. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2021.



LEGEND

(line)	SITE BOUNDARY
(line)	FORMER RAILROAD TRACKS
(line)	FORMER SITE FEATURES
(line)	STORMWATER CONVEYANCE
UST	UNDERGROUND STORAGE TANK
AST	ABOVE GROUND STORAGE TANK
MW-7	MONITORING WELL LOCATION (GHD, 2020)
B-13	BORING LOCATION (GHD, 2020)
MW-1	MONITORING WELL LOCATION (GEOENGINEERS, INC., 1990)
B-3	BORING LOCATION (GEOENGINEERS, INC., 1990)
HA-1	HAND-AUGER BORING (GEOENGINEERS, INC., 1994)
(line)	DIESEL UST EXCAVATION LIMITS (GEOENGINEERS 1989)
(line)	REMEDIAL EXCAVATION LIMITS (GEOENGINEERS 1995)
(line)	MTCA SITE BOUNDARY (DASHED WHERE INFERRED)
A	PROPOSED MONITORING WELL LOCATION
G	PROPOSED SOIL BORING LOCATION

0 15 30 ft

Coordinate System: WASHINGTON SOUTH STATE PLANE NAD83 FEET

N

GHD

PHILLIPS 66 BINGEN (AOC 5826)
217 E STUEBEN STREET, BINGEN, WA

PROPOSED INVESTIGATION SITE MAP

Project No. **11190941**
Date **March 2021**

FIGURE 2

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Plot Date: 09 March 2021 1:09 PM

Data Source: SURVEY BY STATEWIDE SURVEYING INC., DATED 11/12/2020.

Tables

Table 1

Summary of Soil Analytical Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Location	Location Description	Sample Date	Sample Depth	TPH	TPHg-HCID	TPHd-HCID	TPHo-HCID	TPHg	TPHd	TPHo	Benzene	Toluene	Ethylbenzene	Total Xylenes	EDB	EDC	MTBE	Naphthalene	Total Lead
	MTCA Method A Screening Levels			**--**	**--**	**--**	**--**	**100[a]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**	**0.005**	**N/A**	**0.1**	**5**	**250**
			(feet)	*(mg/kg)*				*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
1989 Diesel Storage Tank Excavation																			
1	North wall	05/19/89	3	11	--	--	--	--	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--
2	East wall	05/19/89	3.4	83	--	--	--	--	--	--	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--
3	South wall	05/19/89	1	**7,920**	--	--	--	--	--	--	<0.001	<0.001	<0.001	0.004	--	--	--	--	--
4	Base	05/19/89	9	98	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	West wall	05/19/89	2.5	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	Near oil storage building	05/19/89	1.5	9,200	--	--	--	--	--	--	<0.001	0.002	<0.001	0.003	--	--	--	--	--
1990 Soil Borings																			
B-1		05/07/90	3	ND	--	--	--	--	--	--	ND	0.002	ND	0.001	--	--	--	--	--
B-2		05/07/90	3	ND	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
B-3		05/07/90	7.5	ND	--	--	--	--	--	--	ND	0.002	ND	0.003	--	--	--	--	--
B-4		05/07/90	3	6	--	--	--	--	--	--	ND	0.004	0.001	0.006	--	--	--	--	--
MW-1		05/07/90	5	11	--	--	--	--	--	--	ND	0.003	ND	0.001	--	--	--	--	--
MW-2		05/07/90	3	ND	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
MW-3		05/07/90	3	6	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
MW-4		05/07/90	5	10	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
RP-1	Hand auger excavation	05/07/90	0.5	18	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
		05/07/90	1.5	15	--	--	--	--	--	--	ND	ND	ND	ND	--	--	--	--	--
1994 May Soil Borings																			
B-5		05/15/94	5.0	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
		05/12/94	9	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
MW-5		05/12/94	5	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
		05/12/94	20	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
1994 July Soil Borings																			
B-6	Truck loading rack	07/25/94	2.5	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
		07/25/94	5.0	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
B-7	Former heating oil tank	07/25/94	5.0	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
B-8	Former pumps	07/25/94	2.5	--	D	D	ND	--	1,200	170	--	--	--	--	--	--	--	--	--
		07/25/94	5.0	--	D	D	ND	--	6,400	<50	--	--	--	--	--	--	--	--	--
HA-1	Garage floor drain	07/25/94	5.0	--	ND	ND	ND	--	--	--	0.0005	0.0005	0.0005	0.0005	--	--	--	--	--
HA-2	Product ASTs	07/25/94	1.0	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
HA-3	Product ASTs	07/25/94	1.5	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
HA-4	Product ASTs	07/25/94	1.5	--	ND	D	ND	--	71	<50	--	--	--	--	--	--	--	--	--
HA-5	Product ASTs	07/25/94	1.5	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
HA-6	Retention pond	07/25/94	1.0	--	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--
HA-7	Horizontal ASTs	07/25/94	0.5	--	D	D	D	<2.0	14,000	32,000	<0.013	<0.013	0.029	0.038	--	--	--	--	--
		07/25/94	2.0	--	ND	D	D	--	<25	<50	--	--	--	--	--	--	--	--	--
HA-8	Horizontal ASTs	07/25/94	0.25	--	D	D	D	2.4	4,100	53,000	<0.013	<0.013	<0.013	0.068	--	--	--	--	--
		07/25/94	1.5	--	ND	D	D	--	31	410	--	--	--	--	--	--	--	--	--
HA-9	Warehouse	07/25/94	0.25	--	D	D	D	<2.0	1,000	2,400	<0.013	<0.013	<0.013	<0.013	--	--	--	--	--
		07/25/94	1.5	--	ND	D	D	--	200	520	--	--	--	--	--	--	--	--	--

Table 1

Summary of Soil Analytical Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Location	Location Description	Sample Date	Sample Depth	TPH	TPHg-HCID	TPHd-HCID	TPHo-HCID	TPHg	TPHd	TPHo	Benzene	Toluene	Ethylbenzene	Total Xylenes	EDB	EDC	MTBE	Naphthalene	Total Lead
	MTCA Method A Screening Levels			**--**	**--**	**--**	**--**	**100[a]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**	**0.005**	**N/A**	**0.1**	**5**	**250**
			(feet)	***(mg/kg)***				***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***	***(mg/kg)***
HA-10	Warehouse	07/25/94	0.25	--	ND	D	D	--	1,100	4,800	--	--	--	--	--	--	--	--	--
		07/25/94	1.5	--	ND	ND	D	--	71	320	--	--	--	--	--	--	--	--	--
HA-11	Warehouse	07/25/94	0.25	--	D	D	D	<2.0	580	6,700	<0.013	<0.013	<0.013	<0.013	--	--	--	--	--
		07/25/94	1.5	--	ND	ND	D	--	--	--	--	--	--	--	--	--	--	--	--
S-1	Former waste oil AST	07/25/94	surface	--	D	D	D	--	12,000	52,000	--	--	--	--	--	--	--	--	--
S-2	West end warehouse	07/25/94	surface	--	D	D	D	2.5	19,000	42,000	<0.013	<0.013	0.049	0.100	--	--	--	--	--
1995 Excavation - West Portion																			
Loading Rack																			
4	Surface, south side of loading rack	09/14/95	0.1	--	D	D	D	--	--	--	--	--	--	--	--	--	--	--	--
17	Base, central portion	09/14/95	3.0	--	<20	<50	<100	--	44	<50	--	--	--	--	--	--	--	--	--
18	Base, west end	10/09/95	3.0	--	<20	<50	<100	--	40	<50	--	--	--	--	--	--	--	--	--
37	Base, east end	10/09/95	3.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
41	North wall	10/09/95	2.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
42	South wall	10/09/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
43	South wall, west end	10/09/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
44	West wall	10/09/95	2.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
45	North wall, west end	10/09/95	2.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Horizontal AST																			
7	North wall, west end	09/13/95	2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8	Base, west end	09/13/95	2.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9	West wall	09/13/95	2.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	Base, north end	09/13/95	2.0	--	--	--	--	--	1,500	4,400	--	--	--	--	--	--	--	--	--
11	Base, east end	09/13/95	2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12	South wall	09/13/95	1.0	--	--	--	--	--	390	750	--	--	--	--	--	--	--	--	--
19	Base, north end	09/14/95	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20	Base, south end	09/14/95	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	East wall	09/25/95	1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30	South wall, east end	09/25/95	1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
31	South wall, west end	10/09/95	1.5	--	--	--	--	--	180	260	--	--	--	--	--	--	--	--	--
Product Pump																			
14	Below product pump #2	09/14/95	2.5	--	--	--	--	<2	130	<50	<0.013	<0.013	<0.013	<0.013	--	--	--	--	--
15	Below product pump #4, south end	09/14/95	2.5	--	--	--	--	<2	<25	<50	<0.013	0.017	<0.013	<0.013	--	--	--	--	--
16	Below, product pump # 4, north end	09/14/95	2.5	--	--	--	--	<2	620	920	<0.013	<0.013	<0.013	<0.013	--	--	--	--	--
63	Below product pump #4, north end	10/16/95	4.5	--	--	--	--	<2	170	<50	--	--	--	--	--	--	--	--	--
Former Pumps																			
21	West wall	09/14/95	8.0	--	--	--	--	--	<25	--	--	--	--	--	--	--	--	--	--
22	North wall	09/19/95	7.0	--	--	--	--	--	<25	--	--	--	--	--	--	--	--	--	--
23	East wall	09/19/95	7.0	--	--	--	--	--	<25	--	--	--	--	--	--	--	--	--	--
24	Southeast corner	09/19/95	8.5	--	--	--	--	--	<25	--	--	--	--	--	--	--	--	--	--
25	North wall	09/19/95	7.0	--	--	--	--	--	<25	--	--	--	--	--	--	--	--	--	--
26	Base, southeast corner	09/19/95	9.0	--	--	--	--	--	3,700	--	--	--	--	--	--	--	--	--	--
38	South wall, east end	10/09/95	8.0	--	--	--	--	--	**3,300**	100	--	--	--	--	--	--	--	--	--
39	South wall, center	10/09/95	8.0	--	--	--	--	--	**6,000**	<50	--	--	--	--	--	--	--	--	--

