Groundwater Monitoring Sampling and Analysis Plan

Cap Sante Marine Site
Anacortes, Washington
Ecology Consent Decree No. 9917

for
Washington State Department of Ecology on Behalf of Port of Anacortes

May 30, 2014

GeoEngineers
Earth Science + Technology

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GeoEngineers

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Anacortes, Washington
Ecology Consent Decree No. 9917

File No. 5147-005-10

May 30, 2014

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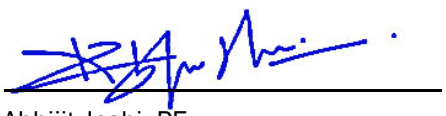

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LIST OF ABBREVIATIONS AND ACRONYMS

BGS	Below ground surface
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
COCs	Chemicals of Concern
DO	Dissolved oxygen
EC	Electric Conductivity
Ecology	Washington State Department of Ecology
FS	Feasibility Study
GeoEngineers	GeoEngineers Inc.
HASP	Health and Safety Plan
MTCA	Model Toxics Control Act
MLLW	Mean lower low water
NWTPH	Northwest Total Petroleum Hydrocarbon
PAHs	Polycyclic aromatic hydrocarbons
pH	Acidity
Port	Port of Anacortes
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
ORP	Oxygen reduction potential
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
TDS	Total dissolved solids
TEQ	Toxicity equivalent
TOC	Top of Well Casing
TPH	Total petroleum hydrocarbons
RI	Remedial Investigation
UST	Underground Storage Tank
WAC	Washington Administrative Code

1.0 INTRODUCTION

This document presents the Groundwater Monitoring Sampling and Analysis Plan (SAP) to evaluate groundwater conditions for the Cap Sante Marine Site (Site) located between 11th and 13th Streets east of Q Avenue in Anacortes, Washington (Figure 1). The Site is referred to in the Washington State Department of Ecology (Ecology) databases as the Cap Sante Marine Site (Ecology Facility/Site Identification No. 67532227) and is subject to cleanup actions in accordance with Ecology Consent Decree No. 9917 (Consent Decree). Ecology is managing the Site as part of the Fidalgo and Padilla Bay component to the Puget Sound Initiative.

The Site includes portions of the Former Cap Sante Marine Lease Area and Fisherman's Work and Parking Area (see Figure 2) that have been environmentally impacted from historical uses of these areas. Residual contamination exceeding Model Toxics Control Act (MCTA) cleanup levels remains in-place at the Site following implementation of Ecology's Cleanup Action Plan (CAP; Ecology 2013), and engineering and institutional controls have been established to prevent human/terrestrial wildlife contact with this contamination. Compliance groundwater monitoring will be performed by the Port of Anacortes (Port) to evaluate the long-term effectiveness of the cleanup action and to ensure that the residual contaminants remaining in soil do not pose a threat to human health and the environment.

This SAP has been prepared pursuant to the requirement of the Consent Decree and describes the sampling and analysis approach to be used to perform groundwater compliance monitoring. The objectives of groundwater compliance monitoring are to confirm natural attenuation performance and to ensure that groundwater conditions at the point of compliance (i.e., point at which groundwater discharges to the surface waters of Fidalgo bay) do not exceed MTCA cleanup levels. The primary objective of this SAP is to describe the location and number of groundwater monitoring wells, constituents of concern (COCs) that will be evaluated, and frequency and duration of monitoring that will be performed. Supporting documents to this SAP include a Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP).

2.0 BACKGROUND INFORMATION

Background information describing the Site including its known history, current uses, extent of contamination in site media (soil, groundwater and sediment), a summary of environmental investigations and interim remedial action completed at the Site is presented in the Remedial Investigation/Feasibility Study Report (RI/FS; GeoEngineers, 2013) and CAP (Ecology, 2013). The following sections provide a general description of the Site including site history, geology and hydrogeology, and summary of contamination remaining at the Site.

2.1. Historical Use and Cleanup Actions Performed

The Site and surrounding area was originally a portion of the Fidalgo Bay tide flats, which were filled to the current grade between the 1940s and early 1950s using dredged material from the adjacent federal waterway. The property was acquired by the Port in 1956 and was leased to a series of tenants who operated a boatyard and marina support area providing small boat storage,

boat launch, boat maintenance, and offshore fueling facilities. From the late 1970s to 2007, Cap Sante Marine, Ltd. occupied the Former Cap Sante Marine Lease Area and provided small vessel storage, launch, and minor maintenance services. Vessel fueling was historically provided from a float located offshore from the Site. Fuel (gasoline, diesel, and two-stroke oil pre-mix) was supplied to the float via a series of underground pipelines that were supplied by the former underground storage tanks (USTs) that were located within the Former Cap Sante Marine Lease Area.

During the early 1980s, petroleum fuel was observed seeping into the marine waters at several locations east of the Site which were the result of leaking USTs and/or associated product lines. Although the USTs and supply lines were repaired in 1982, petroleum seepage continued to be observed at the Site. In 1984, the Port installed and operated a petroleum recovery system under order from the U.S. Coast Guard to control the observed fuel seepage. The petroleum recovery system consisted of an interceptor recovery trench system coupled with a recovery well. The recovery trench extended to a depth of about 8 to 10 feet below ground surface (bgs). After six months of operation, petroleum seepage into the harbor was no longer observed and product recovery operations ceased. During operation of the recovery system approximately 1,250 gallons of fuel were recovered from the trench. In 1985 the Port discontinued product recovery operations and replaced the old USTs with two new 12,000 gallon fuel tanks. Fueling service at the Site was discontinued and the fuel float facility was demolished in 2006 as part of Site redevelopment activities.

In 2007, the Port completed an interim action to address petroleum and metals contaminated soil in the vicinity of the historical USTs. Results of confirmation soil samples obtained during the interim action remedial excavation activities (GeoEngineers, 2008) as well as the post-interim action groundwater monitoring results (GeoEngineers, 2009a; GeoEngineers, 2009b) demonstrated that the interim action was successful in addressing contamination at this portion of the Site. Area redevelopment was completed in conjunction with the 2007 interim action and included shoreline habitat restoration, construction of an engineered retaining block wall and public access walkway (esplanade) within the former Cap Sante Marine Lease Area. In 2010, a restaurant with surface parking was constructed west of the esplanade. Other areas of the Site are used for boat launching and general parking. The Former Cap Sante Marine and Fisherman's Work and Parking Areas are shown relative to the current property and surrounding area layout on Figure 2.

2.2. Geology and Hydrogeology

Soil at the Site generally consists of dredged fill material overlying native marine sediment (silts and sands) and glacial deposits. The dredged fill material is comprised of a fine to medium sand with varying amounts of silt and gravel and extends from the ground surface to depths of approximately 5 to 12 feet bgs. The fill material is typically about 8 feet thick in most areas of the Site.

Three hydrogeologic units have been identified at the Site, including: (1) a shallow, unconfined aquifer occurring in the dredged fill; (2) a native silt confining unit; and (3) a deeper, confined aquifer. Measured depth to groundwater at the Site ranges from approximately 4 to 6 feet bgs (approximately Elevation 7 to 8.5 feet mean lower low water [MLLW]). Observed groundwater flow

direction is predominantly to the east-southeast toward Cap Sante Marina. Based on the results of tidal studies completed at the Site, tidal influence on groundwater levels and flow direction appears to be limited with a 0.8-foot fluctuation in groundwater levels in near shore wells during a high-low tide cycle. Measured fluctuation in groundwater levels away from the shore (approximately 100 to 200 feet) is approximately 0.1 feet.

2.3. Current Site Conditions

2.3.1. Soil Conditions

Based on the result of previous remedial investigation (RI) studies (Landau, 2007 and GeoEngineers, 2013) and as described in the CAP, COCs including gasoline- and/or diesel-range petroleum hydrocarbon and polycyclic aromatic hydrocarbons (PAHs) are present in soil within the southwest portion of the Former Cap Sante Marine Lease Area and the northeast portion of the Fisherman's Work and Parking Area at concentrations exceeding soil cleanup levels established by the CAP. COCs in the southwest portion of the former Cap Sante Marine Lease Area include gasoline- and diesel-range petroleum hydrocarbons, and PAHs in soil at depths ranging from 8 to 14 feet bgs. COCs in the northeast portion of the Fisherman's Work and Parking Area include gasoline-range petroleum hydrocarbon and PAHs in soil at depths ranging from 3 to 10 feet bgs. Chemical analytical results and locations of the RI samples documenting presence of these COCs in Site soils are presented in the RI/FS Report. The approximate areas of COCs exceedances in soil are shown relative to the Site on Figure 2.

2.3.2. Groundwater Conditions

Results of groundwater monitoring activities following the completion of the 2007 interim action indicated that groundwater in the vicinity of the historical USTs did not exceed cleanup levels established by the CAP. Additionally, results of the 2012 RI study indicated that residual contamination located in the southwest portion of the Former Cap Sante Marine Area and northeast portion of the Fisherman's Work and Parking Area is not adversely impacting groundwater at the Site.

3.0 COMPLIANCE GROUNDWATER MONITORING

The compliance groundwater monitoring program will utilize the established network of monitoring wells to evaluate the groundwater conditions at the Site. In accordance with the CAP, existing monitoring wells at the Site will be sampled on a quarterly basis for at least one year. Further monitoring requirements will be evaluated by Ecology following completion of the initial year of monitoring. The following sections describe monitoring well locations, sampling frequency, and sampling procedures for the compliance groundwater monitoring program.

3.1. Monitoring Well Network

Existing groundwater monitoring wells GEI-MW-6 and GEI-MW-7 will be used to evaluate groundwater conditions within and/or downgradient of residual soil contamination. Monitoring well GEI-MW-6 is positioned downgradient of residual petroleum hydrocarbon and PAH contaminated soil located in the southwest corner of the Former Cap Sante Marine Lease Area. Monitoring well GEI-MW-7 is positioned at the shoreline within the area of residual petroleum hydrocarbon and PAH contaminated soil located in the eastern portion of the Fisherman's Work and Parking Area.

Monitoring wells GEI-MW-6 and GEI-MW-7 are shown on Figure 2. Well construction details for GEI-MW-6 and GEI-MW-7 are presented in Appendix C.

3.2. Groundwater Sampling Frequency

In accordance with the CAP, samples will be initially collected on a quarterly basis from well locations GEI-MW-6 and GEI-MW-7 for a minimum of four consecutive quarters to evaluate groundwater conditions at the Site. If, following completion of four consecutive quarters of groundwater sampling, results indicate that cleanup levels are being met the quarterly groundwater sampling schedule will be discontinued and the frequency of any continued sampling evaluated by Ecology. If COCs exceed groundwater cleanup levels after the four initial quarterly monitoring events, additional groundwater monitoring will be conducted on a semi-annual basis for two years. If groundwater sample results continue to exceed the groundwater cleanup levels after two years without abating, additional monitoring will be considered by Ecology.

3.3. Groundwater Sampling and Analysis

Groundwater samples will be collected from each of the two monitoring wells and analyzed for the chemical parameters identified in Table 1. The analytical results will be compared to Site cleanup levels (see Table 1) to evaluate whether residual soil contamination is adversely impacting groundwater at the Site. Groundwater sampling procedures are summarized below.

3.3.1. Groundwater Sampling Procedure

Groundwater levels will be measured at each monitoring well location during each monitoring event to the nearest 0.01 foot prior to sampling using an electric water level indicator (e-tape). The water levels will be recorded relative to the surveyed casing rim elevations.

Monitoring wells GEI-MW-6 and GEI-MW-7 located within zone of tidal influence (i.e., 200 feet from the shoreline based on previous tidal studies, see Section 2.2) will be sampled within one hour of the lowest tide level on the day of sampling to the extent practicable. Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in groundwater samples. Groundwater samples will be obtained from monitoring wells using a peristaltic pump and disposable polyethylene tubing. Specifically, groundwater will be pumped at approximately 0.5 liter per minute or less using a peristaltic pump through tubing placed within the screened interval. A Horiba U-22 water quality measuring system (with flow-through-cell) or equivalent will be used to monitor the following water quality parameters during purging:

- Electrical conductivity (EC),
- Dissolved oxygen (DO),
- Acidity (pH),
- Total dissolved solids (TDS),
- Oxygen reduction potential (ORP),
- Turbidity,
- Salinity, and
- Temperature.

Water samples will be obtained after these parameters vary by less than 10 percent on three consecutive measurements (i.e., ambient groundwater conditions). The stabilized field measurements will be documented on a field log, and then groundwater samples will be obtained. Purge water generated during these activities will be stored in labeled 30-gallon or 55-gallon drums for subsequent characterization.

All reusable sampling equipment will be decontaminated prior to use using the procedures described in the QAPP (Appendix A).

3.3.2. *Chemical Analysis*

Water samples will be obtained from monitoring wells GEI-MW-6 and GEI-MW-7 for COCs to evaluate compliance with the Site cleanup standards presented in Table 1, including:

- Gasoline-range hydrocarbons using Ecology Method NWTPH-Gx,
- Diesel- and heavy oil-range hydrocarbons using Ecology Method NWTPH-Dx, and
- Polycyclic aromatic hydrocarbons (PAHs) using EPA Method 8270 SIM.

Sample handling procedures, including labeling, container and preservation are described in the QAPP (Appendix A).

3.3.3. *Disposition of Investigation-Derived Materials*

3.3.3.1. PURGE AND DECONTAMINATION WATER

Purge and decontamination water generated during monitoring well installation and/or sampling activities will be placed in labeled and sealed 30-gallon or 55-gallon drums. The drums will be temporarily stored at the Site in a secure location pending receipt of chemical analytical results and identification of an appropriate disposal facility.

