# REMEDIAL INVESTIGATION REPORT

## Reserve Silica Ravensdale Site

Prepared for: Reserve Silica Corporation

Project No. 160315-01 • November 2017

Aspect CONSULTING

earth + water

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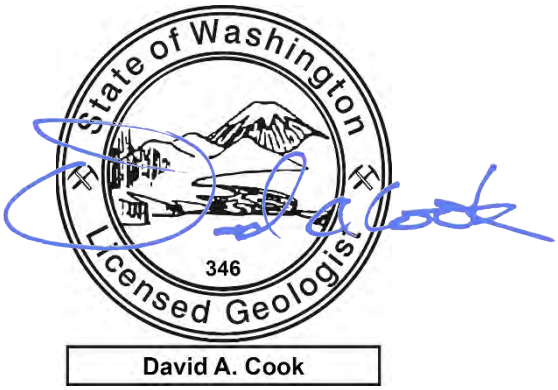


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# Acronyms

| | |
|---|---|
| Aspect | Aspect Consulting, LLC |
| AST | aboveground storage tank |
| BPA | Bonneville Power Administration |
| CKD | cement kiln dust |
| CSM | conceptual site model |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| DDES | King County Department of Development and Environmental Services |
| DPH | King County Department of Public Health (predecessor to PHSKC) |
| DSP | Dale Strip Pit |
| Ecology | Washington State Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| Ideal | Ideal Basic Industries |
| IMP | Industrial Mineral Products |
| LDA | Lower Disposal Area |
| mg/kg | milligrams per kilogram |
| MTCA | Washington State Model Toxics Control Act Cleanup Regulation |
| NOV | Notice of Violation |
| NPDES | National Pollutant Discharge Elimination System |
| OU | Operable Unit |
| PAHs | polycyclic aromatic hydrocarbons |
| Phase I ESA | Phase I Environmental Site Assessment |
| PHSKC | Public Health – Seattle & King County |
| PLP | potentially liable party |
| RCW | Revised Code of Washington |
| REC | Recognized Environmental Condition |
| RI | Remedial Investigation |
| SAP/QAPP | Sampling and Analysis and Quality Assurance Project Plan |
| SHA | Site Hazard Assessment |
| Smith Bros. | Smith Bros. Silica Sand Inc. |
| TESI | Tacoma Environmental Services, Inc. |
| TPH | total petroleum hydrocarbons |

| | |
|---|---|
| USGS | U.S. Geological Survey |
| UST | underground storage tank |
| VOCs | volatile organic compounds |
| WAC | Washington Administrative Code |
| WRIA | Water Resource Inventory Area |

# Executive Summary

The Remedial Investigation (RI) Report prepared by Aspect Consulting LLC presents a summary of the information collected to fully characterize the nature and extent of contamination at the Reserve Silica Ravensdale Property, located in Ravensdale, Washington (the Property). In 2016, the Washington State Department of Ecology (Ecology) completed a Site Hazard Assessment (SHA) for the Property and classified the Property (using a 1–5 scale, with 1 being the highest level of concern and 5 the lowest) with a site ranking of 1 based on concentrations of arsenic and lead in surface water and arsenic in groundwater that pose a potential risk to human health and the environment.

The Property is divided into seven lots/tax lots totaling 377 acres. Potentially hazardous conditions are located on two of these seven lots. The Plant Site contains a fuel storage area including an underground storage tank (UST). Cleanup of the UST is expected to be routine. Cement Kiln Dust (CKD) was deposited in the 1980's, when it was legal to do so, in two areas of Lot 6. These areas are referred to as the Dale Strip Pit (DSP), which is approximately 13 acres in size and the Lower Disposal Area (LDA), which covers approximately 8 acres. Leachate that exceeds pH, arsenic and lead cleanup thresholds is discharging from the LDA. Portions of the haul road on Lot 6 also contain slag which is high in arsenic. Otherwise, no hazardous conditions have been identified anywhere else on the Property.

This RI Report is prepared for submittal Ecology to meet the requirements of Model Toxics Control Act cleanup regulation (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC 173-340). This RI Report addresses the entire Property, but relies on, and references, the ongoing environmental characterization and cleanup work by the potentially liable party (PLP), Holcim (US) Inc. and/or its predecessors, who imported CKD onto Lot 6 and has assumed responsibility for the management and cleanup of the CKD deposits. MTCA requires the identification of a "Site," with Site defined as any area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located. Based on this definition the Site should be reduced from the full Property to Lot 6 or the portion containing the LDA and the area in which the leachate is discharging.

Portions of Lot 5 and Lot 6 were used, in part, for a combination of surface open pit and underground coal and then silica sand mining from the early 1900s through 2007. Mine reclamation of the open pits on Lot 6 has included landfilling them with both CKD and inert waste (generally soil). Lot 6 is regulated by King County under a Closed Landfill Permit. Currently, ongoing operations at the Property are limited to Lot 5 and consist of backfilling and reclaiming the former silica sand open pit. This work is regulated by King County under both a Grading Permit and an Inert Waste Permit. The former silica sand processing Plant Site (Plant Site Lot) is used as the center of operations for oversight of the landfilling activities and includes, among other things, an office building, and the fuel storage area mentioned above.

Based on our understanding of the Property use history, permitted landfill and/or mine closure activities, previous investigations on the Property, and Aspect's 2017 subsurface investigation, the known contaminants of concern (COCs) and the media that they are known and/or suspected to have impacted on the Property are:

- pH in surface water and groundwater;
- Dissolved arsenic in surface water and groundwater; and
- Total arsenic and lead in road base and fill soil.

Potential sources of hazardous substances at the Plant Site include a diesel UST and a fueling and equipment/vehicle maintenance area. Based on the results of the Plant Site investigation, the COCs and the media that they may have impacted also include:

- Diesel- and oil-range petroleum hydrocarbons in shallow soil across the eastern portion of the Plant Site.

It is recommended that the focus of continued remedial action be on the LDA, leachate from the LDA, and migration of high pH and arsenic-contaminated groundwater and surface water that either is piped to the Infiltration Ponds, flows overland into the South Pond, or migrates to groundwater in the shallow aquifer. Specific recommendations for additional work associated with the LDA, developed partially on the results of Ecology's SHA and the work of Holcim, consist of the following:

- Implement, as an interim measure, leachate management measures to prevent overland and underground flow of high pH discharge from the LDA, including potential modification to the seep collection system and regular, frequent and ongoing operation and maintenance.
- Evaluate the source and migration pathways for high pH and arsenic-contaminated surface water in and groundwater around the South Pond and develop and implement remedial actions to protect human health and the environment.
- Determine the nature and extent of high pH and arsenic-contaminated groundwater downgradient (presumably to the west and northwest) of the LDA and the seep collection system.
- Conduct a feasibility study in accordance with the requirements of MTCA to evaluate a full range of remedial alternatives, ranging from in-situ treatment and monitoring to full removal of the CKD deposits in the LDA, to permanently mitigate discharge of high pH and arsenic-contaminated water from the LDA.

# 1 Introduction

The Remedial Investigation (RI) Report has been prepared for the Reserve Silica Ravensdale Property, located in Ravensdale, Washington (the Property; Figure 1-1). The Property is comprised of seven tax parcels, totaling 377 acres, which were used, in part, first for coal and then for silica sand mining from the early 1900s through 2007. Coal mining, which occurred in the early to mid-1900s, consisted of a combination of surface open pit and underground mining. Silica sand surface mining activities occurred between the mid-1960s and 2007.

Both the surface coal and silica sand mining resulted in several deep pits, roughly oriented north-northwest to south-southeast (Figure 1-2). The deep pits are oriented along the "strike"[1] of the coal and sandstone units that generally dip to the west-southwest at the Property. Mine reclamation of the open pits has included landfilling them with both cement kiln dust (CKD) and inert waste (generally soil). There are two CKD-filled former mine pits, the lower disposal area (LDA), and the Dale Strip Pit (DSP), that together comprise two units of a limited purpose closed landfill (Figure 1-2). These permitted landfill areas are found on Lot 6 and have been capped and are in the post-closure inspection, maintenance and monitoring phase, with final closure activities ongoing in accordance with the Limited Purpose Landfill (Post-Closure) Annual Permit PR0015708.

There are three other areas (former silica sand mine pits) at the Property that are currently being landfilled with inert waste (inert waste transported to the Property from public works and redevelopment projects throughout the region) under Inert Waste Landfill Permit #PR0082027 (see Figure 1-2 and Sections 2.2.3 and 3.2 for more details). These areas are located on Lot 5.

This RI Report has been prepared for submittal to the Washington State Department of Ecology (Ecology) to meet the requirements of Model Toxics Control Act cleanup regulation (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC 173-340). This report is also in general accordance with the Remedial Investigation Checklist Guidance (Ecology, 2016a).

This RI Report addresses the entire Property, but relies on, and references, the ongoing environmental characterization and cleanup work by the potentially liable party (PLP), Holcim (US) Inc. Corporation and/or their predecessors, who brought the CKD to the Property. Holcim (US) Inc. is coordinating with Ecology and is currently conducting interim actions to meet the MTCA requirements for 56.8 acres of land referred to as the 'Easement Area,' which is wholly located within Lot 6. The Easement Area consists of the CKD-filled LDA and DSP landfill areas and the haul road connecting those two areas and is coterminous with Lot 6.

[1] In geologic terms, "strike" is the direction of the line formed by the intersection of a rock surface with a horizontal plane.

Reserve Silica Corporation and Holcim (US) Inc. entered an agreement in 2002, which was updated in 2011, under which Holcim (US) Inc. agreed to be fully and solely responsible for addressing regulatory requirements and environmental concerns associated with the presence of CKD. Therefore, the MTCA "Site," defined as any area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located, includes those portions of Lot 6 where high pH and arsenic are present in leachate, surface water and groundwater, which is being managed and addressed by Holcim. The investigation and cleanup of the Easement Area (and the Site—as defined by high pH and arsenic contamination) is being conducted separately, in accordance with MTCA, the requirements of the Closed Landfill Permit, and the *Minimum Functional Standards for Solid Waste Handling* code (WAC 173-304). Additional information regarding the Closed Landfill can be found in Sections 2.1 and 3.1.

# 2 Property Description and Background

The section describes the Property history and setting and includes a summary of the coal mining, sand mining, and reclamation and landfilling; a description of the environmental setting; and a discussion of the geology and hydrogeology.

## 2.1 Property Description

The Property consists of seven King County tax parcels, as depicted on Figure 2-1 and described below:

1. Parcel No. 3522069018, approximately 52 acres, with an address of 28131 Black Diamond-Ravensdale Road, in the NW¼ of Section 36 and S½ of Section 35 of Township 22 North, Range 6 East; hereafter referred to as the Plant Site Lot.
2. Parcel No. 3622069065, approximately 40 acres; in the SW¼ of Section 36, Township 22 North, Range 6 East; hereafter referred to as Lot 1.
3. Parcel No. 0121069010, approximately 40 acres; in the SW¼ of Section 36, Township 22 North, Range 6 East and the NW¼ of Section 1, Township 21 North, Range 6 East; hereafter referred to as Lot 2.
4. Parcel No. 0121069002, approximately 83 acres; in the NW¼ and the N½ of the SW¼ of Section 1, Township 21 North, Range 6 East; hereafter referred to as Lot 3.
5. Parcel No. 0121069012, approximately 43 acres; which is in the NW¼ of Section 1, Township 21 North, Range 6 East; hereafter referred to as Lot 4
6. Parcel No. 0121069011, approximately 52 acres, which is in the NW¼ of Section 1, Township 21 North, Range 6 East; hereafter referred to as Lot 5 or the Inert Waste Lot Parcel No. 3622069138, approximately 67 acres; which is in the SW¼ of Section 36, Township 22 North, Range 6 East and the NW¼ of Section 1, Township 21 North, Range 6 East; hereafter referred to as Lot 6 or the Closed Landfill Lot

The Property is primarily zoned Mineral Resource-Related, although most of Lot 3 is zoned Forest (Figure 2-1; King County, 2017). The surrounding land to the south and east is undeveloped forest land to the east and south, Ravensdale Lake and King County Parks recreational open space to the north, and forest land and King County Parks recreational open space to the west (Figure 2-1). A 500-foot wide Bonneville Power Administration (BPA) easement transects the Property from east to west and contains three sets of transmission towers and overhead electrical lines (Figure 2-1).

Currently, ongoing operations at the Property consist of landfilling of the inert waste landfill at the former silica sand pit mines on Lot 5 and ongoing monitoring of the closed CKD landfill (the LDA and DSP) on Lot 6 (Figure 1-2). The former silica sand processing Plant Site (Plant Site), located on the Plant Site Lot, is used as the center of operations for oversight of the landfilling activities and includes an office building,

equipment and fuel storage area, and truck wash. Other parts of the Plant Site Lot are not currently being used; additional details regarding these features and historical operations are provided in Section 3.3.

## 2.2 Property History

Surface and underground coal mining was conducted on the Property between the early 1900s and approximately 1950. Sand mining began in approximately 1968 and continued until December 2007. Five past coal and sand mining pits are located on the Property (all filled or are being backfilled); from east to west they include the DSP, the Upper Pit, the North Pit and Lower Pit, and the LDA (Figure 1-2). A summary of the history of the five pits is as follows:

- The DSP is a former coal mine that was backfilled between November 1982 and 1989 with a combination of CKD, borrow (mixtures of soil, sand and/or gravel), and other materials (Arcadis, 2006), which may have included clay-rich till and mining wastes (TESI, 2000) and/or rejected clay and sand batches and glass cullet (Ideal, 1984);
- Sand mining of the Upper Pit, North Pit and Lower Pit occurred between the early 1970s and 2007. Most the Upper Pit was backfilled in 2006 and 2007, but began prior to 2003, under a county grading permit. Filling of the North Pit and Lower Pit is ongoing under an inert waste landfill permit; and
- The LDA is a former sand mine that was filled with CKD between June 1979 and August 1981.

Additional details of the coal mining, sand mining, and reclamation and filling are provided in Sections 2.2.2 through 2.2.4.

### *2.2.1 Owner and Operator History*

Coal mining began in the early 1900s but operator and ownership information prior to 1968 is not available. Prior to that time, underground and open pit coal mining was conducted in certain areas by various operators. A Preliminary Investigation report, prepared by Tacoma Environmental Sciences Inc. (TESI) includes a list of individuals and corporations that have had business interests in the Property between the early 1970s and 1997 (TESI, 2000). Smith Bros. Silica Sand, Inc. (Smith Bros.), began sand mining in approximately 1968 (Ideal, 1984) under a lease from Burlington Northern Railroad Company. The Property was then leased by Industrial Mineral Products, which took over from Smith Bros. in 1972. L-Bar Products Incorporated then began leasing the Property from Industrial Mineral Products on January 1, 1986. In May 1991, L-Bar Products Inc. changed its name to Reserve Silica Corporation and Reserve Silica still leased the Property for sand mining operations at this time. In 1996, Reserve Silica purchased the Property from Meridian Minerals, following a transfer to that entity from Burlington Northern Railroad. Sand mining and processing has been conducted at the Property by each user since 1968, and areas of the historic mine workings have been backfilled during this period.

Until production ceased in November of 2008, Reserve Silica produced golf course bunker sand and sand used in glass and cement production. From prior to December 2006

to present, the Property has been operated as a commercial disposal facility for inert construction materials (e.g., excavated soil and concrete) to backfill mine workings as part of the mine reclamation process. This work is conducted under Seattle and King County Department of Public Health Inert Waste Permit No. PR0082027. The King County Department of Development and Environmental Services (DDES) also regulates the current ongoing reclamation activity under an approved Reclamation Plan through Grading Permit L7061122.

During reclamation of the surface coal and silica sand mines (known as the DSP and LDA), described in the following sections, Industrial Mine Products Inc. (IMP) hauled CKD generated at the Ideal Basic Industries, Inc. (Ideal) Seattle Cement Manufacturing Plant, beginning in 1979, to the Dale Strip Pit Reclamation Project, which appears to have included both the LDA and the DSP, for disposal. Under the terms of a 1979 agreement, IMP assumed title to the CKD and was responsible for selecting the disposal site, obtaining all necessary permits, and complying with all applicable laws. In 1984, Ideal and IMP entered a Cement Kiln Dust Storage and Indemnification Agreement that allowed Ideal to dispose of CKD but retain ownership of the material (Ideal and IMP, 1984). In 1991, Ideal was purchased and merged with several other companies to become Holnam, Inc., which became Holcim (US) Inc. in the early 2000s.

Reserve Silica and Holcim are parties to an existing 'Easement Agreement' under which Holcim has the sole responsibility for investigating, monitoring and implementing response or corrective actions at the LDA and DSP. The area covered by the Easement Agreement defines Operable Unit #1 (also known as Lot 6), the Closed Landfill (Figure 1-2; Section 3.1) and the terms 'Easement Area' and 'Closed Landfill' are used synonymously in project documentation that we reviewed to prepare this RI report.

### 2.2.2 Coal Mining History

The coal mines in the Ravensdale district were opened in 1899 by the Seattle and San Francisco Railway and Navigation Property and bought and operated by the Northwestern Improvement Company by 1912 (Evans, 1912). Underground mining of the coal seams that make up the DSP was conducted between 1924 and 1948 with an estimated production tonnage of 263,000 tons (Metropolitan Engineers, 1972). Surface strip mining of the DSP coal seams was conducted around 1946 to 1950 (Metropolitan Engineers, 1972). The DSP was 1,800 feet long, north to south, averaged 140 feet wide, east to west, and 40 feet deep with sloping sides (Metropolitan Engineers, 1972). The extent of coal mining activities conducted on the Property is depicted on Figure 2-2. The mine was constructed to allow groundwater to gravity drain to the mine portal, where it continuously drains from the mine portal to the ground surface under a Sand and Gravel General Permit (Arcadis, 2006). Discharge from the mine portal is ongoing, as discussed further in Sections 2.3.4 and 3.2.

### 2.2.3 Sand Mining History

Sand mining began in the area now known as the LDA in approximately 1968, and continued on other portions of the Property until December 2007. The raw material occurred as a quartz-rich, clay-cemented sandstone that was excavated from open surface cuts at three locations, currently represented by the LDA, the North Pit/Lower Pit, and

the Upper Pit (Figure 1-2). The sandstone was hauled to the Plant Site where it was disaggregated, separating the fines from the sand by washing and drying. The fines contained in the process water were deposited in settling ponds located to the west of the Plant Site (Figure 1-2; Section 3.4). The silica sand was sold regionally to glass companies and later as bunker sand for golf courses.

### 2.2.4 Reclamation and Landfilling

Reclamation and landfilling have been conducted under county grading permits since 1971, including a King County Department of Permitting and Environmental Review Grading Permit (#L7061122; Bennett, 2014) and later the King County Building and Land Development Grading Permit (No. 1122-58; Ideal, 1984). A 1989 Reclamation Plan presented methods and schedules for reclamation of the mining areas, including both the historical coal mine/CKD-disposal areas and the active (at that time) sand mining areas (Brown, 1989). Later, reclamation and landfilling of the LDA was conducted under a Public Health – Seattle & King County (PHSKC) (or its predecessors) Solid Waste Permit (Ideal, 1984). Beginning in 2012, PHSKC approved an inert waste disposal permit for reclamation and landfilling of the Lower and North Pits (PHSKC, 2012). A 2014 Interim Reclamation Plan describes the reclamation activities for the Lower and North Pits (Bennett, 2014).

**Lower Disposal Area.** The LDA was filled with approximately 175,000 cubic yards of CKD between June 1979 and August 1981, with an area of approximately 3.5-acres and a depth of 40 feet (Ideal, 1984). The surface cover—including a two-foot layer of clay underneath a seven-foot layer of overburden from sand mining operations, and revegetation of the LDA—was completed by the fall of 1983.

**Dale Strip Pit Area.** The DSP was filled with approximately 250,000 cubic yards of material beginning on November 1, 1982 (Arcadis, 2006). Because of standing water in the DSP at the time of backfilling, the southern third of the DSP was reportedly filled with clay and fine sand from the settling ponds, to prevent leaching of effluent from the CKD into the underlying coal mine workings, and the northern two-thirds were filled with non-CKD materials (Ideal, 1984). In 1984, a change to Washington State waste regulations reclassified CKD as dangerous waste and Ideal petitioned Ecology for an exemption to the Washington State Dangerous Waste Regulations (WAC 173-303) to allow for continued disposal of CKD at the DSP (Ideal, 1984). Ecology issued temporary exemptions to allow for continued CKD disposal into 1988. CKD disposal reportedly continued until May 1988 but landfilling continued into 1989, and capping of the DSP was completed in the early 1990s (TESI, 2000). The cap of the DSP consists of a four-foot layer of clay soil underneath three feet of sand overburden from sand mining operations (Hart Crowser, 1989).

**Upper Pit.** The Upper Pit was filled under DDES Grading Permit #L70G1122 and reclaimed with inert fill in the 2000s.

**Lower and North Pits.** Currently, the Lower Pit and the North Pit are undergoing backfilling under the Inert Waste Landfill Permit #PR0082027, issued by PHSKC. The inert waste landfill is permitted to accept up to 2.75 million cubic yards of inert waste, including cured concrete, asphaltic materials, brick and masonry, ceramic materials,

glass, stainless steel and aluminum, and soil that meets chemical criteria defined in the permit (PHSKC, 2016a).

**Roadway Areas.** IMP reportedly accepted processed slag from the ASARCO smelting facility in Tacoma, Washington and although there is no documentation of disposal of slag at the Property, investigations completed by TESI "…noted slag material, possibly from ASARCO, in the road base and eroded slopes in the vicinity of the LDA" (TESI, 2000). The TESI report also notes that material in the LDA bank and base of the ditch at the west side of the lower haul road includes melted glass, coal, ASARCO slag, CKD and limestone (TESI, 2000). This area is within Lot 6, the Closed Landfill Operable Unit (OU #1). RI activities were completed in 2017 by Aspect to evaluate the potential for slag in the roadway and shoulders of the Lower Haul Road. The results of that investigation are summarized in Section 4.4.2.

## 2.3 Environmental Setting

### *2.3.1 Topography*

The Property is located on the southwest flank and at the base of a glacially carved bedrock high, known locally as Ravensdale Hill (TESI, 2000). The hill rises from an elevation of approximately 600 feet at Ravensdale Lake to a high of approximately 1,000 feet (Figure 2-3). The DSP and Upper Pit are located on a moderately flat glacial terrace at approximately 950 feet elevation. From this elevation, the surface slopes steeply downward to the west and southwest (Figure 2-3). The topography has been modified by the mining activities, resulting in north-northwest trending pits excavated along the strike of sedimentary beds. The LDA, DSP, and Upper Pit have been filled. The North Pit and Lower Pit are currently being filled. A 60- to 80-foot high, near-vertical face currently comprises the eastern edges of the North Pit and Lower Pit (Figure 2-3).

The elevation of the Property ranges from approximately 600 feet NAVD88 on the northern portions of the Property, near Ravensdale Lake and Black-Diamond Ravensdale Road, and slopes uphill steeply to the east and southeast, reaching a high of more than 1,000 feet NAVD88 at the northeast corner (Figure 2-3).

### *2.3.2 Land Use*

The current land use of the Property is varied as discussed throughout this document. Future land use for much of the Property will remain as is but could transition from the currently zoned "mineral resource-related" to other mixed uses. However, the Closed Landfill and the Inert Waste Landfill will be managed in accordance with applicable state regulations. The currently applicable regulations for the Closed Landfill are the *Minimum Functional Standards for Solid Waste Handling*, WAC 173-304. The currently applicable regulations for the Inert Waste Landfill are the *Solid Waste Handling Standards*, WAC 173-350. Once reclamation of the Inert Waste Landfill is complete, which is anticipated to be in 2018, it will transition to management under a closed landfill permit. The landfills will be maintained under appropriate land use designations, in accordance with the applicable landfill regulations, in perpetuity.

The environmentally sensitive areas on the Property include wetland, coal mine hazard areas, and steep slope and erosion hazard areas (Figure 2-4; King County, 2017). The

southwest corner of the Property is a King County Class 1 wetland, as described in more detail in Section 3.5 (Figure 2-4). A small wetland is also identified on the western end of Parcel 1, as described in more detail in Section 3.4. In addition, but not shown on Figure 2-4, Parcel 1 overlies a Category 1 Critical Aquifer Recharge Area and the entire Property is located within a 5-Year Wellhead Protection Area (King County, 2017).

### 2.3.3 Forestry

A Forest Management Plan was prepared by American Forest Management in 2016 (AFM, 2016), based partially on an evaluation of the forested areas of the site conducted by International Forestry Consultants, Inc. (IFC, 2012). The plan was prepared with the objective of improving forest conditions over time to provide forestland values, which may include periodic economic returns from the harvesting of timber, wildlife habitat, recreation and aesthetics. The plan concluded that the Property is not expected to produce a sustainable flow of timber on an industrial scale due to the property size and the current conditions (AFM, 2016). This conclusion was consistent with the findings of the IFC study, which indicates that the Property is not well suited for long-term commercial forestry (IFC, 2012).

### 2.3.4 Surface Water

The Property lies within the Lake Sawyer drainage basin, which is part of the Lower Green-Duwamish River Watershed of the Duwamish-Green Water Resource Inventory Area (WRIA) 9. A local surface water divide roughly correlates to the BPA power transmission lines near the center of the Property (SubTerra, 2006). North of this divide, drainage features receive most of their recharge via groundwater in the recessional outwash gravel. Drainage features to the south of the divide are recharged primarily by surface water that flows on the lodgement till and bedrock. Runoff from the southern mining areas remains as surface water on top of the till and drains to Wetland B (Figure 2-5), which eventually discharges to Sonia Lake and Ginder Lake to the south of the Property.

Ravensdale Lake is located adjacent to the Plant Site on the north and is reportedly fed by springs and surface water (Figure 2-5). Ravensdale Lake drains to Ravensdale Creek, classified as a riverine, unknown perennial, unconsolidated bottom, permanently flooded stream (US Fish & Wildlife, 2017; Figure 2-5), which flows directly into Lake Sawyer. It is assumed that Wetland A also receives recharge via groundwater. According to the National Wetlands Inventory, the lake is approximately 19.25 acres and is classified as a lacustrine, limnetic, unconsolidated bottom, permanently flooded wetland (US Fish & Wildlife, 2017). King County classifies Ravensdale Lake as a Class 2 wetland (King County, 2017).

The South Pond is located within the Easement Area and is supplied by precipitation and groundwater/leachate from the LDA (Figure 2-5; SubTerra, 2006). Historically, stormwater that accumulated in open mine pits flowed into a man-made drainage to a culvert beneath the haul road and into the South Pond (TESI, 2000). Water in the South Pond reportedly evaporated or infiltrated and occasionally overflowed to the west (TESI, 2000). Surface water sampling of the South Pond has been conducted on a regular basis since February 2005 for field parameters, general chemistry and dissolved metals. The pH of surface water in the South Pond has been measured to range from 9.22 to 13.13,

and is typically between 10 and 12; all of which exceed the surface water standard of 6.5 to 8.5. The preliminary results of a wetland delineation completed in January 2017 indicate that the South Pond is a hydrogeomorphic wetland that is a primarily ground water driven system (Shannon & Wilson, 2017).

A series of three infiltration ponds are located at the northwest corner of Lot 6, straddling the property line but primarily on the west-adjacent property (Figure 2-5). The infiltration ponds are at the north end of a series of ditches, eroded channels and swampy areas that collect stormwater and uncontrolled leachate discharge from the LDA (TESI, 2001). Leachate from the LDA that is captured in the seep collection ditch and is hard piped to the infiltration ponds (Golder, 2016). Surface water sampling of the infiltration ponds has been conducted on a regular basis since February 2015 for field parameters, general chemistry and dissolved metals. The pH of surface water in the infiltrations ponds has been measured to range from 8.00 to 12.78, with higher pH measured beginning in February 2013 (Golder, 2013), presumably associated with the discharge of captured LDA leachate from the seep collection ditch.

### *2.3.5 Groundwater Use*

SubTerra presents a summary of domestic water supply wells within 1 mile upgradient and 2 miles downgradient of the Property at the time the report was prepared (SubTerra, 2006). The nearest domestic wells are community water supply wells that provide water supply to the Maple Ridge Highlands community, located to the northwest of the Property. The wells range in total depth from 74 to 209 feet below ground surface (bgs). The community of Ravensdale, located north and northeast of the Property, has municipal water service through the Evergreen Water and Improvement Association from a supply well located more than 5,000 feet from the Property.

Ecology performed a review of groundwater use within a 2-mile radius of the Property as part of the 2016 Site Hazard Assessment (SHA). The review identified 21 wells within the search radius with completion depths ranging from 36 to 360 feet. Six of the 21 wells were identified as irrigation supply wells. The nearest water supply well noted in the SHA is located almost a mile (4,500 feet) northeast of the Property and serves the Ravensdale Mobile Home Park (Ecology, 2016b).

## 2.4 Geology and Hydrogeology

The Property is in the Puget Sound Lowland, a structural and topographic basin between the Cascade Range and the Olympic Mountains. During the Pleistocene Epoch (2.6 million to about 11,000 years ago), at least six major glacial episodes occurred, with the latest, the Vashon Stade, ending approximately 13,000 years ago. Repeated advance and retreat of continental ice sheets resulted in scouring and deposition of glacial sediments. The geology of the Ravensdale area is dominated by Pleistocene glacial outwash, glacial till and Tertiary bedrock of the Puget Group, consisting of about 6,200 feet of nonmarine sedimentary rocks that range in age from early Eocene (55 to 33 million years ago) to early Oligocene (33 to 23 million years ago) (Figure 2-6; Vine, 1969). Three geologic units have been identified on the Property, in addition to artificial fill soil, and include (1) Eocene age sedimentary bedrock units of the Puget Group-Renton Formation, (2)

Vashon-age lodgment silty sand and gravel till and (3) Vashon recessional outwash gravel (SubTerra, 2006).

**The Puget Group-Renton Formation** forms the sedimentary bedrock core of the northwest trending ridge that underlies the Property and consists of arkosic sandstone, siltstone, carbonaceous shale and coal beds that were deposited in a meandering stream/floodplain environment during middle Eocene time (SubTerra, 2006). These units have been uplifted and tilted by tectonic activity so that they strike about N25W and dip down to the southwest at an angle between 50 and 60 degrees (SubTerra, 2006). A normal fault truncates these beds on the northern portion of the Property (Figure 2-6). Because of coal and sand mining, the current topography of these bedrock areas is characterized by a series of northwest trending cuts and pits that have been partially or completely backfilled. Geologic cross sections prepared by others are presented on Figure 2-7.

**The Vashon-age lodgment till** occurs as a 5- to 15-foot thick mantle at the land surface, except for the bedrock highs, and consists of an unsorted mixture of cobbles and pebbles, densely compacted in a matrix of sand, silt and clay (SubTerra, 2006). Till typically functions as a confining unit and the relatively low permeability of the till on the Property is evident by Wetland B which has developed on top of the till.

**Vashon recessional outwash gravel** is documented to the northwest of Black Diamond-Ravensdale Road and is typically sandy, cobbly gravel to gravelly cobbles with low silt content (SubTerra, 2006). The Vashon recessional outwash gravel averages about 40 feet thick, with local variability up to 150 feet thick, and comprises the local aquifer to the northwest portions of the Property.

Three aquifers are identified near the Property according to studies by SubTerra (SubTerra, 2006):

1. The uppermost aquifer is an unconfined aquifer in glacial deposits that appears connected to surface water features in the area, including Ravensdale Lake and Wetland A. Surface water runoff from north of the power line drainage divide, as well as groundwater that drains from the DSP mine portal and seepages from the LDA, eventually discharge to this uppermost aquifer (SubTerra, 2006);
2. A glacial till (the Vashon lodgment till) confining layer separates the uppermost aquifer from a lower aquifer, which is located within glacial outwash sands and gravels and preglacial sediments that are up to 200 feet thick (SubTerra, 2006). This middle, glacial outwash aquifer is identified to the west but is absent beneath the Property (SubTerra, 2006); and
3. Bedrock comprises a third, low-yield aquifer that is generally an unreliable source for domestic water supply (SubTerra, 2006). Groundwater flow within the Puget Group-Renton Formation is extremely restricted due to high clay content (SubTerra, 2006). The bedrock aquifer has been classified as a bedrock-confining unit in US Geological Survey groundwater studies, assuming to represent the relatively impermeable basement of the glacial aquifer system, and water wells completed within it are typically low yield and unreliable with flow and recharge achieved primarily through bedrock fractures (Woodward et al., 1995).

There may be limited groundwater flow from south to north within the Puget Group-Renton Formation, along bedding planes and within bedrock fractures, but this flow is likely disrupted on the north end of the Property by the fault that generally cross cuts the geology structure in an east-west orientation along the northern portion of the Property (Figure 2-6). The low permeability of the bedrock is evident where open mine cuts have been observed to hold surface water year-round. However, in areas where open cuts or permeable fill are connected to underground mine workings, groundwater readily flows from south to north through the old mine workings where it is discharged through the DSP mine portal. The bedrock aquifer is present at the Property beneath the uppermost aquifer.

# 3 Subject Property Areas (Operable Units and Natural Areas)

As shown on Figure 1-2 there are four areas where the Property has been utilized and modified through mining operations and reclamation activities:

(1) The Closed Landfill (also known as the 'Easement Area' containing the CKD-filled LDA and DSP), located within Lot 6;

(2) Inert Waste Landfill (former silica sand mine open pits now being backfilled and reclaimed), located within Lot 5; and

(3 and 4) Former Settling Ponds and the Plant Site (Plant Site Lot).

The Property also includes natural vegetation areas that were never subjected to mining operations (Lots 1 through 4). For purposes of the RI, the Property has been divided into three Operable Units (OUs):

- OU #1. The Closed Landfill (Lot 6; Section 3.1);
- OU #2. Inert Waste Landfill (Lot 5; Section 3.2); and
- OU #3. Plant Site (Plant Site Lot; Section 3.3).

The Property has also been divided into three natural areas:

- Wetland A/Former Settling Ponds (Plant Site Lot; Section 3.4);
- Wetland B (located within Lots 3 and 4; Section 3.5); and
- Natural Vegetation Areas (Lots 1, 2 and portions of Lots 3 and 4; Section 3.6; Figure 3-1).

## 3.1 OU #1 Closed Landfill (Lot 6)

As Operable Unit #1, the DSP and LDA together comprise two units of a limited-purpose, closed landfill in post-closure inspection, maintenance, and monitoring in accordance with the Limited Purpose Landfill (Post-Closure) Annual Permit PR0015708, issued annually by PHSKC (Figure 3-2; PHSKC, 2016b). The DSP, filled by 1989 and formally closed in 2003, is regulated under WAC 173-304. The LDA, filled by 1983 and formally closed in 1985, is regulated under WAC 173-301, with post-closure requirements being conducted in accordance with WAC 173-304. The characterization, monitoring and remediation of the Closed Landfill (OU#1) area is being overseen by Holcim (US) Inc.

The landfill and backfilling activities conducted between 1979 and 1981 were completed in compliance with King County Building and Land Development Grading Permit No. 1122-58 (Ideal, 1984). The DSP and LDA areas received a King County Department of Public Health (DPH) Special Landfill Permit, No. 17-101 in August 1981 (Ideal, 1984). King County DPH issued a Disposal Site Permit in 1982, which was renewed for 1983 but denied in 1984. Ecology issued temporary exemptions between 1984 and 1988 to

allow for continued disposal of CKD even though it had been reclassified as dangerous waste in 1984 (Section 2.2.3). Landfilling of CKD ceased in 1988.

The Post-Closure Permit defines the minimum standards for post-closure performance, including groundwater quality standards and points of compliance for the LDA and DSP, and surface water quality standards (PHSKC, 2016b).

### 3.1.1 Lower Disposal Area (LDA)

The LDA was mined for silica sand to a depth of approximately 40 feet bgs beginning in the 1960s and reclaimed by landfilling of CKD between 1979 and 1982. Reclamation, including placement of a soil cap over the CKD, was completed by the fall of 1983. Surface water and groundwater monitoring began in late 1986 and leachate collection began in 1987. The soil cover on the LDA was upgraded in 2007 (Golder, 2013).