Table 1

Summary of Soil Analytical Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Location	Location Description	Sample Date	Sample Depth	TPH	TPHg-HCID	TPHd-HCID	TPHo-HCID	TPHg	TPHd	TPHo	Benzene	Toluene	Ethylbenzene	Total Xylenes	EDB	EDC	MTBE	Naphthalene	Total Lead
	MTCA Method A Screening Levels			**--**	**--**	**--**	**--**	**100[a]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**	**0.005**	**N/A**	**0.1**	**5**	**250**
			(feet)	*(mg/kg)*				*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
40	South wall, west end	10/09/95	8.0	--	--	--	--	--	**2,400**	98	--	--	--	--	--	--	--	--	--
1995 - Drain Line Discharge and Retention Pond																			
13	warehouse	09/13/95	0.0-0.5	--	D	D	D	--	11,000	4,800	--	--	--	--	--	--	--	--	--
27	warehouse	09/25/95	0.0-0.5	--	D	D	D	--	3,300	2,400	--	--	--	--	--	--	--	--	--
28	warehouse	09/25/95	0.0-0.5	--	D	D	D	--	12,000	4,000	--	--	--	--	--	--	--	--	--
46	Surface, retention pond	10/09/95	0.0-0.5	--	--	--	--	--	2,800	3,600	--	--	--	--	--	--	--	--	--
47	Surface, retention pond	10/09/95	0.0-0.5	--	--	--	--	--	26,000	16,000	--	--	--	--	--	--	--	--	--
48	Surface, retention pond	10/09/95	0.0-0.5	--	--	--	--	--	2,600	1,800	--	--	--	--	--	--	--	--	--
1995 Excavation - East Portion																			
32	Wall, former loading rack	10/09/95	1.0	--	--	--	--	--	590	1,900	--	--	--	--	--	--	--	--	--
33	Base, former loading rack	10/09/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
34	Base, former waste oil AST	10/09/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
35	North wall, former loading rack	10/09/95	1.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
36	Waste oil AST	10/09/95	1.0	--	--	--	--	--	86	130	--	--	--	--	--	--	--	--	--
49	Base, waste oil AST	10/09/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
50	Base, warehouse	10/09/95	3.0	--	--	--	--	--	41	82	--	--	--	--	--	--	--	--	--
51	Base, warehouse	10/09/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
52	Base, warehouse	10/11/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
53	Base, warehouse	10/11/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
54	Base, warehouse	10/11/95	3.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
55	Base, warehouse	10/11/95	3.5	--	--	--	--	--	31	<50	--	--	--	--	--	--	--	--	--
56	Wall, former loading rack	10/11/95	1.0	--	--	--	--	--	600	2,500	--	--	--	--	--	--	--	--	--
57	Base, warehouse	10/11/95	3.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
58	Base, warehouse	10/11/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
59	North wall	10/11/95	1.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
60	Base, west of warehouse	10/11/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
61	West of warehouse	10/11/95	1.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
62	Base, west of warehouse	10/11/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
64	South wall	10/16/95	2.0	--	--	--	--	--	**3,800**	**12,000**	--	--	--	--	--	--	--	--	--
65	South wall	10/16/95	2.0	--	--	--	--	--	190	750	--	--	--	--	--	--	--	--	--
66	South wall	10/16/95	2.0	--	--	--	--	--	1,600	**4,200**	--	--	--	--	--	--	--	--	--
67	South wall	10/16/95	2.0	--	--	--	--	--	86	120	--	--	--	--	--	--	--	--	--
68	South wall	10/16/95	2.0	--	--	--	--	--	<25	110	--	--	--	--	--	--	--	--	--
69	Base, warehouse	10/16/95	3.0	--	--	--	--	--	<25	200	--	--	--	--	--	--	--	--	--
70	Base, warehouse	10/16/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
71	North wall	10/16/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
72	West of warehouse	10/16/95	1.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
73	Wall, west of warehouse	10/16/95	1.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
74	Base, retention pond	10/16/95	2.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
75	Base, retention pond	10/16/95	2.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
76	Base, retention pond	10/16/95	2.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
77	Base, retention pond	10/16/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--

Table 1

Summary of Soil Analytical Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Location	Location Description	Sample Date	Sample Depth	TPH	TPHg-HCID	TPHd-HCID	TPHo-HCID	TPHg	TPHd	TPHo	Benzene	Toluene	Ethylbenzene	Total Xylenes	EDB	EDC	MTBE	Naphthalene	Total Lead
	MTCA Method A Screening Levels			**--**	**--**	**--**	**--**	**100[a]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**	**0.005**	**N/A**	**0.1**	**5**	**250**
			(feet)	*(mg/kg)*				*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
78	Base, retention pond	10/16/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
79	South wall, retention pond	10/17/95	2.0	--	--	--	--	--	<25	69	--	--	--	--	--	--	--	--	--
80	East wall, retention pond	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
81	East wall, retention pond	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
82	North wall, retention pond	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
83	North wall, warehouse	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
84	North wall, warehouse	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
85	West wall, former loading rack	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
86	South wall, former loading rack	10/17/95	2.0	--	--	--	--	--	140	<50	--	--	--	--	--	--	--	--	--
87	Base, former loading rack	10/17/95	3.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
88	West wall, former loading rack	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
89	North wall, former loading rack	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
90	East wall, former loading rack	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
91	Base, former loading rack	10/17/95	3.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
92	Base, former loading rack	10/17/95	3.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
93	North wall, former loading rack	10/17/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
1995 Excavation - Driveway Surface Staining																			
108	Wall, west of warehouse	10/19/95	1.5	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
109	Base, west of warehouse	10/19/95	2.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
110	Wall, west of warehouse	10/19/95	1.0	--	--	--	--	--	<25	<50	--	--	--	--	--	--	--	--	--
2020 Remedial Investigations																			
S.11190941.100620.DT.B9-1.0'	B-9, former 6,000-gal Diesel UST (south), near Location 3 - 1989 Diesel Storage Tank Excavation	10/06/20	1.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100920.DT.B9-15.0'		10/08/20	15.0	--	--	--	--	<3.0	71	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100920.DT.B9-20.0'		10/08/20	20.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100620.DT.B10-2.0'	B-10, located along southern property fence line	10/06/20	2.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100620.DT.B11-2.0'	B-11, located along southern property fence line	10/06/20	2.0	--	--	--	--	<3.0	42	200	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.B12-4.0'	B-12, located along southern property fence line	10/08/20	4.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.B13-4.0'	B-13, located along southern property fence line	10/08/20	4.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.B14-4.0'	B-14, located along southern property fence line	10/08/20	4.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.B15-5.0'	B-15, located along southern property fence line	10/08/20	5.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100720.DT.MW6-24.0'		10/07/20	24.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100720.DT.MW6-29.2'	MW-6, southeast corner of site, location of former 1,00-gallon UST	10/07/20	29.2	--	--	--	--	15	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100720.DT.MW6-35.0		10/07/20	35.0	--	<20	<50	<100	**110**	<25	<50	<0.0050	<0.010	<0.010	<0.020	<0.0050	<0.010	<0.010	<0.010	1.8
S.11190941.100720.DT.MW6-40.0		10/07/20	40.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.MW7-12.0'	MW-7, south of site, outside property fence line	10/08/20	12.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.MW7-30.0'		10/08/20	30.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--