3.3.3.2. DISPOSITION OF INCIDENTAL WASTE

Incidental waste generated during sampling activities such as gloves, plastic sheeting, paper towels and similar expended and discarded field supplies will be disposed of at local trash receptacle or county disposal facility.

3.4. Monitoring Well Decommissioning

Upon receipt of approval from Ecology that the compliance monitoring is complete and the monitoring wells will no longer be used, monitoring wells GEI-MW-6 and GEI-MW-7 will be decommissioned by a well driller licensed in the State of Washington in accordance with Ecology requirements (WAC 173-160-460).

4.0 QUALITY ASSURANCE AND CONTROL

Quality assurance/quality control (QA/QC) procedures and standards that will be implemented during groundwater monitoring activities are presented in the QAPP (Appendix A). The purpose of this document is to describe quality control procedures that will be implemented to produce chemical and field data that are representative, valid and accurate for use in evaluating the environmental data.

5.0 HEALTH AND SAFETY

Groundwater monitoring and sampling activities will be performed in accordance with the requirements of the Federal Occupational Safety and Health Act (29 CFR 1910, 1926). These regulations include requirements that workers are to be protected from exposure to contaminants. A Site HASP describing actions that will be taken to protect the health and safety of GeoEngineers, Inc.'s (GeoEngineers) personnel is provided in Appendix B.

6.0 SCHEDULE

Initial groundwater monitoring activities will be performed on a quarterly basis for one year following Ecology approval of this SAP. Currently, it is anticipated that initial groundwater monitoring activities will be performed in August 2014, November 2014, February 2015 and May 2015. The schedule for additional groundwater monitoring will be based on analytical results from the initial four monitoring events (i.e., semi-annual monitoring) or as determined by Ecology for evaluating the long-term effectiveness of the cleanup action. No groundwater monitoring activities will be performed without prior approval from Ecology.

7.0 REPORTING

The results of the compliance groundwater monitoring will be provided to Ecology following each of the monitoring events as part of the project progress reporting. After completion of the four initial quarterly groundwater monitoring events, a Compliance Groundwater Monitoring Report summarizing the results of each quarterly groundwater monitoring event will be submitted to Ecology for review. Data generated as part of the groundwater monitoring program will be submitted to Ecology in the format required by Environmental Information Management (EIM) Policy 840 following completion of data review and validation.

8.0 LIMITATIONS

This report has been prepared for the exclusive use of the Port of Anacortes, their authorized agents and regulatory agencies in their evaluation of the Cap Sante Marine Site in Anacortes, Washington. No other party may rely on the product of our services unless we agree in advance and in writing to such reliance.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions express or implied should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

9.0 REFERENCES

GeoEngineers, Inc. (GeoEngineers, 2008), "Interim Action Report, Cap Sante Marine, Ecology Agreed Order No. DE-07TCPHQ-4197, Anacortes, Washington," GEI File No. 5147-005-03, prepared for the Port of Anacortes, December 9, 2008.

GeoEngineers, Inc. (GeoEngineers, 2009a), "September 2008 Compliance Groundwater Monitoring, Cap Sante Marine, Ecology Agreed Order No. DE-07TCPHQ-4197, Anacortes, Washington," GEI File No. 5147-005-05, prepared for the Port of Anacortes, January 12, 2009.

GeoEngineers, Inc. (GeoEngineers, 2009b), "March 2009 Compliance Groundwater Monitoring, Cap Sante Marine, Ecology Agreed Order No. DE-07TCPHQ-4197, Anacortes, Washington," GEI File No. 5147-005-05, prepared for the Port of Anacortes, April 29, 2009.

GeoEngineers, Inc. (GeoEngineers, 2013), "Remedial Investigation/Feasibility Study, Cap Sante Marine, Anacortes, Washington, Ecology Agreed Order No. DE-07TCPHQ-4197," GEI File No. 5147-005-09, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, December 10, 2013.

Landau Associates (Landau, 2007), "Landau Associates, Investigation Data Report, Cap Sante Marine Lease Area, Anacortes, Washington," prepared for the Port of Anacortes, August 21, 2007.

Washington State Department of Ecology (Ecology, 2013), "Cleanup Action Plan (CAP), Cap Sante Marine Site, Anacortes, Washington," by the Washington State Department of Ecology, Toxics Cleanup Program, Lacey, Washington, December 10, 2013.

TABLES

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Table 1

Groundwater Cleanup Levels[1]

Cap Sante Marine Site

Anacortes, Washington

Constituent	Groundwater Cleanup Level (µg/L)
Petroleum Hydrocarbons	
Gasoline-Range	1,000
Diesel-Range	500
Heavy Oil-Range	500
Non-Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)	
Acenaphthene	643
Acenaphthylene	NE
Anthtracene	25,900
Benzo(ghi)perylene	NE
Fluoranthene	90
Fluorene	3,460
Naphthalenes	4,940
Phenanthrene	NE
Pyrene	2,590
Carcinogenic PAHs	
Benzo(a)anthracene	see TEQ
Benzo(a)pyrene	see TEQ
Benzo(b)fluoranthene	see TEQ
Benzo(k)fluoranthene	see TEQ
Chrysene	see TEQ
Dibenz(a,h)anthracene	see TEQ
Indeno(1,2,3-cd)pyrene	see TEQ
Total cPAHs (TEQ)	0.100

Notes:

[1]Groundwater cleanup levels referenced from the Cleanup Action Plan (Ecology, 2013).

NE = not established.

µg/L = micrograms per liter

TEQ = toxicity equivalency

FIGURES

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N
W E
S

2,000 0 2,000

Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Cap Sante Marine Site
Anacortes, Washington

GeoEngineers

Figure 1

Path: \\sea\projects\5\5147005\GIS\5147005l0_VicinityMap.mxd Map Revised: 21 May 2014 cgonzales

CENTRAL PIER

MSE BLOCK WALL

ESPLANADE (CONCRETE PAVEMENT)

RESTAURANT (ANTHONY'S)

B DOCK

A DOCK

BOAT LAUNCH

T DOCK

ROCK REVETMENT

GEI-MW-7

HISTORICAL BULKHEAD (APPROXIMATE)

CAP SANTE MARINE INTERIM ACTION (2007)

ESPLANADE (CONCRETE PAVEMENT)

FISHERMAN'S WORK AND PARKING AREA

FORMER CAP SANTE MARINE LEASE AREA

GEI-MW-6

OFFICE BUILDING

MARINE STORAGE WAREHOUSE (WEB LOCKER)

MARINE STORAGE WAREHOUSE (WEB LOCKER)

HISTORICAL BULKHEAD (APPROXIMATE)

Q AVE

Path: \\sea\projects\5\51470050\GIS\51470050_CurrentSiteConditionsGW_rev032414.mxd Map Revised: 30 May 2014 maugust

Data Source: Base aerial provided by the Port of Anacortes, March 2013. Skagit County GIS.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes:
1. Sampling locations in the vicinity of the areas identified to contain COCs exceeding site cleanup levels are shown on this figure.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Legend

Monitoring Well Location

Areas With Contaminant of Concern (COCs) Exceeding Soil Cleanup Level

Approximate Area of TPH Exceedance in Soil

Approximate Area of PAH Exceedance in Soil

PAH - Polycyclic Aromatic Hydrocarbons

TPH - Petroleum Hydrocarbons (Gasoline, Diesel and/or Heavy Oil)

N E S W

60 0 60

Feet

Site Plan

Cap Sante Marine Site
Anacortes, Washington

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Figure 2

APPENDICES

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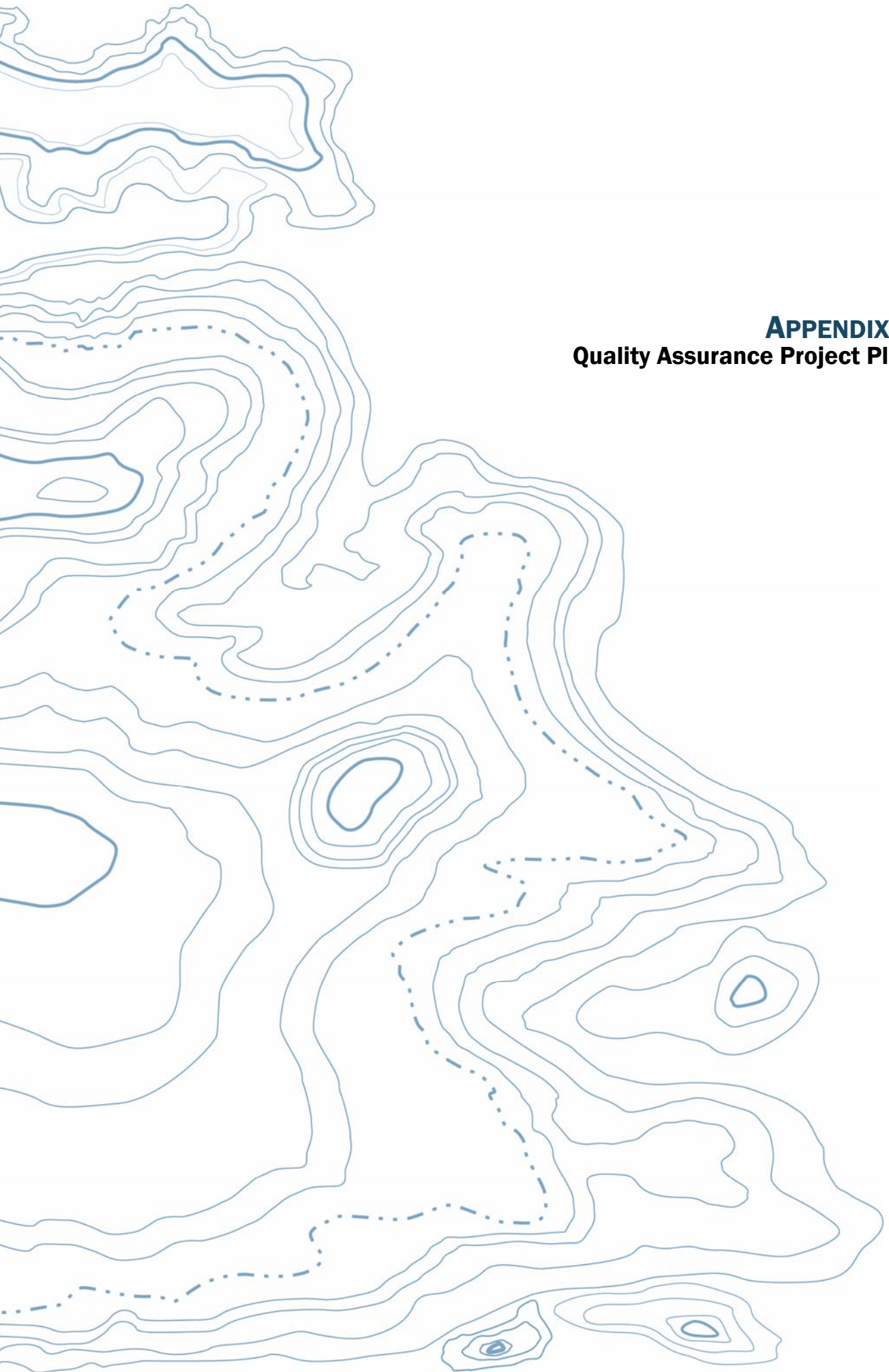

APPENDIX A
Quality Assurance Project Plan

Quality Assurance Project Plan

Cap Sante Marine Site
Anacortes, Washington
Ecology Consent Decree No. 9917

for
Washington State Department of Ecology on Behalf of the Port of Anacortes

May 30, 2014

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Quality Assurance Project Plan

Cap Sante Marine Site
Anacortes, Washington
Ecology Consent Decree No. 9917

File No. 5147-005-10

May 30, 2014

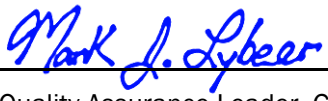
Approved By:

Signature:  Date: May 30, 2014

John M. Herzog, PhD, Principal, GeoEngineers

Signature:  Date: May 30, 2014

Robert S. Trahan, Environmental Geologist, GeoEngineers

Signature:  Date: May 30, 2014

Mark J. Lybeer, Quality Assurance Leader, GeoEngineers

RST:JMH:leh

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared for sampling and analytical activities that will be completed as part of the groundwater monitoring for the Cap Sante Marine Site (Site). This QAPP serves as the primary guide for the integration of quality assurance (QA) and quality control (QC) functions for groundwater monitoring activities that will be completed at the Site and is to be used in conjunction with the Groundwater Monitoring Sampling and Analysis Plan (SAP; GeoEngineers, 2014). This QAPP presents the objectives, procedures, organization, function activities, and specific quality assurance/quality control (QA/QC) activities designed to achieve the data quality objectives (DQOs) established for the project. Environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that the precision, accuracy, representativeness, completeness, and comparability (PARCC) of the data generated meet the specified DQOs to the maximum extent possible.

The QAPP was prepared following the United States Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA, 2001), Guidance for Quality Assurance Project Plans (EPA, 2002), EPAs Contract Laboratory Program (EPA, 2004) and Washington State Department of Ecology's (Ecology's) Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004). The information contained in this QAPP is based on information available at the time of preparation. This QAPP may be updated as additional information becomes available.