Highly-alkaline leachate seeps out of the toe of the western slope of the LDA, mixes with surface water in a drainage ditch and is piped to the infiltration ponds (Figure 3-3). Occasionally, leachate overfills the drainage ditch and flows, uncontrolled, over the ground surface to the west and into a low-lying area. The leachate outbreaks are located along a length of approximately 500 feet along the western side of the LDA.

Preliminary results of a wetland delineation conducted in early 2017 indicate that this low-lying area meets wetland criteria and includes the South Pond on the south and the low-lying area on the north[2], separated by a grassy swale (Shannon & Wilson, 2017). The wetland is located at the base of the LDA slope, to the west of the lower haul road and the seep collection ditch. The wetland is long and narrow, trending roughly north-south for a length of approximately 900 feet with widths ranging from 25 to 160 feet.

Investigations conducted by others on behalf of Holcim (the responsible party for the DSP and LDA, Lot 6 as shown on Figure 1-2) indicate that most of the seepage from the LDA is a result of groundwater in contact with landfilled CKD (Arcadis, 2006). Groundwater and surface water monitoring at the LDA have been conducted since 1986 to evaluate the nature of the leachate and its impact on groundwater and surface water quality.

In 2004, Arcadis, on behalf of Holcim, prepared and submitted a Conceptual Design Plan to Ecology to mitigate leachate outbreak from the LDA (Arcadis, 2004). Arcadis reported that the leachate, with a pH between 10 and 12, was seeping out of the slope at the northwest corner of the LDA, mixing with surface water and draining to the stormwater infiltration ponds (Arcadis, 2004). Arcadis inferred that the former sand mine at the LDA was acting as a bathtub, filling up with water and then flowing over the low bedrock wall that constituted the western limit of sand mining in that area, through CKD-containing fill material and discharging to the ground surface as leachate with elevated pH. Arcadis

[2] This low-lying area was previously identified as an excavated depression, a man-made feature that was excavated sometime between 1974 and 1989 for stormwater infiltration and sediment retention. ELS indicated that this area did not meet requirements for designation as a jurisdictional wetland (ELS, 2004a).

concluded that preventing leachate generation was not likely to be possible and recommended capture and treatment of the leachate instead.

Quarterly groundwater and surface water monitoring and sampling are ongoing at the LDA by consultants engaged by responsible party, Holcim, in general accordance with the Sampling and Analysis and Quality Assurance Project Plan (SAP/QAPP; Arcadis, 2006), and modified in 2008 and 2016 (Golder, 2016). In 2013, a surface water collection ditch and concrete catch basin were constructed to capture leachate and pipe it to the infiltration ponds (Figure 3-3; Golder, 2016). In September 2013, a gravel-filled interceptor trench was installed south of the LDA to capture groundwater flowing north before it contacted the CKD (Golder, 2016). The investigation into environmental impacts attributable to the leachate coming from the LDA, and selection and implementation of remedial actions to address them, are ongoing.

In 2016, Ecology issued a Notice of Violation (NOV) to Reserve Silica (as property owner) under Chapter 90.48.120(1) Revised Code of Washington (RCW) for causing high pH water to leach out of the LDA and into the infiltration pond, at pH levels exceeding permit limits and the state water quality standards for groundwater (WAC 173-200). Reserve Silica then notified Holcim the responsible party for monitoring and mitigating water quality issues at the LDA.

Ecology measured pH of discharge seeps and surface water in the infiltration ponds on April 19, 2016 to range from 12 to 14. Follow-up pH measurements in the infiltration ponds and from the seep collection system on April 27, 2016 indicated pH ranging from 12 to 13. The pH of groundwater in monitoring wells around the infiltration pond ranged from 7.1 to 10.2, which violates the water quality standards (WAC 173-200). The pH limits specified by the permit for effluent discharges to surface and groundwater, as well as the water quality standard for groundwater, are 6.5 to 8.5.

### *3.1.2 Dale Strip Pit (DSP)*

The DSP was mined for coal to a depth of approximately 40 feet bgs between 1924 and 1948 and reclaimed by landfilling of CKD and other material between 1982 and 1989, although CKD disposal was reported to have ceased in May 1988. Reclamation, including placement of a soil cap over the CKD, was completed by 1991. Partial closure of the DSP special use landfill is documented in the Hart Crowser Inc *Plan of Operation, Special Use Landfill, L-Bar Sand Mine*, Ravensdale, Washington (Hart Crowser, 1989). The closure activities included placement of a soil cover, consisting of four feet of clay under three feet of sand, revegetation, implementation and monitoring of access restrictions, groundwater monitoring, and reporting.

Groundwater investigations were conducted at the DSP by Robinson & Noble, Inc. in 1985 and 1986. At the time of these investigations, water discharge was ongoing from the DSP mine portal culvert at an outflow of approximately 30 gallons per minute and Robinson & Noble concluded that the water was a blend of natural and CKD-impacted water based on differences in potassium and sulfate concentrations between it and groundwater (Robinson & Noble, 1985). CKD-impacted groundwater was not identified in bedrock monitoring wells during the investigations (Robinson & Noble, 1986).

The hydrogeologic system of the DSP is dominated by the surrounding bedrock, which strikes north-south and dips westerly at a high angle (Section 2.4). Downward vertical gradients in nested bedrock wells around the DSP suggest that the historical mine workings are a groundwater discharge path for the bedrock system beneath the DSP. Groundwater is interpreted to be flowing into the historical underground mine workings and discharging to the ground surface through the mine portal (Figure 3-2; Golder, 2014). The mine effluent limits and monitoring requirements are regulated by a Sand and Gravel General Permit.

Groundwater sampling at the DSP has been conducted since 1985 (Robinson & Noble, 1985) as a requirement of the 1984 exemption of CKD from the dangerous waste regulations (Section 2.2.4). Since 2006, ongoing compliance monitoring at the DSP has been conducted in accordance with the SAP/QAPP (Arcadis, 2006) and includes collection and analysis of groundwater samples from four bedrock wells, monitoring of water levels and pH at two additional wells, and sampling of discharge water from the mine portal (Golder, 2016).

In 2015, Golder requested a continuance of the 2012 variance for reduced groundwater monitoring frequency at the DSP (Golder, 2015). The request was based on the following evidence:

- Groundwater pH and concentrations of arsenic indicate that there have been no impacts to DSP bedrock groundwater from the CKD;
- The results of a statistical trend analysis suggest that arsenic in the bedrock groundwater is attributable to background concentrations; and
- Data for arsenic and potassium in bedrock groundwater demonstrate that there are no seasonal variations or short-term temporal trends in concentrations.

The variance request was approved by PHSKC in an April 7, 2016 letter, reportedly in consultation with Ecology (PHSKC, 2016c). Groundwater monitoring of bedrock wells at the DSP and the mine portal is currently conducted on an annual basis.

The DSP does not pose a risk to human health or the environment. The surface cap prevents exposure to human, terrestrial, and ecological receptors and will be maintained in perpetuity. Long-term groundwater monitoring of bedrock monitoring wells indicates that there have been no impacts to groundwater associated with the CKD. Future land use will be consistent with applicable regulations for closed landfills.

## 3.2 OU #2 Inert Waste Landfill (Lot 5)

Operable Unit #2 is the Inert Waste Landfill, currently operating under Inert Waste Landfill Permit #PR0082027, issued by PHSKC annually, and originally issued on July 12, 2012 (Figure 3-4; PHSKC, 2012)). Prior to 2012, landfilling was completed under a grading permit with King County. The landfill permit allows for acceptance and disposal of inert waste including cured concrete, asphaltic materials, brick and masonry, ceramic materials, glass, stainless steel and aluminum, and soil that meets specified chemical criteria. The inert waste is accepted in accordance with the permit-required program, implemented to detect and prevent noninert waste from being accepted, which consists of the submittal by importers of a Clean Soil/Inert Waste Acceptance Agreement

"certifying" that imported soil is free of contaminates. The landfilling is conducted in accordance with the permit requirements and Interim Reclamation Plan (Bennett, 2014) that describes specifically the receipt, handling, and landfilling of inert material in compliance with WAC 173-350-410(4).

The Upper Pit, the eastern-most sand pit, was over 100 feet deep and was being filled with native, clean filter-pressed clay, reportedly generated by gravel mining at the Lakeside Industries Issaquah pit, at its north end during site reconnaissance in 2000 (TESI, 2000). Currently, active landfilling is occurring in the North Pit and Lower Pit (Figure 3-4). Fill is brought in by dump trucks, tipped at the eastern side of the pits, inspected and recorded by a representative of Reserve Silica, and pushed by bulldozer into the pit.

All material is required to meet the clean soil/inert waste criteria established in the permit and imported fill is screened, inspected, and monitored to ensure that it meets these criteria and to avoid receipt and/or disposal of any hazardous substances as defined by WAC 173-340. Reserve Silica provides a Decision Tree guidance for disposal of materials in the inert waste landfill, which indicates acceptance of soil or rock with pH between 6.5 and 8.5 pH, containing less than 5% nonnative organic debris, and having chemical concentrations below the permit criteria or other applicable MTCA criteria (Appendix A). If waste does not meet this criterion, Reserve Silica will not accept the material and recommends disposal at a noninert waste landfill (Appendix A). A copy of the Decision Tree is provided in Appendix A and can also be easily obtained on the Reserve Silica website. The Interim Reclamation Plan provides the details for reclamation of the inert waste landfill, which includes placement of a 1- to 2-foot thick layer of fine-grained, low permeability native soil and revegetation with a deep-rooted grass/legume cover mix (Bennett, 2014).

There are verbal accounts of acceptance of soil during active sand mining in the 1980s, maybe as a courtesy to customers. Full trucks would arrive and Reserve Silica would allow them to dump their load of soil before being filled with sand.

The inert waste landfill will be closed in accordance with the requirements of WAC 173-350-410 and the Inert Waste Landfill permit. Future land use will be consistent with applicable regulations for closed inert waste landfills.

### 3.2.1 Corrective Actions at Inert Waste Landfill

In 2005, approximately 11,000 cubic yards of high pH jet grout spoils from a Sound Transit project were deposited in the Upper Pit. Floyd|Snider conducted sampling activities in September 2005 that indicated background soil pH between 8.3 and 8.7, and pH of the jet grout ranging from 11.6 to 12.4 (Floyd|Snider, 2005). Approximately 59,180 tons of mixed soil and grout were excavated from the Upper Pit in late 2005 and completed on January 13, 2006 and transported to the CEMEX facility (formerly Rinker) in Everett, Washington for disposal (Floyd|Snider, 2006).

Soil generated from the Lincoln Square Expansion site in Bellevue, Washington was imported for disposal at the Inert Waste Landfill in July 2014. An equipment operator at the landfill observed a crushed underground storage tank (UST) and noted a hydrocarbon odor coming from the soil stockpile containing the UST (Shannon & Wilson, 2015).

Reserve Silica notified PHSKC of the findings on July 11, 2014 (Shannon & Wilson, 2015). A soil sampling program was designed and implemented to characterize the imported soil, including the original stockpiled soil and soil that had pushed over the disposal face.

Approximately 88 soil samples were collected from sampling grids and analyzed by an onsite, mobile laboratory for diesel- and heavy-oil range petroleum hydrocarbons and follow-up analyses by a fixed base laboratory (Figure 3-5). Soil that contained visual or olfactory signs of petroleum or contained concentrations of diesel- and/or heavy oil-range organics above 50 milligrams per kilogram (mg/kg), which is below the permit acceptance criteria of 200 mg/kg, were excavated for transport and disposal at an appropriate facility. A total of 914 cubic yards of petroleum-contaminated soil were removed from the inert waste landfill and taken to the AAA Monroe Inert Waste Landfill in Snohomish, Washington or the CEMEX Facility in Everett, Washington (Shannon & Wilson, 2015).

The landfill permit allows for disposal of material not specified in the permit with prior approval by PHSKC. The following information is summarized based on emails provided to us that document conversations and approvals by PHSKC and Ecology. PHSKC approved the disposal of SR-520 demolition concrete debris at the inert waste landfill on February 10, 2016. In 2016, a Washington State Department of Transportation (DOT) contractor imported debris from the SR-520 floating bridge demolition to the Inert Waste Landfill for disposal. A reported 23 truckloads of concrete were disposed of between approximately August 19 and 23, 2016. PHSKC rescinded the approval on September 16, 2016 because of pH in concrete samples above 12.5, the criteria for the designation of dangerous waste. Resampling of the concrete indicated pH below 12.5, presumed sampling error in the original results, and PHSKC and Ecology provided Reserve Silica with approval to begin accepting SR-520 concrete again on September 23, 2016.

## 3.3 OU #3 Plant Site (Plant Site Lot)

### *3.3.1 Plant Site Description*

The Plant Site includes an office building, a former geotechnical soils laboratory, sand processing equipment, an equipment and fuel storage area, and a truck wash (Figure 3-6). An underground storage tank (UST), formerly used for the storage and distribution of diesel fuel, is located just south of the office building (Figure 3-6). Two pad-mounted electrical transformers are located next to the UST.

A description of the operational layout and historical sand processing activities at the Plant Site is provided in the 2004 *Technical Information Report*, prepared by Anthony Burgess Consulting Inc. and SubTerra, Inc. Historically, sandstone mined from surface pits on the south side of Ravensdale-Black Diamond Road was hauled to the Plant Site for crushing and washing. Fines were pumped to the settling ponds. Stormwater and process water were collected in a sump and pumped to the sedimentation pond, also referred to as Pond 5 at the southwestern corner of the Wetland A/Former Settling Ponds Area (Figure 3-1; Section 3.4). The sandstone mining and processing plant operated under an Ecology Sand and Gravel General Permit issued under the federal National

Pollutant Discharge Elimination System (NPDES) and State Waste Discharge Permit regulations.

Historical information indicates that the railroad between the Plant Site and Ravensdale Lake was originally constructed across the lake and that washings from the historical coal preparation plant were used as fill in low-lying areas. Material interpreted by Shannon & Wilson to be coal process waste, consisting of a mixture of coal, clay, silt and sand, was observed to be 5 to 15 feet thick at the bottom of the borings and in all the test pits at thicknesses ranging from 1 inch to 6 feet (Shannon & Wilson, 2002). The coal process waste overlies a loose and organic-rich layer of silty sand, which is interpreted as historical topsoil, over glacial outwash deposits that consist of sandy, cobbly gravel (Shannon & Wilson, 2002).

### 3.3.2 Recognized Environmental Conditions

A Phase I Environmental Site Assessment (Phase I ESA) was conducted for the Plant Site by Farallon Consulting, LLC in 2014 (Farallon, 2014). The Phase I ESA identified several recognized environmental conditions (RECs). As a result, Aspect conducted a site reconnaissance on February 14, 2017 to observe the RECs identified in the Phase I ESA and to assess Plant Site accessibility to develop the scope of work for RI activities. Aspect representatives were accompanied by Pete Cawfield, Operations Manager for the Reserve Silica Ravensdale Site, who has approximately 13 years of familiarity of the Plant Site and greater Reserve Silica site. The RECs are described below.

1. **The potential release of hazardous substances associated with the current storage (also known as the fueling area) and handling of hazardous substances.** During Farallon's site visit they identified what appears to be a typical fueling and vehicle maintenance area, including storage of fuel, grease and oil, as a "hazardous materials storage area." This term may not be appropriate based on Aspect's observations and interview because the area is not a typical gas station or auto service facility. It is more of a storage area that contains petroleum products, aboveground fueling facilities and mobile equipment used to complete remote vehicle maintenance. Farallon observed three aboveground storage tanks (ASTs) used for current or former storage of gasoline, diesel, and waste oil, and additional containers (up to 55-gallons) of other "hazardous materials," such as petroleum products, antifreeze, new and used oils and greases. Significant staining observed on the ground near this storage area was additional evidence of possible past releases of hazardous materials. See the results below of the soil and groundwater testing at this area.

2. **The potential release of hazardous substances associated with the possible storage, handling, and use of hazardous substances at and near the former laboratory building.** Farallon observed small (up to 5-gallon) containers of gasoline, equipment cleaner, and engine oil in the former "laboratory building," that were not situated on secondary containment. Farallon concluded that "mine laboratories are known to have utilized chlorinated solvents and other hazardous materials as part of operations."

   However, based on Aspect's observations made during the February 2017 site visit and discussions with Mr. Cawfield, Aspect determined that the laboratory is a former geotechnical soils lab, used for drying soil samples and performing geotechnical

analyses (such as grain size, moisture content, etc.). Geotechnical soils labs do not typically use or store more than *de minimis* quantities of hazardous materials. Aspect does not consider the condition a REC to the Plant Site and investigation of the soils lab is not warranted.

3. **The potential release of hazardous substances associated with a diesel UST.** Site representatives interviewed by Farallon indicated that a UST was formerly used on the Plant Site, and Farallon identified documentation suggesting possible past maintenance of a 10,000-gallon diesel UST, but Farallon was unable to determine the location of the UST.

   During Aspect's February 2017 site visit, Mr. Cawfield identified the location of the UST and its fill ports as just south of the former soils lab and office building (Figure 3-6). Mr. Cawfield confirmed that the UST was approximately 10,000-gallons in size, and was formerly used for storage of diesel as fuel for powering sand drying equipment. When the sand mining and drying operations were abandoned, Mr. Cawfield indicated that they had the UST contents removed. Mr. Cawfield was not aware of decommissioning activities or a Site Assessment being completed for the UST.

4. **The potential migration of groundwater with elevated metals and pH to beneath the Plant Area.** In addition to the Phase I ESA, Aspect reviewed quarterly groundwater reports for 2016 groundwater monitoring at the upgradient 'Easement Area', performed by Golder (OU#1, Section 3.1.1 and 3.1.2). Groundwater samples obtained from one of the two monitoring wells located nearest to the Plant Site (well MW-6A; Figure 3-7), in February and May of 2016 show arsenic at concentrations greater than the MTCA cleanup levels for groundwater, and groundwater pH above the preliminary standards set forth in WAC 173-200 and the landfill permit (PHSKC, 2016b). Based on the information in the groundwater monitoring reports, this fourth potential REC for the Plant Site was identified.

Aspect conducted investigation activities in March and April 2017 to evaluate these RECs; the results are presented in Section 4.4.1.

## 3.4 Wetland A/Former Settling Ponds Area (Plant Site Lot)

The Wetland A/Former Settling Ponds Area consists of the eastern portion of the Plant Site Lot and includes Wetland A and five former clay settling ponds (Figure 3-7). Wetland A consists of 0.9 acres located at the northwest corner of the Wetland A/Former Settling Ponds Area, west of the former clay settling ponds (Figure 3-7). The wetland is not identified in the National Wetlands Inventory (US Fish & Wildlife, 2017). King County identifies Wetland A as a Class 2 Wetland (ELS, 2003). The water source to Wetland A is groundwater (ELS, 2003).

The former settling ponds are also classified as wetlands, per the current National Wetlands Inventory, based on the 1990 King County Wetlands Inventory (US Fish & Wildlife, 2017). King County identifies the former settling ponds as unverified Class 4 wetlands (ELS, 2003). Three of the former ponds, Ponds 2, 3 and 4, are identified as palustrine, unconsolidated shore, seasonally flooded, excavated wetlands (US Fish &

Wildlife, 2017). The former settling ponds were flooded infiltration areas, hydrologically maintained by process water from the silica mine processing plant, and not naturally occurring wetlands (ELS, 2003). A 2004 letter from King County indicates that the wetland-like areas were artificially created and artificially maintained and, consequently, are not subject to the King County Sensitive Areas Chapter (King County, 2004).

Currently the Wetland A/Former Settling Ponds Area is overgrown with vegetation and is not being used by Reserve Silica.

### 3.4.1 Previous Investigations

Geotechnical evaluations were completed in the Wetland A/Former Settling Ponds Area by Shannon & Wilson in 2002 and by HWA GeoSciences in 2005/2006 (Shannon & Wilson, 2002; HWA GeoSciences, 2006). Soil borings were advanced to total depths ranging from 46 to 62 feet for geotechnical evaluation of soil conditions. Groundwater was encountered in the borings at depths of 35 to 51 feet bgs, which is somewhat lower in elevation than the surface water of Ravensdale Lake. The soil conditions observed in the borings consisted of 18 to 45 of fill overlying 5 to 15 feet of coal process waste, consisting of layers of sand and silt containing coal fragments. Glacial till was encountered at depths of 45 to 55 feet bgs. No samples were collected for chemical analysis.

## 3.5 Wetland B Area (Lots 3 and 4)

The Wetland B Area is in the southwest corner of the Property and includes Wetland B, its forested wetland buffer and forest land (Figure 3-1). Wetland B is approximately 37 acres of palustrine, forested and scrub-shrub, seasonally flooded wetland (US Fish & Wildlife, 2017), classified by Ecology as a Category II Wetland and by King County as a Class 1 wetland (Ecological Land Services, 2003). The wetland is classified as Deciduous Forested Wetland/Riparian Forest habitat (ELS, 2004b). The wetland is in a linear depression that is approximately 0.5- to 1-foot lower than the surrounding land and appears to be hydrologically maintained primarily by groundwater, but may include secondary input surface water runoff (Ecological Land Services, 2003). The wetland extends off the property to the south (Figure 3-1).

The wetland and the surrounding forest land are dominated by red alder with lesser amounts of black cottonwood, western red cedar, Sitka spruce, western hemlock, Douglas-fir, and big leaf maple (Ecological Land Services, 2003). Shrubs form a dense mid-understory layer throughout the wetland and surrounding forest and include salmonberry, willows, black twinberry, Douglas spiraea, Himalayan blackberry, evergreen blackberry, red huckleberry and vine maple (Ecological Land Services, 2003). Outside of the wetland, the habitat of OU#4 is Lowland Deciduous-Closed Canopy-No Understory (ELS, 2004b).

ELS completed an update to the wetland delineation for Wetland B in 2015, in which there were no changes found to the 2003 wetland delineation (ELS, 2015).

## 3.6 Natural Vegetation Areas (Lots 1, 2, 3, 4)

Natural vegetation areas make up the balance of the Property not included in the OUs or areas described in Sections 3.1 through 3.5 (Figure 3-1). Except for activities associated

with construction and maintenance of the electrical transmission lines, including ongoing vegetation management within the transmission line easement, the historical activities in these areas consist of timber harvesting during the coal mining era to provide timber for mine shoring in the 1930s and 1940s (TESI, 2001). The habitat of the natural vegetation areas is classified as Lowland-Coniferous/Deciduous-Closed Canopy-No Understory (ELS, 2004b). The land is not well suited for long-term commercial forestry (Section 2.3.3; IFC, 2012).

### *3.6.1 Previous Investigations*

An investigation program in 2003 included advancement of more than 160 rotary percussion drill holes up to 82 feet deep in the southeast corner of Lot 3 for exploration into potential expansion of surface silica sand mining activities (SubTerra, 2006). The explorations identified glacial till covering bedrock at thicknesses of less than 10 feet on the lower elevations to the west, and up to 40 feet thick at higher elevations to the east. Except for borings completed within active sand mining areas at the time of the exploration, native and undisturbed glacial till and bedrock was observed from the ground surface to the total depth of the borings.

# 4 Field Investigations

## 4.1 Previous Investigations

Investigations have been conducted since the mid-1980s to evaluate elevated pH and concentrations of dissolved metals in groundwater and surface water associated with the landfilling of CKD in the LDA and the DSP. A bibliography of reports documenting these activities is included as Appendix B.

Several investigations have been conducted to evaluate and characterize conditions at the Property. The following documents provide significant information for the Property that has been incorporated into this RI Report and should be referenced for additional details:

- **Metropolitan Engineers, 1972, Final Report Geologic and Hydrologic Conditions**. This report summarizes the coal mining activities early sand mining activities and includes the earliest summary of environmental conditions at the Property.
- **Ideal Basic Industries, 1984, Individual Exemption to Petition for Cement Kiln Dust Designation.** The report includes detailed descriptions of the LDA and the DSP and the Property geology, hydrology and hydrogeology. Also included are copies of regulatory correspondence, including copies of early reclamation plans and mining permits.
- **Tacoma Environmental Sciences, Inc, 2000, Preliminary Investigation Report.** This report includes a detailed background section, including a summary of landfilling and reclamation; a thorough description of topographic, hydrologic, hydrogeologic and geologic conditions; a summary of compliance groundwater monitoring activities conducted at the Property; and a description of results of investigation activities completed to evaluate the nature and extent of fill material in the LDA and the DSP.
- **SubTerra, 2006, Revised Geology and Ground Water Report.** This report includes a detailed description of geologic and hydrogeologic conditions at the Property and includes five detailed cross-sections depicting those conditions.
- **Golder, 2013, Lower Disposal Area Hydrogeological Investigations.** This report documents the results of investigation activities conducted to evaluate groundwater flow in and around the LDA.

These reports are included in Appendix C.

## 4.2 Ecology Site Hazard Assessment

Ecology completed a Site Hazard Assessment (SHA) for the Property in 2016 to gather information on past/present waste management activities, along with other basic site-specific environmental data in order to assess the site for its potential or actual environmental hazard (Ecology, 2016b). During an SHA, threats to human health and the environment are evaluated for each applicable contaminant migration route, resulting in a hazard ranking determination. Sites are ranked on a scale of one (1) to five (5); 1 representing the highest level of concern, and 5 the lowest, relative to other ranked sites

in the state. Based on the results of the SHA, Ecology classified the Reserve Silica site with a site ranking of 1 based on concentrations of arsenic and lead in surface water at the infiltration ponds and the South Pond that pose a potential risk to human health and the environment and arsenic in groundwater that poses a potential risk to human health.

## 4.3 RI Data Gaps

Several outstanding RI data gaps have been identified and consist of the following:

1. The nature and extent of elevated pH and dissolved arsenic and lead in surface water and groundwater attributed to discharge from the LDA (Section 3.1). This data gap is being managed and overseen by the responsible party Holcim (US) Inc., their consultants, and Ecology. Therefore, this data gap is part of the Closed Landfill OU#1 and not part of this RI;
2. The locations, extent, and quality of soil disposal during sand mining in the 1980s (Section 2.2.4);
3. The presence, nature and extent of contaminants of potential concern (COPCs) associated with RECs identified for the Plant Site (Section 3.3.3). Investigation work to address this data gap was conducted by Aspect in March and April 2017 and the results are presented in Section 4.4.1 and
4. The presence, nature and extent of arsenic and lead in soil associated with reported disposal of ASARCO slag, as identified "in the road base and eroded slopes near the LDA" by TESI (TESI, 2000; Section 2.2.4). Investigation work to address this data gap was conducted by Aspect in May 2017 and the results are presented in Section 4.4.2.

Holcim (US) Inc. is responsible for meeting the requirements of the Post-Closure Permit for the LDA, including addressing Data Gap #1 to meet the requirements of MTCA for investigation and cleanup of impacts attributable to leachate discharge from the LDA. Post-closure inspection, maintenance and groundwater monitoring are conducted in accordance with the *Minimum Functional Standards for Solid Waste Handling* (WAC 173-304).

## 4.4 Remedial Investigation

Based on our understanding of the Property use history and permitted landfill and/or mine closure activities, two outstanding data gaps required investigation to complete the RI:

1. Soil and groundwater quality at the Plant Site where historic mining operations occurred, including vehicle maintenance and the storage and use of petroleum products; and
2. Soil quality along the Lower Haul Road where soil containing slag was allegedly observed and may have been deposited.

The following describes the scope of work and results of investigations completed at these locations to evaluate the outstanding data gaps. No other investigation was

warranted at this Property (except for ongoing activities by Holcim related to high pH and arsenic-related leachate from the LDA).

### 4.4.1 Plant Site Investigation

Aspect completed investigation activities on the Plant Site in March and April 2017 to evaluate the RECs and address the outstanding RI data gap for the Plant Site. The work included the advancement of nine borings, construction of groundwater monitoring wells in five of the borings, and collection of soil and groundwater samples for laboratory analysis (Figures 3-6 and 3-7). A summary of soil and groundwater conditions and observations is provided below, and shown in the boring and well construction logs included as Appendix D.

- Three borings were completed to evaluate subsurface conditions and potential releases near the Hazardous Material Storage Area (AB-3, AB-4 and AMW-5; Figure 3-6). One of these borings was completed as a monitoring well to 20 feet bgs with 15 feet of screen (AMW-5). Some staining and a petroleum-like sheen were observed on surface soil at these boring locations. The soils observed in the borings consisted predominantly of sand and gravels with some coal fragments observed to depths ranging from 2 to 8 feet bgs (Appendix D). Groundwater was observed at the time of drilling at depths ranging from 7.5 to 10 feet bgs.
- Three borings were completed to evaluate subsurface conditions and potential releases from the diesel UST (AB-1, AB-2 and AMW-3; Figure 3-6). One of the borings was completed as a monitoring well to 20 feet bgs with 15 feet of screen (AMW-3). The soils observed in these borings consisted of approximately 10 feet of fill material, including sand and sandy silt with woody debris and coal fragments, overlying sand and gravel with increasing density with depth (Appendix D). Groundwater was observed at 7.5 feet bgs at the time of drilling.
- Two monitoring wells were installed to evaluate groundwater quality to the north of Black Diamond-Ravensdale Road SE on the Plant Site (AMW-2 and AMW-4; Figure 3-6). The soil observed in the borings for wells AMW-2 and AMW-4 consisted of gravelly sand and sandy gravel from near the ground surface to the total depth explored of 20 feet bgs (Appendix D). AMW-2 was completed with 10 feet of screen, and AMW-4 was completed with 15 feet of screen. Groundwater was observed at 10 feet bgs in both wells at the time of drilling.
- One monitoring well was installed in the southeast portion of the Wetland A/Former Settling Ponds Area to evaluate groundwater quality in the presumed downgradient direction of monitoring wells located at the Infiltration Ponds (AMW-1; Figure 3-7). Monitoring well AMW-1 was installed to a total depth of 40 feet with 15 feet of screen. Soil observed in the boring for well AMW-1 consisted of:
    - Surface to 10 feet bgs: topsoil overlying loose sandy gravel;
    - 10 to 21 feet bgs: soft, high plasticity clay and silty clay; thin interbeds of silica sands and some coal fragments;
    - 21 to 30.5 feet bgs: coal fragments and shavings in the medium to coarse sand size range;

- 30.5 feet bgs: an interpreted historical ground surface consisting of silty sand loam with abundant organic material; and
- 39 to 40 feet bgs: dense, wet, silty/sandy gravel.

Soil samples were obtained from each of the nine borings at approximate intervals of 2.5 to 5 feet for field screening and potential chemical analysis. Select soil samples and one groundwater sample from each monitoring well were submitted to OnSite Environmental in Redmond, Washington for chemical analysis of COPCs associated with the RECs listed in Section 3.3.2, as described in subsequent sections.

A summary of the soil and groundwater sample results and well data for AMW-1 through AMW-5 is shown in Tables 1 and 2. Full laboratory reports are included in Appendix E. Additionally, one surface water sample was obtained from Ravensdale Lake to support a water rights evaluation (sample RSRL-033017); the results are presented in the laboratory reports but are not discussed as part of this RI.

#### 4.4.1.1 Soil Data

Based on the results of field screening and the proximity of soil samples relative to the groundwater table, a total of eight soil samples were selected for chemical analysis of one or more of the following:

- Gasoline-range, diesel-range, and heavy oil-range petroleum hydrocarbons by Northwest Methods NWTPH-Dx and NWTPH-Gx;
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by U.S. Environmental Protection Agency (EPA) method 8021B;
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and naphthalenes by EPA method 8270D/SIM; and
- Total metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) by EPA method 6010C/7471B.

Diesel-range and heavy oil-range petroleum hydrocarbons were detected at low concentrations in five of the seven soil samples submitted for laboratory analysis but were below the corresponding MTCA Method A cleanup levels in all of the soil samples, with the exception of one sample collected from boring AB-2 near the diesel UST (Figure 3-6). In AB-2, heavy oil-range petroleum hydrocarbons were detected at 3,000 mg/kg in a sample collected from a depth of 2.5 feet bgs; this concentration is greater than the MTCA Method A cleanup level for Unrestricted Land Use of 2,000 mg/kg. Total naphthalenes and total cPAH TEQ[3] were detected in this same sample at concentrations exceeding MTCA Method A cleanup levels (Table 1). BTEX and cPAH concentrations were not detected above the corresponding MTCA Method A cleanup levels in any of the soil samples submitted for analysis (Table 1).

[3] The total toxicity equivalent concentration for the cPAHs, calculated in accordance with WAC 173-340-708(e).

Total metals were not detected above the corresponding MTCA Method A cleanup levels in any of the borings except for AMW-5, where arsenic concentrations were 21 mg/kg, which only slightly exceeds the MTCA Method A cleanup level of 20 mg/kg.

#### 4.4.1.2 Groundwater Data

Groundwater levels were measured in each of the five wells on April 6, 2017, prior to purging and sampling. The calculated groundwater elevations ranged from 590.46 feet NAVD88 at well AMW-1 to 585.58 feet NAVD88 at well AMW-4 (Table 2). The groundwater flow direction based on these elevations is to the north, towards Ravensdale Lake (Figure 4-1).

A groundwater sample was collected from each of the 5 wells and submitted for chemical analysis of the following:

- Gasoline-range, diesel-range, and heavy oil-range petroleum hydrocarbons by Northwest Methods NWTPH-Dx and NWTPH-Gx;
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA method 8021B;
- Polycyclic aromatic hydrocarbons (PAHs), including cPAHs and naphthalenes, by EPA method 8270D/SIM; and
- Dissolved metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) by EPA methods 200.8/7470A.

Petroleum hydrocarbons, metals, and PAHs were not detected at concentrations above the corresponding MTCA Method A cleanup levels in any of the wells except for AMW-2.

Arsenic was detected in the groundwater samples collected from wells AMW-1 and AMW-2, which are located downgradient of the LDA and infiltration ponds located south of Black Diamond-Ravensdale Road (Figure 4-1). The reported concentration at well AMW-2 (5.1 micrograms per liter [µg/L]) only slightly exceeds the MTCA Method A cleanup level of 5.0 µg/L (Table 2). Arsenic was not detected in the groundwater samples collected from wells AMW-3 through AMW-5; and lead was not detected in any of the groundwater samples (Table 2).

The groundwater samples were also submitted for chemical analysis of geochemical indicators, including dissolved cations, alkalinity, chloride and sulfate to support a water rights evaluation. The results of these analyses are presented in Table 2 and included in the laboratory reports (Appendix E) but are not discussed further in this RI. Table 2 also includes the water quality data for each monitoring well, including pH measurements.

#### 4.4.1.3 Plant Site Investigation Results

Diesel- and oil-range petroleum hydrocarbons were detected at concentrations ranging from 380 mg/kg to 3,000 mg/kg in shallow soil across the eastern portion of the Plant Site, as indicated by the results of soil samples collected from a depth of 2.5 feet bgs at borings AB-2, AB-3, AB-4 and AMW-4 (Figure 3-6). Soil samples collected at depths of 7.5 feet bgs contain lower or nondetectable concentrations of petroleum hydrocarbons, suggesting a limited vertical extent in soil. Diesel- and oil-range petroleum hydrocarbons were not detected in groundwater samples collected from any of the wells that were

installed and sampled as part of the investigation on the Plant Site, indicating that there is not a complete pathway for leaching from soil to groundwater.

Concentrations of arsenic in soil collected from 2.5 feet bgs at the boring for well AMW-5 are reported at 21 mg/kg, which is just above the MTCA Method A cleanup level of 20 mg/kg (Table 1). The groundwater sample collected from well AMW-5 did not contain dissolved arsenic above the laboratory reporting limit (Table 2). The source of the arsenic to soil at AMW-5 is not known, its presence in shallow soil may be associated with surface activities in the equipment storage and vehicle maintenance area, but the concentration barely exceeds the MTCA Method A cleanup level, it is limited in extent and not impacting groundwater and therefore, does not pose a risk to human health or the environment.

Groundwater pH measured in the monitoring wells on April 6, 2017 ranged from 6.18 to 6.48, which are assumed to be representative of naturally-occurring groundwater conditions in the area and do not indicate any groundwater impacts from leachate originating at the LDA. The concentrations of dissolved arsenic detected in groundwater at wells AMW-1 and AMW-2 may be associated with elevated pH of leachate originating from the LDA. However, the detected concentrations of dissolved arsenic are significantly lower than those reported in LDA well MW-6A in February and May 2016 (121 and 199 µg/L) (Golder, 2016).