Table 1

Summary of Soil Analytical Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Location	Location Description	Sample Date	Sample Depth	TPH	TPHg-HCID	TPHd-HCID	TPHo-HCID	TPHg	TPHd	TPHo	Benzene	Toluene	Ethylbenzene	Total Xylenes	EDB	EDC	MTBE	Naphthalene	Total Lead
	MTCA Method A Screening Levels			**--**	**--**	**--**	**--**	**100[a]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**	**0.005**	**N/A**	**0.1**	**5**	**250**
			(feet)	*(mg/kg)*				*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*
S.11190941.100820.DT.MW8-8.0'	MW-8, south of site, outside property fence line	10/08/20	8.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--
S.11190941.100820.DT.MW8-15.0'		10/08/20	15.0	--	--	--	--	<3.0	<25	<50	<0.0050	<0.010	<0.010	<0.020	--	--	--	--	--

Notes:

Bold values equal or exceed Department of Ecology Model Toxics Control Act (MTCA) Method A Cleanup Level, per Cleanup Level and Risk Calculation (CLARC) data tables published in August 2015.
Shaded cells indicate the sample was over excavated
Total Petroleum Hydrocarbons (TPH) analyzed by EPA Method 418.1.
TPH as Gasoline-range organics (TPHg) analyzed by EPA Method 8015 prior to 1994 and Northwest Method NWTPH-Gx 1994 to present.
TPH as Diesel-range organics (TPHd) analyzed by EPA Method 8015 prior to 1994 and Northwest Method NWTPH-Dx 1994 to present.
TPH as Heavy Oil-range organics (TPHo) analyzed by EPA Method 8015 prior to 1994 and Northwest Method NWTPH-Dx 1994 to present.
Benzene, toluene, ethylbenzene, total xylenes (BTEX) analyzed by USEPA Method 8020 prior to 1996 and USEPA Method 8260 from 1996 to present.
Hydrocarbon identification (HCID) analyzed by Northwest Method NWTPH-HCID.
EDC = 1,2-Dichloroethane, analyzed by EPA Method 8260B.
EBD = 1,2-Dibromoethane, analyzed by EPA Method 8260B.
MTBE = Methyl tert-butyl ether, analyzed by EPA Method 8260B.
Naphthalene analyzed by EPA Method 8260B.
Lead analyzed by EPA Method 6010D.
D = Detected
EPA = Environmental Protection Agency
MTCA = Model Toxics Control Act
mg/kg = milligrams per kilogram
ND = Not detected above the laboratory reporting limit
-- = Not measured/Not analyzed
< = Less than the stated laboratory reporting limit
[a] Gasoline-range hydrocarbon cleanup level is 100 mg/kg with benzene not present at the Site.

Table 2

Summary of Groundwater Monitoring Data
Former Unocal Bulk Plant 0046
Phillips 66 Site 5887
Bingen, Washington

Well ID	Sample Date	TOC *(feet)*	Depth to Water *(feet)*	LPH Thickness *(feet)*	Groundwater Elevation [bc] *(feet)*	TPH *(ug/L)*	TPH-G *(ug/L)*	TPH-D *(ug/L)*	TPH-O *(ug/L)*	Benzene *(ug/L)*	Toluene *(ug/L)*	Ethylbenzene *(ug/L)*	Total Xylenes *(ug/L)*	EDB *(ug/L)*	EDC *(ug/L)*	Naphthalene *(ug/L)*	Total Lead *(ug/L)*
MTCA Method A Cleanup Level						**1,000[a]**	**1,000/800[a]**	**500**		**5**	**1,000**	**700**	**1,000**	**0.01**	**5**	**160**	**15**
MW-1	05/17/90	98.80	4.89	--	93.91	**1,600**	--	--	--	<1.0	7	3	6	--	--	--	--
MW-1	04/26/94	98.80	6.38	--	92.42	<1,000	--	--	--	<0.50	<0.50	<0.50	<1.0	--	--	--	--
MW-1	05/16/94	98.80	6.31	--	92.49	--	--	--	--	--	--	--	--	--	--	--	--
MW-1	11/02/20	103.90	7.60	--	96.30	--	<100	<110	<110	<050	<1.0	<1.0	<2.0	<1.0	<0.50	<10	--
MW-1	02/08/21	103.90	7.02	--	96.88	--	<100	150	<100	<0.50	<1.0	<1.0	<2.0	<1.0	<0.50	<10	1.91
MW-2[d]	05/17/90	101.79	8.28	--	93.51	<500	--	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--
MW-2[d]	04/26/94	101.79	8.32	--	93.47	<1,000	--	--	--	<0.50	<0.50	<0.50	<1.0	--	--	--	--
MW-2[d]	05/16/94	101.79	8.52	--	93.27	--	--	--	--	--	--	--	--	--	--	--	--
MW-3	05/17/90	100.18	11.60	--	88.58	<500	--	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--
MW-3	04/26/94	100.18	10.98	--	89.20	<1,000	--	--	--	<0.50	<0.50	<0.50	<1.0	--	--	--	--
MW-3	05/16/94	100.18	11.28	--	88.90	--	--	--	--	--	--	--	--	--	--	--	--
MW-3	11/02/20	104.36	10.68	0.3	93.91	--	--	--	--	--	--	--	--	--	--	--	--
MW-3	02/08/21	104.36	9.88	0.05	94.52	--	--	--	--	--	--	--	--	--	--	--	--
MW-4[d]	05/17/90	98.73	14.19	--	84.54	800	--	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--
MW-4[d]	04/26/94	98.73	13.83	--	84.90	<1,000	--	--	--	<0.50	<0.50	<0.50	<1.0	--	--	--	--
MW-4[d]	05/16/94	98.73	12.35	--	86.38	--	--	--	--	--	--	--	--	--	--	--	--
MW-5[d]	05/16/94	99.60	--	--	DRY	--	--	--	--	--	--	--	--	--	--	--	--
MW-5[d]	06/15/94	99.60	--	--	DRY	--	--	--	--	--	--	--	--	--	--	--	--
MW-6	11/02/20	102.55	20.45	--	82.10	--	330	120.00	<100	<050	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<50.0
MW-6 Dup	11/02/20	102.55	20.45	--	82.10	--	360	--	--	<050	<1.0	<1.0	<2.0	<1.0	<0.50	<10	--
MW-6	02/08/21	102.55	17.18	--	85.37	--	<100	<110	<110	<0.50	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<1.00
MW-6 Dup	02/08/21	102.55	17.18	--	85.37	--	<100	<100	<100	<0.50	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<1.00
MW-7	11/02/20	108.13	15.74	--	92.39	--	<100	<96	<96	<050	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<50.0
MW-7	02/08/21	108.13	14.51	--	93.62	--	<100	<100	<100	<0.50	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<1.00
MW-8	11/02/20	107.63	12.39	--	95.24	--	<100	<100	<100	<050	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<50.0
MW-8	02/08/21	107.63	12.11	--	95.52	--	<100	<100	<100	<0.50	<1.0	<1.0	<2.0	<1.0	<0.50	<10	<1.00

Notes:

Bold values equal or exceed Department of Ecology Model Toxics Control Act (MTCA) Method A Cleanup Level, per Cleanup Level and Risk Calculation (CLARC) data tables published in August 2015.
MTCA = Model Toxics Control Act
USEPA = United States Environmental Protection Agency
LPH = Liquid Phase Hydrocarbons
μg/L = Micrograms per liter
-- = Not Analyzed or Sampled
<x = Reported concentration below laboratory method detection limit.
TOC = Top of Casing
Total Petroleum Hydrocarbons (TPH) analyzed by Environmental Protection Agency (EPA) Method 418.1.
TPH as Gasoline-range organics (TPHg) analyzed by Northwest Method NWTPH-Gx.
TPH as Diesel-range organics (TPHd) analyzed by Northwest Method NWTPH-Dx.
TPH as Heavy Oil-range organics (TPHo) analyzed by Northwest Method NWTPH-Dx.
Benzene, toluene, ethylbenzene, total xylenes (BTEX) analyzed by USEPA Method 8260B or 8021B
1,2 Dibromoethane (EDB) analyzed by EPA Method 8260B.
1,2 Dichloroethane (EDC) analyzed by EPA Method 8260B.
Naphthalene anlyzed by EPA Method 8260B.
Lead analyzed by EPA Method 7421/6020 (Total Lead).
[a] Gasoline-range hydrocarbon cleanup level is 1,000 ug/L with benzene not present at the Site.
[b] Groundwater elevation and Top of Casing (TOC) elevation data prior to 2020 is referenced relative to a temporary benchmark established on site within an assumed elevation of 100.00 feet.
[c] Groundwater elevation and TOC elevation reported in 2020 were surveyed to North American Vertical Datum of 88 (NAV88).

