# ASSESSMENT PLAN FOR
# HEGLAR-KRONQUIST LANDFILL
MEAD, WASHINGTON
FACILITY SITE ID: 645
CLEANUP SITE ID: 1135

by
Haley & Aldrich, Inc.
Spokane, Washington

for
Kaiser Aluminum
Spokane Valley, Washington

File No. 0202596-003
December 2023

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22 December 2023
File No. 0202596-003

Kaiser Aluminum
15000 East Euclid Avenue
Spokane Valley, Washington 99216

Attention: Brent Downey, Director of Corporate Environmental Engineering

Subject: 2023 Heglar-Kronquist Assessment Plan
Heglar-Kronquist Landfill, Mead, Washington

Dear Brent:

Haley & Aldrich, Inc. (Haley & Aldrich) prepared this Assessment Plan on behalf of Kaiser Aluminum (Kaiser) for the Heglar-Kronquist Landfill Site (Site) located near the intersection of East Heglar Road and East Kronquist Road in Mead, Washington. Kaiser requested Haley & Aldrich provide this Assessment Plan in response to a Washington State Department of Ecology (Ecology) letter, dated 28 September 2023. We provided these services based on our 18 October 2023 Heglar-Kronquist Additional Site Characterization Support proposal.

Sincerely yours,
**HALEY & ALDRICH, INC.**

Ward McDonald, L.G.
Project Environmental Geologist

John Haney, P.E.
Principal Environmental Engineer

Attachments
2023 Heglar-Kronquist Assessment Plan, Heglar-Kronquist Landfill, Mead, Washington

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# SIGNATURE PAGE FOR

## ASSESSMENT PLAN FOR
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MEAD, WASHINGTON
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## PREPARED FOR
KAISER ALUMINUM
SPOKANE VALLEY, WASHINGTON

REVIEWED AND APPROVED BY:

Ward McDonald, L.G.
Project Environmental Geologist
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# 1. Introduction

Haley & Aldrich Inc. (Haley & Aldrich) prepared this Assessment Plan on behalf of Kaiser Aluminum (Kaiser) for the Heglar Kronquist Landfill Site (Site) near Mead, Washington; the Site location is shown on "Vicinity Map," Figure 1. Kaiser and Haley & Aldrich prepared this Assessment Plan as part of a response to the Washington State Department of Ecology (Ecology) letter, dated 28 September 2023. In the letter, Ecology requested additional Site characterization after reviewing the April 2023 Heglar Kronquist Compliance Monitoring Report (Haley & Aldrich, 2023) and expressed concerns over elevated concentrations of chloride and nitrate in groundwater and surface water during the April 2022 compliance monitoring event. Ecology indicated the "reported trends of chloride and nitrate concentrations are not protective of human health or the environment under the Model Toxics Control Act (MTCA)." As part of Ecology's request, Kaiser provided a response memorandum dated 21 November 2023 summarizing a review of the Institutional Controls Plan (ICP) for the Site (Hart Crowser, 2013b), results of our October 2023 inspection of current conditions of the landfill cap, and the proposed plan and schedule to resume quarterly compliance monitoring at the Site in 2024. As indicated in the response memorandum, Kaiser and Haley & Aldrich prepared this Assessment Plan to detail our proposed 2024 quarterly compliance monitoring activities along with additional assessment to support a return to annual monitoring and/or Site closure by 2025. The Site background and details of planned 2024 compliance monitoring activities are summarized in the sections below.

# 2. Background

The Site is located in a rural area near Mead, Washington, approximately 10 miles northeast of downtown Spokane, Washington (see Figure 1). According to the Washington State Geologic Information Portal (Department of Natural Resource, 2023), the Site is located above the Tertiary volcanic rocks (Columbia River Basalt Group) and the Quaternary mass-wasting deposits (mass-wasting deposits) that consist of landslide deposits and colluvium.

The Site originally was developed as a county gravel pit between 1963 and 1969. Between 1969 and 1974, Kaiser transported black dross (a byproduct of aluminum processing) from the Kaiser Aluminum Trentwood Works in Spokane Valley, Washington, to the Site for disposal in the former gravel pit. Disposal activities ceased in 1974, when elevated levels of chloride and sodium (byproducts of black dross) were detected in one shallow water supply well and a spring downgradient of the Site.

Various site assessments were conducted after disposal activities ceased; findings of those assessments indicated that groundwater and surface water potentially were impacted by contaminants leaching from the landfill. Based on these findings, Kaiser purchased the property in 1984 and capped the landfill to reduce the potential for black dross constituents to leach into groundwater. The 1984 capping activities included:

- installing a low-permeable clay layer;
- placing a vegetated topsoil layer over the clay layer to support the establishment of vegetation and reduce potential erosion;
- installing 17 vents to prevent the buildup of ammonia gas within the landfill;
- installing drainage ditches to promote stormwater runoff around the landfill; and
- Installing a perimeter fence to restrict Site access.

However, the 1984 clay cap desiccated due to lack of precipitation allowing infiltration of stormwater through the landfilled materials and migration of dross constituents into groundwater. Additionally, the cap was constructed without a drainage layer to shed water from the capped area or perimeter swales to direct stormwater runoff from the hillside east of the landfill around the capped area. Subsequently, stormwater from the hillside flowed onto and through the cap further diminishing cap performance.

In 2009, Ecology and Kaiser entered into Agreed Order (AO) No. 6557 to address the groundwater contamination from the Site. The AO required Kaiser to complete a Remedial Investigation (RI) to determine the extent of the contamination and a Feasibility Study (FS) to evaluate cleanup actions under Washington Administrative Code 173-340.

In 2010, Kaiser contracted Exponent, Inc (Exponent) to complete the RI at the Site in two phases to meet requirements outlined in the AO. The first phase was completed to understand the Site hydrogeology and the interaction of shallow groundwater and surface water; the second phase was completed for additional subsurface investigations to assess potential impacts to the groundwater from the landfill (Exponent, 2011).

During the first phase, Exponent completed 15 exploratory borings near the Site and collected 27 water samples, four dross media samples, and 16 air samples (collected from the ammonia gas vents, one borehole, and ambient air) and submitted them for laboratory analysis. During the second phase Exponent drilled seven borings and installed six monitoring wells (MW-1 through MW-6 [now MW-7]; see “Site Plan- Existing Monitoring Network,” Figure 2) to further evaluate hydraulic characteristics. The monitoring wells were screened within the basalt-rubble mass-wasting material identified during Phase 1 activities. The boring locations, boring logs, and monitoring well construction logs from the RI are provided in “Figure 6 of the Exponent RI report – Water Level Elevations” Appendix A and “Boring Logs” Appendix B, respectively. During the RI, Exponent field screened the groundwater for chloride and determined, based on screening results, chloride concentrations in groundwater collected from borings advanced within the fine-grained material were found to be an order of magnitude lower than chloride concentrations found in groundwater outside the fine-grained material. Suggesting the fine-grained material present southwest of the landfill likely impedes groundwater flow downgradient of the landfill likely creating a preferential pathway (see Appendix A).

Based on the results of the RI, nitrate concentrations exceeded a primary health-based standard, sodium concentrations exceeded the United States Environmental Protection Agency’s (EPA’s) recommended upper limit advisory of 60 milligrams per liter (mg/L) for sodium sensitive individuals, and chloride concentrations, specific conductance, and total dissolved solids (TDS) exceeded secondary standards in groundwater and surface water for drinking water aesthetics (Exponent, 2011). The RI also concludes that a portion of nitrates found in groundwater is associated with dross impacts, but natural levels of nitrates and off-site sources of nitrates (agriculture activities) can also impact concentrations found in groundwater and surface water systems in the area.

After completing the RI, Exponent completed the FS in 2012 to evaluate remedial alternatives for the Site. The FS recommended enhancing existing cap and improving Site institutional and engineering controls (Exponent, 2012).

Following the completion and approval of the RI/FS, Ecology released a Final Cleanup Action Plan (FCAP) with the proposed cleanup approach for the Site and in 2013, Ecology and Kaiser entered Consent Decree No. 13202067-4 (Consent Decree) to implement the FCAP. In 2014, Hart Crowser, Inc. (Hart Crowser; now Haley & Aldrich) conducted a geotechnical investigation to confirm existing cap conditions, decommissioned two monitoring wells (3BCD-1 and 3BCD-2) within the cap footprint, repaired damage to the existing passive gas venting system, and designed and conducted the cap enhancements (Hart Crowser, 2015). Hart Crowser contracted Anderson Environmental Contracting, LLC (AEC) to construct the cap enhancements. Cap enhancements included, clearing and grubbing vegetation, grading the existing cap surface, and installing new cap layers. The 1984 cap was enhanced with a high-density polyethylene (HDPE) liner; geotextile fabric liner; gravel protection layer, granular fill; and a layer of topsoil hydroseeded with mixed-grass vegetation (Hart Crowser, 2015). After completion of the cap enhancements Kaiser developed and implemented a Compliance Monitoring Plan (CMP; Hart Crowser, 2013a) and ICP in accordance with Section 8.1 of the FCAP (Washington State Department of Ecology, 2012).

In October 2015, Kaiser began implementing the CMP to monitor the effectiveness of the cap at reducing infiltration of surface water and improving groundwater quality as required by the FCAP. Compliance monitoring includes:

- Inspecting the condition of Site features including the cap, perimeter drainage swales, gas vents (GV-1 through GV-17), signage, and perimeter fencing.
- Conducting groundwater elevation monitoring and sampling groundwater from six monitoring MW-1 through MW-6/7 (see Figure 2).
- Sampling surface water from up to four surface water sample locations (SW-1 through SW-3 and SW-5).
- Collecting in-situ water quality parameters (temperature, pH, conductivity, oxidative reduction potential [ORP], turbidity, and dissolved oxygen [DO]) for groundwater and surface water (see “Groundwater and Surface Water Elevations and Field Parameters” Table 1).
- Submitting water samples to a Washington-accredited chemical analytical laboratory for contaminants of concern (COC) analyses (chloride, nitrate plus nitrite as nitrogen [nitrate/nitrite], total and dissolved sodium, and TDS) in groundwater and surface water (see “Groundwater Chemical Analytical Results” Table 2 and “Surface Water Chemical Analytical Results,” Table 3, respectively).
- Summarizing the findings from each event in a compliance monitoring report.

At the end of the five-year monitoring period required by the Consent Decree, Ecology reviewed the compliance monitoring data and concluded that, although COC concentrations have declined since installation of the enhanced cap, cleanup standards for chloride and nitrate/nitrite at select locations had not been met and annual monitoring should continue for an additional five years. Ecology requested Kaiser to conduct annual monitoring events during the spring when precipitation and snow melt typically are at seasonal highs. After reviewing the April 2023 compliance monitoring report, Ecology sent the 28 September 2023 letter expressing concerns over recent elevated concentrations of chloride and nitrate/nitrite in groundwater and surface water hydraulically downgradient of the Site and indicated “reported trends of chloride and nitrate concentrations are not protective of human health or the environment under MTCA”.

# 3. Goals and Objectives

Kaiser and Haley & Aldrich will use this Assessment Plan to guide the 2024 compliance monitoring events and to support our goal of returning to annual compliance monitoring and/or permanent Site closure in 2025. We will accomplish this goal by completing the following objectives:

- Review geology, hydrogeology, and analytical data for the Site and update the conceptual site model (CSM) completed during the RI/FS.
- Review the CMP analytical suite and update as necessary to achieve the project goal.
- Conduct quarterly compliance monitoring in 2024 to further assess Site conditions post-cap enhancement.
- Assess groundwater and surface water upgradient and/or cross-gradient of the Site to establish background conditions.
- Collect additional hydrogeologic data to better understand fluctuations and flow directions of groundwater and update the CSM with additional data, as appropriate.
- Prepare quarterly compliance monitoring reports, submit reports to Ecology, and upload analytical data collected to Ecology's Environmental Information Management System (EIM).

# 4. Hydrogeologic Conceptual Site Model

According to the RI/FS, the Site is located in a region with complex geology where Cretaceous granitic rocks develop the basement and are overlain by younger basalt flows identified as the Columbia River Basalt group which is interfingered with the fine-grained sediments of the Latah Formation (Exponent, 2011). The regional valleys are filled with glacial age fine-grained and large gravels and boulder-sized sediments likely deposited by glacial outburst floods; younger alluvium deposits are found within drainage valleys (Exponent, 2011).

The RI/FS indicates that the Site is located within an area that mass-wasting is possible due to weathering of basalt and/or undercutting of the soft fine-grained sediments of the Latah Formation below the basalt. According to the RI/FS, the landfill is located on the eastern edge of a "landslide" or mass-wasting and this lithology is a "landslide block" consisting of varying sizes of basaltic boulders, gravels, sands, and silts.

Because of this complex geology, the RI/FS indicates that groundwater flow beneath the Site generally is complex due to the characteristics of the mass-wasting deposits and that groundwater flows below the Site towards MW-1 (northwest of the landfill), SW-5 (west of the landfill), and MW-4 (south of the landfill; see Appendix A). Additionally, according to the RI/FS, groundwater flow is restricted near the southeast corner of the landfill by a fine-grained zone that trends north-northwest to south-southeast between the west end of the landfill and boring 3cba (see Appendix A). The RI/FS indicates that this restriction likely causes groundwater to flow northward until it surpasses the fine-grained zone and immediately flows south toward MW-3, passed the SW-3 spring location, and toward MW-2 in a preferential pathway. Additionally, the RI/FS indicates that chloride concentrations greater than background levels were observed at MW-1 through MW-4 and surface water sample locations SW-2, SW-3, and SW-5 (see Appendix A).

As part of plan preparation, Kaiser and Haley & Aldrich reviewed Exponent's hydrogeologic CSM, compliance monitoring groundwater elevation and analytical data, and surface water analytical data collected from the Site. We relied on this data to update the hydrogeologic CSM and our recommendations for changes to the analytical suite; findings from our review are summarized below.

## 4.1 HYDROGEOLOGIC REVIEW

Haley & Aldrich reviewed the data collected during the RI and the compliance monitoring events and used the data to prepare geologic cross sections of the Site; (see “Cross Section A-A’” and “Cross Section B-B’”, figures 3 and 4, respectively). Our review of the data and cross section A-A’ indicates groundwater generally flows from the east (upgradient of the landfill) to the west (downgradient of the landfill). Based on Cross Section B-B’, groundwater appears to have a minimal vertical gradient between monitoring well MW-3, seeps SW-2 and SW-3, and monitoring well MW-2. This indicates that groundwater flow from MW-3 toward SW-2 and SW-3 and MW-2 is unlikely as originally interpreted in the RI (see  Appendix A). It is also unlikely that groundwater preferentially flows south of the landfill after it passes west of the fine-grained zone identified by Exponent. Additionally, the cross sections and historical groundwater elevation data (see Table 1) indicate groundwater has not directly contacted the bottom of dross elevation in the landfill since monitoring began in 2011.

Haley & Aldrich plotted historical groundwater chloride concentrations in monitoring wells MW-1, MW-3, and MW-4 over time as presented in “Groundwater Chloride Concentrations Versus Time,” Figure 5. Analytical data from these wells indicate a general decline in chloride concentrations following post-cap enhancement in 2014. Chloride concentrations in MW-1 and MW-4 decreased to below the compliance target of 250 mg/L in 2015. This decrease in COCs concentrations post-cap enhancement indicates that a pathway likely exists between groundwater beneath the landfill and these wells. However, chloride concentrations in monitoring wells MW-2, MW-5, and MW-6/7 appear generally stable prior to and following cap enhancements. Based on historical chloride concentrations in these wells and the relatively flat hydraulic gradient between the landfill and southern monitoring wells, it is unlikely that a groundwater pathway exists between the landfill and these wells.

Haley & Aldrich also plotted historical chloride concentrations in surface water at seeps SW-1, SW-3, and SW-5 over time as shown on “Surface Water Chloride Concentrations Versus Time,” Figure 6. Analytical results indicate that chloride concentrations at SW-3 and SW-5 decreased between 2010 and 2020, increased between October 2020 and April 2022, and decreased again during in April 2023. Chloride concentrations at SW-3 and SW-5 have varied by approximately 146 mg/L and 134 mg/L between 2010 and 2023, respectively. Analytical results indicate that chloride concentrations at SW-1 appear stable and generally remain similar to the 2010 concentrations indicating these likely are background concentrations. Chloride concentrations in seep SW-1 have remained less than 30 mg/L and varied by approximately 6.4 mg/L between 2010 and 2023. In summary, it is difficult to confirm if the chloride concentrations at SW-3 and SW-5 are influenced by the landfill dross. Additionally, SW-5 is located within an agricultural field and chloride concentrations at this location might be related to agricultural operations or other sources. Historical data collected from SW-1 indicates that a hydrogeologic pathway does not likely exist between the landfill and SW-1.

## 4.2 GROUND AND SURFACE WATER CHEMISTRY REVIEW

Haley & Aldrich reviewed chemical data collected from monitoring wells MW-1 through MW-6/7 and seeps SW-1, SW-3, and SW-5 between 2010 and 2023. This included conducting a temporal variation and bivariate relationship analyses of groundwater and surface water; findings from these analyses are provided in the sections below.

### 4.2.1 Groundwater Temporal Variation

Haley & Aldrich reviewed chloride concentrations over time in samples collected between 2010 and 2023. Generally, the highest chloride concentrations are observed in monitoring well MW-3; concentrations in this well between 2010 and 2023 are greater than the cleanup level of 250 mg/L (see Figure 5). Temporal variations in chloride concentrations for MW-3 show decreasing trends between 2015 and 2018 and increasing trends between 2018 and 2023. These trends are similar for dissolved sodium and TDS concentrations, except these two constituents show more stable trends between 2018 and 2023 (see “Temporal Variation in Monitoring Wells Versus Chemical Constituents,” Figure 7). Other wells at the Site have chloride concentrations less than the cleanup standard post 2010 sampling, except for one chloride concentrations at MW-1 during the May 2017 compliance monitoring event.

Analytical results indicated that nitrate/nitrite concentrations historically were greater in monitoring well MW-4 when compared to other monitoring wells and detected concentrations were greater than the cleanup standard during each monitoring event except April 2021 and 2023. However, nitrate/nitrite concentrations in MW-4 overall have a decreasing trend over time (see Figure 7). Similarly, time-concentration trends for MW-1 and MW-3 show elevated nitrate/nitrite concentrations greater than the cleanup standard, but overall decreasing trends with the most recent sampling event indicating concentrations are less than the cleanup level. The temporal trends exhibited by MW-3 for chloride appear different than for nitrate/nitrite, suggesting the sources might be different. MW-2 and MW-5 analytical results both indicate nitrate/nitrite concentrations are close to or greater than the cleanup standard and generally have minimal changes over time. Monitoring well MW-6/7 has remained nearly constant over time and does not contain nitrate/nitrite concentrations greater than the cleanup standard. This suggests that concentrations in MW-6/7 represent background water quality concentrations and are not influenced by the landfill.

Haley & Aldrich reviewed historical In-situ water quality parameters collected during compliance monitoring events (see Table 1). Based on our review, the data indicates few temporal changes where pH has remained near neutral (pH generally is between 6.5 and 8) in monitoring wells at the Site between 2010 and 2023 (see “Temporal Variation for Monitoring Wells Versus In Situ Parameters” Figure 8). However, water quality data from the October 2016 sampling event indicates a pH spike in wells across the Site with wells MW-5 and MW-7 reaching pH levels greater than 10. The spike in pH during the October 2016 sampling event is accompanied by a positive spike in conductivity and a negative spike in temperature for most wells. Additionally, the two wells that show the highest recorded pH have only minor changes in conductivity. Although no change in chemical concentrations is observed during this sampling event, a spike in chloride, dissolved sodium, nitrate/nitrite, and TDS does occur in April 2017 in wells MW-3 and MW-1 and could represent a delayed response to the October 2016 event. Based on this data, an unknown event occurred in October 2016 that likely lead to a definitive increase in pH and conductivity that might be related to an anthropogenic release, independent of the landfill.

In general, monitoring well MW-3 contains the greatest conductivity values (consistent with its elevated chloride concentrations) as salts are highly conductive. A large spike in chloride concentrations recorded in April of 2016 was accompanied by a similar spike in conductivity. This was the greatest observed conductivity to date from any of the Site’s monitoring wells during the same event. The sampling event that followed had an order of magnitude decrease in ORP (135 millivolts [mV] in April 2016 to 54 mV [lowest observed to date] in July 2016).

Changes reflected in Site monitoring wells with respect to temperature may be related to seasonal effects. DO concentrations are generally stable over time in the monitoring wells except MW-4, which has anoxic conditions and two events (in April of 2018 and April of 2021) that resulted in oxygenation of groundwater that may be related to spring runoff, storm events, or a source-related event. Notably, these increases in DO (from less than 0.2 mg/L to about 8 mg/L) are accompanied by decreases in nitrate/nitrite concentrations in the same months. An increase in groundwater elevation also was observed in April 2018, but not observed during the April 2021 event. ORP values ranges from about 50 to 250 mV over time and changes appear to reflect seasonality.

### 4.2.2 Groundwater Bivariate Relationships

A positive correlation was observed between chloride concentrations and dissolved sodium and TDS in each monitoring well, except in monitoring well MW-2 where a clear correlation between nitrate/nitrite and chloride was not observed (see “Chloride Versus Chemical Constituents” Figure 9). The lack of correlation between chloride and nitrate/nitrite suggests that chloride and nitrate/nitrite are derived from different sources. Concentrations of nitrate/nitrite in MW-1 and MW-4 have positive correlations with TDS and to a lesser degree with dissolved sodium. Elevated nitrate/nitrite concentrations present in MW-3 do not appear to be correlated to nitrate/nitrite, TDS, or dissolved sodium. This observation may suggest that the source of the elevated nitrate/nitrite in MW-3 is either a separate source than the nitrate/nitrite contributing to MW-4 and MW-1, or the dissolved sodium and TDS trends have been obfuscated.

Correlations between chloride or nitrate/nitrite and in-situ water quality parameters (temperature, conductivity, pH, ORP, DO, or turbidity) were not observed. However, DO versus the analyzed chemical constituents differentiates two groups of data, where MW-4 data shows anoxic to hypoxic conditions (DO less than 2 mg/L) and other monitoring wells show oxic conditions (DO greater than 2 mg/L; see “Dissolved Oxygen Versus Chemical Constituents,” Figure 10). Although there are differences in DO, MW-3 (and MW-1) show similar nitrate/nitrite concentrations to those of MW-4. Additionally, MW-3 has high chloride concentrations that are not observed in MW-4 and high DO compared to MW-4. This data further suggests that there are likely two different sources contributing to groundwater quality.

Differences in DO and nitrate/nitrite concentrations between MW-4 and the rest of the wells cannot be clearly attributed to groundwater elevation or completion lithology. Monitoring wells at the Site were completed in basaltic material and although typical groundwater elevations for wells MW-4 are approximately 70 feet greater than the rest of the wells, MW-3 and MW-1 (shallower wells) show similar nitrate/nitrite concentrations to MW-4. Additionally, MW-5 has the same groundwater elevation as MW-4 yet has lower nitrate/nitrite concentrations (see “Groundwater Elevation Versus Chemical Constituents,” Figure 11) and higher DO concentrations like those of the remaining wells, suggesting groundwater elevation is not driving elevated nitrate/nitrite or DO concentrations. However, MW-1 and MW-3 were the only wells to have concentrations of nitrate/nitrite greater than the cleanup standard. MW-3 and MW-1 shows a positive correlation between groundwater elevation and nitrate/nitrite with r-squared values of 0.77 and 0.7 indicating a 77 and 70 percent correlation, respectively. This correlation was not observed in the other monitoring wells.

### 4.2.3 Surface Water Temporal Relationships

Surface water sampling location seep SW-2 will not be discussed here as only one sample was collected at the initiation of the sampling period. Seep SW-1 shows low and consistent chloride, dissolved sodium, and TDS concentrations over time that may be representative of background water concentrations. SW-3 and SW-5 have similar, and at times overlapping, trends where chloride concentrations decrease from about 2017 to 2020 and then have an overall increase between 2020 and 2023 (see “Temporal

Trends for Surface Water and Chemical Constituents” Figure 12). However, post-2017, only one sample which was collected from SW-3 and SW-5 in May 2022, was greater than the chloride cleanup standard. Samples collected from SW-3 prior to October 2017, were greater than the cleanup standards.

Nitrate/nitrite concentrations in SW-3 and SW-5 show similar erratic behavior with slightly decreasing trends over time. No samples collected at SW-1 exceed the cleanup standard. One sample collected at SW-5, in May 2010, contained concentrations exceeding cleanup standards. Except for three samples collected from SW-3 between 2010 and 2023, nitrate/nitrite concentrations were greater than the cleanup standards.

### 4.2.4 Surface Water Bivariate Relationships

Surface water data observed similar positive correlations as indicated in groundwater. Historical surface water data collected from SW-3 and SW-5 show positive correlations between chloride, dissolved sodium, and TDS and no relationship between chloride and nitrate/nitrite (see Figure 8). In general, SW-5 samples show similar nitrate/nitrite trends to SW-3, but typically with order of magnitude lower concentrations (with the exception of the April 2021 and 2023 events), which could be attributed to dilution since it is downgradient of SW-3 and may be influenced by other surface or groundwater sources. However, this dilution effect is less apparent when considering chloride, where chloride concentrations overlap during more recent sampling periods (post-2019), suggesting the chloride source may be more pervasive near SW-5 compared with the nitrate/nitrite source.

### 4.2.5 Water Quality Summary

Haley & Aldrich has reviewed and characterized Site groundwater quality by several observations. The greatest chloride concentrations between 2010 to 2023 were observed in monitoring well MW-3. Elevated nitrate/nitrite concentrations were observed in MW-4, MW-3, and MW-1 between 2010 and 2023. However, nitrate/nitrite concentrations in these wells trended lower over time. Nitrate/nitrite concentrations show correlations with TDS and dissolved sodium in wells MW-4 and MW-1 but this correlation is lacking in MW-3 which also displays elevated nitrate/nitrite concentrations, suggesting the source of nitrate/nitrite concentrations in MW-3 differs than the source of nitrate/nitrite in MW-4 and MW-1, or the chloride source in MW-3 is obfuscating these dissolved sodium and TDS trends with nitrate/nitrite.

Chloride concentrations in groundwater data indicated positive correlations with dissolved sodium and TDS, except in MW-2. However, a positive correlation with nitrate/nitrite and chloride concentrations were not observed which indicates that the sources of chloride and nitrate/nitrite are different. Additionally, similar nitrate/nitrite concentrations were observed in MW-4 and MW-3. However, MW-3 also contains elevated concentrations of chloride that were not shared with MW-4. This data further suggests that the sources of chloride and nitrate/nitrite are different, and the chloride source likely is localized near MW-3.

Elevated concentrations of nitrate/nitrite and chloride generally were greater than cleanup standards in SW-3. This data suggests that SW-3 is at times influenced by both chloride and nitrate/nitrite sources. Downgradient locations of surface water, SW-5, shows higher dilution of nitrate/nitrite compared with chloride dilution (when compared to SW-3 concentrations). This data indicates that SW-5 may continue to receive a chloride source at its downgradient location, while the nitrate/nitrite source diminishes. Additionally, chloride concentrations in SW-3 and SW-5 show parallel temporal and bivariate relationships to MW-3. This data indicates that the chloride source in MW-3, SW-3, and SW-5 could be the same.

## 4.3 REVISED CONCEPTIONAL SITE MODEL

Groundwater flow generally is east to west, and a pathway likely exists between groundwater beneath the landfill and monitoring wells MW-1, MW-3, and MW-4. Water quality data, groundwater elevation data, and interpreted groundwater flow indicate that a pathway between the landfill and SW-1, MW-2, MW-5, and MW-6/7 likely does not exist. This finding concurs with the findings in the 2023 compliance report and previous reports where "groundwater elevations indicate the direction of groundwater flow, downgradient of the landfill, is west to southwest" (Haley & Aldrich, 2023).

Our review of the groundwater and surface water chemistry data suggests that there likely are two sources of nitrate/nitrite impacting groundwater and surface water at the Site and the sources of chlorides and nitrates could be from different sources. Our analysis is based on the following multiple lines of evidence:

- Data indicates MW-3 chloride concentrations are consistently greater than cleanup standards. Chloride concentrations detected in MW-3 have a positive correlation between chloride, dissolved sodium, and TDS but not nitrate/nitrite suggesting the source for chlorides and nitrate/nitrite might be different.
- Data indicates MW-3 has similar concentrations of nitrate/nitrite to MW-4, but greater DO and no correlation is established between nitrate/nitrite, TDS, and dissolved sodium as observed in MW-4, suggesting there might be two separate sources of nitrate/nitrite in groundwater below the Site.
- Similar temporal and bivariant trends are observed between chloride, TDS, and dissolved sodium at SW-3, SW-5, MW-3, and MW-1. Suggesting the source of chloride at these locations could be the same.
- Data indicates MW-3 and MW-1 have similar nitrate/nitrite concentrations when compared to the range of nitrate/nitrite concentrations found in groundwater at MW-4. Chloride concentrations detected in MW-1 and MW-4 suggest the source of nitrate/nitrite is different than the source of chlorides in the groundwater.
- DO concentrations indicate two different data groups where MW-4 indicates the greatest nitrate/nitrite concentrations at anoxic to hypoxic conditions and the remaining monitoring wells have oxic conditions with some exhibiting elevated nitrate/nitrite concentrations.

The data suggest monitoring locations MW-3 and SW-3 are impacted by a source for both chloride and nitrate/nitrite, monitoring wells MW-1, MW-2 and MW-5 appear to be impacted by a source of nitrate/nitrite, and MW-7 data indicates minimal impacts from a nitrate/nitrite source. Based on current groundwater quality and chemistry data, these sources of chlorides and nitrate/nitrite might be anthropogenic (e.g., dross landfill, artificial fertilizers, road salts) in nature and independent of naturally occurring groundwater and surface water conditions. The current monitoring network does not provide sufficient information to rule out additional sources of chloride and nitrate/nitrite separate from the landfill.

Based on the multiple lines of evidence identified above, it is reasonable to conclude that concentrations of chlorides, TDS, and nitrate/nitrite detected in groundwater beneath the Site are likely from multiple sources (likely related to nearby agricultural land use) and not solely from the landfill.

# 5. Recommendations for 2024 Compliance Monitoring

Based on the updates to the CSM (Section 4), Kaiser and Haley & Aldrich recommend removing monitoring wells MW-2, MW-5, and MW-7, and seep SW-1 from compliance monitoring. These monitoring locations appear to have little, if any, hydraulic connection to the landfill and/or represent groundwater and surface water conditions likely independent of the landfill.

Kaiser and Haley & Aldrich recommend collecting water samples from MW-1, MW-3, MW-4, SW-3, and SW-5 for compliance monitoring. We also recommend collecting upgradient and/or cross gradient groundwater and/or surface water samples from the Site to assess potential regional sources of nitrates/nitrites, chlorides, and TDS and background water quality.

We recommend deploying pressure transducers in monitoring wells MW-1, MW-3, and MW-4 to continuously monitor seasonal groundwater elevation fluctuations. Continuously monitoring groundwater elevation will allow us to better understand groundwater flow direction, seasonal fluctuations, and potential downgradient receptors. Details for the 2024 compliance sampling and groundwater elevation monitoring are provide in the following sections.

# 6. 2024 Compliance Monitoring

Following Ecology's approval of this Assessment Plan, Kaiser will resume quarterly compliance monitoring at the Site. Compliance monitoring will include inspections of institutional and engineering controls and groundwater and surface water monitoring. Kaiser also will conduct additional upgradient and/or cross gradient groundwater and surface water sampling, if feasible. Kaiser and Haley & Aldrich drafted an updated Sampling and Analysis Plan (SAP) that is provided in "2024 Sampling and Analysis Plan" Appendix C. We will implement the SAP during 2024 compliance monitoring. Results of quarterly compliance monitoring will be used to inform future monitoring activities. Activities for compliance monitoring are detailed in the sections below.

## 6.1 INSTITUTIONAL AND ENGINEERING CONTROLS

Kaiser will conduct inspections of institutional and engineering controls, including the cap, associated security features, and stormwater control systems and record our observations on a field log. Specifically, we will visually inspect for the following features and conditions:

- Cap integrity
- Gas vents
- Perimeter fence and gates
- Monitoring wells
- Noxious weeds
- Animal burrow(s)
- Erosion of topsoil above cap
- Signage

## 6.2 LANDFILL GAS VENT SAMPLING

A Kaiser representative will collect three gas vent samples during each of the 2024 compliance monitoring events document current ammonia concentrations and compare the results with historical ammonia concentrations. We will collect each ammonia sample in accordance with the CMP (or equivalent method) from gas vents GV-9, GV-11, and GV-12 and submit the samples to a State of Washington-certified laboratory.

## 6.3 GROUNDWATER AND SURFACE WATER MONITORING

A Kaiser representative will monitor groundwater and surface water at the Site by collecting and submitting groundwater and surface water samples to an analytical laboratory for chemical analysis and deploying In-Situ Rugged Troll 100 pressure transducers (transducer) in existing monitoring wells to monitor fluctuations in groundwater elevation. Monitoring activities are described in further detail below.

### 6.3.1 Groundwater Elevation Monitoring

A Kaiser representative will deploy three transducer devices in MW-1, MW-3, and MW-4 to record seasonal fluctuations in groundwater elevations. We will deploy transducers approximately 1 foot above the bottom of the well. We also will deploy one Baro-Troll in MW-1 to continuously monitor fluctuations in barometric pressure and use the recorded depth to water measurements to correct pressure data recorded by the transducers.

### 6.3.2 Groundwater and Surface Water Sampling

A Kaiser representative will collect groundwater samples from monitoring wells MW-1, MW-3, and MW-4, and surface water samples from SW-3 and SW-5. Groundwater samples will be collected using a stainless-steel submersible pump and surface water samples will be collected using grab sampling techniques. Depth-to-water measurements will be recorded for each monitoring well prior to sampling and the following water quality parameters will be recorded at each location using water quality multimeter equipped with a flow through cell: temperature, pH, specific conductivity, oxidation-reduction potential, and turbidity. Water samples will be transported to a State of Washington-accredited laboratory and analyzed for the following:

- Chloride (by EPA Method 300.0)
- Nitrate/nitrite as nitrogen (EPA Method 353.2)
- Total sodium (surface water only) and dissolved sodium (groundwater only) (EPA Method 6010C)
- TDS (Standard Method [SM] 2540C)

## 6.4 UPGRADIENT AND CROSS GRADIENT GROUNDWATER AND SURFACE WATER SAMPLING

Kaiser and Haley & Aldrich will review publicly available information to identify potential upgradient and/or cross gradient locations to monitor surface water (i.e., streams, rivers, seeps, creeks) and/or groundwater (i.e., residential water supply wells), or other sampling locations. If we identify accessible locations to monitor groundwater and/or surface water, we will assist Kaiser in establishing access agreements or permission from the applicable landowner to collect water samples from their property.

We will collect water quality parameters (see Table 1 for specific parameters) and water samples for chemical analysis. We will submit up to three water samples to the analytical laboratory for the analyses identified in Table 1.

Haley & Aldrich will review data and laboratory results collected from up/cross gradient monitoring and compare to results from current and historical compliance monitoring data. Based on our findings, we will provide Kaiser with recommendations on further monitoring and/or additional investigations of up/cross gradient groundwater and/or surface water conditions.

## 7. Reporting

After Haley & Aldrich receives the analytical results from the laboratory, we will summarize the data in tables and compare the results to the cleanup level established in Consent Decree. We will provide Kaiser compliance monitoring reports that document field activities completed, results of compliance monitoring, findings, and recommendations on future monitoring if recommended.

Each report will include the following:

- Summary of field activities conducted.
- Tables summarizing water quality parameters recorded, analytical results, and institutional controls observed.
- Figures depicting groundwater elevations and cross sections.
- Hydrograph plotting groundwater elevation versus time.
- Updated CSM (included in the final compliance monitoring report only).
- Findings and recommendations on future compliance sampling, if any.

After each compliance monitoring report is prepared, Kaiser will provide Ecology print and electronic copies for their records. The data generated during the event will be uploaded to Ecology’s Environmental Information Management System (EIM) in accordance with Washington Administrative Code 173-340-840 and Ecology’s Toxics Cleanup Program Policy 840.

