Port of Chelan County

Former Cashmere Mill Site
Removal Action Work Plan

February 2013

Prepared by RH2 Engineering, Inc.

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Note: This Removal Action Work Plan was completed under the direct supervision of the following Licensed Professional Engineers and Licensed Geologist registered in the State of Washington.

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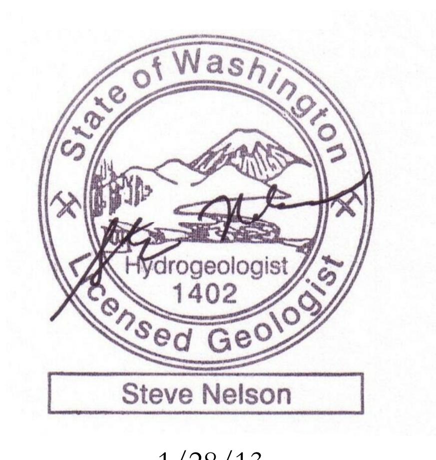

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1. Introduction

This removal action work plan (Plan) was prepared by RH2 Engineering, Inc., (RH2) with support of Maul Foster & Alongi, Inc., (MFA) on behalf of the Port of Chelan County (Port). The Port owns the former Cashmere Mill properties (site) (**Figure 1**) and intends to transfer the site to a prospective purchaser (Crunch Pak, of Cashmere, Washington) that intends to redevelop the site for commercial use as a fruit storage warehouse and fruit bin storage site. As a condition of purchase, Crunch Pak requires removal of all wood waste-related materials resulting from former mill activities from the developable areas of the site, removal of known, and any discovered, petroleum hydrocarbon-contaminated soil (PCS), and backfilling the excavated areas and filling other areas of the site with structural import fill to regrade the site and to improve drainage. The Port intends to conduct wood waste and PCS removal actions and place structural import fill (the removal action) in 2013.

The Washington State Department of Ecology (Ecology) is providing funding through an Interagency Agreement to support the removal action, which outlines the basic objectives of the removal action and requirements to achieve a determination of no-further-action (NFA) for the site. The NFA determination for soil will be based on confirmation that all PCS and wood waste containing contaminant concentrations exceeding associated cleanup levels have been removed from the site. The Port will also conduct groundwater characterization as part of this removal action after wood waste and PCS removal activities are complete. The objective of the groundwater characterization efforts is to confirm that no contaminants of concern remain in groundwater beneath the Site at concentrations exceeding associated cleanup levels. Initial groundwater characterization will be completed to determine the nature and extent of groundwater contaminants and will guide the development of a groundwater monitoring program, if determined necessary based on initial sampling results, to assess the fate of any residual contaminants in groundwater and what form of groundwater remediation, if any, would be required to achieve an NFA for groundwater at the site.

This work plan describes removal action activities to meet the project objectives. The work plan summarizes background information, defines field activities and specifications, and identifies applicable regulatory requirements necessary to complete the removal action. Key personnel, organizations, individual roles, and responsibilities associated with implementation of the removal action are described in Section 7.

Implementation of this work plan following plan approval will include procurement of materials and services, completion of required activities, and restoration of the site. Soil confirmation sampling after wood waste and PCS removal will provide data necessary for obtaining NFA determination for soil at the site. Documentation of all activities completed, including the achievement of the removal action objectives, will be presented in a removal action report.

2. Site Summary

The Port has conducted environmental site assessments at the site since 2007. Reports describing the activities and findings of the assessments pertaining to the nature and extent of wood waste and PCS at the site are summarized in the References section. This section compiles a summary of site conditions and history from these reports.

2.1. Location

The site is located within the City of Cashmere, along Mill Road and Sunset Highway (**Figure 1**). The site is approximately 32.5 acres in size, bounded to the north by the Burlington Northern Santa Fe (BNSF) railroad tracks; to the east, south, and partially to the west by Brender Creek; with the remaining westerly portion bounded by residential and light industrial uses. The northern boundary of the site, along the railroad tracks, is less than 100 feet from the Wenatchee River.

2.2. History

Construction of the Great Northern Railroad in the early 1900s required realignment of the Wenatchee River to the north of the site. Historically, the river occupied a meander extending south and east of the site. Brender Creek now flows along this former meander (RH2, 2007a).

The site was used primarily for lumber milling from the 1940s until the late 1970s (RH2, 2007b) and for a variety of commercial and light industrial uses thereafter. The mill primarily produced thin lumber to construct fruit packing boxes. No wood treatment chemicals or processes were documented to have been used at the site. The Cedarbrook Company, owned by Mr. John Lysaker, bought the property in 1990 from WI Forest Products, and sold the property to the Port in 2007. Based on anecdotal information, this property has never been used for agriculture (RH2, 2007b).

From 2009 to 2011, the Port completed a series of projects to improve the site. The projects included removing existing asphalt-paved areas, and concrete slabs and footings found throughout the site, primarily in the area between Mill Road and Sunset Highway. These pavement materials were crushed and stockpiled for use as fill (the asphalt piles were sold and disposed offsite). The two remaining buildings on site were treated for asbestos materials, and then demolished and the materials disposed offsite.

The Port also completed a limited wood waste removal project in the southeast portion of the site in 2010 and 2011. The Port hired a contractor to remove all surficial wood waste from a portion of the site. The contractor screened the wood waste, removed the larger rocks and wood pieces, and then sold the remaining material as landscape material. Crushed concrete stockpiled onsite was used to fill the excavated area.

2.3. Previous Site Investigations

In 1990, a Phase 1 Environmental Site Assessment was performed by Forsgren and Associates, Inc. prior to the purchase of the property by Mr. Lysaker of the Cedarbrook Company (Forsgren and Associates, Inc., 1990; RH2, 2007b). This assessment identified evidence of *de minimis* soil contamination from lubrication oils at several locations south of Mill Road, and concluded that the contamination likely existed only in the upper 6 inches of soil. The area between Sunset Highway and Mill Road was reportedly almost completely paved with either asphalt or cement/concrete and therefore, any minor spills that occurred in the area would not likely have led to contamination of the underlying soil. Underground storage tanks (USTs) were observed and a recommendation was made to remove them or bring them up to code. Communications with Mr. Lysaker indicated that all the items identified in the Forsgren Environmental Assessment were remedied prior to or immediately following his purchase of the property, including removal of the USTs. The locations of the USTs were not documented, but based on personal communication with Mr. Lysaker, were likely located in the specified areas shown on **Figure 1**. Documentation of these actions was either not prepared or was lost in a large fire that occurred on the site in 2000 and, therefore, could not be verified for this Plan.

RH2 (2007c) completed a feasibility report prior to the Port's purchase of the site. The feasibility report included a limited environmental assessment (RH2, 2007b) and a geologic report (RH2, 2007a). The geologic report helped to characterize the wood waste composition and distribution, and is summarized later in this Plan. The environmental assessment, completed through a detailed historical review including interviews with several knowledgeable community members and a limited subsurface exploration south of mill road, was able to establish the existence of several mill related structures and the former uses and purposes, but was unable to identify any evidence of existing contamination.

In 2009 and 2010, RH2 conducted limited field assessment of PCS discovered during site-development activities. The field assessment included test pit exploration and sampling and analysis of soil for concentrations of total petroleum hydrocarbons (TPH). Assessment locations are shown in **Figure 2** and the findings are described in Section 2.5

In 2010, GeoEngineers, Inc., (GeoEngineers) performed a detailed geotechnical evaluation of the site as part of the Port's redevelopment plans. GeoEngineers drilled nine borings and completed two of the borings as groundwater monitoring wells (B-1, B-2; **Figure 2**) (GeoEngineers, 2010). At two locations (B-1, B-6; **Figure 2**), soil containing petroleum hydrocarbon-like odors was encountered at a depth of 11.5 feet below ground surface (bgs), which is below the depth of the local water table. Samples from the borings contained TPH as diesel and oil concentrations below Ecology Model Toxics Control Act (MTCA) Method A Cleanup Levels. No groundwater samples were collected from the wells as part of the investigation.

RH2 performed a limited groundwater investigation in 2011 consisting of measuring groundwater elevations at one existing monitoring well (B-5) and in four open test pits excavated to the water table during May and June 2011 (RH2, 2011). The depth to the water table ranged from 1.5 to 4.5 feet bgs in the area south of Mill Road, and 2 to 5 feet bgs between Mill Road and Sunset Highway. The groundwater level measured in May and June 2011 at the monitoring well were approximately 0.5 feet higher than the groundwater water level measured in January, 2010, indicating that minor (less than 1 foot) of seasonal groundwater fluctuation may occur at the site.

RH2 performed additional wood waste, soil, and groundwater investigation activities in August 2012 to better delineate wood waste thickness and composition in unexplored areas, to characterize existing conditions of PCS in areas of known contamination, and to determine if groundwater conditions would allow for site dewatering during future wood waste removal. Wood waste samples were analyzed for chemicals typically used during wood treating processes, including petroleum hydrocarbons; metals (arsenic, chromium, copper, lead); and semi-volatile organic compounds (SVOCs). Soil collected from test pits at known PCS sites was tested for TPH as gasoline and TPH as diesel. A dewatering test well was constructed to evaluate groundwater conditions including aquifer characteristics and dewatering requirements. A sample of water from the test well was also analyzed for wood treatment chemicals. The results of the test are included in **Appendix A.**

2.4. Site Characteristics

The site is underlain by unconsolidated Quaternary glacial and alluvial sediments and sedimentary bedrock of the Chumstick Formation (Tabor et al.; 1987). The site is located in a bend in the former channel of the Wenatchee River. The river bend was cut into a glacial outwash terrace, forming a cut bank approximately 20 feet high south of Brender Creek (**Figure 1**). Alluvium was deposited as the river channel incised the surrounding terraces. Brender Creek flows along the base of the river cut bank. Much of the site was formerly occupied by ponds and bogs along the river floodplain. These topographic depressions were filled at various times with wood debris from mill activities. Interviews with several long-time Cashmere residents and the former owner indicate that granular fill was imported to the site. Three primary areas received fill: Area 1 – north of Sunset Highway; Area 2 – the mill pond north of Mill Road; and Area 3 – south of Mill Road in the log storage area (**Figure 1**). In most places, fill was placed directly on top of Wenatchee River alluvium.

Fill includes wood waste (sawdust, lumber ends, bark, and wood debris); granular fill (sand, silt, and gravel with organic material, including logs); and inert fill consisting (concrete, asphalt, metal, lumber, and other building materials). Most of the fill observed during field work consists of slightly decomposed wood waste or granular fill containing wood waste.

Wood waste at the site is a mixture of raw wood, lumber, sawdust, and granular fill. Wood waste was redistributed by site grading that leveled or covered wood waste stockpiles after mill activities concluded. Site history indicates that the former mill only prepared raw timber into lumber, and no wood treatment operations were conducted. No historical activities, documented through interviews with persons familiar with the site history, reportedly included intentional or accidental releases of petroleum hydrocarbons on the site or import of contaminated materials on to the site (Forsgren, 1990; RH2, 2007a).

2.4.1. Hydrology

The site is almost entirely bounded by water features including the Wenatchee River to the north, and Brender Creek to the west, south, and east. Brender Creek flows in a long curving channel about 100 feet north of the southern property line and discharges into the Wenatchee River northeast of the site. Wetlands exist along the Brender Creek shoreline. Year-round flow in Brender Creek likely affects the groundwater level at the site.

An irrigation return ditch (No-Name Creek) flows about 1,000 feet from west to east along the southern shoulder of Mill Road. The ditch is open near the western boundary of the site, where it forms a small pond. From there, the water flows in a culvert for approximately 600 feet. The ditch is open for about 180 feet along Mill Road near the current Cedarbrook shop. Near the eastern boundary of the property, water enters a culvert that crosses Mill Road and flows approximately 500 feet to discharge into Brender Creek. The ditch is open for about 6 feet before re-entering a culvert beneath Sunset Highway.

In the mid-1990s, the property owner undertook a conservation effort in cooperation with the Washington Department of Fish and Wildlife (WDFW) and Chelan County Conservation District to enhance aquatic habitat in over 2,000 feet of Brender Creek. This effort included excavating sediment from the stream channel placing the excavated sediment in a large berm that parallels the creek. The berm is approximately 10 feet high, 60 feet wide, and 1,000 feet long (**Figure 1**).

Groundwater elevations vary across the site, ranging in depth from 1.5 feet to 5.5 feet bgs. The groundwater table likely fluctuates a few feet during the course of a year due to seasonal precipitation patterns and the changes in flows in Brender Creek and the Wenatchee River (GeoEngineers, 2010).

2.5. Description of Areas Considered Under Removal Action

2.5.1. Wood Waste

The site is divided into three general areas corresponding to the areas of historical waste placement. Area 1 is the northern most area located between Sunset Highway and the BNSF railroad tracks. No wood waste was encountered in Area 1 and no removal actions will be conducted in Area 1.

Area 2 is located south of Area 1, between Sunset Highway and Mill Road, and includes the former mill pond (**Figure 1** and **Figure 2**). Wood waste thickness in the former mill pond ranges from 3 to 13 feet (GeoEngineers, 2010) and tapers to less than 3 feet west of the former pond and to a thickness of 10 feet at the eastern property boundary at Area 2. Wood waste in the center of the former mill pond will not be removed in order to maintain the integrity of the culvert that contains No-Name Creek, which is considered by WDFW as a fish-bearing year-round stream. The wood waste east of the former mill pond in Area 2 (**Figure 1**) has a maximum depth of 10 feet and will be removed as part of the removal action.

Area 3 is the largest area and is located south of Mill Road. This area was predominantly used as a storage area for logs and processed lumber when the mill was operational. Wood waste in Area 3 includes wood waste typically mixed with or interlayered with granular fill soils consisting of silty sand with varying amounts of gravel and cobbles. Native alluvium underlying wood waste and granular fill consists of medium dense silty sand and dense to very dense gravel with silt, sand, and cobbles (RH2, 2007a; GeoEngineers, 2010).

In August 2012, RH2 conducted additional characterization activities in Areas 2 and 3 to estimate wood waste thickness in previously unexplored areas. RH2 collected representative samples of wood waste from the five locations where a significant thickness (greater than 1 foot) of wood waste was encountered. Wood waste samples were analyzed for TPH, SVOCs, and metals. Wood waste did not contain detectable concentrations of TPH as gasoline. Wood waste at one location contained TPH as diesel and oil at concentrations of less than 50 milligrams per kilogram (mg/kg) and less than 100 mg/kg, respectively, based on testing using the HCID method without silica gel cleanup step. Woodwaste at a second location contained TPH as diesel and oil at concentrations of 110 mg/kg and 290 mg/kg, respectively, based on testing using the HCID method with the silica gel cleanup step. Most samples contained detectable concentrations of arsenic, chromium, copper, and lead at concentrations similar to natural background; two samples contained chromium concentrations that were twice the value of the natural statewide background concentration of 38 mg/kg, but below the MTCA Method A cleanup level of 100 mg/kg (*Natural Background Soil Metals Concentrations in Washington State*, Ecology Publication No. 94-115). Note that arsenic and lead were also used historically as components of pesticides for applications at orchards in the region, and detection of these metals may be partially attributed to area-wide contamination common to agricultural areas in central Washington (*Area Wide Soil Contamination Task Force Report*, Ross and Associates, et al, 2003).

All samples contained detectable concentrations of SVOCs, primarily phenols and polynuclear aromatic hydrocarbons (PAHs), generally in the range of 20 to 100 micrograms per kilogram (μg/kg) which is near the method detection limit for these compounds. Results of the wood waste chemical analysis are summarized in **Table 1**. Pentachlorophenol was detected in one sample at an estimated concentration below the method detection limit; the same sample also contained several other phenol compounds. The broad range in types of detected compounds in wood waste is characteristic of creosote, which is a mixture of more than 100 separate chemicals including polynuclear aromatic hydrocarbons and phenols (http://www.epa.gov/opp00001/factsheets/chemicals/creosote_main.htm). The proximity of the historic railroad and its use of treated railroad ties for rail operation is a potential source of these trace concentrations of SVOCs detected in wood waste at the site.

Table 1. Wood Waste Analytical Results

	Sample Number				
Analyte	9	14	23	24	26
SVOCs by EPA Method 8270 (ug/kg)					
Benzo (a) pyrene	<20	25	13 J	18 J	16 J
Benzo (a) anthracene	<20	20	11 J	23	16
Total Benzo fluoranthenes	<39	50	16 J	50	20 J
Chrysene	<20	37	28	43	18 J
Dibenz (a, h) anthracene	<20	10 J	<20	<19	<20
Indeno (1, 2, 3-cd) pyrene	<20	36	<20	<19	<20
Fluorene	<20	15	<20	9.5 J	<20
Acenaphthylene	<20	77	<20	<19	<20
Acenaphthene	<20	22	<20	<19	<20
Phenanthrene	<20	160	41	80	29
Anthracene	<20	24	<20	<19	<20
Fluoranthene	<20	75	14 J	46	18 J
Dibenzofuran	<20	35	<20	<19	<20
Fluorene	<20	15 J	<20	<19	<20
Pyrene	<20	86	43	91	38
Benzo (g, h, i) perylene	<20	57	35	<19	<19
Naphthalene	<20	380	27	120	25
1-Methylnapthalene	<20	37	9.8 J	28	<20
2-Methylnapthalene	<20	70	20	58	16 J
bis (2-Ethylhexyl) phthalate	46 B	38 B	41 B	44 B	54 B
2, 4-Dichlorophenol	<200	<190	<200	<190	<200
2-Methylphenol	<20	<19	<20	<19	<20
4-Methylphenol	<39	180	75	240	330
Pentachlorophenol	<200	<190	<200	170 J	<200
2, 4, 6-Trichlorophenol	<98	<94	<98	<95	<97
2, 4, 5-Trichlorophenol	<98	<94	<98	<95	<97
Metals by EPA Method 6010C (mg/kg)					
Arsenic	6	9	9	7	10
Chromium	91.7	29.1	41	38.9	89.6
Copper	15.8	15.8	15.1	27.1	17
Lead	3	15	17	27	15
Total Petroleum Hydrocarbons by NWTPH-HCID (mg/kg)					
HCID-TPH gasoline	-	-	<20	<20	-
HCID – TPH diesel	-	-	>50	110*	-
HCID-TPH oil	-	-	>100	290*	-

Samples collected on 8/30/2012. See **Figure 2** for sample locations.

- Not analyzed
- B – detected in laboratory method blank.
- J – lab estimate below detection limit.

* – Analysis included silica gel cleanup step.

2.5.2. Groundwater below Wood Waste

Based on the mapped depths of wood waste and groundwater elevations, as well as previous visual observations at the site, dewatering will likely be necessary to achieve complete wood waste removal at Area 3.

A dewatering test well was constructed in August 2012 to evaluate the effect of groundwater pumping on site water levels and estimate aquifer properties of the native soil below the wood waste. The results of dewatering testing and water quality analysis and an analysis of dewatering system requirements are summarized in **Appendix A**.

A 5-inch-diameter test well was completed within native soil below the base of wood waste using a 10-foot-long, wire-wrapped, stainless steel screen installed from 12 to 22 feet bgs. Static water level in the well was 4 feet bgs. The dewatering well was pumped at a rate of 92 gallons per minute (gpm) for several hours. The water level in the well drew down 6.2 feet to slightly above the base of the wood waste and then stabilized. After pumping, the groundwater level recovered to the static level in about 60 minutes. A sample of groundwater collected at the end of the pumping test was submitted for analysis of TPH as gasoline and diesel; benzene, ethylbenzene, toluene, and total xylenes (BTEX); total metals (copper, lead, arsenic, chromium); and SVOCs. The groundwater sample did not contain detectable concentrations of TPH, BTEX, or SVOCs. The groundwater sample contained trace levels of metals at concentrations close to their respective laboratory detection limits.

Construction dewatering could generate 50 gpm during shallow excavation into soil that would likely be managed through sumping. Excavation into deeper wood waste below depths of 8 to 10 feet likely will require construction dewatering that will likely generate groundwater discharge rates initially at 50 to 100 gpm and up to 300 to 500 gpm. The rate of groundwater discharge will depend on the permeability of the native soil and wood waste at the excavated area, the depth of the excavation, and the method used for groundwater control.

Dewatering discharge will be evaluated and managed as described in Section 4.

2.5.3. Petroleum Contaminated Sites

Previous investigations encountered PCS at five separate locations. Characterization of the nature and extent of the PCS is summarized in this section. The five PCS sites are shown on **Figures 1, 2,** and **3**.

2.5.3.1. Site 1

On May 7, 2009, RH2 conducted a geologic investigation to evaluate soil and groundwater conditions along a proposed water main replacement alignment. At location TP-2 (**Figure 2**), alluvial soil exhibiting an odor characteristic of gasoline-range hydrocarbons was encountered at a depth of 5.5 feet bgs. The water-saturated soil at the water table depth of 6.0 feet exhibited a faint sheen, as did the groundwater at the water table. No evidence of a measureable thickness of petroleum product was apparent at the water table. No other evidence in surface soil indicated a potential source for the release. No indications of petroleum hydrocarbon seepage were observed or have been observed on the Wenatchee River bank (the nearest body of surface water), which is approximately 250 feet from TP-2.

On September 9, 2009, RH2 explored Site 1 using test pits. Three test pits (S-1, S-2, S-3) were excavated approximately 10 to 30 feet from TP-2 (**Figure 2**). No apparent contamination (an odor characteristic of petroleum hydrocarbons) was present in the soil at these locations. Test pit S-4 was excavated near TP-2 to confirm the type and concentrations of petroleum hydrocarbons in soil at the original discovery location. Test pit S-5 was excavated across Sunset Highway from TP-2, and observations indicated the presence of hydrocarbons in soil. Three additional test pits (S-6, S-7, and S-8) were excavated to assess the extent of soil contamination near S-5, and did not encounter evidence of soil contamination (**Figure 2**). Odors characteristic of gasoline-range hydrocarbons were detected at S-4 and S-5, and possibly at S-6.

Soil samples were retrieved from each excavation sidewall at a depth of approximately 5 to 7 feet bgs and submitted for analysis of gasoline-range hydrocarbons by the U.S. Environmental Protection Agency (EPA) Method 5035A/Ecology Method NWTPH-Gx. Sample S-4 was analyzed for diesel-range hydrocarbons by Ecology Method NWTPH-Dx to confirm the presence or absence of diesel fuel contamination at Site 1.

Table 2a summarizes the laboratory analyses of the initial soil samples from Site 1.

Table 2a. Initial Investigation Results – Site 1

Sample Number	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	
BTEX (µg/kg)									**MTCA Method A Cleanup Level (µg/kg)**
Benzene	<17	<16	<12	<12	<14	<18	<15	<15	30
Toluene	<17	<16	20	650	62	<18	<15	<15	7,000
Ethylbenzene	<17	<16	<12	1,600	370	<18	<15	<15	6,000
Xylenes (total)	<17	<16	29	700	210	<18	<15	<15	9,000
NWPTH-Gx (mg/kg)									**MTCA Method A Cleanup Level (mg/kg)**
TPH as gasoline	8.2	<6.3	<4.7	**1,600**	**490**	<7.4	<6.1	<6.2	30
NWPTH-Dx (mg/kg)									**MTCA Method A Cleanup Level (mg/kg)**
TPH as diesel fuel	-	-	-	910	-	-	-	-	2,000
TPH at heavy oil	-	-	-	<110	-	-	-	-	2,000

Concentrations of TPH as gasoline at Site 1 at S-4 and S-5 exceeded MTCA Method A Cleanup Levels in Soil for Unrestricted Land Use.