2.0 PROBLEM DEFINITION AND BACKGROUND

Detailed information regarding Site and operational history, previous investigations and regulatory history and cleanup actions are presented in the Remedial Investigation/Feasibility Study Report (RI/FS; GeoEngineers, 2013) and Cleanup Action Plan (CAP; Ecology, 2013) and are summarized in the Groundwater Monitoring Sampling and Analysis Plan (GeoEngineers, 2014).

Pursuant to the CAP and Consent Decree, the Port will perform groundwater monitoring activities to evaluate the long-term effectiveness of the cleanup action and to ensure that the residual contaminants remaining in soil do not pose a threat to human health and the environment natural attenuation performance of Site contaminants.

3.0 PROJECT MANAGEMENT AND ORGANIZATION

The project management and organization elements of the QAPP as detailed below address the basic area of project management including the roles and responsibilities of the participants, the project description, quality objectives and criteria, special training/certification and documents and records.

3.1. Project Organization and Responsibilities

Key individuals and positions providing quality assurance (QA) and quality control (QC) are summarized in the following table. A description of the responsibilities, lines of authority and communication for the key individuals and positions providing QA and QC is presented in Sections 3.1.1 through 3.1.9. This element of the plan ensures that the each key project participant has a defined role.

Project Role	Name Organization	Telephone Email Address
Regulatory Project Manager	Nicholas Acklam Ecology	360.407.6913 nack461@ecy.wa.gov Washington State Department of Ecology PO Box 47600 Olympia, Washington 98504-7600
Port of Anacortes Project Manager	Jenkins Dossen Port of Anacortes	360.299.1814 Jenkins@portofanacortes.com 100 Commercial Ave. Anacortes, Washington 98221
Technical Project Manager	John Herzog GeoEngineers	206.406.6431 jherzog@geoengineers.com 600 Stewart Street, Suite 1700 Seattle, Washington 98101
Task Manager/Field Coordinator	Robert Trahan GeoEngineers	206.239.3253 rtrahan@geoengineers.com 600 Stewart Street, Suite 1700 Seattle, Washington 98101
Health and Safety Manger	Wayne Adams GeoEngineers	206.239.3253 wadams@geoengineers.com 1101 Fawcett Avenue, Suite 200 Tacoma, Washington 98402
Quality Assurance Leader	Mark Lybeer GeoEngineers	206.278.2674 mlybeer@geoengineers.com 600 Stewart Street, Suite 1700 Seattle, Washington 98101
Laboratory Project Manager	David Baumeister OnSite Environmental, Inc.	245.883.3881 DBaumeister@onsite-env.com 14648 NE 95th Street, Redmond, Washington 98052

3.1.1. Regulatory Project Manager

The Regulatory Project Manager is responsible for overseeing the implementation of the work to be performed under the Consent Decree. The Regulatory Project Manager will review and approve the SAP, QAPP and subsequent revisions and amendments.

3.1.2. Port of Anacortes Project Manager

The Port of Anacortes Project Manager's duties consist of implementing the project approach and tasks, overseeing the project team members during performance of project tasks.

3.1.3. Technical Project Manager

The Technical Project Manager is responsible for fulfilling contractual and administrative control of the project. The Technical Project Manager's duties include defining the project approach and tasks, selecting project team members and establishing budgets and schedules.

The Technical Project Manager's duties also include implementing the project approach and tasks, overseeing project team members during performance of project tasks, adhering to and communicating the status of budgets and schedules to the Potlatch Project Manager, providing technical oversight, and providing overall production and review of project deliverables. The Technical Project Manager shall maintain the official, approved SAP/QAPP and shall be responsible for distributing updated documents to the recipients listed in the table above.

3.1.4. Task Manager

The individual task managers are responsible for the daily management of project tasks including providing technical direction to the field staff, produces task specific documents including the QAPP, SAP, and Health and Safety Plan (HASP), develops schedules and allocates resources for field tasks, coordinates data collection activities to be consistent with information requirements, supervises the compilation of field data and laboratory analytical results, assures that data are correctly and completely reported, implements and oversees field sampling in accordance with project plan and supervises field personnel. Additionally, the Task Manger coordinates work with on-site subcontractors, verifies that appropriate sampling, testing, and measurement procedures are followed, coordinates the transfer of field data, sample tracking forms, and log books to the Project Manager for data reduction and validation, and participates in QA corrective actions as required.

3.1.5. Field Coordinator

The Field Coordinator will lead the field sampling effort for the project, serving as the direct point of contact between the Task Manager, analytical laboratory, and subcontractors and ensures that the appropriate sampling containers, chain-of-custody (COC) forms and field sampling gear including personal protective equipment (PPE) are available. The Field Coordinator is to ensure that data collection activities are consistent with information requirements and to assure that field information is correctly and completely reported for the entire duration of the project. The Field Coordinator will also coordinate appropriate sampling, testing, and measurement procedures and schedule sample delivery/shipment with the analytical laboratory. The Field Coordinator will transfer field data and sample tracking forms to the project file and data reduction and validation and participate in QA corrective actions as required.

3.1.6. Technical/Field Staff

Technical/Field Staff have the primary responsibility for duties involve field data collection and documentation. Technical/Field Staff are responsible for:

- Understanding and following the QAPP and SAP.
- Checking all equipment and supplies in advance of field operations.
- Ensuring that samples are properly collected, preserved, labeled, packaged, and shipped.
- Ensuring that all field data are carefully recorded and preserved according to the QAPP and SAP.
- Following COC procedures and standard operating procedures when they are required.

3.1.7. Quality Assurance Leader

The Quality Assurance Leader will provide oversight required for the completion of sample analyses for the project and verify, in conjunction with the laboratory manager, that the analytical work is proceeding in accordance with internal laboratory standard practices and the QA/QC guidelines for the project. This person will also oversee completion of data validation activities completed for this project. The Quality Assurance Leader maintains independence from the individual(s) generating the data.

3.1.8. Health and Safety Manager

The Health and Safety Manager will oversee implementation of health and safety programs and verify that work on the project proceeds in accordance with the site-specific HASP.

3.1.9. Laboratory Project Manager

The Laboratory Project Manager will fulfill the analytical requirements of this project including being responsible for sample analyses using appropriate analytical laboratory methods. The specific procedures to be used for COC transfer, internal calibrations, laboratory analyses, reporting, preventive instrument maintenance, and corrective action will follow standard protocols.

4.0 PROJECT AND TASK DESCRIPTION

4.1. Project Description

The Site includes portions of the Former Cap Sante Marine Lease Area and Fisherman's Work and Parking Area that have been environmentally impacted from historical uses of these areas. Because residual contamination exceeding Model Toxics Control Act (MCTA) cleanup levels remains in-place at the Site following implementation of Ecology's Cleanup Action Plan (CAP; Ecology 2013), engineering and institutional controls have been established to prevent human/terrestrial wildlife contact with this contamination. To evaluate the long-term effectiveness of the cleanup action and to ensure that the residual contaminants remaining in soil do not pose a threat to human health and the environment, compliance groundwater monitoring will be performed by the Port of Anacortes (Port).

4.2. Task Description

Sampling and analysis activities that will be conducted as part of the compliance groundwater monitoring activities will include collecting groundwater samples for chemical analysis at a contract laboratory. Specific details of the sampling activities that will be conducted during groundwater monitoring are presented in the SAP.

4.3. Project Schedule

Groundwater monitoring activities being performed by the Port will be initiated following Ecology approval of the SAP. Currently, it is anticipated that sampling activities will begin during the summer of 2014. A schedule for groundwater monitoring and reporting is presented in the SAP.

4.4. Data Quality Objectives

The Data Quality Objectives (DQOs) for the project is to collect environmental monitoring data of known, acceptable, and documentable quality. The specific objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the level of QA/QC required to produce scientifically valid analytical data of known and documented quality. This will be accomplished by establishing criteria for precision, accuracy, representativeness, completeness, and comparability, and by evaluating project data against these criteria.

The sampling design, field procedures, useable laboratory procedures, and QC procedures established for this project were developed to provide defensible data. Specific data quality factors that may affect data usability include quantitative factors such as bias, sensitivity, precision, accuracy and completeness, and qualitative factors such as representativeness and comparability. The specific DQOs associated with these data quality factors are discussed below. Method-specific DQOs for chemical laboratory analysis are summarized in Table A-1.

4.4.1. Analytical Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Although results reported near the MDL provide insight for soil and groundwater conditions, quality assurance dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL), which is typically demonstrated with the lowest point of a linear calibration. The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

The PQLs for groundwater contaminants of concern provided by the Ecology-certified laboratory (OnSite) are presented in Table A-2. The PQLs presented in Table A-3 are considered target reporting limits (TRLs) because several factors may influence final reporting limits. First, moisture and other physical conditions of soil affect detection limits. Second, analytical procedures may require sample dilutions or other practices to quantify a particular analyte at concentrations above

the range of the instrument. The effect is that other analytes could be reported as undetected but at a value higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize subsurface conditions.

4.4.2. Precision

Precision measures the reproducibility of the measurements calculated using the data generated in the analysis of laboratory duplicate samples. Each duplicate analysis will be recorded on the appropriate form, and the equations used to calculate the precision of data should be included. If the difference of the value between two duplicate samples exceeds the MQOs (Table A-1), then the precision should be judged to be out of control and the analyst should be instructed to confirm the source of the precision error. Once confirmed and remedied, the analysis will be rerun providing acceptable precision limits, and the data can then be reported.

Precision is measured using the relative percent difference (RPD) from pairs of duplicate measurements, calculated as follows:

$$\%RPD = \frac{100(d1 - d2)}{\left[\frac{d1 - d2}{2}\right]}$$

Where: *%RPD* = percent relative difference.

d1 and *d2* = the concentrations of the two measurements.

RPD can be calculated using duplicate analyses in the case where an analyte is detected. If an analyte is not detected, the RPD can be calculated from the percent recoveries of the matrix spike (MS) and matrix spike duplicate (MSD) analyses.

4.4.3. Accuracy and Bias

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike and standard. Analytical accuracy is measured by comparing the percent recovery of analytes or surrogates spiked into a sample or QC sample [matrix spike (MS), matrix spike duplicate (MSD) or laboratory control sample (LCS)] to the control limits listed in Table A-1.

Accuracy is calculated using the following formula:

$$\%R = \frac{100(xs - xu)}{K}$$

Where: *%R* = percent recovery of spike (also known as matrix spike recovery [MSR]).

xs = measured value for spiked sample.

xu = measured value for unspiked sample.

K = known value of the spike in the sample.

Bias is a systemic or persistent distortion of a measurement process that causes errors in one direction. It usually is associated with the idea of obtaining data that will lead to a consistently "low" or consistently "high" concentration of a given target analyte.

4.4.4. Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, a process condition, an environmental condition, or parameter variations at a sampling point.

Representativeness is assessed by way of evaluating issues such as (but not limited to) sampling methods, analytical methods used, holding times, laboratory blanks, field blanks, COC records, detection limits, and sample dilutions. The field QA/QC procedures for sample handling, including COC records, will provide for sample integrity until the time of analysis. To make certain that the analytical results of this assessment are representative of the true field conditions, appropriate laboratory QA/QC procedures (as indicated in this QAPP) should be followed.

The degree to which the data are representative of the field conditions will be evaluated during the Quality Assurance Leader's review of the analytical data. The results of the validation review will be summarized in the Data Validation Report.

4.4.5. Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not rejected through data validation. For this project, the requirement for completeness is 90 percent (%).

The following equation is used to calculate completeness:

$$\%\ completeness = \frac{number\ of\ valid\ results\ \times 100}{number\ of\ possible\ results}$$

For instances when samples could not be analyzed (i.e., because of holding time violations for which re-sampling and analysis were not possible, samples that were spilled or broken, etc.), the numerator of this equation becomes the number of valid results minus the number of possible results not reported.

4.4.6. Comparability

Comparability is the qualitative term that expresses the measure of confidence that two data sets or batches can contribute to a common analysis and evaluation. Comparability with respect to laboratory analyses pertains to method type comparison, holding times, stability issues, and aspects of overall analytical quantitation. The following items are evaluated when assessing data comparability:

- Whether two data sets or batches contain the same set of parameters.
- Whether the units used for each data set are convertible to a common scale.
- Whether similar analytical procedures and quality assurance were used to collect data for both data sets.
- Whether the analytical instruments used for both data sets have approximately similar detection levels.
- Whether samples within data sets were selected and collected in a similar manner.

To ensure data comparability, standard sample collection and analytical methods/procedures will be used for this project.

4.4.1. Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a recommended holding time for analysis only. For many methods, recommended holding times may be extended by sample preservation techniques in the field. If a sample exceeds a recommended holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil samples is exceeded, then the possibility exists that some of the organic constituents may have volatilized from the sample or degraded. Results for that analysis would be qualified as estimated to indicate that the reported results may be lower than actual site conditions. Recommended holding times are presented in Tables A-3.

4.4.2. Quality Control Blank Samples

According to the National Functional Guidelines for Organic Data Review (EPA, 2008), "The purpose of laboratory (or field) blank analysis is to assess the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

QC blanks are discussed further in Section 4.0. Analytical results for QC blanks will be interpreted in general accordance with EPA's National Functional Guidelines for Organic (EPA, 2008) and Inorganic Data (EPA, 2004) Review and professional judgment.

4.5. Special Training/Certifications

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.120) require training to provide employees with the knowledge and skills necessary to enable them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet OSHA regulations. In addition, all sampling personnel will be certified in cardiopulmonary resuscitation (CPR) and first aid.

4.6. Documentation and Records

The approved final SAP/QAPP will be maintained in electronic format by the Project Manager, in Microsoft Word format and in an Adobe portable document format (PDF). One hard copy of the SAP/QAPP will be utilized by field staff to ensure consistency with protocols.