## 8. Proposed Schedule

Kaiser plans to conduct the first monitoring event upon receiving Ecology’s approval of this Assessment Plan (presumably in the first quarter of 2024). Subsequent monitoring events will occur in the second, third , and fourth quarters of 2024.

# References

1. Exponent, 2011. Final Remedial Investigation Report, Heglar Kronquist Landfill, Mead, Washington. 9 September.

2. Exponent, 2012. Final Feasibility Study Heglar Kronquist Landfill Mead, Washington. 4 May.

3. Haley & Aldrich, 2023. Heglar Kronquist Landfill Annual Compliance Monitoring Report. 7 July.

4. Hart Crowser, 2015. Cleanup Action Construction Completion Report Heglar Kronquist Landfill. 4 August.

5. Hart Crowser, 2013a. Final Compliance Monitoring Plan Heglar Kronquist Site. 12 August.

6. Hart Crowser, 2013b. Final Institutional Controls Plan Heglar Kronquist Site. 12 August.

7. Washington State Department of Ecology (Ecology), 2012. Final Cleanup Action Plan Heglar Kronquist Site. October.

8. Ecology, 2013. Consent Decree No. 13202067-4.

9. Washington State Department of Natural Resource, 2023. Washington Geologic Information Portal. geologyportal.dnr.wa.gov. Accessed 15 December 2023.

https://haleyaldrich.sharepoint.com/sites/KaiserAluminumFabricatedProducts/Shared Documents/0202596.Heglar Kronquist/003-Heglar Kronquist SSC/Deliverables/2023 HK Assessment Plan/2023_1222 Heglar SCC Assessment Plan - Final.docx

# TABLES

**TABLE 1**

**GROUNDWATER AND SURFACE WATER ELEVATIONS AND FIELD PARAMETERS**

2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date of Measurement | Top of Casing Elevation in feet (NAVD88) | Depth to Water in feet btoc | Groundwater & Surface Water Elevation in feet above msl | Temperature [°C] | pH | Conductivity [µS/cm] | ORP [mV] | Turbidity [NTU] | DO [mg/L] |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Monitoring Wells*** | | | | | | | | | | |
| MW-1 | 30-Sep-10 | *2,183.49* | -- | -- | -- | -- | *847* | -- | -- | -- |
| | 24-Jan-11 | -- | *58.76* | *2,124.73* | -- | -- | -- | -- | *5.17* | -- |
| | 25-Apr-11 | -- | *54.80* | *2,128.69* | *10.74* | *6.93* | *2,010* | -- | *5.09* | -- |
| | 28-Oct-15 | -- | 60.96 | 2,122.53 | 12.13 | 6.97 | 570 | 187 | 342 | 8.71 |
| | 26-Jan-16 | -- | 60.35 | 2,123.14 | 8.76 | 6.99 | 565 | 113 | 35.0 | 8.76 |
| | 22-Apr-16 | -- | 58.04 | 2,125.45 | 11.56 | 7.05 | 428 | 103 | 60.1 | 9.00 |
| | 26-Jul-16 | -- | 58.40 | 2,125.09 | 11.72 | 7.42 | 616 | 47 | 1.40 | 8.98 |
| | 21-Oct-16 | -- | 59.70 | 2,123.79 | 11.52 | 7.88 | 1,197 | 96 | 34.6 | 8.89 |
| | 24-Jan-17 | -- | 59.38 | 2,124.11 | 10.57 | 6.94 | 567 | 257 | 3.70 | 8.59 |
| | 24-Apr-17 | -- | 44.86 | 2,138.63 | 12.52 | 6.86 | 2,397 | 151 | 2.20 | 9.24 |
| | 20-Jul-17 | -- | 47.05 | 2,136.44 | 13.14 | 6.58 | 1,965 | 243 | 3.40 | 9.05 |
| | 10-Jan-18 | -- | 52.80 | 2,130.69 | 10.20 | 6.94 | 837 | 224 | 0.94 | 9.36 |
| | 19-Apr-18 | -- | 46.42 | 2,137.07 | 12.33 | 6.95 | 1,024 | 175 | 23.1 | 9.09 |
| | 12-Oct-18 | -- | 52.84 | 2,130.65 | 11.70 | 7.14 | 864 | 218 | 0.72 | 8.79 |
| | 12-Apr-19 | -- | 53.69 | 2,129.80 | 11.19 | 7.06 | 802 | 85 | 0.00 | 8.40 |
| | 23-Oct-19 | -- | 56.51 | 2,126.98 | 11.42 | 6.84 | 780 | 216 | 3.37 | 8.79 |
| | 4-May-20 | -- | 56.42 | 2,127.07 | 11.30 | 6.85 | 1,120 | 205 | 0.83 | 8.78 |
| | 15-Oct-20 | -- | 57.35 | 2,126.14 | 11.26 | 6.93 | 801 | 164 | 0.00 | 9.28 |
| | 21-Apr-21 | -- | 57.65 | 2,125.84 | 12.60 | 7.15 | 654 | 88 | 1.09 | 8.73 |
| | 21-Apr-22 | -- | 59.27 | 2,124.22 | 10.80 | 6.91 | 561 | 79 | 2.51 | 8.90 |
| | 26-Apr-23 | -- | 59.56 | 2,123.93 | 11.9 | 7.06 | 777 | 135 | 3.38 | 8.73 |
| MW-2 | 30-Sep-10 | *2,186.19* | -- | -- | -- | -- | *1,129* | -- | -- | -- |
| | 24-Jan-11 | -- | *65.80* | *2,120.39* | *7.60* | *7.03* | *590* | -- | *41.6* | -- |
| | 25-Apr-11 | -- | *61.52* | *2,124.67* | *10.59* | *7.15* | *906* | -- | *3.45* | -- |
| | 28-Oct-15 | -- | 67.04 | 2,119.15 | 11.08 | 7.07 | 749 | 197 | 24.7 | 8.25 |
| | 26-Jan-16 | -- | 67.27 | 2,118.92 | 10.94 | 7.07 | 675 | 104 | 0.100 | 7.42 |
| | 22-Apr-16 | -- | 64.52 | 2,121.67 | 11.15 | 7.27 | 1,649 | 125 | 20.1 | 8.44 |
| | 26-Jul-16 | -- | 64.86 | 2,121.33 | 12.03 | 7.40 | 666 | 40 | 12.3 | 7.81 |
| | 24-Oct-16 | -- | 66.21 | 2,119.98 | 11.39 | 7.23 | 714 | 117 | 1.60 | 8.22 |
| | 24-Jan-17 | -- | 65.95 | 2,120.24 | 10.61 | 7.11 | 1,131 | 178 | 7.00 | 8.11 |
| | 24-Apr-17 | -- | 56.46 | 2,129.73 | 11.89 | 7.01 | 1,536 | 151 | 62.2 | 8.58 |
| | 20-Jul-17 | -- | 57.99 | 2,128.20 | 12.20 | 6.63 | 2,209 | 142 | 7.40 | 8.33 |
| | 10-Jan-18 | -- | 60.52 | 2,125.67 | -- | -- | -- | -- | -- | -- |
| | 19-Apr-18 | 2186.38 | 56.50 | 2,129.88 | 12.07 | 7.04 | 1,012 | 178 | 38.4 | 8.95 |
| | 12-Oct-18 | -- | 60.43 | 2,125.95 | 11.97 | 7.10 | 1,092 | 197 | 629 | 8.39 |
| | 12-Apr-19 | -- | 60.89 | 2,125.49 | 11.45 | 7.12 | 885 | 78 | 6.31 | 8.33 |
| | 23-Oct-19 | -- | 62.64 | 2,123.74 | 10.88 | 7.15 | 990 | 212 | 2.65 | 8.33 |
| | 4-May-20 | -- | 62.60 | 2,123.78 | 11.09 | 6.97 | 1,190 | 110 | 1.66 | 8.71 |
| | 15-Oct-20 | -- | 63.55 | 2,122.83 | 10.89 | 7.00 | 953 | 155 | 0 | 8.81 |
| | 21-Apr-21 | -- | 63.83 | 2,122.55 | 10.80 | 7.13 | 684 | 76 | 1.98 | 7.53 |
| | 21-Apr-22 | -- | 65.57 | 2,120.81 | 10.70 | 6.96 | 634 | 161 | 3.67 | 8.11 |
| | 26-Apr-23 | -- | 65.94 | 2,120.44 | 11.1 | 7.12 | 884 | 135 | 2.26 | 7.95 |

**TABLE 1**

**GROUNDWATER AND SURFACE WATER ELEVATIONS AND FIELD PARAMETERS**

2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date of Measurement | Top of Casing Elevation in feet (NAVD88) | Depth to Water in feet btoc | Groundwater & Surface Water Elevation in feet above msl | Temperature [°C] | pH | Conductivity [µS/cm] | ORP [mV] | Turbidity [NTU] | DO [mg/L] |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-3 | 1-Oct-10 | *2,176.18* | -- | -- | -- | -- | *2,965* | -- | -- | -- |
| | 25-Jan-11 | -- | *55.21* | *2,120.97* | -- | -- | -- | -- | *4.30* | -- |
| | 26-Apr-11 | -- | *51.03* | *2,125.15* | *10.25* | *7.78* | *2,787* | -- | *4.81* | -- |
| | 28-Oct-15 | -- | 56.69 | 2,119.49 | 11.47 | 6.91 | 2,067 | 187 | 33.5 | 7.62 |
| | 26-Jan-16 | -- | 56.84 | 2,119.34 | 10.98 | 6.62 | 2,051 | 132 | 12.6 | 7.54 |
| | 22-Apr-16 | -- | 54.07 | 2,122.11 | 11.88 | 7.11 | 5,492 | 135 | 18.4 | 8.18 |
| | 26-Jul-16 | -- | 54.35 | 2,121.83 | 11.66 | 6.93 | 2,030 | 54 | 10.3 | 7.83 |
| | 21-Oct-16 | -- | 55.77 | 2,120.41 | 12.04 | 8.27 | 2,660 | 91 | 41.3 | 7.73 |
| | 24-Jan-17 | -- | 55.54 | 2,120.64 | 10.74 | 6.74 | 1,963 | 199 | 7.20 | 7.67 |
| | 24-Apr-17 | -- | 45.01 | 2,131.17 | 11.94 | 6.75 | 3,321 | 159 | 6.00 | 9.33 |
| | 20-Jul-17 | -- | 46.49 | 2,129.69 | 12.98 | 6.67 | 3,305 | 254 | 7.80 | 7.77 |
| | 10-Jan-18 | -- | 49.70 | 2,126.48 | 10.45 | 6.87 | 2,325 | 230 | 17.9 | 8.26 |
| | 19-Apr-18 | -- | 45.19 | 2,130.99 | 11.93 | 6.60 | 2,305 | 210 | 12.2 | 7.99 |
| | 12-Oct-18 | -- | 49.55 | 2,126.63 | 11.70 | 6.86 | 2,113 | 222 | 15.0 | 7.54 |
| | 12-Apr-19 | -- | 50.14 | 2,126.04 | 11.28 | 6.66 | 2,103 | 117 | 3.50 | 7.48 |
| | 23-Oct-19 | -- | 52.05 | 2,124.13 | 11.55 | 6.91 | 2,140 | 211 | 185 | 7.57 |
| | 4-May-20 | -- | 52.03 | 2,124.15 | 11.35 | 6.80 | 2,650 | 250 | 3.50 | 7.80 |
| | 15-Oct-20 | -- | 52.98 | 2,123.20 | 11.43 | 6.75 | 2,129 | 173 | 0.00 | 7.96 |
| | 21-Apr-21 | -- | 53.29 | 2,122.89 | 11.40 | 7.14 | 1,612 | 93 | 2.32 | 7.79 |
| | 21-Apr-22 | -- | 55.08 | 2,121.10 | 11.00 | 6.67 | 1,617 | 195 | 2.21 | 7.97 |
| | 26-Apr-23 | -- | 55.45 | 2,120.73 | 12.3 | 6.84 | 2,162 | 146 | 6.80 | 7.77 |
| MW-4 | 30-Sep-10 | *2,247.25* | -- | -- | -- | -- | *1,411* | -- | -- | -- |
| | 24-Jan-11 | -- | *51.98* | *2,195.27* | -- | -- | -- | -- | *13.3* | -- |
| | 26-Apr-11 | -- | *51.13* | *2,196.12* | *10.48* | *7.33* | *3,914* | -- | *2.74* | -- |
| | 28-Oct-15 | -- | 53.90 | 2,193.35 | 11.45 | 6.92 | 830 | 167 | 3.20 | 0.13 |
| | 26-Jan-16 | -- | 52.56 | 2,194.69 | 11.14 | 6.81 | 810 | 122 | 13.4 | 0.06 |
| | 22-Apr-16 | -- | 52.39 | 2,194.86 | 11.47 | 6.85 | 1,491 | 145 | 15.4 | 0.25 |
| | 26-Jul-16 | -- | 52.60 | 2,194.65 | 11.73 | 7.06 | 1,172 | 45 | 5.10 | 0.02 |
| | 21-Oct-16 | -- | 52.99 | 2,194.26 | 11.30 | 7.52 | 1,514 | 96 | 5.40 | 0.11 |
| | 24-Jan-17 | *2,247.25* | 52.58 | 2,194.67 | 10.80 | 6.83 | 1,128 | 203 | 7.50 | 0.13 |
| | 24-Apr-17 | -- | 47.99 | 2,199.26 | 11.83 | 6.72 | 1,759 | 153 | 14.7 | 0.66 |
| | 20-Jul-17 | -- | 50.00 | 2,197.25 | 12.25 | 6.73 | 2,248 | 182 | 2.70 | 0.64 |
| | 10-Jan-18 | -- | 50.59 | 2,196.66 | 10.55 | 6.90 | 991 | 220 | 1.40 | 0.59 |
| | 19-Apr-18 | -- | 48.62 | 2,198.63 | 10.11 | 6.94 | 763 | 248 | 8.70 | 9.47 |
| | 12-Oct-18 | -- | 51.48 | 2,195.77 | 11.45 | 6.83 | 940 | 215 | 8.70 | 0.29 |
| | 12-Apr-19 | -- | 51.17 | 2,196.08 | 11.53 | 6.91 | 809 | 67 | 0.00 | 0.20 |
| | 23-Oct-19 | -- | 52.39 | 2,194.86 | 11.16 | 6.84 | 820 | 230 | 11.2 | 0.50 |
| | 4-May-20 | -- | 52.14 | 2,195.11 | 11.30 | 6.64 | 1,000 | 210.7 | 0.26 | 0.10 |
| | 15-Oct-20 | -- | 52.54 | 2,194.71 | 11.17 | 6.83 | 810 | 169.1 | 0.00 | 0.15 |
| | 21-Apr-21 | -- | 52.41 | 2,194.84 | 13.50 | 6.95 | 623 | 60.1 | 5.68 | 8.32 |
| | 21-Apr-22 | -- | 53.54 | 2,193.71 | 11.00 | 6.61 | 558 | 185.3 | 7.27 | 0.63 |
| | 26-Apr-23 | -- | 53.11 | 2,194.14 | 11.2 | 6.86 | 783 | 145.1 | 2.40 | 0.00 |

**TABLE 1**

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2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date of Measurement | Top of Casing Elevation in feet (NAVD88) | Depth to Water in feet btoc | Groundwater & Surface Water Elevation in feet above msl | Temperature [°C] | pH | Conductivity [µS/cm] | ORP [mV] | Turbidity [NTU] | DO [mg/L] |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-5 | 29-Sep-10 | *2,228.26* | -- | -- | -- | -- | *778* | -- | -- | -- |
| | 23-Jan-11 | -- | *33.96* | *2,194.30* | *8.50* | *7.40* | *694* | -- | *3.07* | -- |
| | 25-Apr-11 | -- | *33.58* | *2,194.68* | *9.86* | *6.99* | *780* | -- | *3.67* | -- |
| | 28-Oct-15 | -- | 35.36 | 2,192.90 | 10.35 | 7.31 | 569 | 176 | 65.3 | 9.07 |
| | 26-Jan-16 | -- | 34.27 | 2,193.99 | 9.96 | 7.20 | 538 | 133 | 5.30 | 9.11 |
| | 22-Apr-16 | -- | 34.17 | 2,194.09 | 10.45 | 7.21 | 1,216 | 163 | 8.20 | 9.60 |
| | 26-Jul-16 | -- | 34.40 | 2,193.86 | 11.01 | 7.21 | 533 | 69 | 6.70 | 9.02 |
| | 21-Oct-16 | -- | 34.66 | 2,193.60 | 10.52 | 10.69 | 559 | 75 | 7.20 | 9.04 |
| | 24-Jan-17 | -- | 34.35 | 2,193.91 | 9.98 | 7.21 | 1,016 | 147 | 11.4 | 8.90 |
| | 24-Apr-17 | -- | 32.69 | 2,195.57 | 10.13 | 7.09 | 1,449 | 230 | 4.10 | 10.2 |
| | 10-Jan-18 | -- | 33.40 | 2,194.86 | 9.34 | 7.34 | 860 | 231 | 3.60 | 9.66 |
| | 19-Apr-18 | -- | 32.73 | 2,195.53 | 10.11 | 6.94 | 763 | 248 | 8.70 | 9.47 |
| | 12-Oct-18 | -- | 33.86 | 2,194.40 | 9.95 | 7.17 | 848 | 236 | 13.6 | 8.80 |
| | 12-Apr-19 | -- | 33.57 | 2,194.69 | 10.12 | 7.26 | 750 | 149 | 0.00 | 9.10 |
| | 23-Oct-19 | -- | 34.19 | 2,194.07 | 9.91 | 7.31 | 800 | 227 | 1.59 | 9.01 |
| | 4-May-20 | -- | 34.06 | 2,194.20 | 10.08 | 7.04 | 950 | 237 | 2.28 | 9.41 |
| | 15-Oct-20 | -- | 34.28 | 2,193.98 | 9.91 | 7.12 | 766 | 193 | 0.00 | 9.58 |
| | 21-Apr-21 | -- | 34.19 | 2,194.07 | 9.90 | 6.83 | 541 | 91 | 4.29 | 8.30 |
| | 21-Apr-22 | -- | 34.98 | 2,193.28 | 9.40 | 7.14 | 520 | 161 | 5.70 | 9.46 |
| | 26-Apr-23 | -- | 34.63 | 2,193.63 | 10.1 | 7.17 | 775 | 160 | 3.05 | 9.31 |
| MW-6 | 26-Jan-16 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 22-Apr-16 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW-7 | 26-Jul-16 | 2166.67* | 44.99 | 2,121.68 | 10.60 | 7.20 | 420 | 54 | 22.00 | 9.97 |
| | 21-Oct-16 | -- | 46.38 | 2,120.29 | 10.46 | 10.46 | 427 | 72 | 15.80 | 9.50 |
| | 24-Jan-17 | -- | 46.13 | 2,120.54 | 9.75 | 7.00 | 402 | 150 | 25.00 | 8.79 |
| | 24-Apr-17 | -- | 36.01 | 2,130.66 | 9.21 | 7.08 | 1,335 | 177 | 4.80 | 9.16 |
| | 10-Jan-18 | -- | 40.55 | 2,126.12 | 9.56 | 7.14 | 696 | 228 | 3.80 | 8.52 |
| | 19-Apr-18 | -- | 38.18 | 2,128.49 | 8.76 | 7.10 | 609 | 211 | 0.47 | 8.60 |
| | 12-Oct-18 | -- | 40.45 | 2,126.22 | 9.58 | 7.05 | 726 | 226 | 16.50 | 7.71 |
| | 12-Apr-19 | -- | 40.88 | 2,125.79 | 10.11 | 7.09 | 634 | 99 | 8.35 | 8.09 |
| | 23-Oct-19 | -- | 42.64 | 2,124.03 | 9.71 | 7.11 | 670 | 221 | 12.34 | 8.05 |
| | 4-May-20 | -- | 42.60 | 2,124.07 | 9.94 | 6.81 | 780 | 173 | 2.01 | 8.73 |
| | 15-Oct-20 | -- | 43.59 | 2,123.08 | 9.76 | 6.41 | 641 | 179 | 0.00 | 8.46 |
| | 21-Apr-21 | -- | 43.88 | 2,122.79 | 11.60 | 7.21 | 468 | 80 | 6.82 | 7.95 |
| | 21-Apr-22 | -- | 45.65 | 2,121.02 | 9.60 | 6.85 | 452 | 180 | 5.94 | 8.44 |
| | 26-Apr-23 | -- | 46.02 | 2,120.65 | 9.7 | 6.99 | 668 | 153 | 5.27 | 8.18 |

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KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date of Measurement | Top of Casing Elevation in feet (NAVD88) | Depth to Water in feet btoc | Groundwater & Surface Water Elevation in feet above msl | Temperature [°C] | pH | Conductivity [µS/cm] | ORP [mV] | Turbidity [NTU] | DO [mg/L] |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Surface Springs*** | | | | | | | | | | |
| SW-1 | 14-May-10 | -- | -- | 2149.69 | -- | -- | *694* | -- | -- | -- |
| | 28-Oct-15 | -- | -- | | 9.73 | 7.11 | 1,194 | 183 | 10.4 | 8.51 |
| | 26-Jan-16 | -- | -- | | 8.46 | 7.35 | 444 | 94 | 0.00 | 7.87 |
| | 22-Apr-16 | -- | -- | | 11.12 | 7.56 | 2,023 | 128 | 1.10 | 7.89 |
| | 26-Jul-16 | -- | -- | | 14.29 | 7.30 | 479 | 38 | 0.00 | 7.06 |
| | 21-Oct-16 | -- | -- | | 10.21 | 9.80 | 472 | 140 | 0.80 | 8.73 |
| | 24-Jan-17 | -- | -- | | 7.21 | 7.68 | 394 | 207 | 0.00 | 11.77 |
| | 24-Apr-17 | -- | -- | | 9.24 | 7.24 | 1,370 | 171 | 0.90 | 9.03 |
| | 10-Jan-18 | -- | -- | | 7.87 | 7.32 | 713 | 241 | 0.80 | 10.35 |
| | 19-Apr-18 | -- | -- | | 9.44 | 7.09 | 615 | 220 | 0.64 | 8.64 |
| | 12-Oct-18 | -- | -- | | 9.57 | 6.99 | 694 | 249 | 10.5 | 8.74 |
| | 12-Apr-19 | -- | -- | | 9.54 | 7.23 | 595 | 93 | 3.38 | 8.34 |
| | 23-Oct-19 | -- | -- | | 8.77 | 7.19 | 650 | 230 | 0.00 | 9.11 |
| | 4-May-20 | -- | -- | | 11.95 | 7.77 | 690 | 233 | 0.01 | 8.81 |
| | 15-Oct-20 | -- | -- | | 8.32 | 7.18 | 635 | 176 | 0.00 | 10.14 |
| | 21-Apr-21 | -- | -- | | 6.90 | 7.29 | 420 | 80 | 0.00 | 7.92 |
| | 21-Apr-22 | -- | -- | | 7.60 | 7.12 | 422 | 195 | 0.00 | 11.07 |
| | 26-Apr-23 | -- | -- | | 8.7 | 7.29 | 671 | 123 | 0.46 | 9.67 |
| SW-3 | 14-May-10 | -- | -- | 2,116.48 | -- | -- | *1,577* | -- | -- | -- |
| | 28-Oct-15 | -- | -- | | 9.68 | 7.14 | 1,207 | 182 | 0.90 | 8.49 |
| | 26-Jan-16 | -- | -- | | 9.14 | 6.85 | 1,275 | 116 | 0.00 | 7.96 |
| | 22-Apr-16 | -- | -- | | 12.62 | 7.45 | 4,119 | 135 | 41.3 | 8.08 |
| | 26-Jul-16 | -- | -- | | 9.73 | 7.69 | 1,219 | 36 | 7.40 | 7.75 |
| | 21-Oct-16 | -- | -- | | 9.77 | 7.36 | 880 | 122 | 0.00 | 8.63 |
| | 24-Jan-17 | -- | -- | 2,116.48 | 9.22 | 7.39 | 1,452 | 271 | 0.00 | 11.06 |
| | 24-Apr-17 | -- | -- | | 10.39 | 7.22 | 2,179 | 169 | 1.20 | 8.51 |
| | 10-Jan-18 | -- | -- | | 9.80 | 7.10 | 1,407 | 232 | 0.70 | 8.04 |
| | 19-Apr-18 | -- | -- | | 10.99 | 6.73 | 1,225 | 231 | 13.9 | 7.53 |
| | 12-Oct-18 | -- | -- | | 11.20 | 7.04 | 1,317 | 233 | 31.0 | 7.11 |
| | 12-Apr-19 | -- | -- | | 11.14 | 7.10 | 1,071 | 94 | 0.00 | 7.63 |
| | 23-Oct-19 | -- | -- | | 9.56 | 7.11 | 1,200 | 201 | 0.00 | 8.49 |
| | 4-May-20 | -- | -- | | 10.23 | 7.21 | 1,380 | 205 | 0.00 | 8.79 |
| | 15-Oct-20 | -- | -- | | 9.64 | 7.06 | 1,173 | 176 | 0.00 | 8.89 |
| | 21-Apr-21 | -- | -- | | 9.70 | 7.42 | 839 | 83 | 4.02 | 6.63 |
| | 21-Apr-22 | -- | -- | | 9.60 | 7.05 | 889 | 190 | 204.62 | 9.18 |
| | 26-Apr-23 | --<br>-- | --<br>-- | | 9.70 | 7.23 | 493 | 134 | 16.44 | 9.03 |

**TABLE 1**
**GROUNDWATER AND SURFACE WATER ELEVATIONS AND FIELD PARAMETERS**
2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date of Measurement | Top of Casing Elevation in feet (NAVD88) | Depth to Water in feet btoc | Groundwater & Surface Water Elevation in feet above msl | Temperature [°C] | pH | Conductivity [µS/cm] | ORP [mV] | Turbidity [NTU] | DO [mg/L] |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Surface Springs (Continued)*** | | | | | | | | | | |
| SW-5 | 14-May-10 | -- | -- | 2,058.38 | -- | -- | *1,403* | -- | -- | -- |
| | 28-Oct-15 | -- | -- | | -- | -- | -- | -- | -- | -- |
| | 26-Jan-16 | -- | -- | | -- | -- | -- | -- | -- | -- |
| | 22-Apr-16 | -- | -- | | -- | -- | -- | -- | -- | -- |
| | 26-Jul-16 | -- | -- | | -- | -- | -- | -- | -- | -- |
| | 21-Oct-16 | -- | -- | | -- | -- | -- | -- | -- | -- |
| | 24-Jan-17 | -- | -- | | 1.68 | 7.56 | 1,214 | 323 | 33.0 | 9.90 |
| | 24-Apr-17 | -- | -- | | 16.30 | 7.76 | 1,424 | 172 | 4.30 | 8.90 |
| | 10-Jan-18 | -- | -- | | 3.60 | 7.82 | 1,163 | 240 | 4.80 | 10.49 |
| | 19-Apr-18 | -- | -- | | 19.74 | 8.14 | 876 | 160 | 26.4 | 8.45 |
| | 12-Oct-18 | -- | -- | | 11.70 | 7.76 | 823 | 242 | 63.0 | 8.23 |
| | 12-Apr-19 | -- | -- | | 11.78 | 7.87 | 1,021 | 74 | 9.61 | 7.97 |
| | 23-Oct-19 | -- | -- | | 8.51 | 7.86 | 1,140 | 188 | 0.00 | 9.45 |
| | 4-May-20 | -- | -- | | 13.93 | 7.79 | 1,530 | 208 | 4.55 | 8.68 |
| | 15-Oct-20 | -- | -- | | 7.89 | 7.64 | 1,061 | 143 | 0.00 | 10.08 |
| | 21-Apr-21 | -- | -- | | 15.50 | 7.48 | 954 | 63 | 5.20 | 11.47 |
| | 21-Apr-22 | -- | -- | | 7.30 | 7.55 | 823 | 193 | 109.40 | 192.80 |
| | 26-Apr-23 | -- | -- | | 14.80 | 7.91 | 611 | 142 | 31.24 | 9.76 |

***Notes:***

*Top of casing elevation measured from the top of inner PVC casing (Survey completed in 2010 by Exponent).*

*Italicized parameters are from Exponent's Final Remedial Investigation Report (September 9, 2011) and Final Feasibility Study (May 4, 2012), prior to implementation of the Final Cleanup Action Plan.*

** = Casing elevation determined by measuring the difference in casing elevations between MW-6 and MW-7 during installation of MW-7 on June 16, 2016.*

*-- = Not applicable for surface water locations/water quality parameters not measured during sampling event.*

*NAVD88 = North American Vertical Datum of 1988.*
*btoc = below top of casing.*
*msl = mean sea level.*
*°C = degrees Celsius.*
*µS/cm = microsiemens per centimeter.*

*ORP = oxidation-reduction potential.*
*mV = millivolts.*
*NTU = nephelometric turbidity units.*
*DO = dissolved oxygen.*
*mg/L = milligrams per liter.*

**TABLE 2**

**GROUNDWATER CHEMICAL ANALYTICAL RESULTS**

2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Dissolved Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| ***Monitoring Wells*** | | Concentrations in mg/L | | | |
| MW-1 | *30-Sep-10* | ***77.2*** | ***84.2*** | ***17.70*** | ***489*** |
| | *24-Jan-11* | ***70.7*** | ***85.5*** | ***17.90*** | ***532*** |
| | *25-Apr-11* | ***425*** | ***166*** | ***31.50*** | ***1,190*** |
| | 28-Oct-15 | **44.1** | **83.9** | **14.70** | **507** |
| | 26-Jan-16 | **52.6** | **84.6** | **17.00** | **487** |
| | 22-Apr-16 | **77.1** | **93.1** | **19.20** | **529** |
| | 26-Jul-16 | **85.6** | **90.2** | **21.30 J** | **650 J** |
| | 21-Oct-16 | **74.6** | **81.0** | **21.80** | **596** |
| | 24-Jan-17 | **81.2** | **91.3** | **20.10** | **576** |
| | 24-Apr-17 | **316** | **185** | **44.90** | **1,140** |
| | 20-Jul-17 | **118** | **123** | **33.10** | **726** |
| | 10-Jan-18 | **50.6** | **88.9** | **23.90** | **600** |
| | 19-Apr-18 | **86.9** | **106** | **31.60** | **637** |
| | 12-Oct-18 | **34.8** | **81.6** | **22.10** | **491** |
| | 12-Apr-19 | **42.9** | **84.6** | **24.70** | **504** |
| | 23-Oct-19 | **35.3** | **75.3** | **19.60** | **484** |
| | 4-May-20 | **77.0** | **82.5** | **23.50** | **585** |
| | 15-Oct-20 | **50.6** | **72.3** | **23.90** | **539** |
| | 21-Apr-21 | **75.0** | **75.0** | **1.40** | **410** |
| | 21-Apr-22 | **59** | **63** | **22** | **50** |
| | 26-Apr-23 | **52** | **67** | **4.4** | **490** |
| MW-2 | *30-Sep-10* | ***155*** | ***29.0*** | ***8.97*** | ***657*** |
| | *24-Jan-11* | ***55.6*** | ***24.3*** | ***9.36*** | ***457*** |
| | *25-Apr-11* | ***83.5*** | ***28.3*** | ***8.13*** | ***552*** |
| | 28-Oct-15 | **99.5** | **25.6** | **10.4** | **640** |
| | 26-Jan-16 | **85.0** | **26.0** | **9.12** | **549** |
| | 22-Apr-16 | **57.9** | **29.1** | **7.81** | **499** |
| | 26-Jul-16 | **82.7** | **25.5** | **10.1 J** | **737 J** |
| | 24-Oct-16 | **89.9** | **24.0** | **13.00** | **592** |
| | 24-Jan-17 | **91.1** | **23.8** | **11.90** | **600** |
| | 24-Apr-17 | **48.8** | **27.9** | **8.65** | **494** |
| | 20-Jul-17 | **94.2** | **30.2** | **8.50** | **585** |
| | 10-Jan-18 | **--** | **--** | **--** | **--** |
| | 19-Apr-18 | **93.5** | **30.5** | **13.20** | **600** |
| | 12-Oct-18 | **85.5** | **31.0** | **15.90** | **631** |
| | 12-Apr-19 | **80.5** | **32.4** | **14.50** | **589** |
| | 23-Oct-19 | **67.0** | **37.9** | **15.40** | **630** |
| | 4-May-20 | **67.9** | **27.4** | **14.60** | **641** |
| | 15-Oct-20 | **65.1** | **26.8** | **16.60** | **617** |
| | 21-Apr-21 | **77.0** | **26.0** | **1.10** | **520** |
| | 21-Apr-22 | **76** | **23** | **14.00** | **560** |
| | 26-Apr-23 | **67** | **27** | **2.0** | **460** |

**TABLE 2**
**GROUNDWATER CHEMICAL ANALYTICAL RESULTS**
2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Dissolved Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| MW-3 | *1-Oct-10* | ***788*** | ***235.0*** | ***31.40*** | ***1,980*** |
| | *25-Jan-11* | ***656*** | ***258.0*** | -- | ***1,600*** ***J*** |
| | *26-Apr-11* | ***741*** | ***274.0*** | ***31.10*** | ***1,710*** |
| | 28-Oct-15 | **671** | **299.0** | **23.7** | **1,670** |
| | 26-Jan-16 | **679** | **295.0** | **24.4** | **1,680** |
| | 22-Apr-16 | **607** | **276.0** | **21.5** | **1,530** |
| | 26-Jul-16 | **615** | **266.0** | **22.1** **J** | **1,700** **J** |
| | 21-Oct-16 | **578** | **272.0** | **24.90** | **1,410** |
| | 24-Jan-17 | **561** | **259.0** | **23.90** | **1,360** |
| | 24-Apr-17 | **678** | **272.0** | **38.80** | **1,590** |
| | 20-Jul-17 | **525** | **231.0** | **37.70** | **1,420** |
| | 10-Jan-18 | **462** | **215.0** | **0.66** | **1,370** |
| | 19-Apr-18 | **493** | **228.0** | **36.20** | **1,320** |
| | 12-Oct-18 | **381** | **196.0** | **30.60** | **1,140** |
| | 12-Apr-19 | **475** | **227.0** | **26.00** | **1,160** |
| | 23-Oct-19 | **444** | **222.0** | **24.40** | **1,210** |
| | 4-May-20 | **480** | **226.0** | **21.70** | **1,310** |
| | 15-Oct-20 | **458** | **215.0** | **23.40** | **1,300** |
| | 21-Apr-21 | **590** | **230.0** | **1.90** | **1,200** |
| | 21-Apr-22 | **710** | **210** | **22** | **1,200** |
| | 23-Apr-23 | **540** | **220** | **3.4** | **1,200** |
| MW-4 | *30-Sep-10* | ***175*** | ***82.3*** | ***42.00*** | ***883*** |
| | *24-Jan-11* | ***445*** | ***154*** | ***53.80*** | ***1,550*** |
| | *26-Apr-11* | ***943*** | ***254*** | ***76.30*** | ***2,210*** |
| | 28-Oct-15 | **97.2** | **81.4** | **36.3** | **717** |
| | 26-Jan-16 | **97.0** | **76.1** | **35.3** | **679** |
| | 22-Apr-16 | **124** | **85.5** | **43** | **804** |
| | 26-Jul-16 | **121** | **78.4** | **43.9** **J** | **1,050** **J** |
| | 21-Oct-16 | **90.6** | **68.3** | **46.40** | **754** |
| | 24-Jan-17 | **76.1** | **71.8** | **40.70** | **765** |
| | 24-Apr-17 | **44.7** | **64.7** | **38.90** | **671** |
| | 20-Jul-17 | **40.6** | **60.8** | **37.50** | **653** |
| | 10-Jan-18 | **33.5** | **58.1** | **35.60** | **655** |
| | 19-Apr-18 | **32.0** | **57.2** | **22.10** | **529** |
| | 12-Oct-18 | **28.8** | **59.2** | **33.70** | **647** |
| | 12-Apr-19 | **24.1** | **57.6** | **36.40** | **593** |
| | 23-Oct-19 | **19.0** | **45.8** | **28.40** | **615** |
| | 4-May-20 | **21.4** | **48.7** | **25.00** | **558** |
| | 15-Oct-20 | **30.3** | **49.0** | **29.80** | **579** |
| | 21-Apr-21 | **29.0** | **43.0** | **5.90** | **510** |
| | 21-Apr-22 | **26** | **34** | **29** | **510** |
| | 23-Apr-23 | **26** | **49** | **5.4** | **670** |

