# Field Pilot Study Evaluation Report

USG Interiors Highway 99 Site
7110 Pacific Highway East
Milton, WA 98354

**USG CORPORATION**
**550 WEST ADAMS STREET**
**CHICAGO, ILLINOIS 60661-3676**

June 12, 2020

CDM Smith

*A Report Prepared For:*

USG Corporation
550 W. Adams St.
Chicago, Illinois 60661-36761

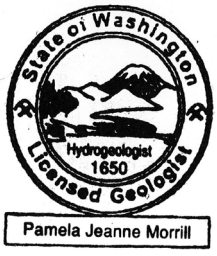
**FIELD PILOT STUDY EVALUATION REPORT**
**7110 PACIFIC HIGHWAY EAST**
**MILTON, WASHINGTON**

June 12, 2020


Brendan Miller, LG
Project Geologist

Dung Nguyen
Project Engineer

Pamela J. Morrill, LHG, PMP
Project Manager




CDM Smith
14432 SE Eastgate Way, Suite 100
Bellevue, Washington 98007
425/519-8300


CDM Smith Project No. 19921.233028

# Table of Contents

# List of Tables



# List of Figures



# Appendices

# Acronyms

| | |
|---|---|
| % | percent by volume |
| µg/L | micrograms per liter |
| bgs | below ground surface |
| CAP | Cleanup Action Plan |
| CDM Smith | CDM Smith Inc. |
| DO | dissolved oxygen |
| Ecology | Washington State Department of Ecology |
| EPA | Environmental Protection Agency |
| IDW | investigation derived waste |
| ISCO | In Situ Chemical Oxidation |
| ISS | In situ soil solidification/stabilization |
| OnSite | OnSite Environmental, Inc. |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MTCA | Model Toxics Control Act |
| ORP | oxidation reduction potential |
| ppb | parts per billion |
| psig | pounds per square inch gauge |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROI | radius of influence |
| scfm | standard cubic feet per minute |
| SOP | standard operating procedure |
| TAL | target analyte list |
| UIC | Underground Injection Control |
| USG | USG Interiors, LLC |

# Executive Summary

This report presents CDM Smith Inc.'s (CDM Smith) summary of a field pilot study at USG Interiors, LLC's (USG) Highway 99 property located in Milton, Washington (site). The purpose of this report is to document and summarize the field methods for the pilot study and to evaluate the effectiveness of air sparging in reducing dissolved arsenic concentrations in groundwater at the site. CDM Smith completed this pilot study on behalf of USG in support of a Cleanup Action Plan (CAP) issued by the Washington State Department of Ecology (Ecology) on June 24, 2016. This work is being performed in accordance with Agreed Order No. DE 11099 between Ecology and USG.

The site is located between Pacific Highway East and Interstate 5 in Milton, Washington in a commercial area situated along the east side of Pacific Highway East. From 1971 through 1973, industrial waste from USG's Tacoma mineral fiber manufacturing plant was used as fill on the site. At that time, ASARCO slag was being used as a raw material. ASARCO slag, and the waste products thereof, contained elevated arsenic concentrations. Industrial waste fill that served as the original source of arsenic at the site was largely removed in 1984/1985, along with some of the impacted native soil located in the southern portion of the property. However, some of the original fill containing industrial waste remains at the site, which contains variable and high concentrations of arsenic and groundwater continues to be impacted by arsenic that leached from source material.

In July 2018, CDM Smith prepared a Field Pilot Study Work Plan (Work Plan) for treatment of arsenic in groundwater at the site. After the Work Plan was completed, CDM Smith completed two additional studies: 1) a bench-scale sparge test with and without the addition of iron and 2) slug testing. Based on the results of those studies, CDM Smith recommended modifications to the pilot testing, including amending the groundwater with ferrous iron prior to the air sparge test, in a proposal dated October 10, 2018.

CDM Smith's Work Plan and proposal included field pilot studies for both air sparging and in situ chemical oxidation (ISCO) using permanganate. Ultimately, ICSO was not pilot tested due to observed limitations in the distribution of ferrous iron amendment injected into groundwater and out of concern for potentially deleterious environmental effects should permanganate injection solution migrate into Hylebos Creek.

Pilot study field activities began in November 2018 with the installation and development of four monitoring wells, two air sparging wells, and two injection wells. The injection wells were registered through Ecology's Underground Injection Control (UIC) Program. Prior to commencement of the actual pilot test, an air sparging radius of influence (ROI) test was conducted to determine the appropriate injection pressure and flow rate. One week prior to the pilot test, approximately 7,000 gallons of amendment solution consisting of iron as ferrous sulfate heptahydrate and potable water was prepared and injected into the subsurface through the new injection wells. The air sparging pilot test occurred on February 14 and 15, 2019.

Process monitoring tools were used during the ROI and air sparging tests to facilitate evaluation of injection pressures, flow rates, injection ROI, distribution of amendment, and short- and long-term effectiveness of treatment. Performance monitoring consisting of groundwater sampling was performed at existing and new monitoring wells before, during, and after pilot testing to evaluate remedial progress. The remedial performance of air sparging was evaluated by assessing indicators of dissolved oxygen (DO) distribution and longevity in the subsurface, redox parameters including oxidation-reduction potential (ORP) and ferrous iron, general water quality parameters, and dissolved arsenic removal.

During the ROI test, it was observed that connection of the wells was highly variable, and treatment was following preferential pathways due to the semi-confined field conditions.

Injection of the ferrous iron following the ROI was problematic and the desired concentrations were not achieved due to the iron coming out of the solution as it was being injected. Based on the pilot study results CDM Smith has concluded the following:

- Sufficient ROI for full-scale implementation of pilot tested technology was not achieved.
- Where amendment was delivered, reasonable reduction in arsenic concentration was achieved.
- Geochemical conditions conducive to oxidative treatment of arsenic were not maintained, likely due to the presence of high organic content in soil at the site including wood fragments observed in soil borings.
- Overall, lithologic, hydrogeological, and geochemical conditions at the site do not appear to be amenable to the air sparging treatment technology that was pilot tested.

CDM Smith is currently developing an alternative approach to address arsenic contamination in soil and groundwater by conducting in situ soil solidification/stabilization (ISS) over a larger area of the site. The extension of the ISS area will now include the majority of area that was previously identified for groundwater remediation with ISCO and/or air sparging. The increased area of ISS will greatly reduce the permeability of soils, in effect causing groundwater to go around, instead of through, soils containing high arsenic concentrations. This should greatly reduce and potentially eliminate the need for treatment by ISCO and/or air sparging.

# Section 1
# Introduction

This report presents CDM Smith Inc.'s (CDM Smith) summary of a field pilot study at USG Interiors, LLC's (USG) Highway 99 property located in Milton, Washington (site). The site location is shown on **Figure 1**. CDM Smith completed this pilot study on behalf of USG in support of a Cleanup Action Plan (CAP) issued by the Washington State Department of Ecology (Ecology) on June 24, 2016 and as a follow-up to our bench scale study completed in March 2018 (CDM Smith, 2018a). This work is being performed in accordance with Agreed Order No. DE 11099 between Ecology and USG.

## 1.1 Purpose and Scope of Work

The purpose of the pilot study was to evaluate the effectiveness of air sparging in removing dissolved arsenic concentrations in site groundwater.

The scope of work to complete this field pilot study included the following:

- Conducted a private utility locate to clear the planned drilling locations for subsurface utilities.
- Completed application for the Underground Injection Control (UIC) Program and submitted it to Ecology.
- Drilled eight soil borings using hollow-stem auger methods. Four groundwater monitoring, two air sparging, and two injection wells were completed in the drilled borings.
- Collected groundwater samples from site wells for baseline and performance analyses.
- Performed a stepwise air sparging radius of influence (ROI) test.
- Amended groundwater with ferrous iron and performed an air sparging pilot test.
- Evaluated the analytical data and prepared this report summarizing our findings.

## 1.2 Report Organization

This report is organized as follows:

- **Section 1:** Introduction, provides an overview of the purpose of this document, and the organization of this report.
- **Section 2:** Site Setting and Background Information, presents a summary of the site location, site history, geology and hydrogeology, and nature and extent of contamination.

- **Section 3:** Pre-Installation Activities, describes activities performed prior to installation of pilot study wells and initiation of the pilot study to address potential data gaps, as well as other pre-field activities such as site access coordination permitting, and subsurface utility clearance.
- **Section 4:** Pilot Study Field Implementation, provides details regarding various components of the pilot system installation and operation, including well installation, well development, sparging/injection system construction and testing, decontamination, environmental protection and investigation derived waste (IDW) management.
- **Section 5:** Monitoring, discusses how process and performance monitoring were performed to facilitate evaluation of the pilot system and remedial progress.
- **Section 6:** Pilot Results Summary and Discussion, provides a summary the results of field pilot study and discussion with respect to the pilot efficacy.
- **Section 7:** Conclusions, provides CDM Smith's conclusions as a result of the findings from this pilot study.
- **Section 8:** References, provides a list of documents used as references throughout this report.

# Section 2

# Site Setting and Background Information

## 2.1 Site Location and Description

The USG Highway 99 property is located between Pacific Highway East and Interstate 5 in Milton, Washington. It is located in a commercial area situated along the east side of Pacific Highway East. Residences are located west of the property across Pacific Highway East. Two businesses currently operate on the site, Discount RV and Kanopy Kingdom, as shown on **Figure 2**. A chain link fence separates the businesses and the western property line along Pacific Highway East. Interstate 5 marks the eastern boundary of the site. Hylebos Creek is located east of the property adjacent to Interstate 5. The western, paved portion of the site is relatively flat, but drops off sharply east of the paved area where the surface slopes down either to Hylebos Creek (Discount RV) or a roadside ditch (Kanopy Kingdom). The site is located at an elevation of approximately 20 feet above Mean Sea Level.

## 2.2 Site History

Interstate 5, situated immediately to the east of the site, was constructed through this area in 1961. Hylebos Creek was re-routed to its current location, adjacent to the eastern side of the site, as part of the construction. The freeway construction and re-routing of Hylebos Creek cut the site off from the adjoining agricultural land to the east.

Fill was imported to bring the Highway 99 site up to grade with Pacific Highway East. This fill included industrial waste from USG's Tacoma plant. From 1959 through 1973, the USG Tacoma plant used ASARCO slag as a raw material for mineral fiber production. Baghouse dust and off-specification product was reportedly used as fill at the Highway 99 site from 1971 through 1973.

In the early 1980s, USG became aware of the association between ASARCO slag and arsenic contamination. Subsequently, in 1982 USG purchased the site. That same year USG voluntarily approached Ecology to negotiate an administrative process to govern removal of fill from the property. Soil and groundwater cleanup standards had not been established in Washington State at this time. Accordingly, Agreed Order No. DE 84-506 established project-specific arsenic cleanup standards of 0.5 milligrams per liter (mg/L) for soil (by the Environmental Protection Agency's [EPA] Toxicity [leaching] method) and for groundwater. The 1984 Order also required USG to conduct post-cleanup groundwater monitoring.

The initial cleanup action on the Highway 99 site occurred between October 1984 and January 1985. Detailed records of the cleanup, termed the source removal action, have not been located. Ecology estimated that 20,000 to 30,000 cubic yards of material was excavated and disposed of off-site. Native soil exceeding the project-specific cleanup standard was reportedly excavated in the southern portion of the property in the vicinity of monitoring well 99-1. This is referred to as the contaminant source area. It is inferred that the 20,000 to 30,000 cubic yards of waste excavated from the site included soil fill mixed with waste insulation, baghouse dust, and native soil, which exceeded the cleanup standard.

USG sold the property to Herbert Rendell in 1986 and it subsequently underwent commercial development. By 1989 it had been developed to its current configuration; it is now owned and occupied by Kanopy Kingdom, a portion of which is leased and occupied by Discount RV. USG maintained responsibility for verification monitoring at wells 99-1 and 99-2, as specified in Agreed Order No. DE87-506 issued in 1987. The 1987 Order retained the 0.5 mg/L groundwater cleanup level for the site. Post-source removal action verification groundwater sampling was performed by USG from June 1985 to April 2006.

The Washington State Model Toxics Control Act (MTCA) was enacted and went into effect in March 1989. In 1991, Ecology established MTCA Method A arsenic cleanup levels of 20 milligrams per kilogram (mg/kg) for soil and 5 micrograms per liter (µg/L) for groundwater. In early 2006, arsenic concentrations in monitoring well 99-1 exceeded the MTCA Method A cleanup level and Ecology required that USG conduct a soil and groundwater assessment for arsenic in the vicinity of well 99-1. This assessment showed that arsenic in soil and groundwater exceeded MTCA Method A cleanup standards. This led to Agreed Order No. DE 6333, dated October 19, 2009, which required USG to perform a Remedial Investigation/Feasibility Study (RI/FS) and CAP.

RI fieldwork was conducted between 2010 and 2012 and characterized the nature and extent of arsenic in soil, sediment, groundwater, and surface water. The FS screened remedial technologies for the various impacted media and developed remedial action alternatives. The final RI, FS and CAP were issued in June 2016 (CDM Smith, 2016a, b; Ecology 2016). The proposed cleanup action generally consisted of in situ soil solidification/stabilization (ISS) to treat the vadose fill/soil hot spot area and treating the groundwater hot spot by in situ chemical oxidation (ISCO), combined with groundwater monitoring, installation of permeable pavement, excavation of contaminated sediment, natural attenuation, and institutional controls. In June 2016, Agreed Order DE 11099 was issued, which provided for the implementation of the remedial action at the site as outlined in the CAP.

In July 2018, CDM Smith prepared a Field Pilot Study Work Plan (Work Plan) for treatment of arsenic in groundwater at the site (CDM Smith, 2018b). After the Work Plan was completed, CDM Smith completed two additional studies: 1) a bench-scale sparge test with and without the addition of iron and 2) slug testing. Based on the results of those studies, CDM Smith recommended modifications to the pilot testing, including amending the groundwater with ferrous iron prior to the air sparge test, in a proposal dated October 10, 2018 (CDM Smith, 2018c).

CDM Smith's Work Plan and proposal included field pilot studies for both air sparging and in situ chemical oxidation (ISCO) using permanganate. Ultimately, ICSO was not pilot tested due to observed limitations in the distribution of ferrous iron amendment injected into groundwater and out of concern for potentially deleterious environmental effects should permanganate injection solution migrate into Hylebos Creek.

## 2.3 Geology and Hydrogeology

Information relevant to site geology and hydrogeology is presented in the following sub-sections.

### 2.3.1 Geology

The site is situated in a north-trending valley that is the floodplain of Hylebos Creek and its tributaries. The valley is located just north of the lower Puyallup River Valley. Alluvium associated with Hylebos Creek and lower Puyallup River forms the uppermost native soil at the site. The alluvium consists predominantly of overbank flood, slack water, and bar accretion deposits. Glacially consolidated glacial drift and interglacial deposits hundreds to thousands of feet thick underlie the alluvial deposits. Generalized stratigraphy consists of fill overlying alluvium, over glacial drift. Each of these units is described in more detail in the Work Plan (CDM Smith, 2018b).

In the pilot study area, fill consisting of brown silty sand is present from the surface to a depth of 11 to 14 feet below ground surface (bgs). In some borings the base of the fill includes sandy silt which was mottled gray and brown with occasional fibers and cinders/slag. This sandy silt contains suspected waste material high in arsenic. From 11 to 14 feet bgs to approximately 35 feet bgs in the pilot study area, saturated, sometimes slightly silty, dark brown sand interpreted as alluvium occurs. The alluvium contains occasional wood fragments. During drilling of the pilot study wells, heaving sands were encountered in the deeper alluvium. Below the alluvium, hard gray silt interpreted as a glacial deposit was encountered in the deepest borings to a depth of 37 feet bgs.

### 2.3.2 Hydrogeology

Groundwater occurs under semi-confined conditions within the alluvial sand and slightly silty sand. The overlying relatively low permeability fill soils consisting of silty to very silty sand act as an upper semi-confining layer. Low permeability soil consisting of silt of the glacial drift acts as a lower confining layer to the alluvial aquifer, restricting vertical flow. During the RI, groundwater was encountered at depths ranging from 4 to 14 feet bgs. During the pilot study, static water levels in the pilot study area were generally around 7 to 8 feet bgs. The groundwater flows east toward Hylebos Creek and south parallel to the creek. The horizontal hydraulic gradient during the RI ranged from 0.003 foot/foot in the central area of the site, steepening to 0.03 foot/foot at the west bank of Hylebos Creek.

## 2.4 Nature and Extent of Contamination

### 2.4.1 Soil

Industrial waste fill that served as the original source of arsenic at the site was largely removed in 1984/1985, along with some of the impacted native soil in the southern portion of the property in the vicinity of monitoring well 99-1. However, some residual fill containing industrial waste remains at the site. Soil boring data indicate that the highest arsenic concentrations at the site typically occur in the interval between 5 and 14 feet bgs. This reflects the 1984/1985 contaminant source removal action as the shallower industrial waste fill was removed and replaced with clean soil fill.

### 2.4.2 Groundwater

The highest arsenic concentrations, identified as the groundwater hot spot, occur in the area bound by wells MW-4, MW-5, 99-1, MW-1, and MW-3 (screened between 14-19, 15-20, 16-26, 13-18, and 15-20 feet bgs, respectively). The dissolved arsenic concentrations in these wells ranged from 630 to 2,490 µg/L in 2010 (CDM Smith, 2016a). The highest concentrations of arsenic in groundwater are observed in well 99-1, which is located in the original contaminant source area. From there, arsenic migrates in the direction of groundwater flow to the east and south.

# Section 3

# Pre-Installation Activities

Activities performed prior to pilot system installation, including hydraulic characterization, site access and coordination, permitting, subsurface utility clearance, and identifying/coordinating site utilities are described in the following sub-sections.

## 3.1 Hydraulic Characterization

Since CDM Smith completed the July 2018 Field Pilot Study Work Plan (CDM Smith, 2018b), site-specific hydraulic characterization activities were performed at the site to determine hydraulic conductivity and groundwater velocity. Such information was necessary to determine the placement of the pilot cell relative to existing and new monitoring wells, as well as relative to Hylebos Creek. In addition, the local groundwater flow regime (i.e., groundwater velocity, gradient, and flow direction) may be subject to change following potential highway construction. Therefore, hydraulic testing was performed to facilitate both the refinement of the pilot study design and subsequent implementation as well as future full-scale consideration.

On September 11, 2018, a round of synoptic groundwater level measurements was performed at select wells located within the pilot testing area to determine the groundwater flow direction and horizontal gradient. **Table 1** presents a summary of water levels measured prior to the pilot study. On September 11 and 12, 2018, slug tests were performed at wells located within the hotspot treatment area to determine the hydraulic conductivity. The collected data represent baseline hydraulic conditions at the site and would be compared to those obtained following any Hylebos Creek rerouting associated with highway construction. Hydraulic testing was performed in accordance with CDM Smith's standard operating procedure.

## 3.2 Permitting

The injection wells for the pilot study were registered through Ecology's UIC Program prior to initiation of field activities (**Appendix A**). All installed wells were registered with Ecology and well construction logs uploaded to Ecology's well log database. Another permit was obtained by a subcontractor to gain access to a public hydrant for amendment injections.

## 3.3 Subsurface Utility Clearance

Standard underground utility clearance practices were performed prior to the start of any intrusive subsurface work at the site. Specifically, Washington Utility Notification Center was notified to obtain utility clearance at least 72 hours prior to commencement of intrusive activities. A geophysical subcontractor, Applied Professional Services Inc., was used to verify the underground utility locations.

# Section 4

# Pilot Study Field Implementation

A description of field activities implemented as part of the pilot study including drilling and well installation, well development, well survey, pre-pilot and pilot activities, decontamination, and management of IDW is provided in this section.