The following documents will be produced during sampling activities:

- Daily field reports documenting field activities will be prepared by the field staff and maintained in both electronic and hard copy formats. The field report will include information on field forms or in the field notebook including daily activities, field screening results and samples collected. Other information included in the field report is listed in Section 4.4.

Records will be retained by GeoEngineers, Inc. (GeoEngineers) in hard copy and in electronic Microsoft Word and/or PDF format for at least 10 years. Electronic data is backed up daily in-office and also sent to a centralized data center for off-site storage.

Individuals identified in Section 2.1 will receive updated versions of the SAP/QAPP electronically (via email with attached PDF). The Technical Project Manager will distribute the updated documents as they become available.

5.0 DATA GENERATION AND ACQUISITION

The data generation and acquisition elements of the QAPP (as detailed below) address aspects of the project design and implementation including the appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and how QC activities are employed and properly documented.

The information presented herein applies directly to the selection of sampling locations and field sampling methodology. The sample nomenclature, the number of samples to be collected, and the rationale for sampling and choosing the appropriate sample locations are presented in this section of the QAPP. Sampling methods including field documentation, sampling and decontamination procedures, are also discussed below.

5.1. Sample Process Design

Specific details of the sampling activities (i.e., sample locations, frequency, field and laboratory analysis, and rational) that will be conducted during the groundwater monitoring well installation and monitoring activities are presented in the SAP.

5.2. Sampling Methods

This section discusses the methodologies that will be used, and the Standard Operating Procedures that will be followed for sample collection, sample nomenclature, sample handling, COC preparation and decontamination.

5.2.1. Groundwater Sampling Equipment

Groundwater samples will be obtained using disposable Teflon bailers and/or using dedicated polyethylene tubing and peristaltic pump and placed in a laboratory specified container with the sample location, date, time, and depth documented. Prior to groundwater sample collection, groundwater levels will be measured in each monitoring well using an electric water level indicator (e-tape) to the nearest 0.01 foot relative to the surveyed casing rim elevations.

5.2.2. Decontamination Procedures

Care will be made to collect samples representative of Site conditions including avoidance of cross-contamination between sample locations during field activities. The following decontamination procedures will be implemented during field activities to avoid cross-contamination:

- Disposable sampling equipment will be used when possible to minimize decontamination requirements. Non-disposable sampling equipment (i.e. stainless steel spoons, bowls, and depth to water meter) will be decontaminated prior to and after use. Decontamination procedures for this equipment will consist of the following:
  - Washing with a brush and non-phosphate detergent solution (e.g., distilled water and Alconox or Liqui-Nox);
  - Rinsing in a container of distilled water;
  - A final rinse by pouring distilled water over the equipment; and
  - Wrapping the decontaminated equipment in aluminum foil and placing the equipment in a disposable plastic bag for storage.
- Field sampling staff will use nitrile gloves and change them between each sample interval and sample location to prevent cross-contamination.
- Pre-cleaned, QA-tested, and previously unused sample jars provided by the Laboratory will be used to contain samples.
- Sample containers will be labeled immediately before they are used to contain a sample. Samples will be assembled and documented according to appropriate COC procedures prior to delivering to the Laboratory including custody seals on each cooler in the event that the Field Staff who collected the sample is not the person delivering the containers.

5.2.3. Field Screening

Purge water generated by the monitoring activities will be visually screened for the presence of petroleum hydrocarbons.

5.2.3.1. VISUAL SCREENING

Water generated during monitoring activities will be observed for visible oil, oil beads and/or sheen. Water sheen screening is further described in the following section (Section 5.2.3.2).

5.2.3.2. WATER SHEEN SCREENING

Visual classification of the petroleum-related sheen from will be evaluated relative to the following field screening criteria:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface.
Slight Sheen	(SS)	Light, colorless, dull sheen; spotty to globular; spread is irregular, not rapid; sheen dissipates rapidly; areas of no sheen remain.
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; globular to stringy; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface.
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; stringy; spread is rapid; entire water surface may be covered with sheen; sheen flows off the sample.

5.3. Analyte-Specific Considerations

For sample containers which may have preservative (e.g. gasoline-range petroleum hydrocarbons), caution will be exercised to avoid spilling the preservative.

5.4. Field Documentation

The field staff will be responsible for documenting field sampling activities in an all-weather (e.g. “Rite-in-the-Rain”) field notebook and on field logs, and by producing a draft technical field report at the end of each day of sampling. The field staff will also be responsible for implementing field QA/QC procedures in accordance with the methods outlined in this QAPP and general good practice sampling protocols. These procedures include recording and documenting relevant and appropriate information regarding project activities, sampling methods and data collected during performance of field activities at each sample location.

The following general guidelines should be followed in documenting fieldwork:

- Documentation will be maintained in a dedicated field notebook and on field forms.
- Notebook documentation will be completed in water proof ink or permanent marker and written errors will be crossed out with a single line.

Field notebooks will include records of pertinent activities related to specific sampling tasks. They will be bound books with sequentially numbered pages. The books will remain in the custody of the Field Coordinator until project completion, after which, the books will be kept in the project files.

The field notebook and forms will be maintained on a real-time basis and will include, where applicable and appropriate, the following information:

- Date, time of specific activities and weather conditions.
- Names of all personnel on the site, including visitors.
- Specific details regarding sampling activities, including sampling locations, type of sampling, depth, and sample numbers.
- Specific problems and resolutions.
- Identification numbers of monitoring instruments used that day.
- Chain-of-custody details, including sample identification numbers.

A draft field report will be prepared upon completion of field sampling activities each day. Field data that was recorded in the notebooks and field forms will be used to complete the field report. The field report will be used to document construction, sampling, and monitoring activities, sampling and Site personnel, and weather conditions, as well as decisions, corrective actions, and/or modifications to the project plans and procedures discussed in this report. The draft field report will be finalized following review by the Field Coordinator and/or Technical Project Manager and kept in the project files.

5.5. Sample Nomenclature

Samples collected by GeoEngineers will be identified according to station and sampling sequence. Sample designations will be such that they can be entered into the GeoEngineers environmental data management system in order to facilitate management, recovery, and reporting of data.

- Groundwater sample nomenclature will follow this convention: Station Designation – Date
  - The station designation is the monitoring well identification.
  - For example, a water sample collected from monitoring well GEI-MW-6 on July 5, 2014 would be labeled GEI-MW-6-070514.
- Duplicate sample nomenclature will follow this convention: Designation – Media Designation – Date
  - The sample designation is “DUP”.
  - Media designation for groundwater is “GW”.
  - For example, a duplicate sample collected on July 5, 2014 would be labeled DUP-GW-070514.

5.6. Sample Preservation, Container and Hold Times

Samples for fixed laboratory analysis will be prepared, containerized, and preserved in the field in accordance with the guidelines described in Table A-3.

Samples will be kept on ice in coolers from the time of collection until delivery to the Laboratory. The samples will be preserved and hand delivered by the Field Staff, Field Coordinator, Technical Project Manager or courier to the laboratory. Alternatively, samples may be packaged and shipped

to the laboratory. Samples will be kept at 0°to 6°C during delivery to the Laboratory and in refrigerated coolers while at the Laboratory until analyzed.

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents may have volatilized from the sample or degraded. Results for that analysis would be qualified as estimated to indicate that the reported results may be lower than actual Site conditions. Holding times are presented in Table A-3.

5.7. Sample Handling and Custody

The Field Staff will be responsible for the care and custody of the samples until they are delivered or shipped to the Laboratory. Sample labels will be placed on all sample containers and will include the following information:

- Project Name or Number
- Sample identification number (nomenclature)
- Date and time

In addition to the above, COC records will be prepared and included in each cooler of samples delivered or shipped to the Laboratory. The COC procedures will be implemented in such a way as to document sample possession from the time of sample collection until sample disposal by the Laboratory.

A sample will be considered in custody if it is:

- In the physical possession or view of the GeoEngineers staff or
- Sealed and placed in a secure location after having been in physical possession.

The COC record will contain the same information as is contained on the sample labels and serve as documentation of sample handling during delivery or shipment. One copy of this custody record will remain with the shipped samples, and one copy will be retained by the Field Staff who originally sampled and relinquished the samples. The sampler's copy will be maintained in the project file.

The samples relinquished to the Laboratory will be subject to transfer-of-custody and shipment procedures, as follows:

- The samples shipped to the Laboratory will be accompanied by a COC record documenting which samples are present in the cooler. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the times of the sample transfer on the record. This custody record will document transfer of sample custody from the sampler to other persons, including the Laboratory.

- The samples will be properly packed for shipment and dispatched to the Laboratory for analysis, with a separate, signed COC enclosed in each sample cooler. If a GeoEngineers representative is not the person delivering the sample coolers to the Laboratory, sample shipping containers will be custody-sealed before being delivered to the Laboratory. The preferred procedure for custody sealing includes use of a custody signed seal placed across filament tape that is wrapped around the cooler at least twice. The custody seal should then be folded over and attached to itself in such a way as the package can only be accessed by cutting the filament tape or breaking the seal.
- Samples will be shipped and analyzed within the established hold times that are listed in Table A-3.

The Laboratory will utilize an established system for sample check-in, sample tracking, laboratory analyses assignment and performance, and sample check-out. The system will allow management review of the laboratory data before the issuance of laboratory reports. The management review will be accomplished on two levels: review of raw data for each analysis, and review of the final results to check for consistency or agreement of the results between parameters. Computers are routinely used for this purpose to take advantage of fast retrieval of information.

Upon receipt of samples accompanied by a COC form identifying the analytical parameters to be performed, the Laboratory Coordinator or a delegate will conduct the following:

- Log in the samples and assign Laboratory identification numbers. For each sample, a record will be generated containing the sample station number, sample description, analytical requirements, pricing information, and report format description.
- Enter these data into the Laboratory computer system.
- Prepare an analysis assignment sheet, noting the analytical parameters to be run and providing spaces for resulting analytical data.
- Assign the samples a position in the Laboratory workload backlog.
- Retain the COC form upon completion of data generation.

5.8. Analytical Methods

Laboratory analytical methods for the chemical analysis of soil and water samples collected during this investigation will include petroleum hydrocarbons and PAHs. Samples and QC samples shall be analyzed following the analytical methods listed in Table A-2, using laboratory instruments prescribed in the methods. The analytical methods must meet the technical acceptance criteria specified by the method prior to the analysis of environmental samples. Samples that are not analyzed initially (i.e., placed on "hold") will be stored at the laboratory for up to 3 months, and will be disposed of by the laboratory following this period. Samples to be analyzed initially will be analyzed within proper holding times, which are listed in Table A-3.

The laboratory is required to comply with their current written standard operating procedures. Individuals responsible for corrective actions are listed in Section 2.1. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data to the laboratory project manager. A narrative describing the anomaly, the steps taken to identify and

correct it, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package.

5.9. Quality Control

Quality control activities that will be implemented for each sampling, analysis or measurement technique are summarized in Table A-4. Formulas for calculating QC statistics are provided in Section 2.4.2.

The Laboratory will maintain and implement documented QA/QC procedures. The laboratory QA/QC program will provide the following:

- Procedures that must be followed for certifying the precision and accuracy of the analytical data generated by the Laboratory.
- Documentation of each phase of sample handling, data acquisition, data transfer, report preparation, and report review.
- Accurate and secure storage and retrieval of samples and data.
- Detailed instructions for performing analyses and other activities affecting the quality of analytical data generated by the Laboratory.
- Appropriate management-level review and approval of procedures, revisions to procedures, and control of procedures in such a way so that laboratory personnel that require specific procedures have access to them.

A summary of target PQLs for groundwater contaminants of concern are presented in Table A-2.

5.9.1. Field Quality Control

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the potential influence of off-site factors on project samples. Examples of off-site factors include airborne VOCs and contaminants that may be present in potable water used during drilling activities.

5.9.1.1. FIELD DUPLICATES

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Field duplicates measure the precision and consistency of laboratory analytical procedures and methods, as well as the consistency of the sampling techniques used by field personnel. Under ideal field conditions, field duplicates, are created by thoroughly mixing a volume of the sample matrix, placing aliquots of the mixed sample in separate containers, and identifying one of the aliquots as the primary sample and the other as the duplicate sample.

For groundwater, one field duplicate will be collected for every ten samples collected or a minimum of one per sampling event.

5.9.2. Laboratory Quality Control

Laboratory QC procedures will be evaluated through a formal data quality assessment process. The analytical laboratory will follow standard analytical method procedures that include specified QC monitoring requirements. These requirements will vary by method, but generally include:

- Method blanks
- Internal standards
- Instrument calibrations
- Matrix spike/matrix spike duplicates (MS/MSD)
- Laboratory control samples/laboratory control sample duplicates (LCS/LCSD)
- Laboratory replicates or duplicates
- Surrogate spikes

5.9.2.1. LABORATORY BLANKS

Laboratory procedures utilize several types of blanks, but the most commonly used blanks for QC monitoring are method blanks. Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process, or reagent (contaminant-free) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since volatile organic compounds (VOCs) can be transported in the laboratory through the vapor phase. If a substance is detected in a method blank, then one (or more) of the following occurred:

- Sample containers, measurement equipment, and/or analytical instruments were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Volatile substances in ambient laboratory air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. If target analytes are detected in method blanks, data validation guidelines assist in determining which substances in project samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, "…there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example" (EPA, 2008).