In 2011 and 2012, during reconstruction of Sunset Highway, PCS in the road alignment at sample locations S-4 and S-5 was remediated by excavation and off-site disposal at the Waste Management municipal waste landfill in East Wenatchee, Washington.

In August 2012, RH2 collected four soil samples for laboratory analysis of TPH as gasoline and BTEX from test pits installed on each side of the extent of the prior remedial action excavation to confirm the remedial action removed contaminants exceeding applicable cleanup levels (**Figure 2**). One sample was analyzed to characterize the TPH composition using Ecology Methods Volatile Petroleum Hydrocarbons/Extractable Petroleum Hydrocarbons (VPH/EPH). Results are summarized in **Table 2b**. Concentrations of TPH as gasoline range from less than 5 mg/kg to

74 mg/kg; toluene and total xylenes were detected in one sample at concentrations of 82 and 105 µg/kg, respectively. Therefore, the representative confirmation samples indicate that no residual PCS containing TPH and BTEX concentrations exceeding MTCA Method A cleanup levels remains at Site 1 and no additional soil remedial action is warranted. Groundwater characterization of Site 1 using monitoring wells will occur after wood waste removal.

Table 2b. Confirmation Sampling Results – Site 1

Sample Number	5	6	7	8	
BTEX (µg/kg)					**MTCA Method A Cleanup Level (µg/kg)**
Benzene	<25	<30	<27	<25	30
Toluene	<25	82	<27	<25	7,000
Ethylbenzene	<25	<30	<27	<25	6,000
Xylenes (total)	<25	105	<27	<25	9,000
NWTPH-Gx (mg/kg)					**MTCA Method A Cleanup Level (□g/kg)**
TPH as gasoline	<4.9	73	74	<5.2	100
Ecology Method VPH (µg/kg)					**MTCA Method A Cleanup Level (µg/kg)**
C8-C10 Aromatics	<11,000	-	-	-	na
C10-C12 Aromatics	10,000	-	-	-	na
C12-C13 Aromatics	8,700	-	-	-	na
C5-C6 Aliphatics	<11,000	-	-	-	na
C6-C8 Aliphatics	<11,000	-	-	-	na
C8-C10 Aliphatics	6,500	-	-	-	na
C10-C12 Aliphatics	<11,000	-	-	-	na

- Not analyzed

na - Not available

2.5.3.2. Site 2

Site 2 was identified in October 2009 during removal of existing asphalt pavement and concrete footings from the project site by the Port's contractor. Soil exhibiting an odor characteristic of petroleum hydrocarbons was observed under and adjacent to several large concrete footings (**Figure 2**).

As part of the October 2009 field efforts, RH2 investigated Site 2 via installation of exploration test pits. A representative soil sample (S-1) was collected from test pit S-1b located at the original discovery location. Analytical results of the soil sample S-1 contained diesel-range hydrocarbons at concentrations above MTCA Method A cleanup levels. Soil exhibiting odors characteristic of petroleum hydrocarbons was also observed at test pits TP-2b and TP-5b. Step-out exploration pits S-2b and S-4b) were dug to the north and east, respectively (**Figure 2**). No odors in soil were detected in samples from step out test pits and samples (S-2 and S-4) from the step-out test pits contained no detectable concentrations of TPH as gasoline. At two additional excavations (S-3b and S-5b), no gasoline-range hydrocarbons were detected in soil samples collected from excavation sidewall at a depth of approximately 4 to 6.5 feet bgs. Samples were collected approximately 6 to 12 inches above the water table at the time of excavation. **Table 3** summarizes the laboratory analyses of the soil samples collected associated with Site 2.

Table 3. Investigation Results – Site 2

Sample Number	S-1	S-2	S-3	S-4	S-5	
BTEX (µg/kg)						**MTCA Method A Cleanup Level (µg/kg)**
Benzene	<20	<18	<27	<20	<19	30
Toluene	<20	<18	<27	<20	<19	7,000
Ethylbenzene	<20	<18	<27	<20	<19	6,000
Xylenes (total)	<39	<37	<54	<41	<39	9,000
NWTPH-Gx (mg/kg)						**MTCA Method A Cleanup Level (mg/kg)**
TPH as gasoline	<7.9	<7.3	<11	<8.1	<7.7	100
HCID (mg/kg)						**MTCA Method A Cleanup Level (mg/kg)**
HCID – TPH diesel	**2,500**	-	-	-	-	2,000
HCID-TPH oil	**4,500**	-	-	-	-	2,000

- Not analyzed

Soil containing TPH as diesel/oil exceeding MTCA Method A cleanup levels exists at Site 2 at S-1b, and likely exists at TP-2b and TP-5b where petroleum hydrocarbon-odors were detected similar to those at S1-b. PCS may also underlie concrete foundations at Site 2. Additional soil characterization of this site will take place during the wood waste removal action. Groundwater characterization of Site 2 using monitoring wells will occur after wood waste removal. In addition, any catch basins, drywells, and sumps that are encountered during the wood waste removal will be characterized for petroleum hydrocarbons.

2.5.3.3. Site 3

Petroleum contaminated Site 3 was discovered in 2010 by GeoEngineers during drilling of geotechnical soil borings. Soil boring B-1 was drilled to a depth of 17.5 feet, encountered groundwater at 6 feet, and encountered soil at a depth of 11.5 feet exhibiting odors resembling petroleum hydrocarbons. Soil boring B-6 was drilled to a depth of 11 feet, encountered groundwater at 5.5 feet, and encountered soil containing petroleum hydrocarbon-like odors at a depth of 11.5 feet (**Figure 2**). Soil samples from the two borings were analyzed for diesel-range petroleum hydrocarbons and contained detectable diesel and lube oil-range hydrocarbons concentrations below MTCA Method A cleanup levels (**Table 4**).

Table 4. Investigation Results – Site 3, Mill Pond

Sample Number and depth (feet)	B-1; 11.5 ft	B-6; 11.5 ft	MTCA Method A Cleanup Level (mg/kg)
NWTPH as diesel (mg/kg)	500	1,100	2,000
NWTPH as heavy oil (mg/kg)	820	1,600	2,000

No residual PCS is apparent at Site 3 at concentrations exceeding MTCA Method A cleanup levels. No removal action is planned for Site 3. Groundwater monitoring at Site 3 will be conducted after site-wide removal action is completed (Section 4.4).

2.5.3.4. Site 4

Site Location 4 was discovered in July 2011 as part of the field investigations during test pit exploration to observe the depth of the water table at the site. A multi-point composite soil sample collected from one test pit (S-1) exhibited a strong petroleum hydrocarbon odor and was submitted for analysis of diesel range hydrocarbons. Analytical results indicated the presence of TPH as diesel at concentrations below MTCA Method A cleanup levels (**Table 5**). The result was used as a screening tool to indicate the need for additional characterization, as composite sampling is not appropriate for this type of investigation

Table 5. Initial Investigation Results – Site 4 and Site 5

Sample Number and Depth	Site 4 S-1; 4 ft	Site 5 S-1; 4 ft	Site 5 S-2; 5 ft	MTCA Method A Cleanup Level (mg/kg)
NWTPH as diesel (mg/kg)	-	350	-	2,000
NWTPH as heavy oil (mg/kg)	-	700	-	2,000
HCID-gasoline (mg/kg)	<20	<26	<24	100
HCID-diesel (mg/kg)	6.7	>65	>60	2,000
HCID-oil (mg/kg)	100	>130	>120	2,000

- not analyzed

In August 2012, RH2 further investigated Site 4 with 12 test pits to better characterize the extent and composition of TPH in PCS. Petroleum hydrocarbon-like odors were detected in soil at most sampling locations. The sample with the strongest apparent hydrocarbon odor (S-12) was analyzed to characterize the TPH composition using Ecology Methods VPH and EPH, and for potential use to calculate Method B Cleanup Levels. The VPH/EPH results indicate a concentration of TPH as gasoline of approximately 22 mg/kg and TPH as diesel/oil of approximately 100 mg/kg, which are below Method A Cleanup Levels; use of the Method B Cleanup Level calculation was not warranted based on these results. One sample (S-22) was analyzed for TPH as gasoline and TPH as diesel using Ecology method NWTPH-HCID to identify the types of TPH at the potential western limit of PCS at Site 4. The sample did not contain TPH as gasoline concentrations greater than 20 mg/kg and did contain concentrations of TPH as diesel and oil of greater than 50 and greater than 100 mg/kg, respectively. Results are summarized in **Table 6**.

The August 2012 investigation was for screening purposes to assess the extent of PCS that may be encountered during removal action. PCS containing concentrations of TPH exceeding MTCA Method A cleanup levels will be removed during removal actions at Site 4 as described in Section 4.

Table 6. Additional Investigation Results – Site 4

	Sample Number and depth (feet)		MTCA Method A Cleanup Level (mg/kg)
HCID (mg/kg)	S-12; 3 ft	S-22; 4 ft	
HCID - TPH as gasoline	-	<20	100
HCID - TPH as diesel	-	>50	2,000
HCID - TPH as heavy oil	-	>100	2,000
Ecology Method VPH/EPH (mg/kg)			
C8-C10 Aromatics	3.2	-	na
C10-C12 Aromatics	11 J	-	na
C12-C16 Aromatics	<2.2	-	na
C16-C21 Aromatics	2.2	-	na
C21-C34 Aromatics	6.5	-	na
C5-C6 Aliphatics	<11	-	na
C6-C8 Aliphatics	<11	-	na
C8-C10 Aliphatics	¤ 3.5B	-	na
C10-C12 Aliphatics	<2.2	-	na
C12-C16 Aliphatics	3.6	-	na
C16-C21 Aliphatics	2.9	-	na
C21-C34 Aliphatics	87.0	-	na

\- Not analyzed
na - Not available

2.5.3.5. *Site 5*

Site 5 was discovered during the initial wood waste removal project in 2011. Soil at Site 5 exhibited a faint petroleum hydrocarbon-like odor. A soil sample from Site 5 analyzed for TPH using Ecology method NWTPH-HCID did not contain detectable concentrations of gasoline and diesel-range hydrocarbons (**Table 5**). The stockpiled soil from the Site 5 was disposed offsite.

No residual PCS is apparent at Site 5 at concentrations exceeding Method A cleanup levels. No removal action is warranted for Site 5.

3. Removal Action Objectives

The overall removal action objective is to gain an NFA determination from Ecology for the project site through conducting the necessary field activities to confirm the removal of wood waste and soil containing contaminants exceeding associated cleanup levels, and through adequately characterizing the underlying groundwater to demonstrate that the groundwater has not been impacted and that no adverse impact to groundwater remains at the site. To meet this objective, the planned removal action consists of removing all wood waste in developable areas of the site, removing all known PCS exceeding associated cleanup levels, disposal of all PCS and any petroleum-contaminated wood waste identified during wood waste removal at an appropriate facility, backfilling of all excavated areas with clean fill, and conducting groundwater monitoring to confirm that groundwater at locations identified to have been impacted by petroleum hydrocarbons do not contain contaminant levels that exceed cleanup goals.

4. Removal Action Strategy

4.1. Wood Waste

4.1.1. Wood Waste Removal and Disposal

Wood waste will be entirely removed from developable areas of the site (i.e., areas outside of any critical areas or critical area buffers) by excavation, and transported offsite for reuse or disposal. The excavated areas will be backfilled as soon as possible after wood waste removal using clean import fill or clean native soil from the site.

Wood waste will be removed using large bulldozers and excavators to place excavated wood waste directly into trucks for transport off-site. During wood waste removal, on-site inspectors will screen the wood waste for physical evidence of contaminants using visual indications and a photoionization detector (PID) as described in **Appendix B**, Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP). If contamination is suspected, the wood waste will be stockpiled on site and assessed for the type and concentrations of contaminants and the wood waste will be disposed of based upon the characterization results. When native alluvium is exposed, the native soil will be screened and grid-sampled for analysis of petroleum hydrocarbons and wood treatment chemicals. Laboratory results will be returned 24 hours after receipt of the sample. Upon receipt of soil testing results confirming that no contaminants remain at concentrations above associated cleanup levels, the excavated area will be backfilled with imported structural fill and compacted. Field screening methods and soil confirmation sampling and analysis methods are described in **Appendix B**. Health and safety procedures are described in **Appendix C,** the Health and Safety Plan**.**

Thinnest areas of wood waste in the west and northern portions of the project site Area 3 will be excavated first. The thickest areas of wood waste that are below the water table in the southern portions of Area 3 and eastern portions of Area 2 will be removed last, in late summer 2013, to minimize the requirements for construction dewatering.

4.1.2. Dewatering Effluent Characterization, Treatment, and Disposal

Construction dewatering is estimated to generate 50 to 100 gpm during initial shallow wood waste excavation activities that would likely be managed through sumping. Excavation into deeper wood waste (below depths of 8 to 10 feet) likely will require construction dewatering that may generate groundwater discharge rates ranging from 300 to 500 gpm.

Groundwater withdrawn during pumping will be routed into a settling tank to reduce total suspended solids (TSS). The Port will establish an agreement with the City of Cashmere (City) to accept the discharge water for treatment at the City's wastewater treatment plant (WWTP). The agreement will require periodic water quality monitoring for TPH and wood treatment chemical concentrations and daily inspections of discharge water in the settling tanks to be conducted by the Contractor to confirm that no sheens or odors are present in the discharge. At the start of operation, sampling will occur daily for the first week, and then be adjusted, if warranted, based on analytical results. The discharge will be routed to a connection point (6” PVC pipe stub) to the City of Cashmere’s low pressure sewer system. This connection point is located just off the mill site entrance from Sunset Highway (**Figure 4**), discharge will require pumping, a system curve will be provided in the bid documents.

Should the WWTP become unavailable to accept dewatering effluent during the removal action, the Contractor will use an on-site water treatment system to remove organic compounds from dewatering discharge and route the treated discharge to an on-site infiltration basin constructed in the shallow areas of wood waste. The treatment system will be sized to adequately receive the anticipated dewatering rates and will likely include granular activated carbon filters to remove any dissolved organic compounds and trace metals.

4.1.3. Potentially Contaminated Wood Waste Characterization and Disposal

Wood waste may locally contain inert solid waste including concrete and metal. Anecdotal evidence also suggests the possibility that buried vehicles exist in the wood waste, and that abandoned subsurface utilities may exist, including dry wells. All areas of unusual wastes or abandoned utilities will be observed for indications of contamination and field screened. Field screening results will determine whether wood waste contains contaminants warranting additional characterization and appropriate disposal. Any contaminated wood waste will be removed, stockpiled separately on site for waste characterization, and disposed off-site at an applicable facility permitted to receive the contaminated wood waste. Soil underlying contaminated wood waste will be field-screened and confirmation samples collected. Field screening methods and soil confirmation sampling and analysis methods are described in the SAP/QAPP (**Appendix B**).

4.2. Petroleum Contaminated Sites

4.2.1. Site 2

PCS at confirmed locations containing TPH as diesel exceeding MTCA Method A Cleanup Levels at petroleum contaminated Site 2 will be removed and the limits of PCS removal will be determined by field screening. Excavated PCS will be removed for off disposal at a facility permitted to receive and dispose of the PCS. Confirmation sampling will assess the effectiveness of PCS removal, and the excavation will be backfilled with clean imported soil following confirmation that no contamination exceeding cleanup levels remains. Field screening methods and soil confirmation sampling and analysis methods are described in the SAP/QAPP (**Appendix B**).

4.2.2. Site 4

Concrete foundations will be removed at petroleum contaminated Site 4 during removal actions. PCS at confirmed locations containing TPH as diesel exceeding MTCA Method A Cleanup Levels at Site 4 will be removed and the limits of PCS removal will be determined by field screening. Excavated PCS will be removed for disposal at a permitted facility. Confirmation sampling will assess the effectiveness of PCS removal, and the excavation will be backfilled with clean imported soil following confirmation that no contamination exceeding cleanup levels remains. Field screening methods and soil confirmation sampling and analysis methods are described in the SAP/QAPP (**Appendix B**).

4.2.3. Discovered potentially contaminated soil sites

If field screening during wood waste removal encounters evidence of potentially contaminated soil (e.g., odors, sheens, stains, detections of volatile organic vapors using a PID, etc.), any apparent potentially contaminated soil will be removed and the limits of potentially contaminated soil removal will be determined by field screening. Excavated soil will be removed for on-site stockpiling, characterization, and disposal at a permitted facility. Confirmation sampling will assess the effectiveness of soil removal, and the excavation will be backfilled with clean imported soil following confirmation that no contamination exceeding cleanup levels remains. Field screening methods and soil confirmation sampling and analysis methods are described in the SAP/QAPP (**Appendix B**).

4.3. Excavated PCS and Contaminated Wood Waste Stockpiling

Excavated PCS and contaminated wood waste (CWW) will be stockpiled separately at predefined locations at the project site. Excavated PCS and CWW will be stockpiled separately in a manner that will allow for characterization sampling (composite samples) of the material. Characterization sampling will be conducted per methods described in the SAP/QAPP (**Appendix B**). Characterization of PCS and CWW will demonstrate compliance with acceptance criteria of the designated disposal facility.

The stockpile areas will be constructed to include an impermeable plastic liner placed on compacted gravel, an impermeable plastic cover, and sufficient stormwater controls to isolate the stockpiles from precipitation and surface water prevent stormwater run-on into or runoff from the stockpile area.

4.4. Groundwater Monitoring

Groundwater monitoring will be conducted after removal actions. Groundwater monitoring will characterize groundwater conditions at upgradient/background locations and downgradient of areas of known and discovered PCS and CWW. Groundwater monitoring wells will be installed following Washington Administrative Code (WAC) 173-160 at locations based on the findings of field exploration and observations during wood waste and PCS removal, and to establish the groundwater gradient and flow direction at the site. Proposed locations for groundwater monitoring wells are shown on **Figure 1**. Additional groundwater monitoring wells may be installed downgradient of locations of where PCS or contaminated wood waste is discovered and removed. Groundwater samples will be collected in accordance with the SAP/QAPP (**Appendix B**) from each monitoring well after the wells have been developed in accordance with Ecology standards. Groundwater samples will be analyzed for TPH as gasoline, TPH as diesel/oil, and BTEX. If gasoline is detected in groundwater, samples will also be analyzed for lead, methyl tertiary-butyl ether (MTBE), ethylene dibromide (EDB) and ethylene dichloride (EDC). If WTC is detected in wood waste, groundwater samples will also be analyzed for WTC.

5. Removal Action Implementation

5.1. Wood Waste Removal

Wood waste will be progressively removed from shallow to deeper wood waste layers. Wood waste in Area 2 will be removed up to within approximately 10 feet of the eastern boundary of the parcel and down to native alluvial soil (**Figure 4**); wood waste in Area 3 will be removed up to the critical area buffer zone and parcel boundaries, as applicable, and down to native alluvial soil (**Figure 4**). Non-contaminated wood waste will be placed directly into trucks and transported offsite. Construction dewatering is anticipated only to be required during Area 3 excavation activities and will be implemented at shallower excavations using sumps. When sumping is not able to maintain the integrity of the excavation, dewatering wells will be installed to drain the soil of groundwater and reduce underlying groundwater pressure. Dewater discharge will be managed as described in Section 5.6.3. Wood waste identified as potentially contaminated by field staff during excavation will be stockpiled on site for further characterization.

Wood waste removal will include continuous field observation to evaluate the quality of the wood waste and to screen wood waste and underlying soil exhibiting signs of potential contamination, including odors and stains. If field screening results indicate potential contamination, the wood waste will be removed and stockpiled on site. Confirmation sampling will be conducted of both wood waste and underlying soil.

5.2. Petroleum Contaminated Soil Removal

PCS will be removed from the locations of known cleanup level exceedances at petroleum contaminated Sites 2 and 4, and field screening will guide the extent of initial soil removal. PCS will be removed at areas discovered during wood waste removal and confirmed through field screening. Any apparently contaminated soil exhibiting sheen, staining, odors will be removed below the water table to a maximum depth of 2 feet. Excavated soil in areas of known TPH contamination will be placed into a separate PCS stockpile for characterization and subsequent transport offsite for disposal. Excavated PCS in areas of discovered TPH will also be placed in the on-site PCS stockpile for characterization sampling. Additional PCS removal followed by additional screening and confirmation sampling will be conducted in areas where TPH concentrations are confirmed to exceed MTCA Method A cleanup levels.

5.3. Pollution and Erosion Control Measures

The removal actions at the site will include management of potential pollutants introduced to the site by contractor equipment and to prevent off-site discharge of pollutants by runoff and erosion of excavated materials or by discharges from contractor equipment. The details of pollution and erosion control measures are described in the construction bid documents for the removal action.

5.4. Stormwater Collection and Management

Stormwater management is an important consideration during implementation of the removal action. Stormwater is defined as any precipitation (e.g., rain, snow, and hail) or surface water that accumulates on or flows across the ground surface. Control measures will be incorporated that mitigate stormwater run-on into, as well as runoff from, the excavation. All stormwater shall be removed from the excavation and treated as dewatering water. Temporary alternate drainage pathways, temporary diversion structures, or other measures will be utilized to minimize the amount of stormwater to be managed during the field activities. Stormwater management activities are described in the contract specifications for the removal action.

After the start of excavation and prior to confirmation sampling, water that accumulates in the excavation will be pumped with sump pumps into the construction dewatering system and managed with dewatering discharge.

5.5. Establishment of Work Zones

Work zones for the removal action will include the active excavation area, stockpile areas, and construction dewatering system. These zones will likely shift as excavation proceeds depending on excavation progress. **Figure 4** shows the initial work zones, which will be identified on the site using signage and fencing, where appropriate.

5.6. Removal Action Construction Activities

5.6.1. Dewatering Well and Monitoring Well Network Installation

The removal action contractor will install construction dewatering wells following WAC 173-160. The wells will be installed using either a large diameter auger or air rotary methods to complete the dewatering well borings to a depth of approximately 30 feet, and installing 4- to 6-inch-diameter slotted-screen PVC wells. The boring annular space will be backfilled with pea gravel for the full length of the boring. The wells will be positioned by the contractor around the deepest part of wood waste removal area in locations that would achieve effective groundwater control to facilitate excavation and removal of wood waste below the water table.

The removal action contractor will install temporary monitoring wells at the center and along the perimeter of deep excavations to support operation of the dewatering system and to confirm effective dewatering performance. The monitoring wells will be installed following WAC 173-160 using either an auger or air rotary rig to complete the piezometer borings to a depth of approximately 30 feet, and installing 2-inch-diameter slotted-screen PVC well screen. The boring annular space will be backfilled with pea gravel for the full length of the boring. Monitoring well installation will be observed by, or under the direction of, a Washington State licensed hydrogeologist.

Two monitoring wells constructed in 2010 (B-1, B-2) (**Figure 3**) will be used to support groundwater elevation monitoring of construction dewatering performance.

All dewatering wells and monitoring wells (including the two existing monitoring wells) (GeoEngineers, 2009) will be decommissioned at the end of the construction dewatering activities following WAC 173-160.

5.6.2. Site Clearing and Grubbing

Much of the project site is already cleared of structures and debris. Concrete foundations near petroleum contaminated Site 4 will be removed initially before wood waste removal actions. Areas of the project site covered will granular fill over wood waste will be stripped and the fill removed for off-site disposal.