**TABLE 2**
**GROUNDWATER CHEMICAL ANALYTICAL RESULTS**
2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Dissolved Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| MW-4 Field Duplicate | 28-Oct-15 | 94.8 | 78.8 | 36.5 | 709 |
| | 26-Jan-16 | 70.7 | 74.4 | 35 | 697 |
| | 22-Apr-16 | 122 | 85.9 | 43.3 | 824 |
| | 26-Jul-16 | 116 | 80.8 | 42.9 | 1,050 |
| | 21-Oct-16 | 91.0 | 70.1 | 46.90 | 753 |
| | 24-Jan-17 | 74.5 | 70.2 | 40.90 | 709 |
| | 24-Apr-17 | 43.6 | 67.6 | 39.10 | 649 |
| | 20-Jul-17 | 39.9 | 60.4 | 36.60 | 648 |
| | 10-Jan-18 | 34.2 | 59.0 | 35.80 | 656 |
| | 19-Apr-18 | 31.8 | 57.9 | 21.30 | 526 |
| | 12-Oct-18 | 27.9 | 61.2 | 32.40 | 612 |
| | 12-Apr-19 | 24.8 | 59.8 | 36.50 | 592 |
| | 23-Oct-19 | 20.1 | 45.2 | 28.70 | 569 |
| | 4-May-20 | 21.9 | 48.8 | 24.90 | 561 |
| | 15-Oct-20 | 24.5 | 48.7 | 30.40 | 588 |
| | 21-Apr-21 | 23.0 | 43.0 | 5.90 | 490 |
| | 21-Apr-22 | 26 | 35 | 29 | 530 |
| | 26-Apr-23 | 25 | 47 | 6.3 | 500 |
| MW-5 | *29-Sep-10* | *19.4* | *32.1* | *14.40* | *496* |
| | *23-Jan-11* | *17.9* | *31.8* | *14.20* | *500* |
| | *25-Apr-11* | *18.9* | *32.2* | *13.20* | *488* |
| | 28-Oct-15 | 17.2 | 37.3 | 13 | 504 |
| | 26-Jan-16 | 15.3 | 33.4 | 13.4 | 491 |
| | 22-Apr-16 | 19.1 | 33.3 | 12.4 | 508 |
| | 26-Jul-16 | 20.9 | 33.3 | 13.4 J | 573 J |
| | 21-Oct-16 | 18.9 | 33.2 | 14.90 | 503 |
| | 24-Jan-17 | 18.6 | 33.8 | 13.70 | 481 |
| | 24-Apr-17 | 19.9 | 31.6 | 11.40 | 462 |
| | 20-Jul-17 | 19.4 | 31.4 | 12.10 | 481 |
| | 10-Jan-18 | 19.3 | 31.4 | 13.20 | 508 |
| | 19-Apr-18 | 18.7 | 31.1 | 12.50 | 475 |
| | 12-Oct-18 | 18.0 | 33.0 | 13.30 | 472 |
| | 12-Apr-19 | 18.7 | 34.1 | 13.30 | 459 |
| | 23-Oct-19 | 17.6 | 34.2 | 13.90 | 512 |
| | 4-May-20 | 18.5 | 34.1 | 12.40 | 503 |
| | 15-Oct-20 | 17.5 | 33.1 | 14.40 | 528 |
| | 21-Apr-21 | 20.0 | 32.0 | 1.70 | 450 |
| | 21-Apr-22 | 19 | 31 | 15 | 540 |
| | 26-Apr-23 | 19 | 33 | 2.6 | 350 |
| MW-6 | *29-Sep-10* | *15.6* | *18.6* | *4.95* | *545* |
| | *23-Jan-11* | *19.0* | *23.6* | *7.04* | *425* |
| | *25-Apr-11* | *19.3* | *24.2* | *7.65* | *430* |
| | 28-Oct-15 | Well damaged, no sample collected. | | | |
| | 26-Jun-16 | Well decommissioned. | | | |

**TABLE 2**

**GROUNDWATER CHEMICAL ANALYTICAL RESULTS**

2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Dissolved Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| MW-7 | 26-Jul-16 | **19.3** | **25.0** | **7.01** | **521** |
| | 21-Oct-16 | **17.6** | **23.1** | **7.30** | **394** |
| | 24-Jan-17 | **19.8** | **26.0** | **7.56** | **397** |
| | 24-Apr-17 | **19.4** | **24.4** | **7.06** | **403** |
| | 20-Jul-17 | **20.7** | **25.7** | **7.88** | **423** |
| | 10-Jan-18 | **20.8** | **25.0** | **8.58** | **429** |
| | 19-Apr-18 | **17.3** | **24.8** | **6.19** | **383** |
| | 12-Oct-18 | **19.5** | **26.2** | **8.20** | **424** |
| | 12-Apr-19 | **19.6** | **27.5** | **8.61** | **408** |
| | 23-Oct-19 | **18.8** | **26.5** | **8.42** | **417** |
| | 4-May-20 | **19.2** | **26.1** | **7.91** | **433** |
| | 15-Oct-20 | **26.2** | **25.2** | **9.20** | **418** |
| | 21-Apr-21 | **23.0** | **25.0** | **1.10** | **490** |
| | 21-Apr-22 | **24** | **24** | **10** | **460** |
| | 26-Apr-23 | **22** | **28** | **1.8** | **360** |
| **Federal or State Cleanup Standard** | | 250 | -- | 14.00 | -- |

***Notes:***

***Bold*** *denotes a detected concentration.*

*Italicized values are from Exponent's Final Remedial Investigation Report (September 9, 2011) and Final Feasibility Study (May 4, 2012), prior to implementation of the Final Cleanup Action Plan.*

*Shaded cell denotes concentrations that meet or exceed the cleanup standard. The exceeded cleanup standard is also shaded.*

*mg/L = milligrams per liter.*

*-- = not analyzed for or not available.*

*J = estimated value.*

** = results beginning October 2015 are nitrate and nitrite as nitrogen.*

*Chloride cleanup level based on federal and state drinking water secondary maximum contaminant level based on taste and odor concerns.*

*Nitrite cleanup level based on background concentrations in groundwater.*

*EPA's recommended range for sodium for most individuals is 30,000 to 60,000 micrograms per liter (µg/L) based on aesthetic effects (taste). The EPA recommended level for sodium-sensitive consumers is 20,000 µg/L (see WAC 246-290-310(3)(a)). The upper limit of EPA's recommended range for most individuals of 60,000 µg/L is used for comparison.*

## TABLE 3
## SURFACE WATER CHEMICAL ANALYTICAL RESULTS

2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Total Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| ***Surface Spring*** | | Concentrations in mg/L | | | |
| SW-2 | *14-May-10* | ***21.7*** | ***27.5*** | ***9.9 J*** | ***408*** |
| SW-1 | 28-Oct-15 | *SW-2 dry during sampling event. Relocate sample location to SW-1.* | | | |
| | 26-Jan-16 | **20.7** | **25.5** | **9.0** | **419** |
| | 22-Apr-16 | **20.0** | **26.4** | **8.4** | **431** |
| | 26-Jul-16 | **21.6** | **25.7** | **8.3 J** | **576 J** |
| | 21-Oct-16 | **20.6** | **27.0** | **10.0** | **443** |
| | 24-Jan-17 | **21.7** | **27.0** | **9.5** | **422** |
| | 24-Apr-17 | **20.0** | **27.6** | **8.1** | **413** |
| | 20-Jul-17 | **20.9** | **25.4** | **7.1** | **410** |
| | 10-Jan-18 | **21.1** | **25.1** | **8.4** | **428** |
| | 19-Apr-18 | **17.6** | **24.6** | **7.69** | **387** |
| | 12-Oct-18 | **19.0** | **25.7** | **7.58** | **407** |
| | 12-Apr-19 | **19.9** | **27.1** | **9.02** | **401** |
| | 23-Oct-19 | **19.2** | **26.6** | **9.04** | **422** |
| | 4-May-20 | **20.5** | **26.5** | **8.68** | **415** |
| | 15-Oct-20 | **20.0** | **25.9** | **9.9** | **420** |
| | 21-Apr-21 | **24.0** | **25.0** | **1.3** | **380** |
| | 21-Apr-22 | **24** | **23** | **11** | **460** |
| | 26-Apr-23 | **23** | **24** | **2.0** | **280** |
| SW-3 | *14-May-10* | ***301*** | ***111.0*** | ***18.0 J*** | ***821*** |
| | 28-Oct-15 | **272** | **130.0** | **15.3** | **932** |
| | 26-Jan-16 | **269** | **116.0** | **15.7** | **925** |
| | 22-Apr-16 | **256** | **118.0** | **14.4** | **860** |
| | 26-Jul-16 | **251** | **112.0** | **15.0 J** | **1,110 J** |
| | 21-Oct-16 | **259** | **115.0** | **16.7** | **848** |
| | 24-Jan-17 | **258** | **120.0** | **15.3** | **825** |
| | 24-Apr-17 | **261** | **119.0** | **16.6** | **878** |
| | 20-Jul-17 | **283** | **126.0** | **20.1** | **907** |
| | 10-Jan-18 | **200** | **103.0** | **17.8** | **842** |
| | 19-Apr-18 | **182** | **98.2** | **16.5** | **698** |
| | 12-Oct-18 | **181** | **103.0** | **16.6** | **728** |
| | 12-Apr-19 | **168** | **97.1** | **16.5** | **701** |
| | 23-Oct-19 | **146** | **91.2** | **14.5** | **700** |
| | 4-May-20 | **157** | **89.1** | **13.1** | **681** |
| | 15-Oct-20 | **158** | **90.4** | **15.5** | **702** |
| | 21-Apr-21 | **190** | **95.0** | **2.4** | **650** |
| | 21-Apr-22 | **290** | **88** | **17** | **670** |
| | 26-Apr-23 | **240** | **100** | **2.9** | **600.0** |

**TABLE 3**
**SURFACE WATER CHEMICAL ANALYTICAL RESULTS**
2023 HEGLAR KRONQUIST LANDFILL ASSESSMENT PLAN
KAISER ALUMINUM
MEAD, WASHINGTON

| Sample Location | Date | Chloride | Total Sodium | Nitrate/ Nitrite as Nitrogen* | Total Dissolved Solids |
|---|---|---|---|---|---|
| SW-3 Field Duplicate | 28-Oct-15 | **265** | **121.0** | **15.1** | **887** |
| | 26-Jan-16 | **273** | **116.0** | **15.7** | **912** |
| | 22-Apr-16 | **247** | **115.0** | **14.4** | **881** |
| | 26-Jul-16 | **250** | **111.0** | **15.0** J | **1,090** J |
| | 21-Oct-16 | **250** | **117.0** | **16.6** | **862** |
| | 24-Jan-17 | **253** | **119.0** | **15.3** | **826** |
| | 24-Apr-17 | **251** | **119.0** | **16.6** | **869** |
| | 20-Jul-17 | **283** | **124.0** | **19.7** | **926** |
| | 10-Jan-18 | **194** | **102.0** | **17.8** | **854** |
| | 19-Apr-18 | **183** | **94.7** | **15.6** | **744** |
| | 12-Oct-18 | **187** | **96.4** | **13.5** | **748** |
| | 12-Apr-19 | **168** | **96.5** | **16.4** | **694** |
| | 23-Oct-19 | **90** | **89.6** | **14.8** | **711** |
| | 4-May-20 | **153** | **87.9** | **13.3** | **722** |
| | 15-Oct-20 | **163** | **88.7** | **15.4** | **714** |
| | 21-Apr-21 | **200** | **98.0** | **3.0** | **670** |
| | 21-Apr-22 | **250** | **88** | **16** | **660** |
| | 26-Apr-23 | **220** | **94** | **2.6** | **880** |
| SW-5 | *14-May-10* | ***252*** | ***96.1*** | ***14.8*** | ***739*** |
| | 28-Oct-15 | Spring Dry During Sampling Event | | | |
| | 26-Jan-16 | | | | |
| | 22-Apr-16 | | | | |
| | 26-Jul-16 | | | | |
| | 21-Oct-16 | | | | |
| | 24-Jan-17 | **228** | **106.0** | **1.1** | **752** |
| | 24-Apr-17 | **121** | **67.3** | **7.5** | **563** |
| | 20-Jul-17 | **191** | **96.6** | **3.7** | **746** |
| | 10-Jan-18 | **145** | **77.6** | **8.2** | **694** |
| | 19-Apr-18 | **93.6** | **63.3** | **5.89** | **501** |
| | 12-Oct-18 | **167** | **82.9** | **5.38** | **696** |
| | 12-Apr-19 | **136** | **80.5** | **7.08** | **568** |
| | 23-Oct-19 | **141** | **85.0** | **3.78** | **684** |
| | 4-May-20 | **149** | **82.6** | **1.79** | **661** |
| | 15-Oct-20 | **142** | **80.4** | **6.6** | **676** |
| | 21-Apr-21 | **200** | **88.0** | **0.2** | **640** |
| | 21-Apr-22 | **280** | **87** | **3.2** | **680** |
| | 26-Apr-23 | **230** | **92** | **0.3** | **700** |
| **Federal or State Cleanup Standard** | | 250 | -- | 14 | -- |

***Notes:***

*Italicized values are from Exponent's Final Remedial Investigation Report (September 9, 2011) and Final Feasibility Study (May 4, 2012), prior to implementation of the Final Cleanup Action Plan.*

***Bold*** *denotes a detected concentration.*

*Shaded cell denotes an exceedance in the cleanup standard. The exceeded cleanup standard is also shaded.*

*-- = not analyzed for or not available.*

*mg/L = milligrams per liter.*

*J = estimated value.*

** = results beginning October 2015 are Nitrate + Nitrite as Nitrogen.*

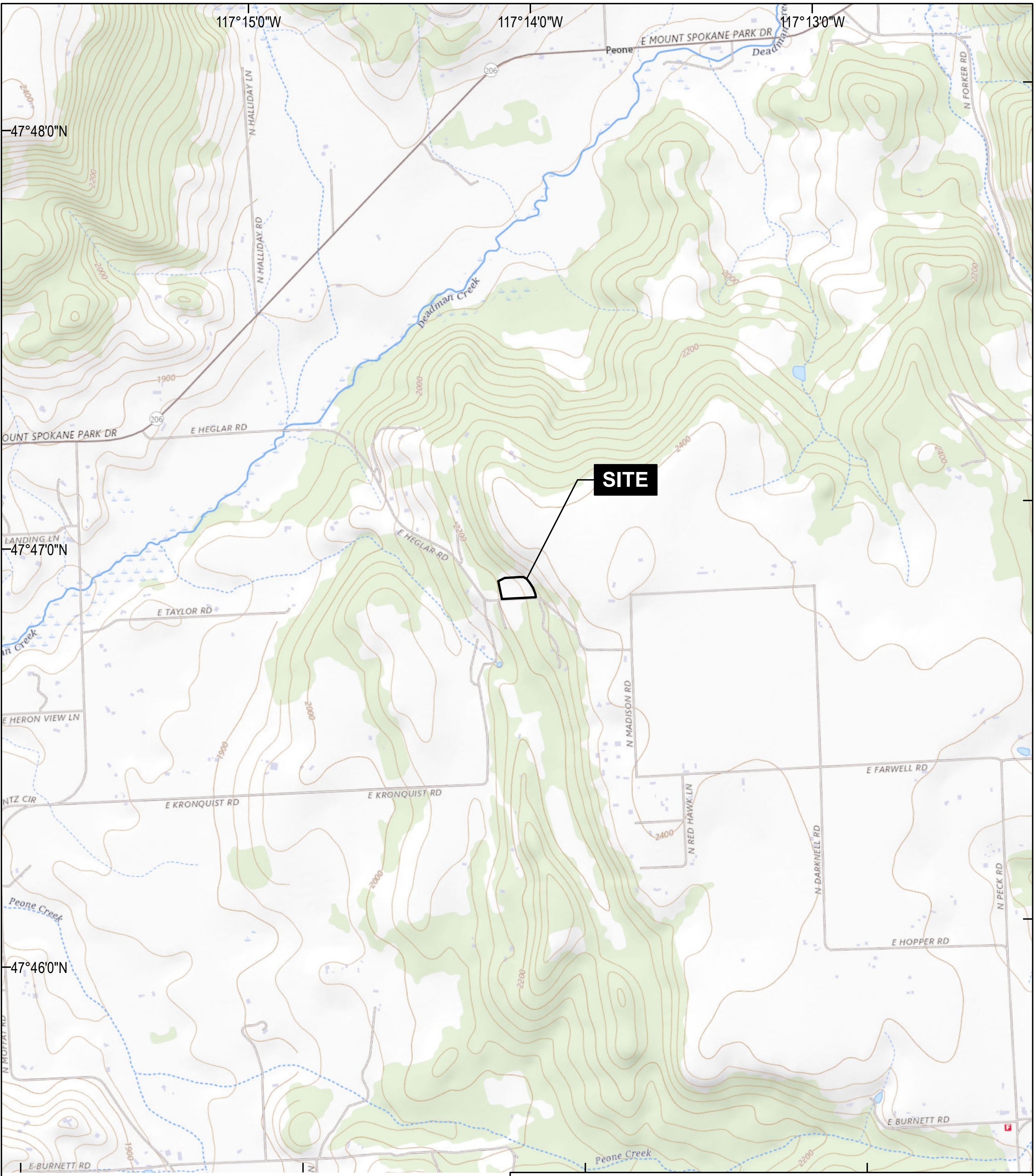
*Chloride cleanup level based on federal and state drinking water secondary maximum contaminant level based on taste and odor concerns.*

*Nitrite cleanup level based on background concentrations in groundwater.*

*EPA's recommended range for sodium for most individuals is 30,000 to 60,000 micrograms per liter (µg/L) based on aesthetic effects (taste).*

*The EPA recommended level for sodium-sensitive consumers is 20,000 µg/L (see WAC 246-290-310(3)(a)). The upper limit of EPA's commended range for most individuals of 60,000 µg/L is used for comparison.*

# FIGURES



N

MAP SOURCE: USGS
SITE COORDINATES: 47°46'51"N, 117°14'09"W

HALEY ALDRICH

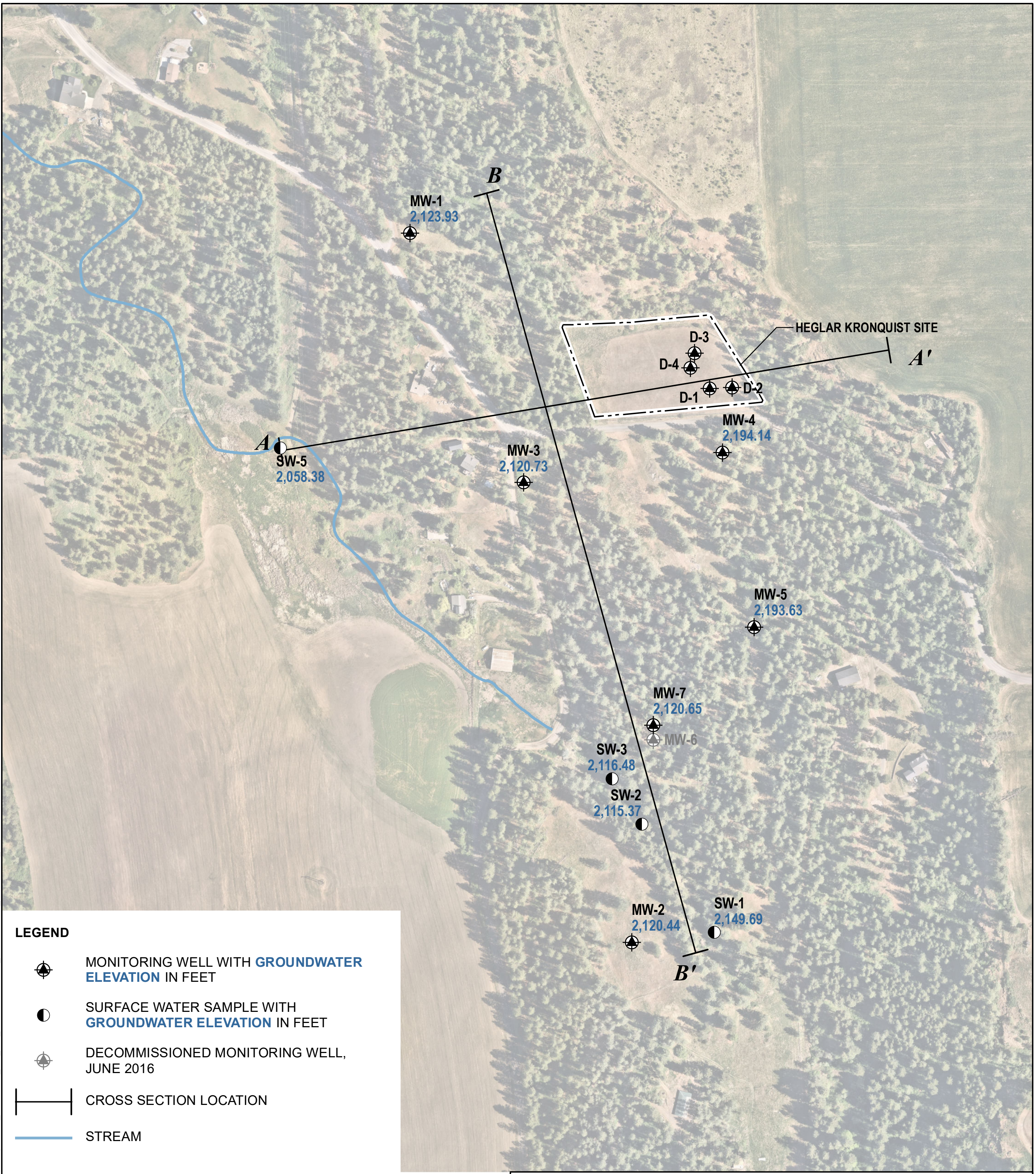
HEGLAR KRONQUIST SITE
MEAD, WASHINGTON

VICINITY MAP

APPROXIMATE SCALE: 1 IN = 2000 FT
DECEMBER 2023

FIGURE 1

GIS: \\haleyaldrich.com\share\sea_projects\Notebooks\1792605_Heglar_Kronquist_Compliance_Monitoring\GIS\MGIS\Maps\2023_05\202596_001_001_VICINITY_MAP.mxd - jday - 6/3/2022 4:36:32 PM



**NOTES**

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. MONITORING WELL AND SURFACE WATER SAMPLING LOCATIONS SURVEYED BY ADAMS AND CLARK, INC. 2011; REFERENCED TO NAD 83 WASHINGTON STATE PLANE NORTH (US FEET) AND NAVD 88.

3. AERIAL IMAGERY SOURCE: NEARMAP, 13 MAY 2021

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

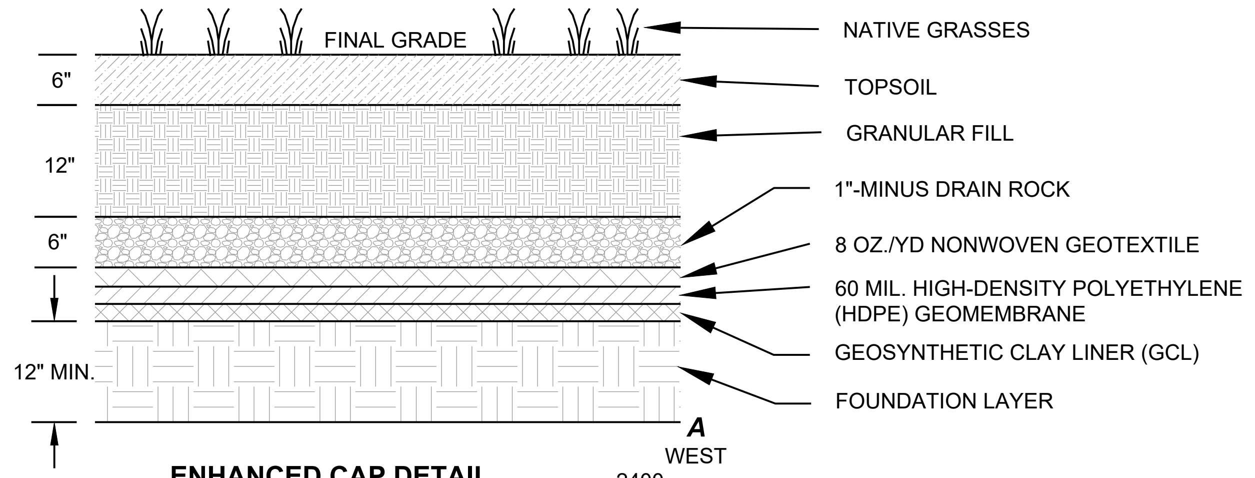
HEGLAR KRONQUIST SITE
MEAD, WASHINGTON

SITE PLAN

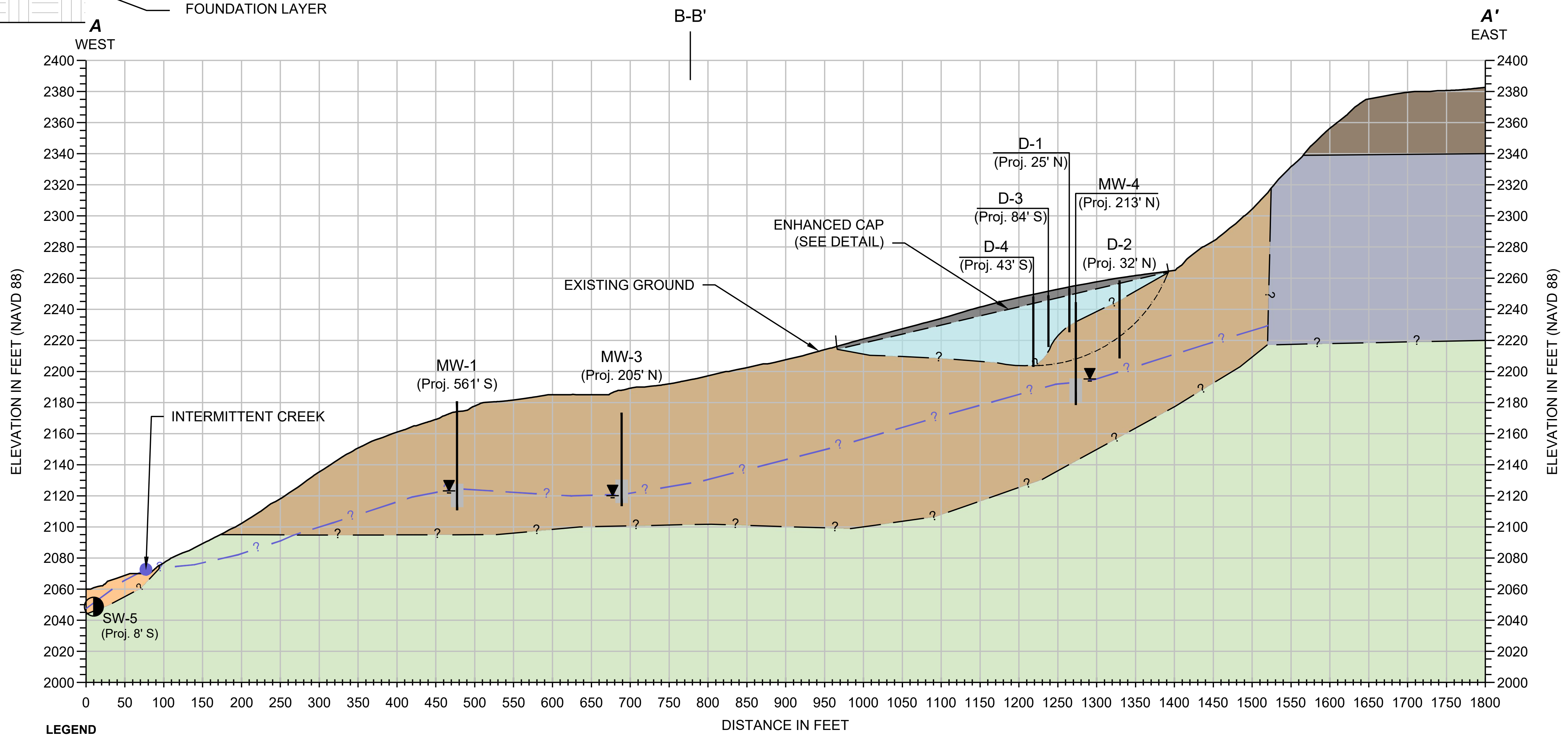
DECEMBER 2023

FIGURE 2

GIS: \\haleyaldrich.com\share\CF\Projects\0202596\GIS\Maps\2023_12\202596_001_002_GROUNDWATER_ELEVATIONS_INFERRED_FLOW.mxd - khaskins - 12/14/2023 9:42:50 AM



**ENHANCED CAP DETAIL**



**LEGEND**

— — ? — APPROXIMATE BOTTOM OF LANDFILL

— — ? — — APPROXIMATE GROUNDWATER LEVEL

🟫 ESU 1: LANDSLIDE BLOCK

🟩 ESU 2: LATAH FORMATION

🟫 ESU 3: PALOUSE FORMATION

🟪 ESU 4: BASALT

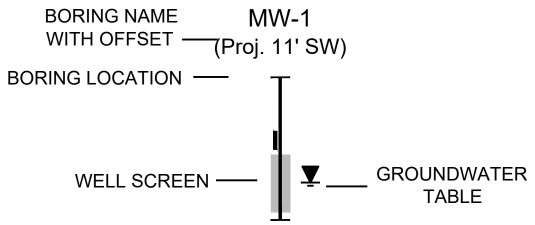
🟧 ESU 5: ALLUVIUM

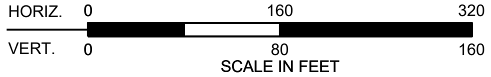
🟦 ESU 6: DROSS

**NOTES**

1. ALL LOCATIONS ARE APPROXIMATE
2. EXISTING GROUND SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS), 2019.
3. SUBSURFACE INFORMATION SOURCED FROM THE FINAL REMEDIAL INVESTIGATION REPORT (EXPONENT, 2011).
4. GROUNDWATER DATA BASED ON DEPTH TO WATER MEASUREMENTS COLLECTED ON APRIL 26TH 2023 BY HALEY & ALDRICH.
5. ENHANCED CAP DETAIL SOURCED FROM CLEANUP ACTION CONSTRUCTION COMPLETION REPORT, HART CROWSER, 2015

**LEGEND**





HALEY ALDRICH

HELGAR KRONQUIST SITE
MEAD, WASHINGTON

CROSS SECTION A-A'

DECEMBER 2023

FIGURE 3

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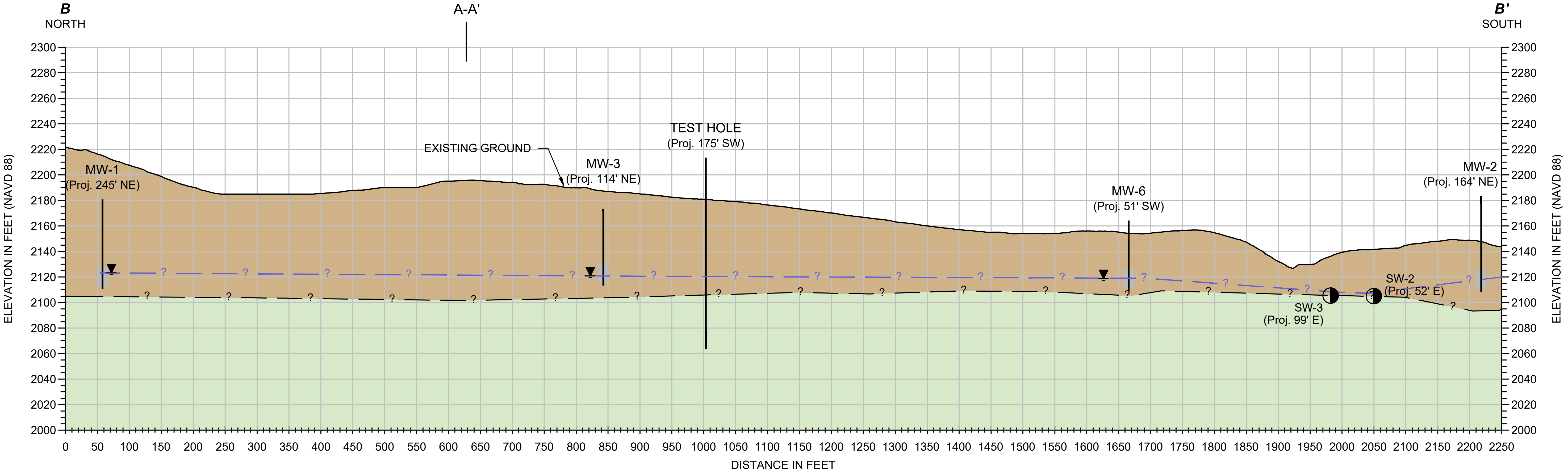
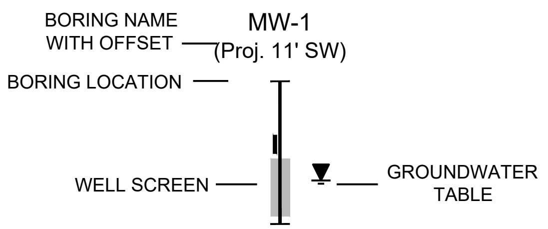
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0202596\CAD\XREFS\SEC_BB.DWG



**LEGEND**



**LEGEND**

- – – APPROXIMATE GROUNDWATER LEVEL
- ◑ SURFACE WATER SAMPLE
- 🟫 ESU 1: LANDSLIDE BLOCK
- 🟩 ESU 2: LATAH FORMATION

**NOTES**

1. ALL LOCATIONS ARE APPROXIMATE
2. EXISTING GROUND SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS). 2019,
3. SUBSURFACE INFORMATION SOURCED FROM THE FINAL REMEDIAL INVESTIGATION REPORT (EXPONENT, 2011).
4. GROUNDWATER DATA BASED ON DEPTH TO WATER MEASURMENTS COLLECTED ON APRIL 26TH 2023 BY HALEY & ALDRICH.