5.9.2.2. CALIBRATIONS

Several types of instrument calibrations are used, depending on the analytical method, to assess the linearity of the calibration curve and assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations, and continuing calibration verification.

5.9.2.3. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD)

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH can affect the results for semi-volatile organic compounds. Or, the presence of a particular compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix effects cannot be determined due to dilution and/or high levels of related substances in the sample. A matrix spike is evaluated by spiking a project sample with a known amount of one or more of the target analytes, ideally at a concentration that is 5 to 10 times higher than the sample result. A percent recovery is then calculated by subtracting the un-spiked sample result from the spiked sample result, dividing by the known concentration of the spike, and multiplying by 100.

MS/MSD samples will be analyzed at a frequency of one MS/MSD per sample set or batch. The samples for the MS/MSD analyses should be collected from a boring or sampling location that is believed to have only low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for the MS/MSD analyses as required by the laboratory.

5.9.2.4. LABORATORY CONTROL SAMPLE/ LABORATORY CONTROL SAMPLE DUPLICATES (LCS/LCSD)

Also known as blank spikes, laboratory control samples (LCS) are similar to MS samples in that a known amount of one or more of the target analytes are spiked into a prepared sample medium, and a percent recovery of the spiked substances is calculated. The primary difference between LCS and MS samples is that the LCS uses a contaminant-free sample medium. For example, reagent water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance, and analyst performance.

5.9.2.5. LABORATORY REPLICATES/DUPLICATES

Laboratories utilize MS/MSDs, LCS/LCSDs, and/or replicates to assess precision. Replicates are a second analysis of a field-collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process; they most commonly consist of a second analysis on the extracted media.

5.9.2.6. SURROGATE SPIKES

Surrogate spikes are used to verify proper extraction procedures and the accuracy of the analytical instrument. Surrogates are substances with characteristics similar to the target analytes. A known concentration of surrogate is added to the project sample and passed through the instrument, and percent recovery is calculated. Each surrogate used has acceptance limits (i.e., an acceptable range) for percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified acceptance limits, a possibility of false positives exist, although non-detect results are considered accurate.

5.10. Instrument/Equipment Testing, Inspection, and Maintenance

5.10.1. Field Instrumentation

Field instrumentation used during this project includes a water quality meter and electrical water level indicator (e-tape). The field equipment is maintained as needed by an outside servicer qualified to maintain such devices consistent with manufacturer's specifications.

Field instrument calibration and calibration checks facilitate accurate and reliable field measurements. The calibration of the field equipment used on the project will be checked and adjusted as necessary in general accordance with the manufacturer's recommendations. Methods and intervals of calibration checks and instrument maintenance will be based on stability characteristics, required accuracy, intended use, and environmental conditions.

All equipment is visually inspected before use by the Field Staff to ensure it is clean and in good working condition. Inspection includes visual inspection of the outside of the equipment, and battery checks.

5.10.1.1. WATER QUALITY METER

The water quality meter will be calibrated in accordance with the manufactures recommendations. In the event that the instrument does not calibrate properly, spare parts will be available for minor field maintenance. If the instrument cannot be made to work based on available equipment, a separate instrument will be shipped to the field team and the non-calibrating instrument will not be used.

5.10.2. Laboratory Instrumentation

For chemical analytical testing, calibration procedures will be performed in general accordance with the analytical methods used and the laboratory's standard operating procedures (SOPs). Calibration documentation will be retained at the laboratory.

All laboratory instrument calibrations and their appropriate chemical standards are to comply with the specific methods within EPA SW-846, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, 3rd Edition, December 1996 and the Laboratory SOPs. Calibration documentation, initial (ICALs) and continuing (CCALs), will be retained at the Laboratory. Deficiencies to be resolved are the responsibility of the Laboratory Project Manager.

5.11. Inspection/Acceptance of Supplies and Consumables

Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory. For example, jars will be inspected to ensure that they are the correct size and quantity and were not damaged in shipment.

5.12. Data Management, Reporting and Deliverables

The data generated by the Laboratory will be managed in accordance with the procedures outlined in this QAPP and applicable Laboratory operating procedures. The Laboratory Project Manager is responsible for laboratory record-keeping, document control, and delivery of reliable and accurate data.

Laboratories will report data in formatted hardcopy and electronic form to the Technical Project Manager and QA Leader. Upon completion of analyses, the laboratory will prepare electronic deliverables for data packages in accordance with the specifications in the agreed-upon *Special Conditions for Lab Analysis* document. The laboratory will provide electronic data deliverables (EDDs) within 2 business days after GeoEngineers' receipt of printed-copy analytical results, including the appropriate QC documentation.

The Electronic Data Deliverable (EDD) should follow the EQuIS Chemistry 4-file format. Specific details regarding data types, valid values, and field definitions are referenced in the Lab Specification. Ultimately, the EDDs provided by the Laboratory must be delivered as text (.txt), comma-delimited (.csv), or Excel files.

Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the client/field sample identification, the laboratory sample identification, reporting units, analytical methods, analytes tested, analytical results, extraction and analysis dates, quantitation limits, and data qualifiers. Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues.

Chromatograms will be provided for samples analyzed using Ecology Method NWTPH-Gx and NWTPH-Dx. The laboratory will assure that the full height of all peaks appear on the chromatograms and that the same horizontal time scale is used for all chromatograms to allow for comparisons between chromatograms.

Relevant data generated as part of the project will be reported to Ecology as required by the Consent Decree.

6.0 ASSESSMENT AND OVERSIGHT

6.1. Assessments and Response Actions

6.1.1. Review of Field Documentation and Laboratory Receipt Information

Documentation of field sampling data will be reviewed periodically for conformance with project QC requirements described in this QAPP. At a minimum, field documentation will be checked for proper documentation of the following:

- Sample collection information (date, time, location, matrices, etc.);
- Field instruments used and calibration data;
- Sample collection protocol;
- Sample containers, preservation, and volume;
- Field QC samples collected at the frequency specified;
- COC protocols; and
- Sample shipment information.

Sample receipt forms provided by the laboratory will be reviewed by the Technical Project Manager or Quality Assurance Leader for QC exceptions. The final laboratory data package will describe (in the case narrative) the effects that any identified QC exceptions have on data quality. The laboratory will review transcribed sample collection and receipt information for correctness prior to delivering the final data package.

6.1.2. Response Actions for Field Sampling

The Field Staff, or a designee, will be responsible for correcting equipment malfunctions or requesting new equipment throughout the field sampling effort and resolving situations in the field that may result in nonconformance or noncompliance with the QAPP. Corrective measures will be documented in the field notebook.

6.1.3. Corrective Action for Laboratory Analyses

The Laboratory is required to comply with their current written standard operating procedures. The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data to the Laboratory Project Manager. A narrative describing the anomaly, the steps taken to identify and correct it, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package.

7.0 DATA VALIDATION AND USABILITY

7.1. Data Review, Verification and Validation

The data validation and usability elements of the QAPP as detailed below address the QA/QC activities that occur after data collection and/or data generation is complete. Implementation of these elements ensures that the data conform to the specified criteria and will achieve the project objectives. Data validation will be performed in general accordance with the two EPA documents, EPA Contract Laboratory Program National Functional Guidelines for *Organic* and *Inorganic* Data Review (EPA, 1999 and 2004).

The data are not considered final until validated. All data, including laboratory and field QC sample results, will be summarized in a data validation report. Specific acceptance criteria are discussed in Section 2.4.2. The data validation report will focus on data that did not meet the MQOs specified in Table A-1. The data validation report will also describe any deviations from this QAPP and actions taken to address those deviations.

Level III laboratory data packages will be obtained for all groundwater samples. At a minimum, these data will be reviewed for the following QC parameters:

- Holding times and sample preservation
- Method blanks
- MS/MSD analyses
- LCS/LCSD analyses

- Surrogate spikes
- Duplicates/replicates
- Field/Lab duplicates

In addition to these QC parameters, other documentation such as sample receipt forms and case narratives will be reviewed to evaluate laboratory QA/QC.

7.2. Verification and Validation Methods

The Quality Assurance Leader will verify and validate data received from the laboratory. Any issues will be discussed with the Laboratory Project Manager and/or the Technical Project Manager, if needed. Issues will be resolved by these individuals. The final data validation report will document the results of any issue resolution process.

Hard-copy laboratory reports will provide the analysis-specific information including final sample analytical results, reportable field and laboratory QA/QC analytical results, and PQLs. The laboratory data will also be reported via electronic media using the tabular outputting capabilities of standard software formats.

The term "reporting limit" will be used interchangeably with "quantitation limit" to mean the lowest concentration at which an analyte can be quantified subject to the quality control criteria of the analytical method. These terms are different from "MDL," which refers to the lowest concentration that the analytical method can ideally detect.

The Quality Assurance Leader will be responsible for overseeing data validation qualifiers including but not limited to "U," "J,", and "R" to explain final data quality issues that are affecting the laboratory data for the data user. The validation process will take any specific laboratory qualifiers, and any other laboratory quality control issues into consideration when applying and creating this final set of usable qualifiers, as described in the EPA document "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use" (EPA, 2009). The qualifiers U, J and R are explained as follows:

- "U" indicates that a compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit, which is corrected for dilution and percent moisture.
- "J" indicates that a compound was detected below the reporting limit and the value is estimated or the value was estimated by the validator because of instrument bias reasons.
- "R" qualifier indicates that the sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

If any target analytes are found in a laboratory method blank, it will be regarded as blank contamination. In these cases, the result of a given analyte in the method blank will be compared to any positive result of the same analyte in the associated field samples. If a field sample result is less than five times (ten times for common laboratory contaminants like acetone, phthalates, etc.)

the result that is reported in the method blank, the result will be considered blank contamination. Accordingly, the result will be qualified as not-detected "U" at the elevated reporting limit.

7.3. Reconciliation With User Requirements

A data validation report will be produced by the project Quality Assurance Leader to identify cases where the projects MQOs were not met. The data validation report will include a discussion of the uncertainty and limitations of the data.

8.0 REFERENCES

GeoEngineers, Inc. (GeoEngineers, 2013), "Remedial Investigation/Feasibility Study, Cap Sante Marine, Anacortes, Washington, Ecology Agreed Order No. DE-07TCPHQ-4197," GEI File No. 5147-005-09, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, December 10, 2013.

Washington State Department of Ecology (Ecology, 2013), "Cleanup Action Plan (CAP), Cap Sante Marine Site, Anacortes, Washington," Washington State Department of Ecology, Toxics Cleanup Program, Lacey, Washington, December 10, 2013.

Washington State Department of Ecology (Ecology), "Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies," publication 04-03-030, dated July 2004.

United States Environmental Protection Agency (EPA), "Guidance for Quality Assurance Project Plans, EPA QA/G-5" publication EPA/240/R-02/009, Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC, dated December 2002.

United States Environmental Protection Agency (EPA), "Requirements for Quality Assurance Project Plans, EPA QA/R-5," publication EPA/240/B-01/003, Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC, dated March 2001.

United States Environmental Protection Agency (EPA). "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," publication EPA-540/R-99/008, Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC, dated October 1999.

United States Environmental Protection Agency (EPA). "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," publication EPA 540-R-04-004, Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC, dated October 2004.

Table A-1

Measurement Quality Objective

Cap Sante Marine Site

Anacortes, Washington

Laboratory Analysis	Reference Method[1]	Check Standard (LCS) R Limits[2,3] (%)	Matrix Spike (MS) R Limits[3] (%)	Surrogate Standards (SS) R Limits [2,3,4] (%)	MS Duplicate Samples or Lab Duplicate RPD Limits[5] (%)	Field Duplicate Samples RPD Limits[5] (%)
		Water	Water	Water	Water	Water
Gasoline-range Hydrocarbons	Ecology NWTPH-Gx	50 - 150	NA	50 - 150	≤30	≤35
Diesel- and Heavy oil-range Hydrocarbons	Ecology NWTPH-Dx	50 - 150	NA	50 - 150	≤40	≤35
PAHs	EPA 8270/SIM	70 - 130	70 - 130	70 - 130	≤30	≤35

Notes:

[1]Method numbers refer to EPA SW-846 Analytical Methods or Washington State Department of Ecology (Ecology) recommended analytical methods.

[2]Recovery ranges are estimates.

[3]Percent Recovery Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes.

[4]Individual surrogate recoveries are compound specific.

[5]RPD control limits are only applicable if the concentrations are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2X the MRL for soils and 1X the MRL for waters.

LCS = Laboratory Control Sample

MS/MSD = Matrix Spike/Matrix Spike Duplicate

PAHs = polycyclic aromatic hydrocarbons

RPD = Relative Percent Difference

Table A-2

Target Reporting Limits for Groundwater Samples

Cap Sante Marine Site

Anacortes, Washington

Analyte	CAS Number	Analytical Method	Target Practical Quantitation Limit (PQL)[1]
Petroleum Hydrocarbons (µg/L)			
Diesel-range petroleum hydrocarbons	NA	NWTPH-Gx	100
Diesel-range petroleum hydrocarbons	NA	NWTPH-Dx	250
Heavy-oil range petroleum hydrocarbons	NA	NWTPH-Dx	500
Polycyclic Aromatic Hydrocarbons (µg/L)			
1-Methylnaphthalene	90-12-0	EPA 8270 SIM	0.1
2-Methylnaphthalene	91-57-6	EPA 8270 SIM	0.1
Acenaphthene	83-32-9	EPA 8270 SIM	0.1
Acenaphthylene	208-96-8	EPA 8270 SIM	0.1
Anthracene	120-12-7	EPA 8270 SIM	0.1
Benzo[a]anthracene	56-55-3	EPA 8270 SIM	0.01
Benzo[a]pyrene	50-32-8	EPA 8270 SIM	0.01
Benzo[b]fluoranthene	56-55-3	EPA 8270 SIM	0.01
Benzo[g,h,i]perylene	191-24-2	EPA 8270 SIM	0.01
Benzo[k]fluoranthene	207-08-9	EPA 8270 SIM	0.01
Chrysene	218-01-9	EPA 8270 SIM	0.01
Dibenz[a,h]anthracene	53-70-3	EPA 8270 SIM	0.01
Fluoranthene	206-44-0	EPA 8270 SIM	0.1
Fluorene	86-73-7	EPA 8270 SIM	0.1
Indeno[1,2,3-c,d]pyrene	193-39-5	EPA 8270 SIM	0.01
Naphthalene	91-20-3	EPA 8270 SIM	0.1
Phenanthrene	85-01-8	EPA 8270 SIM	0.1
Pyrene	129-00-0	EPA 8270 SIM	0.1

Notes:

[1] Values from Analytical Resources, Inc. of Tukwila, Washington.