5.6.3. Dewatering Activities

Areas of shallow fill that lie below the water table will be excavated with the support of groundwater sumps to remove water from the excavation. Sumps will be used as long as the integrity of the excavation is maintained with sumping. Deeper excavations will require dewatering wells to reduce groundwater pressure underlying the wood waste and to allow excavation to proceed below the water table to the base of the wood waste. Electric submersible pumps will be placed in each dewatering well and a discharge line will be routed to a manifold that collects all discharge water. Each well will have independent flow control valves.

Water from sumps and from dewatering wells will be routed from the manifold to a series of 20,000-gallon settling tanks. The water will then be routed to a manhole for discharge to the Cashmere WWTP. If the WWTP discharge option is not available, the water will be treated for organic compounds using granular activated carbon filters and the water will be discharged under permit to an infiltration basin constructed on site (**Figure 4**). **Appendix A** contains calculations of anticipated dewatering discharge rates.

5.6.4. Wood Waste Excavation

5.6.4.1. Potentially Contaminated Wood Waste or Fill Material

Field inspectors will continuously monitor wood waste removal to observe indications of contamination in wood waste and in native soil underlying wood waste. If visible or olfactory indications of contamination are observed (stains, sheens, odors, etc.), then field screening will be conducted by the field inspector to assess the potential for TPH in wood waste and in soil underlying the wood waste. If field screening indicates the presence of TPH, wood waste will be excavated and stockpiled in the CWW stockpile area for disposal characterization. Excavation and stockpiling of CWW will proceed until confirmation sampling indicates that the CWW has been removed and wood waste removal actions will proceed.

5.6.4.2. Unanticipated Anomalies

Unexpected materials in the wood waste may include inert waste, or equipment from former mill activities. Inert solid waste such as construction debris (concrete, metal, plastic) will be segregated from wood waste and placed in a separate inert solid waste stockpile and subsequently disposed off-site at a permitted facility. Equipment that may have included petroleum hydrocarbons, heavy metals, and polychlorinated biphenyls (PCBs) (vehicles, oil drums, motors, electrical transformers, etc.) will be removed from the wood waste and stockpiled separately from other wastes on site for characterization and subsequent off-site disposal at a permitted facility. The wood waste, fill, and underlying soil will be field screened for the type of potential contaminants, and any contaminated wood waste, fill, and underlying soil will be excavated and stockpiled on site for disposal characterization. Confirmation sampling will assess the effectiveness of the removal action and will test compounds pertinent to the type of waste or materials encountered.

5.6.5. Site 2 Excavation, Stockpiling and Characterization

Petroleum contaminated Site 2 removal actions will be conducted independently of wood waste removal actions. The PCS at the known area of contamination at Site 2 will be removed and placed into the PCS stockpile for subsequent off-site disposal. Field screening will be used to identify the limits of PCS removal. Confirmation sampling will confirm the effectiveness of PCS removal action. The excavated area will be backfilled with import structural fill following receipt of analytical results confirming that no contaminants exceeding applicable cleanup levels remain on site.

5.6.6. Site 4 Excavation, Stockpiling and Characterization

Petroleum contaminated Site 4 removal actions will be conducted independently of wood waste removal actions. The concrete foundations at Site 4 will be removed before removal actions at Site

4. The PCS at the known area of contamination at Site 4 will be removed and placed into the PCS stockpile for subsequent off-site disposal. Field screening will be used to identify the limits of PCS removal. Confirmation sampling will confirm the effectiveness of PCS removal action. The excavated area will be backfilled with import structural fill following receipt of analytical results confirming that no contaminants exceeding applicable cleanup levels remain on site.

5.6.7. Excavated Material Transport

Wood waste will be loaded directly from the excavation and into trucks for transport off-site. All trucks containing wood waste will be covered with plastic tarps to prevent loss of wood waste from the truck during transport in a manner which meets any applicable local, state or federal requirements.

PCS and CWW will be loaded directly from PCS stockpiles into trucks for transport off-site to a permitted disposal facility. All trucks containing PCS and CWW will be lined and covered with plastic tarps to prevent loss of PCS and CWW from the truck during transport. The trucks will be weighed upon entering and leaving the project site to determine the amount of PCS and CWW exported from the site. Manifests of PCS and CWW transported from the site will be maintained and will be used to determine contractor payment.

All inert solid waste will be loaded directly from the inert solid waste stockpile and into trucks for transport offsite to a permitted disposal facility.

5.6.8. Wood Waste Area Confirmation Soil Sampling and Analysis

Once wood waste has been excavated to native soil, confirmation soil samples in areas where PCS has not been observed through field screening will be collected from the excavation base and analyzed for petroleum hydrocarbons and wood treatment chemicals. A sample grid will be created by dividing the excavated surface area into individual 200-foot by 200-foot grids in areas where PCS has not been detected during previous investigations, and into 100-foot by 100-foot grids where PCS has been previously detected. The grid system will extend only within the boundaries of the wood waste excavation. **Figure 5** illustrates the proposed grid sample spacing.

One sample will be collected from the center of each grid. Based on the anticipated excavation dimensions, a total of 36 soil samples (33 from the base and 3 field duplicates) will be collected.

If confirmation grid samples indicate MTCA Method A cleanup level exceedance for TPH or MTCA Method B cleanup level exceedance for WTC, additional soil will be removed from the grid. Field screening will be used to identify the limits of soil removal. Confirmation sampling will confirm the effectiveness of soil removal action. The excavated area will be backfilled with import structural fill. Field screening and confirmation sampling methods will follow the SAP/QAPP (**Appendix B**).

If confirmation sample analytical results indicate an exceedance of an associated cleanup level, then four additional soil samples (referred to as "stepped out" samples) will be collected from the base of the excavation. The stepped out samples should generally be spaced evenly and located approximately 20 to 40 feet from the original confirmation sample location based on field conditions. These four stepped out soil samples will only be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results from the stepped out samples indicate compliance with associated cleanup levels, then the area within the boundaries of the stepped out samples will be excavated and a confirmation sample will be collected from the new excavation. This confirmation sample will be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results of the samples indicate an exceedance of the associated cleanup level, then consider continuing the process of stepping out or excavate the remaining area of the grid being sampled. This process could continue until confirmation samples indicate compliance with associated cleanup levels as site conditions allow.

5.6.9. Material Import and Backfilling

The wood waste and PCS removal actions will create large excavated areas. The removal action objective includes replacing all excavated material with import structural fill up to the elevation of the Wenatchee River floodplain and compacting the imported fill to support redevelopment of the site. The imported fill will be obtained from a verified and tested clean source of off-site fill, loaded into trucks, and placed directly into the excavated areas. The inspector shall observe the import fill source to confirm whether it is native or fill. If the source is a native material (undisturbed) then three (3) composite samples will be collected, if the material is determined to be fill (previously disturbed material) then 10 composite samples shall be collected. Each sample shall be tested for TPH as gasoline/BTEX and TPH as diesel. The imported fill will be placed in 1-foot-thick lifts and compacted to meet redevelopment objectives, which will be verified as filling proceeds using field inspection and nuclear gauge instrumentation. The details of import material specifications, placement, and compaction will be described in the removal action construction bid documents.

5.6.10. Groundwater Monitoring Well Installation

5.6.10.1. Well Construction

Groundwater monitoring wells to characterize groundwater at the site will be installed after wood waste and PCS removal actions. A well drilling contractor will install groundwater monitoring wells following WAC 173-160. The wells will be installed using either an auger or air rotary rig to complete the monitoring well borings to a depth of approximately 20 to 30 feet, and installing 2-inch-diameter slotted-screen PVC wells. The screen length will be 10 feet. The slot size will be based on the grain-size distribution of the native alluvium encountered at the monitoring well location. The boring annular space will be backfilled with graded silica-sand filter pack size appropriately for the screen up to at least 1 foot above the top of the screen slots. The remaining portion of the annular space will be filled with granular bentonite up to within 2 feet of ground surface. The remaining annular space will be filled with crushed gravel or clean sand to provide a firm base for a flush-mount locking well monument that will be placed over the top of the well and secured in place with concrete. Well drilling and construction will be observed by or under the direction of a Washington State licensed hydrogeologist.

5.6.10.2. Well Location Methodology

At least one well will be located upgradient from any potentially contaminated sites. At least two monitoring wells will be located downgradient of areas of known PCS at Sites 1, 2, and 4. Additional groundwater monitoring wells may be required at locations within and downgradient of areas of PCS or CWW discovered during removal actions. Groundwater gradient at the project site is undefined, but presumed to be oriented subparallel to the Wenatchee River. Two background monitoring wells will be located in areas likely upgradient of the downgradient wells. The proposed monitoring well locations are shown on **Figure 1**. The top of well casing will be surveyed by a licensed surveyor to determine horizontal location and vertical elevation. The surveyor will tie the well locations and elevations to a Site survey benchmark, referenced to NAVD 88.

5.6.10.3. Well Development

The monitoring wells will be developed using surging and pumping techniques until the water from the well flows free and clear of sediment and turbidity has stabilized. Well development procedures are fully described in the SAP/QAPP in **Appendix B**. Once wells have been developed, they will not be sampled for at least 24 hours, preferably 48 hours.

5.6.10.4. Sampling Program

The monitoring wells will be sampled to characterize the groundwater conditions at the site including the presence of TPH in groundwater downgradient of PCS sites, in areas background to the PCS removal sites, and to establish groundwater elevations and flow direction at the PCS removal sites. The monitoring wells will be initially sampled four times, approximately every 3 months, to establish the groundwater conditions and groundwater flow direction. If groundwater concentrations of TPH are detected in any samples from at least one monitoring well downgradient of a PCS site, an additional year of quarterly monitoring will be conducted in all of the wells at the site. Groundwater sampling, monitoring, and reporting procedures are fully described in the SAP/QAPP in **Appendix B**.

6. Removal Action Schedule

The removal action will be conducted during 2013. Contract bid documents will be submitted for public bidding in January 2013. The contractor will be selected in February 2013 and will mobilize to the project site shortly thereafter. Removal action field activities will begin with establishment of work areas, and removal of concrete foundations and surficial granular fill. PCS removal actions at petroleum contaminated Sites 2 and 4 will proceed independently of wood waste removal, likely during early summer 2013. Wood waste removal will start in March 2013, and proceed through August or September 2013. Backfilling of the wood waste excavation will proceed as soon as soil confirmation grid sampling demonstrates the particular grid area is compliant with cleanup levels.

A proposed schedule for removal actions is provided in the removal action Construction Bid documents.

7. Removal Action Organization

The Port, and its consultants at RH2 and Ecology, are guiding and implementing this removal action. An accredited analytical laboratory that will be identified at a later date will provide laboratory services. RH2 environmental staff is responsible for checking, downloading, and calibrating the field instruments, collecting and transporting samples under chain of custody to the laboratory representatives. RH2 will evaluate all water quality and quantity data, using methods approved by Ecology.

Key personnel involved in this project and their responsibilities are as follows.

Laura Jaecks, Port of Chelan County, is the owner's representative. The Port is responsible for development of documents and implementation field activities necessary to meet the removal action objective, and for interacting with interested public and stakeholders. Phone: (509) 661-3118. Email: laura@ccpd.com.

Karen Kornher, *P.E.,* RH2, Engineering, Inc., is the project manager and agent between the sampling staff at RH2 and the Port. Phone: (509) 886-6764. Email: kkornher@rh2.com.

Steve Nelson, L.G., L.HG., L.E.G., RH2, Engineering, Inc., is the project lead for the development of this work plan and analysis of data for the final project report. Phone: (425) 951-5406. Email: snelson@rh2.com.

Mary Monahan, Central Regional Office, Department of Ecology Toxics Program, is responsible for Ecology's review and approval of the work plan and construction-related documents, and will advise on sampling requirements, quality assurance, and quality control issues during project implementation and assessment. Phone: (509) 454-7840. Email: mmon461@ecy.wa.gov

The primary contact for laboratory coordination for sample management and data quality will be determined upon selection of the contract laboratory.

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Figures

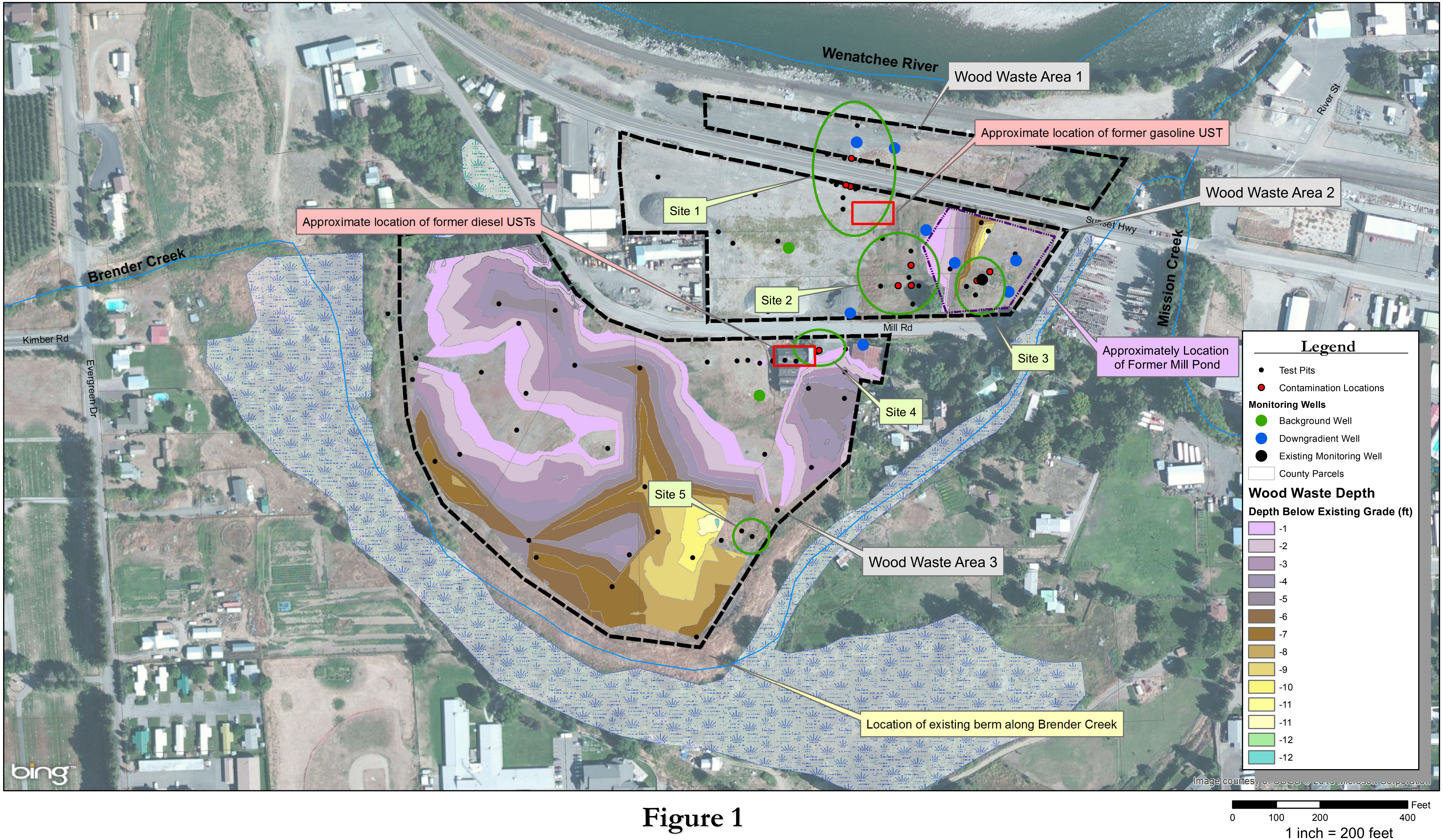

Figure 1
Cashmere Mill Site
Characterization
Site Map

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General Legend

1. Triangles represent test pits where soil samples where taken and sent to a lab for analysis.
2. Circles represent test pits excavated for lithologic purposes. Samples may have been

Figure 2
Cashmere Mill Site
Site Characterization
Wood Waste Areas 1 and 2

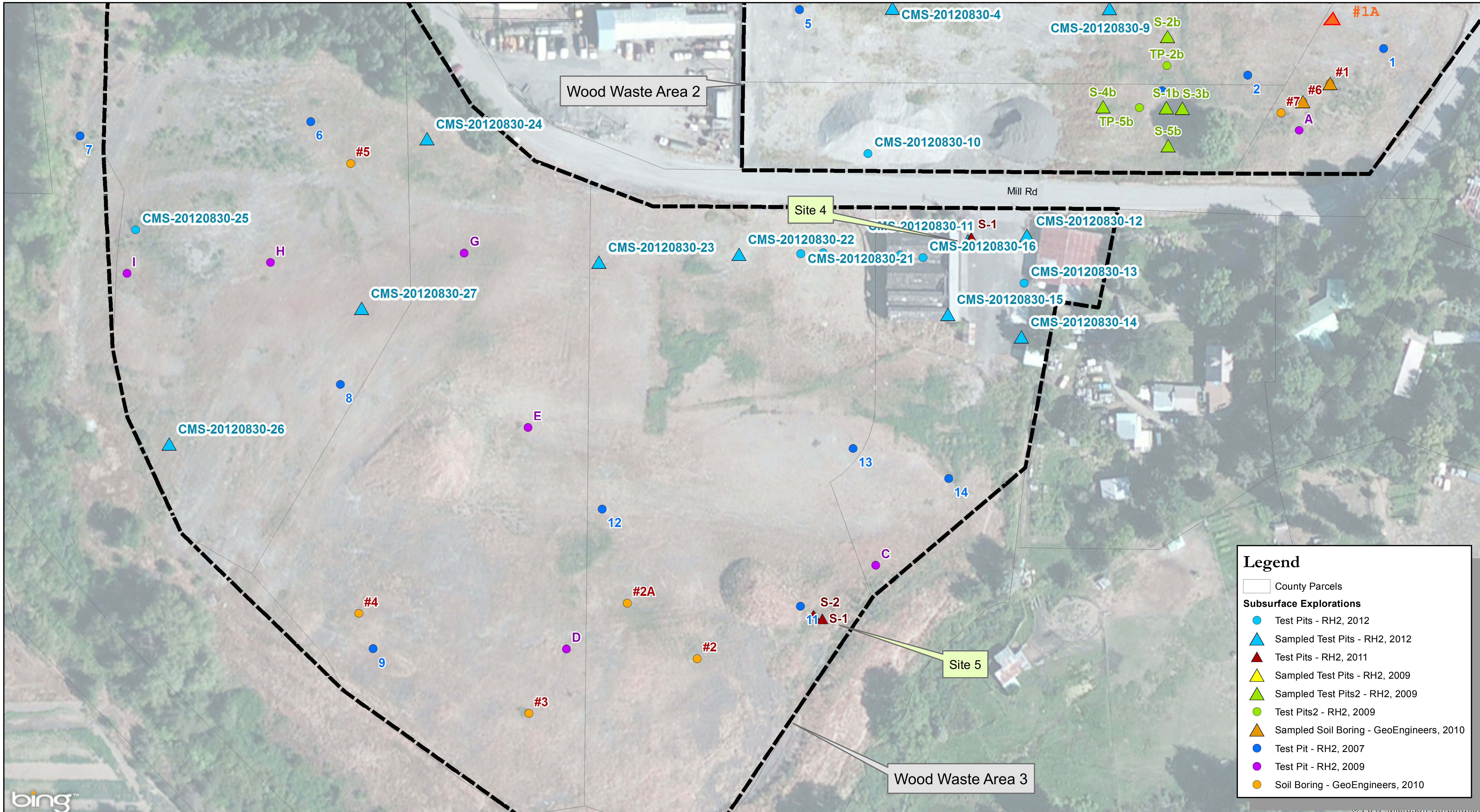
0 75 150 Feet

1 inch = 75 feet

RH2

N

last modified by: ARN on 6/13/2012 J:\data\PCC\208-020\01 Port\127 Site Clean-up\GIS\Characterization Plan Fig2.mxd



General Legend

1. Triangles represent test pits where soil samples where taken and sent to a lab for analysis.
2. Circles represent test pits excavated for lithologic purposes. Samples may have been

Figure 3
Cashmere Mill Site
Site Characterization
Wood Waste Area 3

0 100 200 Feet

1 inch = 100 feet

RH2

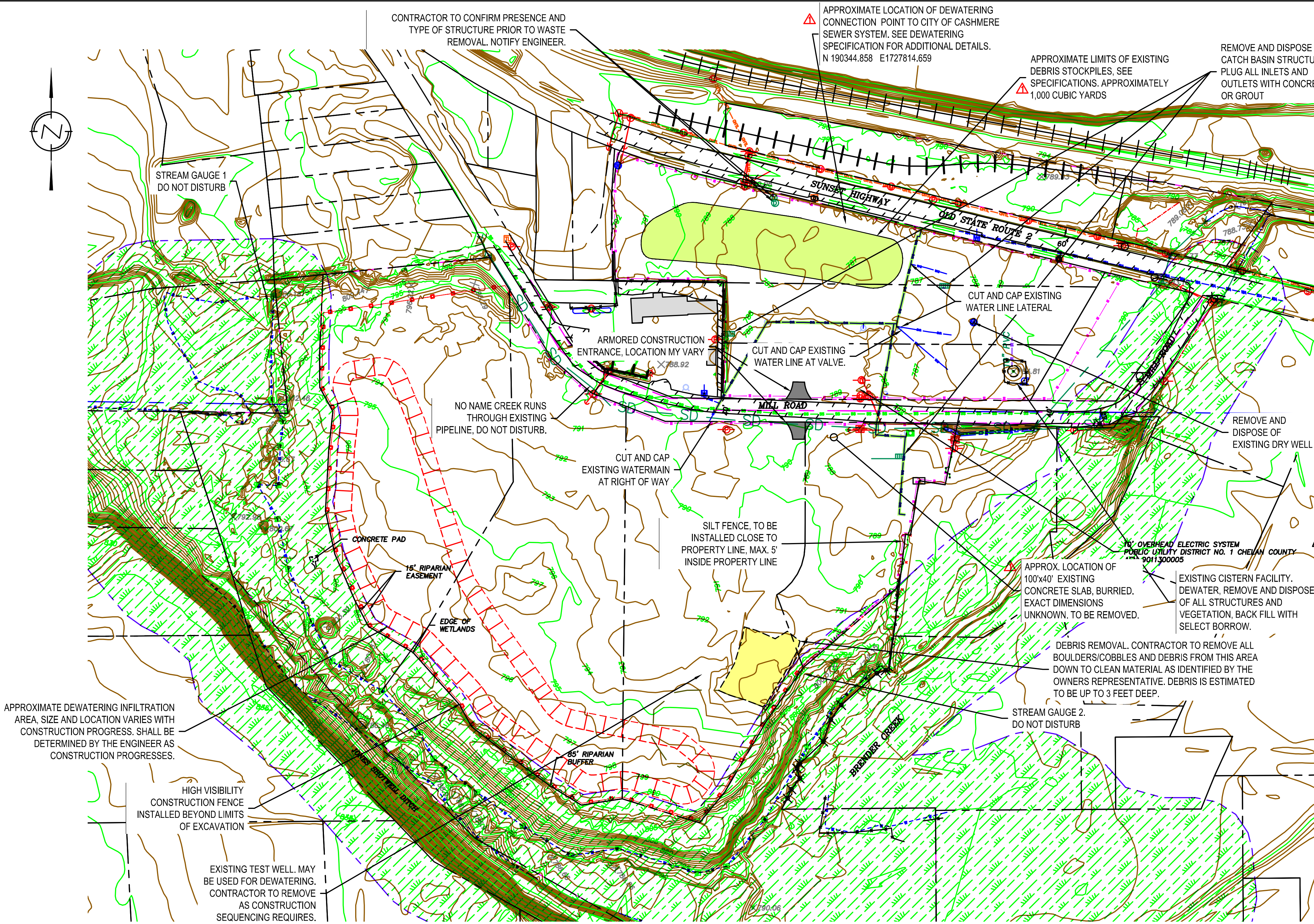
N

last modified by: ARN on 12/3/2012 J:\data\PCC\208-020\01 Port\127 Site Clean-up\GIS\Characterization Plan Fig3.mxd