## 4.1 Drilling and Well Installation

All drilling operations in support of the pilot study were conducted under an approved health and safety program, by a Washington State-licensed driller (Holt Services Inc.), and under the supervision of a CDM Smith geologist. Hollow-stem auger drilling technology was utilized to facilitate collection of soil samples for lithologic logging in accordance with the Unified Soil Classification System as described in **Appendix B**. A total of four monitoring wells, two air sparging wells, and two injection wells were installed at the locations shown on **Figure 2**. These eight pilot study wells were constructed as depicted on boring/well construction logs provided in **Appendix B**.

## 4.2 Well Development

Following a minimum of 48 hours upon completion of all well installation activities, the injection and monitoring wells were developed using a combination of surging, bailing, and pumping techniques. The wells were considered properly developed following stabilization of field parameters including pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and specific conductivity, and until visual turbidity had improved. At least 20-gallons of groundwater were purged from each well during development. At one of the air sparging wells (AS2), anomalous drawdown to the top of the screened interval was observed during pumping, possibly indicating limited hydraulic connectivity between the aquifer and the well screen.

## 4.3 Well Survey

All new wells were surveyed by a Washington State-licensed surveyor using the appropriate city and county benchmarks. The wellhead casing elevations were surveyed to the nearest 0.01 foot. The top of each well casing was notched at the survey point at which subsequent groundwater level measurements were obtained. Survey information is included on the well construction logs in **Appendix B**.

## 4.4 Pre-Pilot Activities

Pre-air sparging pilot activities, consisting of an air sparging ROI test and injection of ferrous iron amendment, were conducted to support the air sparging pilot test, as described below.

### 4.4.1 Air Sparging ROI Testing

ROI testing activities were performed prior to commencement of the actual pilot test. Specifically, a step injection test was conducted to determine the appropriate injection pressure and flow rate for the air sparging pilot test. ROI testing was completed in two days starting on January 16, 2019.

Prior to the step injection testing, water levels at the injection and nearby monitoring wells were measured and recorded. At the start of the step injection testing, air was injected into each air sparging well (AS1 and AS2) individually at a flow rate of approximately 1 to 4 standard cubic feet per minute (scfm) using an air compressor. Helium was utilized as a tracer gas to facilitate evaluating the effective air sparging ROI. The helium flow rate was adjusted manually at the gas cylinder in order to target an influent helium concentration of approximately 5 percent by volume (%), which was measured at the influent sampling port of each injection well using a MGD-2002 Dielectric Helium Detector. In practice, during initial ROI testing, injected helium concentrations varied between 5-15% and stable helium readings were only achievable at approximately 7%.

Due to the increased helium concentration and concerns about its effect on the density of injected air, helium was shut off for the initial ROI testing at AS1. While helium was shut off, ROI was assessed using visual observation of bubbling in monitoring wells and water level measurements. Air sparging wellhead pressures were measured using pressure gauges installed on the air sparging manifold at each wellhead. Monitoring wellhead pressures were obtained using an Extech differential pressure manometer through specialty J-plugs with built-in valves obtained for the pilot testing. When feasible, helium and wellhead pressure were measured hourly, at a minimum, or as often as practicable at the nearby monitoring wellheads. Water levels were also measured at least every 2 hours following system startup and 15 minutes after system shutdown, or as often as practicable. Pressure was measured prior to removing the J-plugs and taking manual water level measurements through the drop tube. Once the drop tube was opened, the next set of pressure measurements were not taken until at least 1 hour after the tube had been sealed to allow for collection of representative pressure readings.

During the tests, ROI effects were observed almost immediately at most wells, with built-up pressure occasionally ejecting the J-plugs. The J-plugs were then removed from the drop tubes for safety, to observe bubbling, and to measure water levels. Surfacing of bubbling groundwater from monitoring wells sometimes required the replacement of the J-plug and well lid for the remainder of the test, preventing the measurement of water levels.

The upward displacement of water caused by introduction of air into a saturated formation can create a transient groundwater mound (USACE, 2013). Significant groundwater mounding (>1-foot) was observed during the ROI, even at the lowest achievable flow rate of 1.1 scfm. Wellhead pressures at the air sparging wells were closely monitored. The air sparge wellheads injection pressure was maintained well below 20 pounds per square inch gauge (psig) at all times to avoid fracturing the aquifer unintentionally.

An iterative series of tests were conducted to determine the injection rate that corresponds to the largest possible ROI while minimizing significant groundwater mounding/displacement and aquifer pressurization caused by high flow rates. Based on helium, pressure, and water level readings in the monitoring wells, an injection flow rate of approximately 1 scfm was selected for actual pilot testing.

### 4.4.2 Ferrous Iron Amendment

Approximately one week prior to the pilot test, on February 5, 7, and 8, 2019, a solution of ferrous iron as ferrous sulfate heptahydrate was prepared and subsequently injected into the subsurface through the new injection wells. Ferrous iron amendment enhances coprecipitation of iron with oxidized arsenic species to form arsenic-iron-oxyhydroxide precipitate (see Work Plan-CDM Smith, 2018b).

Injection was completed using a positive-displacement diaphragm pump at low pressure (<10 psig). Injection rates ranged between 4 and 10 gallons per minute. Ferrous iron solution was prepared in multiple small batches of 175-gallons each using water obtained from a fire hydrant and ferrous sulfate heptahydrate mixed and solubilized via recirculation. Precipitation from the solution, possibly due to water quality issues, resulted in lower-than-anticipated ferrous iron concentrations as measured by a field test kit from grab samples occasionally taken from batches. Batch concentrations averaged approximately 60% below the anticipated concentration. In-line filters (5-micron) were employed on February 7 and 8 to remove precipitates from the solution before delivery to the injection wells. In total, approximately 7,000 gallons of amendment solution containing approximately 110 pounds of ferrous sulfate heptahydrate was injected into both injection wells in approximately equal portions (i.e., 3,500 gallons into each well).

## 4.5 Pilot Test Activities

Pilot testing occurred on February 14 and 15, 2019. Like the ROI test, air was injected into both air sparging wells using an air compressor. The procedure was identical to the ROI but without the addition of or monitoring for helium. Both wells were sparged simultaneously for the pilot test. Based on the ROI test, the lowest achievable flow rate of approximately 1.1 scfm was used to sparge the wells. On February 14, 2019 the wells were sparged continuously for 3 hours at a flow rate of 1.1 scfm. On February 15, 2019, after initially sparging for approximately 1 hour, sparging was cycled on and off in 20-minute intervals at a flow rate just below 1 scfm in an attempt to surge DO into the formation more effectively. The monitoring wells were left opened for the duration of the air sparing pilot to facilitate monitoring.

Groundwater monitoring during the pilot test consisted of grab sampling of groundwater using a peristaltic pump in order to monitor changes in redox parameters (e.g., DO, ORP) and concentrations of arsenic and ferrous iron using field test kits. Starting one week after the pilot test, monitoring wells were sampled monthly to assess the persistence of redox conditions and changes in arsenic concentrations from the pilot test. Further details of the groundwater monitoring used to determine the effectiveness of the pilot test are presented in **Section 5**.

## 4.6 IDW Management

IDW generated during field implementation, including drill cuttings, development water, purged water, and decontamination rinse water, was containerized and temporarily stored onsite in a designated area. Drill cuttings were placed directly into 55-gallon drums pending waste profiling. A composite soil sample was collected from the soil drums on December 10, 2018 and submitted to OnSite Environmental, Inc. (OnSite) of Redmond, Washington for waste profiling purposes. Similarly, purged groundwater from sampling, decontamination water, and well development water was containerized in drums. Following waste characterization, all IDW drums were transported under manifest documentation to an appropriately licensed disposal facility by Clean Harbors Environmental Services Inc.

# Section 5
# Monitoring

A variety of monitoring tools were used to facilitate evaluation of injection pressures, flow rates, injection ROI, distribution of the amendment, and short- and long-term effectiveness of treatment. Additionally, groundwater sampling was performed at existing and newly installed monitoring wells to evaluate remedial progress. This section provides a summary of the results of monitoring activities and performance evaluation processes that were conducted.

## 5.1 Process Monitoring

### 5.1.1 Air Sparging Monitoring

When the air sparging pilot test was in progress, pH, DO, specific conductance, ORP, ferrous iron, arsenic, pressure, and water levels were measured at nearby monitoring wells. Groundwater parameters measured immediately before, during, and after the air sparging pilot test are presented on **Table 2**. In addition, gas leak checks were performed at each connection in the sparging manifold prior to each sparging event.

### 5.1.2 Amendment Injection Monitoring

During ferrous iron amendment injection prior to air sparging, amendment batch injection duration, number of batches prepared, and pressure readings were recorded to allow for determination of the accumulative injection volume, injection flow rate, and injection pressures. In addition, visual inspection for leaks and condition of the injection equipment was conducted every hour or more frequently. Grab samples of the prepared injection solutions were also collected and analyzed for ferrous iron using a Hach field test kit.

## 5.2 Performance Monitoring

Prior to commencement of any pilot testing activities, baseline groundwater sampling at select existing and new wells was performed on December 7 and 10, 2018. In February 2019, sampling was conducted prior to amendment injection, during air sparging, and post-air sparging. Follow-up groundwater monitoring was subsequently performed at wells located within the treatment area one week following air sparging (sampled February 21-22, 2019), and 5-weeks following air sparging (sampled March 21-22, 2019).

### 5.2.1 Groundwater Sampling Methods

Depth to groundwater from the top of the well casing at each well was measured using an electronic water level indicator prior to beginning sampling**.** Low-stress, low-flow groundwater sampling techniques using dedicated sample tubing was used to collect formation-representative groundwater samples in accordance with CDM Smith's standard operating procedure (SOP).

A peristaltic pump with dedicated tubing was used to withdraw groundwater from the screened interval of the well casing at a rate of less than 0.5 liters per minute. Depth to water during purging was measured to ensure that draw-down during pumping was minimal. Purge water was

passed through a flow-through-cell equipped with a water quality meter that measures parameters of temperature, specific conductance, pH, DO, and ORP. A separate portable turbidimeter was used to measure turbidity of the sample prior to collection. Water quality parameters were recorded at 3 to 5-minute intervals and purging was performed until parameters had stabilized to within approximately 10 percent over three consecutive readings. The tubing was then disconnected from the flow-through-cell apparatus and groundwater was discharged directly from the pump outlet into the appropriate sample containers. Groundwater to be collected for dissolved metals analysis was field-filtered using disposable 0.45-micron filters discharged directly into laboratory supplied bottles for analysis of dissolved metals rather than total metals.

Groundwater samples to be submitted for laboratory analysis were collected directly into laboratory-supplied pre-cleaned bottles containing preservatives as appropriate per the analytical methods. Sample containers were labeled with an identification number, date, and time of collection, and project name. Groundwater samples were immediately packed in an iced cooler pending transport to the analytical laboratory.

### 5.2.2 Analytical and Field Parameters

A variety of field and analytical parameters were measured at existing and newly installed monitoring wells during baseline sampling, prior to amendment injection, during air-sparging, and post-air sparging to facilitate performance evaluation of the pilot-tested treatment techniques. A brief description of the various field and analytical parameters that were measured and their associated rationale are provided as follows:

- **Standard field parameters:** Temperature, pH, DO, ORP, and specific conductivity were measured during groundwater purging and sampling using a multi-parameter groundwater quality meter. Wells were purged until the indicator parameters stabilized in accordance with CDM Smith's SOP. Field parameters measured during both baseline and subsequent groundwater sampling are summarized on **Table 3.**

- **Dissolved and total arsenic:** Samples were collected from formation-representative groundwater and submitted for analysis of dissolved (filtered in the field using 0.45-micron in-line filter) and total arsenic periodically to aid in evaluation of remedial performance. The samples were analyzed using EPA Method 200.8 by OnSite. Hach and Quick™ arsenic field test kits were also used to aid in determination of dissolved arsenic concentrations in groundwater as appropriate. Analytical lab data for dissolved and total arsenic are summarized on **Table 4** and displayed on **Figure 3**. Arsenic data collected using field test kits are provided in **Tables 2** and **3**. During the first sampling event of the pilot study, total arsenic was analyzed at all the pilot study monitoring and injection wells and at monitoring well 99-1. Dissolved arsenic was analyzed at three of these wells. The results from the three wells show that total and dissolved arsenic concentrations are similar regardless of filtering, indicating the success in achieving non turbid samples as the totals analyses were reporting arsenic that was only in the dissolved phase.

- **Dissolved and total iron:** Samples were collected from formation-representative groundwater and submitted for analysis of dissolved (field filtered) and total iron to monitor the delivery of the ferrous iron amendment injected into the pilot area. These data are summarized on **Table 4** and presented on **Figure 4**.

- **Ferrous iron:** Ferrous iron was measured using a HACH test kit. Changes in ferrous iron concentrations are indicative of changes in redox conditions; as soluble ferrous iron is oxidized to insoluble ferric iron under aerobic conditions, ferrous iron monitoring is used as an indirect line of evidence of the ROI of the sparging. Ferrous iron data collected throughout the pilot test are summarized in **Tables 2** and **3** and presented on **Figure 4**.

- **Target analyte list (TAL) metals[1] and bromate:** Changes in pH and ORP as a result of air sparging may result in significant, albeit generally transient, metal mobilization in monitoring wells located within the anticipated injection ROI. Therefore, TAL metals were monitored at the start of the pilot study. Introduction of oxygen to groundwater with bromide may lead to the production of bromate; therefore, bromate was monitored at the start of the pilot study. Subsequent analysis for TAL metals and bromate was not required due to stable pH and ORP during the pilot study and the absence of detectable bromate at the start of the pilot study. TAL metals and bromate data collected during baseline sampling are summarized on **Table 5**. Total iron results are shown on **Table 4**.

- **Groundwater level:** Depth to water was manually recorded at each monitoring well using a water level indicator. Groundwater levels measured before and after the pilot are presented on **Table 1**. Groundwater levels measured during the air sparging test are presented on **Table 2**.

Laboratory analysis of all water samples was performed by OnSite. OnSite's laboratory reports are provided in **Appendix C**. An internal quality assurance review was conducted by CDM Smith on the analytical data from OnSite and it appears that OnSite followed their appropriate quality assurance/quality control procedures and the target method reporting limits were met. None of the results were presented with any laboratory qualifier flags. All laboratory control data appear to be within control limits (i.e., matrix spike/matrix spike duplicate, duplicate quality control, surrogate recoveries). Nothing was detected in the method blanks. Field duplicate samples were collected from monitoring well M2 on December 7, 2018 and submitted to OnSite. Duplicate sampling data are presented on **Tables 4** and **5** and exhibited normal variation that occurs within groundwater samples.

### 5.2.3 Performance Evaluation

The remedial performance of air sparging was evaluated by assessing indicators of DO distribution and longevity in the subsurface, redox parameters including ORP and ferrous iron, general water quality parameters, and dissolved arsenic removal. Several key parameters were used to aid evaluation of remedial performance as described below:

[1] Silver, Aluminum, Arsenic, Barium, Beryllium, Calcium, Cadmium, Cobalt, Chromium, Copper, Iron, Mercury, Potassium, Magnesium, Manganese, Sodium, Nickel, Lead, Antimony, Selenium, Thallium, Vanadium, Zinc.

- **Arsenic reduction effectiveness**: Short- and long-term effectiveness of the treatment technology was evaluated by assessing changes in dissolved arsenic concentrations at monitoring wells located within and immediately outside of the anticipated ROI of the air sparging. Changes in arsenic concentrations throughout the pilot study are summarized on **Figure 3.**
- **Injection and sparging ROI:** The ferrous iron amendment injection ROI was evaluated by comparing concentrations of iron (ferrous, total, and dissolved) in groundwater sampled at the monitoring wells located within the anticipated injection ROI to the injected concentration. In addition, concentration trends over time were assessed to determine arrival time and persistence (i.e., longevity) of the added reagent in the subsurface. For air sparging tests, multiple lines of evidence, such as changes in redox conditions as indicated by pH, DO, and ORP, and field observations of groundwater levels were used to aid in evaluation of the effective air sparging ROI. Monitoring of iron concentrations throughout the pilot study are summarized on **Figure 4**. Field parameters measured at the time of the air sparging test are shown on **Table 2**.
- **Geochemical evaluation**: Evaluation of changing geochemical conditions, with DO and ORP parameters indicating establishment of aerobic conditions, was also used as an indicator of the area influenced by amendment injection and air sparging. Monitoring of DO and ORP parameters throughout the pilot study are summarized on **Figure 5**.

# Section 6

# Pilot Results Summary and Discussion

This section summarizes the results of field pilot study with discussion with respect to the amendment injection and air sparging ROIs, geochemical changes as a result of the pilot testing activities, and reduction of arsenic in site groundwater.

## 6.1 Injection and Sparging ROI

**Figure 4** shows the changes in the concentrations of three species of iron (dissolved, total, and ferrous) over the duration of the pilot. Prior to air sparging or amending with ferrous iron, total and ferrous iron concentrations in the pilot study area ranged from 2.6 to 9.2 mg/L total iron and 2.2 to 3.9 mg/L ferrous iron. A decrease in ferrous iron to approximately 1.5 mg/L was apparent following the air sparging ROI test, as observed in monitoring wells M2, M3, and M4. Such decrease was attributable to oxidation of ferrous to ferric iron, and potential coprecipitation with arsenic as oxygen was introduced into the formation.

Following the injection of ferrous iron amendment and air sparging pilot test, increases in the concentrations of total and dissolved iron were most evident at the injection wells, where concentrations were an order of magnitude greater than before the injections. For example, total iron increased from 3.3 mg/L during baseline sampling to 150 mg/L at INJ2 one week following air sparging. Iron concentrations at the nearby monitoring wells did not increase as much or decreased over the same time interval. For example, total iron increased from 3.3 to 5.7 mg/L at M1 and decreased from 8.8 to 3.2 mg/L at 99-1 from baseline sampling to one week following air sparging. These results indicate that the iron delivered to the formation had not been widely distributed into the entire pilot area and was mostly confined to the immediate vicinity of the injection wells.

**Table 2** shows groundwater field parameter measurements taken just before, during, and immediately after the air sparging test. Of the parameters monitored, ORP, DO, depth to water, ferrous iron and the arsenic field test are most indicative of the ROI of the air sparging test. Of the two air sparging test days, the greatest ROI was most apparent during the second day when sparging with air was surged into the formation by cycling the air compressor on and off.

The results of the monitoring of each of these parameters are discussed below.

- **ORP:** ORP values became increasing positive over the tests, indicating the transition to conditions favoring oxidation. This was more effective on the second day of testing with positive ORP values that persisted or increased after air sparging ceased.
- **DO:** DO concentrations were variable during the first day of testing with no clear increase. On the second day, DO increased in the three monitoring wells nearest the air sparing wells (M2, M3, and M4) and persisted after air sparging ceased. Concentrations in wells M1 and 99-1 did not increase significantly.

- **Depth to groundwater:** Excessive groundwater mounding was observed on the first day of testing. This was less apparent on the second day when using the surging strategy. The depth to groundwater quickly recovered once air sparging ceased.
- **Ferrous iron:** Over both days of testing, decreasing ferrous iron concentrations were observed in the three monitoring wells nearest the air sparing wells (M2, M3, and M4). This is indicative of oxidation of ferrous to ferric iron, and potential coprecipitation with arsenic, due to the oxygen sparged into the formation.
- **Arsenic field test:** Concentrations of arsenic as measured using the field test kit showed generally decreasing trends in most monitoring wells during air sparging, but results were variable. On the second day of testing, arsenic decreased the most in the three wells nearest the air sparing wells (M2, M3, and M4). At well M1 an increase in arsenic was observed following sparging, possibly indicating advection of groundwater upgradient from the groundwater hotspot due to sparging.