Appendices

Appendix A
Quality Assurance Project Plan

Appendix A Quality Assurance Project Plan

Table of Contents

1. Introduction ... 1
2. Objectives of Investigation ... 2
3. Project Organization ... 2
4. Data Quality Objectives (DQO) ... 4
   - 4.1 Quality Assurance Objectives for Measurement Data ... 4
   - 4.2 Laboratory Quality Assurance ... 4
     - 4.2.1 Accuracy, Precision, and Sensitivity of Analyses ... 4
     - 4.2.2 Completeness, Representativeness, and Comparability ... 4
   - 4.3 Field Measurement Quality Assurance ... 5
5. Sampling (Experimental) Design ... 5
6. Special Training/Certification ... 5
7. Field Procedures ... 5
   - 7.1 Sample Custody and Document Control ... 6
     - 7.1.1 Field Logbook ... 6
     - 7.1.2 Sample Numbering ... 6
     - 7.1.3 Chain of Custody Records ... 7
     - 7.1.4 Sample Documentation in the Laboratory ... 8
     - 7.1.5 Storage of Samples ... 8
     - 7.1.6 Sample Documentation ... 8
     - 7.1.7 Field Instrumentation ... 8
8. Laboratory Procedures ... 9
   - 8.1 Analytical Methods ... 9
   - 8.2 Calibration Procedures and Frequency ... 9
     - 8.2.1 Instrument Calibration ... 9
     - 8.2.2 Gas Chromatography/Mass Spectrometry (GC/MS) ... 9
     - 8.2.3 Gas Chromatography ... 10
   - 8.3 Compound Identification ... 10
   - 8.4 Quantitation ... 10
   - 8.5 Quantitation Limit Requirements ... 11
9. Quality Control ... 11
   - 9.1 Quality Control for Laboratory Analyses ... 11
     - 9.1.1 Method Blanks ... 11
     - 9.1.2 Laboratory Control Sample/Duplicate Analyses ... 11
     - 9.1.3 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses ... 11
     - 9.1.4 Surrogate Analyses ... 12
   - 9.2 Quality Control for Field Sampling ... 12
     - 9.2.1 Field Duplicate Samples ... 12

Table of Contents (Continued)

9.2.2 Trip Blank Sample Analysis 12

9.3 Quality Control Documentation 12

9.4 Inspection/Acceptance of Supplies and Consumables 12

10. Data Management Procedures 13

10.1 General 13

10.2 Laboratory Reporting, Data, Presentation, and Final Report 13

10.3 Document Control System 13

10.4 Quality Control Check Points and Data Flow 14

11. Audits 14

12. Data Review, Verification, and Validation 15

12.1 General 15

13. Data Quality Assessment 16

13.1 Specific Routine Procedures Uses to Assess Data Precision, Accuracy, and Completeness 16

13.1.1 Precision 16
13.1.2 Accuracy 17
13.1.3 Completeness 17
13.1.4 Quality Control Exceedances 17

14. Preventative Maintenance 17

15. Corrective Action 18

Table Index

Table 4.1 Analytical Parameters - Groundwater

Table 4.2 Analytical Parameters - Soil

Table 4.3 Sampling and Analysis Summary

Table 7.1 Sample Container, Preservation, and Holding Time Periods

Table 10.1 Laboratory Reporting Deliverables

QAPP Distribution List

Name/Organization	Number of Copies
______________________ - GHD Project Manager	1
______________________ - GHD Field Quality Assurance Officer	1
______________________ - GHD Quality Assurance Officer	1
______________________ - Laboratory Project Manager	1
______________________ - Regulatory Agency	1

Quality Assurance Project Plan
Supplemental Remedial Investigation
Phillips 66 Company
Bingen, Washington
Revision Number 0
July 2019

Prepared By:	GHD Services Inc. (GHD)		
Approved By:	______________________	Date:	____________
	GHD Project Manager		
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Approved By:	______________________	Date:	____________
	GHD Field Quality Assurance Officer		
Approved By:	______________________	Date:	____________
	Laboratory Project Manager		
Approved By:	______________________	Date:	____________
	Laboratory Quality Assurance Officer		

1. Introduction

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and Quality Assurance/Quality Control (QA/QC) activities designed to achieve the specific data quality goals associated with the Supplemental Remedial Investigation (SRI). The SRI addresses soil and groundwater collection at the Phillips 66 Company site located at 217 East Steuben Street, Bingen, Klickitat County, Washington.

The objectives of this QAPP are to provide sufficiently thorough and concise descriptions of the measures to be applied during soil and groundwater investigation such that the data generated will be of a known and acceptable level of precision and accuracy. This QAPP provides comprehensive information regarding the project personnel responsibilities, and sets forth specific procedures to be used during sampling of relevant environmental matrices and analyses of data.

The remaining sections of the QAPP outline the analytical activities and responsibilities for this investigation and are organized as follows:

Section 2 - Objectives of Investigation: references the SRI Work Plan regarding the objectives of the investigation.

Section 3 - Project Organization: describes the key project personnel and their duties.

Section 4 - Data Quality Objectives: summarizes the quality assurance objectives to achieve the required accuracy and precision.

Section 5 - Sampling Design: references the sampling design described in the SRI Work Plan.

Section 6 - Special Training/Certification: describes the field and laboratory training requirements.

Section 7 - Field Procedures: describes the documentation required for samples during collection, transport, and storage at the laboratory. Actual field procedures are described in the Field Sampling Plan (FSP).

Section 8 - Laboratory Procedures: provides a description of the analytical methodologies to be used for the investigation. Summarizes instrument calibration and analyte identification and quantitation.

Section 9 - Quality Control: describes the different types of field and laboratory quality control required for the project.

Section 10 - Data Management Procedures: provides a summary of the laboratory's data flow from bench to final report, document control, and quality control check points.

Section 11 - Audits: describes the internal laboratory audits.

Section 12 - Data Review, Verifications, and Validation: provides a general overview of the validation of the laboratory data.

Section 13 - Data Quality Assessment: provides a summary of QA/QC topics to be included in the final report. Contains formulas for precision, accuracy, and completeness.

Section 14 - Preventive Maintenance: provides a brief description of maintenance on laboratory and field instrumentation and its documentation.

Section 15 - Corrective Action: provides a summary of the steps necessary for corrective actions.

2. Objectives of Investigation

Sections 2 and 3 of the SRI Work Plan describe the objectives of the investigation.

3. Project Organization

A brief description of the duties of the key project personnel is presented below.

GHD Project Manager

- Provides day-to-day project management
- Provides managerial guidance to the GHD QA/QC Officer
- Prepares and reviews reports
- Conducts preliminary chemical data interpretation and assessment
- Responsible for overall project completion in accordance with the approved design

GHD Quality Assurance/Quality Control Officer

- Oversees and reviews laboratory activities
- Determines laboratory data corrective action
- Performs analytical data validation and assessment
- Reviews laboratory QA/QC
- Assists in preparation and review of final report
- Provides technical representation for analytical activities
- Provides managerial and technical guidance to the Field Sampling Supervisor
- Maintains officially approved QAPP document

Field Sampling Supervisor

- Provides immediate supervision of all on-Site activities
- Provides field management of sample collection and field QA/QC
- Provides technical representation for field activities
- Is responsible for maintenance of the field equipment
- Responsible that all field personnel are properly trained and certified

Laboratory - Project Manager, Analytical Contractor

- Ensures resources of laboratory are available on an as-required basis
- Coordinates laboratory analyses
- Supervises laboratory's in-house chain of custody
- Schedules analyses of samples
- Oversees review of data
- Oversees preparation of analytical reports
- Approves final analytical reports

Laboratory - Quality Assurance/Quality Control Officer, Analytical Contractor

- Overviews laboratory QA/QC
- Overviews QA/QC documentation
- Conducts detailed data review
- Decides laboratory corrective actions, if required
- Provides technical representation for laboratory QA/QC procedures
- Keeps up-to-date training records of analysts

Laboratory - Sample Custodian - Analytical Contractor

- Receives and inspects the sample containers
- Records the condition of the sample containers
- Signs appropriate documents
- Verifies chain of custody and their correctness
- Notifies Laboratory Project Manager and Laboratory QA/QC Officer of sample receipt and inspection
- Assigns a unique laboratory identification number correlated to the field sample identification number and enters each into the sample receiving log
- Initiates transfer of samples to the appropriate lab sections with assistance from the Laboratory Project Manager
- Controls and monitors access to and storage of samples and extracts

The analytical laboratory selected to perform the analyses will be Pace Analytical Services (Pace). The soil and the groundwater analyses will be performed by Pace at the Minneapolis, Minnesota location. Pace is accredited under the State of Washington Department of Ecology (WDOE) Environmental Laboratory Accreditation Program.

4. Data Quality Objectives (DQO)

4.1 Quality Assurance Objectives for Measurement Data

The overall quality assurance objective is to develop and implement procedures for sample collection and analyses, which will provide data with an acceptable level of accuracy and precision.

Quality assurance measures for this project will begin with sample containers. Soil and groundwater sample containers will be purchased from a certified manufacturer and will be pre-cleaned (I-Chem Series 200 or equivalent).