LEGEND

- RIGHT OF WAY
- EDGE OF WATER BOUNDARY
- CENTER LINE OF STREAM
- 85' RIPARIAN SETBACK
- WETLAND HABITAT AREA
- CULVERT
- EDGE OF PAVEMENT
- EDGE OF GRAVEL / DIRT
- EDGE OF SHOULDER
- BOTTOM OF DITCH
- GUARDRAIL / RAILING
- ECOLOGY BLOCK WALL
- RAILROAD TRACK
- FENCE LINE
- EDGE OF CONCRETE
- IRRIGATION LINE
- WATER LINE - CITY OF CASHMERE
- WATER LINE - PRIVATE
- SEWER LINE - CITY OF CASHMERE
- OVERHEAD TELEPHONE / UTILITY LINE
- OVERHEAD POWER LINE
- WETLAND INCLUDING BUFFER
- FOUND ALUMINUM OR BRASS IN MONUMENT CASE [AS NOTED]
- FOUND IRON PIPE [AS NOTED]
- FOUND REBAR OR REBAR & CAP [AS NOTED]
- FOUND REBAR & CAP IN MONUMENT CASE [AS NOTED]
- FOUND RAILROAD SPIKE [AS NOTED]
- CALCULATED POINT NOT SET OR FOUND
- POLE ANCHOR
- UTILITY POLE
- POWER POLE
- POWER POLE WITH TRANSFORMER AND SWEEP
- POWER POLE WITH TRANSFORMER
- POWER POLE WITH SWEEP
- ELECTRIC METER
- POWER BREAKER BOX
- TELEPHONE PEDESTAL
- CATCH BASIN
- SEWER MANHOLE
- WATER METER
- WATER VALVE
- WELL - DOMESTIC / IRRIGATION
- FIRE HYDRANT
- IRRIGATION VALVE
- PUMP
- BOLLARD
- CARSONITE POST
- SIGN
- METAL POST

	HIGH VISIBILITY FENCE
	SILT FENCE
	APPROXIMATE DEWATERING INFILTRATION AREA
	ARMORED CONSTRUCTION ENTRANCE
	EXISTING FILL PILES
	DEBRIS REMOVAL AREA



ALL SCHEDULES - EXISTING SITE AND TESC PLAN

1" = 100'

NOTES

- CONTRACTOR SHALL INSTALL HIGH VISIBILITY CONSTRUCTION FENCING AND SILT FENCE PRIOR TO ANY EXCAVATION ACTIVITIES.
- CONTRACTOR TO MAINTAIN ONE WAY TRAFFIC ON MILL ROAD AT ALL TIMES. SUBMIT A TRAFFIC CONTROL PLAN TO THE CITY FOR REVIEW PRIOR TO IMPEDING TRAFFIC.
- DEPTH TO BOTTOM OF WOOD WASTE AND WOOD WASTE VOLUMES ARE ESTIMATED.
- THE DEPTH TO BOTTOM OF WOOD WASTE SHOWN WITHIN THE PLANS IS FOR GENERAL UNDERSTANDING ONLY. ACTUAL WOOD WASTE REMOVAL VOLUME SHALL BE DETERMINED IN THE FIELD BY THE OWNERS REPRESENTATIVE.
- ALL DEWATERING ACTIVITIES SHALL CONFORM TO THE DEWATERING SPECIFICATIONS.
- EXISTING DOMESTIC WATER SYSTEMS ARE ALL CONSIDERED LIVE. PROTECT DURING CONSTRUCTION.
- CONNECTION TO LOW PRESSURE SEWER SYSTEM WILL BE THROUGH EXISTING 6" PVC, LOCATED APPROXIMATELY 4 FEET BELOW THE GROUND SURFACE. PIPE IS CAPPED. CONTRACTOR TO REMOVE CAP AS NECESSARY FOR CONTRACTOR DESIGNED CONNECTION. CONNECTION DESIGN TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. SEE DEWATERING SPECIFICATIONS FOR SYSTEM CURVE.
- CONTRACTOR TO DESIGN MILL ROAD CROSSING AS NECESSARY TO CONVEY DEWATERING DISCHARGE TO SEWER CONNECTION POINT. DESIGN SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.

Figure 4
Proposed Removal Action Activities

RANDY L. ASPLUND, STATE OF WASHINGTON, 22780, REGISTERED PROFESSIONAL ENGINEER

KAREN KORNHER, STATE OF WASHINGTON, 29675, REGISTERED PROFESSIONAL ENGINEER

port of chelan county — cultivating innovation

PORT OF CHELAN COUNTY
CASHMERE MILL SITE REMEDIATION

EXISTING SITE AND TESC PLAN

RH2 ENGINEERS PLANNERS SCIENTISTS

RH2 ENGINEERING, INC.
http://www.rh2.com
mailbox@rh2.com 1.800.720.8052

BELLINGHAM 360.676.0836
454 West Horton Road

BOTHELL 425.951.5400
22722 29th Drive SE, Suite 210

EAST WENATCHEE 509.886.2900
300 Simon Street, Suite 5

RICHLAND 509.946.5181
114 Columbia Point Drive, Suite C

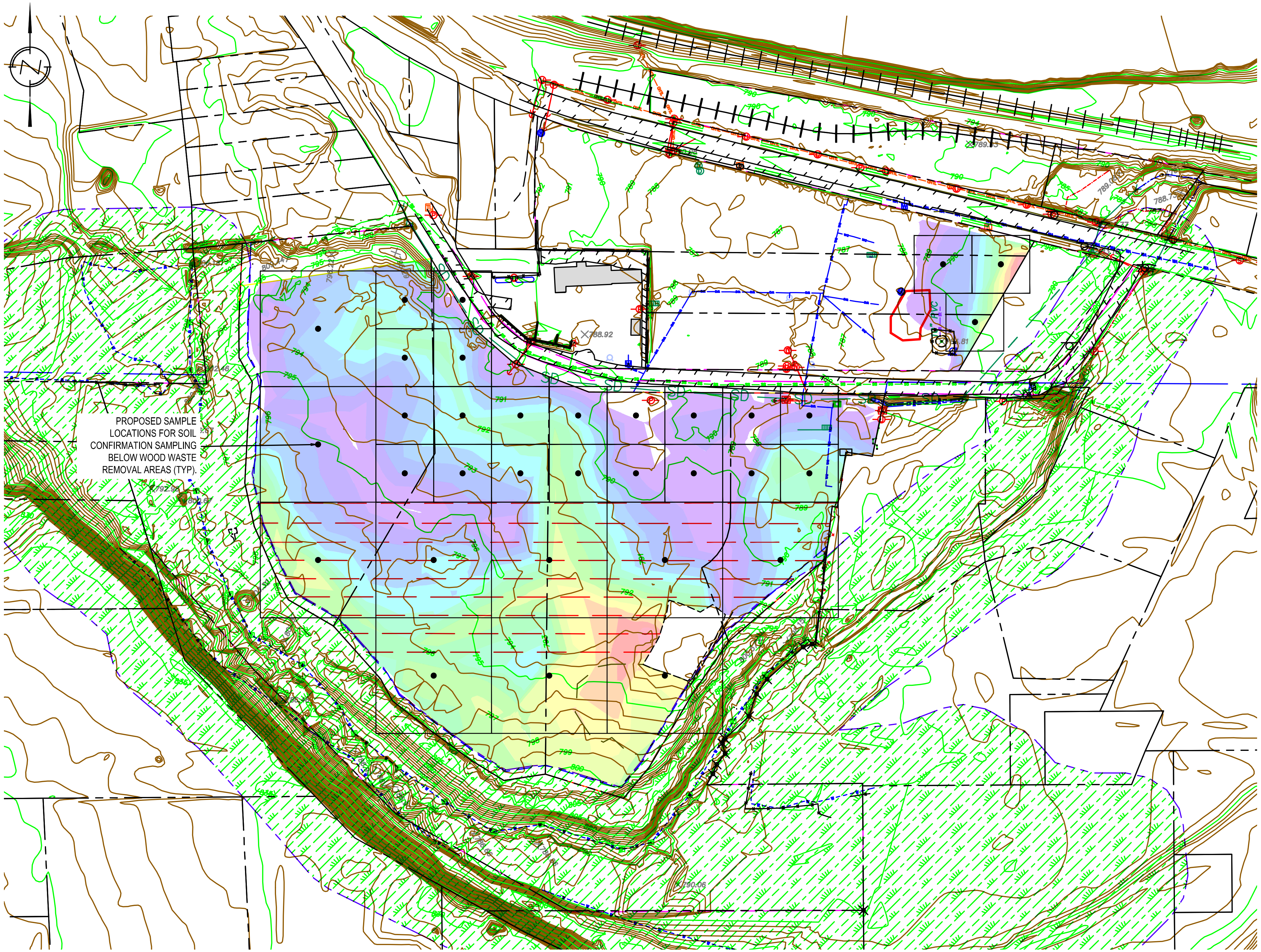
SILVERDALE 360.876.7960
2021 NW Myhre Rd, Suite 107

TACOMA 253.272.3059
621 Pacific Avenue Suite 104

SCALE: SHOWN
0 1" 2"
DRAWING IS NOT TO SCALE IF BAR IS NOT 2" LONG

PLOT:	1
DWG NO.	C01
ENGINEER:	ARN
REVIEWED:	RCP
DATE:	Feb 12, 2013
CLIENT:	PCC
JOB NO.:	208-020
FILENAME:	MSITE-P-SITE.DWG
SHEET NO.	1 / 5

NO.	REVISION	BY	REVIEW	DATE
2	REVISED PER ADDENDUM 2	ARN	KLK	2/07/13



PROPOSED SAMPLE LOCATIONS BELOW WOOD WASTE

1" = 100'

SIGNED: 01/28/13

KAREN KORNHER
29875
REGISTERED PROFESSIONAL ENGINEER

SIGNED: 01/28/13

port of chelan county
cultivating innovation

PORT OF CHELAN COUNTY
CASHMERE MILL SITE REMEDIATION

FIGURE 5
SAMPLING GRID

RH2
ENGINEERS
PLANNERS
SCIENTISTS

RH2 ENGINEERING, INC.
http://www.rh2.com
mailbox@rh2.com 1.800.720.8052

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SILVERDALE 360.876.7960
2021 NW Myhre Rd, Suite 107

TACOMA 253.272.3059
621 Pacific Avenue Suite 104

SCALE: SHOWN
0 1" 2"
DRAWING IS NOT TO SCALE IF BAR IS NOT 2" LONG

PLOT: 1		DWG NO.
ENGINEER: ARN		C06
REVIEWED: RCP		

Appendices

Appendix A – Dewatering Test Well Evaluation

RH2 TECHNICAL

Memorandum

Client: Port of Chelan County

Project: Former Cashmere Mill

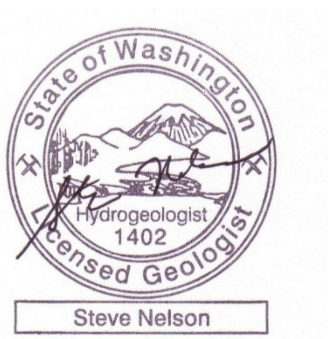
Project File: PCC 208020.01.127 **Project Manager:** Karen Kornher, P.E.

Composed by: Steve Nelson, L.G., L.HG, L.E.G

Reviewed by: Randy Asplund, P.E.

Subject: Construction Dewatering at the Former Cashmere Mill Site

Date: November 7, 2012



11/7/2012

11/7/2012

Introduction

This technical memorandum summarizes the soil, wood waste, and groundwater conditions at the Port of Chelan County (Port) former Cashmere Mill (the Site) to support the design and implementation of construction dewatering for the upcoming Site remediation project. The Site was formerly used as a lumber mill during the early- to mid-1900s. Wood waste from milling activities and log storage was deposited on the Site at and below existing grade to depths up to 15 feet. Some woodwaste was likely placed in natural topographic depressions that were former stream channels or ponds at the confluence of Wenatchee River and Brender Creek. Portions of the wood waste were placed below the current depth of the water table at the Site (approximately 4 to 6 feet). The Port intends to remove portions of wood waste from the Site and replace the wood waste with compacted granular fill to recover developable land. Removal and replacement of wood waste below the water table will require some form of construction dewatering to maintain excavation stability and minimize excavation of wet wood waste and soil.

Summary of Investigations

Between 2007 and 2012, the Port conducted several investigations to document the composition and properties of soil and wood waste and to identify groundwater conditions at the Site. The investigations included test pit exploration to depths ranging from 4 to 15 feet, soil borings and monitoring wells completed at depths of 15 feet, and a dewatering test well to a depth of 26 feet. **Figure 1** identifies test pit and boring locations. Representative samples of soil, wood waste, and groundwater were collected and analyzed for chemical composition. A bibliography of the investigations is included as a reference list attached to this memorandum (**Attachment 1**). Site boring logs and test pit exploration findings are included in **Attachment 2**.

A dewatering test well was constructed to evaluate the effect of groundwater pumping on water levels and estimate aquifer properties of the native soil below the wood waste. The 5-inch-diameter well was completed within native soil below the base of wood waste using a 10-foot-long, wire-wrapped, stainless steel screen installed from 12 to 22 feet below grade. Static water level in the well was 4 feet below ground surface. The dewatering well was pumped at a rate of 92 gallons per minute (gpm) for several hours. The water level in the well drew down 6.2 feet to slightly above the base of the wood waste and then stabilized. After pumping, the groundwater level recovered to the static level in about 60 minutes. **Figure 2** shows the results of the dewatering pumping and recovery test. The specific capacity of the well was 14.8 gpm per foot of drawdown (**Attachment 3**). The analysis of the pumping and recovery tests indicates an aquifer transmissivity value of approximately 32,000 gallons per foot per day, or 3 feet squared per minute (ft^2/min).

Summary of Findings

<u>Soil and Wood Waste</u>

The wood waste is a mixture of variable amounts of sawdust, scrap lumber, and woody debris (bark, limbs, and roots). The wood waste also contains variable amounts of sand to cobble-size granular fill and locally contains minor amounts of concrete and metal construction debris. The wood waste thickness ranges from a few inches at the surface to up to 15 feet.

Native soil underlying the wood waste consists of layers of sand, gravelly sand, and silty sand deposited by the Wenatchee River and Brender Creek.

<u>Groundwater</u>

The local groundwater table exists below the Site at depths ranging from 4 to 6 feet. Groundwater elevations fluctuate approximately 1 foot during the year, and surface water elevations of the Wenatchee River and Brender Creek fluctuate by several feet during the year. Groundwater elevations do not appear to fluctuate with surface water levels.

Excavations into the wood waste a few feet below the water table typically encounter minor seepage from the wood waste at rates of less than 10 gpm into the open excavations. Seepage rates increase from progressively deeper excavations. Over several hours, the water level in the open excavations in wood waste typically rises to the elevation of the local water table. Excavations into native soil below the water table experience much higher seepage rates from the native soil, and water levels in open excavations quickly rise to the local water table elevation.

Dewatering Objectives

The observations of groundwater levels during shallow excavation, soil and monitoring well construction, and dewatering well testing indicates that the native soil has a much higher transmissivity value than wood waste. Excavation into the shallow wood waste a few feet below the water table level will encounter seepage that likely can be controlled with local sumping. Deeper excavations will encounter higher rates of seepage that may not be controlled with local sumping and could create unstable excavations (for example, quick conditions, piping, and sand boils) if groundwater pressures in the native soil beneath the wood waste are not reduced.

The dewatering test well indicates that the native soil exhibits a permeability that would support construction dewatering consisting of dewatering wells or well points. Either of these two methods could be used to depressurize the native soil below the wood waste before excavation. However, the large area that likely will require construction dewatering and permeability of the native soil indicates that dewatering wells would likely be selected as the preferred method for dewatering.

Construction dewatering could generate 50 gpm during shallow excavation into soil that would likely be managed through sumping. Excavation into deeper wood waste below depths of 8 to 10 feet likely will require construction dewatering that will likely generate groundwater discharge rates ranging from 300 to 500 gpm. The range of groundwater discharge will depend on the permeability of the native soil and wood waste at the excavated area, the depth of the excavation, and the method used for groundwater control.

The native soil exhibits a relatively high transmissivity value that groundwater withdrawal could affect groundwater levels at a distance of 50 to 200 feet from the well. It is possible that groundwater withdrawal could capture a portion of Brender Creek streamflow, depending on the degree of hydraulic continuity between the creek and the adjacent saturated wood waste and native soil. Based on the predicted groundwater withdrawal rates, the change in flow will not likely be measurable. However, even this insignificant effect may be mitigated by infiltrating groundwater discharging from the dewatering system back into the ground next to Brender Creek in order to recharge the groundwater and augment flow in the creek.

Using the Theis method and cumulative drawdown analysis (Cashman and Preene, 2001), RH2 estimated the total groundwater withdrawal rate from a wellfield surrounding the deepest area of excavation measuring approximately 350 feet by 300 feet. A calibrated spreadsheet model was used to calculate the drawdown at eight individual pumping wells surrounding the excavation area and an observation well at the center of the area. Using the estimate of transmissivity (3 ft^2/min) from the dewatering test, a network of eight well pumping at a combined rate of 400 gpm would theoretically induce a groundwater drawdown of approximately 12 to 13 feet at the edge of the excavation and 11.6 feet at the center of the excavation (**Attachment 3**). This theoretical estimate may be used to guide contractors to prepare bid estimates. Successful groundwater control will require establishing background water level data in the excavation area before construction and confirming the progress and performance of groundwater control during construction. Groundwater monitoring wells and dewatering wells should be constructed so that well screens fully penetrate the native soil aquifer and are fully developed prior to use.

<u>Water Quality and Discharge</u>

Groundwater withdrawn during pumping should be routed into a settling tank and then passed through a granular activated carbon filter to remove any dissolved organic compounds and trace metals. The treated water should be periodically monitored for turbidity and organic compounds and discharged to one or more infiltration areas identified on the Site as suitable for groundwater recharge and capable of recharging the native soil and augmenting Brender Creek.

Bibliography

Cashman, P.M. and Preene, M. (2001) *Groundwater Lowering in Construction: A Practical Guide.* Spon, London

Figures:

- Figure 1 – Test Pit and Soil Boring Locations
- Figure 2 – Dewatering Drawdown and Recovery Test Results

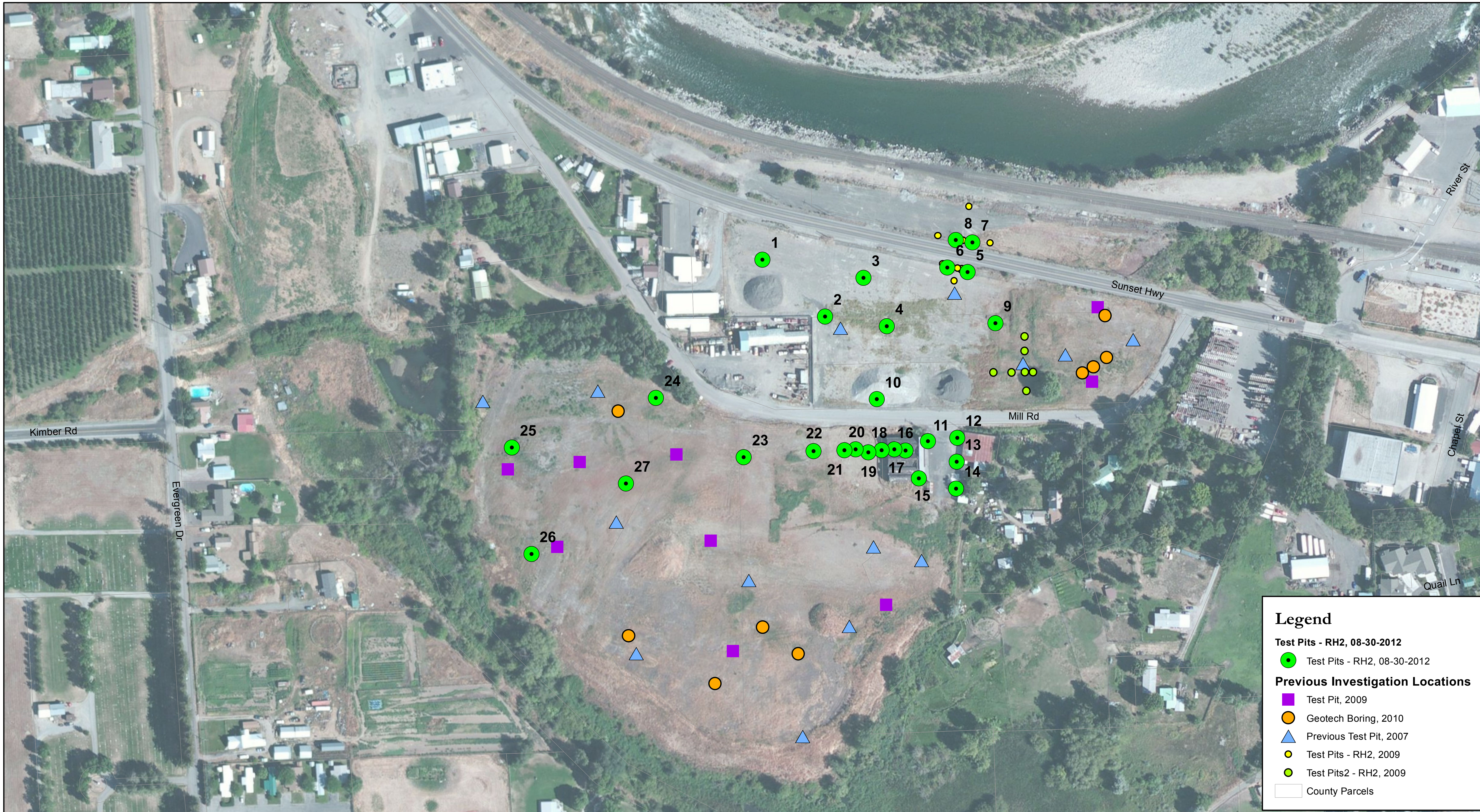
Attachments:

- Attachment 1 – Bibliography of Site Investigations
- Attachment 2 – Site Boring Logs and Test Pit Logs
- Attachment 3 – Dewatering Evaluation Summary

Figures

Figure 1

Test Pit and Soil Boring Locations



Feet
0 100 200 400
1 inch = 200 feet

Cashmere Mill Site

Test Pit and Soil Boring Locations

Figure 1

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Figure 2
Dewatering Drawdown and Recovery Test Results