### 4.4.2 Lower Haul Road Investigation

Aspect completed investigation activities along a portion of the Lower Haul Road, running along the west side of the LDA within Lot 6/OU #1, the Closed Landfill area, on May 15 and 16, 2017 to evaluate the potential presence of slag in road bed fill and address the outstanding RI data gap for the Lower Haul Road. The work included advancement of eight borings (AB-05 through AB-12; Figure 4-2) and collection of soil samples for laboratory analysis (Figure 4-2). Select soil samples from each boring were submitted to OnSite Environmental for laboratory analysis of total arsenic and total lead and for Synthetic Precipitation Leaching Procedure (SPLP), which measures potential leachability of metals. Where encountered, groundwater grab samples were collected from the borings and field measurements for pH were taken using a portable water quality meter. Additionally, the pH of the SPLP extracts was measured in the lab using by EPA Method 9041A.

The borings were advanced by Holocene Drilling, Inc. of Puyallup, Washington using hollow-stem auger drilling methods with continuous sampling in 18-inch drives using 2-inch-diameter, steel split-spoon samplers. The borings were advanced to total depths ranging from 18 to 20 feet bgs, except for the northernmost boring AB-05, where refusal on suspected bedrock was met at a depth of 10.5 feet bgs. The boring logs are included in Appendix D. A cross section showing soil types and metals data along the Lower Haul Road is included as Figure 4-3.

Soils observed in the borings were highly variable, consisting primarily of silty sand/sandy silt with gravel, coal, organic material, woody debris and brick fragments and orange-yellow sand from sand mining operations mixed with coal and woody debris (Figure 4-3). Soil interpreted to be native, in-place soil was encountered at a depth of 14

feet bgs in boring AB-06 (glacial till) and 19 feet bgs in boring AB-09 (peat). Groundwater was observed in borings AB-06, AB-07, AB-09, AB-10, and AB-11 at depths ranging from 7.3 to 19 feet bgs and was not observed in borings AB-05, AB-08 or AB-12.

Slag was observed in the upper 2 feet of the gravel fill beneath the roadbed in borings AB-08 through AB-12 and as a minor constituent of the base course at the surface of the Lower Haul Road, as observed in loose gravel along road shoulder. Slag was also observed to be mixed with sand/silty sand and coal fragments in soil to depths of 5.5 to 6.5 feet bgs in borings AB-11 and AB-12 (Figure 4-3). Thin, interbedded layers of CKD were observed in the upper two feet at borings AB-07 and AB-12 and at a depth of approximately 11 feet bgs at boring AB-11.

#### 4.4.2.1 Soil Data

Based on the results of field screening and the observed presence of slag and other fill materials in the borings, a total of 16 soil samples were selected for laboratory analysis. Detected concentrations of total lead and total arsenic in soil were compared to three potentially applicable criteria: background concentrations of arsenic and lead in Puget Sound soils (Ecology, 1994); MTCA Method A cleanup levels (WAC 173-340-740); and Ecological Indicator Soil Concentrations (WAC 173-340-7493). The laboratory results and comparison to these three criteria are presented in Table 3. The laboratory analytical reports are included in Appendix E.

Total arsenic was detected in 11 of the 16 soil samples submitted for analysis at concentrations ranging from 24 to 360 mg/kg, all of which exceed the MTCA Method A Cleanup Level and Ecological Indicator Soil Concentrations of 20 mg/kg and 7 mg/kg, respectively (Table 3). The reported concentration of lead in one boring (AB-07) exceeded the MTCA Method A cleanup level of 250 mg/kg, while five detected concentrations of lead exceed the Ecological Indicator Soil Concentration of 50 mg/kg (Table 3).

The SPLP method simulates and then analyzes a laboratory-prepared leachate using the soil samples. SPLP is designed to evaluate material sitting in place that is exposed to rainfall to simulate the leaching potential of a contaminant and assess chemical mobility in the environment. Fifteen soil samples were submitted for analysis using the SPLP method; arsenic and lead were not detected above the laboratory reporting limits in any of the simulated leachate samples.

#### 4.4.2.2 Lower Haul Road Investigation Results

As shown on Table 3, concentrations of total arsenic and lead are present in surface and shallow subsurface fill along the Lower Haul Road. The reported concentrations of arsenic and lead do not appear to correlate to specific types of fill or with the observed presence of slag in the sample (Figure 4-3). Despite the presence of slag and/or the concentrations of arsenic and lead in soils, these metals do not appear to be leachable based on the results of the SPLP testing. Groundwater grab samples measured for pH showed some variability; the groundwater in two northern borings ranged from 6.79 to 7.58 (in borings AB-07 and AB-06, respectively; Table 3). In contrast, the grab sample from boring AB-11, where cement kiln dust was present at depths greater than 2 feet bgs, and in greater quantities, the pH of groundwater was 12.67 (Table 3). The pH of the

SPLP extracts ranged from 6 to 12, with pH above 8.5 in 5 of the 14 samples (Table 3). There does not appear to be any correlation between high pH in SPLP extracts and the concentration of total arsenic or lead in the corresponding soil sample.

# 5 Conceptual Site Model

"Conceptual site model" (CSM) is defined in MTCA (WAC 173-340-200). It provides a conceptual understanding of a site that identifies potential or suspected sources of hazardous substances, types and concentrations of hazardous substances, potentially contaminated media, and actual and potential exposure pathways and receptors. Typically, the CSM is initially developed during the scoping of the RI and further refined as additional information is collected. It is a tool used to assist in making decisions at a site.

This site is complex due to its varied uses, geology, and mining and reclamation history. Even with the site complexity, much is known because of the mining exploration and mining activities that have established a thorough representation of the stratigraphy, lithologies of different geologic units, and groundwater characteristics at this site. Similarly, the COCs are known through environmental investigations completed by Holcim (US) Inc. relative to the Closed Landfill area (pH and arsenic at the LDA and DSP that make up OU#1). Based on the conditions of the permit(s) for the Inert Waste Landfill (and interim actions completed to remain consistent with those permits) it is assumed that the Inert Waste Landfill areas (former mining pits) were filled as required through the conditions of the permit. Additionally, COCs (petroleum hydrocarbons and affiliated chemicals like PAHs and metals) have been evaluated at the Plant Site and along the Lower Haul Road where RI activities was completed between March and May 2017 to address RI data gaps.

The CSM is as follows: materials were placed in historical open pit mines created by the mining of silica sand and coal out of north-south striking bedrock that dips steeply to the west, while mine operations activities, such as fueling and maintaining vehicles, occurred at the Plant Site. Materials placed in the open pits included CKD and inert waste (primarily soil) which have been, or will be, capped in compliance with landfill closure requirements. Groundwater does not appear to be creating leachate from any of the landfilled areas, except in one unique instance.

Investigations indicate that shallow groundwater, present in surficial fill and native glacial sediments, flows into the bathtub-like condition created by the low-permeability bedrock floor and walls of the LDA, resulting in groundwater that is in contact with CKD. This contact results in the generation of leachate at the northwest portion of the LDA that spills over the western, undisturbed bedrock wall, causing high pH runoff, which could affect surface water and groundwater downgradient of the LDA.

There has been no evidence of COCs in groundwater that is collected within the underground coal mine workings that emerges through the north portal (based on testing by others at this location) suggesting that groundwater is not in contact with CKD in the DSP.

Groundwater is present under two conditions at the Property: 1) shallow and unconfined in valley-fill glacial deposits with flow towards topographic lows and surface water bodies; and 2) deeper in bedrock through fractures and bedding planes from south to north. Bedrock groundwater likely discharges to the shallow glacial aquifer near the base

of Ravensdale Hill with the flow direction towards the Plant Site and Ravensdale Lake. The five monitoring wells installed by Aspect at the Plant Site and Wetland A/Former Settling Ponds Area during the March/April 2017 RI are assumed to be representative of groundwater quality migrating from the portions of the Property on the south side of Black Diamond-Ravensdale Road, including the Closed Landfill (OU#1) and the Inert Waste Landfill (OU#2). The results of the RI indicate that groundwater on the south end of the Plant Site Lot, as identified at wells AMW-1 and AMW-2, contain concentrations of dissolved arsenic that may be attributable to leachate from the LDA and LDA discharges into the infiltration ponds that are located immediately upgradient from AMW-1 and AMW-2. However, the pH of groundwater at wells AMW-1 and AMW-2 is at normal levels and although the concentrations of dissolved arsenic in groundwater are at or below the MTCA Method A cleanup level, arsenic concentrations in these two wells are higher than in wells further downgradient at the Plant Site (arsenic was not detected in wells AMW-3, 4 or 5).

The following additional evidence supports this CSM.

- **Valley-Fill Glacial Deposits.** Glacial outwash sediments are present as valley fill and consist primarily of terrace gravels and stratified drift including pebbles, cobbles and boulders interstratified with sand and silt. Ravensdale Lake formed in a glacial melt-water channel in glacial stratified drift/outwash deposits in the valley floor. Ravensdale Lake appears to be a key receptor for activities that occurred at the Plant Site and may receive a portion of groundwater from the LDA and infiltration ponds.

- **Mantle of Glacial Deposits.** Glacial till, consisting of silty clay with boulders, gravel and sand forms a 5- to 15-foot-thick mantle over bedrock on surrounding hills, including Ravensdale Hill.

- **Low Yielding Bedrock.** Rising from the valley to the east, the western flanks of Ravensdale Hill are composed of uplifted, tilted, folded and faulted bedrock of the Puget Group-Renton Formation consisting of steeply-dipping sedimentary rock layers. Surface sandstone and coal mining has resulted in deep mine cuts that have been, or are current being, filled and reclaimed. The Puget Group-Renton Formation forms the sedimentary bedrock core of the northwest trending ridge that underlies the Property and consists of arkosic sandstone, siltstone, carbonaceous shale and coal beds.

  This Formation has been classified as a bedrock-confining unit in U.S. Geological Survey (USGS) groundwater studies and water wells completed within it are typically low yield and unreliable, with flow and recharge achieved primarily through bedrock fractures. There may be limited groundwater flow from south to north within the Puget Group-Renton Formation, along bedding planes and within bedrock fractures, but this flow is likely disrupted on the north end of the Property by a geologic fault that causes the strike of the bedrock to be oriented generally east-west on the north side of the fault (Figure 2-6).

  The geologic fault is expected to block any northerly movement of groundwater flow through north-south trending bedding plane fractures south of the fault.

Therefore, for this CSM, the geologic structure acts as a barrier for deeper bedrock aquifer groundwater flow from trending toward the topographic low at Ravensdale Lake. The low permeability of the bedrock is evident where open mine cuts have been observed to hold surface water year-round, except at the DSP where surface mining cuts are connected to underground mine workings, which act as a groundwater discharge path.

- **Groundwater Aquifer.** Groundwater is present in valley-fill glacial deposits, and receives surface water runoff from much of the northern portion of the Property, including the LDA. This aquifer is connected to surface water features in the area, including Ravensdale Lake.

- **Groundwater Discharge.** Near the LDA, shallow groundwater is flowing to the northwest through surface mine spoils and native mantle of glacial sediments located on top of the bedrock. Around the southern and southeastern extents of the LDA, this groundwater flows into the fill material that comprises the LDA. The LDA acts as a bathtub, filling up with groundwater that spills over the low bedrock wall that constitutes the western limit of sand mining in that area (Arcadis, 2004) and eventually discharges as surface seeps into the seep collection ditch, along the northwest side of the LDA (Golder, 2013).

The discharge water contains elevated pH and concentrations of dissolved metals that exceed water quality standards. The leachate collected in the seep collection ditch is discharged to the Infiltration Ponds where the pH of surface water and groundwater in surrounding compliance wells exceeds the permit limits and state water quality criteria range of 6.5 to 8.5. Uncontrolled leachate from the LDA flows overland into the low-lying, swampy area located downslope to the west of the north end of the LDA and likely infiltrates through the glacial outwash sediments to the top of the water-bearing zone, where groundwater flow is assumed to be towards the north and north-northwest. Groundwater samples collected from wells installed as part of the Plant Site RI suggest that the plume of elevated pH and increased concentrations of dissolved metals does not extend onto the Plant Site at concentrations of regulatory concern.

## 5.1 Contaminants of Concern

The known COCs and the media that they are known and/or suspected to have impacted the Property are:

- pH in surface water and groundwater;
- Dissolved arsenic in surface water and groundwater; and
- Total arsenic and lead in road base and fill soil.

Potential sources of hazardous substances at the Plant Site include a diesel UST and a fueling and equipment/vehicle maintenance area. Based on the results of the Plant Site investigation, the COPCs and the media that they may have impacted also include:

- Diesel- and oil-range petroleum hydrocarbons in shallow soil across the eastern portion of the Plant Site.

## 5.2 Receptors and Exposure Pathways

The potential exposure pathways and receptors include the following:

- Direct contact by human, terrestrial and ecological receptors with leachate as surface water that occasionally flows uncontrolled to the low-lying areas to the west of the LDA and is piped to the Infiltration Ponds;
- Direct contact by human, terrestrial and ecological receptors with surface water that has been impacted by leachate migrating to groundwater and groundwater discharge to surface water;
- Migration of leachate to groundwater with ingestion of groundwater;
- Direct contact by workers at the Plant Site with soil that contains petroleum hydrocarbons; and
- Direct contact by human, terrestrial, and ecological receptors with fill soil that contains arsenic and lead.

# 6 Conclusions

## 6.1 Remedial Investigation Summary

There are three source areas on the Property, where the documented or potential presence of COCs may pose a risk to human health and the environment, including:

- Leachate containing high pH and arsenic discharging from the LDA;
- Arsenic and lead in road base and shallow subsurface fill soil within Lot 6/OU# 1, the Closed Landfill area, along the Lower Haul Road; and
- Storage and use of petroleum products on the Plant Site.

The RI indicates that soil and groundwater at the Plant Site has not been impacted by releases of COCs at concentrations of regulatory concern except for one location (AB-2) near the former UST where soil exceeds MTCA Method A cleanup levels for oil-range hydrocarbons and cPAHs. Additionally, two wells installed near the south boundary of the Plant Site Lot show slightly elevated concentrations of arsenic (AMW-1 and AMW-2). These wells are located downgradient of the LDA and Infiltration Ponds, and indicate that leachate from the LDA may extend to beneath the south portion of the Plant Site Lot but at significantly lower concentrations than is detected at wells located on the north side of the Infiltration Ponds, or near the LDA.

Investigation along the Lower Haul Road indicates that road base and shallow subsurface fill soil contains concentrations of arsenic and lead that exceed both MTCA Method A cleanup levels and ecological indicator soil concentrations. However, arsenic and lead in soils are not leachable and, therefore not mobile. Because the Lot 6/OU #1, the Closed Landfill area, has restricted access and is being monitored and remediated to address high pH leachate discharging from the LDA, there is low risk to human health or the environment attributable to arsenic and lead in road base and shallow subsurface fill soil along the Lower Haul Road. Therefore, the COCs at the Property (high pH and arsenic) relate to ongoing remediation at the Closed Landfill area (Lot 6/OU#1).

Activities to evaluate impacts to human health and the environment attributable to leachate discharging from the LDA are ongoing by the responsible party, Holcim. The extent of the MTCA "Site", defined as any area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located, includes those portions of Lot 6 where high pH and arsenic are present in leachate, surface water and groundwater, which is being managed and addressed by Holcim and has yet to be fully defined.

## 6.2 Recommendations

Based on the results of this RI, it is recommended that the focus of continued remedial action be on the LDA, leachate from the LDA, and migration of high pH and arsenic-contaminated groundwater and surface water that either is piped to the Infiltration Ponds, flows overland into the South Pond, or migrates to groundwater in the shallow aquifer. Specific recommendations for additional work associated with the LDA, developed

partially on the results of Ecology's SHA and the work of Holcim, consist of the following:

- Implement, as an interim measure, leachate management measures to prevent overland and underground flow of high pH discharge from the LDA, including potential modification to the seep collection system and regular, frequent and ongoing operation and maintenance.
- Evaluate the source and migration pathways for high pH and arsenic-contaminated surface water in and groundwater around the South Pond and develop and implement remedial actions to protect human health and the environment.
- Determine the nature and extent of high pH and arsenic-contaminated groundwater downgradient (presumably to the west and northwest) of the LDA and the seep collection system.
- Conduct a feasibility study in accordance with the requirements of MTCA to evaluate a full range of remedial alternatives, ranging from in-situ treatment and monitoring to full removal of the CKD deposits in the LDA, to permanently mitigate discharge of high pH and arsenic-contaminated water from the LDA.

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# Limitations

Work for this project was performed for Reserve Silica (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

# TABLES

# Table 1. Plant Site Investigation Soil Results

Project No. 160315, Reserve Silica Plant Site
Ravensdale, Washington

| | | Exploration Name | AB-1 | AB-2 | AB-2 | AB-3 | AB-4 | AMW-3 | AMW-5 |
|---|---|---|---|---|---|---|---|---|---|
| | | Depth | 7.5 ft | 2.5 ft | 7.5 ft | 2.5 ft | 2.5 ft | 7.5 ft | 2.5 ft |
| **Chemical Name** | **MTCA Method A Unrestricted Land Use** | **MTCA Method B Most Restrictive Cleanup Level** | | | | | | | |
| **Petroleum Hydrocarbons[4] (mg/kg)** | | | | | | | | | |
| Gasoline-Range Organics | 30 | | -- | -- | -- | 7.1 U | 7.4 U | -- | 6.8 U |
| Diesel-Range Organics | 2,000 | | 42 U | **1,600** | 33 U | **810** | **1,100** | **160** | **380** |
| Heavy Oil-Range Organics | 2,000 | | 84 U | **3,000** | 67 U | **520** | **1,800** | **350** | **510** |
| **BTEX[1] (mg/kg)** | | | | | | | | | |
| Benzene | 0.03 | 18 | 0.021 U | 0.020 UJ | 0.020 U | 0.020 U | 0.020 U | 0.022 U | 0.020 U |
| Toluene | 7 | 6,400 | 0.11 U | 0.072 UJ | 0.071 U | 0.071 U | 0.074 U | 0.11 U | 0.068 U |
| Ethylbenzene | 6 | 8,000 | 0.11 U | 0.072 UJ | 0.071 U | 0.071 U | 0.074 U | 0.11 U | 0.068 U |
| Total Xylenes | 9 | 16,000 | 0.11 U | 0.072 UJ | 0.071 U | 0.071 U | 0.074 U | 0.11 U | 0.068 U |
| **Metals[2] (mg/kg)** | | | | | | | | | |
| Arsenic | 20 | 0.67 | -- | -- | -- | 12 U | 12 U | -- | **21** |
| Barium | | 16,000 | -- | -- | -- | **150** | **110** | -- | **78** |
| Cadmium | 2 | 80 | -- | -- | -- | 0.59 U | 0.62 U | -- | 0.59 U |
| Chromium | | | -- | -- | -- | **32** | **22** | -- | **20** |
| Lead | 250 | | -- | -- | -- | **11** | **12** | -- | **9.1** |
| Mercury | 2 | 24 | -- | -- | -- | 0.30 U | 0.31 U | -- | 0.29 U |
| Selenium | | 400 | -- | -- | -- | 12 U | 12 U | -- | 12 U |
| Silver | | 400 | -- | -- | -- | 1.2 U | 1.2 U | -- | 1.2 U |
| **cPAHs and Naphthalenes[3] (mg/kg)** | | | | | | | | | |
| 1-Methylnaphthalene | | 35 | **0.036** | **23** | **0.017** | -- | -- | **0.066** | -- |
| 2-Methylnaphthalene | | 320 | **0.059** | **43** | **0.03** | -- | -- | **0.098** | -- |
| Naphthalene | | 1,600 | **0.13** | **63** | **0.077** | -- | -- | **0.17** | -- |
| Total Naphthalene | 5 | 1,600 | **0.225** | **129** | **0.124** | -- | -- | **0.334** | -- |
| Benz(a)anthracene | | 1.4 | 0.011 U | **5.4** | 0.0089 U | -- | -- | **0.019** | -- |
| Benzo(a)pyrene | 0.1 | 0.14 | 0.011 U | **0.75** | 0.0089 U | -- | -- | **0.012** | -- |
| Benzo(b)fluoranthene | | 1.4 | 0.011 U | **1.6** | 0.0089 U | -- | -- | 0.011 U | -- |
| Benzo(j,k)fluoranthene | | | 0.011 U | **0.61** | 0.0089 U | -- | -- | 0.011 U | -- |
| Chrysene | | 140 | 0.011 U | **4.5** | 0.0089 U | -- | -- | **0.013** | -- |
| Dibenzo(a,h)anthracene | | 0.14 | 0.011 U | 0.43 U | 0.0089 U | -- | -- | 0.011 U | -- |
| Indeno(1,2,3-cd)pyrene | | 1.4 | 0.011 U | 0.43 U | 0.0089 U | -- | -- | 0.011 U | -- |
| Total cPAH TEQ (ND = 1/2 RDL) | 0.1 | 0.14 | 0.008305 U | **1.599** | 0.0067195 U | | | 0.01623 | |

**Notes**

[1]Petroleum hydrocarbons analyzed using Northwest Methods NWTPH-Gx and NWTPH-Dx.
[2]Benzene (B), toluene (T), ethylbenzene (E), and xylenes (X) analyzed using Environmental Protection Agency (EPA) method 8021B
[3]Total metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) by EPA method 6010C/7471B
[4]Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and naphthalenes by EPA method 8270D/SIM
mg/kg = milligrams per kilogram (parts per million)
MTCA= Model Toxics Control Act
U = analyte was not detected at a concentration greater than the indicated laboratory reporting limit.
J = the internal standard associated with the analyte is out of control limits and the reported concentration is an estimate.
-- = analyte not tested
ft = feet below ground surface
Bold denotes a detected concentration. Shading indicates a concentration that exceeds the MTCA Method A regulatory cleanup level.
Underlining indicates a concentration that exceeds the MTCA Method B regulatory cleanup level.

## Table 2. Plant Site Investigation Groundwater Results

Project No. 160315, Reserve Silica Plant Site
Ravensdale, Washington

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Exploration Name** | **AMW-1** | **AMW-2** | **AMW-3** | **AMW-4** | **AMW-5** |
| | | **Sample Name** | AMW-1-040617 | AMW-2-040617 | AMW-3-040617 | AMW-4-040617 | AMW-5-040617 |
| | | **Sample Date** | 4/6/2017 | 4/6/2017 | 4/6/2017 | 4/6/2017 | 4/6/2017 |
| | | TOC Elevation (feet NAVD88) | 611.48 | 601.03 | 591.44 | 599.49 | 599.92 |
| | | Groundwater Elevation (feet NAVD88) | 590.46 | 588.39 | 585.59 | 585.58 | 585.66 |
| | | Approximate Range of Screened Interval (feet NAVD88) | 567-582 | 577-587 | 571-586 | 576-591 | 576-591 |
| | | Temperature (°C) | 12.07 | 10.58 | 9.90 | 9.98 | 8.00 |
| | | Specific Conductance (µS/cm) | 377.64 | 629.40 | 386.70 | 745.90 | 287.60 |
| | | Dissolved Oxygen (mg/L) | 0.13 | 0.23 | 0.31 | 0.51 | 3.58 |
| | | pH | 6.31 | 6.48 | 6.24 | 6.33 | 6.18 |
| | | Oxidation Reduction Potential (mv) | -20.39 | -16.50 | 46.80 | 60.50 | 69.90 |
| | | Turbidity (NTU) | 1,000+ | 3.63 | 3.77 | 41.50 | 2.72 |
| **Chemical Name** | **MTCA Method A Cleanup Level for Groundwater** | **MTCA Method B Cleanup Level for Groundwater** | | | | | |
| **Petroleum Hydrocarbons[1] (ug/L)** | | | | | | | |
| Gasoline Range Organics | 800 | | 100 U | 100 U | 100 U | 100 U | 100 U |
| Diesel Range Organics | 500 | | 280 U | 250 U | 260 U | 260 U | 260 U |
| Motor Oil Range Organics | 500 | | 450 U | 410 U | 410 U | 410 U | 410 U |
| **BTEX[2] (ug/L)** | | | | | | | |
| Benzene | 5 | 0.795 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Toluene | 1,000 | 640 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Ethylbenzene | 700 | 800 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Total Xylenes | 1,000 | 1,600 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| **Conventionals (dissolved)[3] (ug/L)** | | | | | | | |
| Alkalinity as Bicarbonate (mg/L as CaCO3) | | | **160** | **340** | **170** | **140** | **74** |
| Alkalinity as Carbonate (mg/L as CaCO3) | | | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Chloride | | | **8,500** | **13,000** | **3,400** | **2,300** | 2,000 U |
| Sulfate | | | **5,700** | 25,000 U | **59,000** | **250,000** | **76,000** |
| **Metals (dissolved)[4] (ug/L)** | | | | | | | |
| Arsenic | 5 | 0.0583 | **4.1** | **5.1** | 3.0 U | 3.0 U | 3.0 U |
| Barium | | 3,200 | **100** | **190** | **37** | **39** | 25 U |
| Cadmium | 5 | 8 | 4.0 U | 4.0 U | 4.0 U | 4.0 U | 4.0 U |
| Calcium | | | **20,000** | **73,000** | **42,000** | **95,000** | **37,000** |
| Chromium | 50 | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Lead | 15 | | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Magnesium | | | **12,000** | **23,000** | **21,000** | **48,000** | **13,000** |
| Mercury | 2 | | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 0.50 U |
| Potassium | | | **4,900** | **3,000** | **1,700** | **2,800** | **1,200** |
| Selenium | | 80 | 5.0 U | 5.0 U | 5.0 U | 5.0 U | 5.0 U |
| Silver | | 80 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Sodium | | | **15,000** | **14,000** | **7,300** | **5,100** | **3,200** |

# Table 2. Plant Site Investigation Groundwater Results

Project No. 160315, Reserve Silica Plant Site
Ravensdale, Washington

| | | Exploration Name | AMW-1 | AMW-2 | AMW-3 | AMW-4 | AMW-5 |
|---|---|---|---|---|---|---|---|
| | | Sample Name | AMW-1-040617 | AMW-2-040617 | AMW-3-040617 | AMW-4-040617 | AMW-5-040617 |
| | | Sample Date | 4/6/2017 | 4/6/2017 | 4/6/2017 | 4/6/2017 | 4/6/2017 |
| **Chemical Name** | **MTCA Method A Cleanup Level for Groundwater** | **MTCA Method B Cleanup Level for Groundwater** | | | | | |
| **PAHs[5] (ug/L)** | | | | | | | |
| 1-Methylnaphthalene | | 1.51 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| 2-Methylnaphthalene | | 32 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Acenaphthene | | 960 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Acenaphthylene | | | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Anthracene | | 4,800 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Benz(a)anthracene | | 0.12 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Benzo(a)pyrene | 0.1 | 0.012 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Benzo(b)fluoranthene | | 0.12 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Benzo(g,h,i)perylene | | | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Benzo(j,k)fluoranthene | | | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Chrysene | | 12 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Dibenzo(a,h)anthracene | | 0.012 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Fluoranthene | | 640 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Fluorene | | 640 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Indeno(1,2,3-cd)pyrene | | 0.12 | 0.0094 U | 0.0093 U | 0.0093 U | 0.0094 U | 0.0094 U |
| Naphthalene | 160 | 160 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Phenanthrene | | | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Pyrene | | 480 | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |
| Total Naphthalenes | 160 | | 0.094 U | 0.093 U | 0.093 U | 0.094 U | 0.094 U |

**Notes**

[1]Petroleum hydrocarbons analyzed using Northwest Methods NWTPH-Gx and NWTPH-Dx.

[2]Benzene (B), toluene (T), ethylbenzene (E), and xylenes (X) analyzed using Environmental Protection Agency (EPA) method 8021B.

[3]Dissolved cations (Ca, Mg, K, Na) by EPA method 6010C; Dissolved alkalinity by method SM 2320B; Dissolved chloride by method SM 4500-CI E; Dissolved sulfate by ASTM D516-07.

[4]Metals analyzed using EPA Method 200.8/7470A.

[5]Polycyclic aromatic hydrocarbons (PAHs) analyzed by EPA method 8270D/SIM.

*The Washington State Model Toxics Cleanup Act (MTCA) Method A cleanup level for gasoline-range petroleum hydrocarbons is 1000 ug/L when B is not present or the total of ETX is less than 1% of total gasoline mixture; or, 80 ug/L for all other gasoline mixtures.

ug/L = micrograms per liter

U = analyte was not detected at a concentration greater than the indicated laboratory reporting limit.

°C = degrees Celcius

µS/cm = microsiemens per centimeter

mg/L = milligrams per liter

mv = millivolts

NTU = Nephelometric Turbidity Unit

Bold denotes a detected concentration.

Shading indicates a concentration that exceeds the MTCA Method A regulatory cleanup level.

Underlining indicates a concentration that exceeds the MTCA Method B regulatory cleanup level.

# Table 3 - Haul Road Soil Quality Investigation Results

Project No. 160315 - Reserve Silica Plant Site
Ravensdale, Washington

| Exploration Name | Depth (ft bgs)[1] | Total Metals in Soil | | Groundwater Grab Sample | SPLP Extract | | |
|---|---|---|---|---|---|---|---|
| | | Arsenic | Lead | pH | Arsenic | Lead | pH |
| | | (mg/kg) | | | (mg/L) | | |
| AB-5 | 9 | 11 U | 5.6 U | -- | 0.40 U | 0.20 U | 6.5 |
| AB-6 | 1.5 | 11 U | 5.5 U | 7.58 | 0.40 U | 0.20 U | 7.5 |
| | 14 | 11 U | 5.6 U | | 0.40 U | 0.20 U | 9.0 |
| AB-7 | 1.5 | **360** | **710** | 6.79 | 0.40 U | 0.20 U | 12.0 |
| AB-8 | 1.5 | **96** | **57** | | 0.40 U | 0.20 U | 6.0 |
| | 7.5 | 12 U | **7.0** | **--** | 0.40 U | 0.20 U | 7.0 |
| AB-9 | 1.0 | **75** | **37** | | 0.40 U | 0.20 U | 7.0 |
| | 5 | **48** | **97** | **--** | 0.40 U | 0.20 U | 12.0 |
| AB-10 | 10 | **24** | **16** | | 0.40 U | 0.20 U | 7.0 |
| | 12 | **81** | **32** | **--** | 0.40 U | 0.20 U | 10.0 |
| AB-11 | 1.5 | **180** | **71** | | 0.40 U | 0.20 U | 9.0 |
| | 5 | **38** | **21** | 12.67 | 0.40 U | 0.20 U | 8.5 |
| | 10 | 11 U | **9.1** | | -- | -- | -- |
| | 15 | **100** | **68** | | 0.40 U | 0.20 U | 8.0 |
| AB-12 | 1.0 | **40** | **21** | -- | 0.40 U | 0.20 U | 8.0 |
| | 5 | **36** | **7.5** | | 0.40 U | 0.20 U | -- |
| **Natural Background Soil Metals Concentrations** | | **7** | **24** | **NA** | **NA** | **NA** | **NA** |
| **MTCA Method A Soil Cleanup Level (Unrestricted)** | | **20** | **250** | **NA** | **NA** | **NA** | **NA** |
| **Ecological Indicator Soil Concentrations** | | **7** | **50** | **NA** | **NA** | **NA** | **NA** |

**Notes**

[1]Depth of soil sample collected in feet below ground surface (ft bgs)

"--" Indicates sample not analyzed/tested

mg/kg = milligrams per kilogram (parts per million)

mg/L = milligrams per liter

MTCA= Model Toxics Control Act

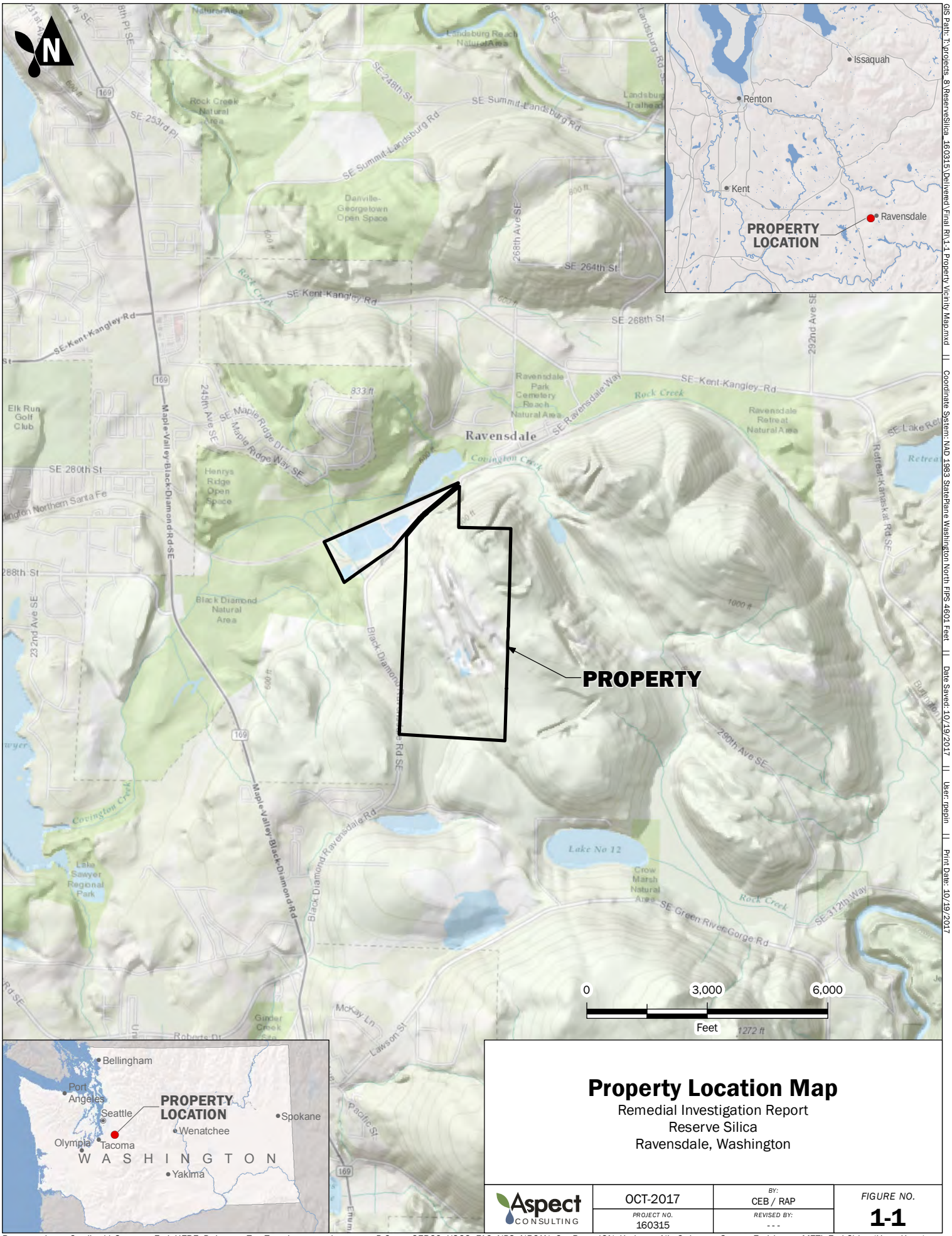
NA = not applicable

SPLP = Synthetic Precipitation Leaching Procedure

U = analyte was not detected at a concentration greater than the indicated laboratory reporting limit.

Bold denotes a detected concentration. Shading indicates a concentration that exceeds the Ecological Indicator Soil Concentrations.
Underlining denotes a detected concentration exceeds the MTCA Method A Soil Cleanup Level.