HORIZ. 0 140 280
VERT. 0 70 140
SCALE IN FEET

HALEY ALDRICH

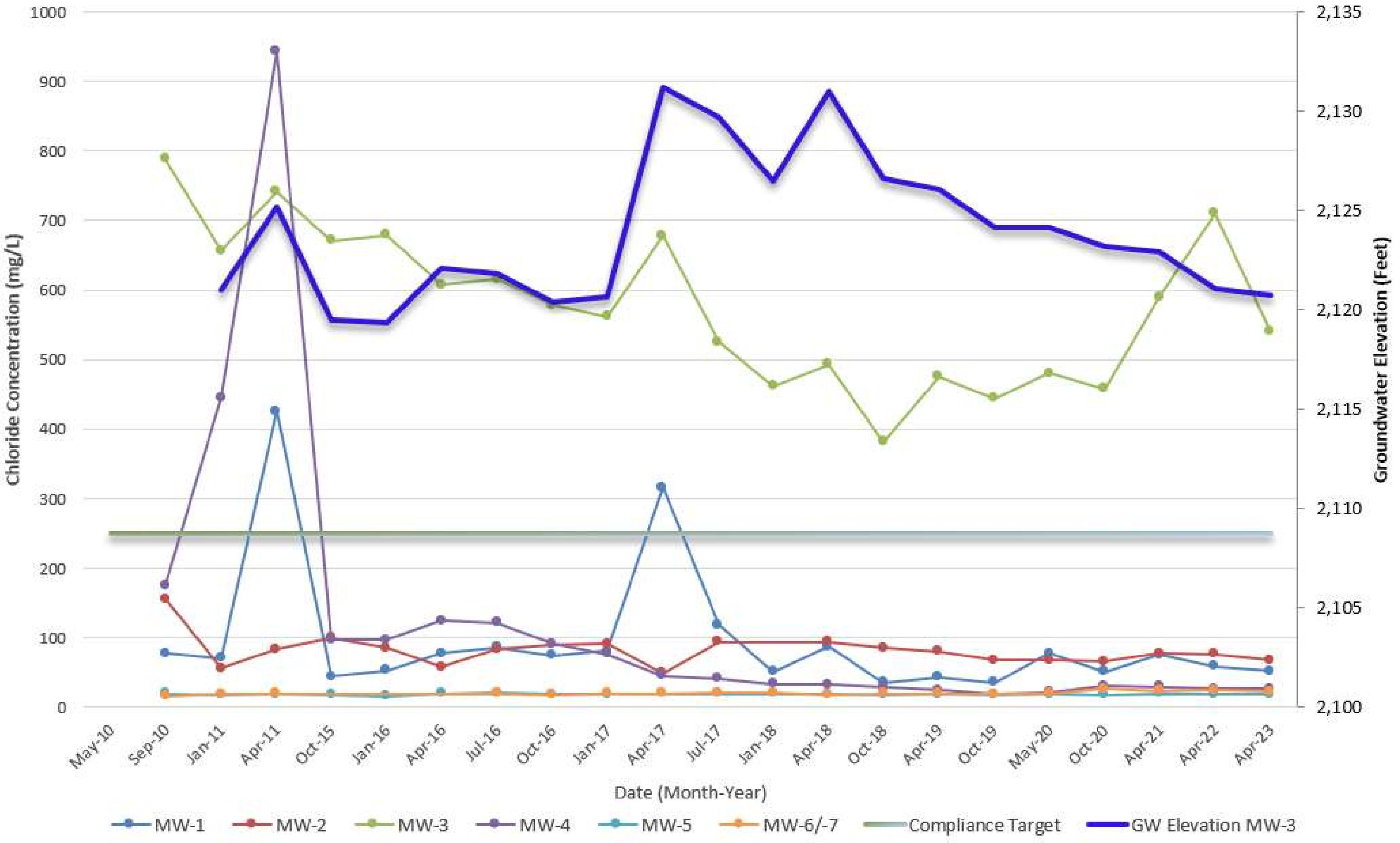
HELGAR KRONQUIST SITE
MEAD, WASHINGTON

CROSS SECTION B-B'

DECEMBER 2023

FIGURE 4

KHASKINS
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0202596\CAD\XREFS\SEC_BB.DWG
Printed: 12/15/2023 2:47 PM Sheet: 0004



Notes:

mg/L = milligrams per liter

Groundwater elevation referenced to North American Vertical Datum of 1988

**FIGURE 5**

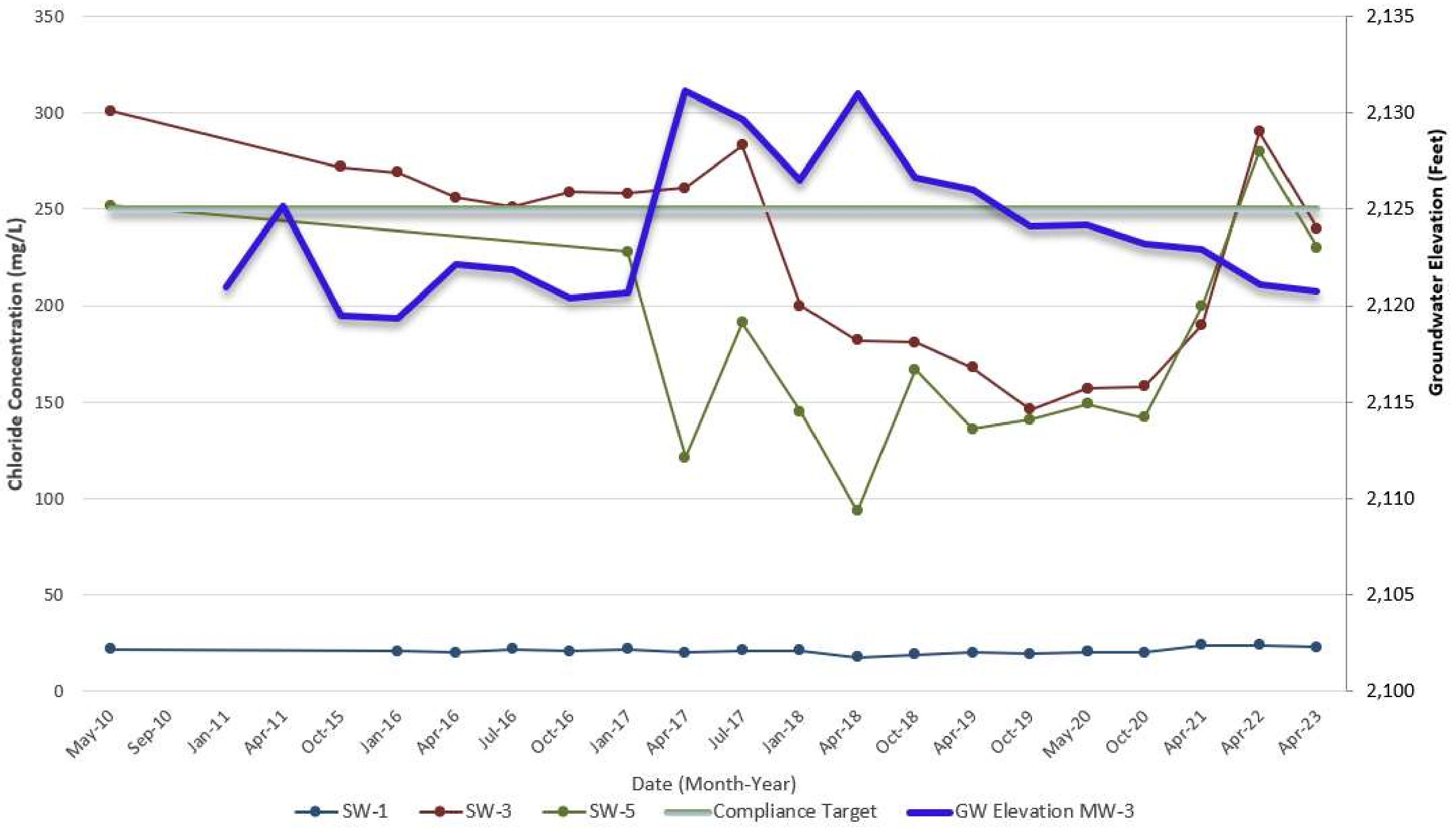
**GROUNDWATER CHLORIDE CONCENTRTAIONS VERSUS TIME**

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

HALEY ALDRICH



Notes:

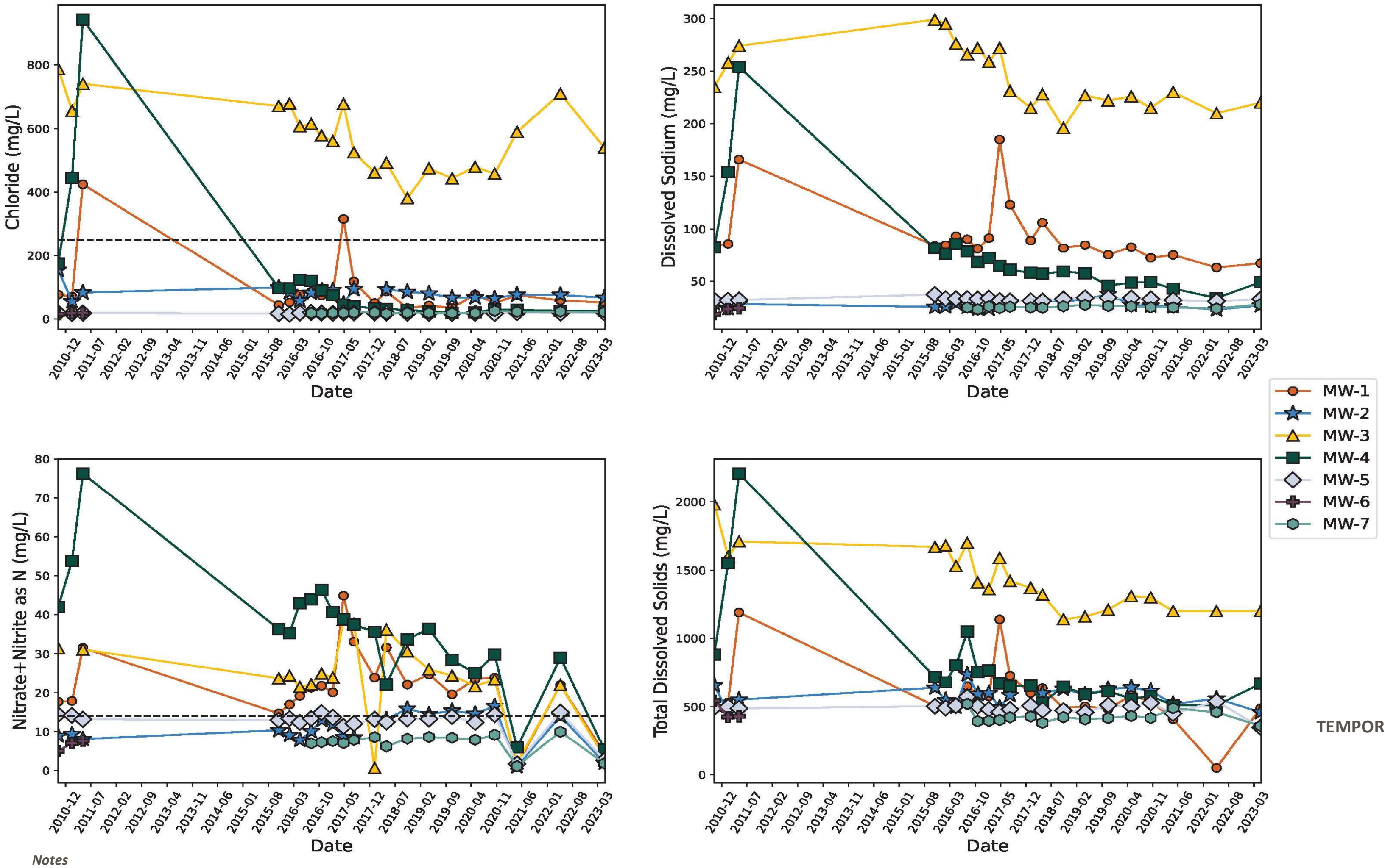
mg/L = milligrams per liter

Groundwater elevation referenced to North American Vertical Datum of 1988

**FIGURE 6**

**SURFACE WATER CHLORIDE CONCENTRATIONS VERSUS TIME**

KAISER ALUMINUM
MEAD, WASHINGTON
DECEMBER 2023



*Notes*

*mg/L = milligrams per liter*

*Date = YYYY-MM*

**FIGURE 7**

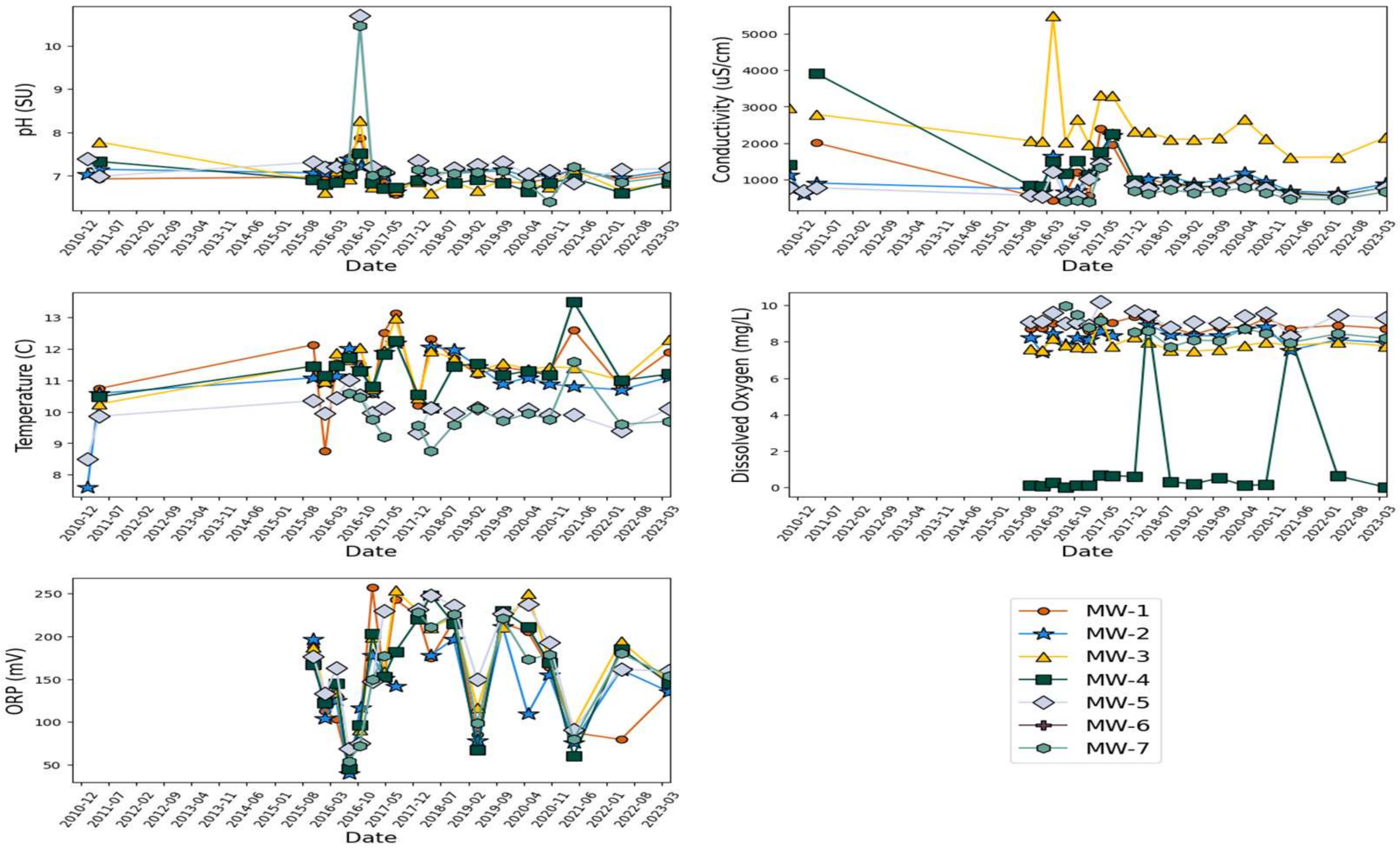
**TEMPORAL VARITAION IN MONITORING WELLS VERSUS CHEMICAL CONSTITUENTS**

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

HALEY ALDRICH



## FIGURE 8

## TEMPORAL VARITAION FOR GROUNDWATER MONITORING WELLS VERSUS IN-SITU PARAMETERS

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

***Notes***

*mV = millivolt*

*ORP = Oxidation-reduction potential*

*C° = Degrees Celsuis*

*SU = Standard Units*

*uS/cm = Microsiemens per centimeter*

*mg/L = Milligrams per Liter*

*Date = YYYY-MM*

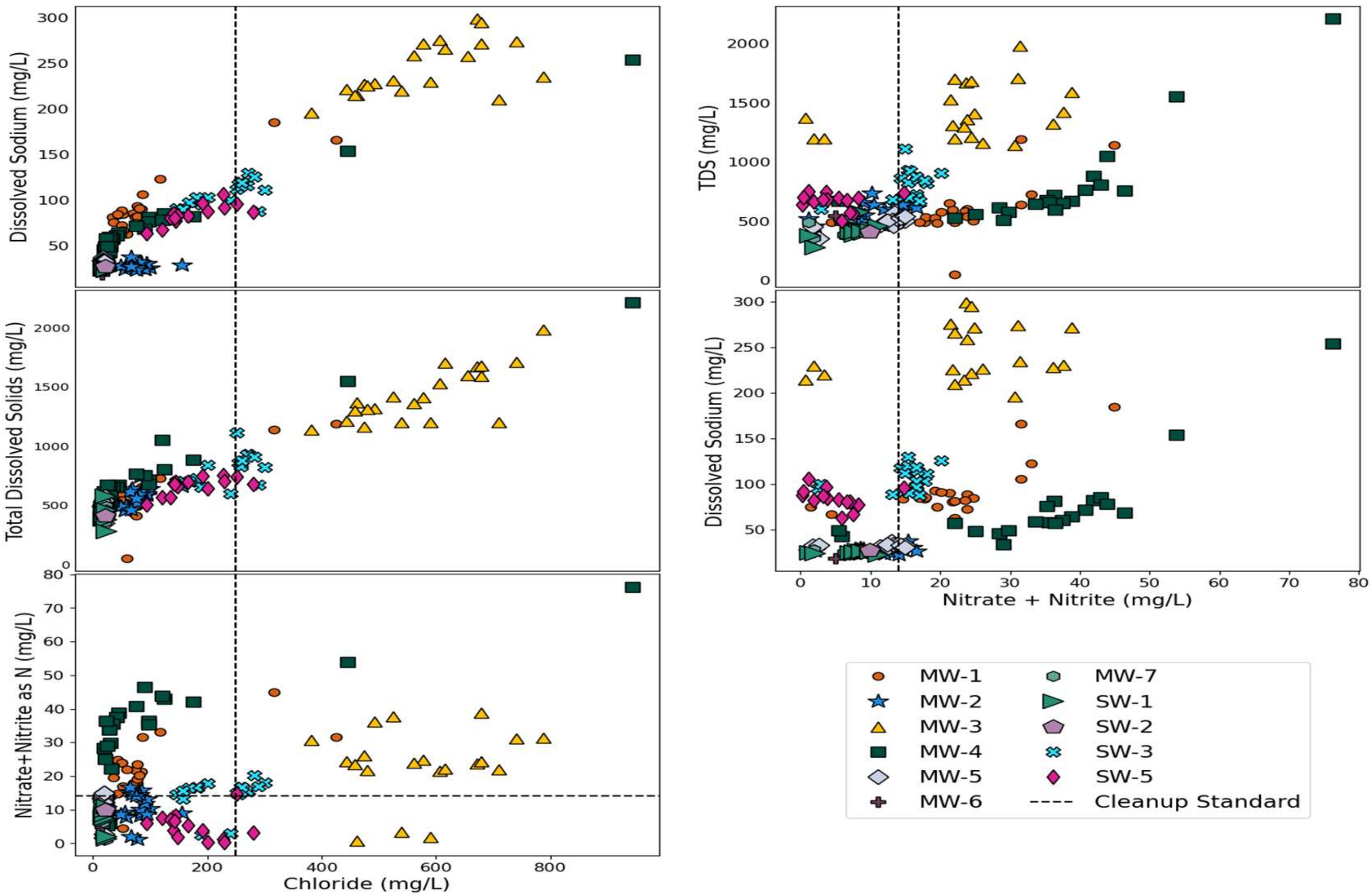


**FIGURE 9**

**CHLORIDE VERSUS CHEMICAL CONSTITUENTS**

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

***Notes***

*Dashed vertical and horizontal lines represent the cleanup standard for chloride (vertical lines; 250 mg/L) and nitrate + nitrate (horizontal line; 14 mg/L)*

*mg/L = milligrams per liter*

*TDS = Total Dissolved Solids*

*Date = YYYY-MM*

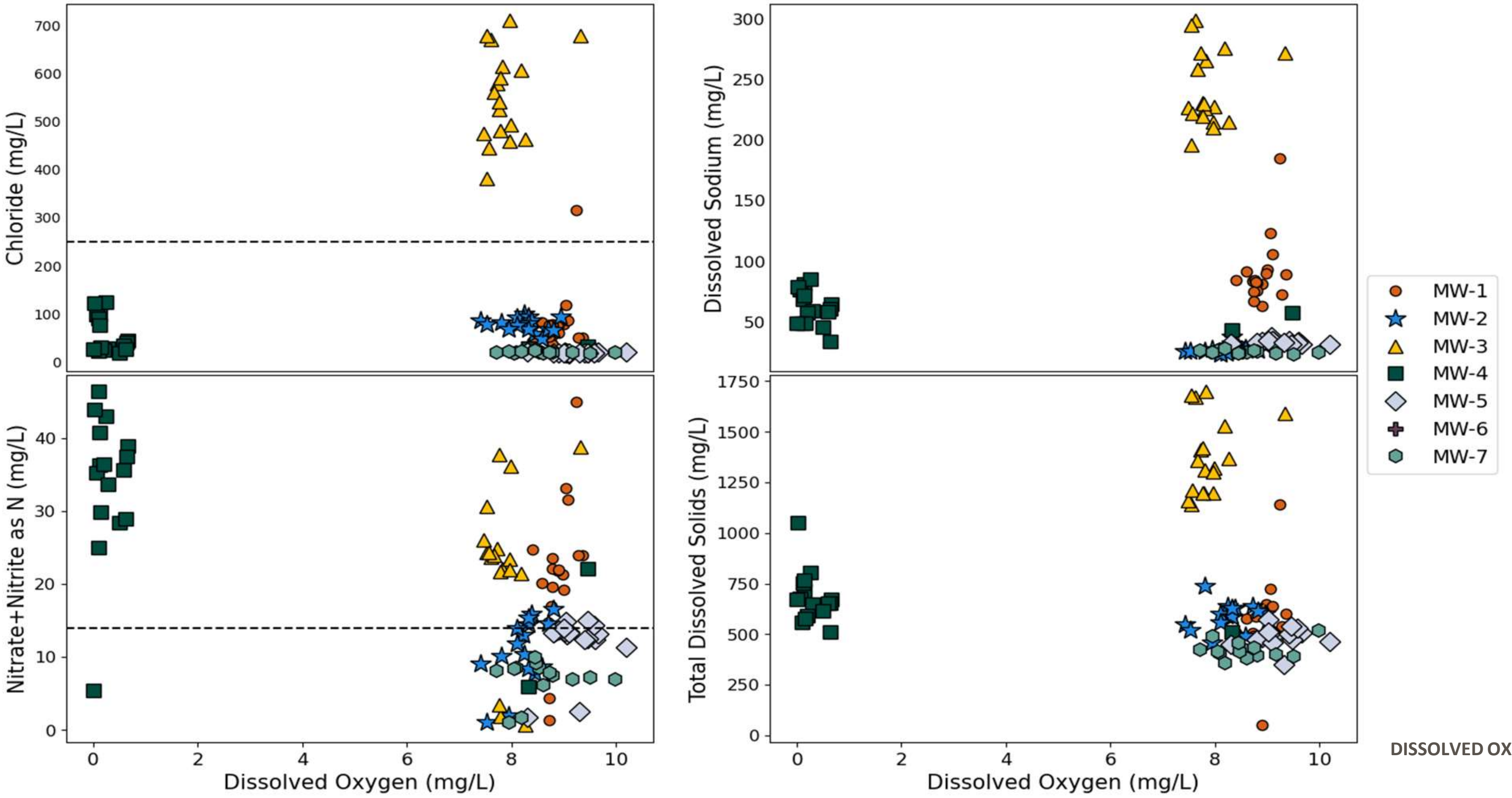


**FIGURE 10**

**DISSOLVED OXYGEN VERSUS CHEMICAL CONSTITUENTS**

KAISER ALUMINUM

MEAD, WASHINGTON

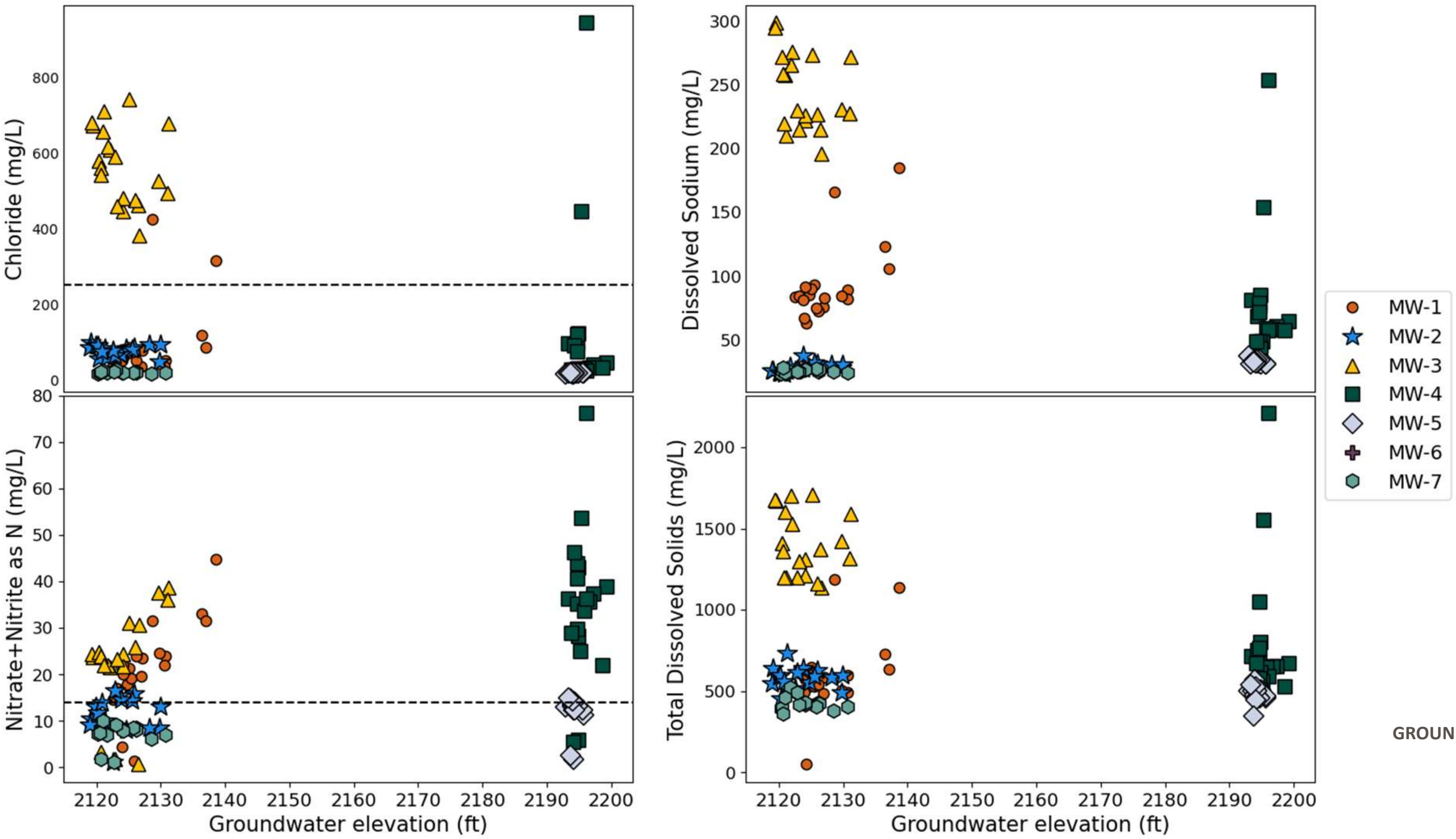
DECEMBER 2023

***Notes***

*mg/L = milligrams per liter*

*Dashed vertical and horizontal lines represent the cleanup standard for chloride (vertical lines; 250 mg/L) and nitrate + nitrate (horizontal line; 14 mg/L)*

*Date = YYYY-MM*



*Notes*

*mg/L = milligrams per liter*

*Dashed lines represent cleanup standard for chloride (250 mg/L) and nitrate + nitrite (14 mg/L).*

*Date = YYYY-MM*

**FIGURE 11**

**GROUNDWATER ELEVATION VERSUS CHEMICAL CONSTITUENTS**

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

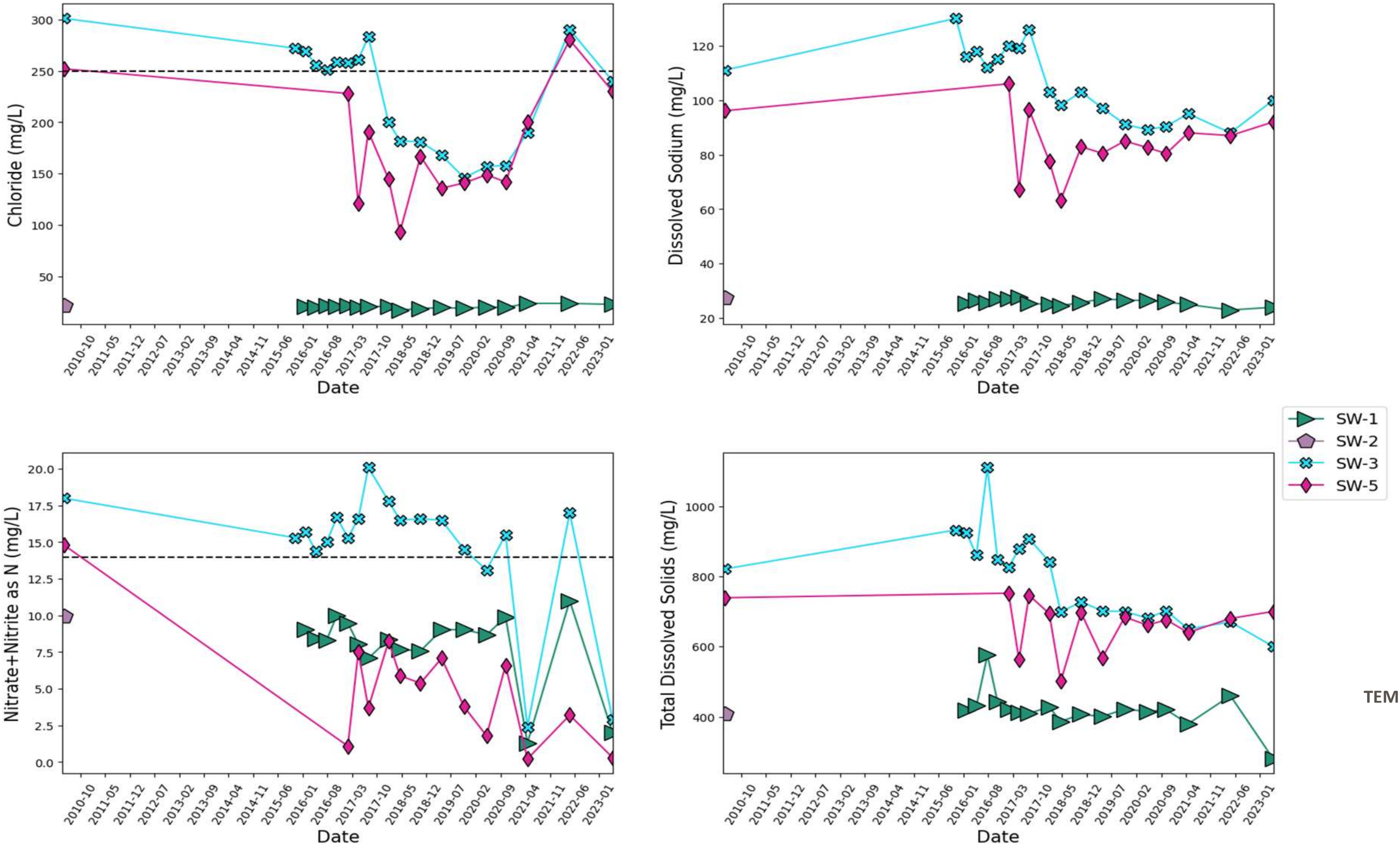


**FIGURE 12**

**TEMPORAL TRENDS FOR SURFACE WATER AND CHEMICAL CONSTITUENTS**

KAISER ALUMINUM

MEAD, WASHINGTON

DECEMBER 2023

***Notes***

*mg/L = milligrams per liter*

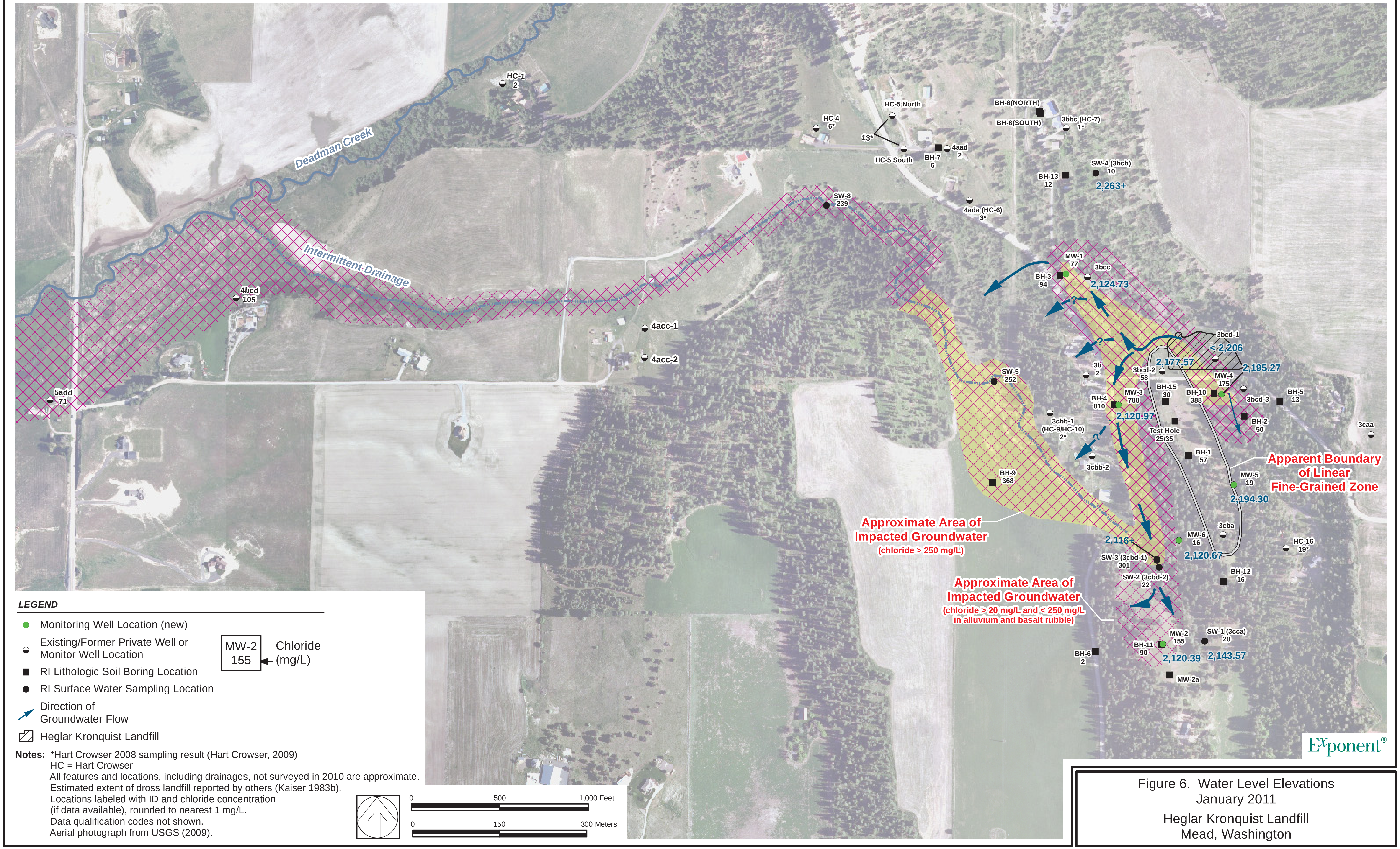
*Dashed lines represent cleanup standard for chloride (250 mg/L) and nitrate + nitrite (14 mg/L).*

*Date = YYYY-MM*

HALEY ALDRICH

# APPENDIX A

# Water Level Elevations, Figure 6 of the Exponent RI report



Notes: *Hart Crowser 2008 sampling result (Hart Crowser, 2009)
HC = Hart Crowser
All features and locations, including drainages, not surveyed in 2010 are approximate.
Estimated extent of dross landfill reported by others (Kaiser 1983b).
Locations labeled with ID and chloride concentration
(if data available), rounded to nearest 1 mg/L.
Data qualification codes not shown.
Aerial photograph from USGS (2009).