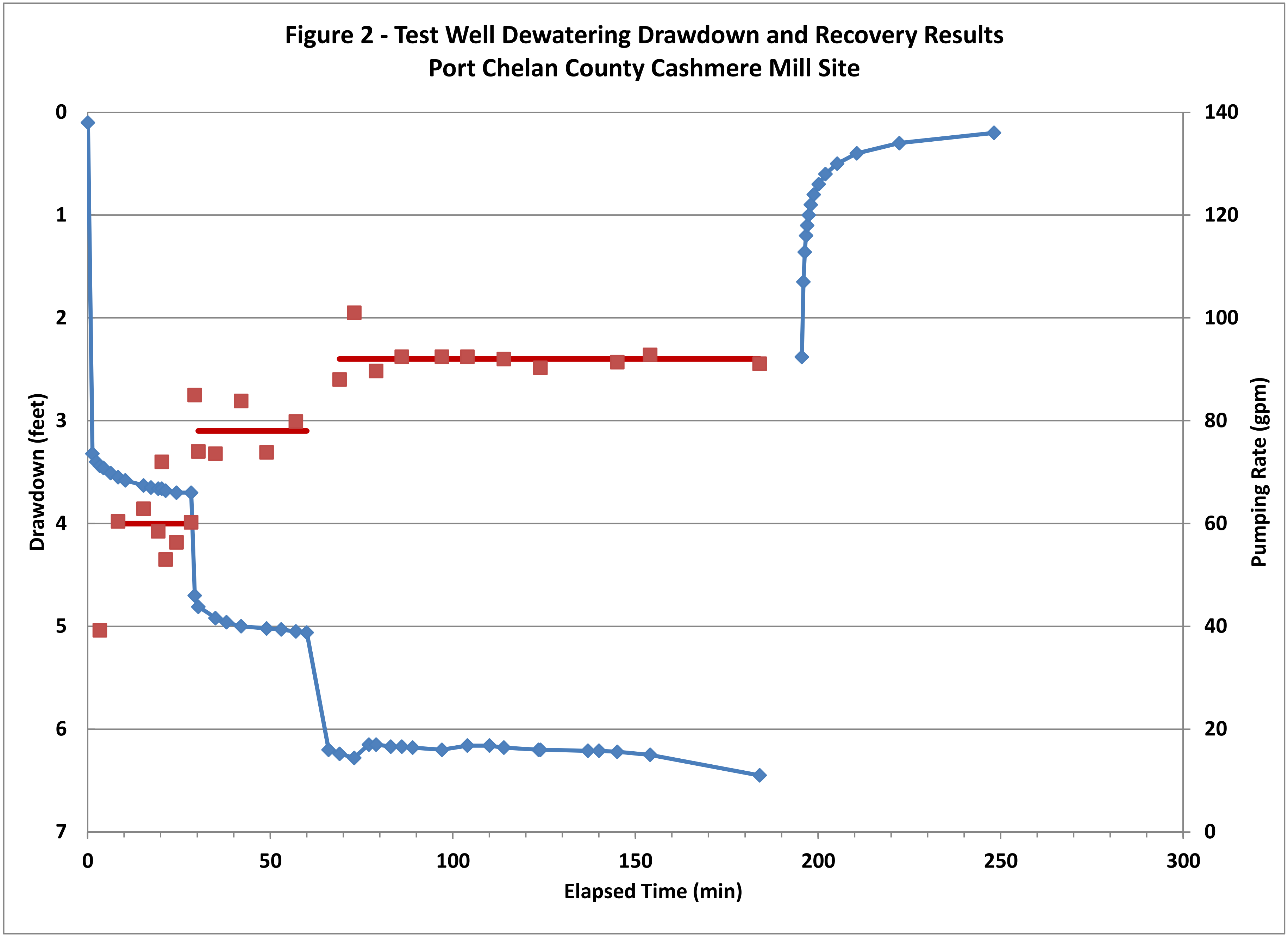


Figure 2 - Test Well Dewatering Drawdown and Recovery Results
Port Chelan County Cashmere Mill Site
Drawdown (feet)
Pumping Rate (gpm)
Elapsed Time (min)
0
1
2
3
4
5
6
7
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300

ATTACHMENTS

ATTACHMENT 1
Bibliography of Site Investigations

Cashmere Mill Site Geological Investigation Bibliography

- 1990. *Phase 1 Environmental Site Assessment*, Forsgren and Associates, Inc.
    - No subsurface explorations.

- 2007. *Feasibility Report* and *Geologic Report*. RH2 Engineering, Inc.
    - Fourteen (14) test pits excavated with a backhoe; characterized subsurface conditions.

- 2009. *Cashmere Mill Site Improvements, Phase 1 – Surface Cleanup*. RH2 Engineering, Inc.
    - Nine (9) test pits excavated with a backhoe; data used for support of design project.

- 2010. *Redevelopment of Cashmere Mill Site, Mill Road, and Sunset Highway, Cashmere Washington*. GeoEngineers, Inc.
    - Nine (9) borings or attempted borings characterizing subsurface conditions.

- 2012. *Cashmere Mill Site Remediation*. RH2 Engineering, Inc.
    - Twenty-six (26) test pits excavated with a backhoe; data used for support of design project.

Attachment 2
Site Boring Logs and Test Logs

2007 Investigation

Table 1. Soil Log for Test Pits, (TP) Cashmere Mill Site

TP-1 Corner of Mill Rd and Sunset

15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark brown sand, gravel, cobbles, round	TP-1	0950
5.0	FILL	wood waste and sawdust		
7.0	FILL	dark silty sand, gravel, cobbles		
9.0	FILL	wood waste and sawdust		
11.0	FILL	water		
12.0	FILL	dark silty sand, gravel, cobbles with logs		

TP-2 50 ft N of "well"

15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark brown organic material	TP-2	1020
3.0	FILL	grey silty sand, grave, cobbles w/ clay		
13.0	FILL	water		

TP-3 Site of old office along Sunset

15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	ALLUVIUM	brown-grey sand, gravel, cobbles	NA	1040
6.0	ALLUVIUM	water		

Table 1. Continued

TP-4 Site of old smokestack
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	brown silty sandy gravelly fill	NA	1100
3.0	FILL	brown silty sandy gravelly fill-stop due to unexpected water line (likely abandoned)		

TP-5 Near western property line, N of Mill Rd
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	pavement, dark brown, sand, gravel, silt w/organics		1110
3.0	ALLUVIUM	brown sand, gravel, cobbles		
4.0	ALLUVIUM	water		
5.0	ALLUVIUM	brown sand, gravel, cobbles		

TP-6 Middle of open area in NW corner of lot S of Mill Rd
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark brown-black silty wood waste, bricks, car parts		1130
6.0	ALLUVIUM	grey sand, gravel, cobbles w/ roots, water		
8.0	ALLUVIUM	grey sand, gravel, cobbles		

Table 1. Continued

TP-7 NW corner of lot, along sediment basin pond on Brender Cr.
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	ALLUVIUM	brown sand, gravel, cobbles		1145
4.0	ALLUVIUM	brown sand, gravel, cobbles		

TP-8 E of trailer, S of hockey rink in NW corner of lot S of Mill Rd
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark silty sand, gravel, cobbles		1202
7.0	ALLUV/FILL	dark silty sand, gravel, cobbles, water		

TP-9 200 ft SW of Shangri-la, 100 ft N of Brender Cr.
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark wood waste		1209
8.0	ALLUVIUM	grey silty sand, gravel, cobbles w/ small organics (roots)	TP-9	

Table 1. Continued

TP-10 Southern most bend in Brender Cr, 50 ft N of berm
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	wood waste and sawdust	TP-10	1226
8.0	ALLUVIUM	grey silty fine sand w/ clay		
10.0	ALLUVIUM	water		
11.0	ALLUVIUM	grey silty fine sand w/ gravel		

TP-11 S edge of existing excavated pit, below 6-ft high cut face in wood waste, SW corner of property
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	wood waste	TP-11	1240
13.0	ALLUVIUM	grey clay		
14.0	ALLUVIUM	grey clay and gravel		

TP-12 100 ft S of water meter in lot S of Mill Rd
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark silty sand, gravel and wood waste	TP-12	1300
3.0	ALLUVIUM	grey silty sand and gravel w/ conglomerate and peat layers 0.5-1.0 ft thick		
8.0	ALLUVIUM	water		
9.0	ALLUVIUM	sand, gravel, cobbles		

Table 1. Continued

TP-13 100 ft W of single wide trailer
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	ALLUVIUM	brown sand, gravel, cobbles		1316
3.0	ALLUVIUM	brown sand, gravel, cobbles		

TP-14 50 ft S of single wide trailer
15-Jan-07

Depth (feet)	Material	Description	sample	time
0.0	FILL	dark brown sand, gravel, cobbles w/organics		1320
4.0	ALLUVIUM	brown-orange sand, gravel, cobbles with foreset beds		
5.0	ALLUVIUM	brown-orange sand, gravel, cobbles with foreset beds		

Figure 4. Alluvium consisting of poorly sorted sand, gravel and cobbles in Test Pit No. 3, located at the former site of the mill offices, approximately 50 feet south of Sunset Highway. Depth of test pit is 6 feet. Groundwater was encountered at a depth of 6 feet.

Figure 5. Imported soil overlying wood waste fill in Test Pit No. 1 located at the former site of the mill pond, near the intersection of Mill Road and Sunset Highway. Depth of test pit is 12 feet. Groundwater was encountered at a depth of 11 feet.

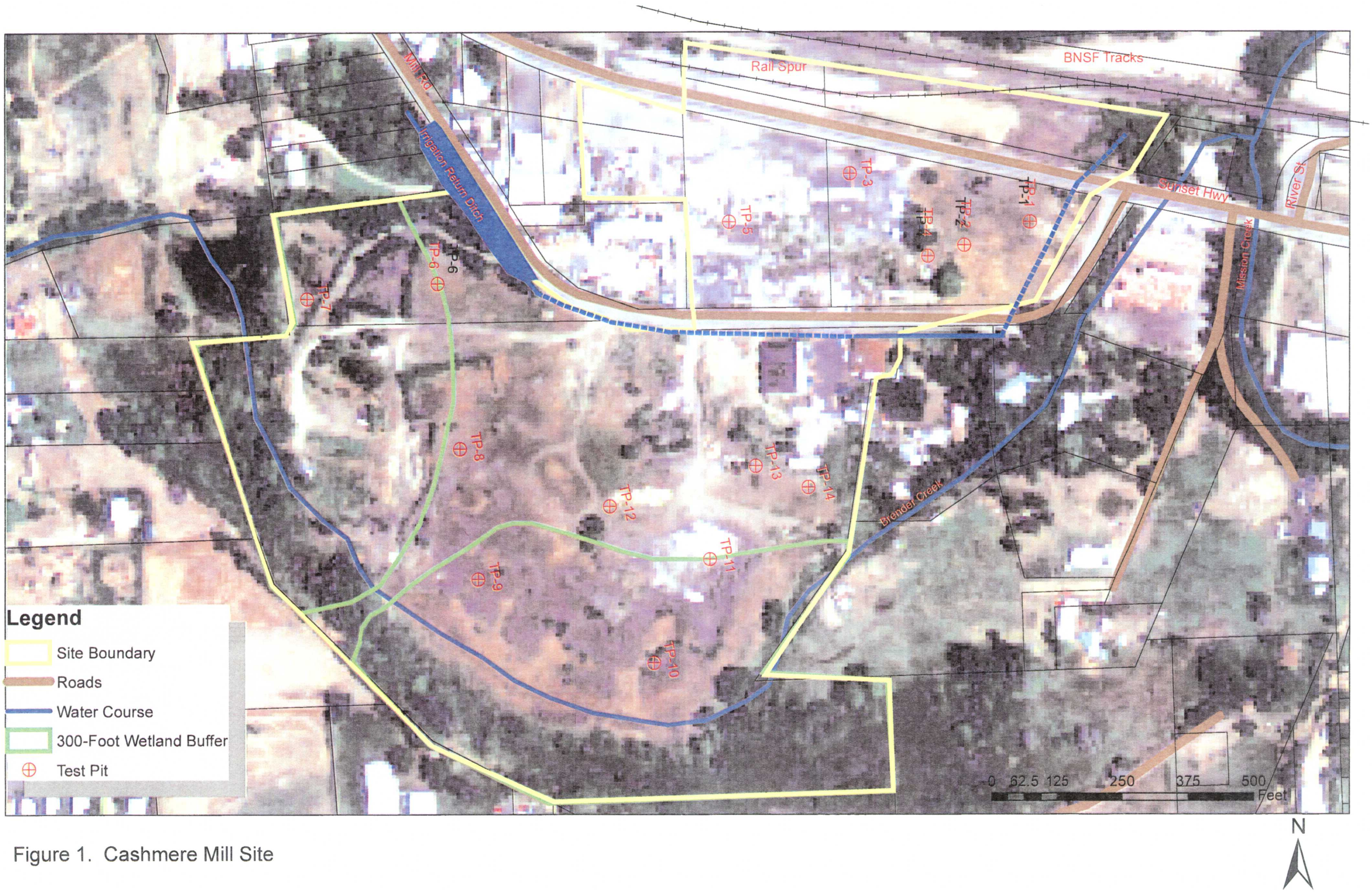


Figure 1. Cashmere Mill Site

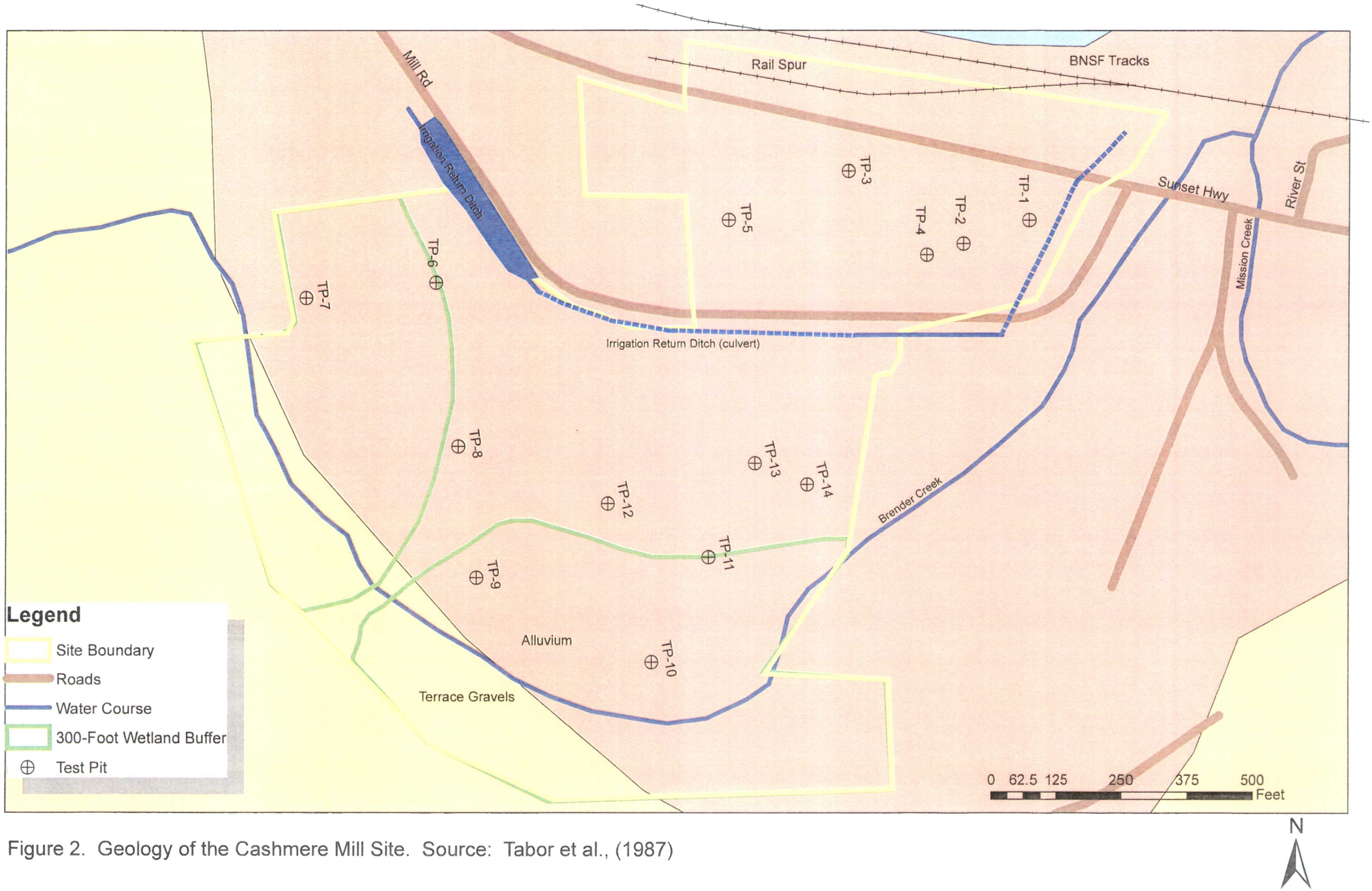
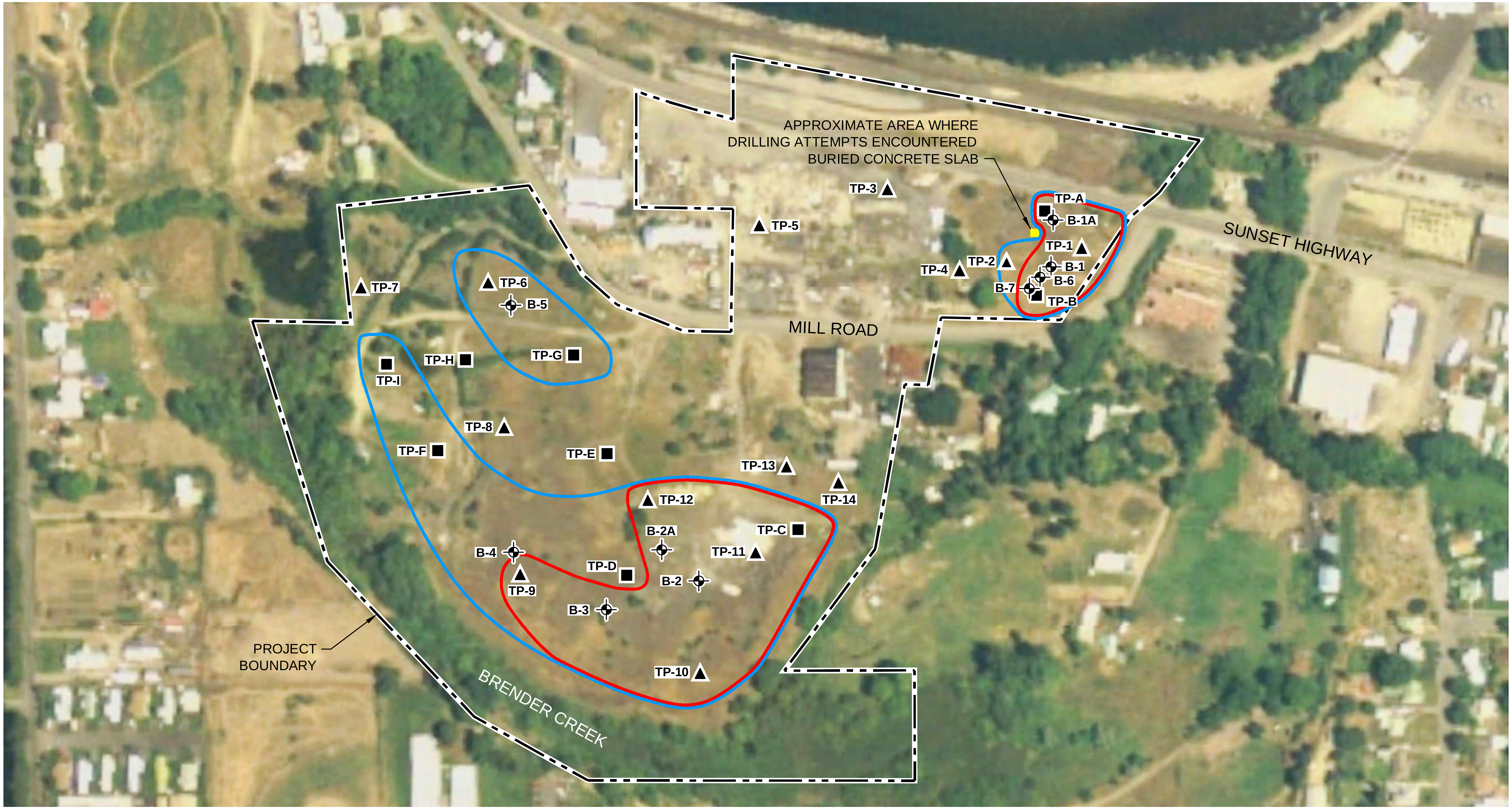


Figure 2. Geology of the Cashmere Mill Site. Source: Tabor et al., (1987)

2009 Investigation



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. can not 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.

Reference: Base Aerial from IR3 Imagery.