# FIGURES




# Property Location Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 1-1 |
| | PROJECT NO. 160315 | REVISED BY: --- | |



GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\1-1 Property Vicinity Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/19/2017 || User: jpepin || Print Date: 10/19/2017

GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\1-2 Current Conditions.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/19/2017 || User: npepin || Print Date: 10/19/2017

N

PLANT SITE

FORMER SETTLING PONDS

PLANT SITE LOT
KING COUNTY TAX
PARCEL 3522069018

LOT 6
KING COUNTY TAX
PARCEL 3622069138

LOT 1
KING COUNTY TAX
PARCEL 3622069065

LOT 2
KING COUNTY TAX
PARCEL 0121069010

LOT 5
KING COUNTY
TAX PARCEL
0121069011

Lower Disposal Area

North Pit

Upper Pit

Dale Strip Pit

CLOSED LANDFILL

Lower Pit

LOT 4
KING COUNTY TAX
PARCEL 0121069012

LOT 3
KING COUNTY TAX
PARCEL 0121069002

Closed Landfill/Easement Area

Inert Waste Landfill

Plant Site

Former Settling Ponds

Historical Coal and/or Sand Mine Pit Extent

Property

Tax Parcel

0 250 500

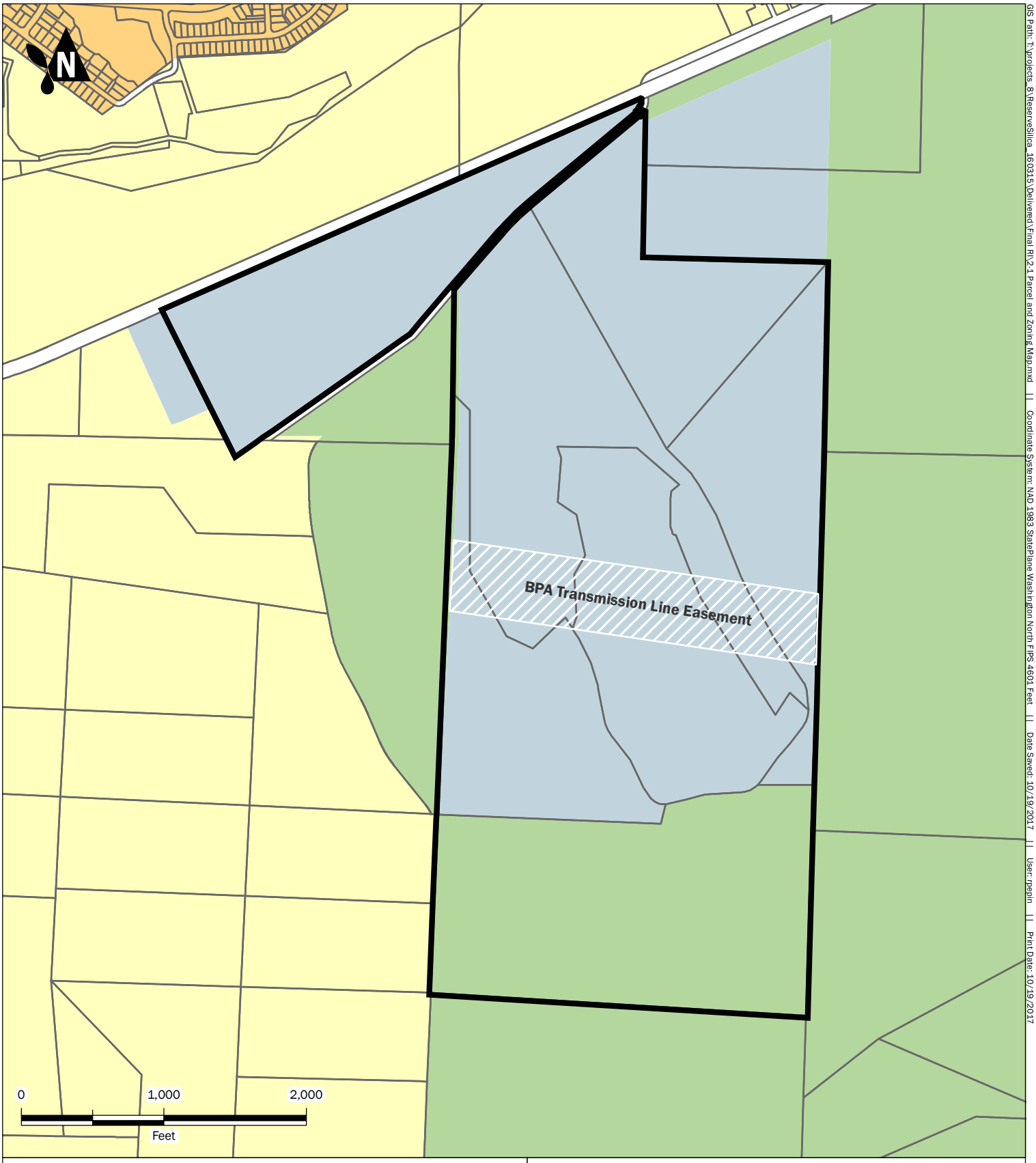
Feet

# Current Conditions

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 1-2 |
| | PROJECT NO. 160315 | REVISED BY: --- | |

*Basemap Layer Credits || Pictometry International Corp. 2015*




**Zoning**

- Forest
- Mineral Resource-Related
- Rural Area
- Single-Family Residential

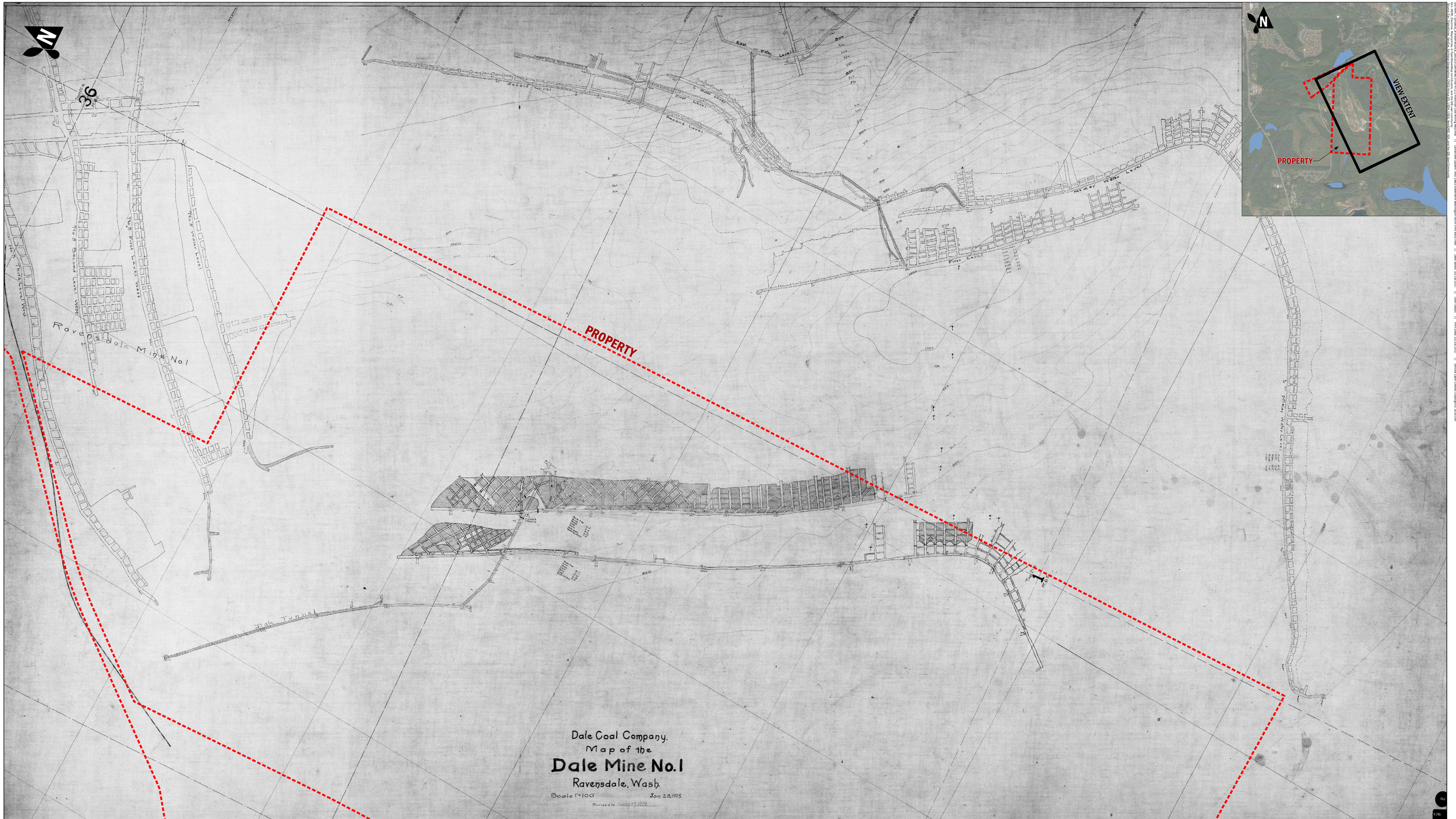
- Property
- Tax Parcel

*Note: Zoning data from King County, July 2016. Updated October 2017 to reflect changes in parcel boundaries.*

# Parcel and Zoning Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect Consulting | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-1 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |




Source: Dale Coal Company, 1931. Not to Scale.

# Historical Coal Mining Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect Consulting | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-2 |
| | PROJECT NO. 160315 | REVISED BY: --- | |


Property

Tax Parcel

0 1,000 2,000

Feet

*Topographic contours/hillshade derived from King County LiDAR, 2003.*

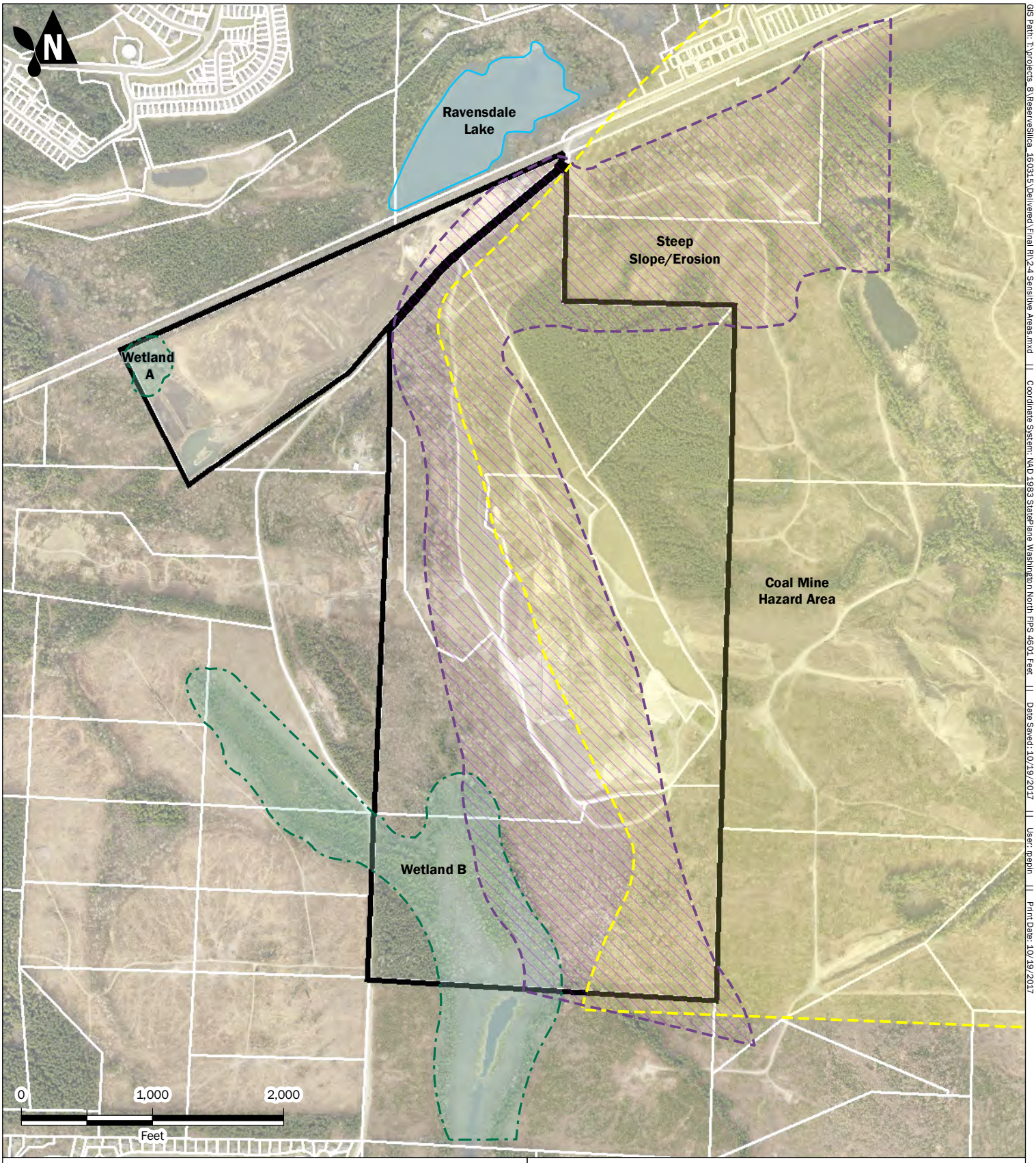
# Topographic Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-3 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

*Basemap Layer Credits || Pictometry International Corp. 2015*

GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\2-3 Topographic Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/19/2017 || User: rpepin || Print Date: 10/19/2017




GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\2-4 Sensitive Areas.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/19/2017 || User: mpin || Print Date: 10/19/2017

**Sensitive Areas**

- Coal Mine Hazard Area
- Steep Slope/Erosion Hazard Area
- Wetland
- Ravensdale Lake

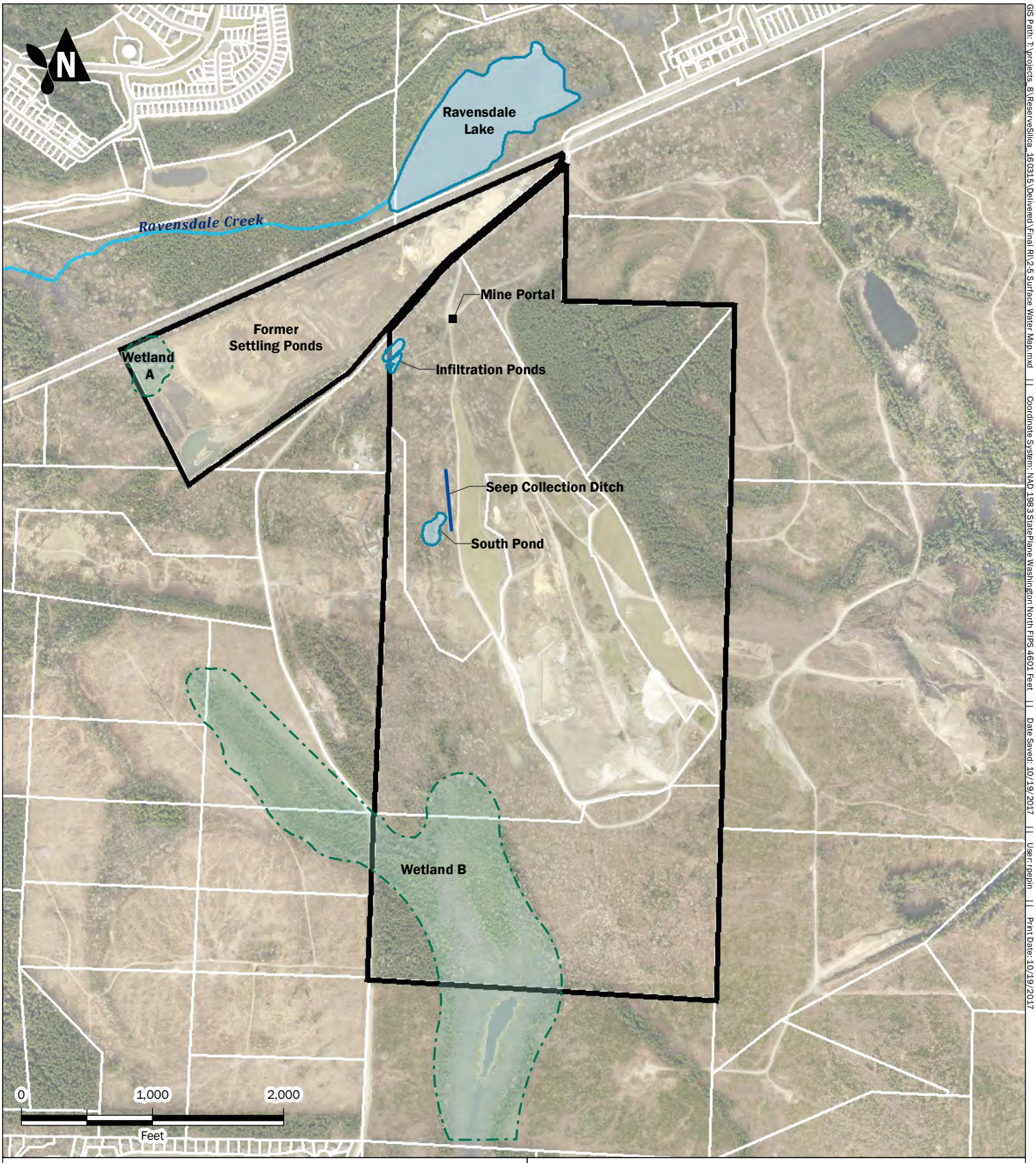
- Property
- Tax Parcel

# Sensitive Areas Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-4 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

*Basemap Layer Credits || Pictometry International Corp. 2015*




Surface Water Feature
Property
Wetland
Tax Parcel
Seep Collection Ditch

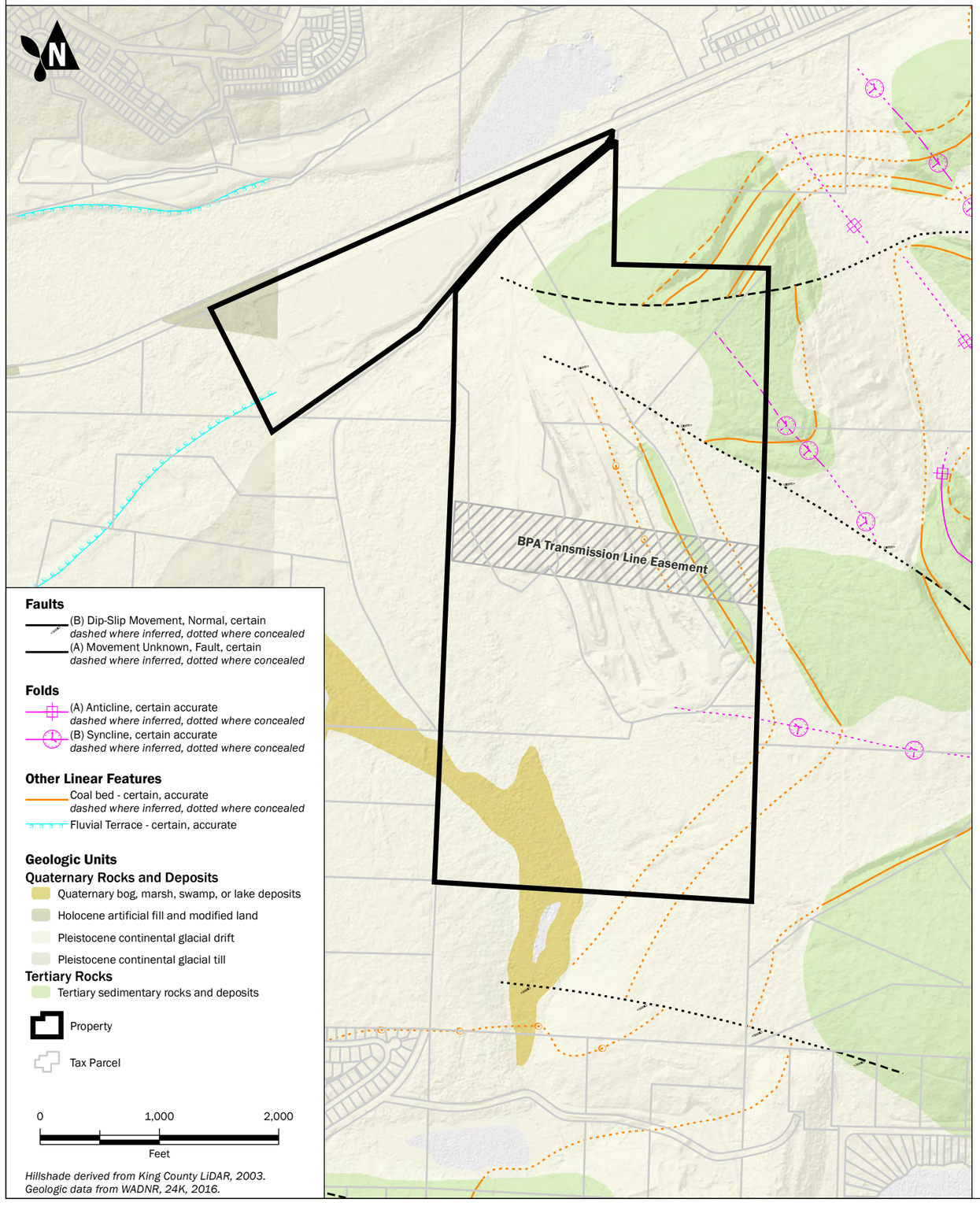
# Surface Water Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-5 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

Basemap Layer Credits || Pictometry International Corp. 2015

## Current Geologic Map




**Faults**

- (B) Dip-Slip Movement, Normal, certain
  *dashed where inferred, dotted where concealed*
- (A) Movement Unknown, Fault, certain
  *dashed where inferred, dotted where concealed*

**Folds**

- (A) Anticline, certain accurate
  *dashed where inferred, dotted where concealed*
- (B) Syncline, certain accurate
  *dashed where inferred, dotted where concealed*

**Other Linear Features**

- Coal bed - certain, accurate
  *dashed where inferred, dotted where concealed*
- Fluvial Terrace - certain, accurate

**Geologic Units**

**Quaternary Rocks and Deposits**

- Quaternary bog, marsh, swamp, or lake deposits
- Holocene artificial fill and modified land
- Pleistocene continental glacial drift
- Pleistocene continental glacial till

**Tertiary Rocks**

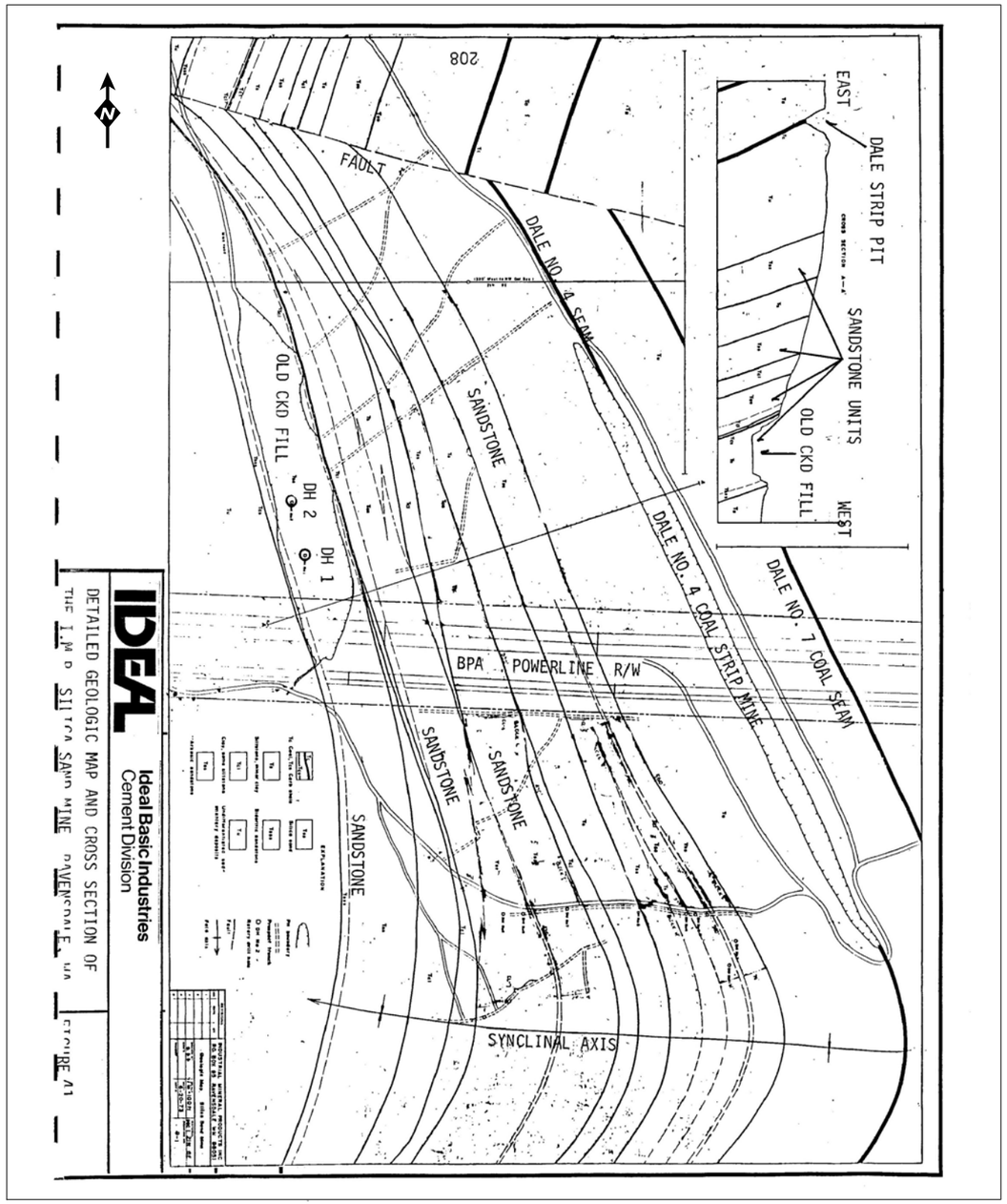
- Tertiary sedimentary rocks and deposits

- Property
- Tax Parcel

0 1,000 2,000
Feet

*Hillshade derived from King County LiDAR, 2003.*
*Geologic data from WADNR, 24K, 2016.*

## 1984 Geologic Map (Ideal)

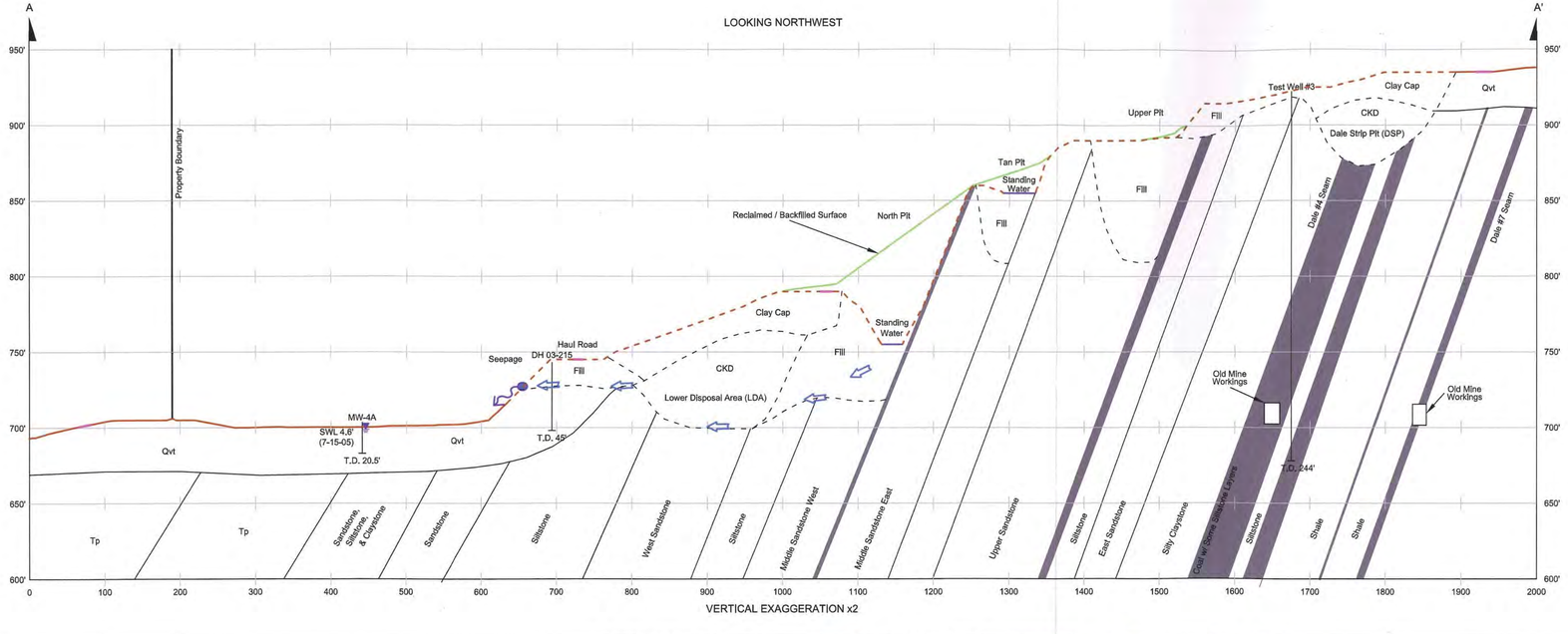



# Geologic Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect Consulting | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-6 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final Ri\2-6 Geologic Map.mxd | | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | | Date Saved: 10/19/2017 | | User: rpepin | | Print Date: 10/19/2017




Geologic Interpretation Based on:
Robinson & Noble, Inc. June 1986
Arcadis Geraghty & Miller July 2005
Reserve Silica Staff November 2003 & July 2005
USGS Water Resources Investigation Report 92-4098

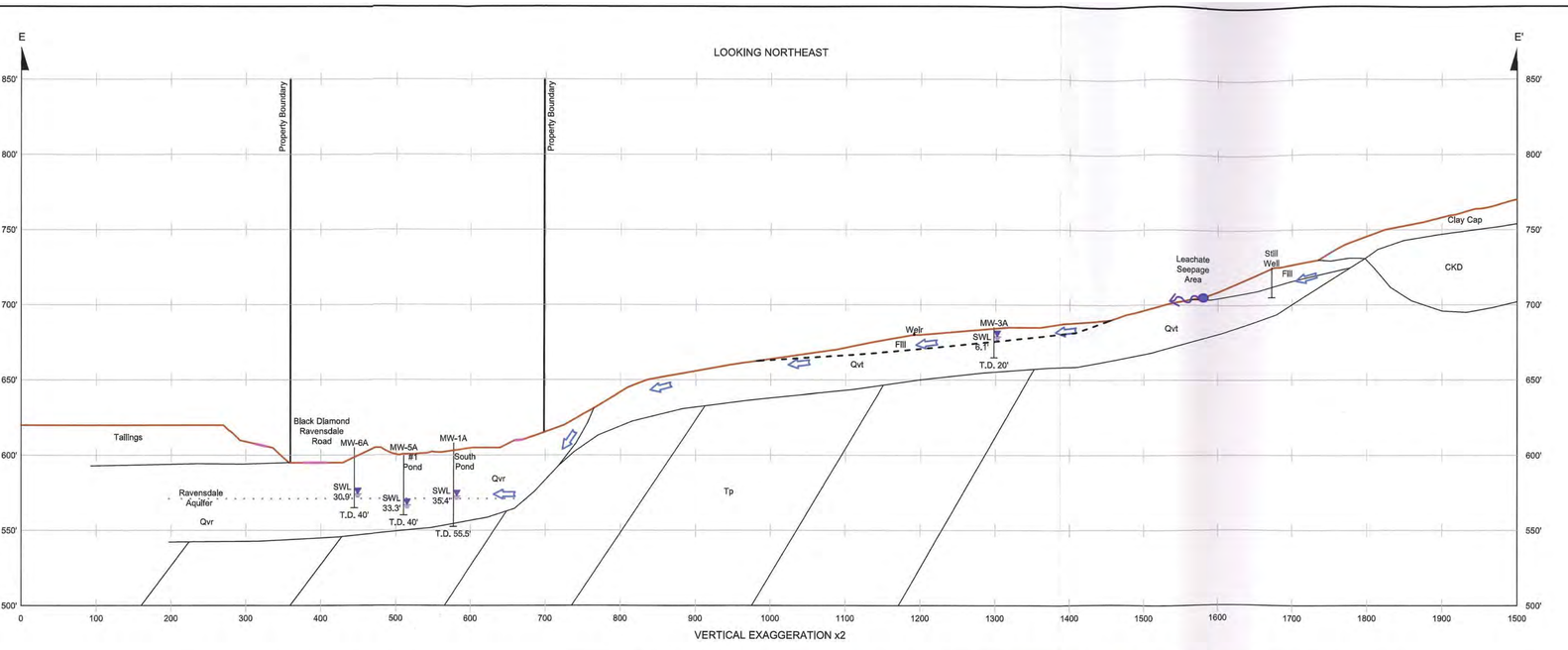
Qva = Vashon Advance Outwash
Qvt = Vashon Lodgement Till
Tp = Puget Group Sediments
= Direction of Ground Water Flow
CKD = Cement Kiln Dust Backfill Material

= Existing Natural Surface
= Existing Modified Surface
= Natural Geologic Contact
= Modified Geologic Contact
= Coal

HORIZONTAL SCALE 1"=100'
VERTICAL SCALE 1"=50'
DESIGNED DATE 11/26/06 BY SHS
DRAWN DATE 11/26/06 BY AA

SubTerra, Inc.®
P.O. Box 520, 218 East North Bend Way, North Bend WA 98045
Telephone: (425) 888-5425 E-mail: SubTerra@subterra.us Fax: (425) 888-2725

Figure 4
Reserve Silica
Ravensdale Project
Cross Section A-A'




Source: Geologic cross sections from SubTerra, Inc, 2005.

Geologic Interpretation Based on:
Robinson & Noble, Inc. June 1986
Arcadis Geraghty & Miller July 2005
Reserve Silica Staff November 2003 & July 2005
USGS Water Resources Investigation Report 92-4098

Qva = Vashon Advance Outwash
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Tp = Puget Group Sediments
= Direction of Ground Water Flow
CKD = Cement Kiln Dust Backfill Material

= Existing Natural Surface
= Existing Modified Surface
= Natural Geologic Contact
= Modified Geologic Contact
= Coal

HORIZONTAL SCALE 1"=100'
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Figure 8
Reserve Silica
Ravensdale Project
Cross Section E-E'

## Geologic Cross Sections

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect Consulting | OCT-2017 | BY: CEB / RAP | FIGURE NO. 2-7 |
| | PROJECT NO. 160315 | REVISED BY: --- | |

N

OU #3 PLANT SITE

WETLAND A/FORMER SETTLING PONDS AREA

PLANT SITE LOT

LOT 6

LOT 1

NATURAL VEGETATION

OU #1: CLOSED LANDFILL

OU #2: INERT WASTE LANDFILL

LDA

Dale Strip Pit

Upper Pit

North Pit

CLOSED LANDFILL

Lower Pit

LOT 4

LOT 5

LOT 2

WETLAND B AREA

NATURAL VEGETATION

LOT 3

**Operable Unit (OU)/Area Designation**

- OU #1: Closed Landfill
- OU #2: Inert Waste Landfill
- OU #3: Plant Site
- Wetland A/Former Settling Ponds Area
- Wetland B Area
- Natural Vegetation

- Historical Coal and/or Sand Mine Pit Extents
- Property
- Tax Parcel

0 250 500
Feet

# Operable Units and Natural Areas Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-1 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

NOTES

1. BASE TOPOGRAPHY OUTSIDE OF LDA FOOTPRINT PREPARED BY AERO-METRIC, INC., SEATTLE, WA FROM AERIAL PHOTOS FLOWN ON FEBRUARY 10, 2007.
   HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 27 US FEET
   VERTICAL DATUM: NGVD 29
   CONTOUR INTERVAL: 5 FT
2. BASE TOPOGRAPHY INSIDE OF LDA FOOTPRINT PREPARED BY PACIFIC GEOMATIC SERVICES, INC., MOUNTLAKE TERRACE, WA FROM FIELD DATA TAKEN ON NOVEMBER 1, 2007.
   HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 27 US FEET
   VERTICAL DATUM: NGVD 29
   CONTOUR INTERVAL: 1 FT
3. BASE TOPOGRAPHY INSIDE OF DSP FOOTPRINT PREPARED BY PARAMETRIX, INC., BELLEVUE, WA FROM FIELD DATA TAKEN ON JULY 6, 2011.
   HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 27 US FEET
   VERTICAL DATUM: NGVD 29
   CONTOUR INTERVAL: 1 FT
4. MONITORING INCLUDES ONLY WATER LEVELS AND FIELD PARAMETERS.