## 6.2 Geochemical Evaluation

The persistence of aerobic conditions is an indicator of the overall performance of the air sparing pilot test and the extent to which repeated air sparging would be required to achieve cleanup goals. Aerobic conditions are indicated by positive ORP parameters and elevated DO. Monitoring of DO and ORP parameters throughout the duration of the pilot study are summarized on **Figure 5**. DO fell to pre-pilot levels by approximately two weeks following the ROI test and one month following the air sparging test. ORP remained slightly to moderately positive at M2, M3, and M4 two weeks following the ROI test; however, one week following the air sparging test, ORP returned to negative values in all but one well (INJ1). Together, ORP and DO parameters observed during the pilot suggest that geochemical conditions favorable to remediating arsenic could only be maintained with very frequent periodic air sparging.

## 6.3 Arsenic Reduction Effectiveness

**Figure 3** shows the changes in arsenic concentrations in the pilot study area over the duration of the pilot study. Decreases in arsenic concentrations were most evident at the wells nearest the air sparging wells. The two injection wells, INJ1 and INJ2, are located between 3 and 5 feet away from the nearest air sparging well. Concentrations of arsenic in the injection wells decreased from over 2,000 µg/L prior to the pilot to concentrations that were not detectable using the field test kit for arsenic (5-10 parts per billion [ppb]; 1 ppb is approximately equal to 1 µg/L). Decreases in arsenic were less apparent at monitoring wells further away (5 to 8 feet) from the air sparging wells. For example, at monitoring wells M2 and M4, dissolved arsenic concentrations measured during the 1-month post-pilot monitoring event decreased from 1,100 to 440 and 420 to 320 µg/L, respectively, when compared to baseline results. Arsenic concentrations in the hotspot area downgradient of the air sparging wells at well 99-1 decreased from 2,200 to 560 µg/L over the duration of the pilot study. Upgradient of the air sparging wells, at monitoring well M1, an increase in arsenic concentrations over the duration of the pilot study was observed with a final dissolved arsenic concentration of 2,900 µg/L representing the highest concentration within the pilot area at the conclusion of the study, up from 1,600 µg/L of total arsenic prior to the test.

# Section 7
# Conclusions

The pilot study was performed in general accordance with the proposal to demonstrate the effectiveness in removing dissolved arsenic in site groundwater using air sparging During the ROI test, it was observed that connection of the wells was highly variable and treatment was following preferential pathways due to the semi-confined field conditions.

Injection of the ferrous iron following the ROI was problematic and the desired concentrations were not achieved due to the iron coming out of the solution as it was being injected. Based on the pilot study results CDM Smith has concluded the following:

- Sufficient ROI for full-scale implementation of pilot tested technology was not achieved.
- Where amendment was delivered, reasonable reduction in arsenic concentration was achieved.
- Geochemical conditions conducive to oxidative treatment of arsenic were not maintained, likely due to the presence of high organic content in soil at the site including wood fragments observed in soil borings.
- Overall, lithologic, hydrogeological, and geochemical conditions at the site do not appear to be amenable to the air sparging treatment technology that was pilot tested.

CDM Smith is currently developing an alternative approach to address arsenic contamination in soil and groundwater by conducting ISS over a larger area of the site. The extension of the ISS area will now include the majority of area that was previously identified for groundwater remediation with ISCO and/or air sparging. The increased area of ISS will greatly reduce the permeability of soils, in effect causing groundwater to go around, instead of through, soils containing high arsenic concentrations. This should greatly reduce and potentially eliminate the need for treatment by air sparging and/or ISCO.

Groundwater monitoring after implementation of ISS will be used to evaluate the effectiveness of ISS on the groundwater contaminant plume. When sufficient groundwater data have been obtained, the need for implementation of other groundwater treatment methods around the ISS treatment zone will be evaluated.

# Section 8
# References


CDM Smith Inc. 2016a. *Remedial Investigation Report, USG Interiors Highway 99 Site, Milton, Washington.* June 23, 2016.

CDM Smith Inc. 2016b. *Feasibility Study, USG Interiors Highway 99 Site, Milton, Washington.* June 23, 2016.

CDM Smith Inc. 2018a*. Hot-Spot Characterization and Bench-Scale Testing, USG Interiors Highway 99 Site, 7110 Pacific Highway East, Milton, WA 98354*. March 23, 2018.

CDM Smith Inc. 2018b*. Field Pilot Study Work Plan, USG Interiors Highway 99 Site, 7110 Pacific Highway East, Milton, WA 98354*. July 25, 2018.

CDM Smith Inc. 2018c*.* Letter to Jennifer Brennan, Subject: Proposal, Field Pilot Study, Highway 99 Site, Milton, Washington. October 10, 2018.

Ecology. 2016. *Cleanup Action Plan, USG Interiors Highway 99 Site, Milton, Washington. Prepared for USG Corporation. Issued by Washington State Department of Ecology Toxics Cleanup Program, Southwest Regional Office*. June 23, 2016.

United States Army Corps of Engineers (USACE). 2013. Environmental Quality: In-Situ Air Sparging. EM 200-1-19. December 31, 2013.

# Tables

**Table 1**
**Summary of Groundwater Elevation Measurements**
**Hwy 99 Site**
USG Interiors
Milton, Washington

| Monitoring Well I.D. | Date Measured | Top of Casing Elevation [a] (feet) | Depth to Groundwater (ft below TOC) | Groundwater Elevation (feet) |
|---|---|---|---|---|
| INJ1 | 03/21/19 | 21.60 | 8.20 | 13.40 |
| INJ2 | 03/21/19 | 21.25 | 7.86 | 13.74 |
| M1 | 03/21/19 | 21.53 | 8.13 | 13.47 |
| M2 | 03/21/19 | 21.40 | 8.01 | 13.59 |
| M3 | 03/21/19 | 21.49 | 8.10 | 13.50 |
| M4 | 03/21/19 | 21.71 | 8.33 | 13.27 |
| MW1 | 05/25/10 | 23.02 | 10.19 | 12.83 |
| | 07/15/10 | | 9.85 | 13.17 |
| | 05/22/12 | | 9.04 | 13.98 |
| | 09/11/18 | | 9.77 | 13.25 |
| | 03/21/19 | | 9.11 | 13.91 |
| MW2 | 05/25/10 | 22.37 | 8.42 | 13.95 |
| | 07/15/10 | | 8.51 | 13.86 |
| | 05/22/12 | | 7.71 | 14.66 |
| | 09/11/18 | | 8.29 | 14.08 |
| | 03/21/19 | 22.39 | 7.94 | 14.45 |
| MW3 | 05/25/10 | 20.22 | 7.22 | 13.00 |
| | 07/15/10 | | 7.32 | 12.90 |
| | 05/22/12 | | 6.28 | 13.94 |
| | 09/11/18 | | 7.21 | 13.01 |
| | 03/21/19 | | 6.85 | 13.37 |
| MW4 | 05/25/10 | 20.40 | 7.41 | 12.99 |
| | 07/15/10 | | 7.51 | 12.89 |
| | 05/22/12 | | 6.63 | 13.77 |
| | 09/11/18 | | 7.35 | 13.05 |
| | 03/21/19 | | 7.02 | 13.38 |
| MW5 | 05/25/10 | 19.07 | 6.17 | 12.90 |
| | 07/15/10 | | 6.22 | 12.85 |
| | 05/22/12 | | 5.32 | 13.75 |
| | 09/11/18 | | 6.02 | 13.05 |
| MW6 | 05/25/10 | 19.89 | 7.08 | 12.81 |
| | 07/15/10 | | 7.16 | 12.73 |
| | 05/22/12 | | 6.19 | 13.70 |
| | 09/11/18 | | 6.88 | 13.01 |
| MW7 | 05/25/10 | 21.06 | 7.81 | 13.25 |
| | 07/15/10 | | 8.02 | 13.04 |
| | 05/22/12 | | 8.15 | 12.91 |
| | 09/11/18 | | 8.49 | 12.57 |
| | 03/21/19 | 21.09 | 7.42 | 13.67 |
| MW8 | 05/25/10 | 19.12 | 5.34 | 13.78 |
| | 07/15/10 | | 5.57 | 13.55 |
| | 05/22/12 | | 4.59 | 14.53 |
| | 09/11/18 | | 5.61 | 13.51 |
| MW9 | 05/25/10 | 20.87 | 1.72 | 19.15 |
| | 07/15/10 | | 1.89 | 18.98 |
| | 05/22/12 | | 0.63 | 20.25 |
| | 09/11/18 | | 1.69 | 19.18 |
| MW10 | 05/22/12 | 14.15 | 0.79 | 13.36 |
| | 09/11/18 | | 1.18 | 12.97 |

CDM Smith

**Table 1**
**Summary of Groundwater Elevation Measurements**
**Hwy 99 Site**
USG Interiors
Milton, Washington

| Monitoring Well I.D. | Date Measured | Top of Casing Elevation [a] (feet) | Depth to Groundwater (ft below TOC) | Groundwater Elevation (feet) |
|---|---|---|---|---|
| MW11 | 05/22/12 | 15.41 | 6.90 | 8.51 |
| | 09/11/18 | | 1.31 | 14.10 |
| MW12 | 05/22/12 | 21.54 | 0.00 | 21.54 |
| | 09/11/18 | | 0.00 | 21.54 |
| MW13 | 05/22/12 | 22.16 | 8.27 | 13.89 |
| | 09/11/18 | | 8.56 | 13.60 |
| MW14 | 05/22/12 | 30.3 | 10.60 | 19.70 |
| | 09/11/18 | | 10.39 | 19.91 |
| 99-1 | 05/25/10 | 21.34 | 8.22 | 13.12 |
| | 07/15/10 | | 8.47 | 12.87 |
| | 05/22/12 | | 7.60 | 13.74 |
| | 09/11/18 | | 8.28 | 13.06 |
| | 03/21/19 | 21.37 | 7.98 | 13.39 |
| 99-2 | 05/25/10 | 22.64 | 9.62 | 13.02 |
| | 07/15/10 | | 9.71 | 12.93 |
| | 05/22/12 | | 8.89 | 13.75 |
| | 09/11/18 | | 9.69 | 12.95 |

Notes:

a) Datum used: NAD 83/91 Washington South Zone NAVD '88, US Feet.
ft bgs - Feet below ground surface.
TOC - top of casing.

CDM Smith

**Table 2**
**Field Measured Parameters During Air Sparging**
USG Hwy 99
Milton, Washington

| Analyte | | Monitoring Well I.D. M1 | M2 | M3 | M4 | 99-1 |
|---|---|---|---|---|---|---|
| **Field-Measured Parameters** | | | | | | |
| **pH** | | | | | | |
| **2/14/2019** | Pre-sparge | 6.7 | -- | 6.6 | 6.5 | 5.8 |
| | During sparge | 6.7 | -- | 6.6 | -- | 6.7 |
| | Post-sparge | 6.7 | 6.6 | 6.7 | 6.7 | 6.7 |
| **2/15/2019** | Pre-sparge | 6.8 | 6.6 | 7.1 | 6.6 | 6.8 |
| | During sparge | 6.8 | 6.8 | 6.7 | 6.6 | 6.7 |
| | Post-sparge | 6.8 | 7.0 | 6.8 | 6.7 | 6.7 |
| **Oxidation-Reduction Potential (mV)** | | | | | | |
| **2/14/2019** | Pre-sparge | -48 | -6 | -40 | -37 | 62 |
| | During sparge | -15 | -- | -22 | -- | -31 |
| | Post-sparge | -16 | -4 | -9 | -20 | -34 |
| **2/15/2019** | Pre-sparge | -48 | -28 | -49 | -33 | -53 |
| | During sparge | 16 | 22 | 44 | 18 | 3 |
| | Post-sparge | 36 | 27 | 50 | 44 | 19 |
| **Specific Conductivity (µS/cm)** | | | | | | |
| **2/14/2019** | Pre-sparge | 286 | 450 | 328 | 263 | 253 |
| | During sparge | 285 | -- | 341 | -- | 258 |
| | Post-sparge | 279 | 458 | 317 | 250 | 260 |
| **2/15/2019** | Pre-sparge | 286 | 576 | 278 | 234 | 259 |
| | During sparge | 291 | 340 | 287 | 230 | 253 |
| | Post-sparge | 294 | 351 | 293 | 229 | 250 |
| **Dissolved Oxygen (mg/L)** | | | | | | |
| **2/14/2019** | Pre-sparge | 0.77 | 1.17 | 0.88 | 1.04 | 3.19 |
| | During sparge | 0.80 | -- | 1.37 | -- | 0.61 |
| | Post-sparge | 0.70 | 0.76 | 0.67 | 0.75 | 0.54 |
| **2/15/2019** | Pre-sparge | 0.36 | 0.59 | 0.97 | 1.35 | 0.57 |
| | During sparge | 0.39 | 7.99 | 0.86 | 1.29 | 0.39 |
| | Post-sparge | 0.80 | 2.98 | 2.44 | 4.75 | 0.77 |
| **Depth to water (feet BTOC)** | | | | | | |
| **2/14/2019** | Pre-sparge | 5.49 | 5.42 | 5.49 | 5.66 | 5.36 |
| | During sparge | 4.32 | -- | 2.47 | -- | 4.24 |
| | Post-sparge | 5.80 | 5.85 | 6.00 | 4.47 | 5.85 |
| **2/15/2019** | Pre-sparge | 6.06 | 6.03 | 6.00 | 6.22 | 5.96 |
| | During sparge | 6.25 | 3.89 | 6.17 | 6.35 | 5.03 |
| | Post-sparge | 6.30 | 6.10 | 5.47 | 6.37 | 6.20 |

**Table 2**
**Field Measured Parameters During Air Sparging**
USG Hwy 99
Milton, Washington

| Analyte | | Monitoring Well I.D. M1 | M2 | M3 | M4 | 99-1 |
|---|---|---|---|---|---|---|
| **Ferrous Iron (mg/L)** | | | | | | |
| **2/14/2019** | Pre-sparge | 5.0 | >3.3 | 6.4 | 7.9 | 2.0 |
| | During sparge | 5.1 | -- | 3.5 | -- | 1.5 |
| | Post-sparge | 4.6 | 8.8 | 2.2 | 6.8 | 2.5 |
| **2/15/2019** | Pre-sparge | 4.9 | 9.4 | 3.3 | 4.5 | 2.6 |
| | During sparge | 4.7 | 0.3 | 1.2 | 3.4 | 3.0 |
| | Post-sparge | -- | -- | -- | -- | -- |
| **Arsenic field test* (ppb)** | | | | | | |
| **2/14/2019** | Pre-sparge | 2,500 | >1,000 | 2,000 | 500 | >1,000 |
| | During sparge | 3,000 | -- | 3,000 | -- | >5,000 |
| | Post-sparge | 1,500 | 500 | 2,000 | 500 | 800 |
| **2/15/2019** | Pre-sparge | 1,500 | 750 | 1,500 | 800 | 1500 |
| | During sparge | 4,000 | 90 | 1,000 | 400 | 600 |
| | Post-sparge | 2,000 | 60 | 300 | 100 | 750 |

Notes:
-- - Not measured
mV - millivolts
µS/cm - microsiemens per centimeter
mg/L - milligrams per liter
BTOC - below top of casing
*Quick™ Arsenic Test Kit
ppb - parts per billion
> - greater than the concentration given

**Table 3**
**Field Measured Parameters**
USG Hwy 99
Milton, Washington

| Analyte | Date Sampled | Monitoring Well I.D. M1 | M2 | M3 | M4 | 99-1 | AS1 | AS2 | INJ1 | INJ2 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Field-Measured Parameters** | | | | | | | | | | |
| **pH** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 6.8 | 6.8 | 6.8 | 6.5 | 6.5 | -- | -- | 6.9 | 7.0 |
| Pre-Injection | 02/05/19 | -- | 6.6 | 6.7 | 6.6 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 6.8 | 6.6 | 6.7 | 6.7 | 6.7 | 7.2 | 7.0 | 5.8 | 6.0 |
| | 3/21-22/19 | 6.5 | 6.3 | 6.5 | 6.3 | 6.5 | -- | -- | 5.9 | 6.1 |
| **ORP (mV)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | -65 | -59 | -80 | -67 | -67 | -- | -- | -57 | -78 |
| Pre-Injection | 02/05/19 | -- | 40 | 19 | 2 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | -73 | -60 | -77 | -37 | -40 | -130 | -94 | 8 | -23 |
| | 3/21-22/19 | -88 | -41 | -76 | -79 | -124 | -- | -- | 11 | -34 |
| **Temperature ($^{o}$C)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 15.3 | 14.1 | 14.2 | 15.1 | 14.0 | -- | -- | 15.7 | 14.6 |
| Pre-Injection | 02/05/19 | -- | 13.2 | 13.4 | 14.1 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 13.5 | 13.0 | 13.3 | 13.5 | 12.7 | 12.2 | 12.7 | 11.1 | 10.6 |
| | 3/21-22/19 | 13.8 | 12.6 | 13.4 | 13.6 | 12.9 | -- | -- | 12.8 | 12.5 |
| **Specific Conductivity (µS/cm)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 355 | 483 | 426 | 379 | 396 | -- | -- | 390 | 494 |
| Pre-Injection | 02/05/19 | -- | 509 | 420 | 320 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 369 | 591 | 383 | 305 | 337 | 315 | 368 | 660 | 1150 |
| | 3/21-22/19 | 350 | 659 | 382 | 334 | 315 | -- | -- | 985 | 1350 |
| **Dissolved Oxygen (mg/L)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 0.24 | 0.20 | 0.22 | 0.24 | 0.19 | -- | -- | 0.22 | 0.24 |
| Pre-Injection | 02/05/19 | -- | 0.14 | 0.24 | 0.18 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 1.72 M | 1.20 M | 3.08 M | 3.80 M | 1.73 M | 4.17 M | 1.21 M | 0.67 M | 3.46 M |
| | 3/21-22/19 | 0.38 | 0.20 | 0.38 | 0.14 | 0.14 | -- | -- | 0.12 | 0.21 |
| **Turbidity (NTU)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 9 | 7 | 19 | 4 | 14 | -- | -- | 7 | 12 |
| Pre-Injection | 02/05/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 0 | 16 | 64 | 0 | 0 | 24 | 4 | 0 | 0 |
| | 3/21-22/19 | 2 | 1 | 7 | 3 | 5 | -- | -- | 28 | 6 |

**Table 3**
**Field Measured Parameters**
USG Hwy 99
Milton, Washington

| Analyte | Date Sampled | Monitoring Well I.D. M1 | M2 | M3 | M4 | 99-1 | AS1 | AS2 | INJ1 | INJ2 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Alkalinity (mg/L)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pre-Injection | 02/05/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 180 | 180 | 200 | 160 | 160 | -- | -- | 100 | 180 |
| | 3/21-22/19 | 180 | 280 | 240 | 200 | 180 | -- | -- | 140 | 180 |
| **Ferrous Iron (mg/L)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 2.8 | 3.1 | 3.9 | 3.2 | 2.9 | -- | -- | 2.3 | 2.2 |
| Pre-Injection | 02/05/19 | -- | 1.8 | 1.5 | 1.5 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | 5.2 | 3.2 | 5.1 | 5.1 | 2.3 | 5.0 | 2.5 | 6.2 | 9.7 |
| | 3/21-22/19 | 3.1 | 4.8 | 5.4 | 5.1 | 2.7 | -- | -- | 7.4 | 27.8 |
| **Arsenic field test (ppb)** | | | | | | | | | | |
| Pre-ROI test | 12/7-10/18 | 190 K | 70 K | 40 K | 190 K | 100 K | -- | -- | 400 K | 190 K |
| Pre-Injection | 02/05/19 | -- | 400 | 1,000 | 800 | -- | -- | -- | -- | -- |
| Post-sparging monitoring | 2/21-22/19 | >1,000 | 160 | 1,000 | 300 | 800 | 10 | 10 | <10 | <10 |
| | 3/21-22/19 | >1,000 | 200 | 300 | 100 | 600 | -- | -- | <10 | <5 |

Notes:
-- - Not measured
mV - millivolts
µS/cm - microsiemens per centimeter
µg/L - micrograms per liter
mg/L - milligrams per liter
ppb - parts per billion
> - greater than the concentration given
< - less than the concentration given
M - Value biased high due to suspected meter malfunction
K - Hach field kit for arsenic appears not to be reporting correctly