Legend

B-1 — Boring by GeoEngineers, Inc. (January 2010)

TP-A — Previous Test Pit by RH2 Engineering, Inc. (November 2009)

TP-1 — Previous Test Pit by RH2 Engineering, Inc. (January 2007)

Approximate Limits of Wood Waste Fill

Approximate Areas where Bottom of Wood Waste Fill was Encountered at or Below Depth of 8 Feet

N
W E
S

200 0 200
FEET

Site Plan

Redevelopment of Cashmere Mill Site
Cashmere, Washington

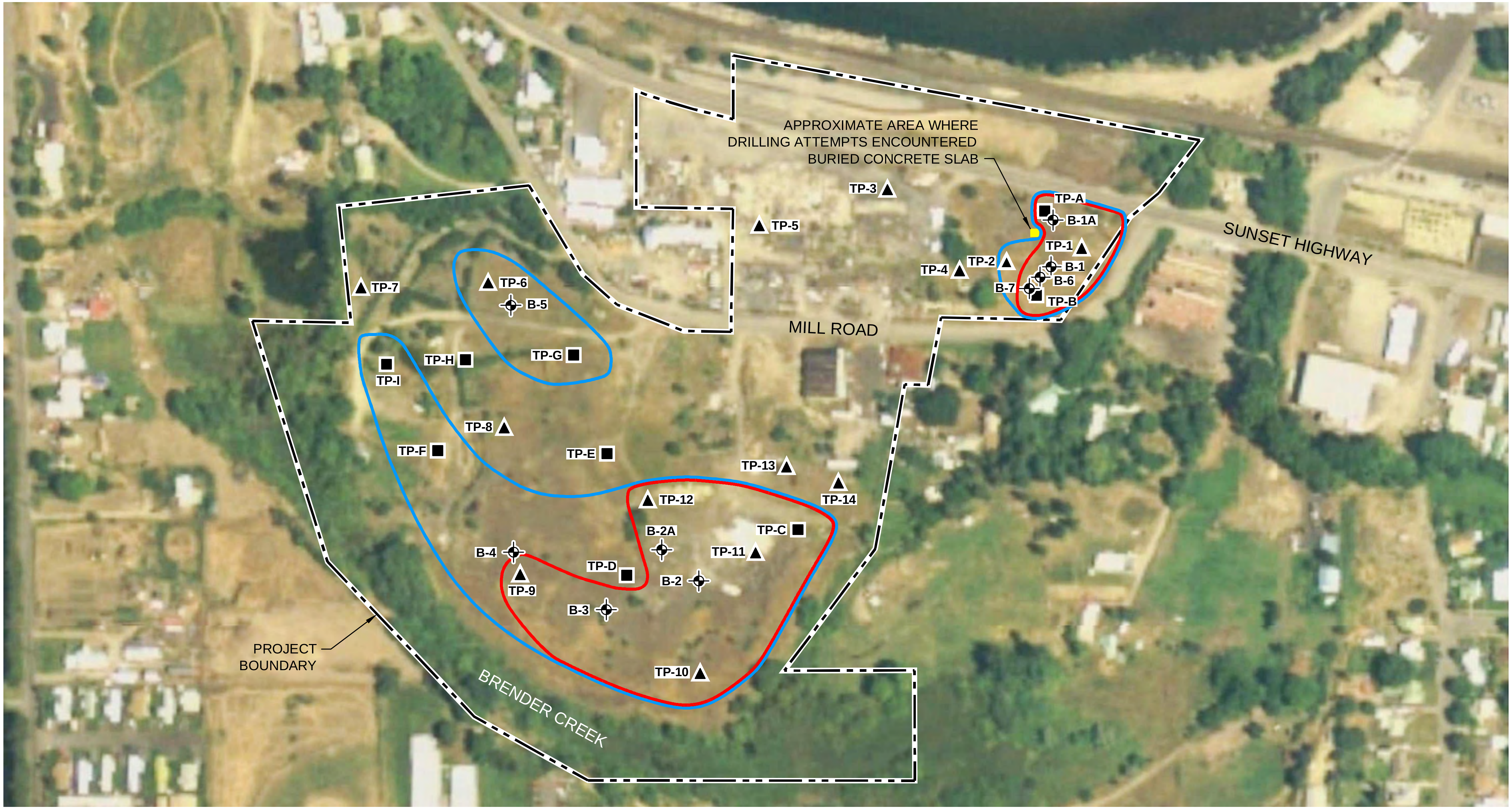
GEOENGINEERS

Figure 2

Date: 11/30/09
No Samples Taken

Test Pit	Time	Depth From Surface	Description
A	9:15	0 to 2.5	Brown Silty Sand
		2.5 to 8	Gray Wood Waste with Silty Sand and Gravel
		8	Water Table
B	9:30	0 to 3	Brown Wood Waste with Silty Sand
		3 to 8.5	Gray Wood Waste with Silty Sand and Gravel
		8.5	Water Table
C	9:50	0 to 2	Brown Wood Waste
		2 to 5	Brown Silty Sand with Cobbles
		5 to 7	Gray Silty Sand
		7	Water Table
D	10:06	0 to 4.5	Brown Wood Waste
		4.5 to 7	Gray Silty Sand - Free of Organics
		7	Water Table
E	11:46	0 to 3	Brown Silty Sand with Gravel
		3 to 3.5	Brown Silty Sand with Cobles
		3.5 to 6	Gray Silty Sand
F	10:25	0 to 1	Brown Silty Sand
		1 to 3.5	Bright Orange/Brown Wood Waste
		3.5 to 5	Gray Silty Sand with Cobles
G	11:24	0 to 2	Brown Silty Sand
		2 to 4	Gray Silty Sand with Cobles
		4 to 5.5	Dark Black/Brown Wood Waste - Bark Chips
		5.5	Water Table
H	11:10	0 to 2	Brown Silty Sand
		2 to 3.5	Gray Silty Sand with Cobles
		3.5 to 5	Gray Silty Sand
		5	Water Table
I	10:56	0 to 3	Brown Silty Wood waste
		3 to 4	Gray Wood Waste with Silty Sand and Cobles
		4 to 6	Gray Silty Sand

2010 Investigaton



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Reference: Base Aerial from IR3 Imagery.

Legend

B-1	Boring by GeoEngineers, Inc. (January 2010)
TP-A	Previous Test Pit by RH2 Engineering, Inc. (November 2009)
TP-1	Previous Test Pit by RH2 Engineering, Inc. (January 2007)
	Approximate Limits of Wood Waste Fill
	Approximate Areas where Bottom of Wood Waste Fill was Encountered at or Below Depth of 8 Feet

200 0 200

FEET

Site Plan

Redevelopment of Cashmere Mill Site
Cashmere, Washington

GEOENGINEERS

Figure 2

W:\Redmond\Projects\8\8593001\00\CAD\859300100 Fig 2.dwg\TAB:Landscape modified by tmichaud on Mar 04, 2010 - 11:47

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	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
	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 MORE THAN 50% PASSING NO. 200 SIEVE	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
	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 A-1

Drilled — Start: 1/20/2010; End: 1/20/2010	Total Depth (ft): 17.5	Logged By: NCS Checked By: HRP	Driller: Holocene Drilling
Drilling Method: Hollow-stem Auger/SPT/D&M	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D-50	
Surface Elevation (ft) / Vertical Datum: Undetermined	Top of Casing Elevation (ft):	Latitude / Longitude:	Horizontal Datum: N/A

A 2 (in) well was installed on 1/20/2010 to a depth of 17.5 (ft).
Well was developed on 1/22/2010.

Groundwater

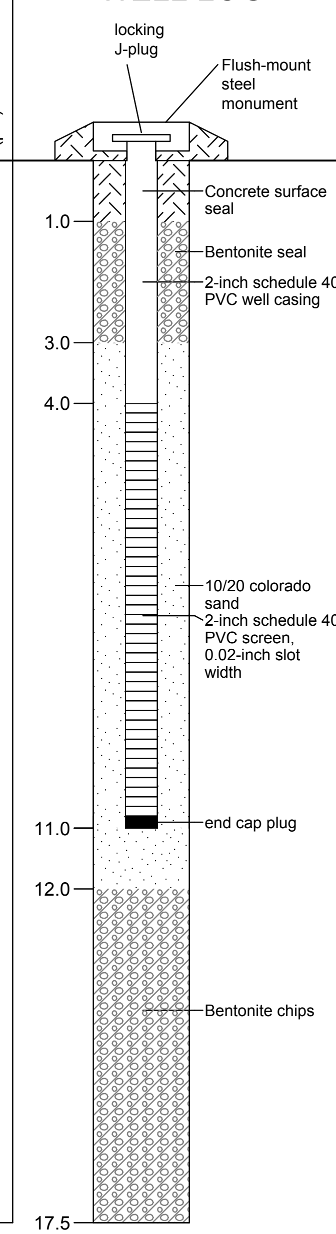
Date Measured	Depth to Water (ft)	Elevation (ft)
1/22/2010	5.2	

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.; Shelby Tube 3 inches I.D.

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)
	0	6		1	OL	Dark brown wood waste with silty sand, gravel and cobbles (soft, moist) (fill)	30	
						(wood waste includes chips and bark fragments to 2 inches long) organic content = 26%		
		14	9	2		Grades to dark brown and medium stiff	49	31
				2a		(wood waste includes chips up to 3 inches long)		
	5	12	5	3		Grades with increasing silty sand content	69	36
				3a		(wood waste includes sawdust, bark and chips to 1 inch long)		
		12	8	4	SM/OL	Gray and brown silty fine to coarse sand with wood waste, gravel and cobbles (very loose, wet) (fill)	20	57
				4a		(wood waste includes sawdust and chips from ½ to 2½ inches long)		
	10	12	3	5		(wood waste includes roots and sticks to ¼-inch-diameter)	52	55
		24		5a 6	OL	Dark brown decomposed wood waste with silty fine sand (very soft, wet) (fill)		
						(hydrocarbon odor and sheen at top of sample; sample submitted for chemical analysis)		
					GP	Gray fine to coarse gravel with sand and cobbles (dense, wet) (alluvium)		
	15	18	40	7			10	
		5	50/5"	8				

WELL LOG



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

Log of Monitoring Well B-1

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Figure A-2
Sheet 1 of 1

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 17.3	Logged By NCS; Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D-50
Latitude / Longitude	System Datum: N/A	Groundwater — Date Measured: 1/21/2010; Depth to Water (ft): 7.0; Elevation (ft):

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0			1		SM	Brown silty fine to coarse sand with gravel, cobbles, and trace wood waste (medium dense, moist) (fill)	19		Wood waste includes bark fragments to 1-inch
		0	59	2						Sampler driven on gravel or cobble
						OL	Dark brown wood waste with silty sand, gravel and cobbles (very stiff, moist) (fill)			Softer drilling Wood waste includes sawdust and chips to 1 inch long
	5	15	30	3				31		
				3a	∇					
		18	6	4		SM	Dark brown silty fine to coarse sand with gravel and trace of wood waste (very loose, wet) (fill)	26	75	Wood waste includes sawdust and chips to ½ inch long
				4a			Organic content = 4%	25		
	10	0	6	5						No recovery
			53	6				33	66	Wood waste includes sawdust and small decomposing chips
				6a 6b		GP	Gray fine to coarse gravel with cobbles (very dense, wet) (alluvium)			Rough drilling
	15									
		15	50/4"	7				13		

Boring was completed about 40 feet NE of intended location. Various attempts to drill at the intended location, and at 2.5, 5, 10 NW and 15 feet E, and 25 feet NE of intended location encountered a concrete obstruction at a depth of 2.5 feet.

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

Log of Boring B-1A

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Figure A-3
Sheet 1 of 1

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 14.1	Logged By NCS, Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Hammer Data	Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)	
Latitude Longitude		Horizontal Datum	N/A

A 2 (in) well was installed on 1/22/2010 to a depth of 13.5 (ft).
Well was developed on 1/22/2010.

Groundwater

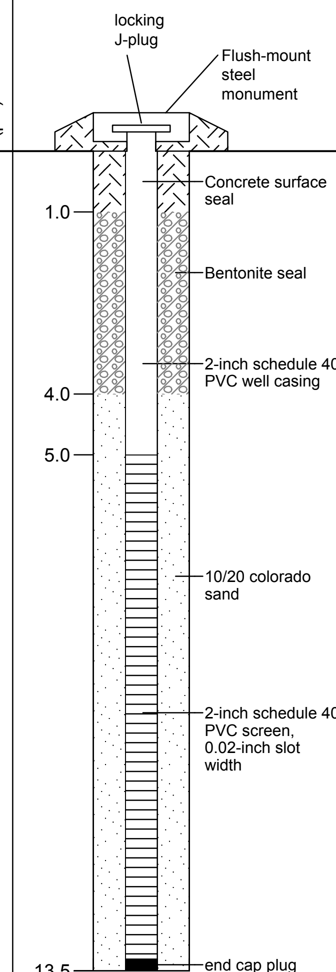
Date Measured	Depth to Water (ft)	Elevation (ft)
1/22/2010	6.7	

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)
	0	6		1	OL/SM	Dark brown wood waste mixed with silty sand, gravel, and cobbles (soft/loose, moist) (fill)	40	
						(wood waste includes chips, bark and lumber fragments to 3 inches long) Organic content = 29%		
		6	47	2		(sampler driven on gravel or cobble)		
	5	12	12	3			47	48
				3a		Grades to medium stiff (wood waste includes sawdust and wood chips to 2 inches long)		
		15	27	4		Grades to stiff (wood waste includes sawdust and wood chips to 2 inches long)	39	56
				4a				
	10	18	16	5		Grades to medium stiff (wood waste includes sawdust and wood chips to ½ inch long)		
				5a	SM	Gray silty fine to medium sand with gravel and wood waste (medium dense, moist) (fill)	58	
		5	50/2"	6	GM	Gray silty fine to coarse gravel with sand and cobbles (very dense, wet) (alluvium) (Harder drilling)		
		0	50/1"	7		Refusal on boulder/cobbles		

WELL LOG



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

Redmond: Date:2/10/10 Path:W:\REDMOND\PROJECTS\18\1859300100\GINT\1859300100.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_WELL

Log of Monitoring Well B-2

GEOENGINEERS

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Figure A-4
Sheet 1 of 1

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft)	12.7	Logged By NCS / Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D-50	
Latitude / Longitude	System Datum: N/A	Groundwater: Date Measured 1/21/2010	Depth to Water (ft) 7.0; Elevation (ft)
Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.			

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0								OL	Dark brown wood waste with silty sand, gravel and cobbles (soft, moist) (fill)			
						1					71		Wood waste includes sawdust, bark and chips to 3 inches long
						2					23		Large wood chunks in sampler Organic content = 13%
													Rough drilling
	5		0	18		3							No recovery
							∇		OL/ML	Dark brown fine-grained wood waste mixed with sand, gravel and cobbles (soft/loose, wet) (fill mixed)			
						4							Change in drilling
									GP-GM	Gray sandy fine to coarse gravel with silt and cobbles (dense, wet) (alluvium)			Rough drilling
	10		6	42		5							
			1	50/2"		6							Sampler driven on gravel or cobble

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

Redmond: Date:2/10/10 Path:W:\REDMOND\PROJECTS\18\1859300100\GINT\1859300100.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Log of Boring B-2A

GEOENGINEERS

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Figure A-5
Sheet 1 of 1

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 12.7	Logged By NCS Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	Automatic 140 (lbs) / 30 (in) Drop
Latitude Longitude		System Datum	N/A
Drilling Equipment	Diedrich D-50		

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
1/21/2010	7.0	

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

Elevation (feet)	Depth (feet)	Interval / Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0				1			OL/SM	Dark brown wood waste mixed with silty sand, gravel and cobbles (soft/loose, moist) (fill)	39		Wood waste includes sawdust, bark fragments and chips from ¾ inch to 3 inches long
		6	22		2			OL	Orange brown wood waste (stiff, moist) (fill)	93		Wood waste includes fine shavings and sawdust Organic content = 63%
	5	6	50/6"		3			OL/SM	Dark brown wood waste mixed with silty sand, gravel and cobbles (medium stiff/medium dense, moist) (fill)	65		Wood waste includes sawdust and chips to ½ inch long Sampler driven on gravel or cobble
		10	63		4	▽		SM	Gray silty fine to coarse gravel with sand and cobbles (very dense, wet) (alluvium)			Rough drilling
	10											Rough drilling
		2	50/2"		5							

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

Redmond: Date:2/10/10 Path:W:\REDMOND\PROJECTS\18\1859300100\GINT\1859300100.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Log of Boring B-3

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Drilled	Start 1/21/2010 / End 1/21/2010	Total Depth (ft) 12.5	Logged By NCS / Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M
Surface Elevation (ft) / Vertical Datum	Undetermined	Hammer Data	Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50
Latitude / Longitude		System / Datum	N/A	Groundwater: Date Measured 1/21/2010	Depth to Water (ft) 8.0; Elevation (ft)

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0			1		OL/SM	Brown wood waste mixed with with silty sand, gravel and cobbles (soft/loose, moist) (fill)	46		Wood waste includes bark and chips to 2 inches long
		16	22	2		OL	Dark brown wood waste with silty sand, gravel and cobbles (stiff, moist) (fill)	39	46	Large wood chunks in sampler Wood waste also includes chips and bark to 3 inches long
				2a				96		Organic content = 57%
	5	18	24	3				49	40	Large wood chunks in sampler
				3a						
		10	32	4						
						SM	Gray silty fine sand with organic matter (medium dense, moist) (fill)			Hard drilling
		12	23	5	▽	SM	Gray silty fine to medium sand with gravel and cobbles (medium dense, wet) (alluvium)	31		Rough drilling %F=20
	10									
		18	50/6"	6						
						GP	Gray fine to coarse gravel with sand, gravel and cobbles (very dense, wet) (alluvium)			

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

Log of Boring B-4

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Figure A-7
Sheet 1 of 1

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 5.8	Logged By NCS Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	Automatic 140 (lbs) / 30 (in) Drop
Drilling Equipment	Diedrich D-50	Latitude Longitude	
System Datum	N/A		

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/21/2010	2.0	

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0			5		1			OL/SM	Dark brown wood waste mixed with silty sand, gravel and cobbles (soft/loose, moist) (fill)	28		Wood waste includes bark and chips to 1 inch long
			6	20		2	▽		SM	Dark brown silty fine to medium sand with organic matter, gravel and cobbles (loose, wet) (fill)			
									GM	Gray silty fine to coarse gravel with sand and cobbles (very dense, wet) (alluvium)			Rough drilling
	5		1	50/4"		3							Sampler driven on gravel or cobble

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

Log of Boring B-5

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 11.5	Logged By NCS, Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D-50	
Latitude / Longitude	System Datum: N/A	Groundwater	

Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/21/2010	6.0	

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0								OL/SM	Dark brown wood waste mixed with silty sand, gravel and cobbles (soft/loose, moist) (fill)			Wood waste includes chips and bark to 1 inch long
									SM	Brown silty fine to coarse sand with gravel, cobbles and trace wood waste (loose, wet) (fill)			Wood waste includes sawdust and chips to ½-inch
	5		14	11		1							No sheen, no odor
	6						∇						
													Wood waste includes bark and lumber fragments to 1 inch
	10		18	26		2							Heavy sheen and hydrocarbon odor from sample; sample submitted for chemical analysis

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

Log of Boring B-6

GEOENGINEERS

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

Drilled	Start 1/21/2010	End 1/21/2010	Total Depth (ft) 11.5	Logged By NCS / Checked By HRP	Driller Holocene Drilling	Drilling Method Hollow-stem Auger/SPT/D&M

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D-50	
Latitude / Longitude	System Datum: N/A	Groundwater	
Notes: Auger Data: 5 inches I.D; 9.5 inches O.D.		Date Measured: 1/21/2010	Depth to Water (ft): 5.0; Elevation (ft):

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0								OL/SM	Dark brown wood waste mixed with silty sand, gravel and cobbles (soft to medium stiff/loose, moist to wet) (fill)			Wood waste includes shavings and chips to 2 inches long
	5		18	16		1	∇						No sheen, no odor
									SM	Brown silty fine to coarse sand with gravel, cobbles and wood waste (loose, wet) (fill)			Wood waste includes shavings and chips to 2 inches long
	10		18	19		2							No sheen, no odor

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

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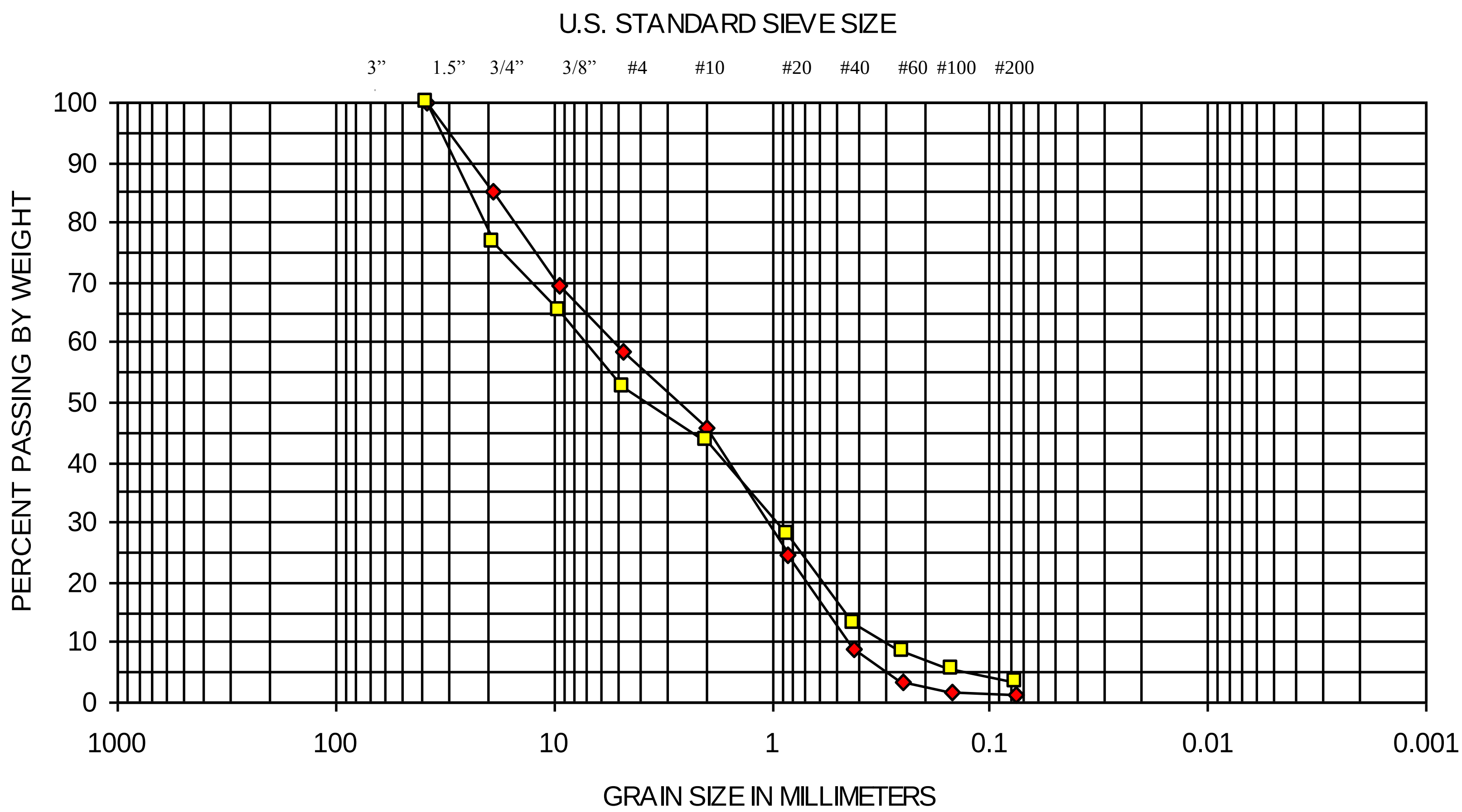
Log of Boring B-7

GeoEngineers

Project: Redevelopment of Cashmere Mill Site
Project Location: Cashmere, Washington
Project Number: 18593-001-00

18593-001-00 T100 XXX:RBM:rbm 02-01-2010 (Sieve.ppt)

GeoEngineers



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
■ (yellow square)	B-1	15 – 16.5	Fine to medium sand with gravel (SP)
◆ (red diamond)	B-1A	16 – 17.5	Fine to coarse sand with gravel (SP)

SIEVE ANALYSIS RESULTS

FIGURE A-11

2012 Investigation

Feet
0 75 150 300
1 inch = 150 feet

Cashmere Mill Site
Sampling Locations

RH2 ENGINEERS PLANNERS SCIENTISTS

N

last modified by: ARN on 6/13/2012 J:\data\PCC\208-020\01 Port\127 Site Clean-up\GIS\Characterization Plan Fig1.mxd