PROPERTY BOUNDARY
MWB-2DSP
MWB-6DSP
DALE STRIP PIT (DSP)
MWB-1SDSP
MWB-1DDSP
MWB-4SDSP
MWB-5DSP
POWER LINES AND TOWERS
Upper Pit
Lower Pit
North Pit
LOWER DISPOSAL AREA (LDA)
INTERCEPTOR TRENCH
DISCHARGE OUTLET
MWB-3LDA
SITE ENTRANCE
PORTAL
STILL WELL
MWB-2LDA
MWB-1LDA
CLEANOUT (TYP)
CONSTRUCTED WETLANDS
WEIR
MW-3A
MW-4A
RAVENSDALE - BLACK DIAMOND RD
MW-1A
MW-2A
SEEP COLLECTION DISCHARGE PIPE
TIGHTLINE DISCHARGE
MW-5A
INFILTRATION PONDS
INFILTRATION #1
PROPERTY BOUNDARY

LEGEND
- COVER AREA
- MW-1A — ALLUVIAL MONITORING WELL
- MWB-1DDSP — BEDROCK MONITORING WELL
- MWB-2DSP — BEDROCK MONITORING WELL (NOTE 4)
- LDA SURFACE WATER SAMPLING LOCATION

- Operable Unit #1: Closed Landfill
- Pit
- Property
- Tax Parcel

*Basemap Source: Golder Associates, 2007.*
*Not to Scale.*

SCALE IN FEET
0 150 300
Feet

# Operable Unit #1
# Closed Landfill Features

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-2
PROJECT NO. 160315 | REVISED BY: ---

HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 27 US FEET
VERTICAL DATUM: NGVD 29
CONTOUR INTERVAL: 5 FT

2. BASE TOPOGRAPHY INSIDE OF LDA FOOTPRINT PREPARED BY PACIFIC GEOMATIC SERVICES, INC., MOUNTLAKE TERRACE, WA FROM FIELD DATA TAKEN ON NOVEMBER 1, 2007.

HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 27 US FEET
VERTICAL DATUM: NGVD 29
CONTOUR INTERVAL: 1 FT

DSP COVER (2010-2011)

Upper Pit

Lower Pit

North Pit

LDA COVER (2007)

INTERCEPTOR TRENCH (2013)

TEST TRENCH NO. 1 (2008)

DROP INLET (2013)

SEEP COLLECTION SYSTEM DISCHARGE PIPE (2015)

SEEPAGE COLLECTION DITCH (2013)

TEST TRENCH NO. 2 (2008)

INFILTRATION PONDS

MW-1LDA
MW-2LDA
MW-3LDA
MW-4LDA
MW-4DSP
MW-5LDA
MW-1A
MW-2A
MW-3A
MW-5A

Operable Unit #1: Closed Landfill
Seep Collection Ditch
Tightline Discharge Pipe
Infiltration Pond
Pit
Property
Tax Parcel

*Basemap Source: Golder Associates, 2016. Not to Scale.*

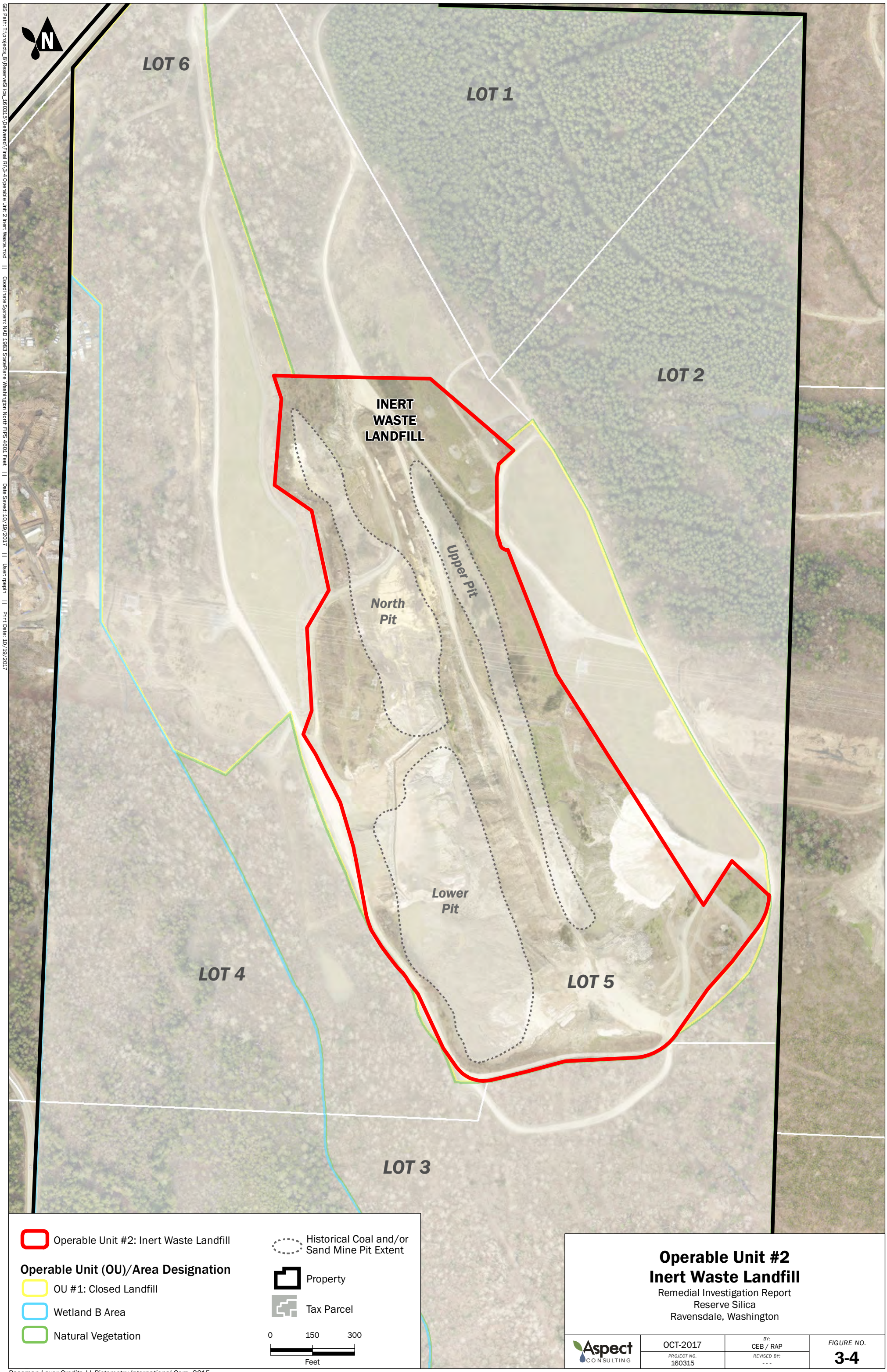
0 110 220
Feet

# Operable Unit #1
# LDA Facilities Layout

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect Consulting | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-3 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

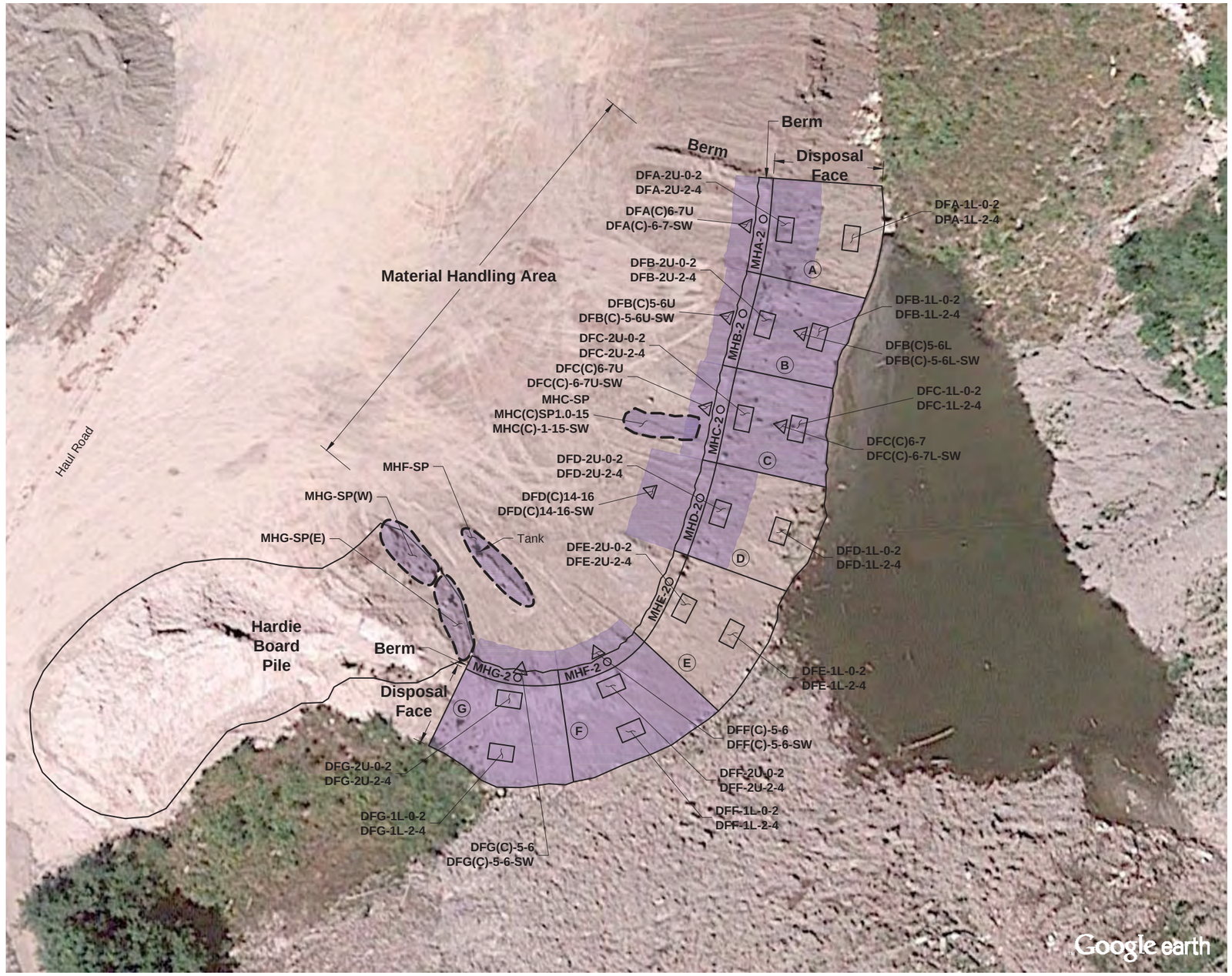
GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final Rpt 3-3 Operable Unit 1 LDA Facilities Layout.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/19/2017 || User: rpapin || Print Date: 10/19/2017




# Operable Unit #2
# Inert Waste Landfill

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-4 |
| | PROJECT NO. 160315 | REVISED BY: --- | |




N

HART CROWSER SOIL SAMPLE DESIGNATION

Disposal Face Samples:

D F G - 1 L - 0 - 2

Disposal Face Grid Lower Depth

Material Handling Berm Samples:

M H G - 2

Material Handling Grid Sample No.

Material Handling Stockpile Samples:

M H G - S P

Material Handling Grid Stockpile

LEGEND

- Confirmation Sample
- Berm Sample
- Grid Sample
- Excavated Soil
- Approximate Stockpile Locations
- (A) Grid Designation

0 30 60

Approximate Scale in Feet

NOTE

Map adapted from observations and measurements in the field. Aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service. Imagery is dated 7-15-2014.

Reserve Silica Inert Landfill
28131 Black Diamond - Ravensdale Road SE
Ravensdale, Washington

**SITE PLAN**

January 2015 21-1-12400-002

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

Source: Shannon & Wilson, Inc. 2015. Not to Scale

# 2014 Corrective Action Sampling Map

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-5 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

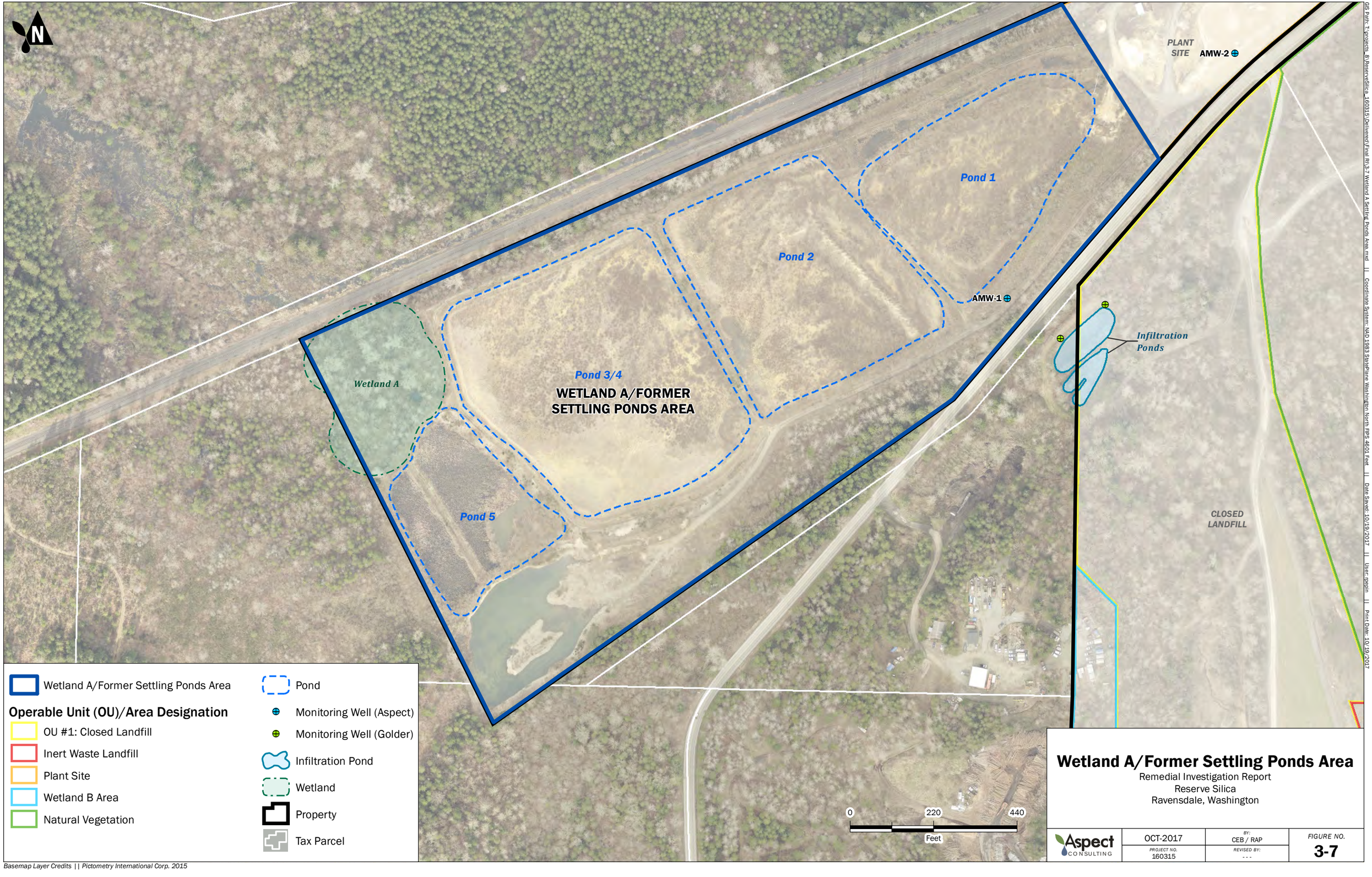

# Operable Unit #3
# Plant Site

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-6 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

Basemap Layer Credits || Pictometry International Corp. 2015

GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\3-6 Operable Unit 3 Plant Site.mxd || Coordinate System: NAD 1983 2011 StatePlane Washington North FIPS 4601 Ft US || Date Saved: 10/19/2017 || User: rpepin || Print Date: 10/19/2017




Wetland A/Former Settling Ponds Area

**Operable Unit (OU)/Area Designation**

- OU #1: Closed Landfill
- Inert Waste Landfill
- Plant Site
- Wetland B Area
- Natural Vegetation

- Pond
- Monitoring Well (Aspect)
- Monitoring Well (Golder)
- Infiltration Pond
- Wetland
- Property
- Tax Parcel

# Wetland A/Former Settling Ponds Area

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 3-7 |
|---|---|---|---|
| | PROJECT NO. 160315 | REVISED BY: --- | |

*Basemap Layer Credits || Pictometry International Corp. 2015*

Ravensdale Lake

AMW-5 585.66
AB-4
AB-3
AMW-4 585.58
AMW-3 585.59
AB-1
AB-2
586
587
588
AMW-2 588.39
589
590
AMW-1 590.46
Infiltration Ponds

0 180 360
Feet

**AMW-2** Well Name
**588.39** Groundwater Elevation (ft, NAVD88)
Groundwater Elevation Contour
*based on 4/6/17 depth to water measurements*
*dashed where inferred*
Groundwater Flow Direction
Boring
Monitoring Well (Aspect)
Monitoring Well (Golder)

**Operable Unit (OU)/Area Designation**
OU #1: Closed Landfill
OU #3: Plant Site
Wetland A/Former Settling Ponds Area
Natural Vegetation
Property
Tax Parcel

# Groundwater Elevation Map
# Plant Site Investigation

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | NOV-2017 | BY: CEB / RAP | FIGURE NO. 4-1 |
| | PROJECT NO. 160315 | REVISED BY: EAC | |

*Basemap Layer Credits || Pictometry International Corp. 2015*

GIS Path: T:\projects_8\ReserveSilica_160315\Delivered\Final RI\4-1 Groundwater Elevation - Plant Site Area.mxd || Coordinate System: NAD 1983 2011 StatePlane Washington North FIPS 4601 Ft US || Date Saved: 11/14/2017 || User: ecumbaker || Print Date: 11/14/2017

AB-5 (702.63)

AB-6 (709.48)

AB-7 (717.69)

AB-8 (723.62)

AB-9 (724.84)

AB-10 (731.25)

AB-11 (731.19)

AB-12 (741.77)

CLOSED LANDFILL

LDA

INERT WASTE LANDFILL

North Pit

LOWER HAUL ROAD

Exploration Name → AB-12 (741.77) ← Surface Elevation (ft, NAVD88)

Boring (Aspect)

Historical Coal and/or Sand Mine Pit Extent

Property

Tax Parcel

**Operable Unit (OU)/Area Designation**

OU #1: Closed Landfill

OU #2: Inert Waste Landfill

Natural Vegetation

*Note: Boring surface elevation estimated from King County LiDAR, 2003.*

0 50 100

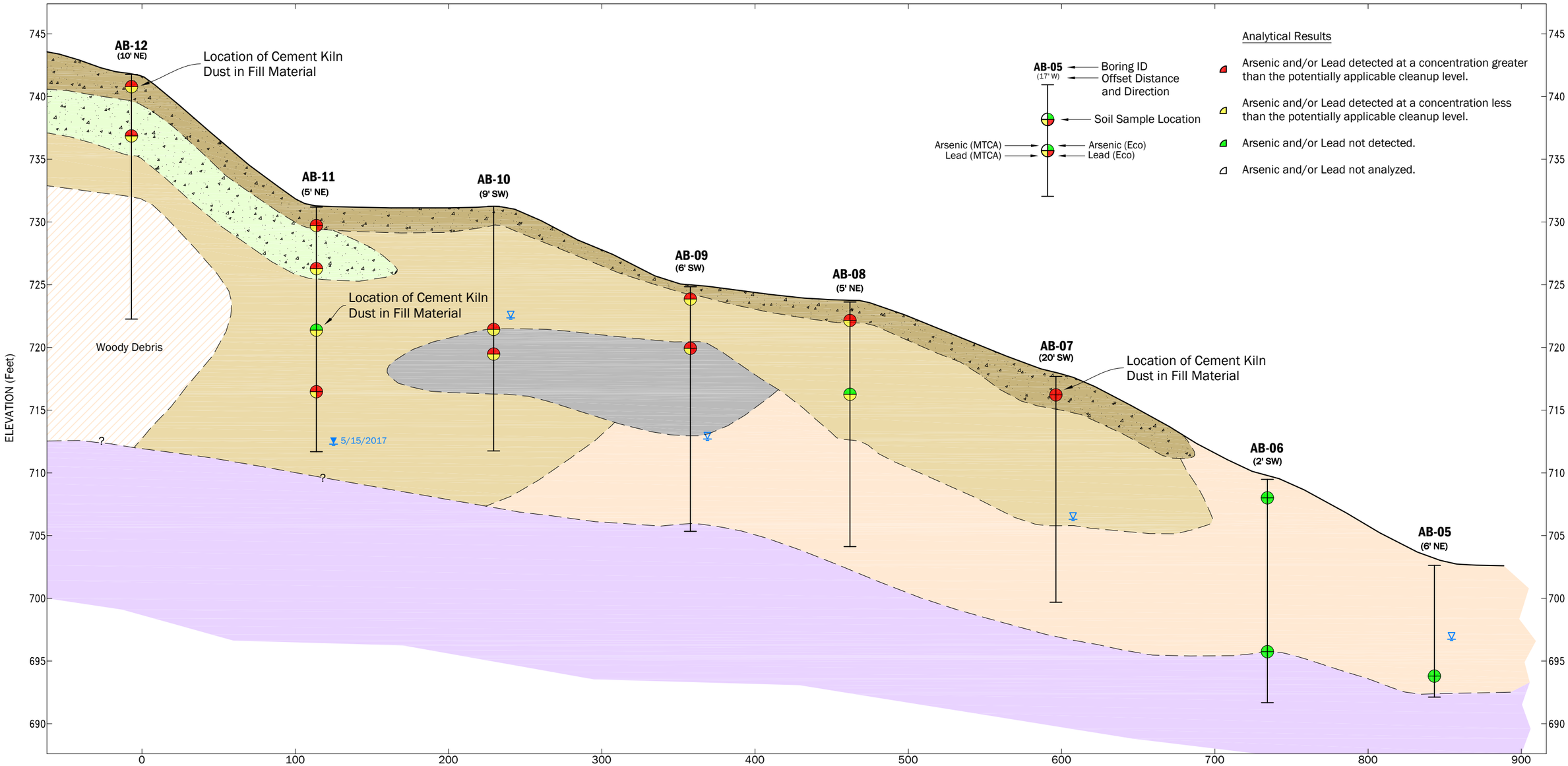
Feet

# Lower Haul Road Investigation Locations

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | OCT-2017 | BY: CEB / RAP | FIGURE NO. 4-2 |
| | PROJECT NO. 160315 | REVISED BY: EAC | |

**A** South — North **A'**




AB-05 (17' W) ← Boring ID; Offset Distance and Direction

Soil Sample Location

Arsenic (MTCA) / Lead (MTCA) ← Arsenic (Eco) / Lead (Eco)

Analytical Results

- Arsenic and/or Lead detected at a concentration greater than the potentially applicable cleanup level.
- Arsenic and/or Lead detected at a concentration less than the potentially applicable cleanup level.
- Arsenic and/or Lead not detected.
- Arsenic and/or Lead not analyzed.

**Fill**

- Sand and gravel, contains variable amounts of silt, mixed with slag fragments (GP/SP)
- Silty sand or sandy silt, mixed with gravel, coal fragments, organic material, woody debris and brick fragments (SM/ML)
- Slightly silty sand, orange-yellow, medium to coarse grained, mixed with coal fragments and woody debris, variable silt and gravel (SP)
- Sand or silty sand, dark-colored with coal and slag fragments (SP/SM)
- Silty gravel and silty sand with coal fragments fining downward (GM/SM)

**Native**

- Bedrock, glacial till, or wetland material

- Depth to Groundwater at Time of Drilling
- Depth to Groundwater (5/15/17)
- Estimated Fill/Native Soils Contact
- Fill Horizons Contain Slag

Horizontal Scale: 1" = 65'
Vertical Scale: 1" = ~8'
Vertical Exaggeration 8x

0 — 65 — 130 Feet

*This figure is intended to be reproduced in color. If it is not details may be omitted.*

# Geologic Cross Section A-A'

Remedial Investigation Report
Reserve Silica
Ravensdale, Washington

Aspect Consulting

| | | | |
|---|---|---|---|
| | Nov-2017 | BY: KB/SCC | FIGURE NO. 4-3 |
| PROJECT NO. 160315 | | REVISED BY: - | |

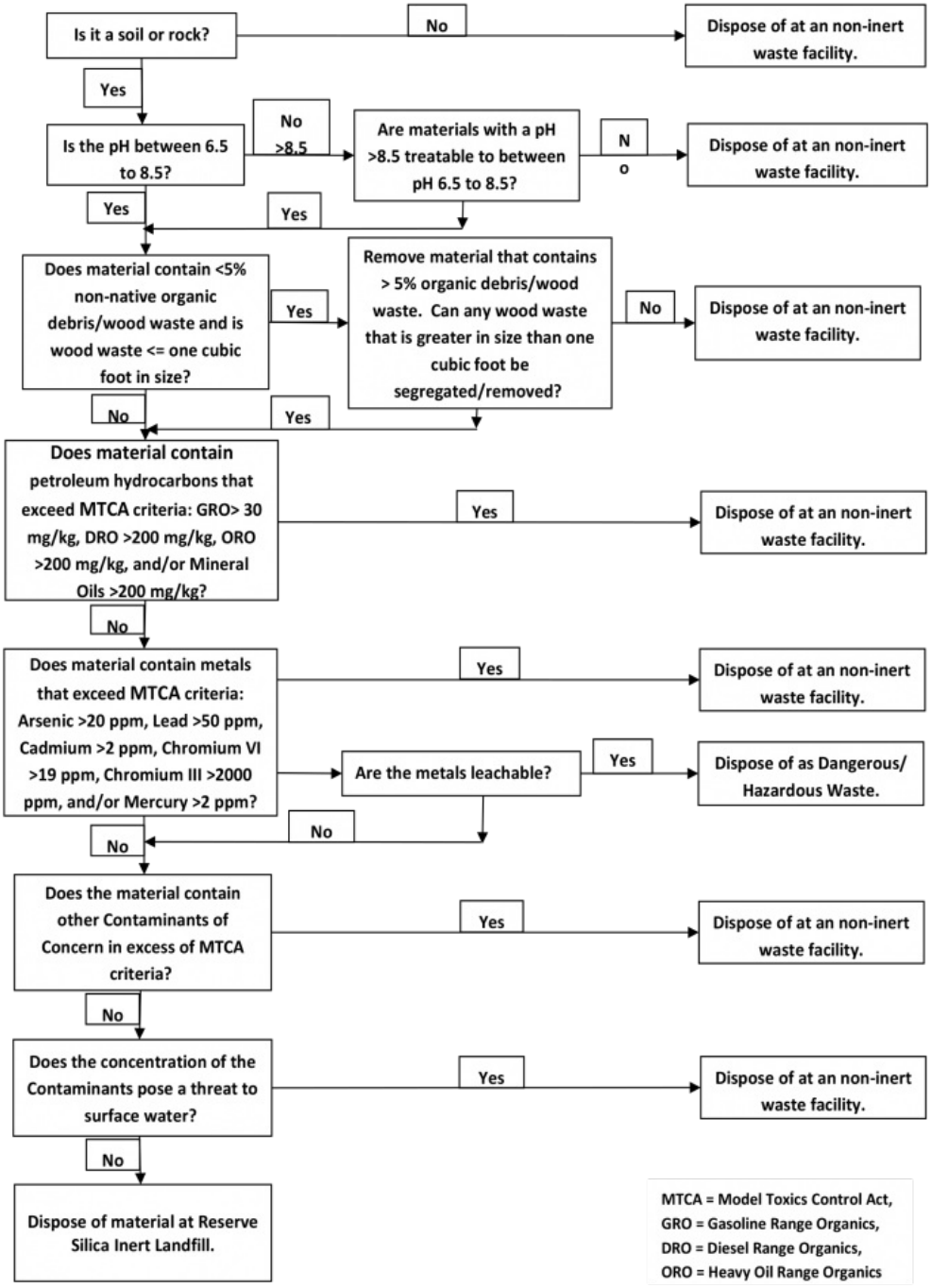
CAD Path: Q:\Reserve Silica\160315 Ravensdale RIFS\2017-10 RI Report\160315-AA.dwg Section A-A' || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Nov 14, 2017 3:25pm || User:scudd

# APPENDIX A

# Inert Waste Landfill Decision Tree

# Decision Tree | Reserve Silica Corporation

reservesilica.com/decision-tree/



# APPENDIX B

# Bibliography of Closed Landfill Environmental Reports

# APPENDIX B

# Bibliography of Closed Landfill Environmental Reports

# B. Closed Landfill Reports

Metropolitan Engineers, Consulting Engineers. 1972. Final Report Geologic and Hydrologic Conditions Sludge Disposal Site(s) Near Ravensdale, Washington. Prepared for Municipality of Metropolitan Seattle, King County, Washington. September 1972.

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# APPENDIX C

## Property Environmental Reports of Significance (on CD)

These reports are provided separately.
Title pages are retained.

MUNICIPALITY OF METROPOLITAN SEATTLE

King County, Washington



# FINAL REPORT
# GEOLOGIC AND HYDROLOGIC CONDITIONS
# SLUDGE DISPOSAL SITE(S)
# NEAR RAVENSDALE, WASHINGTON

This report is provided separately

September, 1972

Metropolitan Engineers, Consulting Engineers
100 West Harrison
Seattle, Washington
98119

Row Free

This agreement is provided separately

# CEMENT KILN DUST STORAGE
# AND
# INDEMNIFICATION AGREEMENT

THIS AGREEMENT is made this 28th day of September, 1984 between Ideal Basic Industries, Inc., a Colorado company, doing business through its Cement Division's Pacific Region, 3030 One Union Square, 600 University Street, Seattle, Washington 98101 ("Ideal"), and Industrial Mineral Products, Inc., a WASHINGTON corporation, P.O. Box 95, Ravensdale, Washington 98051 ("IMP").

## Recitals

0.1 IMP has been disposing of cement kiln dust generated by Ideal's Seattle plant in a disposal site at Ravensdale, Washington pursuant to P.O. No. C015-056 dated June 1, 1984. Such disposal has heretofore been made by IMP under a Solid Waste Permit issued to IMP by the Seattle-King County Health Department.

0.2 Under the new regulations promulgated by the State of Washington, Department of Ecology, governing the handling of dangerous wastes and made effective July 27, 1984, cement kiln dust is no longer excluded from regulation.