**Table 4**
**Arsenic and Iron in Groundwater (EPA 200.8/6010D)**
USG Hwy 99
Milton, Washington

| Analyte | Date Sampled | Cleanup Level/Standard (µg/L) | Monitoring Well I.D. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | M1 | M2 | M3 | M4 | 99-1 | AS1 | AS2 | INJ1 | INJ2 |
| **Total Arsenic (µg/L)** | | **5** [a] | | | | | | | | | |
| Pre-ROI test | 12/7-10/2018 | | 1,600 | 1,300/1,400 D | 720 | 1,600 | 2,400 | -- | -- | 2,300 | 2,100 |
| Pre-Injection | 2/5/2019 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Post-Air sparge | 2/21-22/2019 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 3/21-22/2019 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Dissolved Arsenic (µg/L)** | | **5** [a] | | | | | | | | | |
| Pre-ROI test | 12/7-10/2018 | | -- | -- | 700 | -- | 2,200 | -- | -- | -- | 2,100 |
| Pre-Injection | 2/5/2019 | | -- | 1,100 | 310 | 420 | -- | -- | -- | -- | -- |
| Post-Air sparge | 2/21-22/2019 | | 2,600 | 420 | 780 | 300 | 530 | -- | -- | <10 T | <10 T |
| | 3/21-22/2019 | | 2,900 | 440 | 420 | 320 | 560 | -- | -- | <10 T | <5 T |
| **Total Iron (µg/L)** | | **300** [b] | | | | | | | | | |
| Pre-ROI test | 12/7-10/2018 | | 3,300 | 7,800/7,500 D | 7,500 | 9,200 | 8,800 | -- | -- | 2,600 | 3,300 |
| Pre-Injection | 2/5/2019 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Post-Air sparge | 2/21-22/2019 | | 5,700 | 5,700 | 7,700 | 5,600 | 3,200 | 11,000 | 5,900 | 49,000 | 150,000 |
| | 3/21-22/2019 | | -- | -- | -- | -- | -- | -- | -- | 86,000 | -- |
| **Dissolved Iron (µg/L)** | | **300** [b] | | | | | | | | | |
| Pre-ROI test | 12/7-10/2018 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pre-Injection | 2/5/2019 | | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Post-Air sparge | 2/21-22/2019 | | 5,500 | 5,200 | 6,200 | 5,600 | 3,000 | 6,100 | 2,400 | 49,000 | 150,000 |
| | 3/21-22/2019 | | -- | -- | -- | -- | -- | -- | -- | 78,000 | 230,000 |

Notes:
a) Washington Administrative Code Chapter 173-340, Model Toxics Control Act Cleanup Regulation Method A Groundwater Cleanup Level
Method A suggested groundwater cleanup level used when available
b) National Secondary Drinking Water Standard
T - Result of field test kit on filtered sample.
D - Duplicate sample results presented following /
µg/L - micrograms per liter
< - less than the concentration given

**Table 5**
**Total Metals and Bromate in Groundwater**
USG Highway 99
Milton, WA

| Total Metals (EPA 200.8/6010D/7470A) | Cleanup Levels/Standards | Monitoring Well ID and Sampling Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | M1 | M2 | M3 | M4 | 99-1 | INJ1 | INJ2 |
| | | 12/10/2018 | 12/7/2018* | 12/7/2018 | 12/10/2018 | 12/7/2018 | 12/10/2018 | 12/10/2018 |
| | µg/L | µg/L | | | | | | |
| Aluminum | 200 [d] | 220 | 110/110 U | 680 | 160 | 110 U | 240 | 700 |
| Antimony | 6 [b] | 5.6 U | 5.6/5.6 U | 5.6 U | 5.6 U | 5.6 U | 17 | 5.6 U |
| Barium | 2000 [b] | 45 | 51/50 | 58 | 48 | 28 U | 41 | 56 |
| Beryllium | 4 [b] | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Cadmium | 5 [a] | 4.4 U | 4.4/4.4 U | 4.4 U | 4.4 U | 4.4 U | 4.4 U | 4.4 U |
| Calcium | | 29,000 | 41,000/40,000 | 27,000 | 33,000 | 34,000 | 37,000 | 33,000 |
| Chromium | 100 [c] | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Cobalt | | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Copper | 1000 [d] | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Lead | 15 [a] | 1.1 U | 1.1/1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U |
| Magnesium | | 16,000 | 18,000/18,000 | 14,000 | 15,000 | 17,000 | 16,000 | 14,000 |
| Manganese | 50 [d] | 1,200 | 1300/1200 | 1,100 | 1,400 | 1,100 | 1,100 | 810 |
| Mercury | 2 [a] | 0.5 U | 0.5/0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| Nickel | | 22 U | 22/22 U | 22 U | 22 U | 22 U | 22 U | 22 U |
| Potassium | | 4,800 | 5,300/5,300 | 6,000 | 4,200 | 4,100 | 4,700 | 6,100 |
| Selenium | 50 [b] | 5.6 U | 5.6/5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U |
| Silver | 100 [d] | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Sodium | | 17,000 | 28,000/26,000 | 34,000 | 19,000 | 17,000 | 18,000 | 52,000 |
| Thallium | 2 [b] | 5.6 U | 5.6/5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U | 5.6 U |
| Vanadium | | 11 U | 11/11 U | 11 U | 11 U | 11 U | 11 U | 11 U |
| Zinc | 5000 [d] | 28 U | 28/28 U | 28 U | 28 U | 28 U | 28 U | 28 U |
| **Bromate (EPA 300.1)** | 10 [b] | -- | -- | -- | -- | 10 U | 10 U | 10 U |

Notes:
Bold and boxed values exceed the listed standard
a) Washington Administrative Code Chapter 173-340, Model Toxics Control Act Cleanup Regulation
Method A suggested groundwater cleanup level used when available
b) National Primary Drinking Water Standard Maximum Contaminant Level (MCL)
c) If hexavalent chromium is not present
d) National Secondary Drinking Water Standard
µg/L - micrograms per liter.
U - analyte not detected at or greater than the listed concentration.
* Duplicated sample results reported following /
-- - Not analyzed

# Figures


SOURCE: ESRI WORLD IMAGERY, 2018

CDM Smith

FIELD PILOT STUDY
USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 1
Vicinity Map

DOCUMENT PATH: E:_Projects\USG Highway 99\MapDocuments\Figure-1_Vicinity-Map.mxd; 4/20/2020 12:47:11 PM; CAD XREFS: ARSENIC-11X17BD_ARSENIC-SITEBASE, FIGURE 1 (PROPOSED BORINGS).

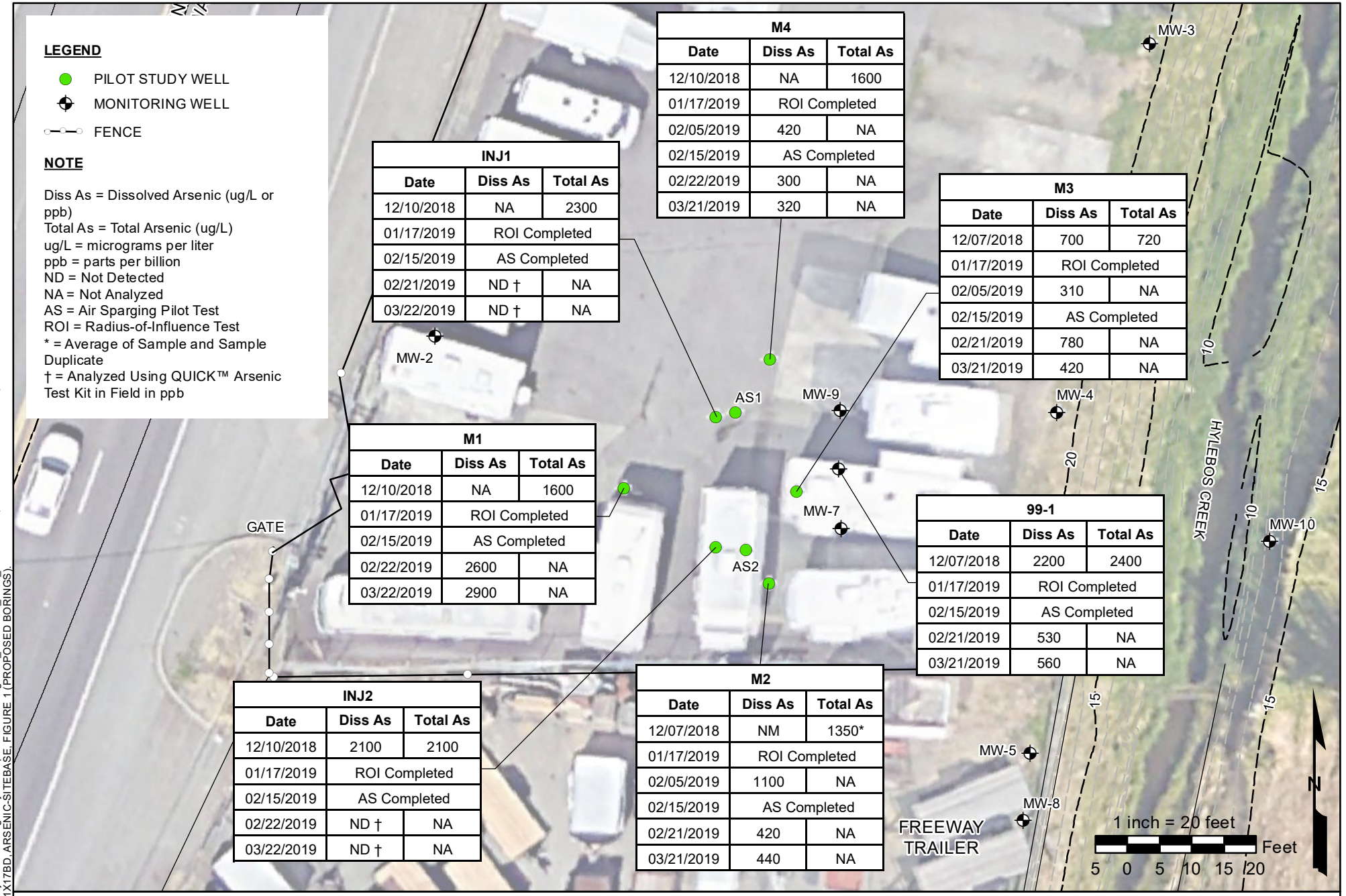

SOURCE: GOOGLE EARTH PRO, 2016

CDM Smith

FIELD PILOT STUDY
USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 2
Site Plan and
Pilot Study Area

DOCUMENT PATH: E:_Projects\USG Interiors - Hwy 99\MapDocuments\Pilot Study\Figure-2_HWY-99-Core.mxd; 5/1/2020 3:35:24 PM; CAD XREFS: ARSENIC-11X17BD, ARSENIC-SITEBASE, FIGURE 1 (PROPOSED BORINGS).



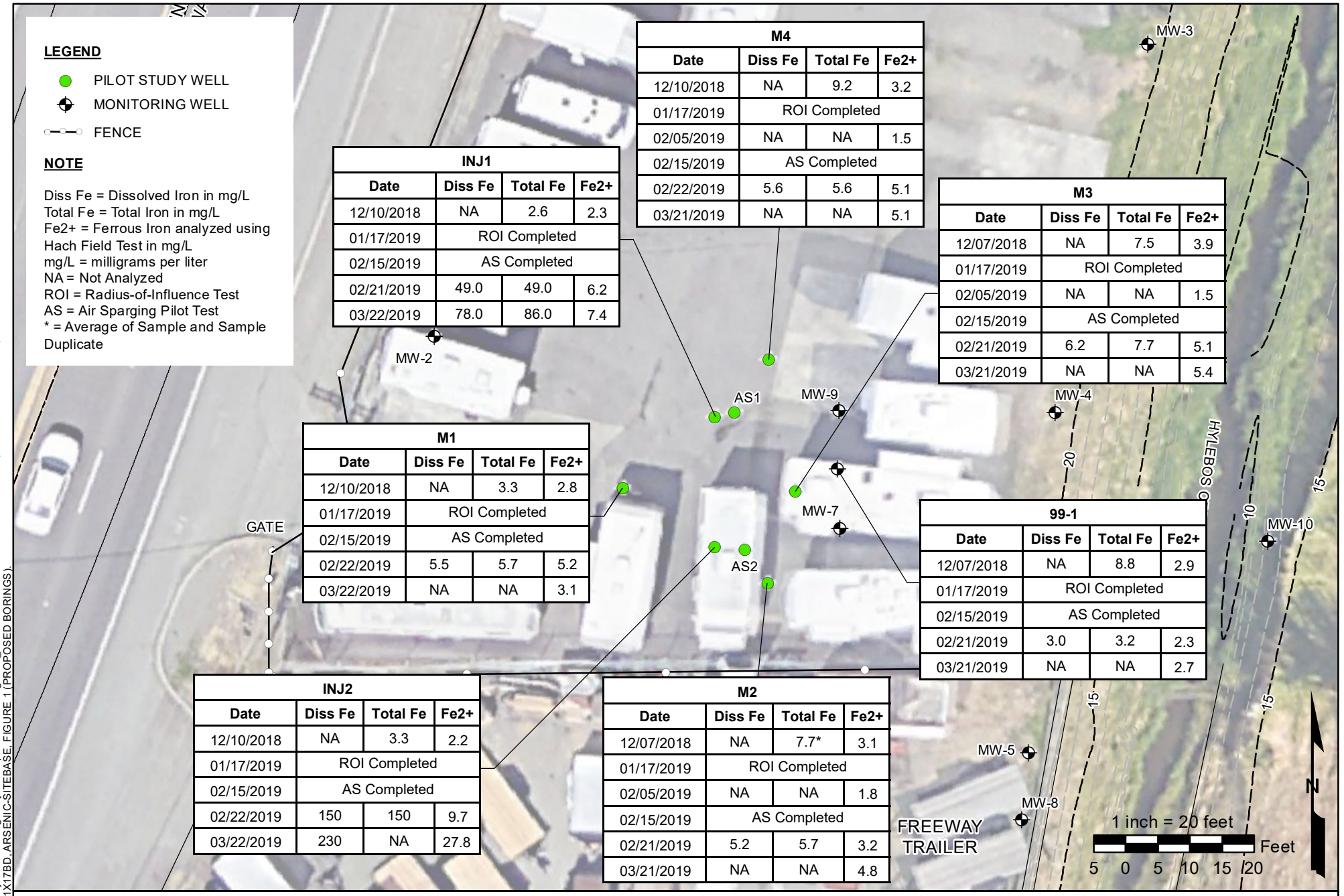

SOURCE: GOOGLE EARTH PRO, 2016

CDM Smith

FIELD PILOT STUDY
USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 3
Arsenic Concentrations in Groundwater

DOCUMENT PATH: E:_Projects\USG Highway 99\MapDocuments\Figure-4_Dissolved_Total_Arsenic.mxd; 4/17/2020 10:59:44 PM;
CAD XREFS: ARSENIC-11X17BD_ARSENIC-SITEBASE, FIGURE 1 (PROPOSED BORINGS).



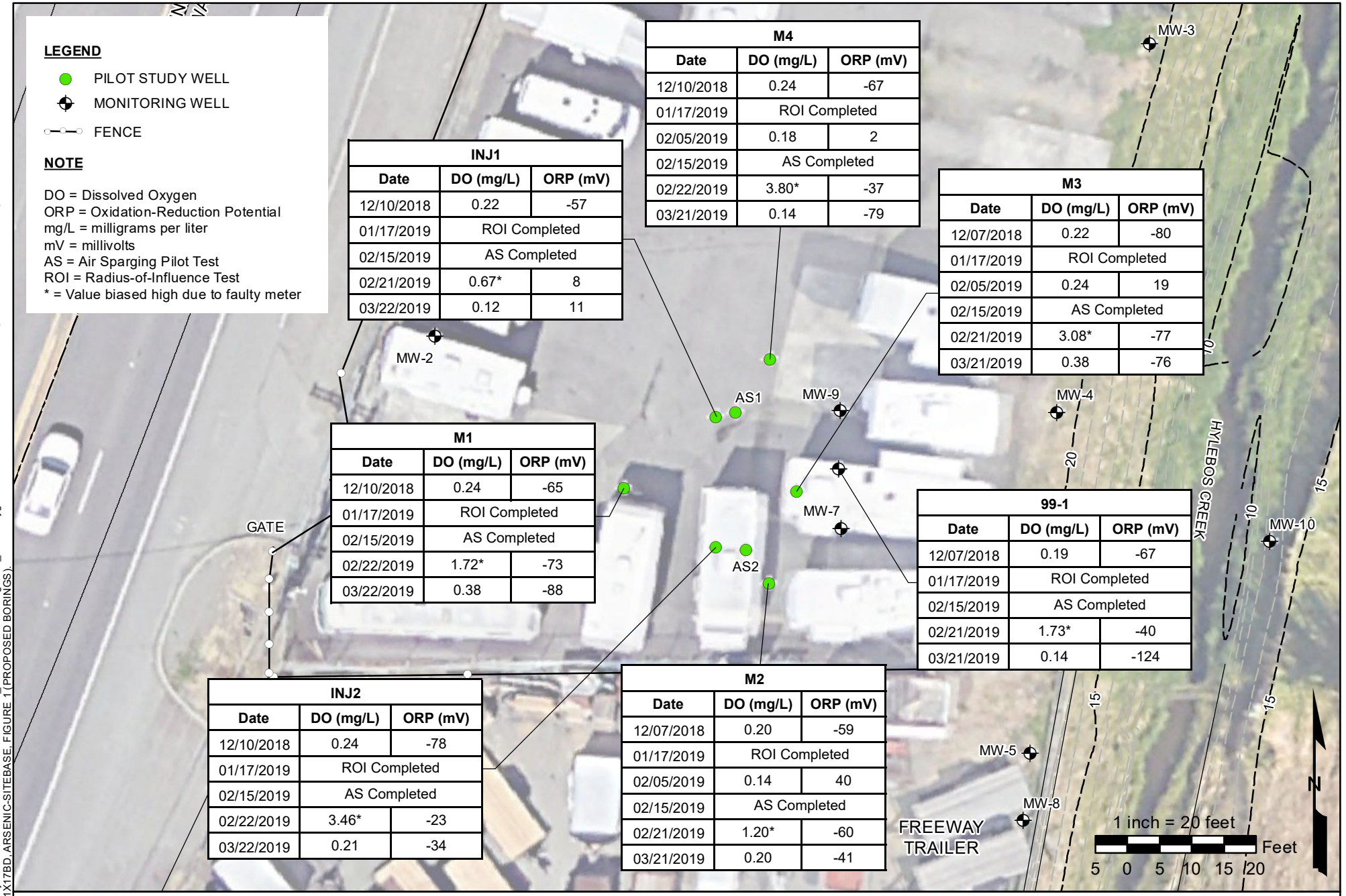

SOURCE: GOOGLE EARTH PRO, 2016

CDM Smith

FIELD PILOT STUDY
USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 4
Iron Concentrations in Groundwater

DOCUMENT PATH: E:_Projects\USG Highway 99\MapDocuments\Figure-4_Iron-Concentrations-in-Groundwater.mxd; 4/20/2020 2:44:22 PM;
CAD XREFS: ARSENIC-11X17BD_ARSENIC-SITEBASE_FIGURE 1 (PROPOSED BORINGS).




SOURCE: GOOGLE EARTH PRO, 2016

CDM Smith

FIELD PILOT STUDY
USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 5
Dissolved Oxygen and Redox Conditions in Groundwater

DOCUMENT PATH: E:_Projects\79171-BonitaPeakMD\GIS\MXD\08_IROD\IROD 2019\Figure-6_Diss-Oxygen-and-Redox-Conditions-in-GW.mxd; 4/20/2020 11:55:30 AM; CAD XREFS: ARSENIC-11X17BD_ARSENIC-SITEBASE_FIGURE 1 (PROPOSED BORINGS).