Cashmere Mill Site Test Pit Summary – August 30, 2012

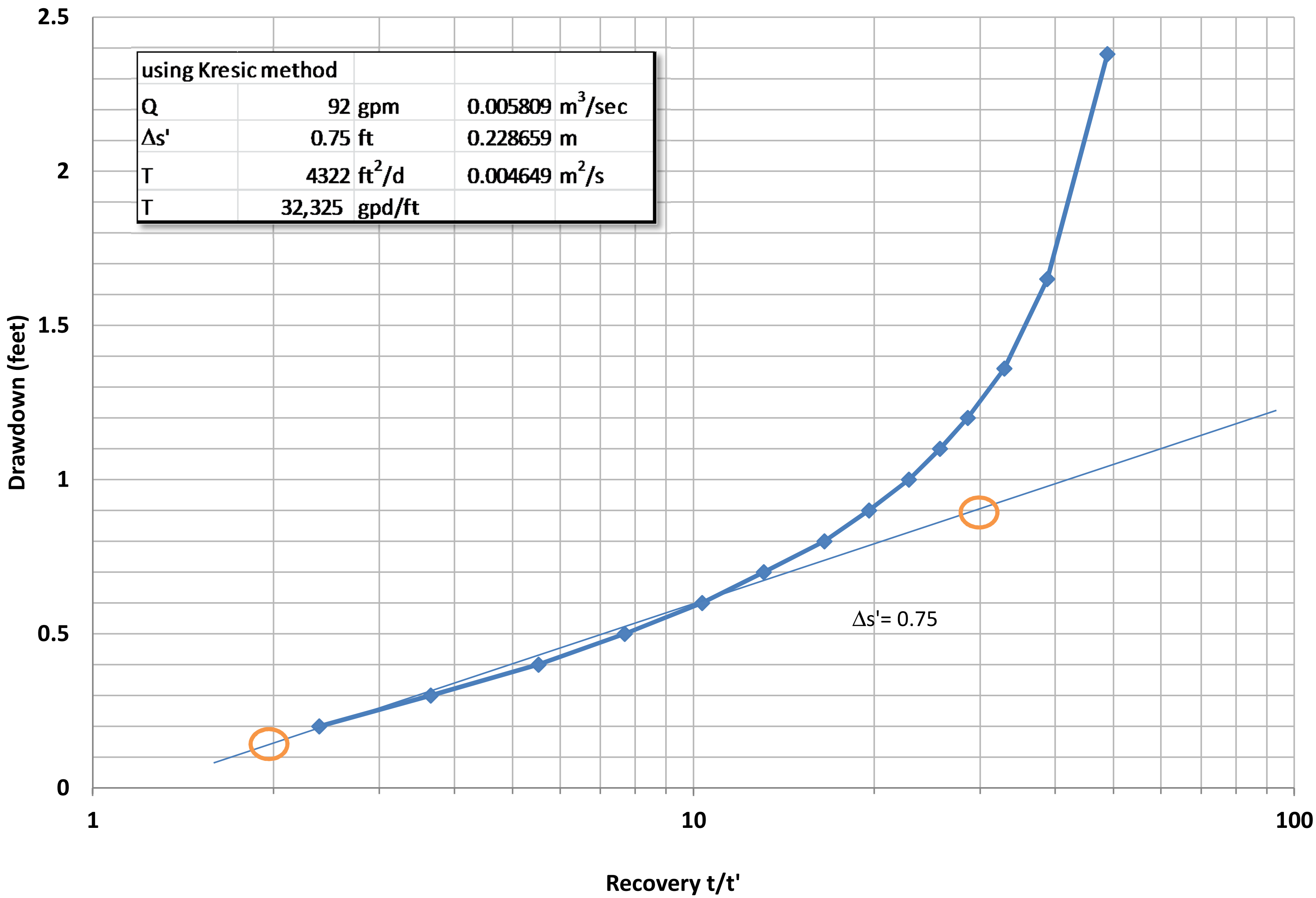
Project & Owner	Port of Chelan County	Project Number	208.020.01.127
Dates	August 30, 2012	Location	Cashmere Mill Site
Field Rep	Adam Neff	Photos	J:\data\PCC\208-020\01 Port\127 Site Clean-up\GEO\photos

Boring	Total Depth	Samples Collected	Depth and Description
CMS-08302012-1	6	N	Sandy COBBLE with gravel (GP). No petroleum odor, no wood waste.
CMS-08302012-2	6	N	Sandy COBBLE with gravel (GP). No petroleum odor, no wood waste. Water level: 4.3’
CMS-08302012-3	5.5	N	Cobbly SAND with gravel (SP). No petroleum odor, no wood waste. Water level: 5.1’
CMS-08302012-4	7	Y	SAND with gravel and cobbles (SP). Light petroleum odor, no wood waste. Water level: 2.5’
CMS-08302012-5	7	Y	Cobbly SAND with gravel (SP). No petroleum odor, no wood waste. Water level: 6’
CMS-08302012-6	7	Y	SAND with gravel and cobbles and construction debris (SP). Significant petroleum odor, no wood waste. Water level: 6.7’
CMS-08302012-7	6	Y	0-3 Mix of wood waste, sand, and gravel. Light petroleum odor. 3-6 SAND with gravel and cobbles (SP).
CMS-08302012-8	5	Y	0-2.5 Mix of wood waste, sand, and gravel. 2.5-5 Coarse SAND with gravel and cobbles (SP). No petroleum odor.
CMS-08302012-9	4.5	Y	0-3 wood waste 3-4.5 grey coarse cobbly SAND with gravel (SP). Water level: 3.5’. No odor.
CMS-08302012-10	5.5	N	0 - 2.2 Crushed concrete 2.2 - 2.5 FILL sand with gravel and organics 2.5 – 5.5 Coarse sand w/gravel and cobbles. Water level 5’
CMS-08302012-11	4	Y	0 – 1 sand with gravel and wood waste 1 – 4 gray coarse sand with gravel and cobble. Hydrocarbon smell. Water level at 3.2’
CMS-08302012-12	4	Y	0 – 2 mix, sand with silt, gravel, cobbles and wood waste 2 – 4 Cobbly sand w/gravel. Hydrocarbon smell in all material. Water level at 2.5 ft.
CMS-08302012-13	4	N	0 – 4 fill with wood waste and construction debris. Hydrocarbon smell. Water level 2.8’

CMS-08302012-14	6.8	Y	0 – 2.8 Silt, sand, cobbles and some wood waste 2.8 – 6.5 Wood waste 6.5 – 6.8 medium sand (clean, native). No odor.
CMS-08302012-15	6.5	Y	0 – 3.5 mixed fill with some construction debris, Sand w/gravel and cobbles 3.5 – 6.5 clean wood waste. Water level at 6.0'. No odor.
CMS-08302012-16	4	N	0 – 4 sand with gravel and cobbles. Slight hydrocarbon smell. Water level at 4'
CMS-08302012-17	4	N	0 – 4 fill with construction debris, sandy cobble w/gravel. Hydrocarbon smell.
CMS-08302012-18	2	N	0 – 2 crushed concrete. 2' refusal on slab of concrete (railroad rail on concrete)
CMS-08302012-19	2.5	N	0 – 2.5 crushed concrete. 2' refusal on slab of concrete (railroad rail on concrete)
CMS-08302012-20	2	N	0 – 2 crushed concrete. 2' refusal on slab of concrete (railroad rail on concrete)
CMS-08302012-21	2	N	0 – 2 crushed concrete. 2' refusal on slab of concrete
CMS-08302012-22	5	Y	0 – 1 crushed concrete 1 – 4 mixed sand with gravel, some cobbles and construction debris. Hydrocarbon smell 4 – 5 gravelly sand with cobbles (native). Water level at 4.5 ft.
CMS-08302012-23	7.5	Y	0 - 4.5 Sand with gravel and cobbles, some construction debris. Very dense 4.5 – 7 Wood waste with sand and cobble. Hydrocarbon contamination 7 - 7.5 fine sand with organics (native)
CMS-08302012-24	8	Y	0 - 1.5 Top soil with organics 1.5 – 6.5 Wood waste with sand and cobble. Hydrocarbon smell 6.5 – 8 medium sand (native). Water level at 7.5'
CMS-08302012-25	7	N	0 – 6 fine sand with silt, gravel and organics. (very little wood waste, mostly roots) 6 – 7 grey medium sand with gravel (native). Water level at 6.3'
CMS-08302012-26	8.5	Y	0 – 8.3 Wood waste w/sand and silt 8.3 - 8.5 grey sand with gravel and cobbles. Water level at 8'
CMS-08302012-27	7.5	Y	0 - 0.5 top soil w/organics 0.5 – 2 sand w/gravel, some cobbles 2 – 3 wood waste 3 – 5 cobbly sand w/gravel 5 – 6.5 medium sand (native) 6.5 – 7.5 sandy cobble w/gravel (native)

Attachment 3
Dewatering Evaluation Summary

Test Well Pumping Test Results - Dewatering Evaluation Summary
Port Chelan County Cashmere Mill Site



Appendix B – Sampling and Analysis Plan/Quality Assurance Project Plan

Port of Chelan County

Former Cashmere Mill Site Removal Action Sampling and Analysis Plan/Quality Assurance Project Plan

February 2013

Prepared by RH2 Engineering, Inc.

1. Introduction and Objectives

This combined Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) was prepared by RH2 Engineering, Inc., (RH2) with the support of Maul Foster & Alongi, Inc., (MFA) on behalf of the Port of Chelan County (Port). This SAP/QAPP describes procedures for wood waste and soil field screening, wood waste and soil sampling, and groundwater sampling that will be conducted during implementation of the wood waste and petroleum contaminated soil (PCS) removal action at the Port's former mill site in Cashmere, Washington. This SAP/QAPP provides guidance for field and laboratory analysis activities and quality assurance objectives to be performed and tracked for the project. This SAP/QAPP is an appendix to the Cashmere Mill Site Removal Action Work Plan (Work Plan), prepared by RH2 Engineering in January 2013. The Work Plan describes removal action activities to meet the project objectives, summarizes background information, defines field activities and specifications, and identifies applicable regulatory requirements necessary to complete the removal action.

1.1. Background

The Port owns the former Cashmere Mill properties (**Figure 1**), and intends to transfer the site to a prospective purchaser (Crunch Pak, of Cashmere, Washington) that intends to redevelop the site for commercial use as fruit storage warehouse and fruit bin storage site. As a condition of purchase, Crunch Pak requires removal of all wood waste-related materials resulting from former mill activities from the developable areas of the site, removal of known PCS exceeding associated cleanup levels, and backfilling the site with structural import fill to regrade the site and to improve drainage. The Port intends to conduct wood waste and PCS removal actions and backfill the excavated areas (the removal action) in 2013.

The Port has conducted environmental site assessments at the site since 2007. Reports describing the activities and findings of the assessments pertaining to the nature and extent of wood waste and PCS at the site are summarized and referenced in the Work Plan.

1.2. Project Description

The field screening and confirmation sampling procedures and frequencies presented in this SAP/QAPP will provide characterization and confirmation data to support verification of removal action objectives at the site, which include removal of all of the wood waste at the developable areas of the site, as well as removal of all PCS at two or more sites containing total petroleum hydrocarbons (TPH) concentrations exceeding Model Toxics Control Act (MTCA) Method A Cleanup Levels. Non-contaminated wood waste and fill will be transported off site for reuse or disposal. Any soil or wood waste containing contaminants that exceed MTCA Cleanup Levels and discovered during removal actions will be removed, and soil confirmation samples from all excavated areas will be collected to confirm removal action objectives. Wood waste and soil stockpile sampling will support demonstration of compliance with acceptability criteria at the designated off-site disposal facility for any contaminated wood waste (CWW) and PCS excavated during the removal action. Following acceptance of characterization data at the disposal facility, the stockpiled PCS and CWW will be transported directly to the disposal facility. Upon verification of obtaining removal action objectives, the excavations will be backfilled with structural import fill to support site redevelopment.

Characterization sampling will also support the appropriate disposal of groundwater generated during construction dewatering that will facilitate excavation and removal of wood waste below the groundwater table. Characterization will demonstrate compliance with acceptability criteria of the permitted water treatment facility or for permitted on-site disposal. Any stormwater that collects into the excavation during the removal action will be discharged with dewatering discharge. Groundwater monitoring wells will be constructed and sampled to characterize groundwater conditions after removal actions are complete in order to characterize groundwater conditions upgradient (or background) and downgradient of known and discovered PCS and CWW areas at the site.

This SAP/QAPP includes procedures for field screening and collection of the confirmation and characterization samples, sampling methods, documentation of field activities, and laboratory analysis to ensure data quality objectives.

1.3. Project Objectives

The objectives of the removal actions include excavating and removing all wood waste at developable areas of the site, excavating and removing all PCS at the site exceeding MTCA Method A Cleanup Levels, excavating and removing all CWW at the site exceeding MTCA Method B Cleanup Levels, and backfilling the excavation with verified clean structural import fill.

The objectives of the removal actions also include characterizing groundwater conditions after removal actions to obtain sufficient information to establish natural upgradient/background conditions as well as groundwater conditions downgradient of known and discovered PCS and CWW, evaluate potential manmade effects on natural background conditions, and compare on-site groundwater water quality conditions to groundwater quality criteria. Characterization will be sufficient to determine whether the site groundwater meets MTCA Method A and/or B Cleanup Levels or if additional monitoring or groundwater remediation is warranted.

2. Removal Action Organization and Schedule

The Port, and its consultants at RH2 and the Washington State Department of Ecology (Ecology), are guiding and implementing this removal action. An Ecology-accredited laboratory will provide laboratory services. RH2 environmental staff is responsible for checking, downloading, and calibrating the field instruments, and collecting and transporting samples under chain of custody to the laboratory representatives. RH2 will evaluate all water quality and quantity data, using methods approved by Ecology.

2.1. Organization

Key personnel involved in this project and their responsibilities are listed below.

Laura Jaecks, Port of Chelan County, is the owner's representative. The Port is responsible for development of documents and implementation of field activities necessary to meet the removal action objective, and for interacting with interested public and stakeholders. Phone: (509) 661-3118. Email: laura@ccpd.com.

Karen Kornher, *P.E.,* RH2, Engineering, Inc., is the project manager and agent between the sampling staff at RH2 and the Port of Chelan County. Phone: (509) 886-6764. Email: kkornher@rh2.com.

Steve Nelson, L.G., L.HG., L.E.G., RH2, Engineering, Inc., is the project lead for the development of this work plan and analysis of data for the final project report. Phone: (425) 951-5406. Email: snelson@rh2.com.

Mary Monahan, Central Regional Office, Department of Ecology Toxics Program, is responsible for Ecology's review and approval of the work plan and construction-related documents, and will advise on sampling requirements, quality assurance, and quality control issues during project implementation and assessment. Phone: (509) 454-7840. Email: mmon461@ecy.wa.gov.

The primary contact for laboratory coordination for sample management and data quality will be determined upon selection of the contract lab.

2.2. Project Schedule

The wood waste and PCS removal action will begin in March 2013 and is expected to conclude in October 2013. Field and laboratory work will proceed concurrently with the removal action. Groundwater characterization will begin after the removal actions are complete, or as the site become finalized, with the installation of monitoring wells and will proceed through at least 1 year or 4 quarters of sampling and laboratory analysis. A final wood waste and PCS removal action report will be completed in November 2013. Quarterly groundwater monitoring summaries will begin in July 2013 and a final groundwater monitoring report will be completed in July 2014.

3. Quality Objectives

Procedures in this SAP/QAPP are used to collect representative samples and field measurements of the highest possible quality. Usability of the data will be based on both quantitative (precision, accuracy/bias, and completeness) and qualitative (representativeness and comparability) quality assurance objectives.

Measurement quality objectives (MQOs) specify how good the data must be in order to meet the objectives of the project. MQOs are the performance or acceptance thresholds or goals for the project data, based primarily on the data quality indicators precision. In practice, these are often the precision, bias, and accuracy guidelines against which laboratory indicators and field quality control results are compared. To confirm that project MQOs for precision and accuracy are achieved, analytical results for field and laboratory quality control samples will be evaluated. Quality control results that do not meet target values will be qualified during data validation, and their limitations will be noted in the data quality and usability report for the project. To ensure comparability and representativeness of the laboratory data, standard instrumentation will be used for the analyses and the instruments will be properly calibrated and maintained.

Precision is a measure of the variability in the results of replicate measurements due to random error. Random errors are always present because of normal variability in the many factors that affect measurement results. Precision can also be affected by the variations of the actual concentrations in the media being sampled. The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as percent relative standard deviation (% RSD) between sets of duplicate field samples. Project MQOs for laboratory analyses are contained in **Table 1**. Analytical sample bias will be largely investigated at the laboratory where samples will be analyzed, following a laboratory quality assurance process.

Table 1. Project Measurement Quality Objectives for Laboratory Analyses

Parameter	Check Standards/Lab Control Standards (% Recovery Limits)	Precision for Duplicate Samples (RPDs)	Matrix Spike Recoveries
Gasoline-Range Organics	80-120%	±50%	80-120%
Diesel and Oil-Range Organics	80-120%	±50%	80-120%
BTEX, EDB, EDC	75-125%	±25%	75-125%
Chlorophenols, PAHs, cresols, phenols	Varies - 15-150%	±40%	Varies - 15-150%
Metals:	80-120%	±20%	75-125%

Arsenic, Chromium, Copper, Lead			
Volatile Hydrocarbons (VPH)	80-120%	±50%	80-120%
Extractable Hydrocarbons (EPH)	Varies: 21-100% to 45-137%	±50%	Varies: 21-100% to 45-137%

RPD – Relative Percent Difference
BTEX – Benzene, Toluene, Ethylbenzene, Total Xylenes
EDB – Ethylene Dibromide
EDC – Ethylene Dichloride

4. Field Activities

4.1. Soil and Wood Waste Field Screening

Concurrent with the inspection of wood waste removal activities, the composition of the wood waste and the quality of the native soil underlying excavated wood waste will be inspected for evidence of stains, sheens, solid waste, and odor. Areas of exposed wood waste and soil exhibiting potential contamination during inspection will be field screened.

The extent of PCS removal in the areas identified for PCS removal (Site 2 and Site 4; Figures 1, 2, and 3 in Work Plan) and in areas where PCS or CCW has been discovered during wood waste removal actions will be guided by field screening of exposed soil and wood waste during removal.

Field screening will consist of observing exposed soil and wood waste for evidence of stains or sheens, or unusual color, detection of any odors, and collecting representative samples of the upper 6 to 12 inches of soil or a representative sample of potentially contaminated wood waste using clean stainless steel spoons for organic vapor analysis using a Photoionization Detector (PID). A portion of the sample will be placed in an airtight bag for a minimum of 3 minutes, warmed, and then the air in the bag will evaluated for volatile organic compounds (VOCs) using a PID following manufacturers procedures. Field screening locations for which a PID reading exceeding 10 parts per million (ppm) above background observations will be located using a portable GPS unit, and the sampling observations, details and results of field screening will be recorded in a field notebook. All sample locations shall be located in this manner.

Wood waste or soil samples indicating the potential presence of VOC concentrations of greater than 10 parts per million (ppm) in air in samples tested with the PID or containing visible stains, sheens from a sheen test, or moderate to strong odors will be considered contaminated. PCS and CWW will be excavated and stockpiled on site for characterization and off-site disposal.

4.2. Soil Confirmation Sampling Rationale

Collection and analysis of confirmation soil samples from native soil exposed during wood waste removal will provide verification of the presence/absence of soil containing TPH and wood treatment chemical concentrations exceeding cleanup levels below wood waste. Wood treatment chemicals (WTCs) include polynuclear aromatic hydrocarbons (PAHs), methylphenols (cresols), chlorophenols, metals (arsenic, chromium, copper, lead), and TPH as gasoline and diesel/oil.

Collection and analysis of confirmation soil samples from native soil exposed during PCS and CWW removal actions will provide verification of the presence/absence of soil containing TPH and WTCs concentrations exceeding cleanup levels below these areas.

4.3. Soil Confirmation Sampling at Grid Locations

Concurrent with the inspection of wood waste removal activities, the native soil underlying excavated wood waste will be exposed and accessible for grid sampling (Figure 4 of the Work Plan). Representative samples of the upper 6 to 12 inches soil will be collected using clean stainless steel spoons and placed into laboratory-provided containers for semi-volatile organic compounds (SVOCs) and metals analysis. Representative samples of the upper 6 to 12 inches soil will be collected using the U.S. Environmental Protection Agency (EPA) Method 5035 for VOC analysis (see Ecology Fact Sheet 04-09-087). Samples will be analyzed for TPH as gasoline, TPH as diesel/oil, BTEX, and for WTCs. If TPH as gasoline is detected, the sample will also be analyzed for EDB/EDC, MTBE and total lead. The samples will be analyzed on a 24-hour turnaround schedule. **Table 2** in Section 4.6 summarizes sample management details and Section 5 summarizes laboratory methods for soil confirmation sampling. If laboratory results indicate that TPH or WTC concentrations in soil exceeds cleanup levels, soil removal actions and subsequent confirmation sampling will be conducted at the grid location. If laboratory results are below cleanup levels, the excavated area will be backfilled with clean imported structural fill or clean native soil.

If confirmation sample analytical results indicate an exceedance of an associated cleanup level, then four additional soil samples (referred to as "stepped out" samples) will be collected from the base of the excavation. The stepped out samples should generally be spaced evenly and located approximately 20 to 40 feet from the original confirmation sample location based on field conditions. These four stepped out soil samples will only be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results from the stepped out samples indicate compliance with associated cleanup levels, then the area within the boundaries of the stepped out samples will be excavated and a confirmation sample will be collected from the new excavation. This confirmation sample will be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results of the samples indicate an exceedance of the associated cleanup level, then consider continuing the process of stepping out or excavate the remaining area of the grid being sampled. This process could continue until confirmation samples indicate compliance with associated cleanup levels as site conditions allow.

4.4. Soil Confirmation Sampling for Known and Discovered PCS and CWW

PCS removal at Site 2, Site 4, and any discovered PCS or CWW sites will be guided by field screening results to establish the limits of probable contamination. Representative soil samples shall be collected up 6 to 12 inches below the excavation base and at the vertical center of each excavation sidewall using clean stainless steel spoons for SVOCs and metals analysis and using EPA Method 5035 for VOC analysis and placed into laboratory-provided containers. One sample will be collected for every 100 square feet of excavation floor and every 10 linear feet of excavation sidewall. For side walls greater than 20 feet in length samples shall be collected every 20 linear feet. Samples at locations where PCS has been removed at Site 2 and Site 4 will be collected and analyzed for TPH as diesel/oil and BTEX. Samples of soil at locations where PCS has been discovered will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE and total lead if gasoline is detected). Samples of soil at locations where CWW has been removed will be collected from the excavation base and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX and WTC (and total lead, EDC/EDB and MTBE if gasoline is detected).

If former sumps, drywells, or catch basins are encountered during removal actions, the structure will be removed and underlying soil will be field screened for evidence of stains, sheens, unusual color, or odors. If no contamination evidence is apparent, a representative of soil from below the structure will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE, and total lead if gasoline is detected). If contamination evidence is apparent, the location will be remediated and confirmation sampling will be conducted similarly to a discovered PCS site as described in the previous section.

Samples of soil at locations where PCS has been discovered will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE and total lead if gasoline is detected).

All soil confirmation sampling locations will be located using a portable GPS unit and the sampling observations and details will be recorded in a field book.

If laboratory results indicate that TPH/BTEX concentrations in soil exceeds MTCA Method A Cleanup Levels or WTC concentrations exceed Method B Cleanup Levels, additional soil removal actions, as defined in the Work Plan, and subsequent confirmation sampling will be conducted at the removal location.

If PCS cannot be removed due to risk to existing structures, encroachment into adjacent properties or wetland and stream buffers, analysis of representative soil samples on the excavation sidewall and floor will also include analysis of TPH composition by Ecology Methods VPH/EPH for subsequent risk analysis using MTCA Method B.