NA = Not available

EPA = Environmental Protection Agency

mg/L = milligram per liter

µg/L = microgram per liter

Table A-3

Test Methods, Sample Containers, Preservation and Holding Times

Cap Sante Marine Site

Anacortes, Washington

Analysis	Method	Water Sample			
		Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times[1]
Gasoline-Range Hydrocarbons	Ecology NWTPH-Gx	120 mL	Three 40 mL glass vial (VOA)	Cool 4°C, HCl to pH < 2	14 days to extraction/ analysis
Diesel- and Oil-Range Hydrocarbons	Ecology NWTPH-Dx	500 mL	Two 500 mL amber glass with Teflon-lined lid	Cool 4°C, HCl to pH < 2	14 days to extraction 40 days from extraction to analysis
PAHs	EPA 8270 SIM	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction, 40 days from extraction to analysis

Notes:

[1] Holding Times are based on elapsed time from date of collection.

L = liter

mL = milliliter

PAHs = polycyclic aromatic hydrocarbons

Table A-4

Quality Control Samples - Type and Frequency

Cap Sante Marine Site

Anacortes, Washington

Parameter	Field QC Samples	Laboratory QC Samples[1]			
	Field Duplicates	Method Blanks	LCS or OPR	MS / MSD	Lab Duplicates
Gasoline-Range Hydrocarbons	1/10 water samples	1/batch	N/A	NA	1/batch
Diesel- and Oil-Range Hydrocarbons	1/10 water samples	1/batch	1/batch	NA	1/batch
PAHs	1/10 water samples	1/batch	1/batch	1 set/batch	NA

Notes:

[1]An analytical lot or batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/ MSD (or MS and lab duplicate). No more than 20 field samples can be contained in one batch.

LCS = laboratory control sample

MS = matrix spike

MSD = matrix spike duplicate

OPR = ongoing presision and recovery

PAHs = polycyclic aromatic hydrocarbons

QC = quality control

APPENDIX B
Health and Safety Plan

Site Health and Safety Plan

Cap Sante Marine Site
Anacortes, Washington
Ecology Consent Decree No. 9917

for
Washington State Department of Ecology on Behalf of Port of Anacortes

May 30, 2014

GeoEngineers

Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, WA 98101
206.728.2674

Site Health and Safety Plan

Cap Sante Marine Site
Anacortes, Washington
Ecology Consent Decree No. 9917

File No. 5147-005-10

May 30, 2014

Approvals:

Signature:  Date: May 30, 2014

John M. Herzog, PhD, Principal, GeoEngineers

Signature:  Date: May 30, 2014

Robert S. Trahan, Environmental Geologist, GeoEngineers

Signature:  Date: May 30, 2014

Wayne Adams, Health & Safety Program Manager, GeoEngineers

RST:JMH:leh

Table of Contents

1.0 INTRODUCTION

This Health and Safety Plan (HASP) is to be used in conjunction with the GeoEngineers, Inc. (GeoEngineers) Safety Program Manual for the Cap Sante Marine Site (Site) compliance groundwater monitoring. Together, the written safety programs and this HASP constitute the site safety plan for this Site. This plan is to be used by GeoEngineers personnel on this site and must be available on-site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included, and the plan will need to be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

1.1. Liability Clause

If requested by subcontractors, this HASP may be provided for informational purposes only. In this case, Form C-3 shall be signed by the subcontractor. Please be advised that this HASP is intended for use by GeoEngineers Employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by them.

1.2. General Project Information

Project Name: Cap Sante Marine Site

Project Number: 5147-005-10

Type of Project: Groundwater Monitoring

Start/Completion: Spring 2014/TBD

Subcontractors: TBD

2.0 BACKGROUND INFORMATION

2.1. Site Location

The Site is located between 11th and 13th Streets east of Q Avenue in Anacortes, Washington and includes portions of the Former Cap Sante Marine Lease Area and Fisherman's Work and Parking Area.

2.2. Site History

Detailed information regarding Site and operational history, previous investigations and regulatory history and cleanup actions are presented in the Remedial Investigation/Feasibility Study Report (RI/FS; GeoEngineers, 2013) and Cleanup Action Plan (CAP; Ecology, 2013) and are summarized in the Groundwater Monitoring Sampling and Analysis Plan (GeoEngineers, 2014).

3.0 WORK PLAN

Because residual contamination exceeding Model Toxics Control Act (MCTA) cleanup levels remains in-place at the Site following implementation of Ecology's CAP, engineering and institutional controls have been established to prevent human/terrestrial wildlife contact with this contamination. To evaluate the long-term effectiveness of the cleanup action and to ensure that the residual contaminants remaining in soil do not pose a threat to human health and the environment, compliance groundwater monitoring will be performed by the Port of Anacortes (Port).

3.1. Field Activities

The following activities are anticipated for GeoEngineers field personnel during the implantation of the Potlatch Property natural attenuation performance monitoring activities:

- Groundwater Sample Collection
- Monitoring Well Decommissioning

3.2. Field Personnel and Training Records

Anticipated field personnel include the following:

- Abhijit Joshi
- Robert Trahan
- Nathan Solomon

Field personnel will have appropriate training and up to date certifications.

3.3. Chain of Command

Chain of Command	Title	Name	Telephone Numbers
1	Technical Project Manager	John Herzog	206.239.3252 (o)
2	HAZWOPER Supervisor(s)	Robert Trahan	206.239.3253 (o)
3	Field Engineer/Geologist(s)	Robert Trahan Abhijit Joshi Nate Solomon	206.240.2300 (c) 206.223.9028 (c) 206.437.6819 (c)
4	Site Safety and Health Supervisor(s)*	Robert Trahan Abhijit Joshi Nate Solomon	206.240.2300 (c) 206.223.9028 (c) 206.437.6819 (c)
5	Client Assigned Site Supervisor	Becky Darden	360.299.1831 (o)
6	Health and Safety Program Manager	Wayne Adams	253.722.2793 (o)
N/A	Subcontractor	TBD	TBD
N/A	Current Owner	Port of Anacortes	360.293.0694 (o)

***Site Safety and Health Supervisor** The individual present at a hazardous waste site responsible to the employer and who has the authority and knowledge necessary to establish the site-specific health and safety plan and verify compliance with applicable safety and health requirements. Emergency Information

4.0 EMERGENCY INFORMATION

4.1. Evacuation and Contact Information

4.1.1. Primary Medical Facility

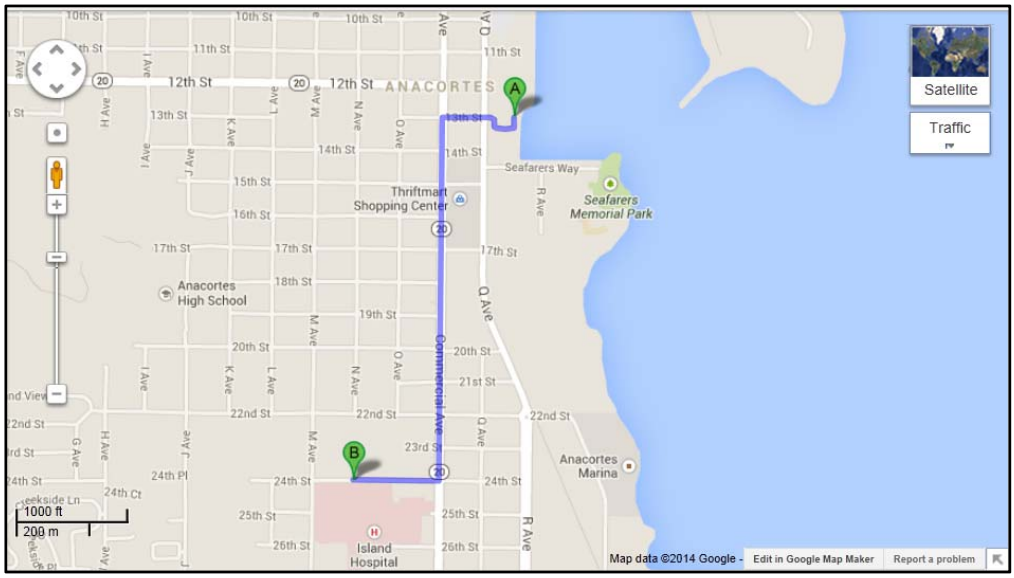
Hospital Name and Address:

Island Hospital
1211 24th Street
Anacortes, WA 98221

Phone Numbers (Hospital ER): Phone: 360.299.1300
Distance: 0.9 miles
Route to Hospital:

1. Head south on 13th St toward Tommy Thompson Trail
2. Turn left onto Commercial Ave
3. Turn right onto 24th St - Destination will be on the left.

Map to Hospital:



Location of Nearest Telephone: Cell phones are carried by field personnel.

Nearest Fire Extinguisher: Located in the GeoEngineers vehicle on-site.

Nearest First-Aid Kit: Located in the GeoEngineers vehicle on-site.

4.2. Standard Emergency Procedures

Get help

- Send another worker to phone 9-1-1 (if necessary)
- As soon as feasible, notify GeoEngineers' Technical Project Manager
  - John Herzog – 206.406.6431

Reduce risk to injured person

- Turn off equipment
- Move person from injury location (if in life-threatening situation only)
- Keep person warm
- Perform CPR (if necessary)

Transport injured person to medical treatment facility (if necessary)

- By ambulance (if necessary) or vehicle
- Stay with person at medical facility
- Keep GeoEngineers manager apprised of situation and notify Human Resources Manager of situation

5.0 HAZARD ANALYSIS

- Identification and evaluation of on-site safety and health hazards;
- A safety and health risk (hazard) analysis for each site task and operation that is identified in the comprehensive work plan.
- This section presents hazards that may be potentially present at the Site. A hazard assessment will be completed at the Site prior to beginning field activities. Updates will be included in the daily log.

5.1. Physical Hazards

- Drill rigs (Monitoring Well Decommissioning)
- Overhead hazards/power lines
- Tripping/puncture hazards (debris on-site, steep slopes or pits)
- Unusual traffic hazard – Street traffic
- Heat/Cold, Humidity
- Utilities/utility locate

5.1.1. Safe Work Practices

- Utility checklist will be completed as required for the location to preventing drilling or digging into utilities.

- Work areas will be within 10-feet of any field activity. High-visibility vests will be worn by on-site personnel to ensure they can be seen by vehicle and equipment operators.
- Field personnel will be aware at all times of the location and motion of heavy equipment in the area of work to ensure a safe distance between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated that it is safe to do so through hand signal or other acceptable means.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet depending on the client and the use of a safety watch.
- Personnel will avoid tripping hazards, steep slopes, pits and other hazardous encumbrances.
    - If it becomes necessary to work within 6 feet of the edge of a pit, slope or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with OSHA/DOSH regulations and the GeoEngineers Health and Safety Program.
- Cold stress control measures will be implemented according to the GeoEngineers Health and Safety Program to prevent frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature). Heated break areas and warm beverages shall be available during periods of cold weather.
- Heat stress control measures required for this site will be implemented according to GeoEngineers Health and Safety Program with water provided on-site.

This section presents hazards that may be potentially present at the Site. A hazard assessment will be completed at the Site prior to beginning field activities. Updates will be included in the daily log.

5.2. Biological Hazard Mitigation Measures and Procedures

Biological hazards can come in the form of wildlife such as rodents, wild animals, insects and spiders. Each of the hazards can present concerns. Protective Measures include:

- Wear long pants, long sleeves, and socks. Tuck pants into boots or socks to provide an insect barrier.
- Use insect repellents containing DEET or Picaridin.
- Be alert when working around abandoned buildings or debris.
- Wear work gloves, and stay on the lookout for spiders.
- Seek medical attention if bitten by a poisonous spider or deer tick or if you experience severe symptoms.
- Avoid scented soaps and perfumes.
- Don't leave food, drinks, and garbage out uncovered.

Exposure can be minimized by following the measures presented in the sections below.

5.2.1. Rodents and Wildlife

Live animals can inflict wounds and can spread diseases such as Rat Bite Fever and Rabies.

- Avoid contact with wild or stray animals. If bitten or scratched, get medical attention immediately.
- Avoid contact with rats or rat-infested buildings. If you can't avoid contact, wear protective gloves and wash your hands regularly.
- Avoid contact with animal and bird droppings. Particles can become airborne and, if inhaled, cause sickness.
- Report dead animals to the proper authorities so they can be disposed of properly.