0.3 As a result, the Seattle-King County Department of Public Health informed IMP in a letter dated September 6, 1984 (I) that it no longer had jurisdiction over cement kiln dust; (II) that a Solid Waste Permit was not appropriate for disposal of cement kiln dust; and (III) that it could not issue a Special Disposal Site Permit. A copy of said

**ROBINSON & NOBLE, INCORPORATED**
GROUND WATER & ENVIRONMENTAL GEOLOGISTS
5915 ORCHARD STREET WEST
TACOMA, WASHINGTON 98467
(206) 475-7711

# HYDROGEOLOGY AND GEOCHEMISTRY
# OF
# INDUSTRIAL MINERAL PRODUCTS
# DALE #4 STRIP PIT

April, 1985

This report is provided separately

**ROBINSON & NOBLE, INCORPORATED**
GROUND WATER & ENVIRONMENTAL GEOLOGISTS
5915 ORCHARD STREET WEST
TACOMA, WASHINGTON 98467
(206) 475-7711

# RESULTS OF DRILLING
# TEST WELLS 3 & 4
# AT THE
# DALE #4 STRIP PIT

**June, 1986**

This report is provided separately

HOLNAM

# PRELIMINARY INVESTIGATION
# RESERVE SILICA PROPERTY
# RAVENSDALE, WASHINGTON

## Prepared for:
## Preston Gates & Ellis, LLP
## Seattle, WA

This report is provided separately

## August, 2000


## Prepared By:
## Tacoma Environmental Sciences, Inc.
## Tacoma, WA

# Revised
# Geology and Ground Water Report
# Reserve Silica Mine
# Ravensdale Washington

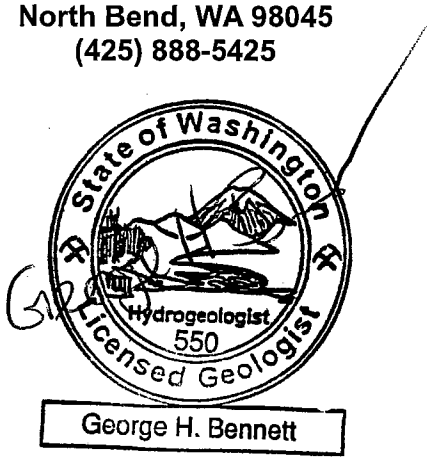
This report is provided separately

**Prepared for:**

## Reserve Silica Corp.

**Prepared by:**


## SubTerra, Inc.
**P. O. Box 520**
**North Bend, WA 98045**
**(425) 888-5425**


**June 28, 2006**
**Project No. 2003-23**

REPORT

# LOWER DISPOSAL AREA HYDROGEOLOGICAL INVESTIGATIONS

## RAVENSDALE SITE

## 28131 Ravensdale-Black Diamond Road Ravensdale, Washington 98051

This report is provided separately

**Submitted To:** Mr. Joel Bolduc
Holcim (US) Inc.
1170 Transit Dr.
Colorado Springs, CO 80903

**Submitted By:** Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA

**Distribution:**

| | |
|---|---|
| 1 Copy | Holcim (US) Inc. |
| 3 Copies | Golder Associates Inc. |

**June 11, 2013** **073-93074-04.0500**

A world of capabilities delivered locally

Golder Associates

# APPENDIX D

# 2017 Remedial Investigation Boring and Well Construction Logs

| | | | | |
|---|---|---|---|---|
| Coarse-Grained Soils - More than 50% [1] Retained on No. 200 Sieve | Gravels - More than 50% [1] of Coarse Fraction Retained on No. 4 Sieve | ≦5% Fines [5] | GW | Well-graded gravel and gravel with sand, little to no fines |
| | | | GP | Poorly-graded gravel and gravel with sand, little to no fines |
| | | ≧15% Fines [5] | GM | Silty gravel and silty gravel with sand |
| | | | GC | Clayey gravel and clayey gravel with sand |
| | Sands - 50% [1] or More of Coarse Fraction Passes No. 4 Sieve | ≦5% Fines [5] | SW | Well-graded sand and sand with gravel, little to no fines |
| | | | SP | Poorly-graded sand and sand with gravel, little to no fines |
| | | ≧15% Fines [5] | SM | Silty sand and silty sand with gravel |
| | | | SC | Clayey sand and clayey sand with gravel |
| Fine-Grained Soils - 50% [1] or More Passes No. 200 Sieve | Silts and Clays Liquid Limit Less than 50 | | ML | Silt, sandy silt, gravelly silt, silt with sand or gravel |
| | | | CL | Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay |
| | | | OL | Organic clay or silt of low plasticity |
| | Silts and Clays Liquid Limit 50 or More | | MH | Elastic silt, clayey silt, silt with micaceous or diato-maceous fine sand or silt |
| | | | CH | Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel |
| | | | OH | Organic clay or silt of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat, muck and other highly organic soils |

## Terms Describing Relative Density and Consistency

| | Density | SPT [2] blows/foot |
|---|---|---|
| Coarse-Grained Soils | Very Loose | 0 to 4 |
| | Loose | 4 to 10 |
| | Medium Dense | 10 to 30 |
| | Dense | 30 to 50 |
| | Very Dense | >50 |
| | **Consistency** | **SPT [2] blows/foot** |
| Fine-Grained Soils | Very Soft | 0 to 2 |
| | Soft | 2 to 4 |
| | Medium Stiff | 4 to 8 |
| | Stiff | 8 to 15 |
| | Very Stiff | 15 to 30 |
| | Hard | >30 |

**Test Symbols**

FC = Fines Content
GS = Grain Size
MC = Moisture Content
AL = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

## Component Definitions

| Descriptive Term | Size Range and Sieve Number |
|---|---|
| Boulders | Larger than 12" |
| Cobbles | 3" to 12" |
| Gravel | 3" to No. 4 (4.75 mm) |
| Coarse Gravel | 3" to 3/4" |
| Fine Gravel | 3/4" to No. 4 (4.75 mm) |
| Sand | No. 4 (4.75 mm) to No. 200 (0.075 mm) |
| Coarse Sand | No. 4 (4.75 mm) to No. 10 (2.00 mm) |
| Medium Sand | No. 10 (2.00 mm) to No. 40 (0.425 mm) |
| Fine Sand | No. 40 (0.425 mm) to No. 200 (0.075 mm) |
| Silt and Clay | Smaller than No. 200 (0.075 mm) |

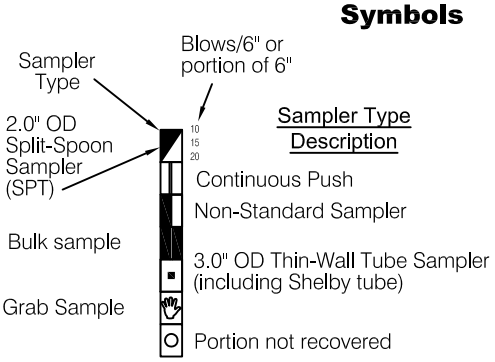
## [3] Estimated Percentage

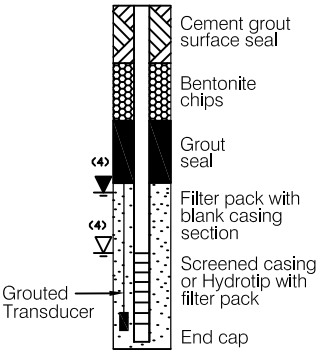
| Percentage by Weight | Modifier |
|---|---|
| <5 | Trace |
| 5 to 15 | Slightly (sandy, silty, clayey, gravelly) |
| 15 to 30 | Sandy, silty, clayey, gravelly) |
| 30 to 49 | Very (sandy, silty, clayey, gravelly) |

## Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

## Symbols




(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater — ATD = At time of drilling; Static water level (date); BGS = below ground surface
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect consulting earth+water
www.aspectconsulting.com
a limited liability company

# Exploration Log Key

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:
PROJECT NO.
FIGURE NO.
D-1

Q:_ACAD Standards\Standard Details\Exploration Log Key C1.dwg

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, W of transformer | | *Coordinates (est)*<br>E:1352921 N:129498 (est) | *Exploration Number*<br>**AB-01** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev.*<br>NA | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/30/2017 | *Top of Casing Elev.*<br>NA | *Depth to Water (Below GS)*<br>7.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | **FILL**<br>Loose, moist, yellow-orange SAND (SP); fine to medium sand | 0 |
| | | | AB-1-2.5 | | SPT= 3,5,4<br>PID= 0.2<br>Sheen= Slight | | **COAL TAILINGS**<br>Loose, moist, black coal tailings; coarse to medium sand size | |
| 5 | | | AB-1-5.0 | | SPT= 2,1,1<br>PID= 0.2<br>Sheen= None | | Bits of wood | 5 |
| | | ▽ 3/30/2017 | AB-1-7.5 | NWTPH-Dx, BTEX, cPAH, Napthalene | SPT= 1,1,2<br>PID= 0.2<br>Sheen= None | | **RECENT LACUSTRINE DEPOSITS**<br>Very soft, wet, brown sandy SILT (ML); abundant woody debris, fine sand | |
| 10 | | Backfilled with bentonite chips | AB-1-10.0 | | SPT= 10,12,16<br>PID= 0.2<br>Sheen= None | | **GLACIAL TILL**<br>Medium dense, wet, gravelly, slightly silty SAND (SW-SM); fine, subrounded gravel, fine to medium sand | 10 |
| | | | AB-1-12.5 | | SPT= 7,15,14<br>PID= 0.2<br>Sheen= None | | Medium dense, wet, gray, sandy slightly silty GRAVEL (GW-GM) interbedded with coarse silty SAND (SM); coarsening downward | |
| 15 | | | AB-1-15.0 | | SPT= 7,15,18<br>PID= 0.2<br>Sheen= None | | | 15 |
| 16.5 | | | | | | | Bottom of exploration at 16.5 ft. bgs. | |
| 20 | | | | | | | | 20 |

**Legend**

Sample Method: ◪ Split Barrel 2" X 1.375" (SPT)

Water Level: ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-01**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, S of transformer | | *Coordinates (est)*<br>E:1351782 N:128982 (est) | *Exploration Number*<br>**AB-02** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev.*<br>NA | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/30/2017 | *Top of Casing Elev.*<br>NA | *Depth to Water (Below GS)*<br>6' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | **FILL**<br>Loose, moist, yellow-orange SAND (SP); fine to medium sand | 0 |
| | | | AB-2-2.5 | | SPT= 7,6,5<br>PID= 1.8<br>Sheen= Slight | | | |
| | | | | | | | **COAL TAILINGS**<br>Loose, moist, black coal tailings; coarse sand size, strong odor of mothballs | |
| 5 | | ▽ 3/30/2017 | AB-2-5.0 | | SPT= 2,1,1<br>PID= 0.1<br>Sheen= Slight | | | 5 |
| | | | AB-2-7.5 | NWTPH-Dx, BTEX, cPAH, Napthalene | SPT= 0,1,1<br>PID= 0.1<br>Sheen= Slight | | **RECENT LACUSTRINE DEPOSITS**<br>Very soft, wet, brown, sandy SILT (ML); trace fine gravel, trace organics | |
| 10 | | Backfilled with bentonite chips | AB-2-10.0 | | SPT= 11,19,16<br>PID= 0.1<br>Sheen= None | | **RECESSIONAL OUTWASH**<br>Medium dense, wet, brown, silty, sandy GRAVEL (GW) | 10 |
| | | | AB-2-12.5 | | SPT= 4,5,6<br>PID= 0.1<br>Sheen= None | | Loose, wet, gray, slightly gravelly silty SAND (SM); fine gravel, coarse to medium sand, some fining downward | |
| 15 | | | AB-2-15.0 | | SPT<br>PID= 0.1<br>Sheen= None | | Loose, wet, gray, silty, sandy GRAVEL (GW); fine, subrounded gravel, trace coarse gravel, coarse sand | 15 |
| 20 | | | | | | | Bottom of exploration at 16.5 ft. bgs. | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-02**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, S side of fuel shed | | *Coordinates (est)*<br>E:1353367 N:129702 (est) | *Exploration Number*<br>**AB-03** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev.*<br>NA | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/29/2017 | *Top of Casing Elev.*<br>NA | *Depth to Water (Below GS)*<br>7.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | **FILL**<br>Dense, moist, gray, gravelly slightly silty SAND (SW-SM); coarse gravel, fine, medium, and coarse sand | 0 |
| | | | AB-3-2.5 | NWTPH-Dx, NWTPH-Gx w/ BTEX, RCRA 8 | SPT= 16,10,11<br>PID= <1<br>Sheen= Slight | | Loose, moist, yellow-orange silty SAND (SM); iron-oxide stained sand | |
| | | | | | | | **COAL TAILINGS**<br>Loose, moist, black coal interbedded with orange silty SAND (SM); coarse sand size coal tailings | |
| 5 | | | AB-3-5.0 | | SPT= 5,7,6,<br>PID= <1<br>Sheen= None | | | 5 |
| | | ▽ 3/29/2017 | | | | | **RECESSIONAL OUTWASH**<br>Loose, wet, gray, sandy slightly silty GRAVEL (GW-GM); coarse gravel, medium to coarse sand | |
| | | | AB-3-7.5 | | SPT= 5,10,12<br>Sheen= None | | | |
| | | | | | | | Loose, wet, gray, slightly silty GRAVEL (GW); coarse to fine gravel | |
| 10 | | Backfilled with bentonite chips | AB-3-10.0 | | SPT= 3,3,5 | | | 10 |
| | | | AB-3-12.5 | | SPT= 7,9,13 | | | |
| | | | | | | | Loose, wet, gray silty SAND (SM); medium to coarse sand, trace coarse gravel | |
| 15 | | | AB-3-15.0 | | SPT= 7,11,13<br>PID= <1<br>Sheen= None | | | 15 |
| | | | | | | | Bottom of exploration at 16.5 ft. bgs. | |
| 20 | | | | | | | | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◩ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-03**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, E of fuel shed | | *Coordinates (est)*<br>E:1353395 N:129737 (est) | *Exploration Number*<br>**AB-04** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev.*<br>NA | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/29/2017 | *Top of Casing Elev.*<br>NA | *Depth to Water (Below GS)*<br>8.25' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | AB-4-2.5 | NWTPH-Dx, NWTPH-Gx w/ BTEX, RCRA 8 | SPT= 4,11,16<br>PID= <1<br>Sheen= None | | **TOPSOIL**<br>Topsoil | |
| | | | | | | | **FILL**<br>Medium dense, moist, orange silty SAND (SM) interbedded with coal tailings; fine to medium sand, iron-oxide weathered | |
| 5 | | | AB-4-5.0 | | SPT= 5,6,5<br>PID= <1<br>Sheen= None | | **COAL TAILINGS**<br>Loose, moist, black coal tailings; coarse sand size | 5 |
| | | | AB-4-7.5 | | SPT= 1,1,6<br>PID= <1<br>Sheen= None | | | |
| | | ▽ 3/29/2017 | | | | | **RECENT LACUSTRINE DEPOSITS**<br>Soft, wet, brown-orange, sandy SILT (ML); trace gravel | |
| 10 | | Backfilled with bentonite chips | AB-4-10.0 | | SPT= 8,11,9<br>PID= <1<br>Sheen= None | | **RECESSIONAL OUTWASH**<br>Loose, moist, gray, sandy, slightly silty GRAVEL (GW-GM); coarse gravel, medium to coarse sand | 10 |
| | | | AB-4-12.5 | | SPT= 4,5,8 | | | |
| 15 | | | AB-4-15.0 | | SPT= 5,5,8<br>PID= <1<br>Sheen= None | | | 15 |
| | | | | | | | Bottom of exploration at 16.5 ft. bgs. | |
| 20 | | | | | | | | 20 |

**Legend**

Sample Method: ◪ Split Barrel 2" X 1.375" (SPT)

Water Level: ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-04**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; E side of road | | *Coordinates (est)*<br>E:1352855 N:127898 (est) | *Exploration Number*<br>**AB-05** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>702.6296'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/15/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>6' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | PID= 0.2<br>Blows (non-SPT)= 27,39,20<br>Sheen= Slight | | **FILL**<br>Dense, moist, brown, slightly silty SAND (SW-SM); fine to coarse gravel, medium to coarse sand, with brick fragments, slight odor of mothballs | |
| | | | | | PID= 0.0<br>SPT= 6,6,6<br>Sheen= None | | | |
| | 700 | | | | PID= 4.4<br>Blows (non-SPT)= 3,5,9<br>Sheen= Slight | | Bits of charcoal; no more coarse gravel | |
| 5 | | | | | PID= 0.1<br>SPT= 11,6,7<br>Sheen= None | | Dense, moist, brown, gravelly silty SAND (SM); subrounded gravel | 5 |
| | | ▽ 5/15/2017 | | | | | Dense, moist, brown, gravelly, sandy SILT (ML); pockets of iron-oxide weathering | |
| | | | | | PID= 0.1<br>Blows (non-SPT)= 9,12,19<br>Sheen= None | | Hard, wet, brown-gray, slightly gravelly silty SAND (SM); fine to medium sand | |
| | 695 | Backfilled with hydrated bentonite chips | | | Blows (non-SPT)= 50/6" | | | |
| | | | AB-05-9.0 | Total Pb, Total As, SPLP Pb, SPLP As | PID= 0.1<br>Blows (non-SPT)= 47,50/3"<br>Sheen= None<br>PID= 0.1<br>SPT= 50/4" | | Dense, wet to moist, brown, gravelly, sandy SILT (ML) | |
| 10 | | | | | | | | 10 |
| | | | | | | | Bottom of exploration at 10.5 ft. bgs.<br><br>Note: Refusal on bedrock or concrete at 10.5' bgs | |
| | 690 | | | | | | | |
| 15 | | | | | | | | 15 |
| | 685 | | | | | | | |
| 20 | | | | | | | | 20 |
| | 680 | | | | | | | |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ▮ Split Barrel 3" X 2.375" (Mod Cal)
- ◪ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-05**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; E side of road | | *Coordinates (est)*<br>E:1352875 N:127789 (est) | *Exploration Number*<br>**AB-06** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>709.4823'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/15/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>7.25' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | AB-06-1.5 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 39,41,22<br>PID= 0.2<br>Sheen= None | | **FILL**<br>Dense, moist, brown, gravelly, silty slightly silty SAND (SW-SM) interbedded with sandy SILT (ML); with brick and coal fragments | |
| | | | | | PID= 0.2<br>SPT= 6,12,14<br>Sheen= Slight | | | |
| | | | | | PID= 0.2<br>Blows (non-SPT)= 12,14,8<br>Sheen= Slight | | | |
| | 705 | | | | PID= 0.2<br>SPT= 5,1,1<br>Sheen= Organic | | Soft, moist, brown, sandy SILT (ML); abundant organics, with coal and charcoal fragments, trace fine gravel | |
| 5 | | | | | PID= 0.2<br>Blows (non-SPT)= 1,2,6<br>Sheen= Organic | | | 5 |
| | | ▽ 5/15/2017 | | | | | Medium dense, moist, brown, gravelly silty SAND (SM); pockets of iron-oxide weathering, fine to coarse gravel | |
| | | | | | PID= 0.2<br>Blows (non-SPT)= 2,12,14<br>Sheen= Organic | | | |
| | 700 | | | | PID= 0.2<br>Blows (non-SPT)= 7,8,13<br>Sheen= None | | Hard, moist to wet, brown-orange gravelly, sandy SILT (ML); pockets of iron-oxide weathering, fine to coarse subrounded gravel, medium to coarse sand | |
| 10 | | Backfilled with hydrated bentonite chips | | | PID= 0.2<br>SPT= 14,48,50<br>Sheen= None | | | 10 |
| | | | | | PID= 0.2<br>Blows (non-SPT)= 50/4"<br>Sheen= None | | Dense, moist, brown, gravelly, silty SAND (SM); fine to coarse gravel, medium to coarse sand, with brick and coal fragments | |
| | | | | | PID= 0.2 | | | |
| | 695 | | AB-06-14.0 | Total Pb, Total As, SPLP Pb, SPLP As | SPT= 50/5"<br>Sheen= Slight | | **GLACIAL TILL**<br>Dense, moist, dark gray silty SAND (SM); medium to coarse sand, trace fine gravel | |
| 15 | | | | | PID= 0.2<br>SPT= 28,50/1" | | | 15 |
| | | | | | | | Dense, moist, dark gray, gravelly silty SAND (SM); fine to coarse gravel, medium to coarse sand | |
| | | | | | Blows (non-SPT)= 25,50/5" | | | |
| | | | | | | | Bottom of exploration at 17.8 ft. bgs.<br><br>Note: pH of groundwater grab sample =7.58 | |
| | 690 | | | | | | | |
| 20 | | | | | | | | 20 |
| | 685 | | | | | | | |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ▮ Split Barrel 3" X 2.375" (Mod Cal)
- ◪ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-06**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; E side of road | | *Coordinates (est)*<br>E:1352896 N:127651 (est) | *Exploration Number*<br>**AB-07** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>717.6884'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/15/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>11.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | AB-07-1.5 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 38,22,29<br>PID= 0.1<br>Sheen= None | | **FILL**<br>Dense, moist, brown, gravelly slightly silty SAND (SW-SM); fine to coarse gravel, some cement kiln dust, fine gravel-sized slag | |
| | | | | | SPT= 26,11,6<br>PID= 0.2<br>Sheen= None | | | |
| | 715 | | | | Blows (non-SPT)= 9,11,8<br>PID= 0.2<br>Sheen= None | | Medium dense, moist, orange-yellow, slightly silty SAND (SP); charcoal fragments, medium to coarse sand | |
| 5 | | | | | SPT= 2,3,3<br>PID= 0.2<br>Sheen= None | | | 5 |
| | | | | | Blows (non-SPT)= 3,5,6<br>PID= 0.2<br>Sheen= None | | Contains some coarse, subrounded gravel | |
| | 710 | | | | Blows (non-SPT)= 2,3,4<br>PID= 0.2<br>Sheen= None | | | |
| | | | | | SPT= 2,3,5<br>PID= 0.2<br>Sheen= None | | | |
| 10 | | Backfilled with hydrated bentonite chips<br>▽ 5/15/2017 | | | SPT= 1,2,3<br>PID= 0.2<br>Sheen= None | | Interbedded coarse white sand | 10 |
| | | | | | SPT= 4,3,4<br>PID= 0.2<br>Sheen= None | | Abundant woody debris | |
| | 705 | | | | | | Soft, moist, green-brown, slightly gravelly, silty SAND (SM); subrounded, fine gravel | |
| | | | | | Blows (non-SPT)= 5,9,18<br>PID= 0.2<br>Sheen= None | | | |
| 15 | | | | | PID= 0.2<br>Sheen= None | | Dense, moist, orange-brown, sandy SILT (ML); pockets of iron-oxide weathering, coal fragments | 15 |
| | | | | | Blows (non-SPT)= 9,18,32 | | | |
| | 700 | | | | | | Bottom of exploration at 18 ft. bgs.<br><br>Note: pH of groundwater grab sample =6.79 | |
| 20 | | | | | | | | 20 |
| | 695 | | | | | | | |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ▮ Split Barrel 3" X 2.375" (Mod Cal)
- ◪ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-07**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; W side of road | | *Coordinates (est)*<br>E:1352874 N:127517 (est) | *Exploration Number*<br>**AB-08** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>723.6216'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/15/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>No Water Encountered |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | AB-08-1.5 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 15,17,15<br>PID= 0.2<br>Sheen= None | | **FILL**<br>Dense, moist, brown, gravelly, slightly silty SAND (SW-SM); fine to coarse gravel, fine, medium, and coarse sand, gravel-sized slag fragments | 0 |
| | | | | | SPT= 10,9,6<br>PID= 0.2<br>Sheen= None | | Medium dense, moist, orange-beige slightly silty SAND (SP); medium to coarse sand, trace fine gravel, trace woody debris and coal fragments | |
| | 720 | | | | SPT= 5,5,5<br>PID= 0.2<br>Sheen= None | | | |
| 5 | | | | | Blows (non-SPT)= 5,5,5<br>PID= 0.2<br>Sheen= None | | | 5 |
| | | | | | Blows (non-SPT)= 6,8,9<br>PID= 0.2<br>Sheen= None | | Medium dense, moist, orange-brown silty SAND (SM); abundant coal fragments | |
| | | | AB-08-7.5 | Total Pb, Total As, SPLP Pb, SPLP As | SPT= 2,3,4<br>PID= 0.2<br>Sheen= None | | Medium dense, moist, orange-beige slightly silty SAND (SP); medium to coarse sand, trace fine gravel, trace woody debris and coal fragments | |
| | 715 | | | | SPT= 2,3,3<br>PID= 0.2<br>Sheen= None | | | |
| 10 | | Backfilled with hydrated bentonite chips | | | Blows (non-SPT)= 4,4,4<br>PID= 0.2<br>Sheen= None | | | 10 |
| | | | AB-08-11.5 | | | | Medium dense, moist, green-brown silty SAND (SM); abundant woody debris, coal fragments, and brick fragments | |
| | | | | | SPT= 3,3,2<br>PID= 0.2<br>Sheen= None | | | |
| | 710 | | | | SPT= 2,2,2<br>PID= 0.2<br>Sheen= None | | | |
| 15 | | | | | Blows (non-SPT)= 3,4,4<br>PID= 0.2<br>Sheen= None | | Abundant coal fragments | 15 |
| | | | | | SPT= 3,3,4<br>PID= 0.2<br>Sheen= None | | Becomes more organic-rich | |
| | | | | | PID= 0.2<br>Sheen= Organic | | | |
| | 705 | | AB-08-18.0 | | | | | |
| 20 | | | | | | | Bottom of exploration at 19.5 ft. bgs. | 20 |
| | 700 | | | | | | | |

**Legend**

Sample Method
- No Soil Sample Recovery
- Split Barrel 3" X 2.375" (Mod Cal)
- Split Barrel 2" X 1.375" (SPT)

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-08**

Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; center of road | | *Coordinates (est)*<br>E:1352887 N:127413 (est) | *Exploration Number*<br>**AB-09** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>724.8403'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/16/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>12.25' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | AB-09-1.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 48,28,27<br>PID= 0.1<br>Sheen= None | | **FILL**<br>Dense, moist, gray-brown, silty, sandy slightly silty GRAVEL (GP-GM); fine to coarse gravel, medium to coarse sand | |
| | | | | | SPT= 16,11,17<br>PID= 0.3<br>Sheen= None | | Dense, moist, orange, slightly silty, gravelly SAND (SW); fine to coarse gravel, fine gravel-sized slag, medium to coarse sand | |
| | | | AB-09-3.0 | | Blows (non-SPT)= 5,7,11<br>PID= 30.7<br>Sheen= Slight | | | |
| 5 | 720 | | AB-09-5.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 19,27,27<br>PID= 0.5<br>Sheen= None | | Loose, moist, white SAND (SP); coarse sand, strong odor of mothballs, coal fragments | 5 |
| | | | | | Blows (non-SPT)= 10,11,5<br>PID= 0.4<br>Sheen= None | | Dense, moist, gray-brown sandy, silty GRAVEL (GM) interbedded with loose, moist, orange and white SAND (SP); coal fragments | |
| | | | | | SPT= 4,4,4<br>PID= 0.4<br>Sheen= None | | Loose, moist, yellow-gray silty SAND (SM); medium to coarse sand | |
| | | | | | SPT= 8,9,10<br>PID= 0.4<br>Sheen= None | | Interbeds of white coarse sand, small bits of coal | |
| 10 | 715 | Backfilled with hydrated bentonite chips | | | Blows (non-SPT)= 5,6,9<br>PID= 0.4<br>Sheen= None | | | 10 |
| | | ▽ 5/15/2017 | | | SPT= 2,2,2<br>PID= 0.3<br>Sheen= None | | Loose, wet, yellow-brown silty SAND (SM) interbedded with medium dense, wet, yellow, organic-rich SAND (SP); fine to medium sand, coal fragments and wood debris, exhibits rapid dilatency | |
| | | | | | SPT= 1,1,1<br>PID= 0.3<br>Sheen= None | | | |
| 15 | 710 | | | | Blows (non-SPT)= 1,1,1<br>PID= 0.3<br>Sheen= None | | **QUATERNARY WETLAND**<br>Very soft, wet, brown silty SAND (SM); organic-rich, fine to medium sand | 15 |
| | | | | | SPT= 1,1,1<br>PID= 0.3<br>Sheen= None | | | |
| | | | AB-09-18.0 | | SPT= 1,1,2<br>PID= 0.3<br>Sheen= None | | Very soft, wet, brown PEAT (PT); fine to medium sand | |
| 20 | 705 | | | | | | Bottom of exploration at 19.5 ft. bgs. | 20 |
| | 700 | | | | | | | |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- Split Barrel 3" X 2.375" (Mod Cal)
- Split Barrel 2" X 1.375" (SPT)
- Split Barrel 3.25" X 2.375" (D&M)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-09**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; center E of road | | *Coordinates (est)*<br>E:1352892 N:127284 (est) | *Exploration Number*<br>**AB-10** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>731.2477'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/16/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>9' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Blows (non-SPT)= 48,42,47<br>PID= 0.3<br>Sheen= None | | **FILL**<br>Dense, moist, gray, gravelly, silty slightly silty SAND (SW-SM); gravel-sized slag fragments | |
| | 730 | | AB-10-1.5 | | SPT= 12,10,9<br>PID= 0.3<br>Sheen= None | | Medium dense, moist, orange, gravelly, silty SAND (SP) interbedded with white SAND (SP); fine to coarse gravel, with sandstone gravel | |
| | | | | | Blows (non-SPT)= 5,5,9<br>PID= 0.3<br>Sheen= Slight | | | |
| 5 | | | AB-10-5.0 | | Blows (non-SPT)= 6,6,7<br>PID= 3.3<br>Sheen= Slight | | | 5 |
| | 725 | | | | Blows (non-SPT)= 4,6,7<br>PID= 0.3<br>Sheen= None | | | |
| | | | | | SPT= 3,2,3<br>PID= 0.4<br>Sheen= Slight | | | |
| | | ▽ 5/15/2017 | | | Blows (non-SPT)= 2,3,2<br>PID= 0.4<br>Sheen= None | | | |
| 10 | | Backfilled with hydrated bentonite chips | AB-10-10.0 | Total Pb, Total As, SPLP Pb, SPLP As | | | | 10 |
| | 720 | | | | SPT= 2,3,5<br>PID= 0.4<br>Sheen= None | | Medium dense, moist, gray, slightly gravelly silty SAND (SM); abundant coal fragments, fine, medium, and coarse sand, fining downward | |
| | | | | | Blows (non-SPT)= 9,8,12<br>PID= 0.4<br>Sheen= None | | Medium dense, moist, gray SAND (SP); clean with coal fragments | |
| | | | AB-10-12.0 | Total Pb, Total As, SPLP Pb, SPLP As | | | Medium dense, moist, gray, slightly gravelly silty SAND (SM); abundant coal fragments, fine, medium, and coarse sand, fining downward | |
| | | | | | Blows (non-SPT)= 4,10,12,<br>PID= 0.4<br>Sheen= None | | | |
| 15 | | | | | SPT= 12,11,11<br>PID= 0.4<br>Sheen= None | | Dense, moist, orange-beige, silty SAND (SM) interbedded with white SAND (SP); coal fragments, medium to coarse sand | 15 |
| | 715 | | | | Blows (non-SPT)= 8,10,11<br>PID= 0.4<br>Sheen= None | | Brick and coal fragments | |
| | | | AB-10-18.0 | | Blows (non-SPT)= 2,5,6<br>PID= 0.4<br>Sheen= None | | | |
| 20 | | | | | | | Bottom of exploration at 19.5 ft. bgs. | 20 |
| | 710 | | | | | | | |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ▮ Split Barrel 3" X 2.375" (Mod Cal)
- ◪ Split Barrel 2" X 1.375" (SPT)
- ▮ Split Barrel 3.25" X 2.375" (D&M)

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-10**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; center W of road | | *Coordinates (est)*<br>E:1352881 N:127169 (est) | *Exploration Number*<br>**AB-11** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>731.1889'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/16/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>19' (Static) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | 730 | | AB-11-1.5 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 32,36,27<br>PID= 0.3<br>Sheen= None | | **FILL**<br>Dense, moist, gray-brown, silty, sandy GRAVEL (GW); includes coarse gravel-sized slag, mixed with coal fragments and some orange sand | 0 |
| | | | | | Blows (non-SPT)= 14,12,8<br>PID= 0.3<br>Sheen= None | | Medium dense, moist, orange slightly silty SAND (SP) interbedded with white SAND (SP); trace fine gravel, medium to coarse sand | |
| | | | | | Blows (non-SPT)= 7,7,4<br>PID= 0.3<br>Sheen= Organic | | Soft, moist, black, silty SAND (SM); primarily coal fragments, trace fine gravel | |
| 5 | | | AB-11-5.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 42,22,27<br>PID= 0.3<br>Sheen= Organic | | Dense, moist, gray-black silty SAND (SM) interbedded with orange SAND (SP); mixture of slag fragments and coal fragments | 5 |
| | 725 | | | | Blows (non-SPT)= 6,8,9<br>PID= 0.3<br>Sheen= None | | Medium dense, moist, orange, slightly silty SAND (SP) interbedded with white SAND (SP); coal fragments | |
| | | | | | Blows (non-SPT)= 9,7,22<br>PID= 0.3<br>Sheen= None | | Interbedded white sand up to 4" thick<br>Interbedded coal up to 6" thick | |
| 10 | | Backfilled with hydrated bentonite chips | | | Blows (non-SPT)= 48,42,12<br>PID= 0.3<br>Sheen= None | | | 10 |
| | 720 | | AB-11-10.0 | | Blows (non-SPT)= 15,13,10<br>PID= 0.3<br>Sheen= None | | Interbedded cement kiln dust up to 4" thick | |
| | | | | | Blows (non-SPT)= 1,2,2<br>PID= 0.3<br>Sheen= None | | | |
| | | | | | Blows (non-SPT)= 4,9,16<br>PID= 0.3<br>Sheen= Organic | | Medium dense, moist, orange SAND (SP) interbedded with gray SILT (ML); trace coarse gravel, coal fragments | |
| 15 | | | AB-11-15.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 9,16,12<br>PID= 0.3<br>Sheen= None | | | 15 |
| | 715 | | | | Blows (non-SPT)= 8,12,10<br>PID= 0.3<br>Sheen= None | | | |
| | | ▼ 5/15/2017 | AB-11-18.0 | | Blows (non-SPT)= 4,7,10<br>PID= 0.3<br>Sheen= None | | | |
| 20 | 710 | | | | | | Bottom of exploration at 19.5 ft. bgs.<br>Note: pH of groundwater grab sample =12.67 | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ▮ Split Barrel 3" X 2.375" (Mod Cal)
- ◪ Split Barrel 2" X 1.375" (SPT)
- ▮ Split Barrel 3.25" X 2.375" (D&M)

Water Level
- ▼ Static Water Level

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-11**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Environmental Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road; W side of road by pullout | | *Coordinates (est)*<br>E:1352878 N:127048 (est) | *Exploration Number*<br>**AB-12** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>741.7656'(est) | |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>5/16/2017 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>No Water Encountered |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | AB-12-1.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 48,39,28<br>PID= 0.4<br>Sheen= None | | **FILL**<br>Dense, moist, brown slightly silty GRAVEL (GP-GM) | 0 |
| | | | | | | | Dense, moist, black, silty SAND (SM); contains bits of slag, coal, and sandstone | |
| | 740 | | | | SPT= 13,11,11<br>PID= 0.4<br>Sheen= None | | Soft, dry, white Fill; cement kiln dust | |
| | | | | | SPT= 6,10,6<br>PID= 0.4<br>Sheen= None | | Dense, moist, black, silty SAND (SM); contains bits of slag, coal, and sandstone | |
| 5 | | | AB-12-5.0 | Total Pb, Total As, SPLP Pb, SPLP As | Blows (non-SPT)= 2,6,10<br>PID= 0.4<br>Sheen= None | | | 5 |
| | 735 | | | | SPT= 3,6,10<br>PID= 0.4<br>Sheen= None | | Medium dense, moist, orange, slightly silty SAND (SP) interbedded with coarse, white SAND (SP); bits of coal | |
| | | | | | SPT= 2,4,5<br>PID= 0.4<br>Sheen= None | | Some interbeds of gray, silty sand with wood fragments | |
| | | | AB-12-10.0 | | Blows (non-SPT)= 9,7,10<br>PID= 0.4<br>Sheen= Organic | | | |
| 10 | | Backfilled with hydrated bentonite chips | | | | | Loose, moist, brownish-black WOODY DEBRIS Fill | 10 |
| | 730 | | | | Blows (non-SPT)= 5,10,13<br>PID= 0.4<br>Sheen= Organic | | | |
| | | | AB-12-13.0 | | SPT= 3,5,6<br>PID= 0.4<br>Sheen= Organic | | | |
| | | | | | Blows (non-SPT)= 9,9,12<br>PID= 2.1<br>Sheen= Organic | | | |
| 15 | | | | | SPT= 6,6,5<br>PID= 8.4<br>Sheen= Organic | | | 15 |
| | 725 | | | | SPT= 4,5,6<br>PID= 4.8<br>Sheen= Organic | | | |
| | | | AB-12-18.0 | | Blows (non-SPT)= 5,6,5<br>PID= 9.1<br>Sheen= Organic | | | |
| 20 | | | | | | | Bottom of exploration at 19.5 ft. bgs. | 20 |
| | 720 | | | | | | | |

**Legend**

Sample Method
- No Soil Sample Recovery
- Split Barrel 3" X 2.375" (Mod Cal)
- Split Barrel 2" X 1.375" (SPT)
- Split Barrel 3.25" X 2.375" (D&M)

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AB-12**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, SW corner of property, N of road | | *Coordinates (SPN NAD83 ft)*<br>E:1352199 N:128518 | *Exploration Number*<br>**AMW-1** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>607.64' | Ecology Well Tag No.<br>BJU-268 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/28/2017 to 4/4/2017 | *Top of Casing Elev. (NAVD88)*<br>610.85' | *Depth to Water (Below GS)*<br>35' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | 610 | ~3' standing monument with surrounding protective steel bollards | | | | | | 0 |
| | | Concrete monument seal | | | | | **TOPSOIL**<br>Topsoil | |
| | | | | | | | **MINING SLOUGH**<br>Wet, loose, rusty-brown, slightly sandy GRAVEL (GW); fine gravel, fine, medium, and coarse sand | |
| 5 | 605 | | AMW-1-2.5 | | SPT= 16,21,16<br>PID= 0.0<br>Sheen= None | | Loose, moist, orange-brown sandy GRAVEL (GW); fine to coarse gravel, fine, medium, and coarse sand | 5 |
| | | | AMW-1-5.0 | | SPT= 4,7,7<br>PID= 0.0<br>Sheen= None | | Soft, moist, tan, clayey SAND (SC); medium sand | |
| 10 | 600 | Hydrated bentonite chips | AMW-1-7.5 | | | | | 10 |
| | | | AMW-1-10.0 | | SPT= 1,1,1<br>PID= 0.0<br>Sheen= None | | Soft, moist, tan CLAY (CH); high plasticity, some organics and charcoal | |
| | | | | | | | Soft, moist, tan, silty CLAY (CL) interbedded with shiny, medium-coarse silty SAND (SM) | |
| 15 | 595 | | AMW-1-12.5 | | SPT= 0,0,3<br>PID= 0.0<br>Sheen= Slight | | | 15 |
| | | | AMW-1-15.0 | | SPT= 0,0,1<br>PID= 0.0<br>Sheen= None | | Soft, wet, tan CLAY (CH) | |
| 20 | 590 | ▼ 4/6/2017 | AMW-1-20.0 | | SPT= 3,2,3<br>PID= 0.0<br>Sheen= None | | **COAL TAILINGS**<br>Loose, moist, black coal; coal in form of tailings, medium to coarse sand size | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◩ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▼ Static Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB/ALC
Approved by: CEB 6/1/2017

**Exploration Log AMW-1**

Sheet 1 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, SW corner of property, N of road | | *Coordinates (SPN NAD83 ft)*<br>E:1352199 N:128518 | *Exploration Number*<br>**AMW-1** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>607.64' | Ecology Well Tag No.<br>BJU-268 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/28/2017 to 4/4/2017 | *Top of Casing Elev. (NAVD88)*<br>610.85' | *Depth to Water (Below GS)*<br>35' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 25 | 585 | 10/20 silica sand filter pack<br>0.020" screen slot<br>3/28/2017 | AMW-1-25.0 | | SPT= 2,2,3<br>PID= 0.0<br>Sheen= None | | **COAL TAILINGS**<br>Loose, moist, black coal; coal in form of tailings, medium to coarse sand size (continued) | 25 |
| 30 | 580 | | AMW-1-30.0 | | SPT= 2,4,5<br>PID= 0.0<br>Sheen= None | | **RECENT LACUSTRINE DEPOSITS**<br>Loose, moist, brown-gray silty SAND (SM); fine to medium sand, abundant organic material<br>Medium hard, moist to wet CLAY (CH); trace fine sand | 30 |
| 35 | 575 | | AMW-1-35.0 | | SPT= 3,6,16<br>PID= 0.0<br>Sheen= Slight | | **RECESSIONAL OUTWASH**<br>Dense, wet, gray, sandy GRAVEL (GW); coarse gravel | 35 |
| 40 | 570 | | AMW-1-40.0 | | SPT= 16,50/5"<br>PID= 0.0<br>Sheen= None | | Bottom of exploration at 41.5 ft. bgs.<br><br>Note: Original AMW-1 well was decommissioned due to failed initial well construction; new AMW-1 reset on 4/4/2017 | 40 |
| 45 | 565 | | | | | | | 45 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◩ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▼ Static Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB/ALC
Approved by: CEB 6/1/2017