4.2 Laboratory Quality Assurance

The following subsections define the quality assurance goals required to meet the DQOs of the project. A copy of the laboratory's Standard Operating Procedure (SOP) is presented in Attachment A.

4.2.1 Accuracy, Precision, and Sensitivity of Analyses

The fundamental quality assurance objective with respect to the accuracy, precision, and sensitivity of analytical data is to meet the quality control acceptance criteria of each analytical protocol. Summaries of the targeted quantitation limits are provided in Tables 4.1 (soil), 4.2 (groundwater). It should be noted that these limits are targeted quantitation limits only; limits are highly matrix dependent and may not always be achieved.

The method accuracy (percent recovery) will be determined by spiking selected soil and groundwater samples (matrix spikes) with the compounds of interest. Accuracy will be reported as the percent recovery of the spiking compounds and will compare with the criteria given in the appropriate methods, as identified in Section 8. The mathematical formula for accuracy is presented in Section 13.1.2.

The methods precision (reproducibility between duplicate analyses) will be determined based on the duplicate analysis of matrix spike samples of soil and groundwater. Precision will be reported as Relative Percent Differences (RPDs) between duplicate results. The mathematical formula for precision is presented in Section 13.1.1.

4.2.2 Completeness, Representativeness, and Comparability

A completeness requirement of 90 percent will be targeted for the program (see Section 13.1.3 for definition and mathematical formula of completeness).

The quantity of samples to be collected has been estimated in an effort to effectively represent the population being studied. Summaries of the sampling and analysis programs are presented in Table 4.3.

Analytical methods selected for this study are consistent with those used for previous studies (if applicable) to assure comparability of the data. All standards used by the laboratory will be traceable to reliable sources and will be checked with an independent standard.

4.3 Field Measurement Quality Assurance

Measurement data will be generated during field activities. These activities include, but are not limited to, the following:

i) Temperature

ii) pH

iii) Conductivity

iv) Turbidity

v) Oxidation-reduction potential

vi) Dissolved oxygen

vii) Salinity

viii) Documenting time and weather conditions

ix) Observation of sample location appearance and other conditions

The general quality assurance objective for measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the use of standardized procedures.

5. Sampling (Experimental) Design

The sampling design is described in Section 3 of the SRI Work Plan.

6. Special Training/Certification

GHD field personnel all hold current hazardous waste site operation (HAZWOPER) certification required by 29CFR 1910.120. GHD field personnel also undergo an extensive training program. Field personnel must first read the SOPs and attend a series of live seminars and CD-ROM courses on fieldwork topics that need to be monitored. A practical demonstration of skills learned must be provided in the field to senior staff three times, in order for field personnel to be able to work independently. These training requirements pertain to sampling procedures and the calibration/operation of field instrumentation. Field training records are stored electronically per the GHD Quality System.

7. Field Procedures

The field procedures are presented in the FSP.

The sample container, shipping, and packaging requirements are identified in Table 7.1 and in Section 7.1.3.

The following subsections define sample custody and document control.

7.1 Sample Custody and Document Control

The following documentation procedures will be used during sampling and analysis to provide chain of custody control during transfer of samples from collection through storage. Recordkeeping documentation will include use of the following:

i) Field logbooks (bound with numbered pages) to document sampling activities in the field

ii) Labels to identify individual samples

iii) Chain of custody record sheet to document analyses to be performed

iv) Laboratory sample custody logbook

7.1.1 Field Logbook

In the field, the sampler will record the following information in the field logbook (bound) for each sample collected:

i) Project number

ii) Sample matrix

iii) Name of sampler

iv) Sample source

v) Time and date

vi) Pertinent data (i.e., sampling duration)

vii) Analysis to be conducted

viii) Sampling method

ix) Appearance of each sample (e.g., color, particulates, effervescing)

x) Preservation added, if any

xi) Number of sample bottles collected

xii) Pertinent weather data

Each field logbook page will be signed by the sampler. Each logbook is stored in a filing cabinet located in GHD's Tacoma office per the GHD Quality System.

7.1.2 Sample Numbering

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. The sample numbering system to be used is described as follows:

Example: WG-011618-AA-BBB-XXX

Where: WG - Designates sample type

(WG=Groundwater, SG=Soil Gas, TB=Trip Blank, FD=Field Duplicate)

011618: Date of collection (mm/dd/yy)

AA: Sampler initials

BBB: Location I.D.

XXX: Unique sample number

All field samples will be numbered with a unique sample number.

Field duplicates will be submitted blind to the laboratory. The field duplicate location will be specified in the field notebook and on the field sample key submitted to data management.

7.1.3 Chain of Custody Records

Chain of custody forms will be completed for all samples collected during the program.

The chain of custody form will document the transfer of sample containers. Custody seals will be placed on each cooler (or box). The cooler (or box) will then be sealed with packing tape. Sample container labels will include sample number, place of collection, and date and time of collection. All samples should be delivered to the laboratory by same day or overnight delivery.

The chain of custody record, completed at the time of sampling, will contain, but not be limited to, the sample number, date and time of sampling, and the name of the sampler. The chain of custody document will be signed, timed, and dated by the sampler when transferring the samples.

Each sample cooler (or box) being shipped to the laboratory will contain a chain of custody form. The chain of custody form will consist of four copies which will be distributed as follows: The shipper will maintain a copy while the other three copies will be enclosed in a waterproof envelope within the cooler (or box) with the samples. The shipper's copy will be filed in the field project folder located in GHD's Tacoma office per the GHD Quality System. The cooler (or box) will then be sealed properly for shipment. The laboratory, upon receiving the samples, will complete the three remaining copies. The laboratory will retain one copy for their records. The laboratory will return one copy to the GHD QA/QC Officer upon receipt of the samples. One copy will be returned with the data deliverables package.

Upon receipt of the cooler (or box) at the laboratory, the Sample Custodian will inspect the shipping cooler (or box) and the custody seal. The Sample Custodian will note the condition of the cooler (or box) and the custody seal on the chain of custody record sheet. If the shipping cooler (or box) seal is intact, the sample containers will be accepted for analyses. The Sample Custodian will document the date and time of receipt of the container and sign the form.

If damage or discrepancies are noticed (including sample temperature exceedances), they will be recorded in the remarks column of the record sheet, dated, and signed. Any damage or discrepancies will be reported to the Laboratory Project Manager and Laboratory QA/QC Officer before samples are processed.

7.1.4 Sample Documentation in the Laboratory

Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The Sample Custodian will record the client name, number of samples, and date of receipt of samples in the Sample Control Logbook. Samples removed from storage for analyses will be documented in the Sample Control Logbook.

The laboratory will be responsible for maintaining analytical logbooks and laboratory data as well as a sample (on hand) inventory for submittal to the GHD QA/QC Officer on an "as-required" basis. Raw laboratory data produced from the analysis of samples submitted for this program will be inventoried and maintained by the laboratory for a period of 5 years at which time the GHD QA/QC Officer will advise the laboratory regarding the need for additional storage.

7.1.5 Storage of Samples

After the Sample Custodian has completed the chain of custody forms and the incoming sample log, the chain of custody will be checked to ensure that all samples are stored in the appropriate locations. All samples will be stored within an access controlled custody room.

7.1.6 Sample Documentation

Evidentiary files for the entire project shall be inventoried and maintained by the GHD QA/QC Officer and shall consist of the following:

i) Project related plans

ii) Project logbooks

iii) Field data records

iv) Sample identification documents

v) Chain of custody records

vi) Report notes, calculations, etc.

vii) Lab data, etc.

viii) References, copies of pertinent literature

ix) Miscellaneous - photos, maps, drawings, etc.

x) A copy of all final reports pertaining to the project

7.1.7 Field Instrumentation

Field equipment used during this investigation will be calibrated both prior to and following the day's surveys in accordance with the manufacturer's instructions. The equipment will also be operated in accordance with the manufacturer's instructions. Records of calibrations of field equipment will be recorded in a bound field notebook.

8. Laboratory Procedures

8.1 Analytical Methods

Investigative samples will be analyzed for the parameters listed in Tables 4.1 and 4.2 using the methods cited in Table 4.3. These methods have been selected to meet the DQOs for each sampling activity.

Data deliverables for this program will include final results for the investigative samples and corresponding quality control parameters as specified in Section 10.2.

8.2 Calibration Procedures and Frequency

8.2.1 Instrument Calibration

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The frequency of calibration and the concentration of calibration standards are determined by the manufacturer guidelines, the analytical method, or the requirements of special contracts.

A bound notebook will be kept with each instrument requiring calibration in which will be recorded activities associated with quality assurance monitoring and repairs program. These records will be checked during periodic equipment review and internal and external QA/QC audits.