5.2.2. Insects, Bees and Spiders

Hazardous inspects and spiders include:

- Mosquitoes: Rain and flooding may lead to increased numbers of mosquitoes, which can carry diseases such as West Nile virus or dengue fever.
- Bee stings: If you receive multiple stings seek help immediately. Watch for signs of allergic reaction to stings, which typically happen within the first few hours.
- Spiders: The black widow and brown recluse are poisonous spiders that hide behind objects and in rubble piles. Their bites can be severe, causing pain, nausea, fever, and breathing difficulty.

5.3. Ergonomic Hazard Mitigation Measures and Procedures

The following sections provide potential ergonomic hazards and how to mitigate these concerns.

5.3.1. Avoiding Lifting Injuries

Back injuries often result from lifting objects that are too heavy or from using the wrong lifting technique. Keep your back healthy and pain-free by following common sense safety precautions.

- Minimize reaching by keeping frequently used items within arm's reach, moving your whole body as close as possible to the object.
- Avoid overextending by standing up when retrieving objects on shelves.
- Keep your back in shape with regular stretching exercises.
- Get help from a coworker or use a hand truck if the load is too heavy or bulky to lift alone.

5.3.2. Proper Lifting Techniques

- Face the load; don't twist your body. Stand in a wide stance with your feet close to the object.
- Bend at the knees, keeping your back straight. Wrap your arms around the object.
- Let your legs do the lifting!

- Hold the object close to your body as you stand up straight. To set the load down, bend at the knees, not from the waist.

5.4. Engineering Controls

Use reflective traffic cones and/or work vehicle to increase work area visibility. Place all investigation derived waste into labeled drums. Work upwind from the sampling area.

5.5. Chemical Hazards

CHEMICAL HAZARDS AND EXPOSURES (POTENTIALLY PRESENT AT SITE)

Compound/ Description	Exposure Limits/IDLH	Exposure Routes	Symptoms/Health Effects
Gasoline (Unleaded)—clear liquid with a characteristic odor	PEL 300 ppm TLV 300 ppm STEL 500 ppm	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis
Diesel Fuel — liquid with a characteristic odor	None established by OSHA, but ACGIH has adopted 100 mg/m^3 for a TWA (as total hydrocarbons)	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; headache; dermatitis
Benzene	PEL 5 ppm IDLH 500 ppm	Inhalation, ingestion, skin absorption, and/or direct contact	Irritation of eyes, skin, nose, respiratory system, dizziness, headache, nausea, staggered gait, anorexia, exhaustion, dermatitis, bone marrow depression (leukemia).
Toluene	PEL 100 ppm IDLH 500 ppm	Inhalation, absorption, ingestion, direct contact	Irritation to eyes, nose, exhaustion, confusion, dizziness, headaches, dilated pupils, euphoria, anxiety, teary eyes, muscle fatigue, insomnia, paresthesia, dermatitis, liver and kidney damage.
Ethyl benzene	PEL 100 ppm IDLH 800 ppm	Inhalation, ingestion, direct contact	Irritation to eyes, skin, respiratory system, burning of skin, dermatitis.
Xylenes	PEL 100 ppm IDLH 900 ppm	Inhalation, skin absorption, ingestion, direct contact	Irritation to eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoordination, staggering gait, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis.
Lead (and inorganic compounds as lead)	PEL 0.05 mg/m3 TLV 0.05 mg/m3 REL 0.05 mg/m3 IDLH 100 mg/m3	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, irritated eyes, hypotension

Compound/ Description	Exposure Limits/IDLH	Exposure Routes	Symptoms/Health Effects
Polycyclic aromatic hydrocarbons (PAH) as coal tar pitch volatiles	PEL 0.2 mg/m^3 TLV 0.2 mg/m^3 REL 0.1 mg/m^3 IDLH 80 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Dermatitis, bronchitis, potential carcinogen

Notes:
IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
ACGIH = American Conference of Governmental Industrial Hygienists
mg/m3 = milligrams per cubic meter
TWA = time-weighted average (Over 8 hrs.)
PEL = permissible exposure limit
TLV = threshold limit value (over 10 hrs.)
STEL = short-term exposure limit (15 min)
ppm = parts per million

5.5.1. Polycyclic Aromatic Hydrocarbons (PAHs) and Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)

Exposure to cPAHs can occur via inhalation of vapors, ingestion, and skin and eye contact. Skin contact can result in reddening or corrosion. Ingestion can cause nausea, vomiting, blood pressure fall, abdominal pain, convulsions and coma. Damage to the central nervous system can also occur. The U.S. Department of Health and Human Services (1989) has classified 15 PAH compounds as having sufficient evidence for carcinogenicity, while the U.S. EPA (1990) has classified at least 5 of the identified PAHs as human carcinogens. There is no currently assigned PEL-TWA for cPAHs, but the closely related material coal tar is listed as coal tar pitch volatiles with a PEL-TWA of 0.2 mg/m3. PAHs and cPAHs as soil contaminants can be irritating to eyes and mucous membranes. PAHs are also formed during combustion and are linked to lung cancers with exposure to combustion byproducts. Lymphatic cancers are reported in the literature with PAHs in the presence of carbon black.

5.6. Hazards Reporting/Documentation

Update in Daily Report. Include evaluation of:

- *Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)
- *Biological Hazards* (snakes, spiders, other animals, discarded needles, poison ivy, pollen, bees/wasps and others present)

6.0 AIR MONITORING PLAN

AIR MONITORING, FREQUENCY, LOCATION AND ACTION LEVELS

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	Background to 5 ppm in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	5 to 25 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety Manager for guidance.
Combustible Atmosphere	Environmental Remedial Actions	PID or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1,000 ppm	Stop work and evacuate the site. Contact Health and Safety Manager for guidance.
Oxygen Deficient/ Enriched Atmosphere	Environmental Remedial Actions or Confined Spaces	Oxygen meter or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	<19.5>23.5%	Continue work if inside range. If outside range, evacuate area and contact Health and Safety Manager.

- The workspace will be monitored using a photoionization detector (PID). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area in which it will be used and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on-site. It can be tuned to detect one chemical with the response factor entered into the equipment, but the PID picks up all volatile organic compounds (VOCs) present. The ionization potential (IP) of the chemical has to be less than the PID lamp (11.7 / 10.6eV), and the PID does not

detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas), so conversion must be made in order to estimate ppm of the chemical on-site.

- An initial vapor measurement survey of the site should be conducted to detect "hot spots" if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 ppm above background continuously for a 5-minute period as measured in the breathing zone, upgrade to Level C personal protective equipment (PPE) or move to a non-contaminated area.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed one-half the TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is therefore not a preferred tool for determining worker exposure to chemicals. If odors are detected, then employees shall upgrade to respirators with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

7.0 SITE CONTROL PLAN

Work zones will be considered to be within 10 feet of any active drill equipment or sampling activity. Employees should work upwind of the machinery if possible. To the extent practicable, use the buddy system. Do not approach heavy equipment unless you are sure the operator sees you and has indicated it is safe to approach. All personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers etc.). For medical assistance, see Section 3.0 above.

A contamination reduction zone should be established for personnel before leaving the Facility or before breaking for lunches etc. The zone should consist of garbage bags into which used PPE should be disposed. Personnel should wash hands at the Facility before eating or leaving the Facility.

7.1. Traffic or Vehicle Access Control Plans

Traffic entering and exiting the Site will be through controlled access points. Site personnel will be instructed to stop and look both ways before crossing any vehicle access point/roadway.

7.2. Site Work Zones

- Hot zone/exclusion zone: Within 10 feet of any boring or sampling area
- Contamination reduction zone: Within the Site work zone greater than 10 feet of any boring or sampling area
- Decontamination Zone: Rinse hands and remove loose soil from boots

7.3. Buddy System

Personnel on-site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on-site, a buddy system can be arranged with subcontractor/ contractor personnel.

7.4. Site Communication Plan

Positive communications (within sight and hearing distance or via radio) should be maintained between pairs on-site, with the pair remaining in proximity to assist each other in case of emergencies. The team should prearrange hand signals or other emergency signals for communication when voice communication becomes impaired (including cases of lack of radios or radio breakdown). In these instances, you should consider suspending work until communication can be restored. If not, the following are some examples for communication:

- Hand gripping throat: Out of air, can't breathe.
- Gripping partner's wrist or placing both hands around waist: Leave area immediately, no debate.
- Hands on top of head: Need assistance.
- Thumbs up: Okay, I'm all right or I understand.
- Thumbs down: No, negative.

7.5. Decontamination Procedures

Decontamination consists of removing outer protective Tyvek clothing and washing soiled boots and gloves using bucket and brush provided on-site in the contamination reduction zone. Inner gloves will then be removed, and respirator, hands and face will be washed in the Decontamination Zone. Employees will perform decontamination procedures and wash prior to eating, drinking or leaving the site.

7.6. Waste Disposal or Storage

Used PPE to be placed in trash containers. Investigation derived waste will be placed in on-site drums pending characterization and disposal.

8.0 PERSONAL PROTECTIVE EQUIPMENT

After the initial and/or daily hazard assessment has been completed the appropriate protective personal protective equipment (PPE) will be selected to ensure worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Site activities may include handling and sampling solid subsurface material (material may potentially be saturated with groundwater). Depth-to-groundwater measurements may be performed as well. Site hazards include potential exposure to hazardous materials, and physical hazards such as trips/falls, heavy equipment, and exposure.

Air monitoring will be conducted to determine the level of respiratory protection.

- Half-face combination organic vapor/high efficiency particulate air (HEPA) or P100 cartridge respirators will be available on-site to be used as necessary. P100 cartridges are to be used only if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on-site.
- Level D PPE unless a higher level of protection is required will be worn at all times on the site. Potentially exposed personnel will wash gloves, hands, face and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.

Applicable personal protection gear to be used:

X	Hardhat
X	Steel-toed boots (if crushing hazards are a potential or if client requests)
X	Safety glasses (if dust, particles, or other hazards are present or client requests)
X	Hearing protection (if it is difficult to carry on a conversation 3 feet away)
X	Rubber boots (if wet conditions)

Gloves (specify):

X	Nitrile
	Latex
	Liners
	Leather
	Other (specify) _____

Protective clothing:

	Tyvek
	Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
X	Cotton
X	Rain gear (as needed)
X	Layered warm clothing (as needed)

Inhalation hazard protection:

X	Level D
	Level C (respirators with organic vapor filters/ P100 filters)

8.1. Personal Protective Equipment Inspections

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To

obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

8.2. Respirator Selection, Use and Maintenance

If respirators are required, Site personnel shall be trained before use on the proper use, maintenance and limitations of respirators. Additionally, they must be medically qualified to wear a respiratory protection in accordance with 29 CFR 1910.134. Site personnel who will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used. Respirators will be stored in a protective container.

8.3. Respirator Cartridges

If Site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be certified and approved by the National Institute for Occupational Safety and Health (NIOSH). A cartridge change-out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change-out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste or feel, although breakthrough is not an acceptable method of determining the change-out schedule.

8.4. Respirator Inspection and Cleaning

Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned, to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

9.0 ADDITIONAL ELEMENTS

9.1. Cold Stress Prevention

Working in cold environments presents many hazards to site personnel and can result in frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature).

The combination of wind and cold temperatures increases the degree of cold stress experienced by site personnel. Site personnel shall be trained on the signs and symptoms of cold-related illnesses, how the human body adapts to cold environments, and how to prevent the onset of cold-related illnesses. Heated break areas and warm beverages shall be provided during periods of cold weather.

9.2. Heat Stress Prevention

State and federal OSHA regulations provide specific requirements for handling employee exposure to heat stress. GeoEngineers' program complies with these requirements and will be implemented in all areas where heat stress is identified as a potential health issue.

General requirements for preventing heat stress apply to outdoor work environments from May 1 through September 30, annually, only when employees are exposed to outdoor heat at or above an applicable temperature listed in the following table. To determine which temperature applies to each worksite, select the temperature associated with the general type of clothing or personal protective equipment (PPE) each employee is required to wear.

Keeping workers hydrated in a hot outdoor environment requires that more water be provided than at other times of the year. GeoEngineers is prepared to supply at least one quart of drinking water per employee per hour. When employee exposure is at or above an applicable temperature listed in the following table, the Project Manager shall ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times; and
- All employees have the opportunity to drink at least one quart of drinking water per hour.

HEAT STRESS PREVENTION

Type of Clothing	Outdoor Temperature Action Levels (Degrees Fahrenheit)
Non-breathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
All other clothing	89°

9.3. Emergency Response

- Personnel on-site should use the "buddy system" (pairs).
- Visual contact should be maintained between "pairs" on-site, with the team remaining in proximity to assist each other in case of emergencies.
- If any member of the field crew experiences any adverse exposure symptoms while on-site, the entire field crew should immediately halt work and act according to the instructions provided by the Site Safety and Health Supervisor.
- Wind indicators visible to all on-site personnel should be provided by the Site Safety and Health Supervisor to indicate possible routes for upwind escape. Alternatively, the Site Safety and Health Supervisor may ask on-site personnel to observe the wind direction periodically during site activities.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and reevaluation of the hazard and the level of protection required.
- If an accident occurs, the Site Safety and Health Supervisor and the injured person are to complete, within 24 hours, an Accident Report for submittal to the PM, the Health and Safety Program Manager and Human Resources. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

9.4. Personnel Medical Surveillance

GeoEngineers employees are not in a medical surveillance program because they do not fall into the category of "Employees Covered" in OSHA 1910.120(f)(2), which states a medical surveillance program is required for the following employees:

1. All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;
2. All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations;
3. All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and
4. Members of HAZMAT teams.