If confirmation samples indicate no exceedance of TPH and WTC cleanup levels, the excavation will be backfilled with clean fill and compacted. If confirmation samples contain TPH or WTC concentrations above cleanup levels, additional soil will be removed and additional confirmation samples will be collected. If the second confirmation samples contain TPH or WTC concentrations below cleanup levels, the excavation will be backfilled with clean fill. If the second confirmation samples contain TPH and/or WTC concentrations above cleanup levels, Ecology will be notified and an approach for addressing residual contamination at the location will be established.

4.5. Stockpiled Soil Characterization Sampling

Upon completion of excavation of PCS and CWW discovered during wood waste removal activities that generate stockpiles, soil and wood waste samples will be collected from the stockpiles for characterization purposes. Stockpiled PCS samples collected for characterization purposes for off-site disposal will be analyzed for TPH as diesel, BTEX, total lead (and gasoline/BTEX if present in discovered PCS). Stockpiled CWW samples collected for characterization purposes for off-site disposal will be analyzed for TPH and WTCs. Samples of unusual solid wastes discovered during wood waste removal actions and stockpiled will be analyzed for offsite disposal characterization. Appropriate analytical methods for samples of unusual solid wastes will be determined at the time of stockpiling and based on the types of waste materials identified.

Collection and analysis of composite soil samples from different locations of the stockpile will provide analytical data representative of the excavated soil. The analytical data will allow for demonstration of compliance with the acceptability criteria of the off-site disposal facility.

Stockpile soil sampling will consist of preparing one composite soil sample to represent each 500 cubic yards (yd^3) of stockpiled PCS or CWW. Composite samples shall consist of equal portions of discrete samples taken at a frequency of one sample for every 50 yd^3 of material.

4.6. Soil Sample Management

Upon collection, soil and wood waste samples will be individually labeled and immediately placed on ice in a cooler for delivery to the laboratory. All samples will either be delivered by field staff or via courier to the lab with chain of custody protocols to meet holding times. A Chain of Custody form provided by the lab will be submitted for each sampling event. Sample containers and analysis holding times are summarized in **Table 2**.

Table 2. Soil and CWW Sample Containers, Preservation, and Holding Time Requirements

Parameter	Container	Preservative	Holding Time
Gasoline-range TPH/BTEX (using EPA Method 5035), EDB/EDC, MTBE, VPH	4 x 40 mL glass vials	Na_2SO_4 (2 vials) Methanol (2 vials)	7 days
Diesel and Oil-range TPH, EPH	8 oz. glass	none	14 days
chlorophenols, PAHs, phenols, cresols	8 oz. glass	none	14 days
Metals (arsenic, chromium, copper, lead)	8 oz. glass	none	6 months

4.7. Decontamination and Investigation Derived Wastes

Decontamination of sampling equipment will be completed after collection of each sample. Spoons used for collecting soil samples for SVOC and metals analysis will be cleaned using detergent and multiple rinses of potable water. One rinsate sample will be collected for every 20 soil samples collected with non-disposable sampling equipment. Reusable personal safety gear will be decontaminated at the end of each day using detergent and multiple rinses of potable water. Disposable safety gear, such as gloves and ear protection, will be managed as investigation derived wastes (IDW). All investigation derived wastes (IDW) will be collected in a separate container at the site and disposed at a permitted waste facility. All wastewater generated from equipment decontamination will be collected into a separate container and disposed at the City of Cashmere (Cashmere) wastewater treatment plant (WWTP).

Dewatering discharge will be collected in a settling tank before discharge to the Cashmere WWTP. Samples of discharge water will be collected daily to comply with testing conditions established between the Port and Cashmere. Compliance testing may be adjusted depending on flow rates, time of year, and the location of the dewatering area. Representative samples of discharge water will be collected directly from a sampling port in the storage tank and placed into laboratory provided containers and analyzed for TPH/BTEX and any other water quality parameters (to be determined by Cashmere at the time of discharge) on a 24-hour turnaround.

4.8. Sample Chain of Custody/Documentation

Sampling details and field observations will be documentation in field logbooks. Soil and wood waste samples will be identified using sample labels placed on laboratory containers and the sample numbers will be recorded on field sampling data sheets, and laboratory-provided chain-of-custody forms. The sample numbering system for analytical samples collected will be dependent on the type of sample collected. Soil confirmation samples from grid locations will be identified starting with "S-G-###". Soil confirmation samples from PCS Sites 2 and 4 will be identified starting with "S-C-2-###" or "S-C-4-###", respectively. Soil confirmation samples from additionally discovered PCS sites will be identified starting with "S-C-#-###", where the first discovered PCS site will start with the number "6" and proceed sequentially for each subsequently discovered PCS site. Wood waste confirmation samples from CWW sites will be identified starting with "WW-C-#-###", where the first discovered CWW site will start with the number "1" and proceed sequentially for each subsequently discovered CWW site. Characterization samples from stockpiles of PCS and CWW will be identified starting with the identification "S-SP-###" and "WW-SP-###", respectively. Discharge water characterization samples will be identified with "W-###".

For field duplicates, the sample identification number will be XX-###-MMDDYY, where "MMDDYY" stands for month, date, and year of the sample collection. For example, for a field duplicate collected on June 15, 2013, the identification would be XX-###-061513. A sample time of 1700 will be recorded on the sample labels and Chain-of-Custody record for all field duplicates. In addition, it is imperative that the field duplicate number be referenced on the sample collection field sheet.

4.9. Groundwater Sampling

4.9.1. Dewatering Discharge Sample Collection and Analysis

Samples of groundwater will be collected during construction dewatering to characterize dewatering discharge. Water samples will be collected directly from the dewatering system storage containers and placed into laboratory-provided containers for laboratory analysis of TPH as gasoline, TPH as diesel and oil, and BTEX (Section 5).

4.9.2. Groundwater Monitoring Well Sampling

Samples of groundwater will be collected from existing monitoring wells before removal action begins, and from existing and new monitoring wells after removal action is complete. Water samples will be collected from the monitoring wells and placed into laboratory-provided containers for laboratory analysis of TPH as gasoline, TPH as diesel and oil, and BTEX. If gasoline is detected, samples will be analyzed for EDB/EDC, MTBE, and total lead. If CCW was present and removed upgradient of the monitoring well, groundwater samples will also be tested for WTC (Section 5). The Port will notify Ecology by telephone or email as early as possible prior to groundwater monitoring well sampling events. Duplicate samples will be collected at a rate of at least 1 per sampling event, or 1 per 10 samples collected.

Groundwater Monitoring Well sampling frequency will occur as follows:

1. <u>Groundwater Monitoring wells (GMW) where no detection of contamination occurs will be sampled two (2) times. Sample events shall be three (3) to six (6) months apart.</u>

2. Groundwater Monitoring wells (GMW) where contamination is detected but at levels below cleanup levels will be sampled four (4) times. Sample events shall be three (3) to six (6) months apart or quarterly.
3. Groundwater Monitoring wells (GMW) where contamination is detected at levels exceeding cleanup levels will be sampled at least eight (8) times. Sample events shall be three (3) to six (6) months apart or quarterly.

4.9.2.1. Field Meter Calibration Procedures

Field meters will be used to measure depth to water and water quality parameters prior to groundwater sample collection. The following field instruments will be used:

- Electrical well probe – Water level meter, marked every 0.01 foot. When the sensor at the tip of the probe contacts water, the circuit is completed, activating a steady tone and light on the reel.
- Water quality multimeters – Used to measure the following water quality parameters prior to sample collection: pH, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Purge water will be continuously monitored, and parameters recorded to verify stability of groundwater conditions prior to collecting samples for lab analysis.

The meters will be calibrated and operated according to the manufacturer's specifications prior to sampling (once at the start of each day sampling will occur). Field meter calibration will be checked prior to use and at the conclusion of each sampling day. The calibration check will be recorded in the field logbook or on the Sample Collection Log. Results for field measurements will be recorded on the Sample Collection Log.

4.9.2.2. Groundwater Level Measurement

The depth to groundwater will be measured in each well before purging begins. Water level will be measured directly using an electric well probe. Results will be recorded to the nearest 0.01 foot in the field log book. The top of well casing will be surveyed to the nearest 0.01 feet and referenced to NAVD 88.

4.9.2.3. Purging

The wells will be purged using a peristaltic pump and dedicated Teflon-coated tubing that will remain in the well between sampling events. The pump and tubing will be installed and handled for each event while wearing clean disposable gloves. The tubing intake will be positioned at a depth of 2 to 3 feet below the static water level. The well will be purged at a rate of 0.5 to 1 liter per minute. Field parameters to be measured include temperature, pH, turbidity, specific conductance, and dissolved oxygen prior to the water being exposed to the atmosphere. Purging will continue until these parameters have stabilized, with measurements taken at five minute intervals. Purging will be considered complete when two consecutive sets of parameter readings show changes less than the criteria listed in **Table 3**. Well drawdown will be monitored using a well probe during purging and recorded in the field notes.

Table 3. Field Parameter Stability Criteria

Field Parameter	Criteria

pH	± 0.1 Standard Unit (SU)
Temperature	± 0.3°C
Turbidity	± 1 Nephelometric Turbidity Unit (NTU)
Specific Conductance	± 5 microSiemens per centimeter (mS/cm)
Dissolved Oxygen	± 0.3 mg/L

Purge water will be collected and disposed at the Cashmere WWTP.

4.9.2.4. Field Measurement Procedures

Measurements made in the field will include direct measurement of water level at the start of purging; and direct measurement of pH, temperature, specific conductivity, DO, and turbidity during purging. Field instruments will be calibrated according to manufacturer's specifications within 4 hours before purging. The field instrumentation and respective ranges of results and accuracies are summarized in **Table 4**.

Table 4. Summary of Field Measurement Analytical Reporting Limits for Groundwater Quality and Level Monitoring

Parameter	Measurement Method	Accuracy	Expected Range of Results
Temperature (C)	YSI 556 MPS	0.01C	10 to 13 degrees
pH	YSI 556 MPS	0.01 pH units	6.5 to 7.5 pH units
Specific Conductance (mS/cm)	YSI 556 MPS	1 µs/cm	100 to 200 µmhos/cm
Turbidity (NTU)*	HF Scientific MicroTPW	0.01 NTU	5 to 50 NTU
Dissolved Oxygen (DO)	YSI 556 MPS	0.01 mg/L	0.5 to 5 mg/L
Water level (feet)	Solinst Well Probe	0.01 feet	3 to 15 feet

NTU - Nephelometric
TDS – Total Dissolved Solids

4.9.2.5. Groundwater Sample Collection

Groundwater samples will be collected directly from the discharge tubing immediately after purging; samples will be collected while the pump is running at less than 0.5 liters per minute. Sample containers will be filled in the following sequence.

1. Unpreserved samples.
2. Preserved samples.

Samples shall be labeled in the format of [well number]-[date] (date to be in DDMMYY format). Every individual sample container shall be labeled with the date and time of sampling, location, sampler's initials, and preservatives. Replicates will be collected and handled in the same manner.

4.9.3. Groundwater Sample Management

Upon collection, water samples will be individually labeled and immediately placed on ice in a cooler for delivery to the laboratory. All samples will either be delivered by field staff or via courier (i.e. Fed Ex) to the lab with chain of custody protocols to meet holding times. A Chain of Custody form provided by the lab will be submitted for each sampling event. Sample containers and analysis holding times are summarized in **Table 5**.

Table 5. Groundwater Sample Containers, Preservation, and Holding Time Requirements

Parameter	Container	Preservative	Holding Time
Gasoline-range hydrocarbons/BTEX, EDB/EDC, MTBE	3 x 40 mL vial	HCl	14 days
Diesel-range hydrocarbons	2 x 500 ml amber glass	None	30 days
chlorophenols, phenols, cresols, PAHs	2 x 500 ml amber glass	None	7 days
Metals: Arsenic, Chromium, Copper, Lead	500 mL – polyethylene	HNO_3	6 months

The date and time of sample collection, sampler name, purging volumes, field water quality measurements, water levels, time of instrument calibration, and environmental conditions shall be recorded at the time of sampling on a field sampling data sheet. Any deviation from the sampling protocol will be noted.

4.10. Field Logbooks

Field logbooks will provide the means of recording data-collecting activities performed at the site. Entries will be described in as much detail as possible so that persons going to the site can reconstruct a particular situation without reliance on memory.

Field logbooks will be bound and assigned to field personnel, but will be stored in the project file when not in use. Each logbook will be identified by the project name and, if applicable a project number.

The title page of each logbook will contain the following:

- Logbook Number (if applicable)
- Project Name
- Log Entry Start Date and End Date

The following information will be recorded in the logbook at the beginning of each daily entry:

- Date, start time, weather conditions.
- Names of sampling personnel present.

- A summary of sample activities including sample location, sample time, sample description, depth at which the sample was collected, sample volume, the number of containers for the sample and any field notes relating to the well or sample.
- The names of any visitors along with a description of the purpose of the visit.
- Decontamination procedures.
- Field quality control samples including identification numbers used.
- Signature of the person recording any entries into the logbook.

5. Laboratory Analysis Methods

An Ecology-accredited analytical laboratory will conduct analysis for the project. Laboratory standard operating procedures will be on file with the laboratory.

Table 6 summarizes laboratory analysis methods for PCS and MTCA Method A Cleanup Levels, and **Table 7** summarizes laboratory analysis methods for confirmation soil below wood waste and for CWW and MTCA Method A Cleanup Levels.

Table 6. Analytical Summary for PCS at Site 2 and 4

Parameter	Analytical Method	Method Detection Limit (mg/kg)	MTCA Method A Cleanup Level[b] (mg/kg)
Diesel-Range Hydrocarbons	Ecology NWTPH-Dx + Acid/Silica Gel Cleanup	5.0 – 10.0	2,000 – Diesel 2,000 – Heavy Oil 4,000 – Mineral Oil
BETX	EPA 8021	0.01255	0.3 – benzene 6 – ethylbenzene 7 – toluene 9 – total xylenes
EPH[a]	Ecology EPH	5.0 – 10.0	na

[a] If Method B Cleanup Level is used.
[b] From Table 740-1 in WAC 173-340-900.
na = not available

Table 7. Analytical Summary for Confirmation Soil Samples and Contaminated Wood Waste

Parameter	Analytical Method	Detection Limit (mg/kg)	MTCA Method A Cleanup Level[b] (mg/kg)
Gasoline-Range Hydrocarbons	Ecology NWTPH-Gx/5035	5.0	30 (100 if benzene - ND, TEX < 1 %)
BETX	EPA 8021	0.01255	0.3 - benzene 6 - ethylbenzene 7 - toluene 9 – total xylenes
Ethylene dibromide (EDB)[a] Ethylene dichloride (EDC)[a] MTBE[a]	EPA 8260	0.001	0.005 – EDB EDC – Method B 0.1 - MTBE MTBE
Diesel-Range Hydrocarbons	Ecology NWTPH-Dx + Acid/Silica Gel Cleanup	5 – Diesel 10 – Heavy, Mineral	2,000 – Diesel 2,000 – Heavy Oil 4,000 – Mineral Oil
Chlorophenols	EPA SW8041	0.00625	Method B
PAHs	EPA SW8270-SIM	0.005	0.1
Phenols, Cresols	EPA SW8270	0.2 to 0.0201	Method B
Arsenic	EPA 6010C	5	20
Chromium III	EPA 6010C	0.5	2,000
Copper	EPA 6010C	0.2	Method B
Lead[a]	EPA 6010C	0.2	250

[a] If gasoline is detected in the soil or wood waste.
[b] From Table 740-1 in WAC 173-340-900.

Table 8 summarizes laboratory analysis methods for groundwater and MTCA Method A Cleanup Levels.

Table 8. Analytical Summary for Groundwater

Parameter	Analytical Method	Detection Limit (mg/L)	MTCA Method A Cleanup Level[b] (mg/L)
Gasoline-Range Hydrocarbons	NWTPH-Gx	0.25	800 (1,000 if benzene - ND)
BETX	EPA 8021	1 – BTE 2 - Xylenes	5 – Benzene 700 – Ethylbenzene 1,000 – Toluene 1,000 – Xylenes
EDB, EDC[a] MTBE[a]	EPA 8260	0.2 0.00036	0.01 – EDB 5 – EDC 20 – MTBE
Diesel-Range Hydrocarbons	NWTPH-Dx with Acid/Silica Gel Cleanup	0.05 – Diesel 0.1 – Heavy, Mineral	500
Chlorophenols[cc]	EPA SW8041	0.25	Method B
PAHs[c]	EPA SW8270-SIM	0.0001	0.1
Phenols, Cresols[c]	EPA SW8270	0.001 to 0.02	Method B
Arsenic[c]	EPA 200.7	0.5	5
Chromium (total)[c]	EPA 200.7	0.5	50
Copper[c]	EPA 200.7	0.5	Method B
Lead[a,c]	EPA 200.7	0.1	15

[a] If gasoline is detected in groundwater.
[b] From Table 720-1 in WAC 173-340-900.
[c] If CWW was present and removed upgradient of the monitoring well.

6. Quality Control Procedures

6.1. Field

Field quality control will consist of collecting field duplicates, rinsate blanks, and field blanks (groundwater only). Field duplicates consist of two or more samples collected at the same time and place. Field duplicates will be collected at a rate of 1 duplicate sample per 20 field samples. In the case of a quarterly groundwater monitoring event, one duplicate groundwater sample will be collected per monitoring event.

Rinsate blanks are samples obtained by running distilled/deionized water over non-disposable decontaminated sampling equipment used to collect soil samples for SVOCs and metals analysis. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identically to the other samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Rinsate blanks will be collected at a rate of 1 sample per 20 collected samples that are collected using non-disposable sampling equipment.

Field blanks are prepared in the field by filling the appropriate sample container with distilled/deionized water and are then submitted to the laboratory for analysis. A field blank is primarily used to evaluate contamination errors associated with field operations and shipping but may also be used to evaluate contamination errors associated with laboratory procedures. Field blanks will be collected at a rate of one per day per sampling event.

Water quality control measures for dissolved oxygen, temperature, specific conductance, turbidity, and pH, will be measured. Measurement will consist of allowing the water quality multimeter to continuously monitor field parameters until they have stabilized, at which point sampling may occur. All field measurements will be recorded in the field log. Field water quality control requirements are contained in **Table 9**.

Table 9. Field Quality Control Measurements

Parameter	Replicate Samples	Field Calibration Check Standards	Calibration Drift End Check
DO	RPD ≤ 20%	NA	±4%
Temperature	± 0.3℃	NA	N/A
Specific Conductance	± 5 mS/cm	± 5 mS/cm	± 5 mS/cm
Turbidity	± 2 NTU	± 2 NTU	± 2 NTU
pH	± 0.2 pH units	± 0.2 pH units	± 0.2 pH units

6.2. Laboratory

Sample precision will be assessed by collecting replicates at the rate of 1 per batch of 10, or 1 per batch if less than 10 samples are included in a batch of samples. Samples will undergo laboratory standard analytical techniques with standard laboratory quality control procedures.

6.3. Data Management Procedures

All field observations and monitoring results will be recorded on individual well sampling sheets that will be maintained throughout the length of the project and included in all draft and final reports. Field observations and all data will be checked for legibility and completeness before leaving the site locations. Field data will be entered into tables or spreadsheet and included with the laboratory data in all draft and final reports.

Analytical data from the laboratory will be entered in electronic format. After the data are verified, they will be summarized in case narratives and provided in all draft and final reports.

After completing the sampling, staff will compile and evaluate all field and laboratory analytical data against the project MQOs.

6.4. Audits and Reports

Ecology's Laboratory Accreditation Program establishes whether the laboratory has the capability to provide accurate and defensible data. The accreditation involves an evaluation of the laboratory's quality system, staff, facilities, equipment, test methods, records, and reports.

The final report will include a quality assurance section describing data quality. These reports will undergo scientific peer review by staff who have appropriate expertise and who are not directly connected with this project.

6.5. Data Verification and Validation

Data verification is a quality assurance review process to determine the quality and the completeness of the field and analytical data. This is done by determining that all quality control samples meet the acceptance criteria as specified in the standard operating procedure for that method.

Analytical laboratory staff will review all laboratory analysis for the project to verify that the methods and protocols specified in the SAP/QAPP were followed; that all instrument calibrations, quality control checks, and intermediate calculations were performed appropriately; and that the final reported data are consistent, correct, and complete with no omissions or errors. Evaluation criteria will include the acceptability of instrument calibrations, procedural blanks, spike sample analysis, precision data, laboratory control sample analysis, and the appropriateness of assigned data qualifiers. The laboratory staff will prepare a written case narrative describing the results of their data review.

Precision will be estimated by calculating the relative percent difference (RPD) for field duplicate results. Analytical bias will be assumed to be within acceptable limits if laboratory quality control limits are achieved for blanks, matrix spikes, matrix spike duplicates and check standards. Sampling bias will be assessed by verifying that the correct sampling and handling procedures were used. Goals for completeness will be evaluated and, if needed, replacement samples will be obtained and adjustments in subsequent sampling events will be made.

Field quality control procedures include reviewing field notes for completeness, errors, and consistency. Duplicate measurements and documentation of conditions in field notes will support verification of analytical measurements and field measurements.

The project lead will review the data package and case narrative to determine if the results meet the MQOs for accuracy, precision, and bias for that sampling episode. Field duplicate results will be evaluated and compared to the MQOs shown in **Table 1**. Based on these assessments, the data will be accepted, accepted with appropriate qualifications, or rejected.

After the laboratory and field data have been reviewed and verified by the project manager, data submittals will be independently reviewed for errors by another staff person before finalizing.

Appendix C – Site Safety and Health Plan

Appendix C
Site Safety and Health Plan

The following task-specific safety and health requirements are provided for activities in the removal action area, which includes areas of wood waste and soil removal, and areas of wood waste and soil stockpiling.

Site hazards include direct contact exposure to soil and groundwater containing petroleum hydrocarbons at concentrations below 2,000 milligrams per kilogram (mg/kg) and 10 milligrams per liter (mg/L), respectively. Wood waste has been tested for wood treatment chemicals; concentrations of polynuclear aromatic hydrocarbons (PAHs) have been detected at low concentrations close to laboratory method detection limits.

Site hazards include tripping and falling hazards, noise hazards, and heavy equipment hazards common to active excavations.

- All work activities will be performed using safe work practices in accordance with Washington Industrial Safety and Health Act (WISHA) and Occupational Safety and Health Administration (OSHA) regulations.
- Underground utilities shall be located and marked prior to clearing and grubbing and/or excavation activity.
- All electrical, gas, and telephone utilities are to be hand dug within 3 feet of utility markings.
- The excavation shall be inspected daily by a qualified person. Ground personnel shall stay clear of steep side slopes during excavation and sampling activities, unless personnel are protected by mechanical means or the slopes have been stabilized to the angle of repose. Mechanical means (use of excavator bucket) may be necessary for post-excavation sampling activities.
- Personnel and equipment decontamination areas shall be set-up prior to commencing work with petroleum hydrocarbon contaminated soil (PCS) and wood treatment chemical (WTC)-contaminated soil/wood waste.
- Modified Level D personal protective equipment (PPE) shall be worn by personnel working in the removal action area during the excavation and load-out of PCS and WTC-contaminated soil/wood waste.
- Noise protection shall be worn by personnel working on (operating) or near heavy equipment.
- Physiological monitoring shall be performed on personnel working in the removal action area when ambient temperatures exceed 80 degrees Fahrenheit.
- Personnel shall be cautious of using equipment or parking vehicles in dry, tall grasses due to the possibility of starting a fire by contact with catalytic converters or hot exhaust gases.