8.2.2 Gas Chromatography/Mass Spectrometry (GC/MS)

It is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria prior to initiating any ongoing data collection. This is accomplished through the analyses of tuning compounds as specified in the analytical methods.

Calibration of the GC/MS system will consist of an initial calibration curve utilizing at least 5 points. The initial calibration curve for each compound of interest will be verified at the beginning of the day or with each 12 hours of instrument operating time.

All method-specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of 0.99). Higher order fits will not be allowed unless the laboratory can demonstrate that the instrument is working properly and that the instrument response over the concentration range of interest is second-order.

Quantification of samples that are analyzed by GC/MS will be performed by internal standard calibration. For quantitation, the nearest internal standard free of interferences must be used.

8.2.3 Gas Chromatography

Quantification for samples that are analyzed by GC with element selective detectors shall be performed by external standard calibration. Standards containing the compounds of interest will be analyzed at a minimum of five concentrations to establish the linear range of the detector. Single point calibration will be performed at the beginning of each day and at every tenth injection. The response factors from the single point calibration will be checked against the average response factors from multi-level calibration. If deviations in response factors are outside the limits allowed by the analytical method protocols, then system recalibration will be performed. Alternatively, fresh calibration standards will be prepared and analyzed to verify instrument calibration.

All method-specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of 0.995). Higher order fits will not be allowed unless the laboratory can demonstrate that the instrument is working properly, and that the instrument response over the concentration range of interest is second-order.

8.3 Compound Identification

Compounds, which will be analyzed by GC/MS, will be identified by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard references should be obtained on the user's GC/MS within the same 12 hours as the sample analysis. These standard reference spectra may be obtained through analysis of the calibration standards. The following criteria must be satisfied to verify identification:

i) The relative retention time (RRT) of the sample component is within ±0.06 RRT units of the RRT of the standard component.

ii) Correspondence of the sample component and the standard component mass spectrum.

For GC determinations of specific analytes, the RRT of the unknown will be compared with that of an authentic standard. Since a true identification by GC is not possible, an analytical run for compound confirmation will be followed according to the specifications in the methods. Peaks must elute within daily retention time windows established for each indicator parameter to be declared a tentative or confirmed identification. Retention time windows are determined using standard protocols defined in each method.

8.4 Quantitation

The procedures for quantitation of analytes are discussed in the appropriate analytical methods. Sample results are calculated using either an external standard or an internal standard technique. External standard techniques directly compare the response from the sample to the response of the target analyte in the calibration standards. Internal standard technique utilizes the addition of a compound that resembles the target compound but is not commonly found in nature. This compound is added to all standards, samples, and quality control samples. Quantitation is based on the ratio of the target compound in the sample to the response of the internal standard in the sample compared to a similar ratio derived for each calibration standard.

8.5 Quantitation Limit Requirements

Targeted method reporting limits (MRLs) will be consistent with those presented in Tables 4.1 and 4.2 . When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified quantitation limits. Samples will not be diluted by more than a factor of five to reduce matrix effects.

Samples may be diluted to a greater extent if the concentrations of analytes of concern exceed the calibration range of the instrument. In such cases, the Laboratory QA/QC Officer will assure that the laboratory demonstrates good analytical practices and such practices are documented in order to achieve the specified quantitation limits.

9. Quality Control

9.1 Quality Control for Laboratory Analyses

Specific procedures related to internal laboratory quality control samples are described in the following subsections. The types and frequency of quality control samples is presented in Table 4.3. The laboratory is not limited to what is specified on the table, but must include it.

9.1.1 Method Blanks

A method blank will be analyzed by the laboratory at a frequency of one blank per each group of up to 20 samples analyzed or prepared at the same time. The method blank will be carried through the entire analytical procedure. No compound of interest should be detected above the quantitation limit. If a positive result is calculated, the laboratory will contact the GHD QA/QC Officer for further instructions.

9.1.2 Laboratory Control Sample/Duplicate Analyses

A laboratory control sample will be analyzed for all compounds of interest. A laboratory duplicate will be analyzed at a minimum frequency of one per analytical batch. Where method specified limits were not available, general control limits will be used. Percent recoveries will be used to evaluate analytical accuracy while the RPD between duplicate analyses will be used to assess analytical precision.

9.1.3 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses

An MS/MSD sample will be analyzed for all parameters, where applicable. MS/MSD or laboratory duplicate will be analyzed at a minimum frequency of one per analytical batch. Acceptable criteria and analytes that will be used for matrix spikes are identified in the methods (see Table 4.3 for methods). Where method specified limits were not available, general control limits will be used. Percent spike recoveries will be used to evaluate analytical accuracy, while the RPD between duplicate analyses will be used to assess analytical precision.

9.1.4 Surrogate Analyses

Surrogates are organic compounds which are similar to the analytes of interest, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Every blank, standard, and environmental sample analyzed by GC or GC/MS, including MS/MSD samples, will be spiked with surrogate compounds prior to sample preparation.

The compounds that will be used as surrogates and the levels of recommended spiking are specified in the methods. Surrogate spike recoveries must fall within the control limits specified in the methods (see Table 4.3 for methods). If any recoveries are excessively low (<10 percent), or if all recoveries in a sample are low, the laboratory will reanalyze the sample.

9.2 Quality Control for Field Sampling

To assess the quality of data resulting from the field sampling program, field duplicate and trip blanks samples will be collected and submitted to the analytical laboratory as blind samples.

9.2.1 Field Duplicate Samples

Field duplicate samples will be collected and used to assess the aggregate precision of sampling techniques and laboratory analysis. For every 20 investigative samples, a field duplicate sample will be collected and submitted blind to the laboratory. Field duplicates will be assessed using an RPD of 50 percent for groundwater and 100 percent for soil.

9.2.2 Trip Blank Sample Analysis

Trip blank samples will be collected with the groundwater samples to evaluate contamination from sample collection, transportation, storage, and analytical activities. One trip blank will be submitted per sample cooler.

9.3 Quality Control Documentation

All quality control results will be reported as part of the data package. All results will be tabulated and reported using Contract Laboratory Program (CLP)-like forms where applicable. Section 10.2 describes the requirements of the data package.

9.4 Inspection/Acceptance of Supplies and Consumables

Critical supplies and consumables for this project include field equipment, such as meters and pumps, decontamination reagents, sample bottles, and laboratory standards. The laboratory follows strict SOPs that define log in, preparation, and tracking of standards. Field equipment that is supplied by pre-approved vendors is maintained and calibrated by the vendor. All GHD-owned field equipment and reagents used in the field are ordered through the equipment manager per the GHD Quality System. The equipment manager is responsible for maintaining and calibrating all GHD-owned field instruments. All maintenance and calibrations are documented and filed. All field reagents are maintained by the equipment manager and tracked per the GHD Quality System. All field instrumentation is calibrated again in the field prior to use. This calibration is documented in the logbook and on the proper Quality System form, which is kept in the main project file.

10. Data Management Procedures

10.1 General

The contract laboratory will perform internal data verification and data review under the direction of the Laboratory QA/QC Officer. The Laboratory QA/QC Officer will be responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other qualifications based on the quality control criteria outlined in the relevant methods, which would caution the data user of possible unreliability. Data reduction, verification, and reporting by the laboratory will be conducted as detailed in the following:

i) Raw data produced and checked by the responsible analysts is turned over for independent review by another analyst.

ii) The area supervisor reviews the data for attainment of quality control criteria presented in the referenced analytical methods.

iii) Upon completion of all reviews and acceptance of the raw data by the laboratory operations manager, a computerized report will be generated and sent to the Laboratory QA/QC Officer.

iv) The Laboratory QA/QC Officer will complete a thorough inspection of all reports.

v) The Laboratory QA/QC Officer and area supervisor will decide whether any sample reanalysis is required.

vi) Upon acceptance of the preliminary reports by the Laboratory QA/QC Officer, final reports will be generated and signed by the Laboratory Project Manager.

10.2 Laboratory Reporting, Data, Presentation, and Final Report

Reporting and deliverables shall include, but not be limited to, all items listed in Table 10.1.

All sample data and corresponding QA/QC data as specified in the analytical methods, shall be maintained accessible either in hard copy and/or computer data files.

The laboratory will submit an electronic submission of the data within 15 business days of receipt of the final sample included in the sample delivery group (SDG). An SDG will consist of 20 field samples or all samples collected over a period of a week, whichever occurs first. All due dates will be calculated from the Friday of every sampling event. An electronic copy of the results and quality control will be in EQuIS format.

10.3 Document Control System

A document control system ensures that all documents are accounted for when the project is complete.

A project number will be assigned to the project. This number will appear on sample identification tags, logbooks, data sheets, control charts, project memos, analytical reports, document control logs, corrective action forms and logs, quality assurance plans, and other project analytical records. With the exception of field related documents, all documents are electronically stored per the GHD Quality System. Field related documents are stored at GHD's Tacoma office.