9.5. Sampling, Managing and Handling Drums and Containers

Drums and containers used during the cleanup shall meet the appropriate Department of Transportation (DOT), OSHA and U.S. Environmental Protection Agency (EPA) regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container movement. When practicable, drums and containers shall be inspected and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are

positively identified and labeled. Before drums or containers are moved, all employees involved in the transfer operation shall be warned of the potential hazards associated with the contents.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupture may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred. Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

9.6. Sanitation

Washrooms are present in the adjacent Port Seafarer's Memorial Park and nearby retail facilities (i.e. McDonalds, Safeway grocery store).

9.7. Lighting

Field work will be conducted during daylight hours; if at dusk, street lights are present.

10.0 DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

The following forms are required for Hazardous Waste Operations and Emergency Response (HAZWOPER) projects:

- Field Log
- Health and Safety Plan acknowledgment by GeoEngineers employees (Form C-2)
- Contractors Health and Safety Plan Disclaimer (Form C-3)
- Conditional forms available at GeoEngineers office: Accident Report

The Field Report is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subcontractors, client or other parties, etc.;
- Air monitoring/calibration results, including: personnel, locations monitored, activity at the time of monitoring, etc.;
- Actions taken;
- Action level for upgrading PPE and rationale; and
- Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.).

11.0 LIMITATIONS

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

12.0 REFERENCES

GeoEngineers, Inc. (GeoEngineers, 2014), "Groundwater Monitoring Sampling and Analysis Plan, Cap Sante Marine, Anacortes, Washington, Ecology Consent Decree No. 9917," GEI File No. 5147-005-10, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, May 30, 2014.

GeoEngineers, Inc. (GeoEngineers, 2013), "Remedial Investigation/Feasibility Study, Cap Sante Marine, Anacortes, Washington, Ecology Agreed Order No. DE-07TCPHQ-4197," GEI File No. 5147-005-09, prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, December 10, 2013.

Washington State Department of Ecology (Ecology, 2013), "Cleanup Action Plan (CAP), Cap Sante Marine Site, Anacortes, Washington," by the Washington State Department of Ecology, Toxics Cleanup Program, Lacey, Washington, December 10, 2013.

FORM B-1
HEALTH AND SAFETY PRE-ENTRY BRIEFING
CAP SANTE MARINE SITE
FILE NO. 5147-005-10

Inform employees, contractors and subcontractors or their representatives about:

- The nature, level and degree of exposure to hazardous substances they're likely to encounter;
- All site-related emergency response procedures; and
- Any identified potential fire, explosion, health, safety or other hazards.

Conduct briefings for employees, contractors and subcontractors, or their representatives as follows:

- A pre-entry briefing before any site activity is started; and
- Additional briefings, as needed, to make sure that the Site-specific HASP is followed.

Make sure all employees working on the Site are informed of any risks identified and trained on how to protect themselves and other workers against the Site hazards and risks

Update all information to reflect current sight activities and hazards.

All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety and Health Supervisor.

The orientation and the tailgate safety meetings shall include a discussion of emergency response, Site communications and site hazards.

Company Employee

Date	Topics	Attendee	Name	Initials

FORM B-2
SITE SAFETY PLAN – GEOENGINEERS' EMPLOYEE ACKNOWLEDGMENT
CAP SANTE MARINE SITE
File No. 5147-005-10

All GeoEngineers' Site workers shall complete this form, which should remain attached to the Safety Plan and filed with other project documentation.

I hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on Site. I agree to comply with all required, specified safety regulations and procedures.

Print Name	Signature	Date

FORM B-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM
CAP SANTE MARINE SITE
FILE NO. 5147-005-10

I verify that a copy of the current Site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on Site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the Site. By signing below, I agree that the safety of my employees is the responsibility of the undersigned company.

Print Name	Signature	Firm	Date

APPENDIX C
Monitoring Well Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	CC	Cement Concrete
	AC	Asphalt Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE C-1

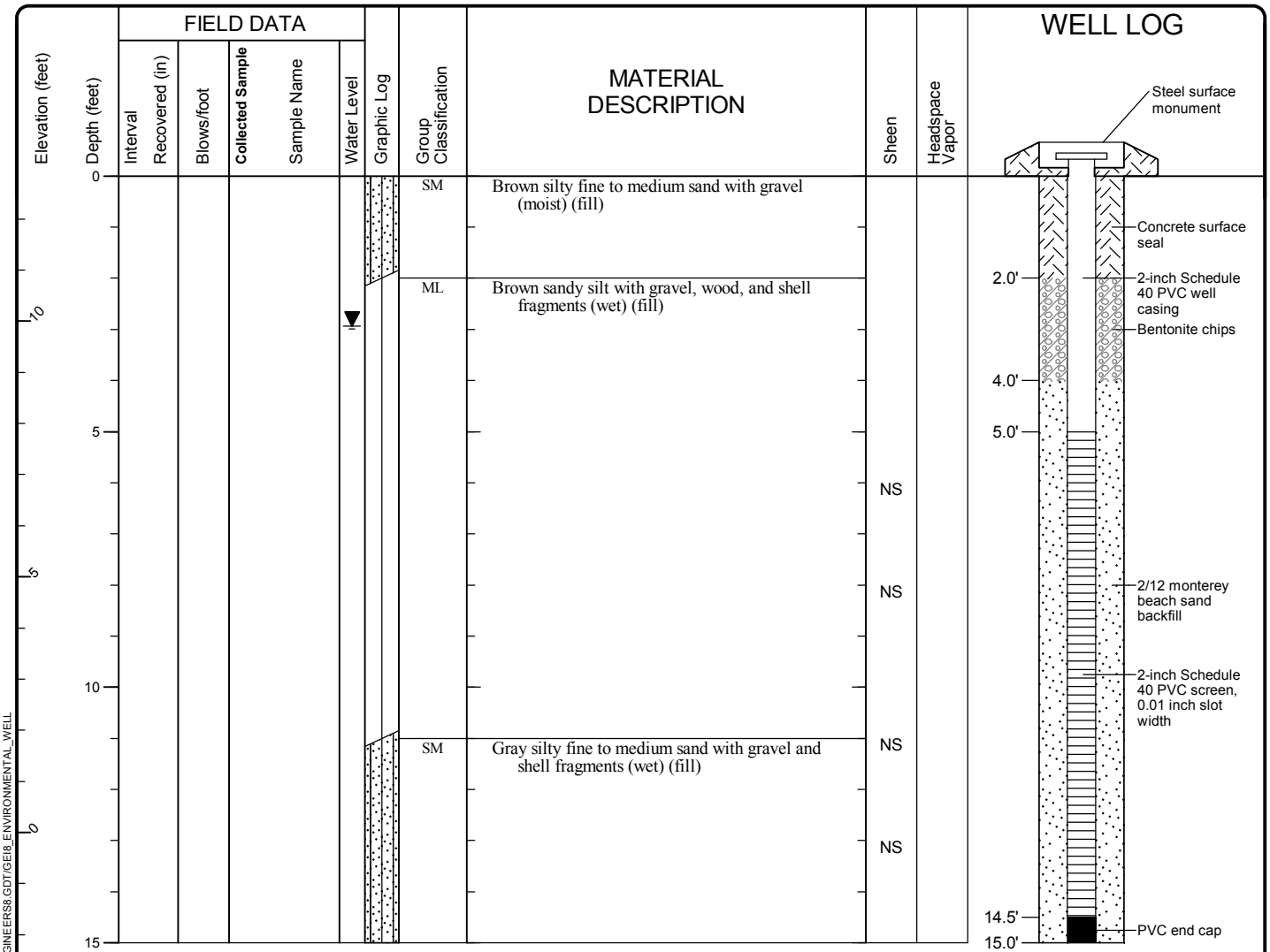
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	2/9/2012	2/9/2012	15	AJ	RST	Cascade Drilling, LP	Hollow Stem Auger

Hammer Data	N/A	Drilling Equipment	CME 75
Surface Elevation (ft) Vertical Datum	12.8 MLLW	Top of Casing Elevation (ft)	12.5
Easting (X) Northing (Y)	1209694.387 556552.4204	Horizontal Datum	NAD83

Licensing agency well number: **BHM145**
A 2 (in) well was installed on 2/9/2012 to a depth of 15 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
2/9/2012	2.9	9.58

Notes: Air knife from 0 to 5 feet. No samples obtained, soil descriptions based on drill cuttings. PID malfunction - No head space vapor readings.



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well GEI-MW-6

GeoEngineers

Project: Former Shell Oil Tank Farm
Project Location: Anacortes, Washington
Project Number: 5147-012-02

Figure C-2
Sheet 1 of 1

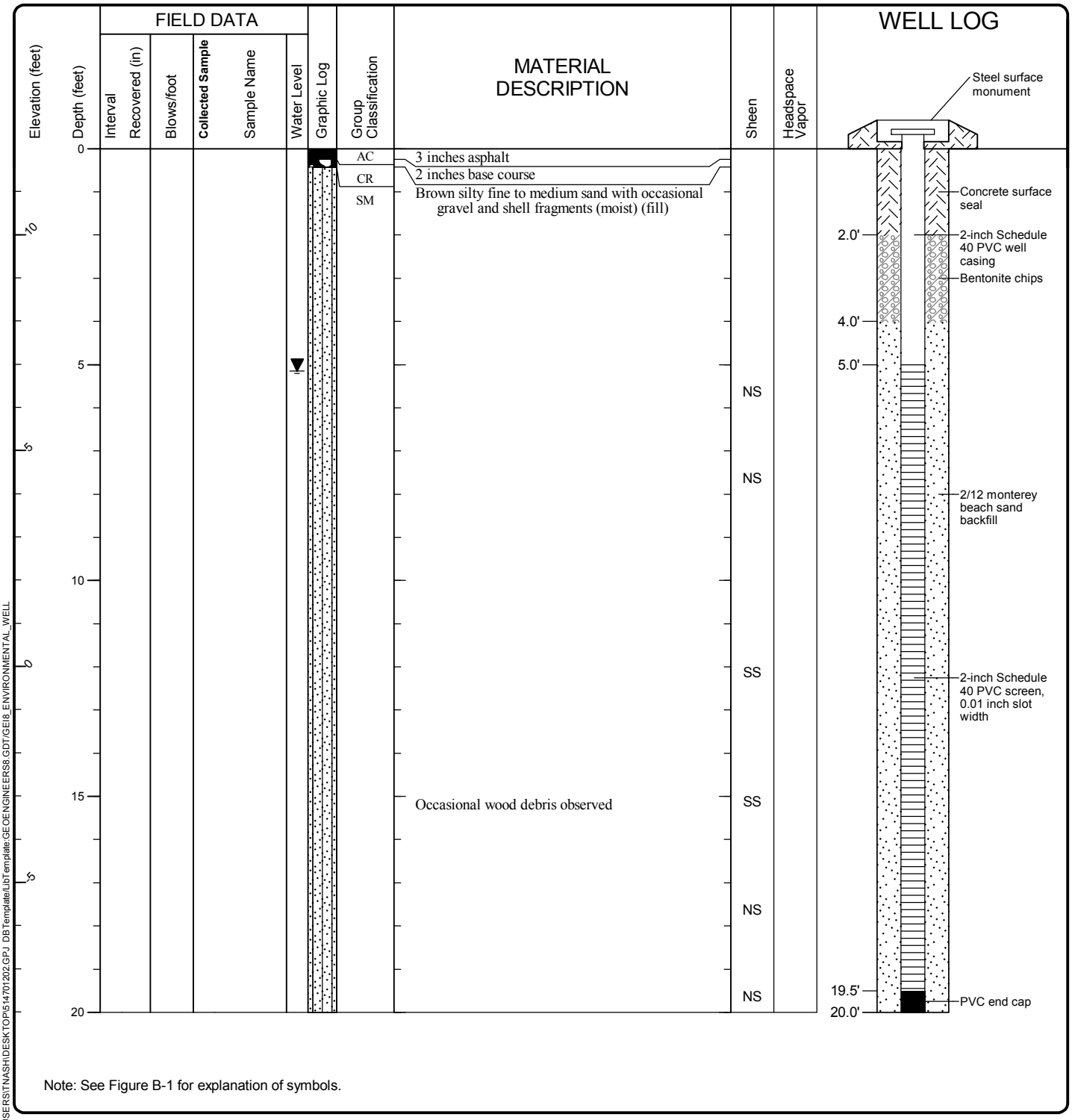
Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
2/10/2012	2/10/2012	20	AJ / RST	Cascade Drilling, LP	Hollow Stem Auger

Hammer Data	N/A	Drilling Equipment	CME 75
Surface Elevation (ft) Vertical Datum	12.0 MLLW	Top of Casing Elevation (ft)	11.7
Easting (X) Northing (Y)	1209845.159 556436.0145	Horizontal Datum	NAD83

Licensing agency well number: **BHM147**
A 2 (in) well was installed on 2/10/2012 to a depth of 20 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
3/6/2012	5.2	6.50

Notes: Air knife from 0 to 5 feet. No samples obtained, soil descriptions based on drill cuttings. PID malfunction - No head space vapor readings.



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well GEI-MW-7

GeoEngineers

Project: Former Shell Oil Tank Farm
Project Location: Anacortes, Washington
Project Number: 5147-012-02

Figure C-3
Sheet 1 of 1

Seattle: Date:4/5/12 Path:C:\USERS\TNASH\DESKTOP\5147012202.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Have we delivered World Class Client Service?

Please let us know by visiting **www.geoengineers.com/feedback**.

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