# Appendix A

# UIC Permit

# Underground Injection Control

View Friendly

Automatically Meet the Nonendangerment Standard For Class V wells that automatically meet the non endangerment standard in accordance with WAC 173-218-100.

---

## Registration Status

**Site Number:** 34241
**Authorization Status:** Rule-Authorized
**Comments:**

## Facility/Site Information

**Facility Name:** USG Interiors 99 Site
**Address:** 7110 Pacific Hwy E
**PO Box/Suite/Building:**
**City:** Milton
**State:** WA **ZIP:** 98354
**Phone:** 253-922-7725
**County:** Pierce
**Facility Site ID:** 84531356

## Contact Information

### Well Owner

**Name:** Jennifer Brennan
**Organization:** USG Interiors LLC
**Address:** 550 West Adams St
**PO Box/Suite/Building:**
**City:** Chicago
**State:** IL **ZIP:** 60661
**E-mail:** jbrennan@usg.com
**Phone:** 312-43-5385

### Property Owner

**Name:** Don Miniken
**Organization:** Freeway Sales
**Address:** 7110 Pacific Hwy E
**PO Box/Suite/Building:**
**City:** Milton
**State:** WA **ZIP:** 98354
**E-mail:**
**Phone:** 111-111-1111

### Technical Contact

**Name:** Pam Morrill
**Organization:** CDM Smith Inc
**Address:** 14432 SE Eastgate Way
**PO Box:** Suite 100
**City:** Bellevue
**State:** WA **ZIP:** 98007

**E-mail:** morrillpj@cdmsmith.com
**Phone:** 425-248-0215

**Main Well Information**

| Well Name | UIC Well Type From Section C (1-12) | Construction Date | EPA Well Type | Status | Depth of UIC Well (ft.) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| INJ2 | 12 | 11/28/2018 | 5B6 - Aquifer remediation | Active | 25 | 47.246434 | -122.334980 |
| INJ1 | 12 | 11/28/2018 | 5B6 - Aquifer remediation | Active | 25 | 47.246490 | -122.334990 |
| AS2 | 12 | 11/29/2018 | 5B6 - Aquifer remediation | Active | 35 | 47.246430 | -122.334970 |
| AS1 | 12 | 11/30/2018 | 5B6 - Aquifer remediation | Active | 35 | 47.246492 | -122.334970 |

**Main Well Information (continued)**

| Well Name | Permit Type | Permit ID | Permit Issuer |
|---|---|---|---|
| INJ2 | MTCA | 84531356 | Ecology |
| INJ1 | MTCA | 84531356 | Ecology |
| AS2 | MTCA | 84531356 | Ecology |
| AS1 | MTCA | 84531356 | Ecology |

# Appendix B

# Well Installation Logs

# SOIL CLASSIFICATION LEGEND

| MAJOR DIVISIONS | | | | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE GRAINED SOILS More than half is larger than No. 200 sieve | GRAVELS More than half coarse fraction is larger than No. 4 sieve | Clean gravels with little or no fines | GW | Well graded gravels, gravel-sand mixtures |
| | | | GP | Poorly graded gravels, gravel-sand mixtures |
| | | Gravel with over 12% fines | GM | Silty gravels, gravel-sand-silt mixtures |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SANDS More than half coarse fraction is smaller than No. 4 sieve | Clean sands with little or no fines | SW | Well graded sands, gravelly sands |
| | | | SP | Poorly graded sands, gravelly sands |
| | | Sands with over 12% fines | SM | Silty sand, sand-silt mixtures |
| | | | SC | Clayey sands, sand-clay mixtures |
| FINE GRAINED SOILS More than half is smaller than No. 200 sieve | SILTS AND CLAYS Liquid limit less than 50 | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | OL | Organic clays and organic silty clays of low plasticity |
| | SILTS AND CLAYS Liquid limit greater than 50 | | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | | CH | Inorganic clays of high plasticity, fat clays |
| | | | OH | Organic clays of medium to high plasticity, organic silts |
| HIGHLY ORGANIC SOILS | | | PT | Peat and other highly organic soils |

## SAMPLE TYPE SYMBOLS

- Disturbed bag or jar sample
- Std. Penetration Test (2.0" OD)
- Type U Ring Sampler (3.25" OD)
- California Sampler (3.0" OD)
- Undisturbed Tube Sample
- Grab Sample
- Core Run
- Non-standard Penetration Test (with split spoon sampler)
- Bulk Sample

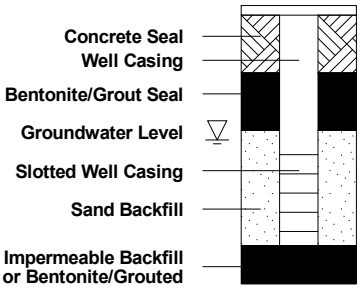
## CONTACT BETWEEN UNITS

- Well-defined change in unit
- Gradational change in unit which was clearly noted in the exploration
- Change in unit which was not clearly defined

## DESCRIPTORS FOR SOIL STRATA AND STRUCTURE (ENGLISH/METRIC)

| General Thickness or Spacing | | Structure | | General Attitude | |
|---|---|---|---|---|---|
| Parting: | less than 1/16 in. (1/6 cm) | Pocket: | Erratic, discontinous deposit of limited extent | Near horizontal: | 0 to 10 deg. |
| Seam: | 1/16 to 1/2 in. (1/6 to 1 1/4 cm) | Lens: | Lenticular deposit | Low angle: | 10 to 45 deg. |
| Layer: | 1/2 to 12 in. (1 1/4 to 30 1/2 cm) | Varved: | Alternating seams of silt and clay | High angle: | 45 to 80 deg. |
| Stratum: | > 12 in. (30 1/2 cm) | Laminated: | Alternating seams | Near Vertical: | 80 to 90 deg. |
| Scattered: | < 1 per ft. (30 1/2 cm) | Stratified: | Alternating layers | | |
| Frequent: | > 1 per ft. (30 1/2 cm) | | | | |

## WELL COMPLETIONS




## STRUCTURE DESCRIPTION (cont.)

| | |
|---|---|
| Fractured | Breaks easily along definite fractured planes |
| Slickensided | Polished, glossy, fractured planes |
| Blocky, Diced | Breaks easily into small angular lumps |
| Sheared | Disturbed texture, mix of strengths |
| Homogeneous | Same color and appearance throughout |

## MOISTURE DESCRIPTION

- Dry - Free of moisture, dusty
- Moist - Damp but no visible free water
- Wet - Visible free water

## MODIFIERS

| | |
|---|---|
| Trace | Particles present at levels estimated < 5% |
| Slightly (Clayey, Silty, Sandy, Gravelly) | Particles present at levels estimated at 5 to 12% |
| Clayey, Silty, Sandy, Gravelly | Particles present at levels estimated at 12 to 30% |
| Very (Clayey, Silty, Sandy, Gravelly) | Percentage of minor constituents estimated > 30% |

## RELATIVE DENSITY OR CONSISTENCY VS. SPT N-VALUE

| COARSE GRAINED | | | FINE GRAINED | | |
|---|---|---|---|---|---|
| Density | N (blows/ft) | Approx. Relative Density (%) | Consistency | N (blows/ft) | Approx. Undrained Shear Str. (psf) |
| Very Loose | 0 to 4 | 0 - 15 | Very Soft | 0 to 2 | <250 |
| Loose | 4 to 10 | 15 - 35 | Soft | 2 to 4 | 250 - 500 |
| Medium Dense | 10 to 30 | 35 - 65 | Medium Stiff | 4 to 8 | 500 - 1000 |
| Dense | 30 to 50 | 65 - 85 | Stiff | 8 to 15 | 1000 - 2000 |
| Very Dense | Over 50 | 85 - 100 | Very Stiff | 15 to 30 | 2000 - 4000 |
| | | | Hard | over 30 | >4000 |

## PHYSICAL PROPERTY TEST

- AL - Atterberg Limits
- FC - Fines Content
- GSD - Grain Size Distribution
- MC - Moisture Content
- MD - Moisture Content/Dry Density
- SG - Specific Gravity
- Perm - Permeability
- TXP - Triaxial Permeability
- Cons - Consolidation
- Chem - Analytical Chemical Analysis
- Corr - Corrosion
- VS - Vane Shear
- DS - Direct Shear
- UC - Unconfined Compression
- TX - Triaxial Compression
- UU - Unconsolidated, Undrained
- CU - Consolidated, Undrained
- CD - Consolidated, Drained

**Notes:**

1. Sample descriptions in this report are based on visual field and 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 classification methods in accordance with ASTM D 2488 were used as an identification guide. Where laboratory data are available, soil classifications are in general accordance with ASTM D 2487.

2. Dual symbols are used to indicate gravel and sand units with 5 to 12 percent fines and fine-grained units that plot in the CL-ML area of the plasticity chart.

3. WOR = weight of rod, WOH = weight of hammer.

USG Interiors
Highway 99 Site
Milton, WA

SOIL CLASSIFICATION/LEGEND LL307 DATABASE.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 12/20/17 REV.

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

WELL NO: **AS1**

STARTED: 11/30/18 COMPLETED: 11/30/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

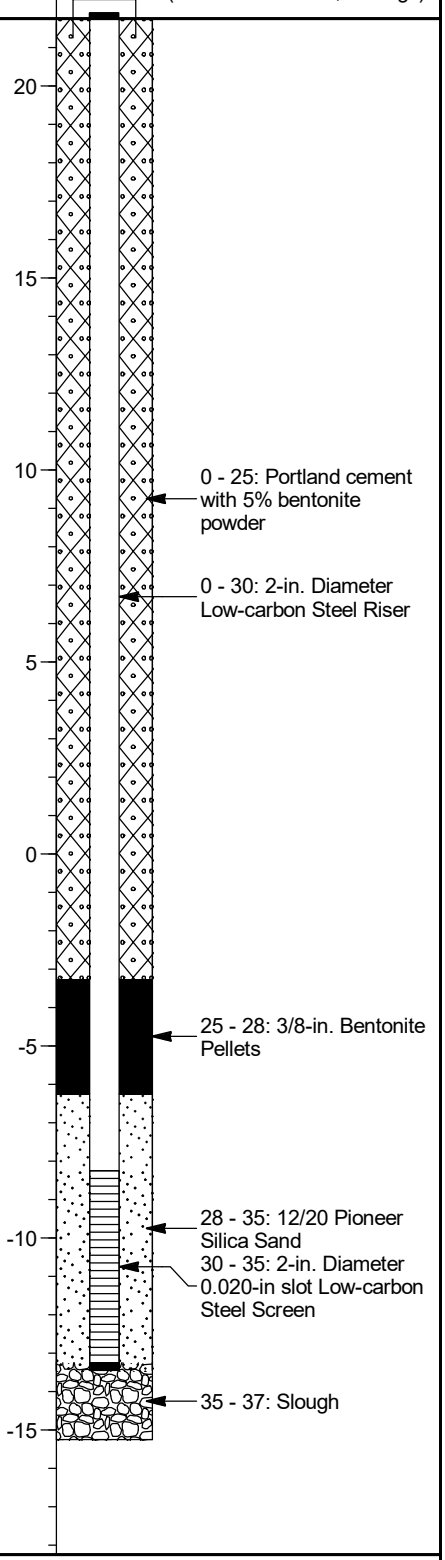
NORTHING: 702987.81 US Feet EASTING: 1184699.53 US Feet
G.S. ELEVATION: 21.75 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 37.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION |
|---|---|---|
| | | Asphalt. |
| | SM | Gravelly silty SAND (SM), gray, poorly graded, fine sand, fine to coarse subrounded gravel, non-plastic silt, medium dense, moist, [FILL, Hf]. |
| 5 | | |
| | | Becomes wet. |
| 10 | ML | Slightly sandy SILT (ML), gray, stiff, moist, non-plastic silt, occasional fibers, [CONTAINS SUSPECTED WASTE MATERIAL]. |
| | SM | Gravelly silty SAND (SM), dark brown, poorly graded, fine to coarse sand, fine subangular to angular gravel, non-plastic silt, dense, moist, numerous cinders/slag, occasional wood fragments, [CONTAINS SUSPECTED WASTE MATERIAL]. |
| 15 | SP SM | 15 ft: Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, wet, [ALLUVIUM, Qal]. |
| 20 | | SAND (SP), dark brown, poorly graded, fine to medium sand, trace silt, medium dense, wet, [ALLUVIUM, Qal]. |
| | | Becomes loose. |
| 25 | SP | |
| 30 | | |
| 35 | ML | SILT (ML), gray, hard, moist to wet, low plasticity, [GLACIAL DRIFT, described from auger response and cuttings]. |
| | | Boring terminated at 37 feet below ground surface (bgs). Groundwater encountered around 7 feet bgs during drilling. Lithology from 0 to 25 feet bgs is |

SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm)

ELEV. (feet): 20, 15, 10, 5, 0, -5, -10, -15

WELL CONSTRUCTION (From - To Interval, feet bgs)




WELL CONSTRUCTION LOG: DORCHESTER USG HWY 99_20181211.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 5/1/20 REV.

CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300

WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

WELL NO: **AS1**

| DEPTH (feet) | GRAPHIC LOG | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) | WELL CONSTRUCTION (From - To Interval, feet bgs) |
|---|---|---|---|---|---|---|---|---|---|
| | | | assumed based on lithology at adjacent (by ~2 feet) boring INJ1. | | | | | -20 | |
| 45 | | | | | | | | -25 | |
| 50 | | | | | | | | -30 | |
| 55 | | | | | | | | -35 | |
| 60 | | | | | | | | -40 | |
| 65 | | | | | | | | -45 | |
| 70 | | | | | | | | -50 | |
| 75 | | | | | | | | -55 | |
| 80 | | | | | | | | -60 | |

CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300

WELL CONSTRUCTION LOG

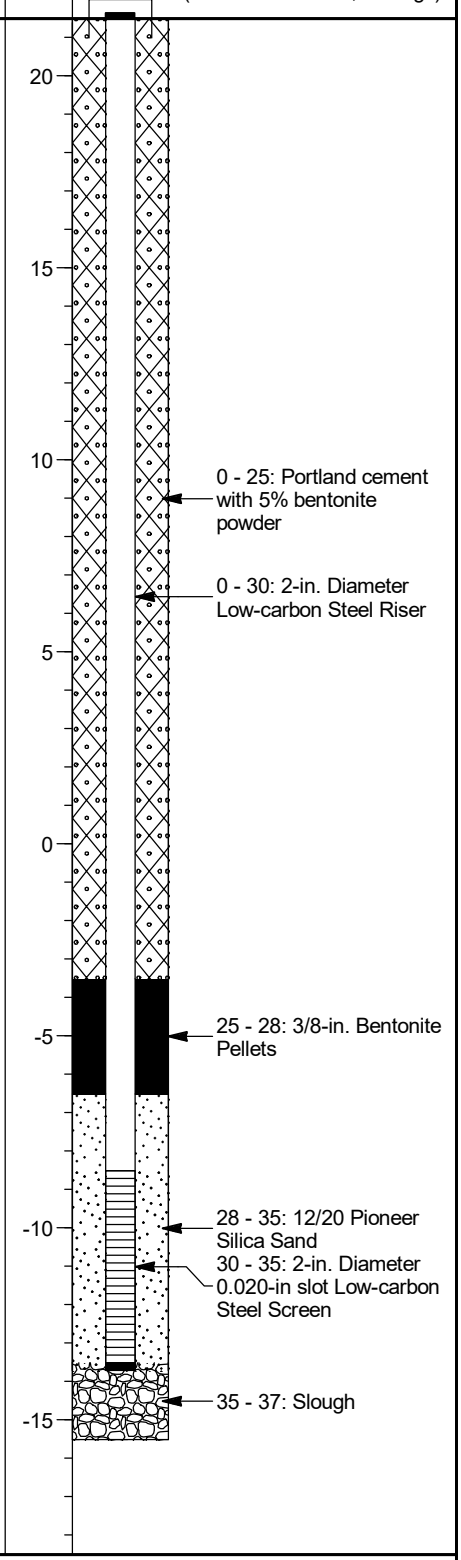
PROJECT: USG Hwy 99
LOCATION: Milton, Washington

WELL NO: **AS2**

STARTED: 11/29/18 COMPLETED: 11/29/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702966.44 US Feet EASTING: 1184701.03 US Feet
G.S. ELEVATION: 21.49 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 35.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|
| 0 | | Asphalt. | | | | | |
| | | Gravelly silty SAND (SM), brown, poorly graded, fine sand, fine to coarse subrounded to rounded gravel, non-plastic silt, dense, moist, [FILL, Hf]. | | | | | |
| 5 | SM | Becomes gray, increasing silt. | | 0.5 | 4<br>26<br>8 | | |
| | | Becomes wet. | | | | | |
| 10 | | Becomes loose. | | 0.4 | 3<br>3<br>4 | | |
| 15 | SP<br>SM | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, moist to wet, [ALLUVIUM, Qal]. | | 0.8 | 3<br>5<br>8 | | |
| 20 | | SAND (SP), dark brown, poorly graded, very fine to fine sand, trace silt, loose, wet, occasional organics [ALLUVIUM, Qal]. | | 1.5 | 1<br>2<br>4 | | |
| 25 | | No samples 25-35 feet due to heave. | | | | | |
| | SP | | | | | | |
| 30 | | | | | | | |
| 35 | ML | SILT (ML), gray, hard, moist, low plasticity, [GLACIAL DRIFT, described from auger response and cuttings]. | | | | | |
| | | Boring terminated 37 feet below ground surface (bgs). Groundwater encountered around 7 feet bgs during drilling. | | | | | |




CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300

WELL CONSTRUCTION LOG



WELL CONSTRUCTION LOG: DORCHESTER USG HWY 99_20181211.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 5/1/20 REV.