Electronic deliverables are maintained on a secured drive of the GHD network and are only accessible to approved GHD personnel. Electronic data deliverables are uploaded into a main project database. The database is only accessible to approved database personnel.

10.4 Quality Control Check Points and Data Flow

The following specific quality control checkpoints will be common to all analyses. They are presented with the decision points.

Chemist - Bench Level Checks

- Systems Check: sensitivity, linearity, and reproducibility within specified limits
- Duplicate analyses within control limits
- Blank spike results within control limits
- Calculation/data reduction checks: calculations cross-checked, any discrepancies between forms and results evident, results tabulated sequentially on the correct forms

Laboratory Project Manager

- Systems operating within limits
- Data transcription correct
- Data complete
- Data acceptable

Sample Control

- Samples returned to sample control following analysis

Laboratory Quality Assurance/Quality Control Officer

- Quality assurance objectives met
- Quality control checks are completed
- Final data and report package is complete

11. Audits

For the purpose of external evaluation, performance evaluation check samples are analyzed periodically by the laboratory. Internally, the evaluation of data from these samples is done on a continuing basis over the duration of a given project.

The GHD QA/QC Officer may carry out performance and/or systems audits to insure that data of known and defensible quality are consistently produced during this program.

Systems audits are qualitative evaluations of all components of field and laboratory quality control measurement systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational during the program or after completion of the program. Such audits typically involve a comparison of the activities given in the QA/QC Plan described herein, with activities actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

The performance audit is a quantitative evaluation of the measurement systems used for a monitoring program. It requires testing the measurement systems with samples of known composition or behavior to quantitatively evaluate precision and accuracy. A performance audit may be carried out by or under the auspices of the GHD QA/QC Officer without the knowledge of the analyst during each sampling event for this program.

It should be noted, however, that any additional external quality assurance audits will only be performed if deemed necessary.

12. Data Review, Verification, and Validation

12.1 General

Validation of the analytical data will be performed by the GHD QA/QC Officer. The data validation will be performed in accordance with the methods and guidance from the documents, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", United States Environmental Protection Agency (USEPA) 540 R 2016 002, September 2016 and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", USEPA 540 R 2016 001, September 2016.

Data associated with the investigation will receive a Level II validation. Assessment of analytical and in-house data will include checks on data consistency by looking for comparability of duplicate analyses, comparability to previous data from the same sampling location (if available), adherence to accuracy and precision control criteria detailed in this QAPP and anomalously high or low parameter values. The results of these data validations will be reported to the Project Manager and the contract laboratory, noting any discrepancies and their effect upon acceptability of the data.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the report. Where data have been reduced or summarized, the method of reduction will be documented in the report. Field data will be audited for anomalously high or low values that may appear to be inconsistent with other data.

13. Data Quality Assessment

Final reports will contain a discussion on QA/QC summarizing the quality of the data collected and/or used as appropriate for each phase of the project. The Project Manager who has responsibility for these summaries will rely on written reports/memoranda documenting the data assessment activities, performance and systems audits, and footnotes identifying qualifications to the data, if any.

Each summary of sampling activities will include a tabulation of the data including:

i) Field duplicate sample results

ii) Maps showing sample locations

iii) An explanation of any sampling conditions or quality assurance problems and their effect on data quality

The GHD QA/QC Officer will prepare quality assurance reports following receipt of all analytical data. These reports will include discussions of the following and their effects on the quality of the data reported:

i) Sample holding times

ii) Laboratory/method blank data

iii) Laboratory control sample recoveries

iv) Field QA/QC data

v) Audit results (if performed)

In addition, the quality assurance reports will summarize all quality assurance problems and give a general assessment of quality assurance results versus control criteria for such parameters as accuracy, precision, etc. The quality assurance reports will be forwarded to the Project Manager.

13.1 Specific Routine Procedures Uses to Assess Data Precision, Accuracy, and Completeness

13.1.1 Precision

Precision will be assessed by comparing the analytical results between duplicate analyses. Precision as percent relative difference will be calculated as follows for values significantly greater than the associated detection limit:

$$\text{Precision} = \left| \frac{(D_2 - D_1)}{(D_1 + D_2)/2} \right| \times 100$$

- D_1 = sample result
- D_2 = duplicate sample result

For results near the associated detection limits, precision will be assessed based on the following criteria:

$$\text{Precision} = \left| \text{Original result} - \text{duplicate result} \right| < \text{CRDL}$$ [1]

13.1.2 Accuracy

Accuracy will be assessed by comparing a set of analytical results to the accepted or "true" values that would be expected. In general, laboratory control sample recoveries will be used to assess accuracy. Accuracy as percent recovery will be calculated as follows:

$$\text{Accuracy} = \frac{A - B}{C} \times 100$$

- A = The analyte determined experimentally from the spike sample
- B = The background level determined by a separate analysis of the unspiked sample
- C = The amount of spike added

13.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set must contain all quality control check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the database is sufficient.

When possible, the percent completeness for each set of samples will be calculated as follows:

$$\text{Completeness} = \frac{\text{usable data obtained}}{\text{total data planned}} \times 100 \text{ percent}$$

13.1.4 Quality Control Exceedances

Procedures discussed previously will be followed for documenting deviations. In the event that a result deviates significantly from method established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

14. Preventative Maintenance

This section applies to both field and laboratory equipment. Specific preventive maintenance procedures for field equipment will be consistent with the manufacturer's guidelines. Specific

[1] CRDL - Contract Required Detection Limit.

preventive maintenance protocols for laboratory equipment will be consistent with the contract laboratory's SOPs.

All analytical instruments to be used in this project will be serviced by laboratory personnel at regularly scheduled intervals in accordance with the manufacturers' recommendations. Instruments may also be serviced at other times due to failure. Requisite servicing beyond the abilities of laboratory personnel will be performed by the equipment manufacturer or their designated representative.

Routine maintenance of the instruments will be performed as per manufacturers' recommendations. The Laboratory Project Manager is responsible for the preventive maintenance of the instruments.

15. Corrective Action

The need for corrective action may be identified by system or performance audits or by standard quality control procedures. The essential steps in the corrective action system will be:

i) Checking the predetermined limits for data acceptability beyond which corrective action is required

ii) Identifying and defining problems

iii) Assigning responsibility for investigating the problem

iv) Investigating and determining the cause of the problem

v) Determination of a corrective action to eliminate the problem (this may include reanalysis or resampling and analyses)

vi) Assigning and accepting responsibility for implementing the corrective action

vii) Implementing the corrective action and evaluating the effectiveness

viii) Verifying that the corrective action has eliminated the problem

ix) Documenting the corrective action taken

x) Follow-up audits will be performed to verify deficiencies have been corrected

For each measurement system, the Laboratory QA/QC Officer will be responsible for initiating the corrective action, and the Laboratory Project Manager will be responsible for implementing the corrective action.

Table 4.1

Analytical Parameters - Soil
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

	Method	Targeted Quantitation Limit (mg/kg)
Volatile Organic Compounds (VOCs)		
1,2-Dibromoethane (EDB)	SW-846 8260(1)	0.005
1,2-Dichloroethane (EDC)	SW-846 8260(1)	--
Benzen	SW-846 8260(1)	0.03
Ethylbenzene	SW-846 8260(1)	6
Hexane	SW-846 8260(1)	--
Methyl-tert-butyl ether (MTBE)	SW-846 8260(1)	0.1
Naphthalene	SW-846 8260(1)	5
Toluene	SW-846 8260(1)	7
Total Xylenes	SW-846 8260(1)	9
Semivolatile Organic Compounds (SVOCs)		
1-Methylnaphthalene	SW-846 8270 SIM(1)	0.1
2-Methylnaphthalene	SW-846 8270 SIM(1)	0.1
Acenaphthene	SW-846 8270 SIM(1)	0.1
Acenaphthylene	SW-846 8270 SIM(1)	0.1
Anthracene	SW-846 8270 SIM(1)	0.1
Benzo(a)anthracene	SW-846 8270 SIM(1)	0.1
Benzo(a)pyrene	SW-846 8270 SIM(1)	0.1
Benzo(b)fluoranthene	SW-846 8270 SIM(1)	0.1
Benzo(g,h,i)perylene	SW-846 8270 SIM(1)	0.1
Benzo(k)fluoranthene	SW-846 8270 SIM(1)	0.1
Chrysene	SW-846 8270 SIM(1)	0.1
Dibenz(a,h)anthracene	SW-846 8270 SIM(1)	0.1
Fluoranthene	SW-846 8270 SIM(1)	0.1
Fluorene	SW-846 8270 SIM(1)	0.1
Indeno(1,2,3-cd)pyrene	SW-846 8270 SIM(1)	0.1
Naphthalene	SW-846 8270 SIM(1)	0.1
Phenanthrene	SW-846 8270 SIM(1)	0.1
Pyrene	SW-846 8270 SIM(1)	0.1
Total Petroleum Hydrocarbons (TPH)		
Gasoline Range Organics (GRO)	NWTPH-Gx(2)	30
Diesel Range Organics (DRO)	NWTPH-Dx(2)	2000
Oil Range Organics ORO)	NWTPH-Dx(2)	2000
Extractable Petroleum Hydrocarbons (EPH)	NWTPH-EPH(2)	--
Volatile Petroleum Hydrocarbons (VPH)	NWTPH-VPH(2)	--

Table 4.1

Analytical Parameters - Soil
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

	Method	Targeted Quantitation Limit (mg/kg)
Metals		
Total Lead	SW-846 6010[(1)]	250
Physical Properties		
Moisture Content	ASTM D2974[(3)]	--

Notes:

(1) SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, with subsequent revisions

(2) NWTPH - Referenced from "Washington State Department of Ecology Analytical Methods for Petroleum ' Hydrocarbons", Publication No. ECY 97-602, June 1997.