Figure 6. Water Level Elevations
January 2011
Heglar Kronquist Landfill
Mead, Washington

# APPENDIX B
# Boring Logs

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-1

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:304888.19 Easting:2524577.95
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2221.75 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 80.0 ft
∇ **FIRST ENCOUNTERED WATER** 72.0 ft / Elev 2149.8 ft
▼ **STABILIZED WATER** 68.7 ft / Elev 2153.1 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/12/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | ML | | 3.0 | Cream and brown, clayey SILT, moist. Trace clay clasts. | 2218.8 | |
| 5<br>10 | | ML | | 10.0 | Light brown, soft SILT. Dry. | 2211.8 | 5<br>10 |
| 15 | | ML | | 15.0 | Light brown SILT with trace to some clay. | 2206.8 | 15 |
| | | SM | | 16.0 | Reddish brown, fine SAND with silt. | 2205.8 | |
| 20 | | ML | | | Brown to reddish brown, soft SILT with trace clay. Silt is mica rich, and dry to slightly moist. | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-1

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 25 | | ML | | 25.0 | Brown to reddish brown, soft SILT with trace clay. Silt is mica rich, and dry to slightly moist. *(continued)* | 2196.8 | 25 |
| | | ML | | 28.5 | Light brown, clayey SILT. Slightly moist. | 2193.3 | |
| 30 | | ML | | 34.0 | Reddish brown, soft SILT. Dry. | 2187.8 | 30 |
| 35 | | ML | | 39.0 | Light brown, soft SILT with trace fine sand. Dry. | 2182.8 | 35 |
| 40<br>45 | | ML | | 45.0 | Light brown, clayey SILT. Slightly moist. | 2176.8 | 40<br>45 |
| 50 | | CL | | | Light brown, silty CLAY. Moist. | | 50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-1

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | CL | ▨ | 52.0 | Light brown, silty CLAY. Moist. *(continued)* | 2169.8 | |
| | | ML | ▨ | 53.0 | Light brown, clayey SILT. Moist. | 2168.8 | |
| 55<br>60 | | CL | ▨ | 61.0 | Light brown to grayish light brown, silty, mica rich CLAY. Moist. | 2160.8 | 55<br>60 |
| 65<br>70 | | CL | ▨ | ▼<br>72.0 ▽ | Light grayish brown CLAY with some silt. Moist. Harder drilling. | 2149.8 | 65<br>70 |
| 75<br>80 | | ML | ▨ | 80.0 | Dark brown, clayey, mica rich SILT. Moist to wet. | 2141.8 | 75<br>80 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-2

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305123.51 Easting:2524879.67
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2264.55 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 80.0 ft
▽ **FIRST ENCOUNTERED WATER** 75.0 ft / Elev 2189.6 ft
▼ **STABILIZED WATER** 75.7 ft / Elev 2188.9 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/11/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| SAMPLE TYPE NUMBER | U.S.C.S. | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) |
|---|---|---|---|---|
| | ML | 1.5 | Dark brown SILT with trace clay. Moist. | 2263.1 |
| | ML | 6.0 | Brown clayey SILT with trace basalt gravel. Dry. | 2258.6 |
| | GM | 9.0 | Silty, fine to course, angular to subangular basalt GRAVEL with trace latah gravel. Dry. Silt decreases with depth. | 2255.6 |
| | GP | 15.0 | Fine to course, angular to subangular, vesicular, basalt GRAVEL with trace silt. Dry. | 2249.6 |
| | GM | 16.5 | Silty basalt GRAVEL. Dry. | 2248.1 |
| | GP | | Angular to subangular, fine to course, basalt GRAVEL with intermittent silty and clayey basalt gravel. (Boulders) | |

DEPTH (feet): 5, 10, 15, 20

(Continued Next Page)

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-2

PAGE 2 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | Angular to subangular, fine to course, basalt GRAVEL with intermittent silty and clayey basalt gravel. (Boulders) *(continued)* | | |
| 25 | | | | | | | 25 |
| | | GP | | | | | |
| 30 | | | | | | | 30 |
| | | | | 33.0 | | 2231.6 | |
| | | | | | Basalt. Cuttings mostly angular and course. Hard Drilling. Intermittent silt/clay strata. Dry from 33' bgs to 75'bgs. Moist to wet from 75'bgs to 78.5' bgs, then dry. | | |
| 35 | | | | | | | 35 |
| 40 | | | | | | | 40 |
| 45 | | | | | | | 45 |
| 50 | | | | | | | 50 |

*(Continued Next Page)*

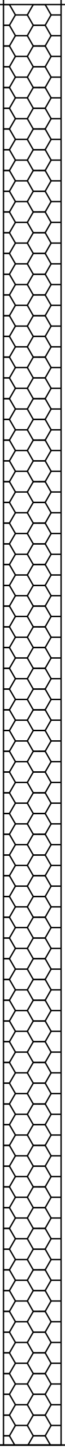
**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-2

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION<br>. | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | |  | | Basalt. Cuttings mostly angular and course. Hard Drilling. Intermittent silt/clay strata. Dry from 33' bgs to 75'bgs. Moist to wet from 75'bgs to 78.5' bgs, then dry. *(continued)* | | |
| 55 | | | | | | | 55 |
| 60 | | | | | | | 60 |
| 65 | | | | | | | 65 |
| 70 | | | | | | | 70 |
| 75 | | | | ∇<br>▼ | | | 75 |
| 80 | | | | 80.0 | | 2184.6 | 80 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305866.78 Easting:2523800.69
**OVA EQUIPMENT**
**GROUND ELEVATION** 2180.61 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 69.0 ft
∇ **FIRST ENCOUNTERED WATER** 60.0 ft / Elev 2120.6 ft
▼ **STABILIZED WATER** 55.6 ft / Elev 2125.0 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/11/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 5 | | GM | | 5.0 | Silty, angular to subangular basalt GRAVEL. Moist. | 2175.6 | 5 |
| | | | | 6.0 | Basalt Boulder | 2174.6 | |
| 10 | | ML | | 10.0 | Reddish brown SILT with trace clay and course, angular latah gravel. Slightly moist. | 2170.6 | 10 |
| 15 | | CL | | 14.5 | Bluish gray and reddish brown silty CLAY. Slightly moist. (Saprolite?) Becomes clayey SILT at 13' bgs. | 2166.1 | 15 |
| 20 | | ML | | | Light brown, soft SILT with trace to some angular to mostly subangular basalt gravel. Dry. Trace to some fine to medium sand from 17' bgs to 17.5' bgs. | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | ML | | 23.0 | Light brown, soft SILT with trace to some angular to mostly subangular basalt gravel. Dry. Trace to some fine to medium sand from 17' bgs to 17.5' bgs. *(continued)* | 2157.6 | |
| 25<br>30 | | ML | | 30.5 | Gravelly SILT. Gravel is mostly course, angular to subangular basalt. Dry. | 2150.1 | 25<br>30 |
| 35<br>40 | | ML | | 40.0 | Brown SILT with fine sand. Dry to slightly moist. | 2140.6 | 35<br>40 |
| 45 | | SP | | 45.0 | Fine to medium SAND with silt and fine to course basalt gravel. | 2135.6 | 45 |
| | | GP | | 48.0 | Subangular to subrounded, course to fine basalt GRAVEL with some to trace silt. | 2132.6 | |
| 50 | | | | | Basalt with intermittent interbeds of silt, clay and fine sand. Moist beginning at 55' bgs. | | 50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-3

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION<br>. | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | Basalt with intermittent interbeds of silt, clay and fine sand. Moist beginning at 55' bgs. *(continued)* | | |
| 55 | | | | | | | 55 |
| | | | | ▼ | | | |
| 60 | | | | ▽ | | | 60 |
| 65 | | | | | | | 65 |
| | | | | 69.0 | | 2111.6 | |

## COMMENTS

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

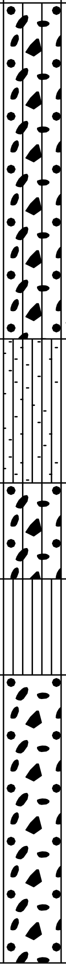
# BORING NUMBER BH-4

PAGE 1 OF 2

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305152.23 Easting:2524141.14
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2170.69 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 50.0 ft
∇ **FIRST ENCOUNTERED WATER** 50.0 ft / Elev 2120.7 ft
▼ **STABILIZED WATER** 47.7 ft / Elev 2123.0 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/11/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 5 | | GM | | 7.0 | Silty basalt GRAVEL. Moist. | 2163.7 | 5 |
| 10 | | ML | | 10.0 | Brown SILT with fine sand and trace basalt gravel. Slightly moist. | 2160.7 | 10 |
| | | GM | | 12.0 | Silty basalt GRAVEL. Dry. | 2158.7 | |
| | | ML | | 14.0 | Brown SILT with fine sand. Dry. | 2156.7 | |
| 15<br>20 | | GP | | | Basalt boulders with intermittent silt strata in between. Silt strata slightly moist, otherwise dry. Basalt cuttings are angular to subangular, fine to course, and vesicular. | | 15<br>20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-4

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 25<br>30<br>35 | | GP | | 37.0 | Basalt boulders with intermittent silt strata in between. Silt strata slightly moist, otherwise dry. Basalt cuttings are angular to subangular, fine to course, and vesicular. *(continued)* | 2133.7 | 25<br>30<br>35 |
| 40<br>45<br>50 | | | | ▼<br>50.0 ∇ | Basalt. | 2120.7 | 40<br>45<br>50 |

## COMMENTS

**APPROVED BY:** ______________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

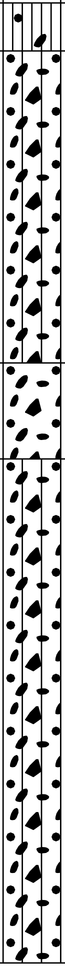
# BORING NUMBER BH-5

PAGE 1 OF 4

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305216.84 Easting:2525077.77
**OVA EQUIPMENT**
**GROUND ELEVATION** 2289.56 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 103.0 ft
∇ **FIRST ENCOUNTERED WATER** 100.0 ft / Elev 2189.6 ft
▼ **STABILIZED WATER** 99.1 ft / Elev 2190.5 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/10/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ML | | 1.0 | Brown gravelly SILT. Dry. | 2288.6 | |
| | | | | GM | | 7.5 | Course to fine, angular to subangular, silty basalt GRAVEL. Dry. Percent silt content variable from increasing to decreasing at approximately 1' intervals. | 2282.1 | |
| 5 | | | | | | | | | 5 |
| | | | | GP | | 9.5 | Fine to course, angular to subrounded basalt GRAVEL with silt. Dry. | 2280.1 | |
| | | | | GM | | | Fine to course, angular to subangular, silty, vesicular basalt GRAVEL. Dry. | | |
| 10 | | | | | | | | | 10 |
| 15 | | | | | | | | | 15 |
| 20 | | | | | | | | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-5

PAGE 2 OF 4

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | GM | | 21.0 | Fine to course, angular to subangular, silty, vesicular basalt GRAVEL. Dry. *(continued)* | 2268.6 | |
| | | | | GP | | | Fine to course, angular to subangular, highly vesicular basalt GRAVEL with trace to some silt. Basalt boulder from 41.5' to 43'. | | |
| 25 | | | | | | | | | 25 |
| 30 | | | | | | | | | 30 |
| 35 | | | | | | | | | 35 |
| 40 | | | | | | | | | 40 |
| 45 | | | | | | 45.0 | | 2244.6 | 45 |
| | | | | ML | | | Brown SILT with trace to some gravel. Moist. Trace clay from 49' to 50'. | | |
| 50 | | | | | | 50.0 | | 2239.6 | 50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-5

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | GP | | 54.0 | Fine basalt GRAVEL with trace to some moist silt. | 2235.6 | |
| 55 | | | | GM | | 55.0 | Silty basalt GRAVEL. Moist. | 2234.6 | 55 |
| 60 | | | | ML | | 64.5 | Brown, clayey SILT with trace to some gravel. Gravel is mixture of garnet+quartz bearing plutonic lithology to ingenous basalt. From 58' to 61', gravels are mostly mica and quartz bearing. From 61' to 64.5', gravels are strictly basalt. | 2225.1 | 60 |
| 65 | | | | GP | | 69.0 | Mostly course, some fine basalt GRAVEL, trace silt. Dry. Possible boulder. | 2220.6 | 65 |
| 70<br>75 | | | | GM | | 77.0 | Fine to course basalt GRAVEL with intermittent increasing to decreasing percent silt content. Trace plutonic gravel at 73.5'. Slightly moist to dry. | 2212.6 | 70<br>75 |
| 80 | | | | GM | | | Fine to course basalt GRAVEL with reddish brown silt and fine sand, trace plutonic gravel. Moist. | | 80 |

(Continued Next Page)

**COMMENTS**

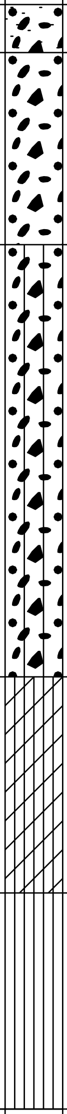
**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-5

PAGE 4 OF 4



| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | GM | | 81.0 | | 2208.6 | |
| | | | | GP | | | Fine to course basalt GRAVEL with brown silt. Dry. | | |
| 85 | | | | | | 85.0 | | 2204.6 | 85 |
| | | | | GM | | | Fine to course silty basalt GRAVEL. Slightly moist. Gravel become mostly fine from 86' to 87'. Some angular latah gravel from 93' to 94'. | | |
| 90 | | | | | | | | | 90 |
| | | | | | | 94.0 | | 2195.6 | |
| | | | | ML | | | Bluish cream and rusty orange-red clayey SILT. Rusty orange red sediment in swirl pattern within the bluish gray (saprolite?). Dry, then becomes moist at 97'. | | |
| 95 | SS<br>BH-5 d 95 | ☒ | 42-6<br>50-3 | | | | | | 95 |
| | | | | | | 98.5 | | 2191.1 | |
| | | | | ML | | ▼<br>▽ | Brown, soft, mica rich SILT with trace fine to medium sand. Wet at 100'. | | |
| 100 | | | | | | | | | 100 |
| | | | | | | 103.0 | | 2186.6 | |

**COMMENTS**

**APPROVED BY:** ______________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-6

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:303751.83 Easting:2524105.04
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2098.41 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 60.0 ft
∇ **FIRST ENCOUNTERED WATER** 60.0 ft / Elev 2038.4 ft
▼ **STABILIZED WATER** 57.0 ft / Elev 2041.4 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/12/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | ML | ▥ | 1.5 | Brown clayey SILT with subrounded basalt and quartz monzonite gravel. Dry. | 2096.9 | |
| | | ML | ▥ | 4.0 | Brown, soft SILT with trace basalt gravel. Dry. | 2094.4 | |
| 5<br>10 | | GM | ● | 10.0 | Subangular to subrounded, silty basalt GRAVEL. Dry. | 2088.4 | 5<br>10 |
| | | CL | ▨ | 12.0 | Cream silty CLAY. Moist. | 2086.4 | |
| | | ML | ▨ | 14.0 | Cream clayey SILT. Moist. | 2084.4 | |
| 15 | | ML | ▥ | 15.0 | Brown to reddish brown, soft SILT with trace clay. Dry. | 2083.4 | 15 |
| | | ML | ▨ | 16.5 | Light brown clayey SILT. Moist. | 2081.9 | |
| | | ML | ▥ | 18.0 | Brown to light brown soft SILT. Moist. | 2080.4 | |
| 20 | | ML | ▨ | | Brown to light brown clayey SILT. Moist. | | 20 |

(Continued Next Page)

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-6

PAGE 2 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | ML | | 21.0 | Brown to light brown clayey SILT. Moist. *(continued)* | 2077.4 | |
| 25<br>30<br>35 | | CL | | 35.0 | Light brown to brown silty CLAY. Moist. Becomes mica rich at 23'. | 2063.4 | 25<br>30<br>35 |
| 40 | | ML | | 41.0 | Brown clayey SILT. Moist. | 2057.4 | 40 |
| 45<br>50 | | CL | | | Brown, silty, mica rich CLAY. Becomes moist to wet at approximately 55'. | | 45<br>50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

## BORING NUMBER BH-6

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 55<br>60 |  | CL | ▨ | ▼<br>60.0 ∇ | Brown, silty, mica rich CLAY. Becomes moist to wet at approximately 55'. *(continued)* | 2038.4 | 55<br>60 |

**COMMENTS**

**APPROVED BY:** ______________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-7

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:306552.73 Easting:2523076.91
**OVA EQUIPMENT**
**GROUND ELEVATION** 2073.21 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 60.0 ft
**FIRST ENCOUNTERED WATER** ---
▼ **STABILIZED WATER** 43.6 ft / Elev 2029.6 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/13/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | ML | | 7.0 | Dark brown SILT with trace clay, some fine, angular to subrounded quartz monzonite gravel. Moist. | 2066.2 | 5 |
| | | | | SP | | 9.0 | Brown, fine to medium SAND, trace silt. Wet. | 2064.2 | |
| 10 | | | | GP | | 12.0 | Angular to subrounded basalt and quartz monzonite GRAVEL with medium to fine sand. Wet. | 2061.2 | 10 |
| 15<br>20 | | | | ML | | | Gravelly SILT with fine to medium sand. Gravels are fine and subangular. Decreasing moisture with depth. | | 15<br>20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-7

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ML | | 21.0 | | 2052.2 | |
| 25 | | | | SP | | 25.0 | Brown, fine SAND with silt, trace clay, trace fine gravel. Moist. Increasing clay content with depth. | 2048.2 | 25 |
| | | | | ML | | 27.0 | Brown SILT with clay, some to trace fine to medium sand. Some bluish gray clay clasts. | 2046.2 | |
| 30 | | | | SP | | 30.0 | Medium SAND with fine sand and silt, some rounded, fine quartz monzonite, mica rich gravel. Increasing silt and gravel content with depth. | 2043.2 | 30 |
| | | | | SP | | 33.0 | Reddish brown, fine to medium SAND with silt. Moist to wet. | 2040.2 | |
| 35 | | | | ML | | 35.0 | SILT with clay and fine gravel. | 2038.2 | 35 |
| | | | | CL | | 39.0 | Light brown, silty CLAY with fine to medium sand and fine gravel. Dry. | 2034.2 | |
| 40 | | | | CL | | 41.0 | Cream CLAY with reddish brown fine sand and mica rich silt. Dry. | 2032.2 | 40 |
| | | | | CL | | 42.0 | Cream, silty, mica rich CLAY. Dry. | 2031.2 | |
| 45 | | | | ML | | ▼<br>48.0 | Reddish brown, soft SILT with trace to some clay and trace fine, subrounded quartz monzonite gravel. Moist. | 2025.2 | 45 |
| 50 | | | | ML | | | Reddish brown SILT with fine to medium sand and fine rounded to subrounded quartz monzonite gravel. (Weathered Bedrock). Slightly moist. Wet at approximately 59' bgs. | | 50 |

(Continued Next Page)

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-7

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 55<br>60 | | | | ML | | | Reddish brown SILT with fine to medium sand and fine rounded to subrounded quartz monzonite gravel. (Weathered Bedrock). Slightly moist. Wet at approximately 59' bgs. *(continued)* | | 55<br>60 |
| | SS<br>BH-7 d 60 | ☒ | 16<br>12 | | | 60.5<br>61.5 | Quartz monzonite | 2012.7<br>2011.7 | |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-8 North

**PROJECT LOCATION** Mead, Washington

**DRILLING CONTRACTOR** Environmental West Exploration

**PROJECT NUMBER** 0907194.000

**DRILLING METHOD** Air Rotary

**LOCATION** Northing:306786.94 Easting:2523641.03

**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

**OVA EQUIPMENT**

**GROUND ELEVATION** 2226.78 ft **HOLE DIAMETER** 6"

**TOP OF CASING ELEVATION** **HOLE DEPTH** 35.0 ft

**FIRST ENCOUNTERED WATER** ---

**STABILIZED WATER** ---

**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/5/10

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | See log BH-8 South | | |
| 5 | | | | | | | 5 |
| 10 | | | | | | | 10 |
| 15 | | | | | | | 15 |
| 20 | | | | | | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-8 North

PAGE 2 OF 2

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | 23.0 | See log BH-8 South *(continued)* | 2203.8 | |
| 25 | | SP | | 27.0 | Light brown, fine to medium SAND, some silt. Dry. Increasing silt with depth. | 2199.8 | 25 |
| 30<br>35 | | | | 35.0 | Basalt. Cuttings are mostly course with trace fine. Intermittent silt until 34' bgs, then no silt. | 2191.8 | 30<br>35 |

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

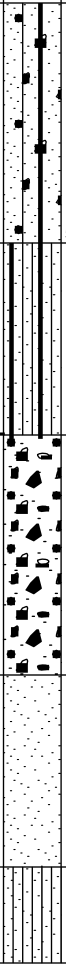
# BORING NUMBER BH-8 South

PAGE 1 OF 2

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:306777.19 Easting:2523644.00
**OVA EQUIPMENT**
**GROUND ELEVATION** 2227.14 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 34.0 ft
**FIRST ENCOUNTERED WATER** ---
**STABILIZED WATER** ---
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/5/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 5 | | SP | | 5.0 | Brown, fine to medium SAND, trace silt, some fine to course gravel. Moist. Incresing silt with depth. | 2222.1 | 5 |
| | | ML | | 9.0 | Brown to light brown SILT with fine sand and trace fine, angular to subangular gravel. Moist. | 2218.1 | |
| 10 | | GP | | 14.0 | Fine to course, angular to subangular baslat GRAVEL with some medium sand. Increasing sand content with depth. | 2213.1 | 10 |
| 15 | | SP | | 18.0 | Brown, medium to fine SAND, trace silt. Increasing silt content with depth. | 2209.1 | 15 |
| 20 | | ML | | | Brown to light brown SILT with fine sand. Dry. | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-8 South

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | ML | | 22.0 | Brown to light brown SILT with fine sand. Dry. *(continued)* | 2205.1 | |
| | | SP | | 24.0 | Gravelly fine SAND with silt. Gravel are angular to subangular basalt. | 2203.1 | |
| 25<br>30 | | | | 34.0 | Basalt. | 2193.1 | 25<br>30 |

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-9

PAGE 1 OF 2

**PROJECT LOCATION** Mead, Washington
**DRILLING CONTRACTOR** Environmental West Exploration
**PROJECT NUMBER** 0907194.000
**DRILLING METHOD** Air Rotary
**LOCATION** Northing:304678.05 Easting:2523477.20
**STAMP (IF APPLICABLE) AND/OR NOTES**
**OVA EQUIPMENT**

Supervising Geologist: Steve Reed - Exponent

**GROUND ELEVATION** 2065.65 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 20.0 ft
∇ **FIRST ENCOUNTERED WATER** 0.5 ft / Elev 2065.2 ft
▼ **STABILIZED WATER** 5.7 ft / Elev 2060.0 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/7/10

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ∇ | Brown, soft SILT with fine sand and clay. Becomes light grayish brown at 5' bgs. Intermittent increasing and decreasing clay content. Moist to wet at 12' bgs. | | |
| 2.5 | | | | | | | | | 2.5 |
| 5.0 | | | | ML | | | | | 5.0 |
| | | | | | | ▼ | | | |
| 7.5 | | | | | | | | | 7.5 |
| 10.0 | | | | | | | | | 10.0 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** 
**DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-9

PAGE 2 OF 2

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ML | | | Brown, soft SILT with fine sand and clay. Becomes light grayish brown at 5' bgs. Intermittent increasing and decreasing clay content. Moist to wet at 12' bgs. *(continued)* | | |
| 12.5 | | | | | | | | | 12.5 |
| 15.0 | | | | | | | | | 15.0 |
| 17.5 | | | | | | | | | 17.5 |
| 20.0 | | | | | | 20.0 | | 2045.7 | 20.0 |
| | SS<br>BH-9 d 20 | ☒ | 16<br>50 | ML | | | Very stiff to hard, brown clayey SILT with red, swirling silt bands and mica (saprolite?) | | |
| | | | | | | 21.5 | | 2044.2 | |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-10

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305242.03 Easting:2524703.30
**OVA EQUIPMENT**
**GROUND ELEVATION** 2238.78 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 55.0 ft
**FIRST ENCOUNTERED WATER** ---
▼ **STABILIZED WATER** 45.0 ft / Elev 2193.8 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/6/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | SP | | 2.0 | Dark brown fine SAND with silt and gravel. Moist. | 2236.8 | |
| | | | | SP | | 4.0 | Grayish brown, fine gravelly SAND. | 2234.8 | |
| 5 | | | | GP | | 10.0 | Fine to course, angular to subangular, vesicular basalt GRAVEL, trace fines. | 2228.8 | 5 |
| 10 | | | | ML | | 12.0 | Dark brown SILT with fine sand. Slightly moist. | 2226.8 | 10 |
| 15<br>20 | | | | | | | Angular to subangular basalt cuttings with intermittent increasing and decreasing silt content. Dry. Becomes moist at 49' bgs. | | 15<br>20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-10

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Angular to subangular basalt cuttings with intermittent increasing and decreasing silt content. Dry. Becomes moist at 49' bgs. *(continued)* | | |
| 25 | | | | | | | | | 25 |
| 30 | | | | | | | | | 30 |
| 35 | | | | | | | | | 35 |
| 40 | | | | | | | | | 40 |
| 45 | | | | | | ▼ | | | 45 |
| 50 | | | | | | 50.0 | | 2188.8 | 50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-10

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | SS<br>BH-10 d 50 | ☒ | 50<br>50 | SP | | 53.0 | Gravelly, silty fine SAND. Wet. | 2185.8 | |
| 55 | | | | GP | | 55.0 | Fine to course, silty basalt GRAVEL. Very hard drilling at 55' bgs. | 2183.8 | 55 |

**COMMENTS**

**APPROVED BY:** ______________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-11

**PROJECT LOCATION** Mead, Washington

**DRILLING CONTRACTOR** Environmental West Exploration

**PROJECT NUMBER** 0907194.000

**DRILLING METHOD** Air Rotary

**LOCATION** Northing:303812.46 Easting:2524478.96

**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

**OVA EQUIPMENT**

**GROUND ELEVATION** 2182.95 ft **HOLE DIAMETER** 6"

**TOP OF CASING ELEVATION** **HOLE DEPTH** 68.0 ft

∇ **FIRST ENCOUNTERED WATER** 65.0 ft / Elev 2118.0 ft

▼ **STABILIZED WATER** 62.0 ft / Elev 2121.0 ft

**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/7/10

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 5 |  | ML |  | 7.0 | Brown SILT with fine sand and course, angular basalt gravel. Slightly moist. Decreasing gravel content with depth. | 2176.0 | 5 |
| 10 |  | ML |  | 13.0 | Brown, soft, mica rich SILT with fine sand. Slightly moist at 12' bgs. | 2170.0 | 10 |
| 15<br>20 |  | GP |  |  | Angular to subangular, fine to course, vesicular, basalt GRAVEL with intermittent increasing and decreasing sand and silt content. Dry to slightly moist. |  | 15<br>20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

## BORING NUMBER BH-11

PAGE 2 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | Angular to subangular, fine to course, vesicular, basalt GRAVEL with intermittent increasing and decreasing sand and silt content. Dry to slightly moist. *(continued)* | | |
| 25 | | | | | | | 25 |
| 30 | | | | | | | 30 |
| 35 | | GP | | | | | 35 |
| 40 | | | | | | | 40 |
| 45 | | | | | | | 45 |
| 50 | | | | | | | 50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-11

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 55 | | GP | | 56.0 | Angular to subangular, fine to course, vesicular, basalt GRAVEL with intermittent increasing and decreasing sand and silt content. Dry to slightly moist. *(continued)* | 2127.0 | 55 |
| 60<br>65 | | | | ▼<br>▽<br>68.0 | Basalt. Very Hard Drilling. Cuttings are angular, non-vesicular. Becomes moist to wet at 65' bgs, then dry at 66' bgs. | 2115.0 | 60<br>65 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-12

PAGE 1 OF 4

**PROJECT LOCATION** Mead, Washington

**PROJECT NUMBER** 0907194.000

**LOCATION** Northing:304186.20 Easting:2524808.80

**OVA EQUIPMENT**

**GROUND ELEVATION** 2202.22 ft **HOLE DIAMETER** 6"

**TOP OF CASING ELEVATION** **HOLE DEPTH** 95.0 ft

**FIRST ENCOUNTERED WATER** ---

▼ **STABILIZED WATER** 77.0 ft / Elev 2125.2 ft

**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/5/10

**DRILLING CONTRACTOR** Environmental West Exploration

**DRILLING METHOD** Air Rotary

**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 5 | | | ⬡ | 6.0 | Basalt with trace silt. Dry. | 2196.2 | 5 |
| | | SP | ░ | 9.5 | Light brown, fine to course SAND with silt. Dry. | 2192.7 | |
| 10<br>15<br>20 | | | ⬡ | | Basalt with intermittent increasing and decreasing sand and silt. | | 10<br>15<br>20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-12

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 25 | | | ⬡ | 25.0 | Basalt with intermittent increasing and decreasing sand and silt. *(continued)* | 2177.2 | 25 |
| | | ML | ▥ | 28.0 | Light brown to brown SILT. Dry. | 2174.2 | |
| 30<br>35<br>40<br>45<br>50 | | | ⬡ | | Basalt (boulders?) with intermittent increasing and decreasing sand and silt. Very hard drilling at 46' bgs and 83' bgs. Sand and silt strata moist after 50' bgs. | | 30<br>35<br>40<br>45<br>50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-12

PAGE 3 OF 4

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | Basalt (boulders?) with intermittent increasing and decreasing sand and silt. Very hard drilling at 46' bgs and 83' bgs. Sand and silt strata moist after 50' bgs. *(continued)* | | |
| 55 | | | | | | | 55 |
| 60 | | | | | | | 60 |
| 65 | | | | | | | 65 |
| 70 | | | | | | | 70 |
| 75 | | | | | | | 75 |
| | | | | ▼ | | | |
| 80 | | | | | | | 80 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-12

PAGE 4 OF 4

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 85 | | | ⬡ | 87.0 | Basalt (boulders?) with intermittent increasing and decreasing sand and silt. Very hard drilling at 46' bgs and 83' bgs. Sand and silt strata moist after 50' bgs. *(continued)* | 2115.2 | 85 |
| 90<br>95 | | CL | ▨ | 95.0 | Bluish gray CLAY with some silt. Moist to wet. Becomes SILT with clay at depth. | 2107.2 | 90<br>95 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

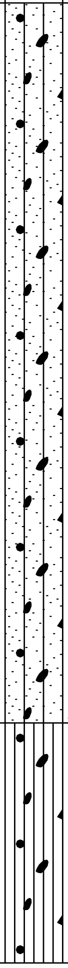
# BORING NUMBER BH-13

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:306433.85 Easting:2523802.09
**OVA EQUIPMENT**
**GROUND ELEVATION** 2224.52 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 74.0 ft
▽ **FIRST ENCOUNTERED WATER** 70.0 ft / Elev 2154.5 ft
▼ **STABILIZED WATER** 67.8 ft / Elev 2156.7 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/4/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Brown to light brown, silty fine SAND with some angular basalt gravel. | | |
| 5 | | | | | | | | | 5 |
| | | | | SP | | | | | |
| 10 | | | | | | | | | 10 |
| 15 | | | | | | 15.0 | | 2209.5 | 15 |
| | | | | | | | Brown to light brown SILT with angular to subangular basalt gravel. | | |
| | | | | ML | | | | | |
| 20 | | | | | | | | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-13

PAGE 2 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | ML | | 25.0 | Brown to light brown SILT with angular to subangular basalt gravel. *(continued)* | 2199.5 | 25 |
| | | | | ML | | 26.5 | Brown to light brown SILT. | 2198.0 | |
| 30<br>35 | | | | ML | | 35.0 | Brown to light brown, gravelly SILT. | 2189.5 | 30<br>35 |
| 40 | | | | ML | | 40.0 | Light brown SILT with trace fine sand. Moist. | 2184.5 | 40 |
| 45<br>50 | | | | ML | | | Brown SILT with fine sand, trace gravel. Moist. | | 45<br>50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-13

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 55<br>60 | | | | ML | | 62.0 | Brown SILT with fine sand, trace gravel. Moist. *(continued)* | 2162.5 | 55<br>60 |
| 65 | | | | | | 68.0 ▼ | Basalt (boulder?). | 2156.5 | 65 |
| 70 | | | | ML | | 70.0 ▽ | Brown to light brown SILT. Moist. | 2154.5 | 70 |
| | SS<br>BH-13 d 70 | ☒ | 37<br>100 | SP | | 74.0 | Brown, fine to medium silty SAND. Wet. Increasing gravel with depth. | 2150.5 | |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

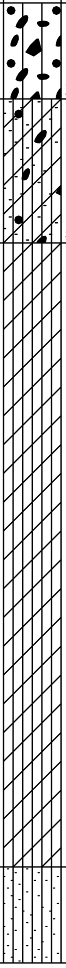
# BORING NUMBER BH-15

PAGE 1 OF 3

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305183.91 Easting:2524429.70
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2215.61 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 73.0 ft
▽ **FIRST ENCOUNTERED WATER** 70.0 ft / Elev 2145.6 ft
▼ **STABILIZED WATER** 66.9 ft / Elev 2148.7 ft
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/13/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| | | GP | | 2.0 | Angular to subangular, silty basalt GRAVEL. | 2213.6 | |
| 5 | | ML | | 5.0 | Light brown clayey SILT with angular basalt gravel. Moist. | 2210.6 | 5 |
| 10<br>15 | | ML | | 18.0 | Light brown SILT with some to trace clay. Dry. Intermittent increasing and decreasing clay content. Moist at 15' bgs. | 2197.6 | 10<br>15 |
| 20 | | ML | | | Light brown to brown SILT with some fine sand. Mica rich. Moist. Increasing sand with depth. | | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER BH-15

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 25<br>30 | | ML | | 31.0 | Light brown to brown SILT with some fine sand. Mica rich. Moist. Increasing sand with depth. *(continued)* | 2184.6 | 25<br>30 |
| | | ML | | 34.0 | Brown to grayish brown clayey SILT with fine sand. Moist. | 2181.6 | |
| 35<br>40<br>45<br>50 | | CL | | | Brown to grayish brown silty CLAY. Moist. Becomes dark brown at 58' bgs. | | 35<br>40<br>45<br>50 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER BH-15

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|
| 55<br>60 |  | CL | ▨ | 61.0 | Brown to grayish brown silty CLAY.  Moist.  Becomes dark brown at 58' bgs. *(continued)* | 2154.6 | 55<br>60 |
| 65<br>70 |  | ML | ▨ | ▼<br>▽<br>73.0 | Dark brown clayey SILT.  Moist.  Wet at 70' bgs. | 2142.6 | 65<br>70 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER D-1

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305426.28 Easting:2524706.59
**OVA EQUIPMENT** 
**GROUND ELEVATION** 2253.34 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 28.0 ft
**FIRST ENCOUNTERED WATER** ---
**STABILIZED WATER** ---
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/18/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Brown to tan, fine SAND with silt. (Cap) | | |
| 2.5 | | | | SP | | | | | 2.5 |
| 5.0 | | | | | | 5.0 | | 2248.3 | 5.0 |
| | | | | | | | Dross. Cutting are gray, fine to medium silty sand and clay sized sediment with strong ammonia odor. Slightly moist at 10' bgs. | | |
| 7.5 | | | | | | | | | 7.5 |
| 10.0 | | | | | | | | | 10.0 |

(Continued Next Page)

**COMMENTS**

**APPROVED BY:** 
**DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER D-1

PAGE 2 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | SS<br>D-1 d 10 | ☒ | 12<br>7<br>5 | | | | Dross. Cutting are gray, fine to medium silty sand and clay sized sediment with strong ammonia odor. Slightly moist at 10' bgs. *(continued)* | | |
| 12.5 | SS<br>D-1 d 11.5 | ☒ | 20<br>14<br>12 | | | | | | 12.5 |
| 15.0 | | | | | | | | | 15.0 |
| 17.5 | | | | | | | | | 17.5 |
| 20.0 | | | | | | 20.0 | | 2233.3 | 20.0 |
| | | | | | | | Basalt (boulder?) | | |
| 22.5 | | | | | | | | | 22.5 |
| 25.0 | | | | | | | | | 25.0 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER D-1

PAGE 3 OF 3

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basalt (boulder?) *(continued)* | | |
| 27.5 | | | | | | | | | 27.5 |
| | | | | | | 28.0 | | 2225.3 | |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER D-2

**PROJECT LOCATION** Mead, Washington

**PROJECT NUMBER** 0907194.000

**LOCATION** Northing:305429.29 Easting:2524771.51

**OVA EQUIPMENT**

**GROUND ELEVATION** 2258.47 ft **HOLE DIAMETER** 6"

**TOP OF CASING ELEVATION** **HOLE DEPTH** 50.0 ft

**FIRST ENCOUNTERED WATER** ---

**STABILIZED WATER** ---

**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/19/10

**DRILLING CONTRACTOR** Environmental West Exploration

**DRILLING METHOD** Air Rotary

**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed - Exponent

Ammonia 180 ppm at 30' bgs, 0 ppm at 40' bgs.