**Exploration Log AMW-1**
Sheet 2 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, NW of intersection on S side of property | | *Coordinates (SPN NAD83 ft)*<br>E:1352798 N:129163 | *Exploration Number*<br>**AMW-2** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>597.51' | Ecology Well Tag No.<br>BJU-269 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/28/2017 | *Top of Casing Elev. (NAVD88)*<br>600.38' | *Depth to Water (Below GS)*<br>9.1' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | 600 | ~3' standing monument with surrounding protective steel bollards | | | | | | |
| 0 | | Concrete monument seal | | | | | **FILL**<br>Dense, slightly moist, red-brown gravelly, SAND (SW); fine to coarse gravel, fine, medium, and coarse sand | 0 |
| | 595 | | AMW-2-2.5 | | SPT= 20,25,20<br>PID= 0.0<br>Sheen= None | | Medium dense, slightly moist, red-brown silty SAND (SM); trace fine gravel | |
| 5 | | Hydrated bentonite chips | AMW-2-5.0 | | SPT= 12,11,10<br>PID= 0.0<br>Sheen= Slight | | **COAL TAILINGS**<br>Loose, moist, black coal interbedded with medium hard, wet, silty CLAY (CL); coal in form of tailing, coarse to medium sand size range | 5 |
| | 590 | | AMW-2-7.5 | | SPT= 2,2,2 | | | |
| | | ▽ 3/28/2017 Same depth on 4/6/17 | | | | | | |
| 10 | | 10/20 silica sand filter pack | AMW-2-10.0 | | SPT= 1,2,1<br>PID= 0.0<br>Sheen= Slight | | **RECENT ALLUVIAL DEPOSITS**<br>Loose, wet, gray silty SAND (SM); fine to medium sand, trace fine gravel, exhibits rapid dilatency | 10 |
| | 585 | 0.010" screen slot | AMW-2-12.5 | | SPT= 1,1,1<br>PID= 0.0<br>Sheen= None | | **RECENT LACUSTRINE DEPOSITS**<br>Soft, wet, gray sandy SILT (ML); fine sand | |
| 15 | | | AMW-2-15.0 | | SPT= 9,12,10<br>PID= 0.0<br>Sheen= None | | | 15 |
| | 580 | | | | | | **RECESSIONAL OUTWASH**<br>Loose, wet, brown-black silty SAND (SM); fine to medium sand | |
| 20 | | | AMW-2-20.0 | | SPT= 5,10,10<br>PID= 0.0<br>Sheen= Slight | | Loose, wet, brown-black GRAVEL (GP); coarse, subrounded gravel | 20 |
| | | | | | | | Bottom of exploration at 21.5 ft. bgs. | |

**Legend**

Sample Method: ◪ Split Barrel 2" X 1.375" (SPT)

Water Level: ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AMW-2**

Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, S of sediment lab, middle of road | | *Coordinates (SPN NAD83 ft)*<br>E:1352950 N:129534 | *Exploration Number*<br>**AMW-3** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>591.46' | Ecology Well Tag No.<br>BJU-270 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/29/2017 | *Top of Casing Elev. (NAVD88)*<br>591.11' | *Depth to Water (Below GS)*<br>10.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Concrete | |
| | | | | | | | **FILL**<br>Loose, gravelly silty SAND (SM) | |
| | 590 | 8" flush-mount steel monument<br>Concrete monument seal<br>Hydrated bentonite chips | AMW-3-2.5 | | SPT= 3,2,2<br>PID= <1<br>Sheen= None | | **COAL TAILINGS**<br>Loose, moist, black coal tailings; coarse to medium sand size | |
| 5 | | 4/6/2017 | AMW-3-5.0 | | SPT= 1,1,1<br>PID= <1<br>Sheen= Slight | | | 5 |
| | 585 | | | | | | **RECENT LACUSTRINE DEPOSITS**<br>Very soft, wet, brown, sandy SILT (ML); trace fine gravel, trace woody debris | |
| | | 10/20 silica sand filter pack<br>0.010" screen slot | AMW-3-7.5 | NWTPH-Dx, BTEX, cPAH, Napthalene | SPT= 0,0,1<br>PID= <1<br>Sheen= None | | | |
| 10 | | 3/29/2017 | AMW-3-10.0 | | SPT= 3,7,9<br>PID= <1<br>Sheen= None | | | 10 |
| | 580 | | | | | | **RECESSIONAL OUTWASH**<br>Loose, wet, brown, sandy slightly silty GRAVEL (GW-GM); coarse gravel | |
| | | | AMW-3-12.5 | | SPT= 5,13,13<br>PID= <1<br>Sheen= Slight | | Loose, wet, gray, gravelly slightly silty SAND (SW-SM) | |
| | | | | | | | Loose, wet, gray-brown silty, sandy GRAVEL (GW); fine to coarse gravel, medium to coarse sand | |
| 15 | | | AMW-3-15.0 | | SPT= 7,18,21<br>PID= <1<br>Sheen= Slight | | | 15 |
| | 575 | | | | | | | |
| 20 | | | AMW-3-20.0 | | SPT= 18,50/3"<br>PID= <1<br>Sheen= Slight | | | 20 |
| | 570 | | | | | | Bottom of exploration at 21.5 ft. bgs. | |

**Legend**

Sample Method
- No Soil Sample Recovery
- Split Barrel 2" X 1.375" (SPT)

Water Level
- Static Water Level
- Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AMW-3**

Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, S of main road, N of tire wash, NW of tree | | *Coordinates (SPN NAD83 ft)*<br>E:1353205 N:129596 | *Exploration Number*<br>**AMW-4** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>596.2' | Ecology Well Tag No.<br>BJU-271 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/29/2017 | *Top of Casing Elev. (NAVD88)*<br>598.76' | *Depth to Water (Below GS)*<br>10.2' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | ~3' standing monument with surrounding protective steel bollards | | | | | | |
| 0 | 595 | Concrete monument seal | AMW-4-2.5 | | SPT= 6,24,50/4"<br>PID= <1<br>Sheen= Moderate | | **FILL**<br>Loose, moist, yellow-orange silty SAND (SM)<br>Dense, moist, orange-brown, slightly gravelly, slightly silty SAND (SW-SM); fine to medium sand, coarse gravel | 0 |
| 5 | 590 | Hydrated bentonite chips | AMW-4-5.0 | | SPT= 17,33,38<br>PID= <1<br>Sheen= None | | Dense, moist, orange-brown, gravelly, slightly silty SAND (SW-SM); fine, medium, and coarse sand, fine gravel<br>Loose, moist, gray-brown slightly silty SAND (SW); medium to coarse sand, fine to coarse gravel | 5 |
| 10 | 585 | 10/20 silica sand filter pack<br>0.010" screen slot<br>▽ 3/29/2017<br>▼ 4/6/2017 | AMW-4-7.5<br>AMW-4-10.0 | | SPT= 7,5,4<br>PID= <1<br>Sheen= None<br>SPT= 8,24,10 | | **RECESSIONAL OUTWASH**<br>Loose, wet, gray, sandy GRAVEL (GW); coarse gravel, coarse sand<br>Dense, wet, gray, slightly silty SAND (SP); trace fine gravel, coarse sand | 10 |
| 15 | 580 | | AMW-4-12.5<br>AMW-4-15.0 | | SPT= 8,50/3"<br>PID= <1<br>Sheen= None<br>SPT= 15,22,23<br>PID= <1<br>Sheen= None | | Becomes siltier<br>Loose, wet, gray-brown, silty, sandy GRAVEL (GW); coarse gravel, coarse sand | 15 |
| 20 | 575 | | AMW-4-20.0 | | SPT= 9,20,19<br>PID= <1<br>Sheen= None | | Bottom of exploration at 21.5 ft. bgs. | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◩ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▼ Static Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AMW-4**

Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

| Aspect CONSULTING | Reserve Silica--Ravensdale - 160315 | | Monitoring Well Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, W of equipment shed | | *Coordinates (SPN NAD83 ft)*<br>E:1353334 N:129710 | *Exploration Number*<br>**AMW-5** |
| *Contractor*<br>Holocene Drilling | *Equipment*<br>Rotary drill rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>596.8' | Ecology Well Tag No.<br>BJU-272 |
| *Operator*<br>Keven Doyle | *Exploration Method(s)*<br>8.5-in OD Hollow-stem Auger | *Work Start/Completion Dates*<br>3/29/2017 | *Top of Casing Elev. (NAVD88)*<br>599.61' | *Depth to Water (Below GS)*<br>10' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Analytical Sample Number & Lab Test(s) | Field Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 0 | 595 | ~3' standing monument with surrounding protective steel bollards<br>Concrete monument seal<br>Hydrated bentonite chips<br>10/20 silica sand filter pack<br>0.010" screen slot<br>▽ 3/29/2017<br>▼ 4/6/2017 | AMW-5-2.5<br>AMW-5-5.0<br>AMW-5-7.5<br>AMW-5-10.0<br>AMW-5-12.5<br>AMW-5-15.0<br>AMW-5-20.0 | NWTPH-Dx, NWTPH-Gx w/ BTEX, RCRA 8 | SPT= 5,11,16<br>PID= <1<br>Sheen= None<br>SPT= 2,5,7<br>PID= <1<br>Sheen= None<br>SPT= 3,5,6<br>Sheen= None<br>SPT= 3,4,10<br>Sheen= None<br>SPT= 7,7,7<br>PID= <1<br>Sheen= None<br>SPT= 5,7,14<br>PID= <1<br>Sheen= None<br>SPT= 8,14,15<br>PID= <1<br>Sheen= None | | **TOPSOIL**<br>Topsoil<br>**FILL**<br>Medium dense, moist, yellow-orange silty SAND (SM) interbedded with coal tailings; trace coarse gravel<br>**RECENT LACUSTRINE DEPOSITS**<br>Loose, moist, red-orange sandy SILT (ML)<br>**RECENT ALLUVIUM**<br>Loose, moist, brown-gray sandy GRAVEL (GW); coarse gravel, coarse sand<br>Loose, wet, gray silty SAND (SM); trace coarse gravel with iron-oxide rinds, coarse sand, fining downward<br>Trace gravel falls out<br>**GLACIAL TILL**<br>Medium dense, wet, gray, gravelly, slightly silty SAND (SW-SM); medium to coarse sand, coarse gravel, thin silty interbeds<br>Bottom of exploration at 21.5 ft. bgs. | 0 |
| 5 | 590 | | | | | | | 5 |
| 10 | 585 | | | | | | | 10 |
| 15 | 580 | | | | | | | 15 |
| 20 | 575 | | | | | | | 20 |

**Legend**

Sample Method
- ◯ No Soil Sample Recovery
- ◩ Split Barrel 2" X 1.375" (SPT)

Water Level
- ▼ Static Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

**Exploration Log AMW-5**
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\RESERVE SILICA- 160315.GPJ November 9, 2017

# APPENDIX E

# 2017 Remedial Investigation Laboratory Analytical Reports

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

April 10, 2017

Carla Brock
Aspect Consulting
401 2nd Avenue South, Suite 201
Seattle, WA 98104

Re: Analytical Data for Project 160315
Laboratory Reference No. 1703-304

Dear Carla:

Enclosed are the analytical results and associated quality control data for samples submitted on March 31, 2017.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**Case Narrative**

Samples were collected on March 28, 29, and 30, 2017 and received by the laboratory on March 31, 2017. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

NWTPH Gx/BTEX Analysis

Per EPA Method 5035A, samples were received by the laboratory in pre-weighed 40 mL VOA vials within 48 hours of sample collection. They were stored in a freezer at between -7°C and -20°C until extraction or analysis.

The surrogate percent recovery is outside control limits for sample AB-2-2.5 due to matrix effects. The sample was re-analyzed with similar results.

The surrogate percent recovery is outside control limits on the high end for sample AB-1-7.5. Because the sample is non-detect, no further action will be taken.

Any other QA/QC issues associated with this extraction and analysis will be indicated with a footnote reference and discussed in detail on the Data Qualifier page.

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Gx/BTEX**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW 3-7.5** | | | | | |
| Laboratory ID: | 03-304-21 | | | | | |
| Benzene | **ND** | 0.022 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *90* | *63-124* | | | | |
| **Client ID:** | **AMW-5-2.5** | | | | | |
| Laboratory ID: | 03-304-33 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.068 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.068 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.068 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.068 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Gasoline | **ND** | 6.8 | NWTPH-Gx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *92* | *63-124* | | | | |
| **Client ID:** | **AB-3-2.5** | | | | | |
| Laboratory ID: | 03-304-41 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Gasoline | **ND** | 7.1 | NWTPH-Gx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *90* | *63-124* | | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Gx/BTEX**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-4-2.5** | | | | | |
| Laboratory ID: | 03-304-47 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.074 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.074 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.074 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.074 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Gasoline | **ND** | 7.4 | NWTPH-Gx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *95* | *63-124* | | | | |
| **Client ID:** | **AB-2-2.5** | | | | | |
| Laboratory ID: | 03-304-53 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.072 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.072 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.072 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.072 | EPA 8021B | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *60* | *63-124* | | | | Q |
| **Client ID:** | **AB-2-7.5** | | | | | |
| Laboratory ID: | 03-304-55 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.071 | EPA 8021B | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *109* | *63-124* | | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**BTEX**
**EPA 8021B**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-1-7.5** | | | | | |
| Laboratory ID: | 03-304-61 | | | | | |
| Benzene | **ND** | 0.021 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.11 | EPA 8021B | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *125* | *63-124* | | | | Q |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Gx/BTEX**
**QUALITY CONTROL**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0404S2 | | | | | |
| Benzene | **ND** | 0.020 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Toluene | **ND** | 0.050 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Ethyl Benzene | **ND** | 0.050 | EPA 8021B | 4-4-17 | 4-4-17 | |
| m,p-Xylene | **ND** | 0.050 | EPA 8021B | 4-4-17 | 4-4-17 | |
| o-Xylene | **ND** | 0.050 | EPA 8021B | 4-4-17 | 4-4-17 | |
| Gasoline | **ND** | 5.0 | NWTPH-Gx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *Fluorobenzene* | *81* | *63-124* | | | | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 03-304-21 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Toluene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Ethyl Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| m,p-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| o-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Gasoline | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| *Surrogate:* | | | | | | | | | | | |
| *Fluorobenzene* | | | | | | *90* | *87* | *63-124* | | | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SPIKE BLANKS** | | | | | | | | | | | |
| Laboratory ID: | SB0404S1 | | | | | | | | | | |
| | SB | SBD | SB | SBD | | SB | SBD | | | | |
| Benzene | **0.861** | **0.856** | 1.00 | 1.00 | | **86** | **86** | 70-124 | 1 | 12 | |
| Toluene | **0.893** | **0.881** | 1.00 | 1.00 | | **89** | **88** | 73-119 | 1 | 12 | |
| Ethyl Benzene | **0.905** | **0.890** | 1.00 | 1.00 | | **91** | **89** | 74-117 | 2 | 12 | |
| m,p-Xylene | **0.905** | **0.896** | 1.00 | 1.00 | | **91** | **90** | 75-117 | 1 | 13 | |
| o-Xylene | **0.914** | **0.896** | 1.00 | 1.00 | | **91** | **90** | 75-116 | 2 | 12 | |
| *Surrogate:* | | | | | | | | | | | |
| *Fluorobenzene* | | | | | | *86* | *82* | *63-124* | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Dx**

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW 3-7.5** | | | | | |
| Laboratory ID: | 03-304-21 | | | | | |
| Diesel Range Organics | **160** | 40 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **350** | 79 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *68* | *50-150* | | | | |
| **Client ID:** | **AMW-5-2.5** | | | | | |
| Laboratory ID: | 03-304-33 | | | | | |
| Diesel Range Organics | **380** | 29 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **510** | 59 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *88* | *50-150* | | | | |
| **Client ID:** | **AB-3-2.5** | | | | | |
| Laboratory ID: | 03-304-41 | | | | | |
| Diesel Range Organics | **810** | 30 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **520** | 59 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *100* | *50-150* | | | | |
| **Client ID:** | **AB-4-2.5** | | | | | |
| Laboratory ID: | 03-304-47 | | | | | |
| Diesel Range Organics | **1100** | 310 | NWTPH-Dx | 4-4-17 | 4-5-17 | |
| Lube Oil Range Organics | **1800** | 620 | NWTPH-Dx | 4-4-17 | 4-5-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *---* | *50-150* | | | | S |
| **Client ID:** | **AB-2-2.5** | | | | | |
| Laboratory ID: | 03-304-53 | | | | | |
| Diesel Range Organics | **1600** | 320 | NWTPH-Dx | 4-4-17 | 4-5-17 | |
| Lube Oil Range Organics | **3000** | 650 | NWTPH-Dx | 4-4-17 | 4-5-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *---* | *50-150* | | | | S |
| **Client ID:** | **AB-2-7.5** | | | | | |
| Laboratory ID: | 03-304-55 | | | | | |
| Diesel Range Organics | **ND** | 33 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **ND** | 67 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *89* | *50-150* | | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Dx**

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-1-7.5** | | | | | |
| Laboratory ID: | 03-304-61 | | | | | |
| Diesel Range Organics | **ND** | 42 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **ND** | 84 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *71* | *50-150* | | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**NWTPH-Dx**
**QUALITY CONTROL**

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0404S1 | | | | | |
| Diesel Range Organics | **ND** | 25 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| Lube Oil Range Organics | **ND** | 50 | NWTPH-Dx | 4-4-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *o-Terphenyl* | *92* | *50-150* | | | | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | |
| Laboratory ID: | 03-303-02 | | | | | | | | | |
| | ORIG | DUP | | | | | | | | |
| Diesel Range | **ND** | **ND** | NA | NA | | NA | NA | NA | NA | |
| Lube Oil Range | **ND** | **ND** | NA | NA | | NA | NA | NA | NA | |
| *Surrogate:* | | | | | | | | | | |
| *o-Terphenyl* | | | | | | *92* *70* | *50-150* | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 03-304-33 | | | | | |
| **Client ID:** | **AMW-5-2.5** | | | | | |
| Arsenic | **21** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Barium | **78** | 2.9 | 6010C | 4-3-17 | 4-3-17 | |
| Cadmium | **ND** | 0.59 | 6010C | 4-3-17 | 4-3-17 | |
| Chromium | **20** | 0.59 | 6010C | 4-3-17 | 4-3-17 | |
| Lead | **9.1** | 5.9 | 6010C | 4-3-17 | 4-3-17 | |
| Mercury | **ND** | 0.29 | 7471B | 4-4-17 | 4-4-17 | |
| Selenium | **ND** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Silver | **ND** | 1.2 | 6010C | 4-3-17 | 4-3-17 | |
| Lab ID: | 03-304-41 | | | | | |
| **Client ID:** | **AB-3-2.5** | | | | | |
| Arsenic | **ND** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Barium | **150** | 3.0 | 6010C | 4-3-17 | 4-3-17 | |
| Cadmium | **ND** | 0.59 | 6010C | 4-3-17 | 4-3-17 | |
| Chromium | **32** | 0.59 | 6010C | 4-3-17 | 4-3-17 | |
| Lead | **11** | 5.9 | 6010C | 4-3-17 | 4-3-17 | |
| Mercury | **ND** | 0.30 | 7471B | 4-4-17 | 4-4-17 | |
| Selenium | **ND** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Silver | **ND** | 1.2 | 6010C | 4-3-17 | 4-3-17 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**

Matrix: Soil
Units: mg/kg (ppm)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 03-304-47 | | | | | |
| **Client ID:** | **AB-4-2.5** | | | | | |
| Arsenic | **ND** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Barium | **110** | 3.1 | 6010C | 4-3-17 | 4-3-17 | |
| Cadmium | **ND** | 0.62 | 6010C | 4-3-17 | 4-3-17 | |
| Chromium | **22** | 0.62 | 6010C | 4-3-17 | 4-3-17 | |
| Lead | **12** | 6.2 | 6010C | 4-3-17 | 4-3-17 | |
| Mercury | **ND** | 0.31 | 7471B | 4-4-17 | 4-4-17 | |
| Selenium | **ND** | 12 | 6010C | 4-3-17 | 4-3-17 | |
| Silver | **ND** | 1.2 | 6010C | 4-3-17 | 4-3-17 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**
**METHOD BLANK QUALITY CONTROL**

Date Extracted: 04-3&4-17
Date Analyzed: 04-3&4-17

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: MB0403SM3&MB0404S1

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Arsenic | 6010C | **ND** | 10 |
| Barium | 6010C | **ND** | 2.5 |
| Cadmium | 6010C | **ND** | 0.50 |
| Chromium | 6010C | **ND** | 0.50 |
| Lead | 6010C | **ND** | 5.0 |
| Mercury | 7471B | **ND** | 0.25 |
| Selenium | 6010C | **ND** | 10 |
| Silver | 6010C | **ND** | 1.0 |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**
**DUPLICATE QUALITY CONTROL**

Date Extracted: 04-3&4-17
Date Analyzed: 04-3&4-17

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 03-302-04

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Arsenic | **ND** | **ND** | NA | 10 | |
| Barium | **12.7** | **13.1** | 3 | 2.5 | |
| Cadmium | **ND** | **ND** | NA | 0.50 | |
| Chromium | **8.55** | **8.50** | 1 | 0.50 | |
| Lead | **ND** | **ND** | NA | 5.0 | |
| Mercury | **ND** | **ND** | NA | 0.25 | |
| Selenium | **ND** | **ND** | NA | 10 | |
| Silver | **ND** | **ND** | NA | 1.0 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**
**MS/MSD QUALITY CONTROL**

Date Extracted: 04-3&4-17
Date Analyzed: 04-3&4-17

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 03-302-04

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Arsenic | 100 | **89.7** | 90 | **91.9** | 92 | 2 | |
| Barium | 100 | **103** | 90 | **108** | 95 | 5 | |
| Cadmium | 50.0 | **47.5** | 95 | **48.6** | 97 | 2 | |
| Chromium | 100 | **103** | 94 | **107** | 98 | 4 | |
| Lead | 250 | **233** | 93 | **238** | 95 | 2 | |
| Mercury | 0.500 | **0.495** | 99 | **0.508** | 102 | 3 | |
| Selenium | 100 | **92.3** | 92 | **94.8** | 95 | 3 | |
| Silver | 25.0 | **21.7** | 87 | **21.9** | 88 | 1 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**TOTAL METALS**
**EPA 6010C/7471B**
**SPIKE BLANK QUALITY CONTROL**

Date Extracted: 04-3&4-17
Date Analyzed: 04-3&4-17

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: SB0403SM3&SB0404S1

| Analyte | Method | Spike Level | SB Result | Percent Recovery |
|---|---|---|---|---|
| Arsenic | 6010C | 100 | **88.9** | 89 |
| Barium | 6010C | 100 | **87.8** | 88 |
| Cadmium | 6010C | 50.0 | **46.7** | 93 |
| Chromium | 6010C | 100 | **95.7** | 96 |
| Lead | 6010C | 250 | **229** | 91 |
| Mercury | 7471B | 0.500 | **0.480** | 96 |
| Selenium | 6010C | 100 | **92.9** | 93 |
| Silver | 6010C | 25.0 | **22.6** | 90 |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW 3-7.5** | | | | | |
| Laboratory ID: | 03-304-21 | | | | | |
| Naphthalene | **0.17** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 2-Methylnaphthalene | **0.098** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 1-Methylnaphthalene | **0.066** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]anthracene | **0.019** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Chrysene | **0.013** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[b]fluoranthene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]pyrene | **0.012** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *2-Fluorobiphenyl* | *74* | *32 - 122* | | | | |
| *Pyrene-d10* | *69* | *33 - 125* | | | | |
| *Terphenyl-d14* | *80* | *36 - 118* | | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-2-2.5** | | | | | |
| Laboratory ID: | 03-304-53 | | | | | |
| Naphthalene | **63** | 0.86 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| 2-Methylnaphthalene | **43** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| 1-Methylnaphthalene | **23** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Benzo[a]anthracene | **5.4** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Chrysene | **4.5** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Benzo[b]fluoranthene | **1.6** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Benzo(j,k)fluoranthene | **0.61** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Benzo[a]pyrene | **0.75** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.43 | EPA 8270D/SIM | 4-3-17 | 4-5-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *2-Fluorobiphenyl* | *68* | *32 - 122* | | | | |
| *Pyrene-d10* | *35* | *33 - 125* | | | | |
| *Terphenyl-d14* | *80* | *36 - 118* | | | | |

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Samples Submitted: March 31, 2017
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Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-2-7.5** | | | | | |
| Laboratory ID: | 03-304-55 | | | | | |
| Naphthalene | **0.077** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 2-Methylnaphthalene | **0.030** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 1-Methylnaphthalene | **0.017** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]anthracene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Chrysene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]pyrene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0089 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *2-Fluorobiphenyl* | *92* | *32 - 122* | | | | |
| *Pyrene-d10* | *82* | *33 - 125* | | | | |
| *Terphenyl-d14* | *82* | *36 - 118* | | | | |

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Samples Submitted: March 31, 2017
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Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AB-1-7.5** | | | | | |
| Laboratory ID: | 03-304-61 | | | | | |
| Naphthalene | **0.13** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 2-Methylnaphthalene | **0.059** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 1-Methylnaphthalene | **0.036** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]anthracene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Chrysene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[b]fluoranthene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]pyrene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.011 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *2-Fluorobiphenyl* | *68* | *32 - 122* | | | | |
| *Pyrene-d10* | *66* | *33 - 125* | | | | |
| *Terphenyl-d14* | *68* | *36 - 118* | | | | |

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Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**
**METHOD BLANK QUALITY CONTROL**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Laboratory ID: | MB0403S1 | | | | | |
| Naphthalene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 2-Methylnaphthalene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| 1-Methylnaphthalene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]anthracene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Chrysene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Benzo[a]pyrene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0067 | EPA 8270D/SIM | 4-3-17 | 4-4-17 | |
| *Surrogate:* | *Percent Recovery* | *Control Limits* | | | | |
| *2-Fluorobiphenyl* | *94* | *32 - 122* | | | | |
| *Pyrene-d10* | *93* | *33 - 125* | | | | |
| *Terphenyl-d14* | *98* | *36 - 118* | | | | |

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Project: 160315

**cPAHs + NAPHTHALENES EPA 8270D/SIM**
**SB/SBD QUALITY CONTROL**

Matrix: Soil
Units: mg/Kg

| Analyte | Result | | Spike Level | | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| **SPIKE BLANKS** | | | | | | | | | | |
| Laboratory ID: | SB0403S1 | | | | | | | | | |
| | SB | SBD | SB | SBD | SB | SBD | | | | |
| Naphthalene | **0.0733** | **0.0821** | 0.0833 | 0.0833 | 88 | 99 | 58 - 114 | 11 | 18 | |
| Benzo[a]anthracene | **0.0848** | **0.0905** | 0.0833 | 0.0833 | 102 | 109 | 56 - 137 | 7 | 15 | |
| Chrysene | **0.0817** | **0.0875** | 0.0833 | 0.0833 | 98 | 105 | 59 - 122 | 7 | 15 | |
| Benzo[b]fluoranthene | **0.0841** | **0.0891** | 0.0833 | 0.0833 | 101 | 107 | 46 - 133 | 6 | 21 | |
| Benzo(j,k)fluoranthene | **0.0812** | **0.0883** | 0.0833 | 0.0833 | 97 | 106 | 47 - 129 | 8 | 21 | |
| Benzo[a]pyrene | **0.0829** | **0.0891** | 0.0833 | 0.0833 | 100 | 107 | 54 - 132 | 7 | 15 | |
| Indeno(1,2,3-c,d)pyrene | **0.0839** | **0.0893** | 0.0833 | 0.0833 | 101 | 107 | 54 - 129 | 6 | 15 | |
| Dibenz[a,h]anthracene | **0.0804** | **0.0859** | 0.0833 | 0.0833 | 97 | 103 | 59 - 122 | 7 | 15 | |
| *Surrogate:* | | | | | | | | | | |
| *2-Fluorobiphenyl* | | | | | *89* | *90* | *32 - 122* | | | |
| *Pyrene-d10* | | | | | *92* | *97* | *33 - 125* | | | |
| *Terphenyl-d14* | | | | | *94* | *99* | *36 - 118* | | | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED ALKALINITY**
**SM 2320B**

Matrix: Water
Units: mg CaCO3/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **RSRL-1-033017** | | | | | |
| Laboratory ID: | 03-304-65 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-4-17 | 4-6-17 | |
| Dissolved Bicarbonate Concentration | **46** | 2.0 | SM 2320B | 4-4-17 | 4-6-17 | |

Date of Report: April 10, 2017
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Project: 160315
cPAHs

**DISSOLVED ALKALINITY**
**SM 2320B**
**QUALITY CONTROL**

Matrix: Water
Units: mg CaCO3/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0404D1 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-4-17 | 4-6-17 | |
| Dissolved Bicarbonate Concentration | **ND** | 2.0 | SM 2320B | 4-4-17 | 4-6-17 | |

| Analyte | Result | | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | |
| Laboratory ID: | 03-304-65 | | | | | | | | |
| | ORIG | DUP | | | | | | | |
| Dissolved Total Alkalinity | **46.0** | **50.0** | NA | NA | NA | NA | 8 | 10 | |
| **SPIKE BLANK** | | | | | | | | | |
| Laboratory ID: | SB0404D1 | | | | | | | | |
| | SB | | SB | | SB | | | | |
| Dissolved Total Alkalinity | **98.0** | | 100 | NA | 98 | 86-117 | NA | NA | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED CHLORIDE**
**SM 4500-Cl E**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **RSRL-1-033017** | | | | | |
| Laboratory ID: | 03-304-65 | | | | | |
| Dissolved Chloride | **ND** | 2.0 | SM 4500-Cl E | 4-4-17 | 4-5-17 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
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Project: 160315

**DISSOLVED CHLORIDE**
**SM 4500-Cl E**
**QUALITY CONTROL**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0404D1 | | | | | |
| Dissolved Chloride | **ND** | 2.0 | SM 4500-Cl E | 4-4-17 | 4-5-17 | |

| Analyte | Result | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | |
| Laboratory ID: | 03-304-65 | | | | | | | |
| | ORIG DUP | | | | | | | |
| Dissolved Chloride | **ND** **ND** | NA | NA | NA | NA | NA | 17 | |
| **MATRIX SPIKE** | | | | | | | | |
| Laboratory ID: | 03-304-65 | | | | | | | |
| | MS | MS | | MS | | | | |
| Dissolved Chloride | **48.2** | 50.0 | ND | 96 | 82-126 | NA | NA | |
| **SPIKE BLANK** | | | | | | | | |
| Laboratory ID: | SB0404D1 | | | | | | | |
| | SB | SB | | SB | | | | |
| Dissolved Chloride | **52.9** | 50.0 | NA | 106 | 92-118 | NA | NA | |

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Project: 160315

**DISSOLVED SULFATE**
**ASTM D516-07**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **RSRL-1-033017** | | | | | |
| Laboratory ID: | 03-304-65 | | | | | |
| Dissolved Sulfate | **14** | 5.0 | ASTM D516-07 | 4-4-17 | 4-10-17 | |

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Project: 160315

**SULFATE**
**ASTM D516-07**
**QUALITY CONTROL**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0404D1 | | | | | |
| Dissolved Sulfate | **ND** | 5.0 | ASTM D516-07 | 4-4-17 | 4-10-17 | |

| Analyte | Result | | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | |
| Laboratory ID: | 03-304-65 | | | | | | | | |
| | ORIG | DUP | | | | | | | |
| Dissolved Sulfate | **14.0** | **14.2** | NA | NA | NA | NA | 1 | 10 | |
| **MATRIX SPIKE** | | | | | | | | | |
| Laboratory ID: | 03-304-65 | | | | | | | | |
| | MS | | MS | | MS | | | | |
| Dissolved Sulfate | **23.3** | | 10.0 | 14.0 | 93 | 77-129 | NA | NA | |
| **SPIKE BLANK** | | | | | | | | | |
| Laboratory ID: | SB0404D1 | | | | | | | | |
| | SB | | SB | | SB | | | | |
| Dissolved Sulfate | **9.78** | | 10.0 | NA | 98 | 91-113 | NA | NA | |

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Project: 160315

**TOTAL METALS**
**EPA 200.8/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 03-304-65 | | | | | |
| **Client ID:** | **RSRL-1-033017** | | | | | |
| Arsenic | **ND** | 3.3 | 200.8 | 4-6-17 | 4-6-17 | |
| Barium | **ND** | 28 | 200.8 | 4-6-17 | 4-6-17 | |
| Cadmium | **ND** | 4.4 | 200.8 | 4-6-17 | 4-6-17 | |
| Chromium | **ND** | 11 | 200.8 | 4-6-17 | 4-6-17 | |
| Lead | **ND** | 1.1 | 200.8 | 4-6-17 | 4-6-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-7-17 | |
| Selenium | **ND** | 5.6 | 200.8 | 4-6-17 | 4-6-17 | |
| Silver | **ND** | 11 | 200.8 | 4-6-17 | 4-6-17 | |

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**TOTAL METALS**
**EPA 200.8**
**METHOD BLANK QUALITY CONTROL**

Date Extracted: 4-6-17
Date Analyzed: 4-6-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0406WM1

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Arsenic | 200.8 | **ND** | 3.3 |
| Barium | 200.8 | **ND** | 28 |
| Cadmium | 200.8 | **ND** | 4.4 |
| Chromium | 200.8 | **ND** | 11 |
| Lead | 200.8 | **ND** | 1.1 |
| Selenium | 200.8 | **ND** | 5.6 |
| Silver | 200.8 | **ND** | 11 |

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Project: 160315

**TOTAL MERCURY**
**EPA 7470A**
**METHOD BLANK QUALITY CONTROL**

| | |
|---|---|
| Date Extracted: | 4-7-17 |
| Date Analyzed: | 4-7-17 |
| Matrix: | Water |
| Units: | ug/L (ppb) |
| Lab ID: | MB0407W1 |

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Mercury | 7470A | **ND** | 0.50 |

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**TOTAL METALS**
**EPA 200.8**
**DUPLICATE QUALITY CONTROL**

Date Extracted: 4-6-17
Date Analyzed: 4-6-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-015-01

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Arsenic | **ND** | **ND** | NA | 3.3 | |
| Barium | **ND** | **ND** | NA | 28 | |
| Cadmium | **ND** | **ND** | NA | 4.4 | |
| Chromium | **ND** | **ND** | NA | 11 | |
| Lead | **ND** | **ND** | NA | 1.1 | |
| Selenium | **ND** | **ND** | NA | 5.6 | |
| Silver | **ND** | **ND** | NA | 11 | |

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**TOTAL MERCURY**
**EPA 7470A**
**DUPLICATE QUALITY CONTROL**

Date Extracted: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-069-01

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Mercury | **ND** | **ND** | NA | 0.50 | |

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**TOTAL METALS**
**EPA 200.8**
**MS/MSD QUALITY CONTROL**

Date Extracted: 4-6-17
Date Analyzed: 4-6-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-015-01

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Arsenic | 222 | **221** | 99 | **227** | 102 | 3 | |
| Barium | 222 | **219** | 99 | **228** | 103 | 4 | |
| Cadmium | 222 | **219** | 99 | **228** | 103 | 4 | |
| Chromium | 222 | **202** | 91 | **210** | 95 | 4 | |
| Lead | 222 | **207** | 93 | **214** | 96 | 3 | |
| Selenium | 222 | **217** | 98 | **228** | 103 | 5 | |
| Silver | 222 | **183** | 83 | **188** | 85 | 3 | |

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Project: 160315

**TOTAL MERCURY**
**EPA 7470A**
**MS/MSD QUALITY CONTROL**

Date Extracted: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-069-01

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Mercury | 12.5 | **12.5** | 100 | **12.7** | 101 | 1 | |

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Project: 160315

**TOTAL METALS**
**EPA 200.8**
**SPIKE BLANK QUALITY CONTROL**

Date Extracted: 4-6-17
Date Analyzed: 4-6-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0406WM1

| Analyte | Method | Spike Level | Result | Percent Recovery |
|---|---|---|---|---|
| Arsenic | 200.8 | 222 | **223** | 101 |
| Barium | 200.8 | 222 | **217** | 98 |
| Cadmium | 200.8 | 222 | **216** | 98 |
| Chromium | 200.8 | 222 | **209** | 94 |
| Lead | 200.8 | 222 | **213** | 96 |
| Selenium | 200.8 | 222 | **229** | 103 |
| Silver | 200.8 | 222 | **194** | 88 |

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**TOTAL MERCURY**
**EPA 7470A**
**SPIKE BLANK QUALITY CONTROL**

Date Extracted: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0407W1

| Analyte | Method | Spike Level | Result | Percent Recovery |
|---|---|---|---|---|
| Mercury | 7470A | 12.5 | **12.6** | 101 |

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Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 03-304-65 | | | | | |
| **Client ID:** | **RSRL-1-033017** | | | | | |
| Calcium | **13000** | 11000 | 6010C | 3-31-17 | 4-7-17 | |
| Magnesium | **4400** | 1100 | 6010C | 3-31-17 | 4-7-17 | |
| Potassium | **ND** | 1100 | 6010C | 3-31-17 | 4-7-17 | |
| Sodium | **4700** | 1100 | 6010C | 3-31-17 | 4-7-17 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**METHOD BLANK QUALITY CONTROL**

Date Filtered: 3-31-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0331F1

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Calcium | 6010C | **ND** | 1100 |
| Magnesium | 6010C | **ND** | 1100 |
| Potassium | 6010C | **ND** | 1100 |
| Sodium | 6010C | **ND** | 1100 |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**DUPLICATE QUALITY CONTROL**

Date Filtered: 3-31-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 03-304-65

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Calcium | **13100** | **13000** | 1 | 11000 | |
| Magnesium | **4380** | **4420** | 1 | 1100 | |
| Potassium | **ND** | **ND** | NA | 1100 | |
| Sodium | **4690** | **4790** | 2 | 1100 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**MS/MSD QUALITY CONTROL**

Date Filtered: 3-31-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 03-304-65

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Calcium | 22200 | **33400** | 91 | **33200** | 91 | 0 | |
| Magnesium | 22200 | **24700** | 92 | **24300** | 90 | 2 | |
| Potassium | 22200 | **21000** | 94 | **21200** | 96 | 1 | |
| Sodium | 22200 | **25400** | 93 | **25700** | 95 | 1 | |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**SPIKE BLANK QUALITY CONTROL**

Date Filtered: 3-31-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0331F1

| Analyte | Method | Spike Level | SB Result | Percent Recovery |
|---|---|---|---|---|
| Calcium | 6010C | 22200 | **23700** | 107 |
| Magnesium | 6010C | 22200 | **20700** | 93 |
| Potassium | 6010C | 22200 | **20600** | 93 |
| Sodium | 6010C | 22200 | **21100** | 95 |

Date of Report: April 10, 2017
Samples Submitted: March 31, 2017
Laboratory Reference: 1703-304
Project: 160315

**% MOISTURE**

Date Analyzed: 4-3&4-17

| Client ID | Lab ID | % Moisture |
|---|---|---|
| AMW 3-7.5 | 03-304-21 | 37 |
| AMW-5-2.5 | 03-304-33 | 15 |
| AB-3-2.5 | 03-304-41 | 16 |
| AB-4-2.5 | 03-304-47 | 19 |
| AB-2-2.5 | 03-304-53 | 23 |
| AB-2-7.5 | 03-304-55 | 25 |
| AB-1-7.5 | 03-304-61 | 41 |

OnSite Environmental Inc.