(3) ASTM - Annual Book of ASTM Standards, American Society for Testing Materials, Section 5 and Section 11

SIM Select Ion Monitoring

-- Not Applicable

Table 4.2

Analytical Parameters - Groundwater
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

	Method	Targeted Quantitation Limit (µg/L)
Volatile Organic Compounds (VOCs)		
1,2-Dibromoethane (EDB)	SW-846 8260(1)	0.01
1,2-Dichloroethane (EDC)	SW-846 8260(1)	5
Benzen	SW-846 8260(1)	5
Ethylbenzene	SW-846 8260(1)	700
Methyl-tert-butyl ether (MTBE)	SW-846 8260(1)	20
Naphthalene	SW-846 8260(1)	160
Toluene	SW-846 8260(1)	1000
Total Xylenes	SW-846 8260(1)	1000
Semivolatile Organic Compounds (SVOCs)		
1-Methylnaphthalene	SW-846 8270 SIM(1)	0.1
2-Methylnaphthalene	SW-846 8270 SIM(1)	0.1
Acenaphthene	SW-846 8270 SIM(1)	0.1
Acenaphthylene	SW-846 8270 SIM(1)	0.1
Anthracene	SW-846 8270 SIM(1)	0.1
Benzo(a)anthracene	SW-846 8270 SIM(1)	0.1
Benzo(a)pyrene	SW-846 8270 SIM(1)	0.1
Benzo(b)fluoranthene	SW-846 8270 SIM(1)	0.1
Benzo(g,h,i)perylene	SW-846 8270 SIM(1)	0.1
Benzo(k)fluoranthene	SW-846 8270 SIM(1)	0.1
Chrysene	SW-846 8270 SIM(1)	0.1
Dibenz(a,h)anthracene	SW-846 8270 SIM(1)	0.1
Fluoranthene	SW-846 8270 SIM(1)	0.1
Fluorene	SW-846 8270 SIM(1)	0.1
Indeno(1,2,3-cd)pyrene	SW-846 8270 SIM(1)	0.1
Naphthalene	SW-846 8270 SIM(1)	0.1
Phenanthrene	SW-846 8270 SIM(1)	0.1
Pyrene	SW-846 8270 SIM(1)	0.1
Total Petroleum Hydrocarbons (TPH)		
Gasoline Range Organics (GRO)	NWTPH-Gx(2)	800
Diesel Range Organics (DRO)	NWTPH-Dx(2)	500
Oil Range Organics ORO)	NWTPH-Dx(2)	500

Table 4.2

Analytical Parameters - Groundwater
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

	Method	Targeted Quantitation Limit
Metals		
Total Lead	SW-846 6010[(1)]	15

Notes:

(1) SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, with subsequent revisions

(2) Hydrocarbons", Publication No. ECY 97-602, June 1997. NWTPH - Referenced from "Washington State

SIM Select Ion Monitoring

Table 4.3

Sampling and Analysis Summary
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

Matrix	Analytical Parameter	Analytical Method	Estimated Number of Samples	Field Duplicates	Trip Blanks	MS/MSD/Dup
Soil						
	Volatile Organic Compounds (VOCs)	SW-846 8260[1]	19	1	1 / day	1/1/0
	Semivolatile Organic Compounds (SVOCs)	SW-846 8270 SIM[1]	19	1	--	1/1/0
	Total Petroleum Hydrocarbons (TPH)	NWTPH[2]	19	1	--	1/1/0
	Metals	SW-846 6010[1]	19	1	--	1/1/0
	Moisture Content	ASTM D2974[3]	19	--	--	0/0/1
Groundwater						
	Volatile Organic Compounds (VOCs)	SW-846 8260[1]	5	1	1 / day	1/1/0
	Semivolatile Organic Compounds (SVOCs)	SW-846 8270 SIM[1]	5	1	--	1/1/0
	Total Petroleum Hydrocarbons (TPH)	NWTPH[2]	5	1	--	1/1/0
	Metals	SW-846 6010[1]	5	1	--	1/1/0

Notes:

(1) SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, with subsequent revisions

(2) NWTPH - Referenced from "Washington State Department of Ecology Analytical Methods for Petroleum Hydrocarbons", Publication No. ECY 97-602, June 1997.

(3) ASTM - Annual Book of ASTM Standards, American Society for Testing Materials, Section 5 and Section 11

SIM Select Ion Monitoring
Dup Duplicate
MS/MSD Matrix Spike/Matrix Spike Duplicate
-- Not applicable

Table 7.1

Sample Container, Preservation, and Holding Time Periods
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

Analyses	Sample Containers	Preservation	Maximum Holding Time	Notes
Soil				
Volatile Organic Compounds (VOCs)	Two 40-mL glass vials with sodium bisulfate or DI water	Cool <6°C	14 days to analysis	Fill per instructions
Semivolatile Organic Compounds (SVOCs)	One 4-oz. glass jar	Cool <6°C	14 days to extraction, 40 days to analysis	
Gasoline Range Organics (GRO)/ Volatile Petroleum Hydrocarbons (VPH)	Four 40-mL glass vials with methanol	Cool <6°C	14 days to analysis	Fill per instructions
Diesel Range Organics (DRO)/ Oil Range Organics ORO)/	One 4-oz. glass jar	Cool <6°C	14 days to extraction, 40 days to analysis	
Extractable Petroleum Hydrocarbons (EPH)	One 8-oz. glass jar	Cool <6°C	14 days to extraction, 40 days to analysis	
Metals	One 4-oz. glass jar	Cool <6°C	180 days to analysis	
Moisture Content	One 4-oz. glass jar	Cool <6°C	7 days to analysis	
Groundwater				
Volatile Organic Compounds (VOCs)	Three 40-mL glass vials Teflon-lined septum	pH <2, HCl Cool <6°C	14 days from collection to analysis	Fill completely with no head space
Semivolatile Organic Compounds (SVOCs)	Two 1L Amber	Cool <6°C	7 days to extraction, 40 days to analysis	
Gasoline Range Organics (GRO)	Three 40-mL glass vials Teflon-lined septum	pH <2, HCl Cool <6°C	14 days from collection to analysis	Fill completely with no head space
Diesel Range Organics (DRO)/ Oil Range Organics ORO)	Two 250-mL Amber	pH <2, HCl Cool <6°C	14 days to extraction, 40 days to analysis	
Metals	250-mL HDPE	pH <2, HNO_3 Cool <6°C	180 days to analysis	

Notes:

HCl Hydrochloric Acid
HDPE High-Density Polyethylene
HNO_3 Nitric Acid

Table 10.1

Laboratory Reporting Deliverables
Supplemental Remedial Investigation
Former Unocal Bulk Plant 0046
Phillips 66 Company
Bingen, Washington

A detailed report narrative should accompany each submission, summarizing the contents and results

A. Chain of Custody Documentation and Detailed Narrative[(1)]

B. Sample Information
   1. Date collected
   2. Date extracted or digested
   3. Date analyzed
   4. Analytical method and reference

C. Data (including all raw data and Contract Laboratory Program [CLP]-like summary forms)
   1. Samples
   2. Laboratory duplicates[(2)]
   3. Method blanks
   4. Spikes, spike duplicates[(2)] [(3)]
   5. Surrogate recoveries[(2)]
   6. Internal standard recoveries
   7. Calibration
   8. Any other applicable quality control (QC) data (i.e., serial dilution)

D. Miscellaneous
   1. Method detection limits and/or instrument detection limits
   2. Percent solids (where applicable)
   3. Metals run logs
   4. Standard preparation logs
   5. Sample preparation logs

All sample data and its corresponding quality assurance/quality control (QA/QC) data shall be maintained accessible to GHD in electronic format.

Notes:

(1) Any QC outliers must be addressed and corrective action taken must be specified
(2) Laboratory must specify applicable control limits for all QC sample results
(3) A blank spike must be prepared and analyzed with each sample batch

about
GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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