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 5 |  |  |  | SP |  | 7.0 | Brown to tan, fine SAND with silt and fine gravel. Trace to some clay. Moist. | 2251.5 | 5 |
| 10 |  |  |  | ML |  |  | Brown, clayey SILT with trace fine gravel and fine sand. Moist |  | 10 |
| 15 | SS<br>D-2 d 15 | ☒ | 17<br>50 |  |  |  |  |  | 15 |
| 20 |  |  |  |  |  | 20.0 |  | 2238.5 | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist

**CLIENT** Kaiser

# BORING NUMBER D-2

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 25<br>30<br>35 | | | | GP | | 38.0 | Course, vesicular, subangular to subrounded, basalt GRAVEL. Strong ammonia odor to approximately 38'bgs. | 2220.5 | 25<br>30<br>35 |
| | | | | GP | | 39.0 | Basalt GRAVEL with reddish brown silt. Slightly moist. | 2219.5 | |
| 40<br>45 | | | | GP | | 45.0 | Mostly angular with some rounded, vesicular basalt GRAVEL. Trace areas of moisture. | 2213.5 | 40<br>45 |
| 50 | | | | | | 50.0 | Basalt. Hard drilling. Trace areas of moisture. | 2208.5 | 50 |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER D-3

PAGE 1 OF 2

**PROJECT LOCATION** Mead, Washington

**PROJECT NUMBER** 0907194.000

**LOCATION** Northing:305528.96 Easting:2524662.27

**OVA EQUIPMENT**

**GROUND ELEVATION** 2248.81 ft **HOLE DIAMETER** 6"

**TOP OF CASING ELEVATION** **HOLE DEPTH** 33.0 ft

**FIRST ENCOUNTERED WATER** ---

**STABILIZED WATER** ---

**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/19/10

**DRILLING CONTRACTOR** Environmental West Exploration

**DRILLING METHOD** Air Rotary

**STAMP (IF APPLICABLE) AND/OR NOTES**

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | SP | | | Light brown to brown, fine to medium SAND with trace silt. Trace to some gray colored material at 7' bgs. | | |
| 5 | | | | | | | | | 5 |
| 10 | | | | | | | | | 10 |
| | | | | | | 12.0 | Dross. From 12' bgs to 15.5' bgs, dross presents as fine to medium sand and silt sized particles. From 15.5' bgs to 25' bgs, dross presents as lithic with cuttings of angular, white, light gray and gray gravel. Very hard drilling in lithic material. Dry. | 2236.8 | |
| 15 | SS<br>D-3 d 15 | | 50 | | | | | | 15 |
| 20 | | | | | | | | | 20 |

(Continued Next Page)

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

## BORING NUMBER D-3

PAGE 2 OF 2

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| 25 | SS<br>D-3 d 20 | | 100 | | | 26.0 | Dross. From 12' bgs to 15.5' bgs, dross presents as fine to medium sand and silt sized particles. From 15.5' bgs to 25' bgs, dross presents as lithic with cuttings of angular, white, light gray and gray gravel. Very hard drilling in lithic material. Dry. *(continued)* | 2222.8 | 25 |
| 30 | | | | | | 31.0 | Dross. Fine to medium, gray, sand and silt sized cuttings. Trace pink colored material. Dry. | 2217.8 | 30 |
| | | | | | | 33.0 | Pinkish red Dross, very hard drilling. Most of the cuttings are thin, platey pieces of metallic material. Dry. | 2215.8 | |

**COMMENTS**

**APPROVED BY:** ______________________________ **DATE:** ____________

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

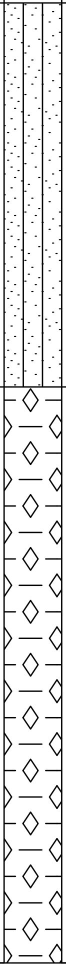
# BORING NUMBER D-4

PAGE 1 OF 2

**PROJECT LOCATION** Mead, Washington
**PROJECT NUMBER** 0907194.000
**LOCATION** Northing:305485.74 Easting:2524649.82
**OVA EQUIPMENT**
**GROUND ELEVATION** 2248.07 ft **HOLE DIAMETER** 6"
**TOP OF CASING ELEVATION** **HOLE DEPTH** 45.0 ft
**FIRST ENCOUNTERED WATER** ---
**STABILIZED WATER** ---
**LOGGED BY** Kevin Knesek, ARCADIS **DATE** 5/19/10

**DRILLING CONTRACTOR** Environmental West Exploration
**DRILLING METHOD** Air Rotary
**STAMP (IF APPLICABLE) AND/OR NOTES**

Supervising Geologist: Steve Reed-Exponent



| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION . | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | SP | | | Dark brown, fine to medium silty SAND (cap). Dry. | | |
| 5 | | | | | | | | | 5 |
| | | | | | | 8.0 | Dross. Presents as medium to fine, gray with trace pink, sand sized particles with trace dross gravel. Dry. | 2240.1 | |
| 10 | | | | | | | | | 10 |
| 15 | D-4 d 15 | | 100 | | | | | | 15 |
| 20 | | | | | | 20.0 | | 2228.1 | 20 |

*(Continued Next Page)*

**COMMENTS**

**APPROVED BY:** **DATE:**

**PROJECT NAME** Heglar Kronquist
**CLIENT** Kaiser

# BORING NUMBER D-4

PAGE 2 OF 2

| DEPTH (feet) | SAMPLE TYPE NUMBER | SAMPLE RECOVERY | BLOW COUNTS (per 6 inches) | U.S.C.S. | GRAPHIC LOG | DEPTHS (feet) | LITHOLOGIC DESCRIPTION | ELEVATIONS (feet) | DEPTH (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lithic dross material. Cuttings are light gray in color with trace metallic flakes. Dry. | | |
| 25 | | | | | | | | | 25 |
| 30 | | | | | | | | | 30 |
| | | | | | | 32.0 | | 2216.1 | |
| | | | | | | | Dross. Presents as gray, fine sand and silt sized particles. Dry. | | |
| 35 | | | | | | 35.0 | | 2213.1 | 35 |
| | D-4 d 35 | ☒ | 73<br>33<br>30 | | | | Lithic, light gray to gray dross. Very hard drilling. Some basalt gravel intermingled at approximately 40' bgs. Dry. | | |
| 40 | | | | | | | | | 40 |
| | | | | | | 43.0 | | 2205.1 | |
| | | | | GP | | | Silty, rounded to subrounded basalt GRAVEL. | | |
| 45 | | | | | | 45.0 | | 2203.1 | 45 |

**COMMENTS**

**APPROVED BY:** ____________________ **DATE:** __________

**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** NA
**Easting** NA
**Casing Elevation:** Abandoned

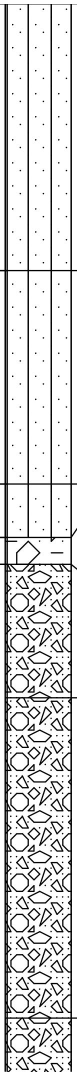
**Borehole Depth:** 75 ft.
**Surface Elevation:** NA

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2a

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA



| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 0 | | | | SM-G | | Brown fine to medium silty SAND with coarse to fine, subrounded basalt gravel. Dry. | |
| 5 | | | | SM | | Brown fine to medium silty SAND. Some coarse sand. Dry. | |
| | | | | SM-G | | Gravelly, fine silty SAND. Gravel is subangular to rounded basalt, coarse. | |
| 10 | | | | GP | | Rounded to subrounded gravel with fine sand and silt (trace to some). Dry to slightly moist. | |
| | | | | Basalt | | Angular to subangular, vesicular basalt cutting, coarse. Dry. Hard drilling. | |
| | | | | | | Trace to some silt from 13 ft - 14 ft. | |
| 15 | | | | | | | |
| | | | | | | Fractured. Easier drilling. | |
| 20 | | | | | | | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** NA
**Easting** NA
**Casing Elevation:** Abandoned

**Borehole Depth:** 75 ft.
**Surface Elevation:** NA

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2a

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 20 | | | | | | | |
| | | | | CL | | Cream, silty CLAY with coarse angular basalt. Slightly moist. | |
| 25 | | | | ML | | Light brown to cream SILT with clay. Trace angular basalt gravel. Coarse gravel. Dry. | |
| | | | | SM | | Light brown to brown SILT with fine to medium sand. Trace angular coarse basalt gravel. Dry. | |
| 30 | | | | SP-G | | Gravelly fine to medium SAND with silt. Gravels are subrounded and coarse, basalt. Trace cream colored clay. Trace fine grantic gravel. Slightly moist. | |
| | | | | GP | | Basalt gravel, coarse, subangular. | |
| | | | | Basalt | | Coarse, angular basalt cuttings. Dry. Hard drilling. | |
| 35 | | | | GP-S | | Brown, fine silty GRAVEL. Gravels mostly Coarse. Subangular basalt. Dry. Gravels decrease with depth. Increasing sand. | |
| | | | | SP | | Reddish brown fine to medium sand SAND. Some subangular basalt gravel. Dry. | |
| 40 | | | | | | | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** NA
**Easting** NA
**Casing Elevation:** Abandoned

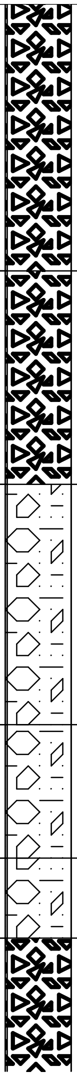
**Borehole Depth:** 75 ft.
**Surface Elevation:** NA

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2a

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA



| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 40 | | | | | | | |
| 45 | | | | SP-L | | Gravelly fine to medium SAND with some silt. Dry. | |
| 50 | | | | GP-S | | Sandy basalt GRAVEL. Gravels coarse, subrounded to subangular. Dry. Trace silt | |
| 55 | | | | GP | | Coarse vesicular basalt GRAVEL. Moist. | |
| | | | | GP-S | | Sandy coarse to fine basalt GRAVEL. Slightly moist. | |
| 60 | | | | SP-G | | Gravelly fine SAND with silt. Moist. | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** NA
**Easting** NA
**Casing Elevation:** Abandoned

**Borehole Depth:** 75 ft.
**Surface Elevation:** NA

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2a

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 60 | | | | CL | ▨ | Cream and reddish brown silty CLAY. Trace fine basalt gravel. Moist. | |
| | | | | ML | ▥ | Brown SILT with fine sand. Trace clay. Dry. | |
| 65 | | | | ML | ▥ | Light brown clayey SILT. Dry. | |
| | | | | ML | ▥ | Soft brown mica rich SILT with fine sand. Moist. | |
| 70 | | | | ML | ▥ | Brown SILT with reddish brown clay. Some fine sand. Trace subrounded Latah gravel. Becomes, dark brown, clayey silt at 71 ft. Mica rich. Moist. | |
| 75 | | | | | | | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

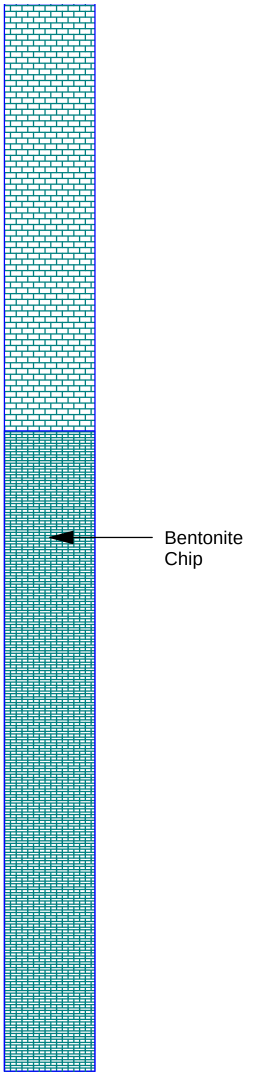
**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 0 | | | | ML | | Light brown soft SILT. Mica rich. Dry. |  |
| 5 | | | | | | Reddish brown soft SILT. Mica rich. Dry. | |
| 10 | | | | | | Light brown soft SILT. Mica rich. Some fine sand. Dry. | |
| 15 | | | | SC | | Grayish brown clayey SILT with fine sand. Dry. | |
| | | | | ML | | Reddish brown SILT with fine sand. | |
| | | | | | | Grayish brown silt with fine sand and clay. Dry. | |
| 20 | | | | | | Reddish brown silt with fine sand. Dry. | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

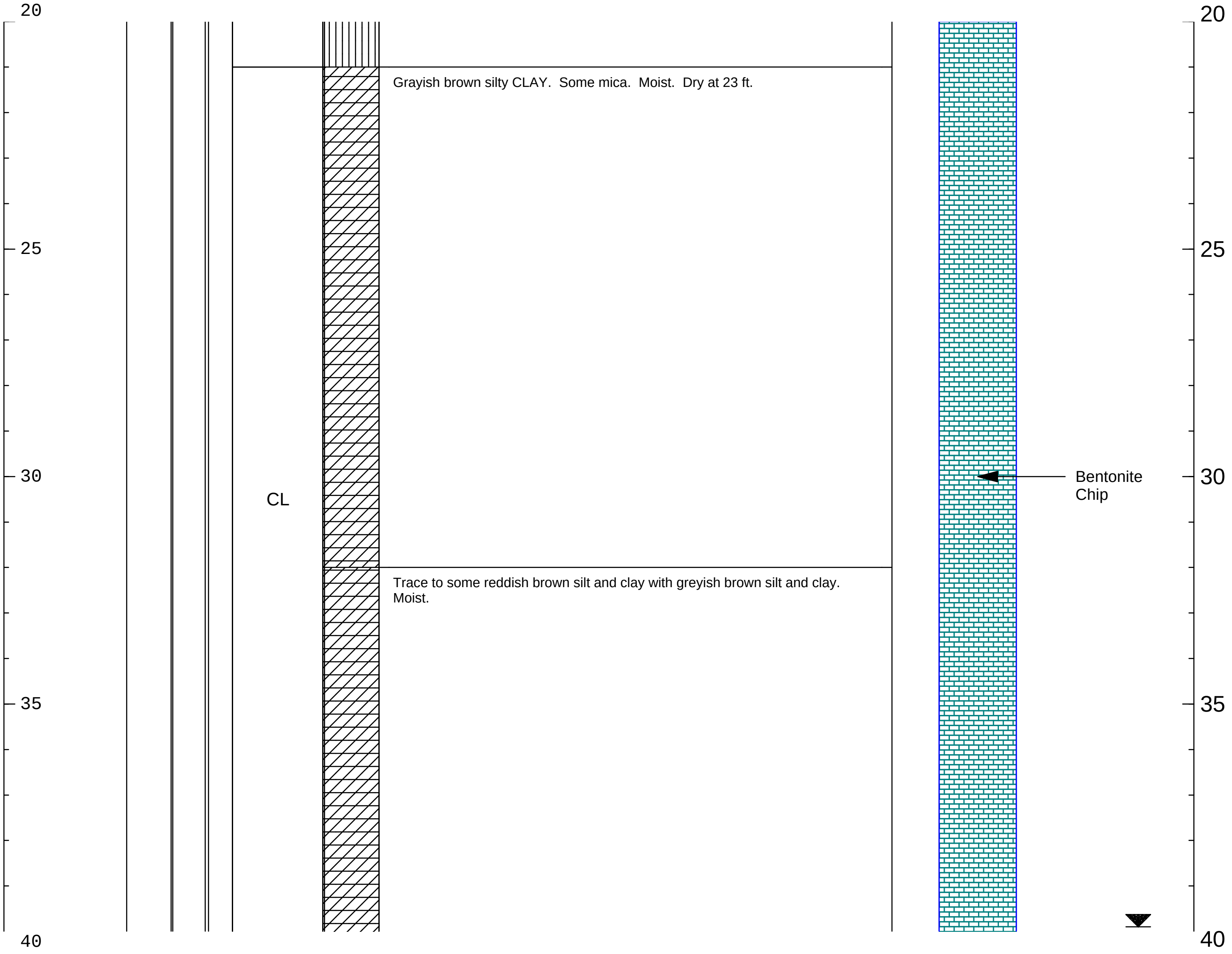
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Grayish brown silty CLAY. Some mica. Moist. Dry at 23 ft.

Trace to some reddish brown silt and clay with greyish brown silt and clay. Moist.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

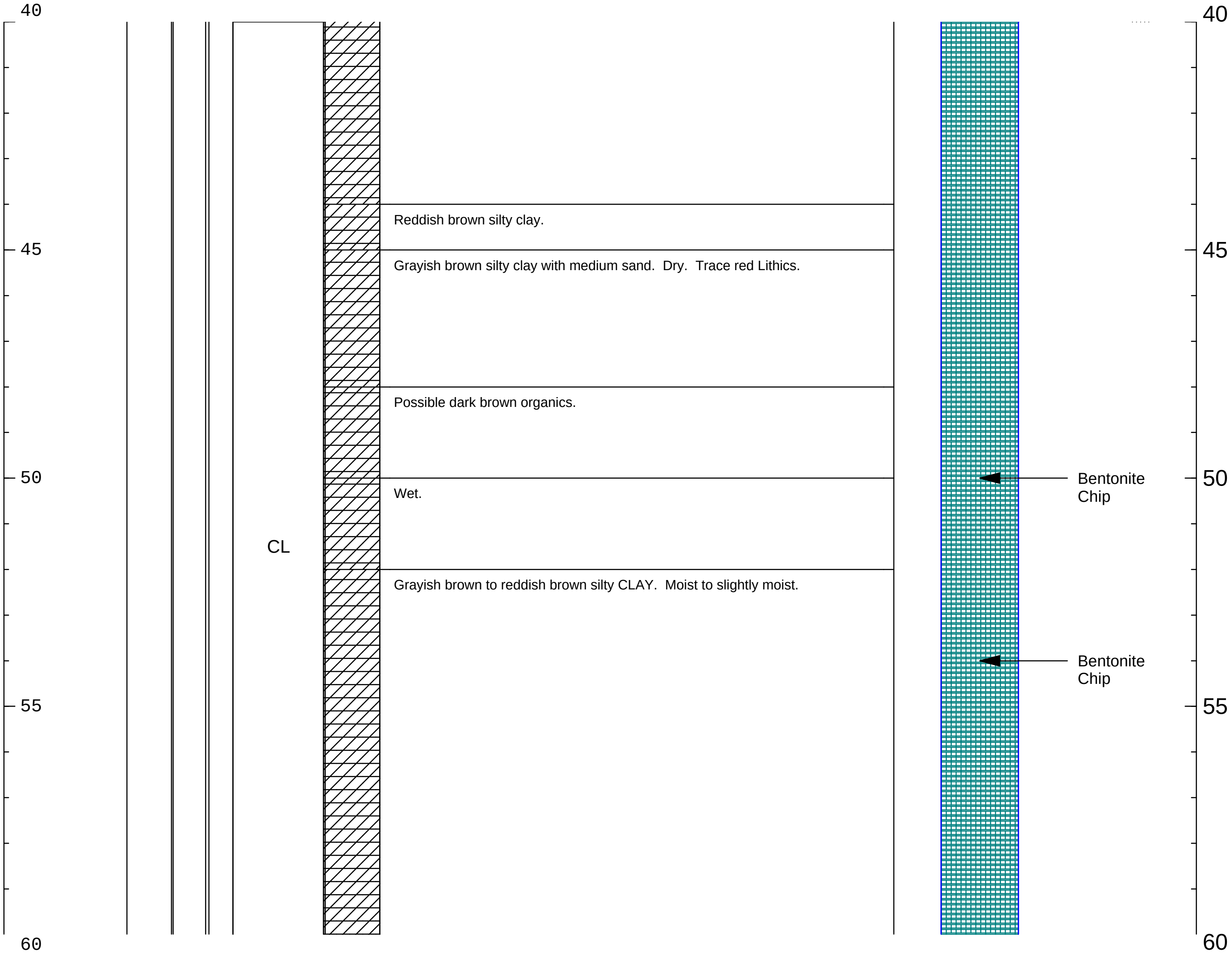
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Reddish brown silty clay.

Grayish brown silty clay with medium sand. Dry. Trace red Lithics.

Possible dark brown organics.

Wet.

Grayish brown to reddish brown silty CLAY. Moist to slightly moist.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level;
GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available;
PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample,
SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

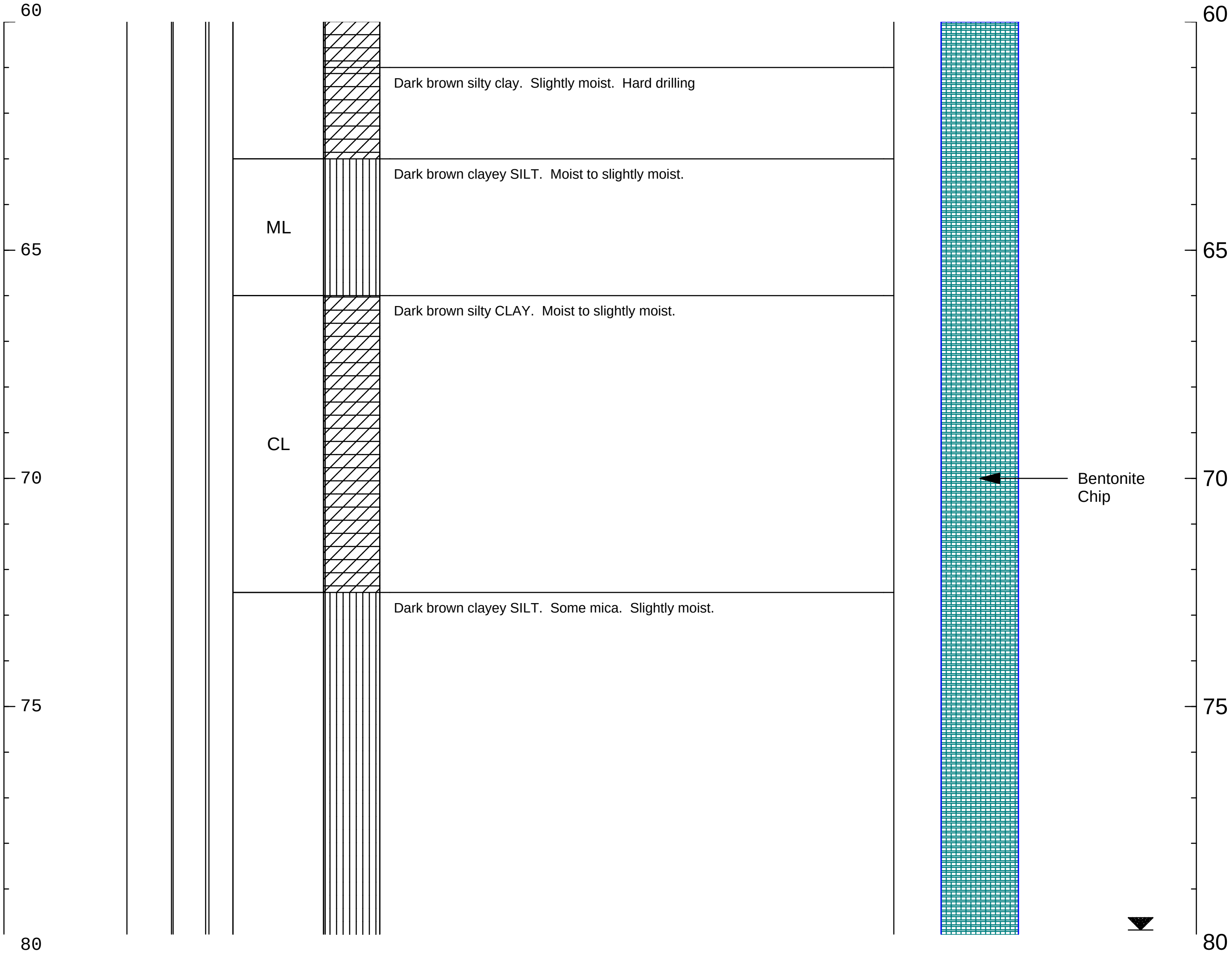
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Dark brown silty clay. Slightly moist. Hard drilling

Dark brown clayey SILT. Moist to slightly moist.

Dark brown silty CLAY. Moist to slightly moist.

Dark brown clayey SILT. Some mica. Slightly moist.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 80 | | | | | | Brown clayey silt. Wet. Muddy. | |
| 85 | | | | | | | |
| | | | | | | Slightly moist to dry. | |
| 90 | | | | ML | | | |
| 95 | | | | | | | |
| 100 | | | | | | | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

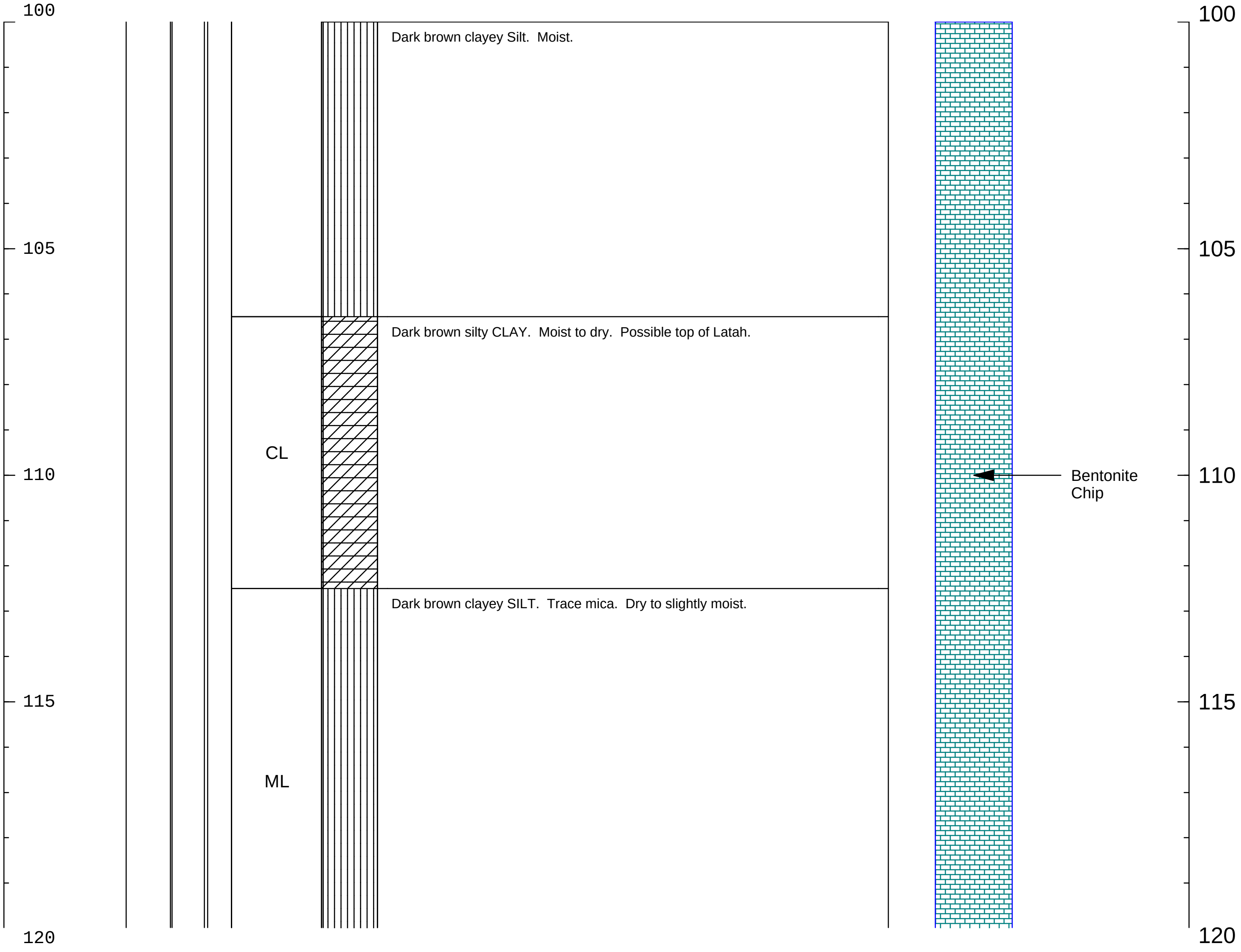
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Dark brown clayey Silt. Moist.

Dark brown silty CLAY. Moist to dry. Possible top of Latah.

Dark brown clayey SILT. Trace mica. Dry to slightly moist.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

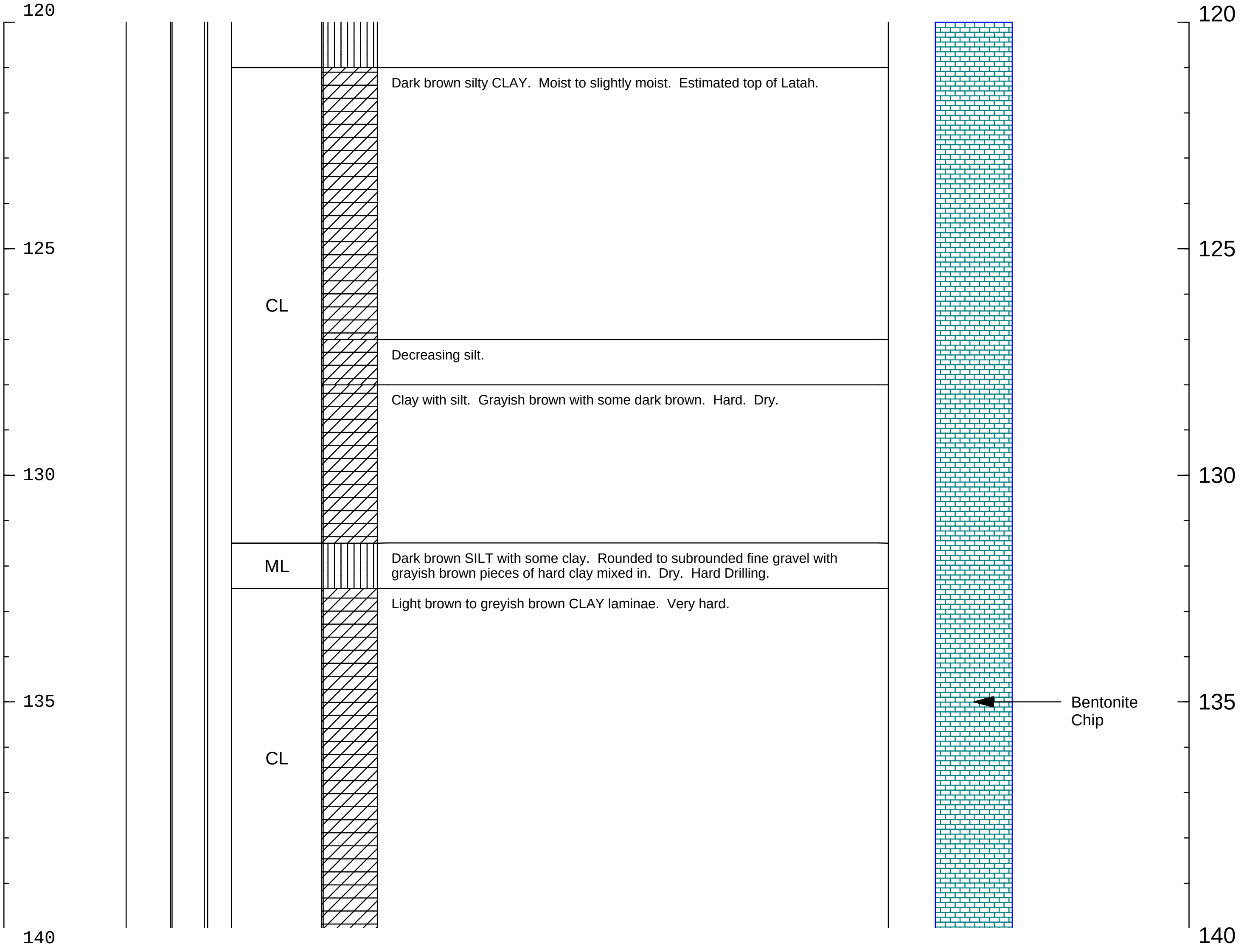
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Dark brown silty CLAY. Moist to slightly moist. Estimated top of Latah.

Decreasing silt.

Clay with silt. Grayish brown with some dark brown. Hard. Dry.

Dark brown SILT with some clay. Rounded to subrounded fine gravel with grayish brown pieces of hard clay mixed in. Dry. Hard Drilling.