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

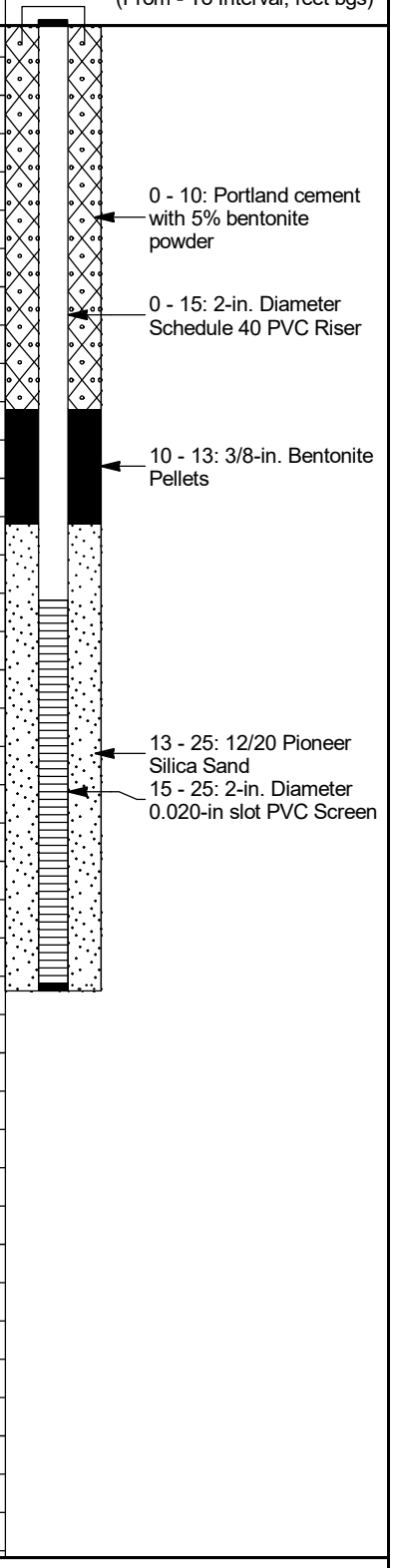
WELL NO: **INJ1**

STARTED: 11/28/18 COMPLETED: 11/29/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702987.36 US Feet EASTING: 1184696.52 US Feet
G.S. ELEVATION: 21.81 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|
| 0 | | Asphalt. | | | | | |
| | SM | Gravelly silty SAND (SM), gray, poorly graded, fine sand, fine to coarse subrounded gravel, non-plastic silt, medium dense, moist, [FILL, Hf]. | 1.5 | 1.5 | 11<br>16<br>9 | | |
| 5 | | Becomes wet. | | | | | |
| 10 | ML | Slightly sandy SILT (ML), gray, stiff, moist, non-plastic silt, occasional fibers, [CONTAINS SUSPECTED WASTE MATERIAL]. | 1.5 | 1.5 | 11<br>31<br>14 | | |
| | SM | Gravelly silty SAND (SM), dark brown, poorly graded, fine to coarse sand, fine subangular to angular gravel, non-plastic silt, dense, moist, numerous cinders/slag, occasional wood fragments, [CONTAINS SUSPECTED WASTE MATERIAL]. | | | | | |
| 15 | SP SM | 15 ft: Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, wet, [ALLUVIUM, Qal]. | 1 | 1 | 4<br>8<br>8 | | |
| 20 | SP | SAND (SP), dark brown, poorly graded, fine to medium sand, trace silt, medium dense, wet, [ALLUVIUM, Qal]. | 1.5 | 1.5 | 3<br>10<br>12 | | |
| 25 | | Becomes loose. | 1.5 | 1.5 | 2<br>2<br>4 | | |
| 30 | | Boring terminated 25 feet below ground surface (bgs). Groundwater encountered around 7 feet bgs during drilling. | | | | | |
| 35 | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

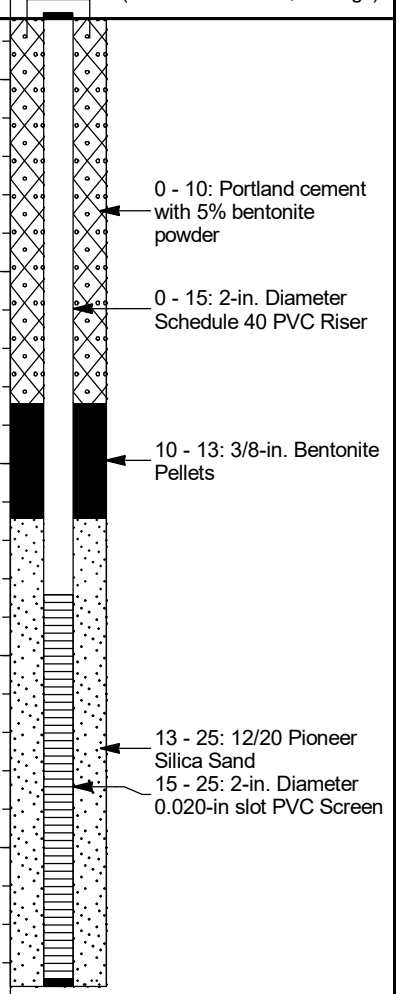
WELL NO: **INJ2**

STARTED: 11/28/18 COMPLETED: 11/28/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702966.85 US Feet EASTING: 1184696.45 US Feet
G.S. ELEVATION: 21.59 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|
| 0 | | Asphalt. | | | | | |
| | | Gravelly silty SAND (SM), brown, poorly graded, fine sand, fine to coarse subrounded gravel, non-plastic silt, dense, moist, [FILL, Hf]. | | | | | |
| | SM | Becomes gray. | | | | | |
| 5 | | | 2.5 | 0.8 | 12<br>22<br>16 | | |
| | | Becomes wet. | | | | | |
| 10 | ML | Sandy SILT (ML), brown, medium stiff, moist to wet, non-plastic silt, very fine sand, occasional fibers, [CONTAINS SUSPECTED WASTE MATERIAL]. | 2.5 | 1 | 2<br>4<br>7 | | |
| | | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, moist to wet, [ALLUVIUM, Qal]. | | | | | |
| 15 | SP SM | Becomes medium dense, 2-inch wood fragment. | 2.5 | 1.2 | 2<br>8<br>10 | | |
| 20 | | SAND (SP), dark brown, poorly graded, fine sand, trace silt, very loose, wet, [ALLUVIUM, Qal]. | 2.5 | 1.2 | 0<br>0<br>0 | | |
| | SP | | | | | | |
| 25 | | Increasing medium sand. | 2.5 | 1.5 | 4<br>7<br>10 | | |
| | | Boring terminated 25 feet below ground surface (bgs). Groundwater encountered around 7 feet bgs during drilling. | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

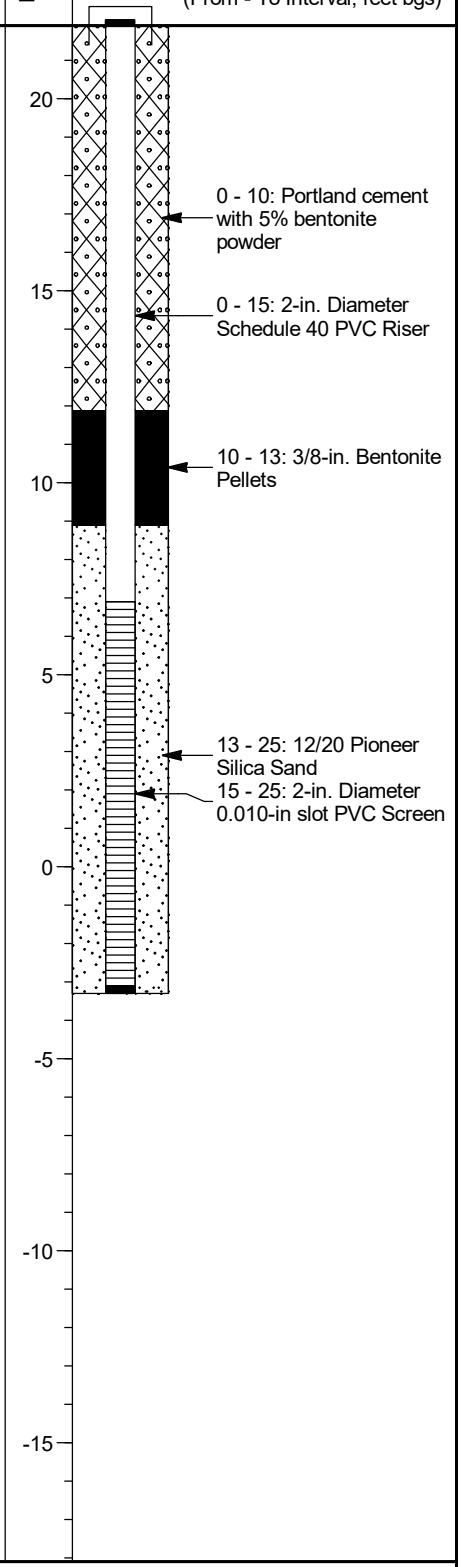
WELL NO: **M1**

STARTED: 11/26/18 COMPLETED: 11/27/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702976.19 US Feet EASTING: 1184682.12 US Feet
G.S. ELEVATION: 21.9 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|
| 0 | | Asphalt. | | | | | |
| | | Gravelly silty SAND (SM), gray, poorly graded, fine sand, fine to coarse subrounded to subangular gravel, non-plastic silt, medium dense, moist, [FILL, Hf]. | | | | | |
| 5 | SM | | | 0.5 | 6<br>14<br>12 | | |
| | | Becomes wet. | | | | | |
| 10 | | Becomes very silty, gravel becomes trace, low-plasticity silt, moist to wet. | | 0.5 | 5<br>3<br>2 | | |
| | | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, wet, [ALLUVIUM, Qal]. | | | | | |
| 15 | | Scattered wood fragments. | | 1 | 3<br>6<br>7 | | |
| | SP SM | | | | | | |
| 20 | | Sand becomes fine to medium. | | 1.5 | 4<br>12<br>14 | | |
| 25 | | | | 1.5 | 6<br>12<br>16 | | |
| | | Boring terminated at 25 feet below ground surface (bgs). Groundwater measured at 7.04 feet bgs after well installation. | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

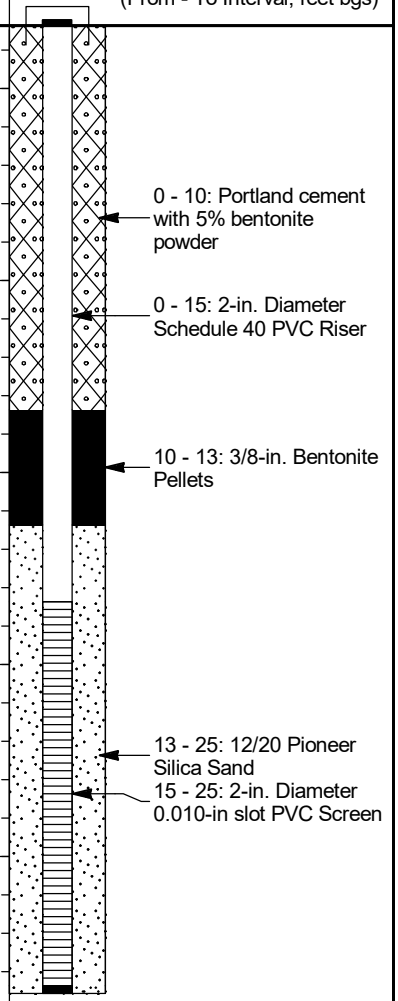
WELL NO: **M2**

STARTED: 11/27/18 COMPLETED: 11/27/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702961.20 US Feet EASTING: 1184704.51 US Feet
G.S. ELEVATION: 21.63 Feet M.P. ELEV:
INITIAL DTW: 7 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | GRAPHIC LOG | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|---|
| 0 | | GP | GRAVEL (GP), gray, poorly graded fine subangular to angular gravel, loose, moist, [STRUCTURAL FILL]. | | | | | 20 |
| | | | Gravelly silty SAND (SM), gray, poorly graded, fine sand, fine to coarse subrounded to rounded gravel, non-plastic silt, very dense, moist, [FILL, Hf]. | | | | | |
| 5 | | | Decreasing coarse gravel. | | 1 | 10<br>24<br>29 | | 15 |
| | | SM | ▼ Becomes wet, increasing silt. | | | | | |
| 10 | | | | | 0 | 5<br>14<br>21 | | 10 |
| | | | Becomes dense, moist, becomes slightly clayey, increasing silt, gravel absent. | | | | | |
| 15 | | SP<br>SM | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, medium dense, wet, [ALLUVIUM, Qal]. | | 1 | 6<br>9<br>10 | | 5 |
| 20 | | SP | SAND (SP), dark brown, poorly graded, fine to medium sand, loose, wet, [ALLUVIUM, Qal]. | | 1.5 | 6<br>2<br>2 | | 0 |
| | | ML | SILT (ML), brown, soft, moist to wet, 2-inch wood fragment, [ALLUVIUM, Qal]. | | | | | |
| 25 | | SP<br>SM | Slightly silty SAND (SP-SM), dark brown, poorly graded, fine sand, loose, wet, [ALLUVIUM, Qal]. | | 1.5 | 2<br>3<br>2 | | -5 |
| | | | Boring terminated 25 feet below ground surface (bgs). Groundwater encountered around 7 feet bgs during drilling. | | | | | -10 |
| 30 | | | | | | | | -15 |
| 35 | | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

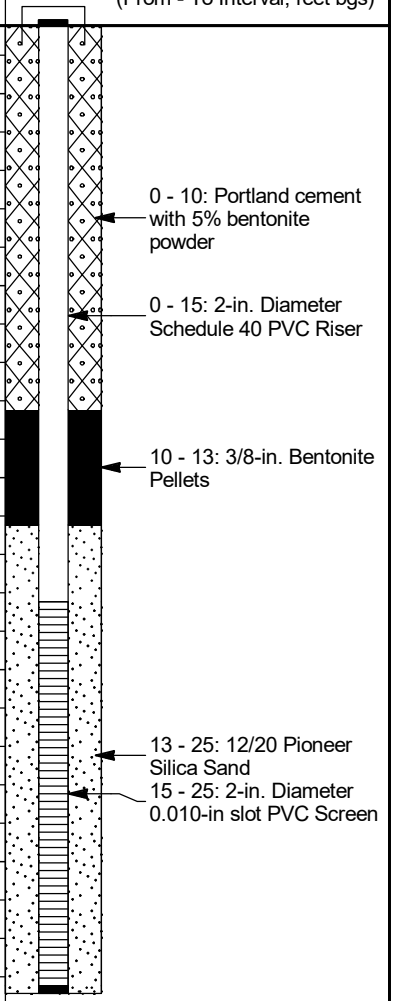
WELL NO: **M3**

STARTED: 11/27/18 COMPLETED: 11/28/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702975.51 US Feet EASTING: 1184708.99 US Feet
G.S. ELEVATION: 21.76 Feet M.P. ELEV:
INITIAL DTW: 10 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | GRAPHIC LOG | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|---|
| 0 | | GP | GRAVEL (GP), gray, poorly graded, fine subangular to angular gravel, loose, moist, [STRUCTURAL FILL]. | | | | | 20 |
| | | | Gravelly silty SAND (SM), gray, poorly graded, fine sand, fine to coarse subrounded to rounded gravel, non-plastic silt, medium dense, moist, [FILL, Hf]. | | | | | |
| 5 | | SM | Decreasing coarse gravel. | | 0.8 | 20<br>16<br>5 | | 15 |
| 10 | | ML | Slightly sandy SILT (ML), gray, soft, moist to wet, low plasticity, very fine sand, [FILL, Hf]. | | 0.8 | 2<br>2<br>2 | | 10 |
| | | | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, loose, wet, [ALLUVIUM, Qal]. | | | | | |
| 15 | | SP SM | Becomes medium dense. | | 1 | 4<br>4<br>8 | | 5 |
| 20 | | SP | SAND (SP), dark brown, poorly graded, fine to medium sand, trace silt, medium dense, wet, [ALLUVIUM, Qal]. | | 1.5 | 4<br>7<br>10 | | 0 |
| 25 | | | Becomes loose, decreasing fine sand. | | 1.5 | 2<br>2<br>3 | | -5 |
| | | | Boring terminated 25 feet below ground surface (bgs). Groundwater encountered around 10 feet bgs during drilling. | | | | | -10 |
| 30 | | | | | | | | -15 |
| 35 | | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

PROJECT: USG Hwy 99
LOCATION: Milton, Washington

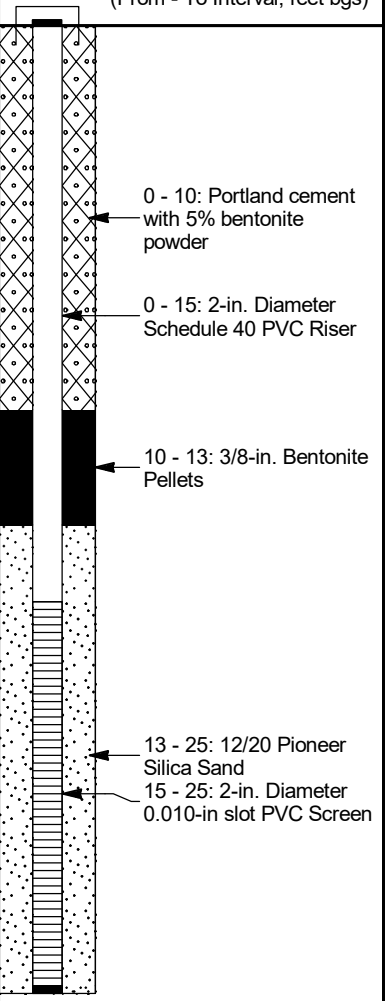
WELL NO: **M4**

STARTED: 11/26/18 COMPLETED: 11/26/18
DRILLING COMPANY: Holt Services, Inc.
DRILLING EQUIPMENT: Mobile Drill B-58
DRILLING METHOD: Hollow-Stem Auger, 7.6-inch diameter
SAMPLING METHOD: Split Spoon
SURFACE COMPLETION: Steel Flush-mount

NORTHING: 702996.02 US Feet EASTING: 1184704.89 US Feet
G.S. ELEVATION: 21.96 Feet M.P. ELEV:
INITIAL DTW: 7.2 Feet TOTAL DEPTH: 25.0 Feet
LOGGED BY: B. Miller
HORIZONTAL DATUM: NAD 83, COORD. SYS.: State Plane 4602
VERTICAL DATUM: NAVD 88

| DEPTH (feet) | USCS | DESCRIPTION | SAMPLER ADV. (feet) | RECOV. (feet) | BLOW COUNTS | PID (ppm) | ELEV. (feet) |
|---|---|---|---|---|---|---|---|
| 0 | | Asphalt. | | | | | |
| | | Gravelly silty SAND (SM), brown, poorly graded, fine sand, fine to coarse subrounded to rounded gravel, non-plastic silt, medium dense, moist, [FILL, Hf]. Becomes gray. | | | | | |
| 5 | SM | Decreasing gravel, increasing silt. | 2 | 1 | 13<br>10<br>6 | | |
| | | Gravel becomes trace. | | | | | |
| | | ▼ Becomes wet. | | | | | |
| 10 | ML | Slightly sandy SILT (ML), mottled gray and brown, stiff, moist, low plasticity, occasional fibers, [CONTAINS SUSPECTED WASTE MATERIAL]. | 2 | 1 | 4<br>4<br>8 | | |
| 15 | SP<br>SM | Slightly silty SAND (SP-SM), dark brown, poorly graded, very fine to fine sand, loose, wet, [ALLUVIUM, Qal]. | 2 | 1.5 | 2<br>5<br>4 | | |
| 20 | | | 2 | 1.5 | 4<br>10<br>11 | | |
| 25 | SP | SAND (SP), dark brown, poorly graded, fine sand, trace silt, medium dense, wet. | 2 | 1.5 | 4<br>4<br>10 | | |
| | | Boring terminated at 25 feet below ground surface (bgs). Groundwater measured at 7.20 feet bgs after well installation. | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |

WELL CONSTRUCTION (From - To Interval, feet bgs)





CDM Smith
14432 SE Eastgate Way Suite 100
Bellevue, WA 98007
Telephone: (425) 519-8300


WELL CONSTRUCTION LOG

# Appendix C

# Analytical Reports

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

January 7, 2019

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 233028
Laboratory Reference No. 1812-096

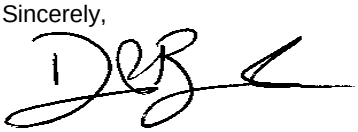
Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on December 10, 2018.

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: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**Case Narrative**

Samples were collected on December 7 and 10, 2018 and received by the laboratory on December 10, 2018. 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.