**Data Qualifiers and Abbreviations**

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

# Chain of Custody



**OnSite Environmental Inc.**
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: Aspect Consulting
Project Number: 160315
Project Name: Reserve Silica
Project Manager: Carla Brock
Sampled by: Kristin Beck

**Turnaround Request (in working days)**

(Check One)

- ☐ Same Day ☐ 1 Day
- ☐ 2 Days ☐ 3 Days
- ☒ Standard (7 Days) (TPH analysis 5 Days)
- ☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | | | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AMW-1-2.5 | 3/28 | 0917 | soil | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 2 | AMW-1-5.0 | | 0920 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | AMW-1-7.5 | | NR | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 4 | AMW-1-10.0 | | 0927 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 5 | AMW-1-12.5 | | 0935 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 6 | AMW-1-15.0 | | 0940 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 7 | AMW-1-20.0 | | 0947 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 8 | AMW-1-25.0 | | 0954 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 9 | AMW-1-30.0 | | 1001 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 10 | AMW-1-35.0 | ↓ | 1016 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kristin Beck | Aspect | 3/31 | |
| Received | [signature] | SPECD-1 | 3/31/17 | 1018 |
| Relinquished | [signature] | SPECD-1 | 3/31 | 1145 |
| Received | [signature] | CORE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**

Please hold

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody



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Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**

(Check One)

- ☐ Same Day ☐ 1 Day
- ☐ 2 Days ☐ 3 Days
- ☒ Standard (7 Days) (TPH analysis 5 Days)
- ☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers |
|---|---|---|---|---|---|
| 11 | AMW-1-40.0 | 3/28 | 1122 | Soil | 2 |
| 12 | AMW-2-2.5 | | 1421 | | 2 |
| 13 | AMW-2-5.0 | | 1425 | | 2 |
| 14 | AMW-2-7.5 | | NR | | 2 |
| 15 | AMW-2-10.0 | | 1433 | | 2 |
| 16 | AMW-2-12.5 | | 1438 | | 2 |
| 17 | AMW-2-15.0 | | 1443 | | 2 |
| 18 | AMW-2-20.0 | | 1452 | | 2 |
| 19 | AMW-3-2.5 | 3/29 | 0910 | | |
| 20 | AMW-3-5.0 | | 0915 | | |

| | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | | | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kat Beck | Aspect | 3/31 | |
| Received | | Spect | 3/31/17 | 1018 |
| Relinquished | | Spect | 3/31/17 | 1145 |
| Received | | CORE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**

Please hold

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody



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Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | BTEX 8021 | cPAHs | NAPTHALENES | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | AMW-3-7.5 | 3/29 | 0919 | soil | 2 | | | | X | | | | | | | | | | | | | | X | X | X | | X |
| 22 | AMW-3-10.0 | | 0924 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 23 | AMW-3-12.5 | | 0927 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 24 | AMW-3-15.0 | | 0940 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 25 | AMW-3-20.0 | | 0949 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 26 | AMW-4-2.5 | | 1103 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 27 | AMW-4-5.0 | | 1108 | | 2 | | | | | | | | | LIMITED VOLUME | | | | | | | | | | | | | |
| 28 | AMW-4-7.5 | | 1112 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 29 | AMW-4-10.0 | | 1117 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 30 | AMW-4-12.5 | ↓ | 1121 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kat Beck | Aspect | 3/31 | |
| Received | | SPECO | 3/31/17 | 1018 |
| Relinquished | | SPECO | 3/31/17 | 1145 |
| Received | | ONE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
~~Please hold~~ >>

Data Package: Standard ☐ Level III ☐ Level IV ☐
Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody



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Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**

(Check One)

- ☐ Same Day ☐ 1 Day
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- ☒ Standard (7 Days) (TPH analysis 5 Days)
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**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | | | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | AMW-4-15.0 | 3/29 | 1134 | soil | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 32 | AMW-4-20.0 | | 1140 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 33 | AMW-5-2.5 | | 1315 | | 2 | | X | | X | | | | | | | | | | X | | | | | | | | X |
| 34 | AMW-5-5.0 | | 1319 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 35 | AMW-5-7.5 | | 1323 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 36 | AMW-5-10.0 | | 1326 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 37 | AMW-5-12.5 | | 1329 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 38 | AMW-5-15.0 | | 1332 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 39 | AMW-5-20.0 | | 1339 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 40 | AMW-5-21.5 | ↓ | 1346 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kat Beck | Aspect | 3/31 | |
| Received | JK | SpectrumT | 3/31/17 | 1018 |
| Relinquished | | Spectrum | 3/31/17 | 1145 |
| Received | | ORE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**

Please hold

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody



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Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | | | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | AB-3-2.5 | 3/29 | 1554 | Soil | 2 | | X | | X | | | | | | | | | | X | | | | | | | | X |
| 42 | AB-3-5.0 | | 1559 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 43 | AB-3-7.5 | | 1603 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 44 | AB-3-10.0 | | NR | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 45 | AB-3-12.5 | | 1614 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 46 | AB-3-15.0 | | 1616 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 47 | AB-4-2.5 | | 1454 | | 2 | | X | | X | | | | | | | | | | X | | | | | | | | X |
| 48 | AB-4-5.0 | | 1459 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 49 | AB-4-7.5 | | 1502 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 50 | AB-4-10.0 | ↓ | 1505 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kurt Beck | Aspect | 3/31 | |
| Received | | Spectrum | 3/31/17 | 1015 |
| Relinquished | | Spectrum | 3/31/17 | 1445 |
| Received | | CORE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
Please hold

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody



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Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | BTEX 8021 | cPAHs | Naphthalenes | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | AB-4-12.5 | 3/29 | 1508 | soil | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 52 | AB-4-15.0 | ↓ | 1513 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 53 | AB-2-2.5 | 3/30 | 0830 | | 2 | | | | X | | | | | | | | | | | | | | X | X | X | | X |
| 54 | AB-2-5.0 | | 0835 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 55 | AB-2-7.5 | | 0840 | | 2 | | | | X | | | | | | | | | | | | | | X | X | X | | X |
| 56 | AB-2-10.0 | | 0843 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 57 | AB-2-12.5 | | 0848 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 58 | AB-2-15.0 | | 0853 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 59 | AB-1-2.5 | | 0930 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 60 | AB-1-5.0 | ↓ | 0933 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Karl Bed | Aspect | 3/31 | |
| Received | | Aspect | 3/31/17 | 1010 |
| Relinquished | | Aspect | 3/31/17 | 1145 |
| Received | | OSE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
Please hold

Data Package: Standard ☐ Level III ☐ Level IV ☐
Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

# Chain of Custody

Page 7 of 7

**OnSite Environmental Inc.**
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: Aspect
Project Number: 160315
Project Name:
Project Manager: C. Brock
Sampled by:

**Turnaround Request (in working days)**
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ _____ (other)

**Laboratory Number:** 03-304

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | Total RCRA Metals | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | BTEX 8021 | cPAHs | Naphthalenes | see note below | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | AB-1-7.5 | 3/30 | ~~0845~~ 0937 | soil | 2 | | | | X | | | | | | | | | | | | | | X | X | 7 | | X |
| 62 | AB-1-10.0 | ↓ | 0942 | ↓ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 63 | AB-1-12.5 | | 0945 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 64 | AB-1-15.0 | | 0949 | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 65 | RSRL-1-033017 | | 1530 | water | 2 | | | | | | | | | | | | | | X | | | | | | | X | |
| | | | | ~~water~~ | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kat Beal | Aspect | 3/31 | |
| Received | | SpeedY | 3/31/17 | 1018 |
| Relinquished | | SpeedY | 3/3/17 | 1145 |
| Received | | OSE | 3/31/17 | 1145 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**

~~Please hold~~

RSRL-1-033017 for: dissolved anions (bicarbonate, carbonate, Cl, sulfate), dissolved cations (Ca, Mg, K, Na)

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

April 19, 2017

Carla Brock
Aspect Consulting
401 2nd Avenue South, Suite 201
Seattle, WA 98104

Re: Analytical Data for Project 160315
Laboratory Reference No. 1704-083

Dear Carla:

Enclosed are the analytical results and associated quality control data for samples submitted on April 7, 2017.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**Case Narrative**

Samples were collected on April 6, 2017 and received by the laboratory on April 7, 2017. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Dissolved Sulfate ASTM D516-07 Analysis

The PQL for sample AMW-2-040617 was increased due to sample interference.

Any other QA/QC issues associated with this extraction and analysis will be indicated with a footnote reference and discussed in detail on the Data Qualifier page.

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Gx/BTEX**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-18-17 | 4-18-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***106*** | ***61-118*** | | | | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-12-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***103*** | ***61-118*** | | | | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-12-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***100*** | ***61-118*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Gx/BTEX**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-12-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***94*** | ***61-118*** | | | | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-12-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***94*** | ***61-118*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Gx/BTEX**
**METHOD BLANK QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Laboratory ID: | MB0412W2 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-12-17 | 4-12-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-12-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***97*** | ***61-118*** | | | | |
| Laboratory ID: | MB0418W1 | | | | | |
| Benzene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Toluene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Ethyl Benzene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| m,p-Xylene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| o-Xylene | **ND** | 1.0 | EPA 8021B | 4-18-17 | 4-18-17 | |
| Gasoline | **ND** | 100 | NWTPH-Gx | 4-18-17 | 4-18-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***Fluorobenzene*** | ***102*** | ***61-118*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Gx/BTEX**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 04-075-02 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Toluene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Ethyl Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| m,p-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| o-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Gasoline | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| ***Surrogate:*** | | | | | | | | | | | |
| ***Fluorobenzene*** | | | | | | ***99*** | ***97*** | ***61-118*** | | | |
| Laboratory ID: | 04-083-01 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Toluene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Ethyl Benzene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| m,p-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| o-Xylene | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| Gasoline | **ND** | **ND** | NA | NA | | NA | | NA | NA | 30 | |
| ***Surrogate:*** | | | | | | | | | | | |
| ***Fluorobenzene*** | | | | | | ***106*** | ***106*** | ***61-118*** | | | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 04-075-01 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Benzene | **49.4** | **48.7** | 50.0 | 50.0 | ND | **99** | **97** | 80-120 | 1 | 13 | |
| Toluene | **51.3** | **49.8** | 50.0 | 50.0 | ND | **103** | **100** | 81-115 | 3 | 14 | |
| Ethyl Benzene | **51.8** | **50.7** | 50.0 | 50.0 | ND | **104** | **101** | 81-114 | 2 | 12 | |
| m,p-Xylene | **52.6** | **50.5** | 50.0 | 50.0 | ND | **105** | **101** | 81-114 | 4 | 13 | |
| o-Xylene | **51.6** | **50.3** | 50.0 | 50.0 | ND | **103** | **101** | 81-113 | 3 | 11 | |
| ***Surrogate:*** | | | | | | | | | | | |
| ***Fluorobenzene*** | | | | | | ***99*** | ***89*** | ***61-118*** | | | |
| Laboratory ID: | 04-083-01 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Benzene | **50.4** | **49.4** | 50.0 | 50.0 | ND | **101** | **99** | 80-120 | 2 | 13 | |
| Toluene | **51.2** | **50.0** | 50.0 | 50.0 | ND | **102** | **100** | 81-115 | 2 | 14 | |
| Ethyl Benzene | **52.3** | **51.2** | 50.0 | 50.0 | ND | **105** | **102** | 81-114 | 2 | 12 | |
| m,p-Xylene | **51.5** | **50.4** | 50.0 | 50.0 | ND | **103** | **101** | 81-114 | 2 | 13 | |
| o-Xylene | **51.4** | **50.2** | 50.0 | 50.0 | ND | **103** | **100** | 81-113 | 2 | 11 | |
| ***Surrogate:*** | | | | | | | | | | | |
| ***Fluorobenzene*** | | | | | | ***102*** | ***99*** | ***61-118*** | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Dx**

Matrix: Water
Units: mg/L (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Diesel Range Organics | **ND** | 0.28 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.45 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***75*** | ***50-150*** | | | | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Diesel Range Organics | **ND** | 0.25 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.41 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***78*** | ***50-150*** | | | | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Diesel Range Organics | **ND** | 0.26 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.41 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***91*** | ***50-150*** | | | | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Diesel Range Organics | **ND** | 0.26 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.41 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***85*** | ***50-150*** | | | | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Diesel Range Organics | **ND** | 0.26 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.41 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***78*** | ***50-150*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**NWTPH-Dx**
**QUALITY CONTROL**

Matrix: Water
Units: mg/L (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0413W1 | | | | | |
| Diesel Range Organics | **ND** | 0.25 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| Lube Oil Range Organics | **ND** | 0.40 | NWTPH-Dx | 4-13-17 | 4-12-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***o-Terphenyl*** | ***83*** | ***50-150*** | | | | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | |
| Laboratory ID: | 04-083-03 | | | | | | | | | |
| | ORIG | DUP | | | | | | | | |
| Diesel Range | **ND** | **ND** | NA | NA | | NA | NA | NA | NA | |
| Lube Oil Range | **ND** | **ND** | NA | NA | | NA | NA | NA | NA | |
| ***Surrogate:*** | | | | | | | | | | |
| ***o-Terphenyl*** | | | | | | ***91*** ***99*** | ***50-150*** | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Naphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 2-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 1-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthylene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluorene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Phenanthrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Anthracene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluoranthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Pyrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Chrysene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***53*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***51*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***59*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Naphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 2-Methylnaphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 1-Methylnaphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthylene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluorene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Phenanthrene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Anthracene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluoranthene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Pyrene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]anthracene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Chrysene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]pyrene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***58*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***66*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***74*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Naphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 2-Methylnaphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 1-Methylnaphthalene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthylene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluorene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Phenanthrene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Anthracene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluoranthene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Pyrene | **ND** | 0.093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]anthracene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Chrysene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]pyrene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.0093 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***90*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***81*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***95*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Naphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 2-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 1-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthylene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluorene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Phenanthrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Anthracene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluoranthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Pyrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Chrysene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***71*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***88*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***96*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Naphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 2-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| 1-Methylnaphthalene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthylene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Acenaphthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluorene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Phenanthrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Anthracene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Fluoranthene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Pyrene | **ND** | 0.094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Chrysene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[b]fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[a]pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.0094 | EPA 8270D/SIM | 4-7-17 | 4-10-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***38*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***66*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***66*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**
**METHOD BLANK QUALITY CONTROL**

Matrix: Water
Units: ug/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Laboratory ID: | MB0407W1 | | | | | |
| Naphthalene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| 2-Methylnaphthalene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| 1-Methylnaphthalene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Acenaphthylene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Acenaphthene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Fluorene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Phenanthrene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Anthracene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Fluoranthene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Pyrene | **ND** | 0.10 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Benzo[a]anthracene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Chrysene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Benzo[b]fluoranthene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Benzo(j,k)fluoranthene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Benzo[a]pyrene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Indeno(1,2,3-c,d)pyrene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Dibenz[a,h]anthracene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| Benzo[g,h,i]perylene | **ND** | 0.010 | EPA 8270D/SIM | 4-7-17 | 4-8-17 | |
| ***Surrogate:*** | ***Percent Recovery*** | ***Control Limits*** | | | | |
| ***2-Fluorobiphenyl*** | ***81*** | ***30 - 124*** | | | | |
| ***Pyrene-d10*** | ***86*** | ***40 - 143*** | | | | |
| ***Terphenyl-d14*** | ***91*** | ***27 - 127*** | | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**PAHs EPA 8270D/SIM**
**SB/SBD QUALITY CONTROL**

Matrix: Water
Units: ug/L

| Analyte | Result | | Spike Level | | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| **SPIKE BLANKS** | | | | | | | | | | |
| Laboratory ID: | SB0407W1 | | | | | | | | | |
| | SB | SBD | SB | SBD | SB | SBD | | | | |
| Naphthalene | **0.444** | **0.417** | 0.500 | 0.500 | 89 | 83 | 29 - 101 | 6 | 47 | |
| Acenaphthylene | **0.431** | **0.445** | 0.500 | 0.500 | 86 | 89 | 20 - 117 | 3 | 50 | |
| Acenaphthene | **0.445** | **0.425** | 0.500 | 0.500 | 89 | 85 | 37 - 109 | 5 | 43 | |
| Fluorene | **0.472** | **0.466** | 0.500 | 0.500 | 94 | 93 | 47 - 108 | 1 | 34 | |
| Phenanthrene | **0.470** | **0.467** | 0.500 | 0.500 | 94 | 93 | 49 - 109 | 1 | 28 | |
| Anthracene | **0.488** | **0.492** | 0.500 | 0.500 | 98 | 98 | 34 - 140 | 1 | 32 | |
| Fluoranthene | **0.478** | **0.476** | 0.500 | 0.500 | 96 | 95 | 45 - 120 | 0 | 39 | |
| Pyrene | **0.496** | **0.480** | 0.500 | 0.500 | 99 | 96 | 42 - 133 | 3 | 39 | |
| Benzo[a]anthracene | **0.524** | **0.528** | 0.500 | 0.500 | 105 | 106 | 71 - 117 | 1 | 28 | |
| Chrysene | **0.488** | **0.480** | 0.500 | 0.500 | 98 | 96 | 53 - 110 | 2 | 25 | |
| Benzo[b]fluoranthene | **0.488** | **0.471** | 0.500 | 0.500 | 98 | 94 | 53 - 123 | 4 | 37 | |
| Benzo(j,k)fluoranthene | **0.479** | **0.483** | 0.500 | 0.500 | 96 | 97 | 52 - 119 | 1 | 41 | |
| Benzo[a]pyrene | **0.458** | **0.458** | 0.500 | 0.500 | 92 | 92 | 37 - 129 | 0 | 33 | |
| Indeno(1,2,3-c,d)pyrene | **0.509** | **0.492** | 0.500 | 0.500 | 102 | 98 | 45 - 128 | 3 | 31 | |
| Dibenz[a,h]anthracene | **0.512** | **0.519** | 0.500 | 0.500 | 102 | 104 | 54 - 120 | 1 | 30 | |
| Benzo[g,h,i]perylene | **0.527** | **0.522** | 0.500 | 0.500 | 105 | 104 | 49 - 117 | 1 | 29 | |
| ***Surrogate:*** | | | | | | | | | | |
| ***2-Fluorobiphenyl*** | | | | | ***85*** | ***81*** | ***30 - 124*** | | | |
| ***Pyrene-d10*** | | | | | ***90*** | ***90*** | ***40 - 143*** | | | |
| ***Terphenyl-d14*** | | | | | ***93*** | ***95*** | ***27 - 127*** | | | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 04-083-01 | | | | | |
| **Client ID:** | **AMW-1-040617** | | | | | |
| Arsenic | **4.1** | 3.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Barium | **100** | 25 | 200.8 | 4-7-17 | 4-10-17 | |
| Cadmium | **ND** | 4.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Chromium | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lead | **ND** | 1.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-13-17 | |
| Selenium | **ND** | 5.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Silver | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lab ID: | 04-083-02 | | | | | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Arsenic | **5.1** | 3.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Barium | **190** | 25 | 200.8 | 4-7-17 | 4-10-17 | |
| Cadmium | **ND** | 4.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Chromium | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lead | **ND** | 1.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-13-17 | |
| Selenium | **ND** | 5.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Silver | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 04-083-03 | | | | | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Arsenic | **ND** | 3.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Barium | **37** | 25 | 200.8 | 4-7-17 | 4-10-17 | |
| Cadmium | **ND** | 4.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Chromium | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lead | **ND** | 1.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-13-17 | |
| Selenium | **ND** | 5.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Silver | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lab ID: | 04-083-04 | | | | | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Arsenic | **ND** | 3.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Barium | **39** | 25 | 200.8 | 4-7-17 | 4-10-17 | |
| Cadmium | **ND** | 4.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Chromium | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lead | **ND** | 1.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-13-17 | |
| Selenium | **ND** | 5.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Silver | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 04-083-05 | | | | | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Arsenic | **ND** | 3.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Barium | **ND** | 25 | 200.8 | 4-7-17 | 4-10-17 | |
| Cadmium | **ND** | 4.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Chromium | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |
| Lead | **ND** | 1.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Mercury | **ND** | 0.50 | 7470A | 4-7-17 | 4-13-17 | |
| Selenium | **ND** | 5.0 | 200.8 | 4-7-17 | 4-10-17 | |
| Silver | **ND** | 10 | 200.8 | 4-7-17 | 4-10-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**METHOD BLANK QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-10-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0407F1

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Arsenic | 200.8 | **ND** | 3.0 |
| Barium | 200.8 | **ND** | 25 |
| Cadmium | 200.8 | **ND** | 4.0 |
| Chromium | 200.8 | **ND** | 10 |
| Lead | 200.8 | **ND** | 1.0 |
| Selenium | 200.8 | **ND** | 5.0 |
| Silver | 200.8 | **ND** | 10 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED MERCURY**
**EPA 7470A**
**METHOD BLANK QUALITY CONTROL**

| | |
|---|---|
| Date Filtered: | 4-7-17 |
| Date Analyzed: | 4-13-17 |
| Matrix: | Water |
| Units: | ug/L (ppb) |
| Lab ID: | MB0407F1 |

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Mercury | 7470A | **ND** | 0.50 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**DUPLICATE QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-10-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-083-05

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Arsenic | **ND** | **ND** | NA | 3.0 | |
| Barium | **ND** | **ND** | NA | 25 | |
| Cadmium | **ND** | **ND** | NA | 4.0 | |
| Chromium | **ND** | **ND** | NA | 10 | |
| Lead | **ND** | **ND** | NA | 1.0 | |
| Selenium | **ND** | **ND** | NA | 5.0 | |
| Silver | **ND** | **ND** | NA | 10 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED MERCURY**
**EPA 7470A**
**DUPLICATE QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-13-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-083-04

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Mercury | **ND** | **ND** | NA | 0.50 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**MS/MSD QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-10-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-083-05

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Arsenic | 200 | **218** | 109 | **208** | 104 | 5 | |
| Barium | 200 | **205** | 102 | **201** | 101 | 2 | |
| Cadmium | 200 | **202** | 101 | **203** | 101 | 0 | |
| Chromium | 200 | **187** | 93 | **184** | 92 | 2 | |
| Lead | 200 | **189** | 95 | **188** | 94 | 1 | |
| Selenium | 200 | **219** | 110 | **218** | 109 | 1 | |
| Silver | 200 | **202** | 101 | **200** | 100 | 1 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED MERCURY**
**EPA 7470A**
**MS/MSD QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-13-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 04-083-04

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Mercury | 12.5 | **12.3** | 98 | **12.5** | 100 | 1 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 200.8**
**SPIKE BLANK QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-10-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0407F1

| Analyte | Method | Spike Level | Result | Percent Recovery |
|---|---|---|---|---|
| Arsenic | 200.8 | 200 | **205** | 102 |
| Barium | 200.8 | 200 | **205** | 102 |
| Cadmium | 200.8 | 200 | **203** | 101 |
| Chromium | 200.8 | 200 | **184** | 92 |
| Lead | 200.8 | 200 | **192** | 96 |
| Selenium | 200.8 | 200 | **213** | 106 |
| Silver | 200.8 | 200 | **191** | 95 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED MERCURY**
**EPA 7470A**
**SPIKE BLANK QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-13-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0407F1

| Analyte | Method | Spike Level | Result | Percent Recovery |
|---|---|---|---|---|
| Mercury | 7470A | 12.5 | **12.9** | 103 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 04-083-01 | | | | | |
| **Client ID:** | **AMW-1-040617** | | | | | |
| Calcium | **20000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Magnesium | **12000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Potassium | **4900** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Sodium | **15000** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Lab ID: | 04-083-02 | | | | | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Calcium | **73000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Magnesium | **23000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Potassium | **3000** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Sodium | **14000** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Lab ID: | 04-083-03 | | | | | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Calcium | **42000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Magnesium | **21000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Potassium | **1700** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Sodium | **7300** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Lab ID: | 04-083-04 | | | | | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Calcium | **95000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Magnesium | **48000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Potassium | **2800** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Sodium | **5100** | 1100 | 6010C | 4-7-17 | 4-7-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | EPA Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Lab ID: | 04-083-05 | | | | | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Calcium | **37000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Magnesium | **13000** | 10000 | 6010C | 4-7-17 | 4-7-17 | |
| Potassium | **1200** | 1100 | 6010C | 4-7-17 | 4-7-17 | |
| Sodium | **3200** | 1100 | 6010C | 4-7-17 | 4-7-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**
**METHOD BLANK QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0407F1

| Analyte | Method | Result | PQL |
|---|---|---|---|
| Calcium | 6010C | **ND** | 1100 |
| Magnesium | 6010C | **ND** | 1100 |
| Potassium | 6010C | **ND** | 1100 |
| Sodium | 6010C | **ND** | 1100 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**
**DUPLICATE QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 03-304-65

| Analyte | Sample Result | Duplicate Result | RPD | PQL | Flags |
|---|---|---|---|---|---|
| Calcium | **13100** | **13000** | 1 | 11000 | |
| Magnesium | **4380** | **4420** | 1 | 1100 | |
| Potassium | **ND** | **ND** | NA | 1100 | |
| Sodium | **4690** | **4790** | 2 | 1100 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**
**MS/MSD QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: 03-304-65

| Analyte | Spike Level | MS | Percent Recovery | MSD | Percent Recovery | RPD | Flags |
|---|---|---|---|---|---|---|---|
| Calcium | 22200 | **33400** | 91 | **33200** | 91 | 0 | |
| Magnesium | 22200 | **24700** | 92 | **24300** | 90 | 2 | |
| Potassium | 22200 | **21000** | 94 | **21200** | 96 | 1 | |
| Sodium | 22200 | **25400** | 93 | **25700** | 95 | 1 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED METALS**
**EPA 6010C**
**SPIKE BLANK QUALITY CONTROL**

Date Filtered: 4-7-17
Date Analyzed: 4-7-17

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0407F1

| Analyte | Method | Spike Level | SB Result | Percent Recovery |
|---|---|---|---|---|
| Calcium | 6010C | 11100 | **11400** | 103 |
| Magnesium | 6010C | 11100 | **10700** | 96 |
| Potassium | 6010C | 11100 | **11400** | 102 |
| Sodium | 6010C | 11100 | **12500** | 112 |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED ALKALINITY**
**SM 2320B**

Matrix: Water
Units: mg CaCO3/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **160** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **340** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **170** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **140** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **74** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED ALKALINITY**
**SM 2320B**
**QUALITY CONTROL**

Matrix: Water
Units: mg CaCO3/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0407D1 | | | | | |
| Dissolved Carbonate Alkalinity | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |
| Dissolved Bicarbonate Concentration | **ND** | 2.0 | SM 2320B | 4-7-17 | 4-10-17 | |

| Analyte | Result | | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | |
| Laboratory ID: | 04-083-03 | | | | | | | | |
| | ORIG | DUP | | | | | | | |
| Dissolved Total Alkalinity | **174** | **178** | NA | NA | NA | NA | 2 | 10 | |
| **SPIKE BLANK** | | | | | | | | | |
| Laboratory ID: | SB0407D1 | | | | | | | | |
| | SB | | SB | | SB | | | | |
| Dissolved Total Alkalinity | **98.0** | | 100 | NA | 98 | 86-117 | NA | NA | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED CHLORIDE**
**SM 4500-Cl E**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Dissolved Chloride | **8.5** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Dissolved Chloride | **13** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Dissolved Chloride | **3.4** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Dissolved Chloride | **2.3** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Dissolved Chloride | **ND** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED CHLORIDE**
**SM 4500-Cl E**
**QUALITY CONTROL**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0407D1 | | | | | |
| Dissolved Chloride | **ND** | 2.0 | SM 4500-Cl E | 4-7-17 | 4-12-17 | |

| Analyte | Result | | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | |
| Laboratory ID: | 04-083-01 | | | | | | | | |
| | ORIG | DUP | | | | | | | |
| Dissolved Chloride | **8.54** | **9.56** | NA | NA | NA | NA | 11 | 17 | |
| **MATRIX SPIKE** | | | | | | | | | |
| Laboratory ID: | 04-083-01 | | | | | | | | |
| | MS | | MS | | MS | | | | |
| Dissolved Chloride | **68.4** | | 50.0 | 8.54 | 120 | 82-126 | NA | NA | |
| **SPIKE BLANK** | | | | | | | | | |
| Laboratory ID: | SB0407D1 | | | | | | | | |
| | SB | | SB | | SB | | | | |
| Dissolved Chloride | **53.8** | | 50.0 | NA | 108 | 92-118 | NA | NA | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED SULFATE**
**ASTM D516-07**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **AMW-1-040617** | | | | | |
| Laboratory ID: | 04-083-01 | | | | | |
| Dissolved Sulfate | **5.7** | 5.0 | ASTM D516-07 | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-2-040617** | | | | | |
| Laboratory ID: | 04-083-02 | | | | | |
| Dissolved Sulfate | **ND** | 25 | ASTM D516-07 | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-3-040617** | | | | | |
| Laboratory ID: | 04-083-03 | | | | | |
| Dissolved Sulfate | **59** | 25 | ASTM D516-07 | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-4-040617** | | | | | |
| Laboratory ID: | 04-083-04 | | | | | |
| Dissolved Sulfate | **250** | 130 | ASTM D516-07 | 4-7-17 | 4-10-17 | |
| **Client ID:** | **AMW-5-040617** | | | | | |
| Laboratory ID: | 04-083-05 | | | | | |
| Dissolved Sulfate | **76** | 25 | ASTM D516-07 | 4-7-17 | 4-10-17 | |

Date of Report: April 19, 2017
Samples Submitted: April 7, 2017
Laboratory Reference: 1704-083
Project: 160315

**DISSOLVED SULFATE**
**ASTM D516-07**
**QUALITY CONTROL**

Matrix: Water
Units: mg/L

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0407D1 | | | | | |
| Dissolved Sulfate | **ND** | 5.0 | ASTM D516-07 | 4-7-17 | 4-10-17 | |

| Analyte | Result | | Spike Level | Source Result | Percent Recovery | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | |
| Laboratory ID: | 04-083-03 | | | | | | | | |
| | ORIG | DUP | | | | | | | |
| Dissolved Sulfate | **59.3** | **61.2** | NA | NA | NA | NA | 3 | 10 | |
| **MATRIX SPIKE** | | | | | | | | | |
| Laboratory ID: | 04-083-03 | | | | | | | | |
| | MS | | MS | | MS | | | | |
| Dissolved Sulfate | **107** | | 50.0 | 59.3 | 95 | 77-129 | NA | NA | |
| **SPIKE BLANK** | | | | | | | | | |
| Laboratory ID: | SB0407D1 | | | | | | | | |
| | SB | | SB | | SB | | | | |
| Dissolved Sulfate | **9.80** | | 10.0 | NA | 98 | 91-113 | NA | NA | |

OnSite Environmental Inc.

**Data Qualifiers and Abbreviations**

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a Sulfuric acid/Silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

# Chain of Custody

Page 1 of 1

**OnSite Environmental Inc.**
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: Aspect
Project Number: 160315
Project Name: Reserve Silica
Project Manager: Carla Brock
Sampled by: Kristin Beck

**Turnaround Request (in working days)**
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ _____ (other)

**Laboratory Number:** 04-083

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx (☐ Acid / SG Clean-up) | Volatiles 8260C | Halogenated Volatiles 8260C | EDB EPA 8011 (Waters Only) | Semivolatiles 8270D/SIM (with low-level PAHs) | PAHs 8270D/SIM (low-level) | PCBs 8082A | Organochlorine Pesticides 8081B | Organophosphorus Pesticides 8270D/SIM | Chlorinated Acid Herbicides 8151A | ~~Total~~ RCRA Metals DISSOLVED | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | Diss. cations (Ca, Mg, K, Na) | Diss. anions (bicarb/carb, Cl, sulfate) | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AMW-1-040617 | 4/6 | 1515 | Water | 10 | | X Please hold | | X | | | | | X Please hold | | | X Please hold | | X | | | | X | X | X | | |
| 2 | AMW-2-040617 | | 1300 | | 10 | | X | | X | | | | | X | | | | | X | | | | X | X | X | | |
| 3 | AMW-3-040617 | | 1845 | | 10 | | X | | X | | | | | X | | | | | X | | | | X | X | X | | |
| 4 | AMW-4-040617 | | 1625 | | 10 | | X | | X | | | | | X | | | | | X | | | | X | X | X | | |
| 5 | AMW-5-040617 | | 1745 | | 10 | | X | | X | | | | | X | | | | | X | | | | X | X | X | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | Kristin Beck | Aspect | 4/7/17 | |
| Received | | SPEC-D-1 | 4/7/17 | 1032 |
| Relinquished | | Speedy | 4/7/17 | 1150 |
| Received | | | 4/7/17 | 1150 |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
All samples are unfiltered.

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