Light brown to greyish brown CLAY laminae. Very hard.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/20/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,075.76'
**Easting** 2,524,489.78'
**Casing Elevation:** NA

**Borehole Depth:** 150ft.
**Surface Elevation:** 2,213.53 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** Test Hole

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 140 | | | | | | | |
| | | | | | | Light to dark grayish brown clay with some silt. Like soap stone. Hard. Dry. | |
| 145 | | | | CL | | Becomes dark brown. Trace wood fragments. | |
| | | | | | | Becomes dark to slightly reddish dark brown. Silt. Dry. | |
| 150 | | | | | | | |

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SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/13/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,875.22'
**Easting** 2,523,833.71'
**Casing Elevation:** 2183.49 ft

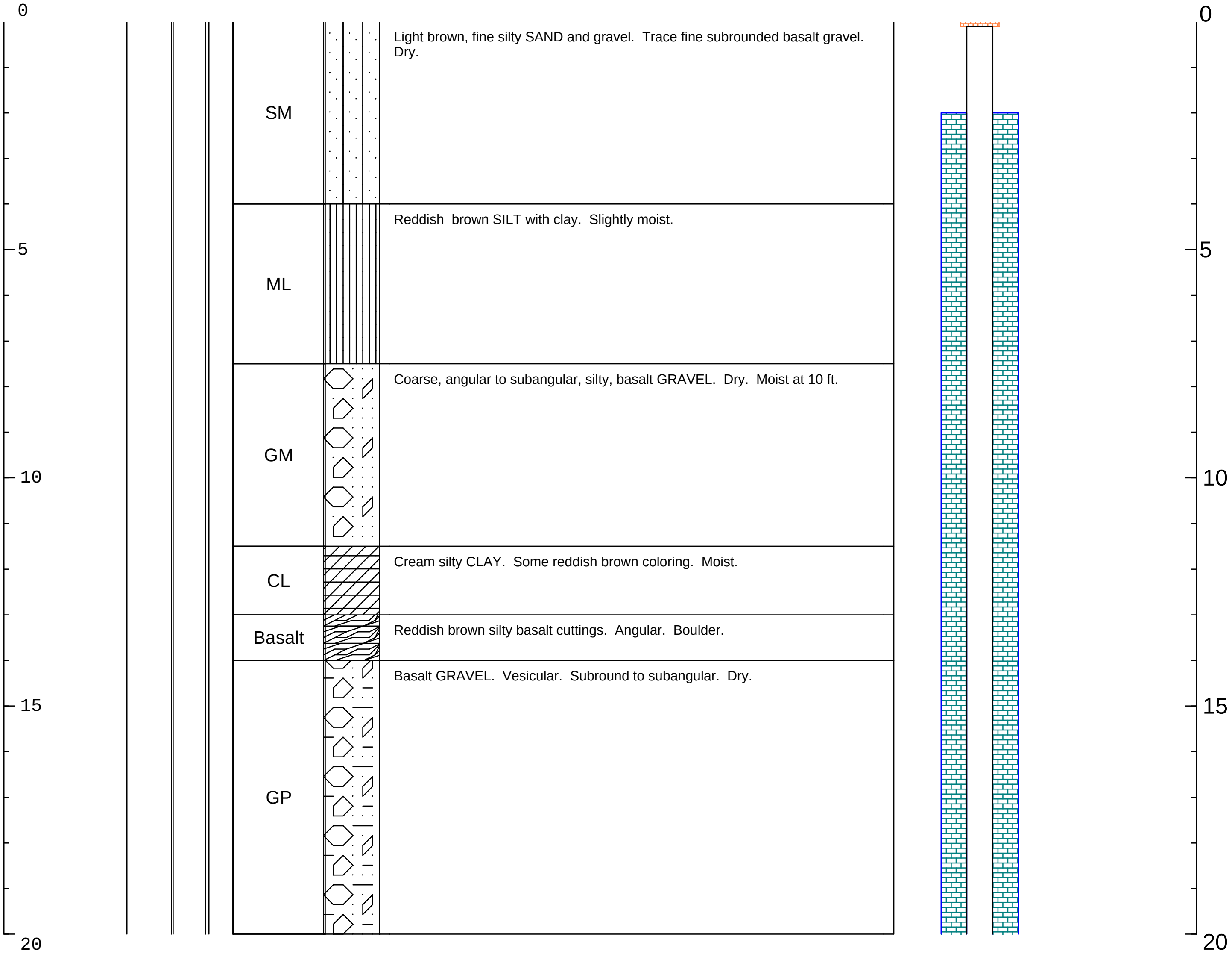
**Borehole Depth:** 70 ft
**Surface Elevation:** 2,180.74 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-1

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA



| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| | | | | SM | | Light brown, fine silty SAND and gravel. Trace fine subrounded basalt gravel. Dry. | |
| | | | | ML | | Reddish brown SILT with clay. Slightly moist. | |
| | | | | GM | | Coarse, angular to subangular, silty, basalt GRAVEL. Dry. Moist at 10 ft. | |
| | | | | CL | | Cream silty CLAY. Some reddish brown coloring. Moist. | |
| | | | | Basalt | | Reddish brown silty basalt cuttings. Angular. Boulder. | |
| | | | | GP | | Basalt GRAVEL. Vesicular. Subround to subangular. Dry. | |

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level;
GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available;
PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample,
SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt

**Date Start/Finish:** 9/13/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,875.22'
**Easting** 2,523,833.71'
**Casing Elevation:** 2183.49 ft

**Borehole Depth:** 70 ft
**Surface Elevation:** 2,180.74 ft

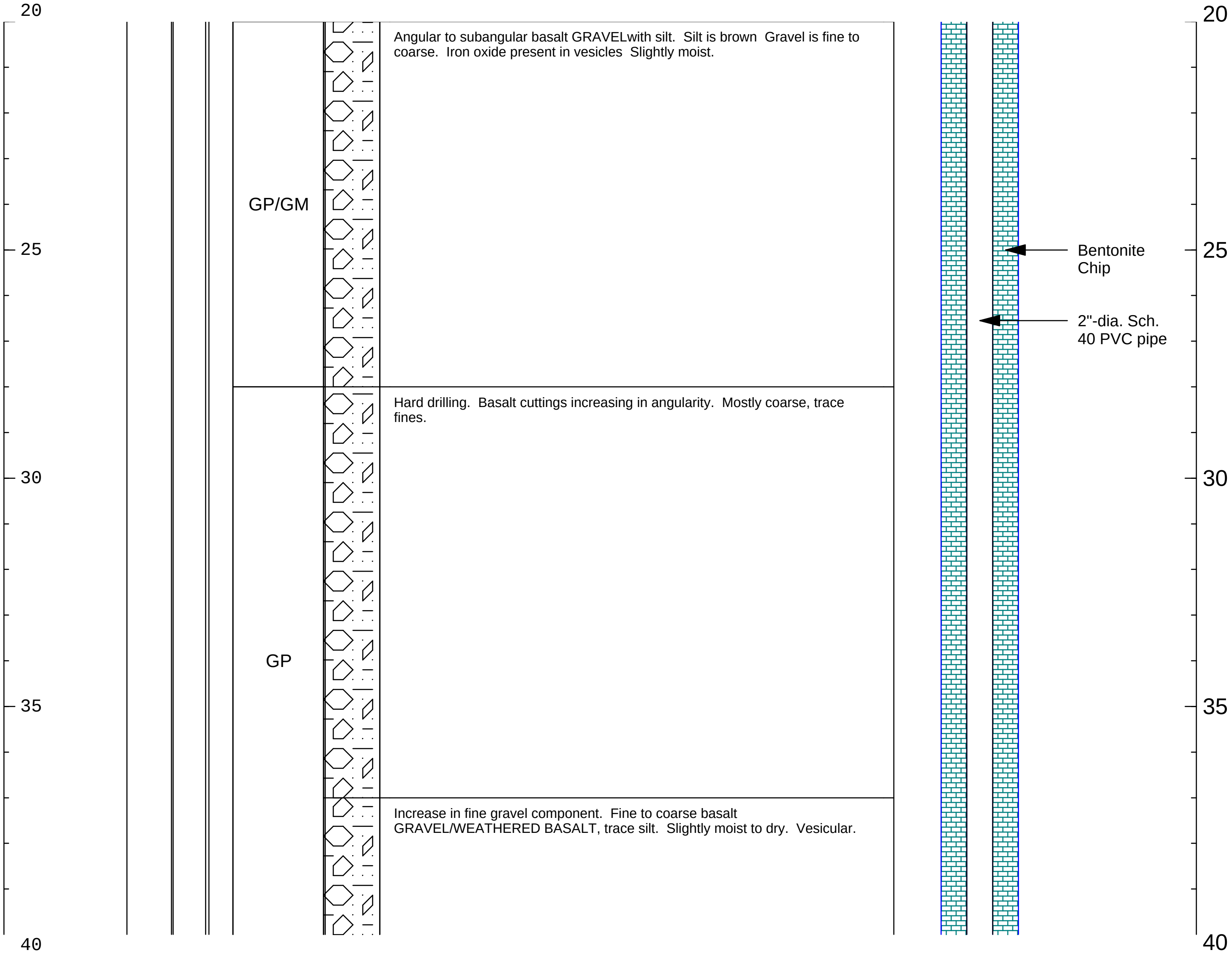
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-1

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 20–28 | | | | GP/GM | | Angular to subangular basalt GRAVELwith silt. Silt is brown Gravel is fine to coarse. Iron oxide present in vesicles Slightly moist. | |
| 28–37 | | | | GP | | Hard drilling. Basalt cuttings increasing in angularity. Mostly coarse, trace fines. | |
| 37–40 | | | | | | Increase in fine gravel component. Fine to coarse basalt GRAVEL/WEATHERED BASALT, trace silt. Slightly moist to dry. Vesicular. | |



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**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
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**Rig Type:**
**Sampling Method:**

**Northing** 305,875.22'
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**Casing Elevation:** 2183.49 ft

**Borehole Depth:** 70 ft
**Surface Elevation:** 2,180.74 ft

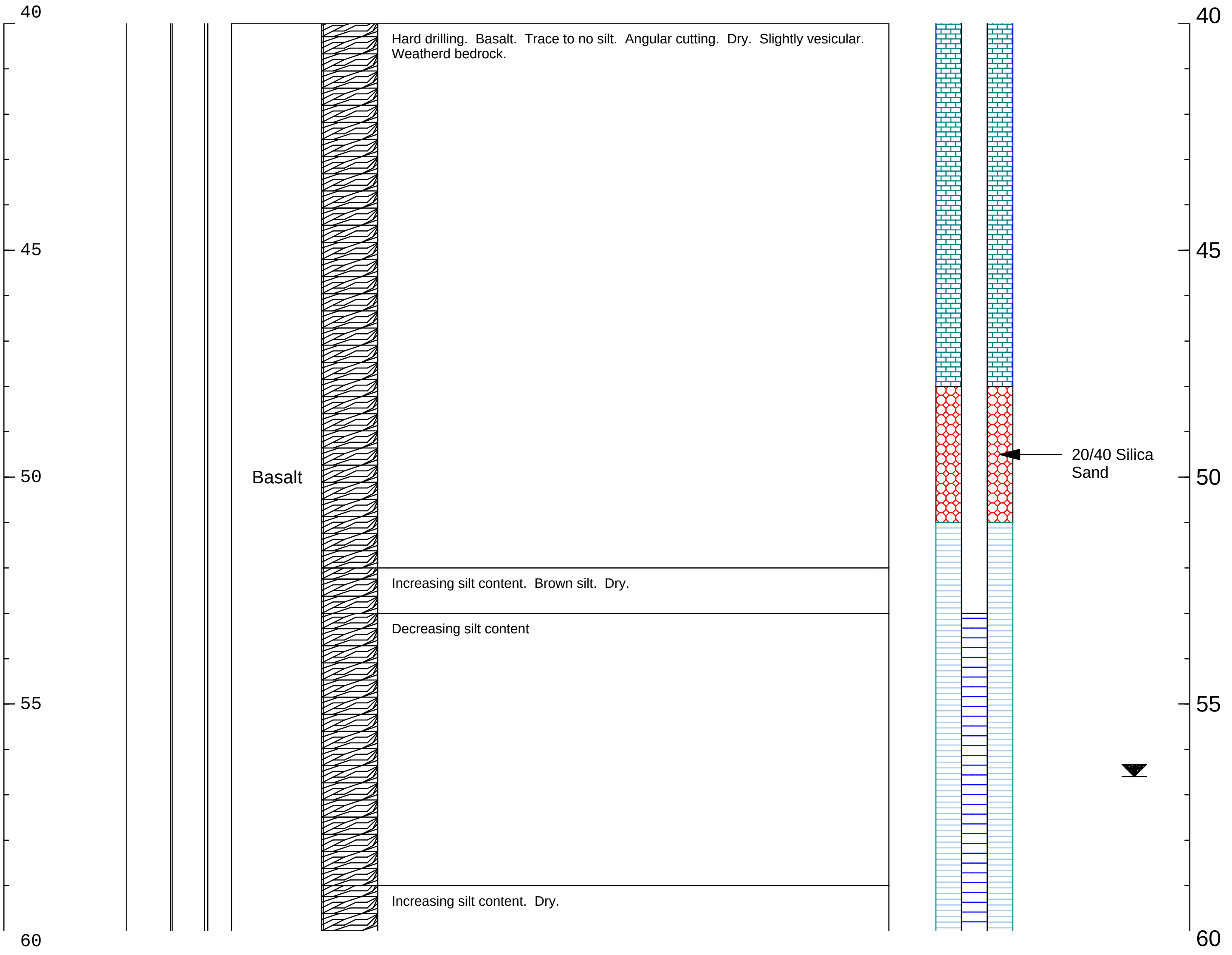
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-1

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Hard drilling. Basalt. Trace to no silt. Angular cutting. Dry. Slightly vesicular. Weatherd bedrock.

Increasing silt content. Brown silt. Dry.

Decreasing silt content

Increasing silt content. Dry.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt

**Date Start/Finish:** 9/13/2010
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**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
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**Northing** 305,875.22'
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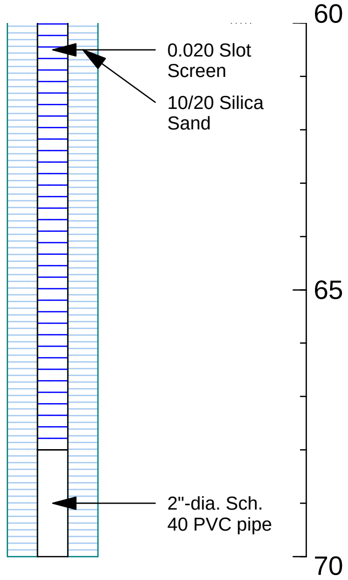
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-1

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 60 | | | | | | Wet basalt. Cuttings angular to subangular. Coarse. Becomes dry at 63 ft. | |
| | | | | | | Wet basalt cutting. Coarse. Angular to subangular. Trace brown silt. | |
| 65 | | | | Basalt | | | |
| 70 | | | | | | | |



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**Date Start/Finish:** 9/16/2010
**Drilling Company:** Enviromental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 303,814.32'
**Easting** 2,524,486.09'
**Casing Elevation:** 2,186.19 ft

**Borehole Depth:** 75 ft
**Surface Elevation:** 2,183.36 ft

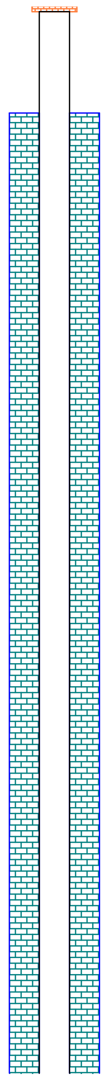
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 0 | | | | ML | | Light, brown SILT with fine sand and some coarse to fine basalt gravel. Dry. | |
| | | | | GM | | Silty, coarse to fine, angular to subangular basalt GRAVEL. Dry | |
| 5 | | | | ML | | Soft brown SILT with trace basalt gravel and trace clay. Dry. | |
| 10<br>15 | | | | | | Becomes greyish brown, soft silt. | |
| | | | | GM | | Fine to coarse silty brown GRAVEL. Some fine to medium sand. Dry. | |
| 20 | | | | ML | | Brown soft SILT. Dry. | |



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**Date Start/Finish:** 9/16/2010
**Drilling Company:** Enviromental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 303,814.32'
**Easting** 2,524,486.09'
**Casing Elevation:** 2,186.19 ft

**Borehole Depth:** 75 ft
**Surface Elevation:** 2,183.36 ft

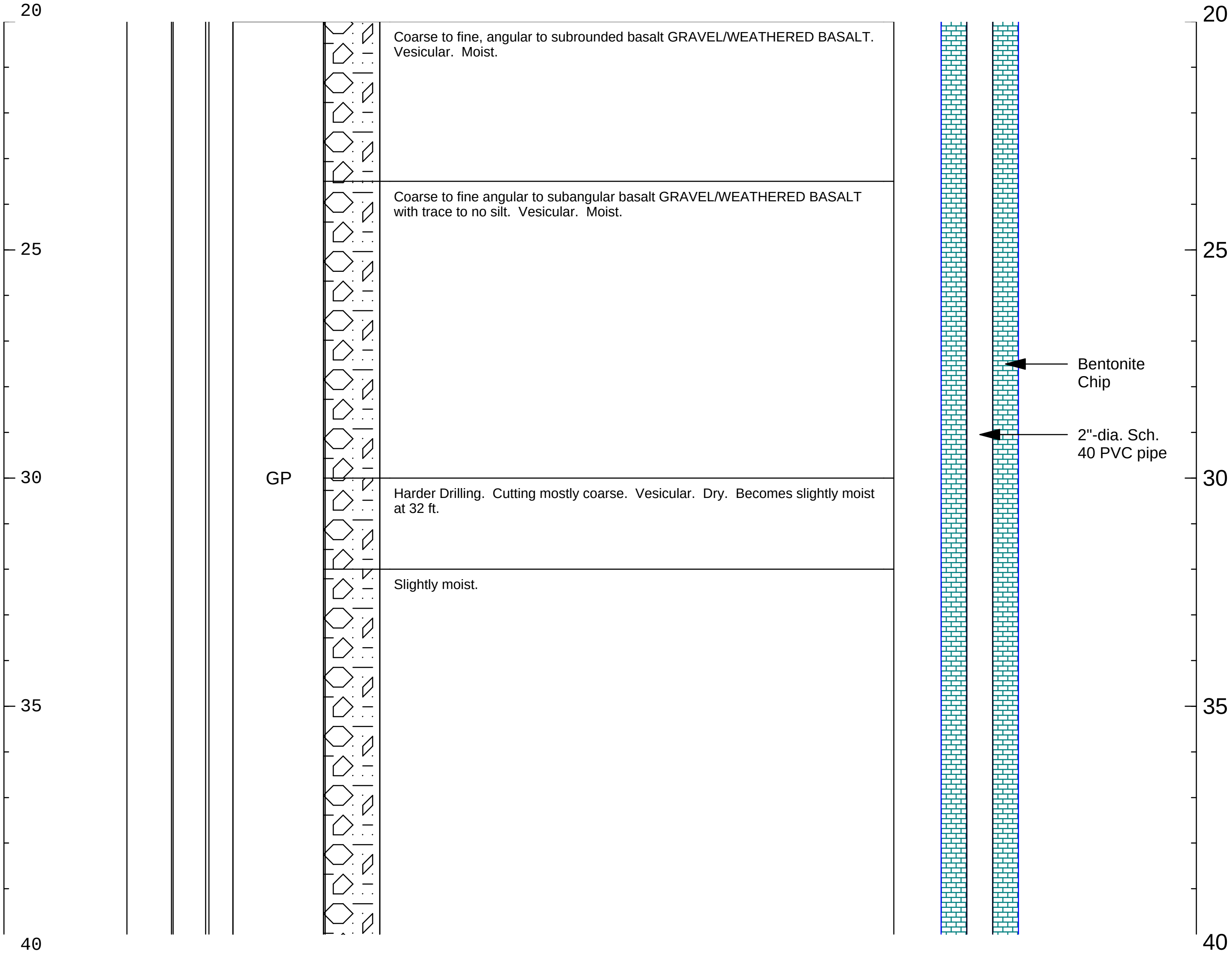
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Coarse to fine, angular to subrounded basalt GRAVEL/WEATHERED BASALT. Vesicular. Moist.

Coarse to fine angular to subangular basalt GRAVEL/WEATHERED BASALT with trace to no silt. Vesicular. Moist.

Harder Drilling. Cutting mostly coarse. Vesicular. Dry. Becomes slightly moist at 32 ft.

Slightly moist.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/16/2010
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**Bit Size:**
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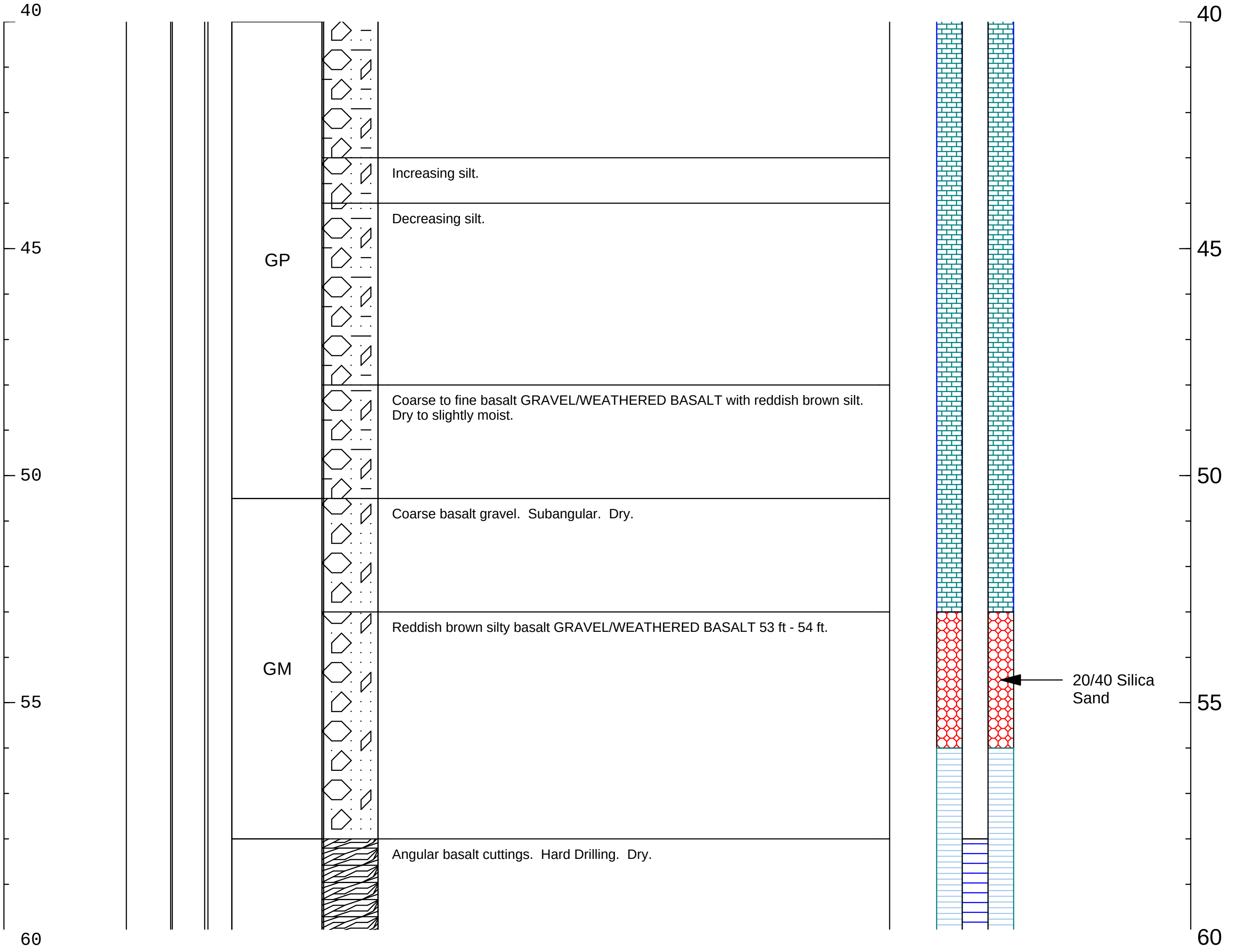
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-2

**Client:** Kaiser Aluminum &
Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| | | | | GP | | | |
| | | | | | | Increasing silt. | |
| | | | | | | Decreasing silt. | |
| | | | | | | Coarse to fine basalt GRAVEL/WEATHERED BASALT with reddish brown silt. Dry to slightly moist. | |
| | | | | GM | | Coarse basalt gravel. Subangular. Dry. | |
| | | | | | | Reddish brown silty basalt GRAVEL/WEATHERED BASALT 53 ft - 54 ft. | |
| | | | | | | Angular basalt cuttings. Hard Drilling. Dry. | |



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SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/16/2010
**Drilling Company:** Enviromental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
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**Northing** 303,814.32'
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**Casing Elevation:** 2,186.19 ft

**Borehole Depth:** 75 ft
**Surface Elevation:** 2,183.36 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

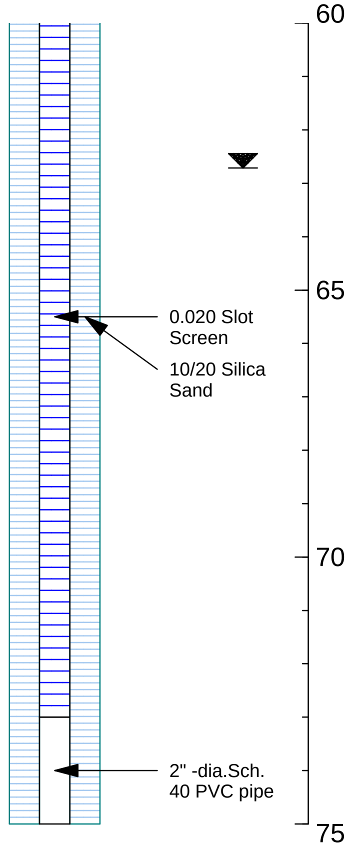
**Well ID:** MW-2

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 60 | | | | | | |
| 65 | | | | | | Dry with trace silt. |
| | | | | Basalt | | Water. Wet Angular basalt cuttings. Some brown silt. |
| | | | | | | Becomes dry. No silt. |
| | | | | | | Moist. |
| | | | | | | Dry. |
| 70 | | | | | | |
| | | | | | | Moist. |
| | | | | | | Wet. Some silt. |
| | | | | | | Moist. |
| | | | | | | Wet. |
| 75 | | | | | | |

Well Construction



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**Date Start/Finish:** 9/17/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,153.62'
**Easting** 2,524,168.26'
**Casing Elevation:** 2176.18 ft

**Borehole Depth:** 60 ft
**Surface Elevation:** 2,173.38 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

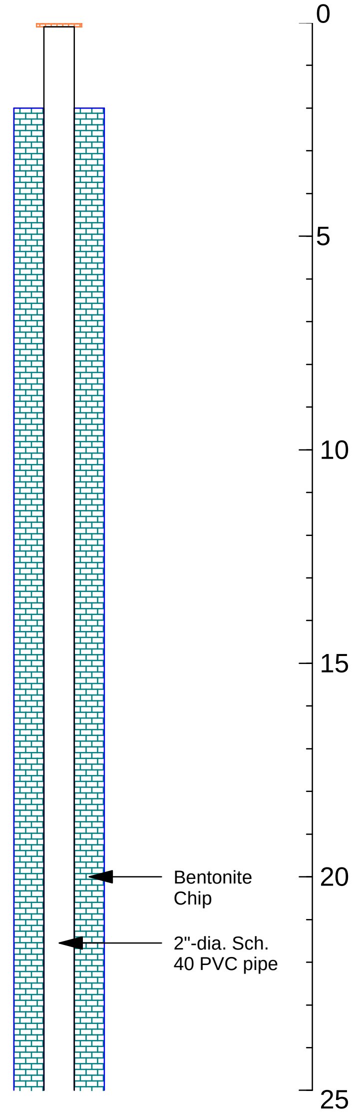
**Well ID:** MW-3

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 0 | | | | GM | | Brown, silty basalt GRAVEL. Gravel mostly fine. Dry. |
| | | | | GP | | Coarse subrounded basalt GRAVEL. Some silt. Dry to slightly moist. |
| 5 | | | | | | Some medium to fine sand. |
| | | | | ML | | Brown SILT with some subangular to subrounded coarse basalt gravel. Slightly moist. |
| 10 | | | | GP | | Coarse to fine angular to subrounded basalt GRAVEL with some silt. Some fine to medium sand. Moist. |
| 15 | | | | ML-G | | Sandy, gravely SILT. Sand is fine to medium. Gravel is fine to coarse subrounded basalt. Moist. |
| 20 | | | | SM | | Medium to fine silty SAND. Moist. |
| 25 | | | | | | |

Well Construction



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**Date Start/Finish:** 9/17/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,153.62'
**Easting** 2,524,168.26'
**Casing Elevation:** 2176.18 ft

**Borehole Depth:** 60 ft
**Surface Elevation:** 2,173.38 ft

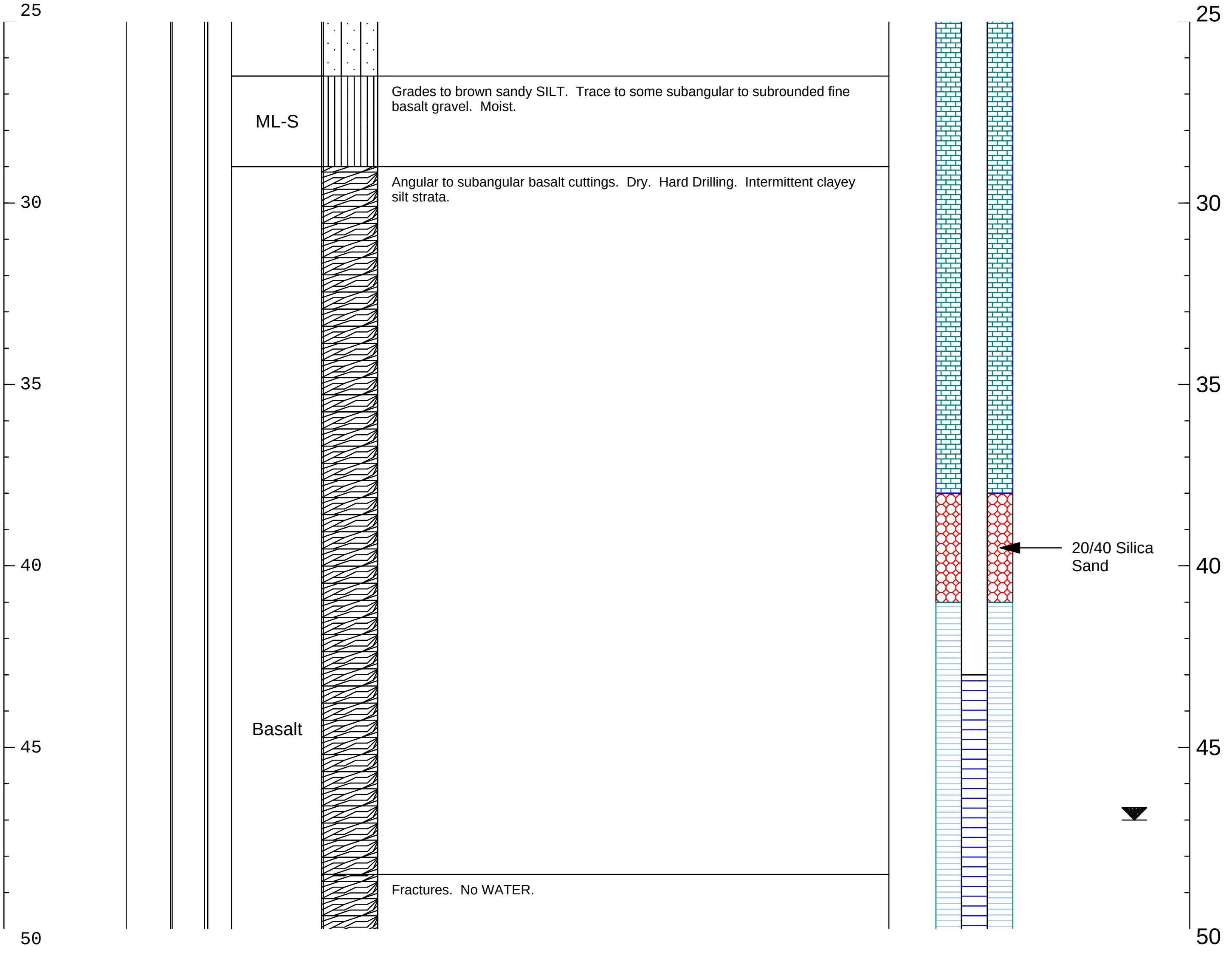
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-3

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| | | | | ML-S | | Grades to brown sandy SILT. Trace to some subangular to subrounded fine basalt gravel. Moist. | |
| | | | | Basalt | | Angular to subangular basalt cuttings. Dry. Hard Drilling. Intermittent clayey silt strata. | |
| | | | | | | Fractures. No WATER. | |



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**Date Start/Finish:** 9/17/2010
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**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,153.62'
**Easting** 2,524,168.26'
**Casing Elevation:** 2176.18 ft

**Borehole Depth:** 60 ft
**Surface Elevation:** 2,173.38 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

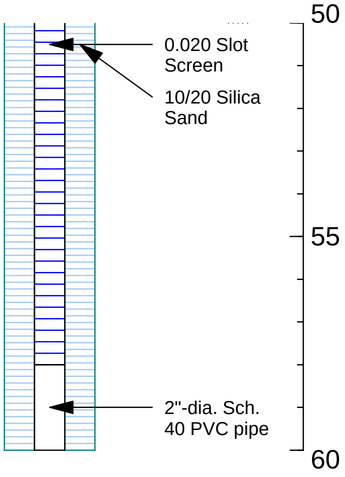
**Well ID:** MW-3

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 50 | | | | | ▨ | |
| | | | | | ▨ | Trace silt. Moist. |
| 55 | | | | | ▨ | Wet. |
| | | | | | ▨ | Competent basalt. Angular cuttings. Dry. |
| 60 | | | | | | |

Well Construction



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**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,241.37'
**Easting** 2,524,745.78'
**Casing Elevation:** 2,247.25 ft

**Borehole Depth:** 66 ft
**Surface Elevation:** 2,244.46 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

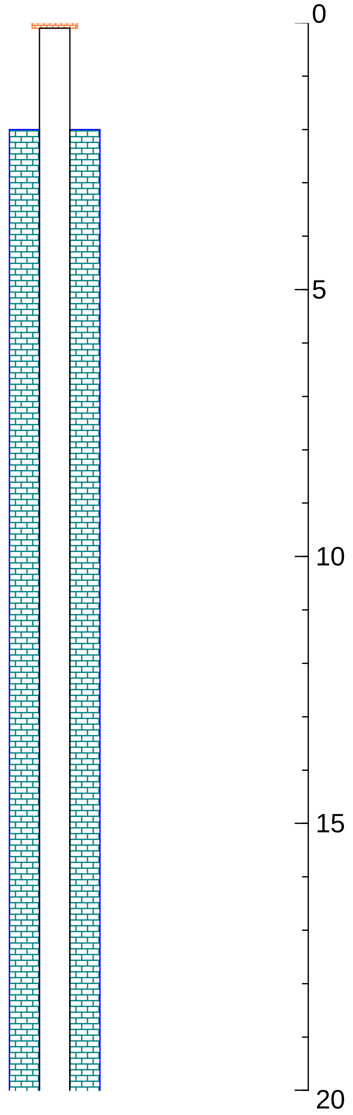
**Well ID:** MW-4

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 0 | | | | ML | | Light brown SILT. Soft. Dry. |
| | | | | GM | | Silty basalt GRAVEL. Coarse to fine, subrounded to subangular. Vesicular. Dry. |
| 5 | | | | GP | | Basalt GRAVEL. Trace silt. Iron Oxide in some vesicules. Trace organics at 7 ft. |
| 10<br>15<br>20 | | | | Weathered Basalt | | Weathered basalt. Vesicular. Cuttings angular to subangular. |

Well Construction



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**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,241.37'
**Easting** 2,524,745.78'
**Casing Elevation:** 2,247.25 ft

**Borehole Depth:** 66 ft
**Surface Elevation:** 2,244.46 ft

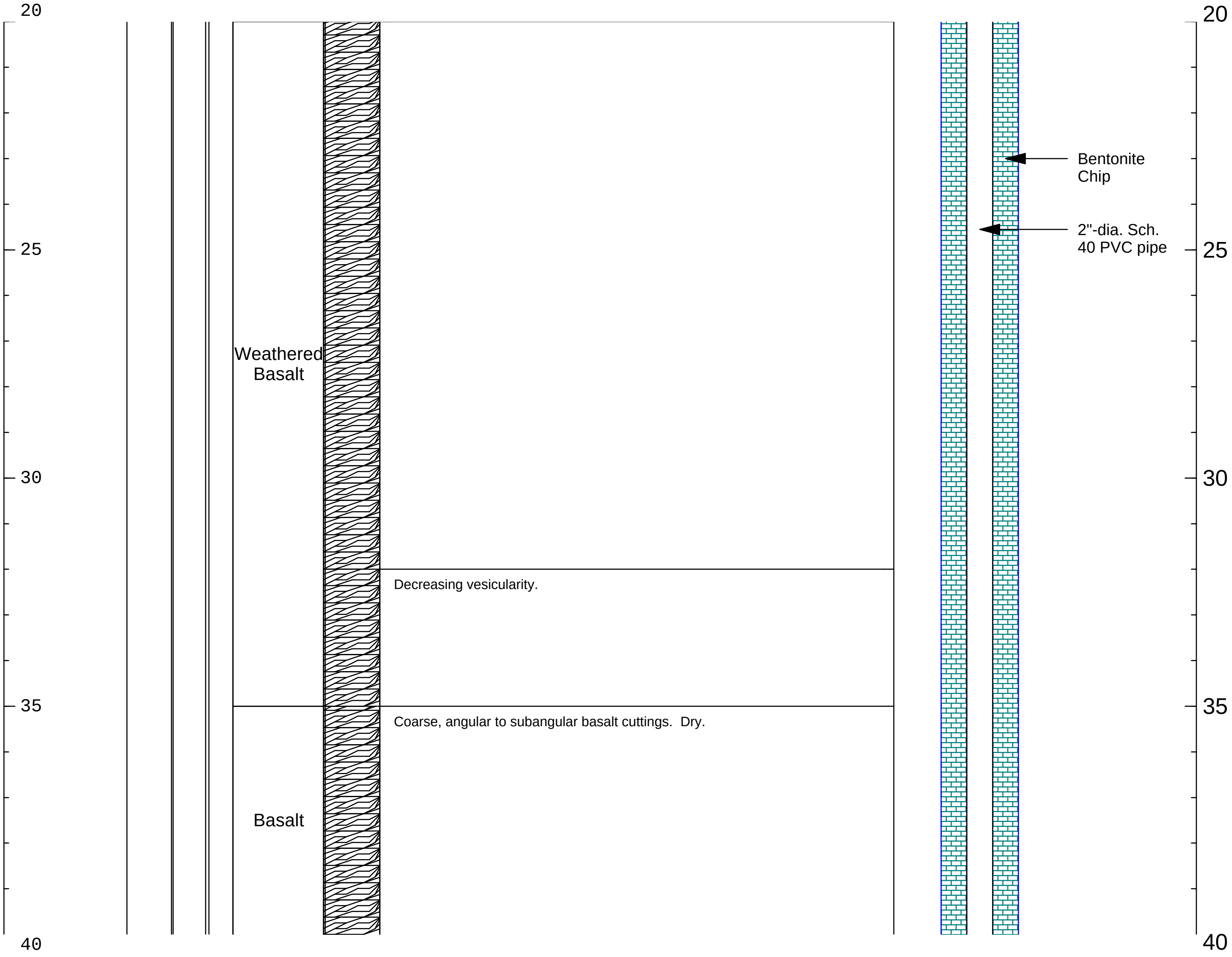
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-4