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

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

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **1DW-Comp** | | | | | |
| Laboratory ID: | 12-096-09 | | | | | |
| Arsenic | **30** | 12 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Barium | **60** | 3.1 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Cadmium | **ND** | 0.61 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Chromium | **35** | 0.61 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Copper | **21** | 1.2 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Lead | **ND** | 6.1 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Mercury | **ND** | 0.31 | EPA 7471B | 12-17-18 | 12-17-18 | |
| Nickel | **16** | 3.1 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Selenium | **ND** | 12 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Silver | **ND** | 1.2 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Zinc | **39** | 3.1 | EPA 6010D | 12-14-18 | 12-14-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

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

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| Laboratory ID: | MB1214SM1 | | | | | |
| Arsenic | **ND** | 10 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Barium | **ND** | 2.5 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Cadmium | **ND** | 0.50 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Chromium | **ND** | 0.50 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Copper | **ND** | 1.0 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Lead | **ND** | 5.0 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Nickel | **ND** | 2.5 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Selenium | **ND** | 10 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Silver | **ND** | 1.0 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Zinc | **ND** | 2.5 | EPA 6010D | 12-14-18 | 12-14-18 | |
| Laboratory ID: | MB1217S1 | | | | | |
| Mercury | **ND** | 0.25 | EPA 7471B | 12-17-18 | 12-17-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 6010D/7471B**
**QUALITY CONTROL**

Matrix: Soil
Units: mg/Kg (ppm)

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 12-061-34 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Arsenic | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| Barium | **112** | **120** | NA | NA | | NA | | NA | 7 | 20 | |
| Cadmium | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| Chromium | **13.7** | **15.1** | NA | NA | | NA | | NA | 10 | 20 | |
| Copper | **16.3** | **16.9** | NA | NA | | NA | | NA | 4 | 20 | |
| Lead | **5.95** | **8.15** | NA | NA | | NA | | NA | 31 | 20 | C |
| Nickel | **13.0** | **13.8** | NA | NA | | NA | | NA | 6 | 20 | |
| Selenium | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| Silver | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| Zinc | **50.4** | **52.9** | NA | NA | | NA | | NA | 5 | 20 | |
| Laboratory ID: | 12-061-34 | | | | | | | | | | |
| Mercury | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 12-061-34 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Arsenic | **92.2** | **97.0** | 100 | 100 | ND | **92** | **97** | 75-125 | 5 | 20 | |
| Barium | **218** | **217** | 100 | 100 | 112 | **106** | **105** | 75-125 | 0 | 20 | |
| Cadmium | **47.9** | **48.2** | 50.0 | 50.0 | ND | **96** | **96** | 75-125 | 1 | 20 | |
| Chromium | **111** | **111** | 100 | 100 | 13.7 | **98** | **98** | 75-125 | 0 | 20 | |
| Copper | **68.0** | **68.5** | 50.0 | 50.0 | 16.3 | **103** | **104** | 75-125 | 1 | 20 | |
| Lead | **243** | **248** | 250 | 250 | 5.95 | **95** | **97** | 75-125 | 2 | 20 | |
| Nickel | **113** | **113** | 100 | 100 | 13.0 | **100** | **101** | 75-125 | 1 | 20 | |
| Selenium | **91.3** | **94.1** | 100 | 100 | ND | **91** | **94** | 75-125 | 3 | 20 | |
| Silver | **23.1** | **23.5** | 25.0 | 25.0 | ND | **92** | **94** | 75-125 | 2 | 20 | |
| Zinc | **149** | **150** | 100 | 100 | 50.4 | **99** | **99** | 75-125 | 0 | 20 | |
| Laboratory ID: | . | | | | | | | | | | |
| Mercury | **0.493** | **0.518** | 0.500 | 0.500 | 0.00870 | **97** | **102** | 80-120 | 5 | 20 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **99-1-20181207** | | | | | |
| Laboratory ID: | 12-096-01 | | | | | |
| Aluminum | **ND** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **2400** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **34000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **8800** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **17000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1100** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **4100** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **17000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **M99-20181207** | | | | | |
| Laboratory ID: | 12-096-02 | | | | | |
| Aluminum | **ND** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **1400** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **50** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **40000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **7500** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **18000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1200** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **5300** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **26000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **M2-20181207** | | | | | |
| Laboratory ID: | 12-096-03 | | | | | |
| Aluminum | **ND** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **1300** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **51** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **41000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **7800** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **18000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1300** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **5300** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **28000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **M3-20181207** | | | | | |
| Laboratory ID: | 12-096-04 | | | | | |
| Aluminum | **680** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **720** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **58** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **27000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **7500** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **14000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1100** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **6000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **34000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **M4-20181210** | | | | | |
| Laboratory ID: | 12-096-05 | | | | | |
| Aluminum | **160** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **1600** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **48** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **33000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **9200** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **15000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1400** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **4200** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **19000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **M1-20181210** | | | | | |
| Laboratory ID: | 12-096-06 | | | | | |
| Aluminum | **220** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **1600** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **45** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **29000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **3300** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **16000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1200** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **4800** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **17000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **INJ2-20181210** | | | | | |
| Laboratory ID: | 12-096-07 | | | | | |
| Aluminum | **700** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **2100** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **56** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **33000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **3300** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **14000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **810** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **6100** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **52000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **INJ1-20181210** | | | | | |
| Laboratory ID: | 12-096-08 | | | | | |
| Aluminum | **240** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Antimony | **17** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **2300** | 33 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **41** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Calcium | **37000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Iron | **2600** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Magnesium | **16000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **1100** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Potassium | **4700** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Sodium | **18000** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**
**METHOD BLANK QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB1213WM1 | | | | | |
| Antimony | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Arsenic | **ND** | 3.3 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Barium | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Beryllium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cadmium | **ND** | 4.4 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Chromium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Cobalt | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Copper | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Lead | **ND** | 1.1 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Nickel | **ND** | 22 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Selenium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Silver | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Thallium | **ND** | 5.6 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Vanadium | **ND** | 11 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Zinc | **ND** | 28 | EPA 200.8 | 12-13-18 | 12-13-18 | |
| Laboratory ID: | MB1213WM1 | | | | | |
| Aluminum | **ND** | 110 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Calcium | **ND** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Iron | **ND** | 56 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Magnesium | **ND** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Manganese | **ND** | 11 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Potassium | **ND** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Sodium | **ND** | 1100 | EPA 6010D | 12-13-18 | 12-13-18 | |
| Laboratory ID: | MB1213W2 | | | | | |
| Mercury | **ND** | 0.50 | EPA 7470A | 12-13-18 | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**
**DUPLICATE 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: | 12-088-06 | | | | | | | | | |
| | ORIG | DUP | | | | | | | | |
| Antimony | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Arsenic | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Barium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Beryllium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Cadmium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Chromium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Cobalt | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Copper | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Lead | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Nickel | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Selenium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Silver | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Thallium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Vanadium | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Zinc | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |
| Laboratory ID: | 12-088-06 | | | | | | | | | |
| Aluminum | **590** | **610** | NA | NA | | NA | NA | 3 | 20 | |
| Calcium | **19400** | **19400** | NA | NA | | NA | NA | 0 | 20 | |
| Iron | **1020** | **1010** | NA | NA | | NA | NA | 2 | 20 | |
| Magnesium | **6920** | **6990** | NA | NA | | NA | NA | 1 | 20 | |
| Manganese | **202** | **204** | NA | NA | | NA | NA | 1 | 20 | |
| Potassium | **2610** | **2530** | NA | NA | | NA | NA | 3 | 20 | |
| Sodium | **6480** | **6480** | NA | NA | | NA | NA | 0 | 20 | |
| Laboratory ID: | 12-096-01 | | | | | | | | | |
| Mercury | **ND** | **ND** | NA | NA | | NA | NA | NA | 20 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**TOTAL METALS**
**EPA 200.8/6010D/7470A**
**MS/MSD QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 12-088-06 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Antimony | **228** | **229** | 222 | 222 | ND | **103** | **103** | 75-125 | 0 | 20 | |
| Arsenic | **226** | **219** | 222 | 222 | ND | **102** | **99** | 75-125 | 3 | 20 | |
| Barium | **231** | **228** | 222 | 222 | ND | **104** | **103** | 75-125 | 1 | 20 | |
| Beryllium | **224** | **230** | 222 | 222 | ND | **101** | **104** | 75-125 | 3 | 20 | |
| Cadmium | **218** | **222** | 222 | 222 | ND | **98** | **100** | 75-125 | 2 | 20 | |
| Chromium | **215** | **214** | 222 | 222 | ND | **97** | **96** | 75-125 | 1 | 20 | |
| Cobalt | **206** | **202** | 222 | 222 | ND | **93** | **91** | 75-125 | 2 | 20 | |
| Copper | **204** | **203** | 222 | 222 | ND | **92** | **92** | 75-125 | 1 | 20 | |
| Lead | **223** | **225** | 222 | 222 | ND | **100** | **101** | 75-125 | 1 | 20 | |
| Nickel | **207** | **205** | 222 | 222 | ND | **93** | **92** | 75-125 | 1 | 20 | |
| Selenium | **226** | **223** | 222 | 222 | ND | **102** | **100** | 75-125 | 1 | 20 | |
| Silver | **213** | **215** | 222 | 222 | ND | **96** | **97** | 75-125 | 1 | 20 | |
| Thallium | **214** | **210** | 222 | 222 | ND | **96** | **95** | 75-125 | 2 | 20 | |
| Vanadium | **215** | **214** | 222 | 222 | ND | **97** | **96** | 75-125 | 1 | 20 | |
| Zinc | **251** | **244** | 222 | 222 | ND | **113** | **110** | 75-125 | 2 | 20 | |
| Laboratory ID: | 12-088-06 | | | | | | | | | | |
| Aluminum | **20900** | **21000** | 22200 | 22200 | 590 | **91** | **92** | 75-125 | 1 | 20 | |
| Calcium | **41200** | **41300** | 22200 | 22200 | 19400 | **98** | **99** | 75-125 | 0 | 20 | |
| Iron | **22600** | **22300** | 22200 | 22200 | 1020 | **97** | **96** | 75-125 | 1 | 20 | |
| Magnesium | **27700** | **27600** | 22200 | 22200 | 6920 | **93** | **93** | 75-125 | 0 | 20 | |
| Manganese | **428** | **426** | 222 | 222 | 202 | **102** | **101** | 75-125 | 1 | 20 | |
| Potassium | **24400** | **24100** | 22200 | 22200 | 2610 | **98** | **97** | 75-125 | 1 | 20 | |
| Sodium | **27600** | **27400** | 22200 | 22200 | 6480 | **95** | **94** | 75-125 | 0 | 20 | |
| Laboratory ID: | 12-096-01 | | | | | | | | | | |
| Mercury | **10.9** | **10.9** | 12.5 | 12.5 | ND | **87** | **87** | 75-125 | 0 | 20 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**DISSOLVED ARSENIC**
**EPA 200.8**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **99-1-20181207** | | | | | |
| Laboratory ID: | 12-096-01 | | | | | |
| Arsenic | **2200** | 30 | EPA 200.8 | | 12-13-18 | |
| **Client ID:** | **M3-20181207** | | | | | |
| Laboratory ID: | 12-096-04 | | | | | |
| Arsenic | **700** | 30 | EPA 200.8 | | 12-13-18 | |
| **Client ID:** | **INJ2-20181210** | | | | | |
| Laboratory ID: | 12-096-07 | | | | | |
| Arsenic | **2100** | 30 | EPA 200.8 | | 12-13-18 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**DISSOLVED ARSENIC**
**EPA 200.8**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB1213D1 | | | | | |
| Arsenic | **ND** | 3.0 | EPA 200.8 | | 12-13-18 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 12-096-04 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Arsenic | **695** | **670** | NA | NA | | NA | | NA | 4 | 20 | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 12-096-04 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Arsenic | **2670** | **2720** | 2000 | 2000 | 695 | **99** | **101** | 75-125 | 2 | 20 | |

Date of Report: January 7, 2019
Samples Submitted: December 10, 2018
Laboratory Reference: 1812-096
Project: 233028

**% MOISTURE**

Date Analyzed: 12-17-18

| Client ID | Lab ID | % Moisture |
|---|---|---|
| 1DW-Comp | 12-096-09 | 18 |

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-naphthalene) 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

January 04, 2019 Service Request No:K1812143

David Baumeister
Onsite Environmental Incorporated
14648 Northeast 95th Street
Redmond, WA 98052

**Laboratory Results for: USG HWY 99**

Dear David,

Enclosed are the results of the sample(s) submitted to our laboratory December 12, 2018
For your reference, these analyses have been assigned our service request number **K1812143.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

**ALS Group USA, Corp. dba ALS Environmental**

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

# Narrative Documents

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

**Client:** Onsite Environmental Incorporated
**Project:** USG HWY 99
**Sample Matrix:** Water

**Service Request:** K1812143
**Date Received:** 12/12/2018

## CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

**Sample Receipt:**

Three water samples were received for analysis at ALS Environmental on 12/12/2018. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4ºC upon receipt at the laboratory.

**General Chemistry:**

No significant anomalies were noted with this analysis.

Approved by _____ Date 01/04/2019

# Sample Receipt Information

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

**Client:** Onsite Environmental Incorporated **Service Request:**K1812143
**Project:** USG HWY 99/233028

## SAMPLE CROSS-REFERENCE

| SAMPLE # | CLIENT SAMPLE ID | DATE | TIME |
|---|---|---|---|
| K1812143-001 | 99-1-20181207 | 12/7/2018 | 1025 |
| K1812143-002 | INJ2-20181210 | 12/10/2018 | 1210 |
| K1812143-003 | INJ1-20181210 | 12/10/2018 | 1330 |

K1812143



**OnSite Environmental Inc.**

14648 NE 95th Street, Redmond, WA 98052 · (425) 883-3881

Laboratory Reference #: 12-096

Laboratory: ALS Environmental

Attenti Mark Harris

1317 South 13th Avenue, Kelso, WA 98626

Phone Number: ( 360 ) 577-7222

Turnaround Request

1 Day 2 Day 3 Day

Standard

Other:

Project Manager: David Baumeister

email: dbaumeister@onsite-env.com

Project Number: 233028

Project Name: USG HWY 99

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | # of Cont. | Requested Analyses |
|---|---|---|---|---|---|---|
| 1 | 99-1-20181207 | 12/7/18 | 10:25 | W | 1 | Bromate |
| 7 | INJ2-20181210 | 12/10/18 | 12:10 | W | 1 | Bromate |
| 8 | INJ1-20181210 | 12/10/18 | 13:30 | W | 1 | Bromate |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | Signature | Company | Date | Time | Comments/Special Instructions |
|---|---|---|---|---|---|
| Relinquished by: | Helen Steel | OSE | 12/11/18 | 1600 | |
| Received by: | | ALS | 12/12/18 | 845 | |
| Relinquished by: | | | | | |
| Received by: | | | | | |
| Relinquished by: | | | | | |
| Received by: | | | | | |

PC MH

# Cooler Receipt and Preservation Form

Client Onsite Service Request *K18* 12143

Received: 12/12/18 Opened: 12/12/18 By: [signature] Unloaded: 12/12/18 By: [signature]

1. Samples were received via? *USPS* *Fed Ex* (*UPS*) *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

| Raw Cooler Temp | Corrected. Cooler Temp | Raw Temp Blank | Corrected Temp Blank | Corr. Factor | Thermometer ID | Cooler/COC ID (NA) | Tracking Number NA | Filed |
|---|---|---|---|---|---|---|---|---|
| 2.0 | 1.9 | - | - | -0.1 | 399 | | 1Z684 E1W 0397 3328 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

4. Packing material: *Inserts* *Baggies* (*Bubble Wrap*) *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA (Y) N
   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA (Y) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA (Y) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

| Sample ID on Bottle | Sample ID on COC | Identified by: |
|---|---|---|
| | | |
| | | |
| | | |

| Sample ID | Bottle Count Bottle Type | Out of Temp | Head-space | Broke | pH | Reagent | Volume added | Reagent Lot Number | Initials | Time |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

***Notes, Discrepancies, & Resolutions:*** _____

# Miscellaneous Forms

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

## Inorganic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated value. |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a matrix interference. |
| X | See case narrative. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |
| H | The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory. |

## Metals Data Qualifiers

| | |
|---|---|
| # | The control limit criteria is not applicable. See case narrative. |
| J | The result is an estimated value. |
| E | The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample. |
| M | The duplicate injection precision was not met. |
| N | The Matrix Spike sample recovery is not within control limits. See case narrative. |
| S | The reported value was determined by the Method of Standard Additions (MSA). |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| W | The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a matrix interference. |
| X | See case narrative. |
| + | The correlation coefficient for the MSA is less than 0.995. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |

## Organic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| A | A tentatively identified compound, a suspected aldol-condensation product. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards. |
| C | The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data. |
| D | The reported result is from a dilution. |
| E | The result is an estimated value. |
| J | The result is an estimated value. |
| N | The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed. |
| P | The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results. |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference. |
| X | See case narrative. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |

## Additional Petroleum Hydrocarbon Specific Qualifiers

| | |
|---|---|
| F | The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard. |
| L | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard. |
| H | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard. |
| O | The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard. |
| Y | The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard. |
| Z | The chromatographic fingerprint does not resemble a petroleum product. |

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso**
**State Certifications, Accreditations, and Licenses**

| Agency | Web Site | Number |
|---|---|---|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| North Carolina DEQ | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

## Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| A2LA | American Association for Laboratory Accreditation |
| CARB | California Air Resources Board |
| CAS Number | Chemical Abstract Service registry Number |
| CFC | Chlorofluorocarbon |
| CFU | Colony-Forming Unit |
| DEC | Department of Environmental Conservation |
| DEQ | Department of Environmental Quality |
| DHS | Department of Health Services |
| DOE | Department of Ecology |
| DOH | Department of Health |
| EPA | U. S. Environmental Protection Agency |
| ELAP | Environmental Laboratory Accreditation Program |
| GC | Gas Chromatography |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| LOD | Limit of Detection |
| LOQ | Limit of Quantitation |
| LUFT | Leaking Underground Fuel Tank |
| M | Modified |
| MCL | Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA. |
| MDL | Method Detection Limit |
| MPN | Most Probable Number |
| MRL | Method Reporting Limit |
| NA | Not Applicable |
| NC | Not Calculated |
| NCASI | National Council of the Paper Industry for Air and Stream Improvement |
| ND | Not Detected |
| NIOSH | National Institute for Occupational Safety and Health |
| PQL | Practical Quantitation Limit |
| RCRA | Resource Conservation and Recovery Act |
| SIM | Selected Ion Monitoring |
| TPH | Total Petroleum Hydrocarbons |
| tr | Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL. |

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | | |

| | | | |
|---|---|---|---|
| **Sample Name:** | 99-1-20181207 | **Date Collected:** | 12/7/18 |
| **Lab Code:** | K1812143-001 | **Date Received:** | 12/12/18 |
| **Sample Matrix:** | Water | | |

| Analysis Method | Extracted/Digested By | Analyzed By |
|---|---|---|
| 300.1 | | MRODRIGUEZ |

| | | | |
|---|---|---|---|
| **Sample Name:** | INJ2-20181210 | **Date Collected:** | 12/10/18 |
| **Lab Code:** | K1812143-002 | **Date Received:** | 12/12/18 |
| **Sample Matrix:** | Water | | |

| Analysis Method | Extracted/Digested By | Analyzed By |
|---|---|---|
| 300.1 | | MRODRIGUEZ |

| | | | |
|---|---|---|---|
| **Sample Name:** | INJ1-20181210 | **Date Collected:** | 12/10/18 |
| **Lab Code:** | K1812143-003 | **Date Received:** | 12/12/18 |
| **Sample Matrix:** | Water | | |

| Analysis Method | Extracted/Digested By | Analyzed By |
|---|---|---|
| 300.1 | | MRODRIGUEZ |

# Sample Results

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

# General Chemistry

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Collected:** | 12/07/18 10:25 |
| **Sample Matrix:** | Water | **Date Received:** | 12/12/18 08:45 |
| **Sample Name:** | 99-1-20181207 | **Basis:** | NA |
| **Lab Code:** | K1812143-001 | | |

## General Chemistry Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---|---|---|---|---|---|---|---|
| Bromate | 300.1 | ND U | ug/L | 10 | 2 | 12/13/18 15:03 | |

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Collected:** | 12/10/18 12:10 |
| **Sample Matrix:** | Water | **Date Received:** | 12/12/18 08:45 |
| **Sample Name:** | INJ2-20181210 | **Basis:** | NA |
| **Lab Code:** | K1812143-002 | | |

## General Chemistry Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---|---|---|---|---|---|---|---|
| Bromate | 300.1 | ND U | ug/L | 10 | 2 | 12/13/18 15:26 | |

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Collected:** | 12/10/18 13:30 |
| **Sample Matrix:** | Water | **Date Received:** | 12/12/18 08:45 |
| **Sample Name:** | INJ1-20181210 | **Basis:** | NA |
| **Lab Code:** | K1812143-003 | | |

## General Chemistry Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---|---|---|---|---|---|---|---|
| Bromate | 300.1 | ND U | ug/L | 10 | 2 | 12/13/18 15:48 | |

# QC Summary Forms

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

# General Chemistry

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | NA |
| **Lab Code:** | K1812143-MB1 | | |

## General Chemistry Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---|---|---|---|---|---|---|---|
| Bromate | 300.1 | ND U | ug/L | 5.0 | 1 | 12/13/18 12:27 | |

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | NA |
| **Lab Code:** | K1812143-MB2 | | |

## General Chemistry Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---|---|---|---|---|---|---|---|
| Bromate | 300.1 | ND U | ug/L | 5.0 | 1 | 12/14/18 15:03 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Analyzed:** | 12/13/18 |
| **Sample Matrix:** | Water | **Date Extracted:** | NA |

**Lab Control Sample Summary**
**Bromate**

| | | | |
|---|---|---|---|
| **Analysis Method:** | 300.1 | **Units:** | ug/L |
| **Prep Method:** | None | **Basis:** | NA |
| | | **Analysis Lot:** | 618673 |

| Sample Name | Lab Code | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Lab Control Sample | K1812143-LCS1 | 23.3 | 25.0 | 93 | 75-125 |

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Onsite Environmental Incorporated | **Service Request:** | K1812143 |
| **Project:** | USG HWY 99/233028 | **Date Analyzed:** | 12/14/18 |
| **Sample Matrix:** | Water | **Date Extracted:** | NA |

**Lab Control Sample Summary**
**Bromate**

| | | | |
|---|---|---|---|
| **Analysis Method:** | 300.1 | **Units:** | ug/L |
| **Prep Method:** | None | **Basis:** | NA |
| | | **Analysis Lot:** | 618673 |

| Sample Name | Lab Code | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Lab Control Sample | K1812143-LCS2 | 23.4 | 25.0 | 94 | 75-125 |

# 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: CDM SMITH
Project Number: 233028
Project Name: USG Hwy 99
Project Manager: PAM MORRILL
Sampled by: BRENDAN MILLER

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

**Laboratory Number: 12-096**

| 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 +Cu+Ni+Zn | Total MTCA Metals | TCLP Metals | HEM (oil and grease) 1664A | TAL METALS | DISSOLVED As | BROMATE | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 99-1-20181207 | 12-7-18 | 1025 | WG | 3 | | | | | | | | | | | | | | | | | | X | X | X | | |
| 2 | M99-20181207 | | 1200 | | 2 | | | | | | | | | | | | | | | | | | X | ~~X~~ | | | |
| 3 | M2-20181207 | | 1330 | | 2 | | | | | | | | | | | | | | | | | | X | ~~X~~ | | | |
| 4 | M3-20181207 | ↓ | 1500 | | 2 | | | | | | | | | | | | | | | | | | X | X | | | |
| 5 | M4-20181210 | 12-10-18 | 0930 | | 2 | | | | | | | | | | | | | | | | | | X | ~~X~~ | | | |
| 6 | M1-20181210 | | 1040 | | 2 | | | | | | | | | | | | | | | | | | X | ~~X~~ | | | |
| 7 | INF2-20181210 | | 1210 | | 3 | | | | | | | | | | | | | | | | | | X | X | X | | |
| 8 | INF1-20181210 | | 1330 | ↓ | 3 | | | | | | | | | | | | | | | | | | X | ~~X~~ | X | | |
| 9 | Low-comp | ↓ | 1450 | SO | 2 | | | | | | | | | | | | | | X | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | [signature] | CDM SMITH | 12-10-18 | 1655 |
| Received | [signature] | CDM | 12/10/18 | 1655 |
| Relinquished | | | | |
| Received | | | | |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
DISSOLVED ARSENIC SAMPLES FIELD FILTERED IF TURBIDITY EXCEEDED 10 NTU.

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

February 8, 2019

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 233028
Laboratory Reference No. 1902-030

Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on February 6, 2019.

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: February 8, 2019
Samples Submitted: February 6, 2019
Laboratory Reference: 1902-030
Project: 233028

**Case Narrative**

Samples were collected on February 5, 2019 and received by the laboratory on February 6, 2019. 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.

Date of Report: February 8, 2019
Samples Submitted: February 6, 2019
Laboratory Reference: 1902-030
Project: 233028

**DISSOLVED ARSENIC**
**EPA 200.8**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190205-M2** | | | | | |
| Laboratory ID: | 02-030-01 | | | | | |
| Arsenic | **1100** | 12 | EPA 200.8 | | 2-7-19 | |
| **Client ID:** | **20190205-M3** | | | | | |
| Laboratory ID: | 02-030-02 | | | | | |
| Arsenic | **310** | 3.0 | EPA 200.8 | | 2-7-19 | |
| **Client ID:** | **20190205-M4** | | | | | |
| Laboratory ID: | 02-030-03 | | | | | |
| Arsenic | **420** | 3.0 | EPA 200.8 | | 2-7-19 | |

Date of Report: February 8, 2019
Samples Submitted: February 6, 2019
Laboratory Reference: 1902-030
Project: 233028

**DISSOLVED ARSENIC**
**EPA 200.8**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0207F1 | | | | | |
| Arsenic | **ND** | 3.0 | EPA 200.8 | 2-7-19 | 2-7-19 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 02-038-06 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Arsenic | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 02-038-06 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Arsenic | **205** | **205** | 200 | 200 | ND | **103** | **103** | 75-125 | 0 | 20 | |

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-naphthalene) 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

**Laboratory Number:** 02-030

Company: COM SMITH
Project Number: 233028
Project Name: USG HWY 99
Project Manager: PAM MORRILL
Sampled by: B. MILLER

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

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers | NWTPH-HCID | NWTPH-Gx/BTEX | NWTPH-Gx | NWTPH-Dx | Volatiles 8260C | Halogenated Volatiles 8260C | 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 | DISSOLVED As* | | | | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20190205-M2 | 2-5-19 | 0950 | WG | 1 | | | | | | | | | | | | | | | | | X | | | | | |
| 2 | 20190205-M3 | ↓ | 1110 | ↓ | ↓ | | | | | | | | | | | | | | | | | ↓ | | | | | |
| 3 | 20190205-M4 | ↓ | 1140 | ↓ | ↓ | | | | | | | | | | | | | | | | | ↓ | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | | COM SMITH | 2-6-19 | 1235 |
| Received | | COSE | 2/6/19 | 1235 |
| Relinquished | | | | |
| Received | | | | |
| Relinquished | | | | |
| Received | | | | |

**Comments/Special Instructions**
* FIELD FILTERED (0.45μ)
~~CONFIRM w/PAH WHICH SAMPLES TO RUN.~~ 2-5-19

Reviewed/Date
Reviewed/Date
Chromatograms with final report ☐

Data Package: Standard ☐ Level III ☐ Level IV ☐
Electronic Data Deliverables (EDDs) ☐ _____

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

March 4, 2019

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 233028
Laboratory Reference No. 1902-135

Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on February 22, 2019.

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: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**Case Narrative**

Samples were collected on February 21 and 22, 2019 and received by the laboratory on February 22, 2019. 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.

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**TOTAL IRON**
**EPA 6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190221-99-1** | | | | | |
| Laboratory ID: | 02-135-01 | | | | | |
| Iron | **3200** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |
| **Client ID:** | **20190221-M3** | | | | | |
| Laboratory ID: | 02-135-02 | | | | | |
| Iron | **7700** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |
| **Client ID:** | **20190221-M2** | | | | | |
| Laboratory ID: | 02-135-03 | | | | | |
| Iron | **5700** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |
| **Client ID:** | **20190221-AS2** | | | | | |
| Laboratory ID: | 02-135-04 | | | | | |
| Iron | **5900** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |
| **Client ID:** | **20190221-AS1** | | | | | |
| Laboratory ID: | 02-135-05 | | | | | |
| Iron | **11000** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |
| **Client ID:** | **20190221-INJ1** | | | | | |
| Laboratory ID: | 02-135-06 | | | | | |
| Iron | **49000** | 250 | EPA 6010D | 2-26-19 | 3-1-19 | |
| **Client ID:** | **20190222-M4** | | | | | |
| Laboratory ID: | 02-135-07 | | | | | |
| Iron | **5600** | 50 | EPA 6010D | 2-26-19 | 3-1-19 | |
| **Client ID:** | **20190222-M1** | | | | | |
| Laboratory ID: | 02-135-08 | | | | | |
| Iron | **5700** | 50 | EPA 6010D | 2-26-19 | 3-1-19 | |

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**TOTAL IRON**
**EPA 6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190222-INJ2** | | | | | |
| Laboratory ID: | 02-135-09 | | | | | |
| Iron | **150000** | 500 | EPA 6010D | 2-26-19 | 2-26-19 | |

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**TOTAL IRON**
**EPA 6010D**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0226WH1 | | | | | |
| Iron | **ND** | 50 | EPA 6010D | 2-26-19 | 2-26-19 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 02-107-01 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Iron | **52.5** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 02-107-01 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Iron | **18700** | **17400** | 20000 | 20000 | 52.5 | **93** | **87** | 75-125 | 7 | 20 | |

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**DISSOLVED METALS**
**EPA 200.8/6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190221-99-1** | | | | | |
| Laboratory ID: | 02-135-01 | | | | | |
| Arsenic | **530** | 6.0 | EPA 200.8 | | 2-27-19 | |
| Iron | **3000** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190221-M3** | | | | | |
| Laboratory ID: | 02-135-02 | | | | | |
| Arsenic | **780** | 6.0 | EPA 200.8 | | 2-27-19 | |
| Iron | **6200** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190221-M2** | | | | | |
| Laboratory ID: | 02-135-03 | | | | | |
| Arsenic | **420** | 3.0 | EPA 200.8 | | 2-27-19 | |
| Iron | **5200** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190221-AS2** | | | | | |
| Laboratory ID: | 02-135-04 | | | | | |
| Iron | **2400** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190221-AS1** | | | | | |
| Laboratory ID: | 02-135-05 | | | | | |
| Iron | **6100** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190221-INJ1** | | | | | |
| Laboratory ID: | 02-135-06 | | | | | |
| Iron | **49000** | 250 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190222-M4** | | | | | |
| Laboratory ID: | 02-135-07 | | | | | |
| Arsenic | **300** | 3.0 | EPA 200.8 | | 2-27-19 | |
| Iron | **5600** | 56 | EPA 6010D | | 2-28-19 | |

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**DISSOLVED METALS**
**EPA 200.8/6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190222-M1** | | | | | |
| Laboratory ID: | 02-135-08 | | | | | |
| Arsenic | **2600** | 30 | EPA 200.8 | | 2-27-19 | |
| Iron | **5500** | 56 | EPA 6010D | | 2-28-19 | |
| **Client ID:** | **20190222-INJ2** | | | | | |
| Laboratory ID: | 02-135-09 | | | | | |
| Iron | **150000** | 500 | EPA 6010D | | 2-28-19 | |

Date of Report: March 4, 2019
Samples Submitted: February 22, 2019
Laboratory Reference: 1902-135
Project: 233028

**DISSOLVED METALS**
**EPA 200.8/6010D**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0228DM1 | | | | | |
| Iron | **ND** | 56 | EPA 6010D | | 2-28-19 | |
| | | | | | | |
| Laboratory ID: | MB1220F1 | | | | | |
| Arsenic | **ND** | 3.0 | EPA 200.8 | 12-20-18 | 2-27-19 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 02-135-01 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Iron | **3030** | **3150** | NA | NA | | NA | | NA | 4 | 20 | |
| | | | | | | | | | | | |
| Laboratory ID: | 12-209-01 | | | | | | | | | | |
| Arsenic | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| | | | | | | | | | | | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 02-135-01 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Iron | **25100** | **24900** | 22200 | 22200 | 3030 | **99** | **98** | 75-125 | 1 | 20 | |
| | | | | | | | | | | | |
| Laboratory ID: | 12-209-01 | | | | | | | | | | |
| Arsenic | **210** | **201** | 200 | 200 | ND | **105** | **101** | 75-125 | 4 | 20 | |

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-naphthalene) 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: COM SMITH
Project Number: 233028
Project Name: VSG HWY 99
Project Manager: PAM MORRILL
Sampled by: B. MILLER

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

**Laboratory Number:** 02-135

| Lab ID | Sample Identification | Date Sampled | Time Sampled | Matrix | Number of Containers |
|---|---|---|---|---|---|
| 1 | 20190221-99-1 | 2-21-19 | 0930 | WG | 2 |
| 2 | 20190221-M3 | | 1030 | | |
| 3 | 20190221-M2 | | 1140 | | |
| 4 | 20190221-AS2 | | 1300 | | |
| 5 | 20190221-AS1 | | 1400 | | |
| 6 | 20190221-INJ1 | | 1500 | | |
| 7 | 20190222-M4 | 2-22-19 | 0930 | WG | |
| 8 | 20190222-M1 | | 1030 | | |
| 9 | 20190222-INJ2 | | 1130 | | |

| Lab ID | 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 | TOTAL Fe | DISSOLVED Fe* | DISSOLVED As* | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | X | X | X | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | X | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | X | X | X | | |
| 8 | | | | | | | | | | | | | | | | | | X | X | X | | |
| 9 | | | | | | | | | | | | | | | | | | X | X | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | | COM SMITH | 2-22-19 | 1347 |
| Received | | OSE | 2/22/19 | 1347 |
| Relinquished | | | | |
| Received | | | | |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
* SAMPLES FILTERED W/ 0.45 MICRON FILTER IN THE FIELD

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 3, 2019

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 233028
Laboratory Reference No. 1903-210

Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on March 22, 2019.

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 3, 2019
Samples Submitted: March 22, 2019
Laboratory Reference: 1903-210
Project: 233028

**Case Narrative**

Samples were collected on March 21 and 22, 2019 and received by the laboratory on March 22, 2019. 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.

Date of Report: April 3, 2019
Samples Submitted: March 22, 2019
Laboratory Reference: 1903-210
Project: 233028

**TOTAL IRON**
**EPA 6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190321-INJ1** | | | | | |
| Laboratory ID: | 03-210-06 | | | | | |
| Iron | **86000** | 2000 | EPA 6010D | 3-28-19 | 3-28-19 | |

Date of Report: April 3, 2019
Samples Submitted: March 22, 2019
Laboratory Reference: 1903-210
Project: 233028

**TOTAL IRON**
**EPA 6010D**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0328WH1 | | | | | |
| Iron | **ND** | 200 | EPA 6010D | 3-28-19 | 3-28-19 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 03-208-03 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Iron | **583** | **375** | NA | NA | | NA | | NA | 43 | 20 | C |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 03-208-03 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Iron | **19500** | **19900** | 20000 | 20000 | 583 | **95** | **97** | 75-125 | 2 | 20 | |

Date of Report: April 3, 2019
Samples Submitted: March 22, 2019
Laboratory Reference: 1903-210
Project: 233028

**DISSOLVED METALS**
**EPA 200.8/6010D**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **Client ID:** | **20190321-99-1** | | | | | |
| Laboratory ID: | 03-210-01 | | | | | |
| Arsenic | **560** | 15 | EPA 200.8 | | 3-26-19 | |
| **Client ID:** | **20190321-M3** | | | | | |
| Laboratory ID: | 03-210-02 | | | | | |
| Arsenic | **420** | 15 | EPA 200.8 | | 3-26-19 | |
| **Client ID:** | **20190321-M2** | | | | | |
| Laboratory ID: | 03-210-03 | | | | | |
| Arsenic | **440** | 15 | EPA 200.8 | | 3-26-19 | |
| **Client ID:** | **20190321-M4** | | | | | |
| Laboratory ID: | 03-210-04 | | | | | |
| Arsenic | **320** | 6.0 | EPA 200.8 | | 3-26-19 | |
| **Client ID:** | **20190321-M1** | | | | | |
| Laboratory ID: | 03-210-05 | | | | | |
| Arsenic | **2900** | 75 | EPA 200.8 | | 3-26-19 | |
| **Client ID:** | **20190321-INJ1** | | | | | |
| Laboratory ID: | 03-210-06 | | | | | |
| Iron | **78000** | 250 | EPA 6010D | | 3-26-19 | |
| **Client ID:** | **20190321-INJ2** | | | | | |
| Laboratory ID: | 03-210-07 | | | | | |
| Iron | **230000** | 500 | EPA 6010D | | 3-26-19 | |

Date of Report: April 3, 2019
Samples Submitted: March 22, 2019
Laboratory Reference: 1903-210
Project: 233028

**DISSOLVED METALS**
**EPA 200.8/6010D**
**QUALITY CONTROL**

Matrix: Water
Units: ug/L (ppb)

| Analyte | Result | PQL | Method | Date Prepared | Date Analyzed | Flags |
|---|---|---|---|---|---|---|
| **METHOD BLANK** | | | | | | |
| Laboratory ID: | MB0326D1 | | | | | |
| Iron | **ND** | 56 | EPA 6010D | | 3-26-19 | |
| Laboratory ID: | MB0326D1 | | | | | |
| Arsenic | **ND** | 3.0 | EPA 200.8 | | 3-26-19 | |

| Analyte | Result | | Spike Level | | Source Result | Percent Recovery | | Recovery Limits | RPD | RPD Limit | Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DUPLICATE** | | | | | | | | | | | |
| Laboratory ID: | 03-174-01 | | | | | | | | | | |
| | ORIG | DUP | | | | | | | | | |
| Iron | **1910** | **1910** | NA | NA | | NA | | NA | 0 | 20 | |
| Laboratory ID: | 03-174-01 | | | | | | | | | | |
| Arsenic | **ND** | **ND** | NA | NA | | NA | | NA | NA | 20 | |
| **MATRIX SPIKES** | | | | | | | | | | | |
| Laboratory ID: | 03-174-01 | | | | | | | | | | |
| | MS | MSD | MS | MSD | | MS | MSD | | | | |
| Iron | **25300** | **25300** | 22200 | 22200 | 1910 | **105** | **105** | 75-125 | 0 | 20 | |
| Laboratory ID: | 03-174-01 | | | | | | | | | | |
| Arsenic | **83.6** | **78.8** | 80.0 | 80.0 | ND | **105** | **99** | 75-125 | 6 | 20 | |

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-naphthalene) 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: COM SMITH
Project Number: 233028
Project Name: USG Htwy 99
Project Manager: P. MORRILL
Sampled by: B. MILLER

**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:** 03-210

| 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 IRON | TCLP Metals | HEM (oil and grease) 1664A | DISSOLVED ARSENIC* | DISSOLVED IRON* | HOLD EXTRA BOTTLE+ | | % Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20190321-99-1 | 3-22-19 | 1150 | WG | 1 | | | | | | | | | | | | | | | | | | X | | | | |
| 2 | 20190321-M3 | ↓ | 1250 | ↓ | ↓ | | | | | | | | | | | | | | | | | | X | | | | |
| 3 | 20190321-M2 | | 1350 | | | | | | | | | | | | | | | | | | | | X | | | | |
| 4 | 20190321-M4 | | 1450 | | | | | | | | | | | | | | | | | | | | X | | | | |
| 5 | 20190322-M1 | 3-22-19 | 0915 | | ↓ | | | | | | | | | | | | | | | | | | X | | | | |
| 6 | 20190322-INF1 | ↓ | 1010 | | 2 | | | | | | | | | | | | | | | Ⓧ | | | | X | X | | |
| 7 | 20190322-INF2 | ↓ | 1120 | ↓ | 1 | | | | | | | | | | | | | | | | | | | X | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | Signature | Company | Date | Time |
|---|---|---|---|---|
| Relinquished | | COM SMITH | 3-22-19 | 1510 |
| Received | | CORE | 3/22/19 | 1510 |
| Relinquished | | | | |
| Received | | | | |
| Relinquished | | | | |
| Received | | | | |
| Reviewed/Date | | Reviewed/Date | | |

**Comments/Special Instructions**
* ALL SAMPLES FILTERED IN FIELD
+ FOR TOTAL Fe ANALYSIS
Ⓧ Added 3/26/19 .DB (STA)

Data Package: Standard ☐ Level III ☐ Level IV ☐

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