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 20–35 | | | | Weathered Basalt | | | |
| 32 | | | | | | Decreasing vesicularity. | |
| 35–40 | | | | Basalt | | Coarse, angular to subangular basalt cuttings. Dry. | |



**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt, BA=Basalt

**Date Start/Finish:** 9/14/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 305,241.37'
**Easting** 2,524,745.78'
**Casing Elevation:** 2,247.25 ft

**Borehole Depth:** 66 ft
**Surface Elevation:** 2,244.46 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

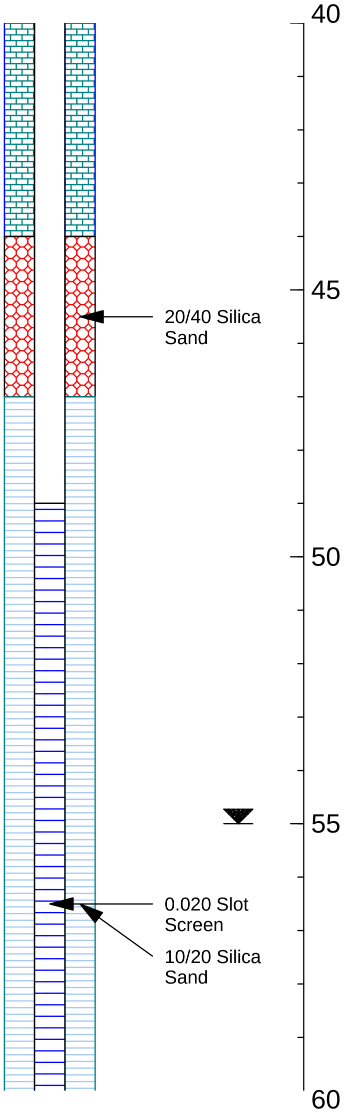
**Well ID:** MW-4

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 40 | | | | | | |
| 45 | | | | | | Wet basalt cuttings with some silt and fine sand. Cuttings mostly fine. Angular to subrounded vesicular. Cuttings become coarser, non-vesicular. Dry after 45.5 ft. |
| 50 | | | | Basalt | | Very hard drilling. |
| 55 | | | | | | |
| | | | | | | Driller reports fracture. |
| 60 | | | | | | |

Well Construction



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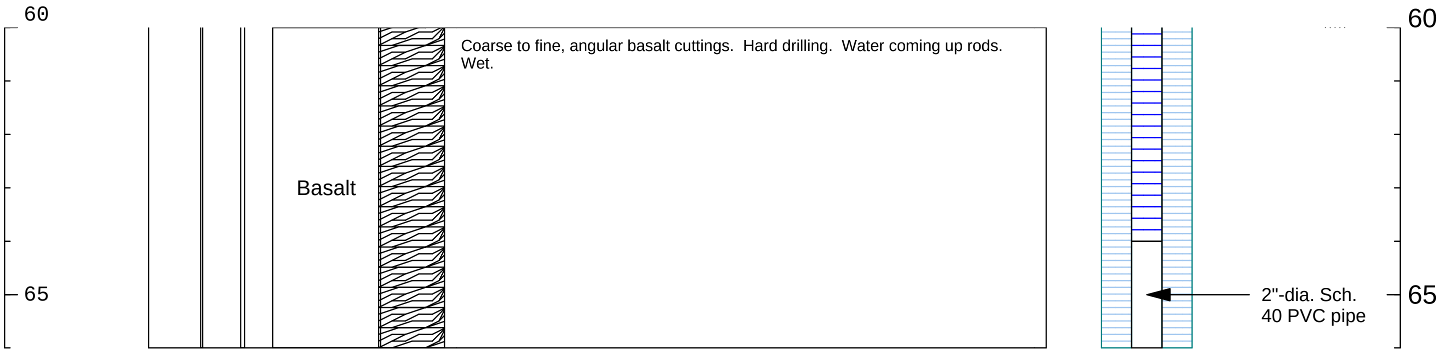
**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 60–66 | | | | Basalt | | Coarse to fine, angular basalt cuttings. Hard drilling. Water coming up rods. Wet. | 2"-dia. Sch. 40 PVC pipe |



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**Date Start/Finish:** 9/21/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 304,733.40'
**Easting** 2,524,840.55'
**Casing Elevation:** 2,228.26 ft

**Borehole Depth:** 47 ft.
**Surface Elevation:** 2,225.63 ft

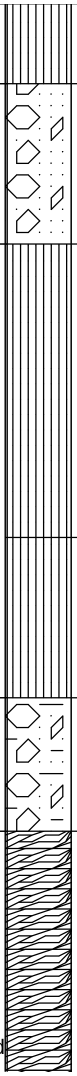
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

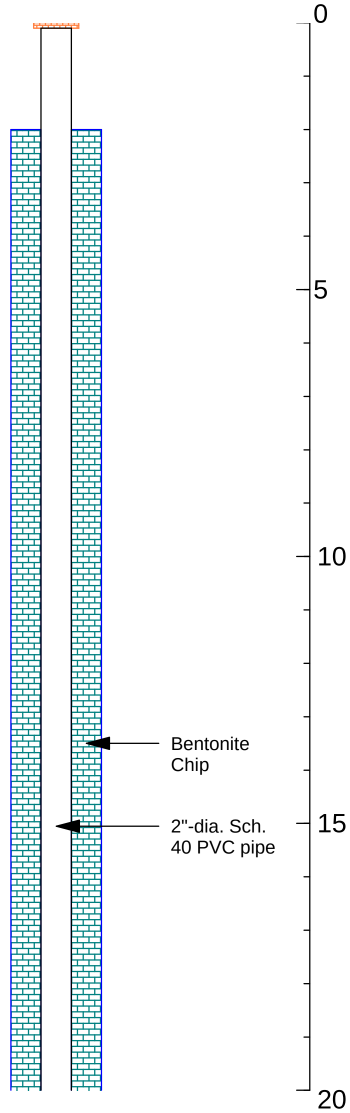
**Well ID:** MW-5

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 0 | | | | ML | | Light brown soft SILT with subngular basalt gravel. Dry. | |
| | | | | GM | | Angular basalt cuttings with silt. Cuttings mostly coarse, somwhat vesicular. Gravel. Dry. | |
| 5 | | | | ML-G | | Reddish brown SILT. Coarse to fine basalt gravelly silt. Basalt gravel is vesicular and subangular to angular. Dry. | |
| 10 | | | | | | Brown to light brown silt. | |
| | | | | GP | | Coarse to fine angular to subangular basalt gravel with some brown silt. Dry. Decreasing silt with depth. | |
| 15 | | | | Weathered | | Basalt cutting. Angular. Mostly coarse. No silt. Dry. Not very hard drilling. | |
| 20 | | | | | | | |





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**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
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**Borehole Depth:** 47 ft.
**Surface Elevation:** 2,225.63 ft

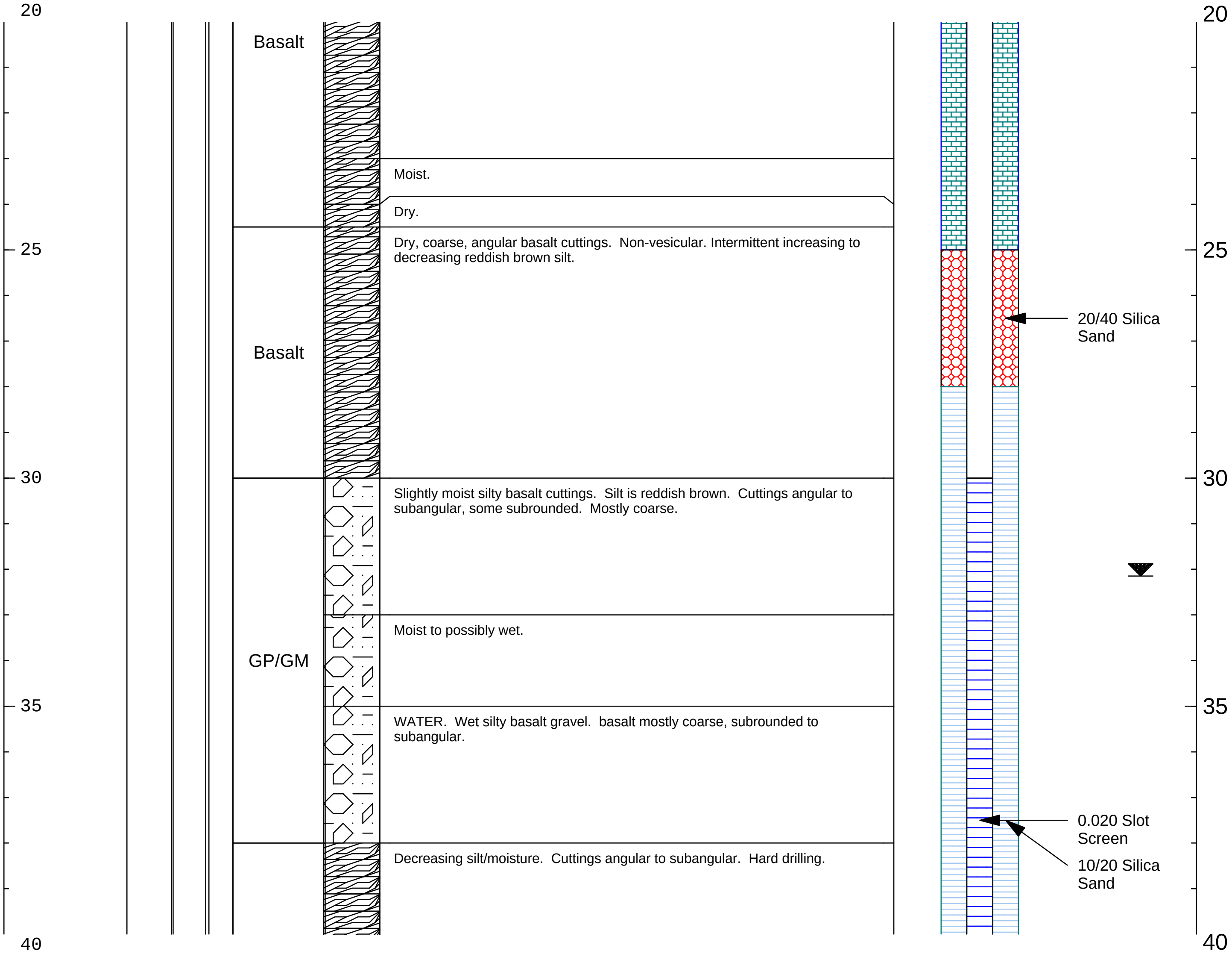
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-5

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|
| 20 | | | | Basalt | | | |
| | | | | | | Moist. | |
| | | | | | | Dry. | |
| 25 | | | | Basalt | | Dry, coarse, angular basalt cuttings. Non-vesicular. Intermittent increasing to decreasing reddish brown silt. | 20/40 Silica Sand |
| 30 | | | | GP/GM | | Slightly moist silty basalt cuttings. Silt is reddish brown. Cuttings angular to subangular, some subrounded. Mostly coarse. | |
| | | | | | | Moist to possibly wet. | |
| 35 | | | | | | WATER. Wet silty basalt gravel. basalt mostly coarse, subrounded to subangular. | 0.020 Slot Screen<br>10/20 Silica Sand |
| | | | | | | Decreasing silt/moisture. Cuttings angular to subangular. Hard drilling. | |
| 40 | | | | | | | |



**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt

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**Driller's Name:** Randy Wilder
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**Surface Elevation:** 2,225.63 ft

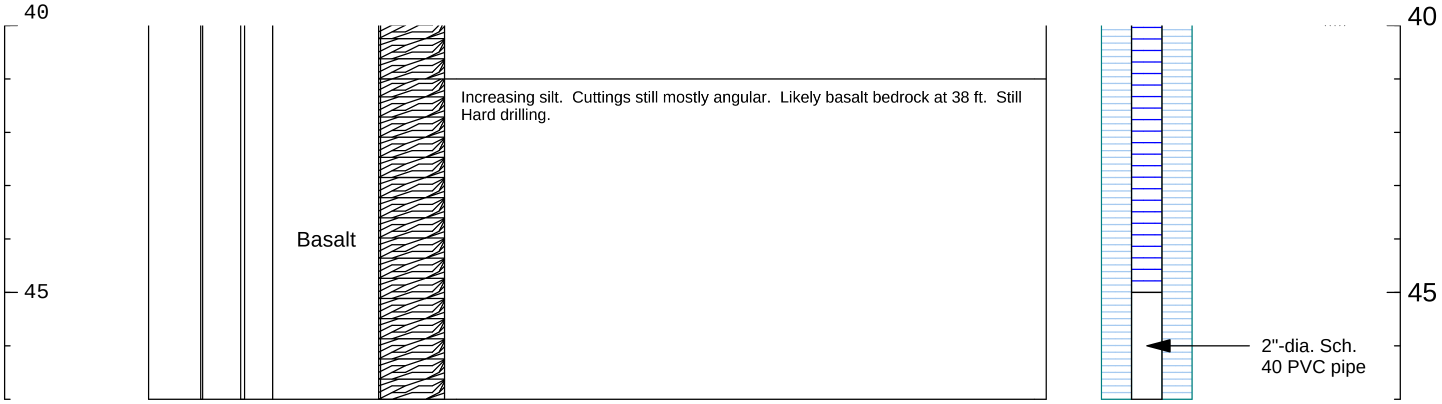
**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-5

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description | Well Construction |
|---|---|---|---|---|---|---|---|



Increasing silt. Cuttings still mostly angular. Likely basalt bedrock at 38 ft. Still Hard drilling.

**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt

**Date Start/Finish:** 9/16/2010
**Drilling Company:** Environmental West Exploration
**Driller's Name:** Randy Wilder
**Drilling Method:** Air Rotary, 6" Tubex
**Bit Size:**
**Auger Size:**
**Rig Type:**
**Sampling Method:**

**Northing** 304,404.30'
**Easting** 2,524,547.02'
**Casing Elevation:** 2,167.21 ft

**Borehole Depth:** 55 ft.
**Surface Elevation:** 2,164.18 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

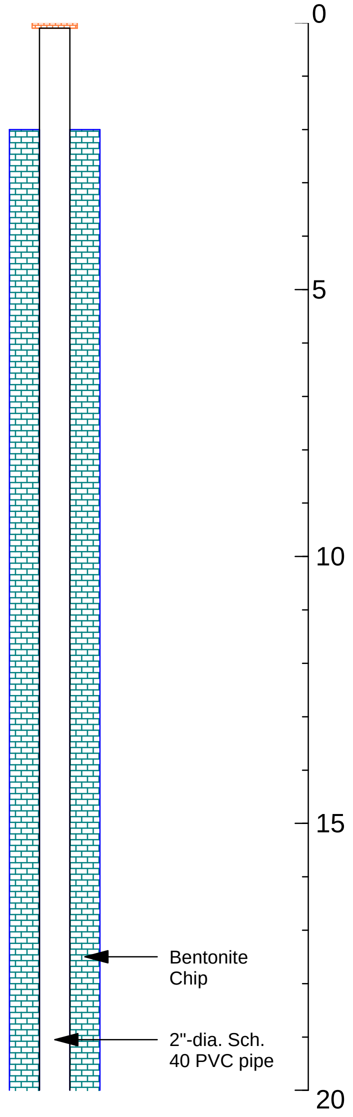
**Well ID:** MW-6

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 0 | | | | GM | | Fine to Coarse, subrounded silty basalt GRAVEL. Dry. Silt is brown to light brown. |
| 5 | | | | GP | | Basalt GRAVEL with silt. Decreasing silt. Dry. |
| | | | | GM | | Basalt GRAVEL with silt. Increasing silt content. |
| | | | | | | Decreasing silt. |
| 10 | | | | | | Cuttings angular. Dry. Hard drilling. |
| 15<br>20 | | | | ML-G | | Soft brown SILT. Some angular to subrounded basalt gravel. Dry. |

Well Construction



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**Surface Elevation:** 2,164.18 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

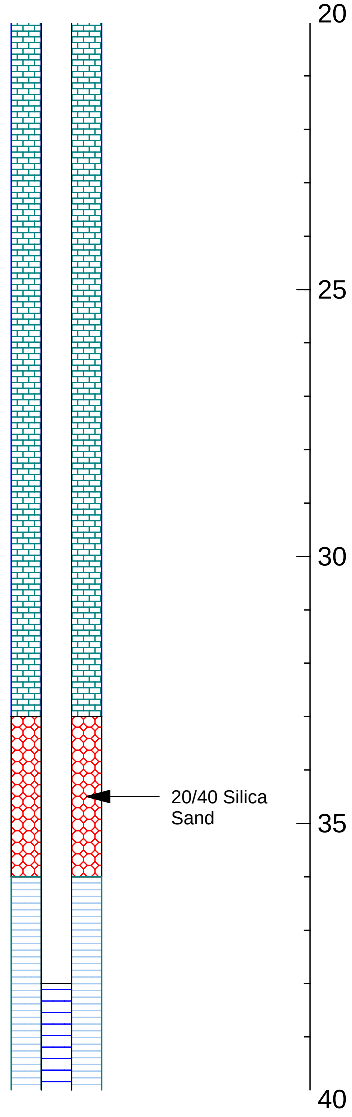
**Well ID:** MW-6

**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

| DEPTH | Sample/Int/Type | Recovery (feet) | Blows / 6 Inches | USCS | Geologic Column | Lithologic Description |
|---|---|---|---|---|---|---|
| 20 | | | | GM | | Silty, subangular basalt GRAVEL. Coarse. Slightly moist. Vesicular. |
| | | | | ML | | Brown, soft moist SILT. Trace subrounded to angular basalt gravel (coarse). Slightly moist. |
| 25 | | | | GP | | Subrounded to subangular fine to coarse basalt GRAVEL with some silt. Slightly moist. |
| | | | | SP | | Brown fine SAND with silt and trace fine basalt gravel. Moist. |
| | | | | GP | | Subangular to subrounded basalt GRAVEL. Trace silt. Dry. Vesicular |
| 30<br>35 | | | | GP-S | | Fine to coarse sandy basalt GRAVEL. Fine to medium sand. Gravel round to subrounded. Dry. |
| | | | | | | Decreasing sand. |
| 40 | | | | GP | | Subrounded to rounded basalt GRAVEL. Trace silt and fine Sand. Dry. |

Well Construction



**Remarks:** ft = feet; " = inch; bgs = below ground surface; msl = mean sea level; GP = Geoprobe; OD = Outer Diamer; NA = Not applicable / Available; PID = Photoionization Detector; PVC = Poly Vinyl Chloride, G=Grab Sample, SB=Split Barrel, TS=Top Soil, C=Concrete, AS=Asphalt

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**Northing** 304,404.30'
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**Casing Elevation:** 2,167.21 ft

**Borehole Depth:** 55 ft.
**Surface Elevation:** 2,164.18 ft

**Logged By:** Kevin Knesek
**Supervising Geologist:** Steve Reed

**Well ID:** MW-6

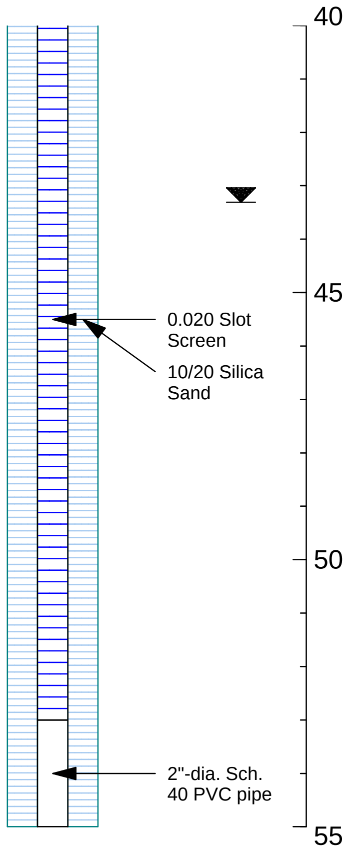
**Client:** Kaiser Aluminum & Chemical Corporation LLC

**Location:** Mead, WA

DEPTH 40 45 50 55

| USCS | Lithologic Description |
|---|---|
| GM | Silty coarse to fine, subrounded to rounded basalt GRAVEL. Wet |
| GP | Coarse to fine, rounded to subrounded basalt GRAVEL with coarse sand. Trace fine sand and silt. Moist to wet. |
| SP | Brown, fine to medium SAND with silt. Trace fine to coarse, rounded to subrounded basalt gravel. Wet. |

Well Construction



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# APPENDIX C

# Sampling and Analysis Plan

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# SAMPLING AND ANALYSIS PLAN FOR
# HEGLAR-KRONQUIST LANDFILL
# MEAD, WASHINGTON
# FACILITY SITE ID: 645
# CLEANUP SITE ID: 1135

by
Haley & Aldrich, Inc.
Spokane, Washington

for
Kaiser Aluminum
Spokane Valley, Washington

File No. 0202596-003
December 2023

HALEY & ALDRICH, INC.
505 W. RIVERSIDE AVENUE
SUITE 205
SPOKANE, WA 99201
509.960.7447

# SIGNATURE PAGE FOR

## SAMPLING AND ANALYSIS PLAN FOR
## HEGLAR-KRONQUIST LANDFILL
## MEAD, WASHINGTON
## FACILITY SITE ID: 645
## CLEANUP SITE ID:1135

**PREPARED FOR**

KAISER ALUMINUM
SPOKANE VALLEY, WASHINGTON

REVIEWED AND APPROVED BY:

Ward McDonald, L.G.
Project Manager
Haley & Aldrich, Inc.

John Haney, P.E.
Principal Environmental Engineer
Haley & Aldrich, Inc.

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# 1. Introduction

Haley & Aldrich Inc. (Haley & Aldrich) prepared this Sampling and Analysis Plan (SAP) for Kaiser Aluminum (Kaiser), formerly DCO Management, LLC, for the Heglar Kronquist Landfill Site (Site) near Mead, Washington. The Site location is shown on “Vicinity Map,” Figure 1. Kaiser entered into a Consent Decree No. 13202067-4 (Consent Decree) with the Washington State Department of Ecology (Ecology) to complete a cleanup action at the Site in 2014. The Site is a capped aluminum dross landfill.

Hart Crowser, Inc. (now Haley & Aldrich) prepared a Compliance Monitoring Plan (CMP) for the Site in 2013 following construction activities to enhance the cap system. The CMP included a SAP which was prepared to meet the requirements of WAC 173-340-820. The 2013 SAP includes monitoring groundwater from monitoring wells, monitoring surface water from springs, and monitoring ammonia in existing landfill gas vents (ammonia monitoring at the Site was discontinued after two years of monitoring). This updated SAP describes the procedures for groundwater, surface water, and ammonia gas sample collection, handling, and chemical analyses recommended in our 22 December 2023 “Assessment Plan for Heglar-Kronquist Landfill.”

# 2. Background

The Site is located in a rural area near Mead, Washington, approximately 10 miles northeast of downtown Spokane, Washington (see Figure 1). Geologically, the Site reportedly is located above landslide deposits (consisting of sediments and basalt rubble; Exponent, 2011). The Site originally was developed as a county gravel pit between 1963 and 1969. Between 1969 and 1974, Kaiser transported black dross (a byproduct of aluminum processing) from the Kaiser Aluminum Trentwood Works in Spokane Valley, Washington, to the Site for disposal in the former gravel pit. Disposal activities ceased in 1974, when elevated levels of chloride and sodium (byproducts of black dross) were detected in one shallow water supply well and a spring downgradient of the Site. Various Site assessments were conducted after disposal activities ceased; findings of those assessments indicated that groundwater and surface water were potentially impacted by contaminants leaching from the landfill. “Site Plan,” Figure 2 shows the general layout of the Site and locations of existing monitoring wells and surface water sample locations.

Kaiser purchased the property in 1984 and capped the landfill to reduce the potential for black dross constituents to leach into groundwater. The 1984 capping activities included installing a low-permeable clay layer (referred to as “Foundation Layer” in the 2012 Remedial Investigation), vegetated topsoil layer, 17 ammonia gas vents, drainage ditches, and perimeter fencing to restrict Site access. However, the 1984 clay cap desiccated due to lack of precipitation allowing infiltration of stormwater through the landfilled materials and migration of dross constituents into groundwater. Additionally, the cap was constructed without a drainage layer to shed water from the capped area or perimeter swales to direct stormwater runoff from the hillside east of the landfill around the capped area. Subsequently, stormwater from the hillside flowed onto and through the cap further diminishing cap performance.

In 2014, Hart Crowser designed and constructed enhancements to the existing cap to remedy the conditions noted above. Hart Crowser constructed a multi-layered, engineered cap over the landfill and repaired damage to the existing passive gas venting system. Construction activities are described in detail in our 4 August 2015 “Cleanup Action Construction Completion Report” (Hart Crowser, 2015). Following construction activities, Hart Crowser began compliance monitoring to assess the effectiveness of the cap at reducing infiltration of surface water and subsequent leaching of chloride, nitrates, and sodium into groundwater as required by the Final Cleanup Action Plan. Hart Crowser initiated compliance monitoring activities during October 2015 in accordance with our Ecology-approved “Final Sampling and Analysis Plan and Quality Assurance Project Plan” (Hart Crowser, 2013b). Compliance monitoring activities include:

- Inspecting the condition of Site features (security controls, cap, passive gas venting system, and monitoring wells).
- Measuring depth to groundwater.
- Sampling groundwater.
- Sampling surface water (when flowing).
- Sampling landfill gases.
- Analyzing water samples for chlorides and nitrates (contaminants of concern) and landfill gas samples for ammonia.

## 3. Scope of Work

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this SAP to guide field activities to conduct compliance monitoring at the Site. Compliance monitoring will consist of the following activities:

- Monitoring groundwater elevation in monitoring wells MW-1, MW-3, and MW-4 by collecting depth to water measurements using an electronic water level meter and pressure transducers.
- Collecting water samples in groundwater monitoring wells MW-1, MW-3, and MW-4 and surface water seep locations SW-3 and SW-5.
- Collecting landfill gas samples from three landfill gas vents.
- Analyzing sample media for contaminants of concern (COC).

## 4. Sampling and Analysis Plan

Haley & Aldrich will use this SAP to guide field activities at the Site during compliance monitoring events. Haley & Aldrich will conduct quarterly monitoring events in 2024; we anticipate annual events will be conducted going forward in 2025. The quarterly and annual monitoring activities, project tasks, and schedule are shown in “Heglar Kronquist Monitoring Schedule” Table 1.

Haley & Aldrich will provide personnel to fill the key roles and responsibilities necessary to complete monitoring activities during each event. The project roles and responsibilities are shown in “Project Roles and Responsibilities,” Table 2 and include: Project Manager, Field Coordinator(s), Data Validation and Review Specialist(s), and the Analytical Laboratory Project Manager. Specific compliance monitoring activities are discussed in more detail in the sections below.

## 5. Field Monitoring Activities

Haley & Aldrich will conduct compliance monitoring activities during each event according to the schedule listed in Table 1. Haley & Aldrich will inspect Site features, collect elevation and water quality data from monitoring wells and surface water locations, collect water samples from monitoring wells and surface water locations, and collect air samples from landfill gas vents. The field monitoring activities are further detailed in the sections below.

## 5.1 SITE FEATURE MONITORING

Haley & Aldrich will visually inspect the perimeter fence, gates, signage, and locks. We will verify that the security control features are intact and posted signage is legible and visible. Haley & Aldrich will inspect the condition of the cap, drainage swales, and the passive gas venting system in accordance with the Institutional Controls Plan ([ICP], Hart Crowser, 2013a).

## 5.2 GROUNDWATER MONITORING

Haley & Aldrich will conduct groundwater monitoring at monitoring wells MW-1, MW-3, and MW-4. We will collect elevation and water quality data at each monitoring well. If, additional groundwater monitoring locations are added in the future, we will collect elevation data and samples in accordance with this SAP. The groundwater monitoring field activities are discussed further in the following sections.

### 5.2.1 Groundwater Elevation Monitoring

Haley & Aldrich will first measure the depth to water at each monitoring well location using a Waterline electronic water level indicator, or equivalent. We will reference each water level measurement to the surveyed top of the polyvinyl chloride (PVC) well casing elevation (TOC) for each well. We will record the date, time of measurement, and depth to water below TOC (measured to the nearest 0.01 foot) in a field notebook or a field form.

After collecting a depth to water measurement, Haley & Aldrich will deploy an In-Situ Rugged Troll 100 pressure transducer (transducer) in each monitoring well sampled to continuously monitor groundwater elevation. We will use stainless steel, braided, vinyl-coated wire to attach the transducer to a locking well plug placed on the PVC casing. We will place the transducer within the wetted well screen approximately one foot above the bottom of the well. The transducer will be programmed to record pressure readings and temperature every six hours.

Haley & Aldrich also will deploy an In-Situ BaroTROLL (BaroTROLL) pressure transducer within the dry section of the riser pipe in MW-1 to record barometric pressure. We will program the BaroTROLL to record pressure and temperature readings on the same time interval as the transducers deployed within the water column. We will use the BaroTROLL pressure data to correct water column transducer data for atmospheric pressure.

### 5.2.2 Groundwater Sampling

Haley & Aldrich will collect groundwater samples using low-flow sampling techniques and a reusable stainless steel Geosub 2 submersible pump equipped with disposable polyethylene sample tubing or dedicated sample tubing. We will place the sample pump intake 1 to 2 feet below the groundwater surface. If the groundwater surface is above the top of the well screen, we will place the pump intake at the middle of the wetted screen. Prior to sampling, we will purge the well casing, to remove stagnant water from the well, at flow rates of 100 to 500 milliliters per minute. While purging we will measure the following water quality parameters:

- pH
- Temperature in degrees of Celsius
- Oxidative reduction potential (ORP) in units of millivolts
- Specific conductivity in units of microsiemens per centimeter

- Dissolved oxygen (DO) in units of milligrams per liter
- Turbidity in nephelometric turbidity units

We will measure water quality parameters using a YSI Pro DSS (YSI) or equivalent water quality meter equipped with a flow-through cell and will record the measurements in a field notebook and/or field sampling form. We will consider purging to be complete once the following three items are met:

- Groundwater quality parameters (pH, Temperature, ORP, Specific Conductivity, and DO) stabilize within 10 percent after three successive readings collected three to five minutes apart.
- Turbidity measurements are below 20 nephelometric turbidity unit (NTU).
- Groundwater elevations stabilize within 0.3 feet after three successive readings three to five minutes apart.

After the purging process is complete, Haley & Aldrich will don new nitrile gloves, disconnect the tubing from the flow-thru call, and collect a water sample by allowing water to flow freely from the sample tubing into laboratory-provided sample containers. After collecting each sample, Haley & Aldrich will place the sample containers into individual zip-top bags and place on ice until the samples are delivered to the analytical laboratory. Groundwater samples will be submitted and analyzed for the following parameters:

- Chloride by EPA Method 300.0
- Nitrate plus nitrite as nitrogen by EPA Method 300.0 or EPA Method 353.2
- Total Dissolved Solids by EPA Method 160.1 or equivalent
- Dissolved Sodium by EPA Method 6010C or equivalent

We will collect dissolved sodium samples by attaching a new, disposable, 0.45-micron filter to the end of the sample tubing and allow filtered water to freely flow into the sample bottle. Additionally, we will collect one duplicate sample and submit to the analytical laboratory for the analyses identified above for quality control purposes.

### 5.3 SURFACE WATER SAMPLING

Haley & Aldrich will conduct surface water quality monitoring at SW-3 and SW-5. We will don new nitrile gloves and collect water samples by allowing the water to freely flow into laboratory provided sample containers. However, if surface water is not running freely, samples will not be collected. After collecting each sample, Haley & Aldrich will place the sample containers into individual zip-top bags and place on ice until the samples are delivered to the analytical laboratory.

Haley & Aldrich will measure water quality parameters (see Section 5.2.2) by placing the water quality meter probe in the flowing water and recording measurements for each parameter. We will record the parameters in a field notebook or sampling field form. Surface water samples will be submitted and analyzed for the following parameters:

- Chloride by EPA Method 300.0
- Nitrate as nitrogen by EPA Method 300.0 or EPA Method 353.2
- Total Dissolved Solids by EPA Method 160.1 or equivalent
- Total Sodium by EPA Method 6010C or equivalent

Additionally, we will collect one duplicate sample and submit to the analytical laboratory for the analysis identified above for quality control purposes.

## 5.4 SAMPLING EQUIPMENT

The following sampling equipment will be used for sampling the monitoring wells and/or surface water locations:

- Nitrile gloves
- Waterline electric water level meter
- Stainless steel Geosub 2 submersible pump, or equivalent
- Water quality meter (includes pH, temperature in degrees in Celsius [°C], Oxidation Reduction Potential [ORP], specific conductivity, dissolved oxygen [DO], and turbidity), or equivalent, with flow through cell and dedicated tubing
- Five-gallon buckets and lids
- Disposable polyethylene sample tubing
- Laboratory provided sample containers
- Zip-top bags
- Coolers with water ice

### 5.4.1 Calibration Procedures and Specifications for Field Instruments

Haley & Aldrich will rent the water quality meter from a third-party vendor. The water quality meter will be received from the vendor pre-calibrated. We do not anticipate needing to calibrate the water quality meter during sampling. However, we will conduct a calibration check at the beginning of the day to verify the water quality meter measurements are accurate. If we observe measurements of calibration standards are greater than 10 percent different than the stated calibration standard concentrations, we will recalibrate the water quality meter.

## 5.5 DECONTAMINATION

Haley & Aldrich will decontaminate reusable equipment between sample locations. If reusable equipment requires decontamination, we will decontaminate the equipment in a solution containing Liquinox detergent and potable water followed by a potable water rinse. We will then conduct a final rinse of the equipment with deionized (DI) water.

## 5.6 LANDFILL GAS SAMPLING

Haley & Aldrich will collect landfill gas samples from gas vents GV-9, GV-11, and GV-12 (vents with the greatest concentrations of ammonia were detected during the RI). We will use ammonia specific absorbent cartridges or summa canisters provided by the analytical laboratory to collect landfill gas samples from the vents. We will follow sampling protocols provided by the analytical laboratory. We will use disposable Teflon tubing to collect the gas samples from within the landfill vent rather than at the surface. We will collect one field blank sample as a quality control sample to assess potential ambient and/or cartridge contamination.

## 5.7 SAMPLE HANDLING AND CUSTODY

After each sample is collected, we will place sample containers in a cooler with ice and transport to the laboratory under standard Chain-of-Custody (COC) documentation. Haley & Aldrich plans to transport the water samples accompanied by the COC and deliver the samples to Eurofins Environment Testing Northwest, LLC (Eurofins) in Spokane, Washington for analysis. Haley & Aldrich personnel with possession of and responsibility for the samples will be recorded on the COC and the transfer of sample possession from one Haley & Aldrich staff member to another will be documented on the COC. Haley & Aldrich will submit the samples to Eurofins for analysis and the requested analyses will be documented on the COC. Haley & Aldrich will direct Eurofins to analyze the samples collected from each monitoring well and surface water location according to the analyses listed in Sections 5.2.2 and 5.3 above.

We will handle the gas sample cartridges in accordance with the analytical labs protocol. We will either hand deliver the ammonia cartridges or deliver via third party delivery service to a Washington State Certified Laboratory for analysis.

### 5.7.1 Sample Labeling

Haley & Aldrich will label samples collected in indelible ink and with the following information:

- Project number
- Sample location identification
- Date and time of sample collection
- Analyses required
- Sampler's initials

Duplicate water samples will be identified by including an additional "00" to the end of the sample location identification and adding an additional 30 minutes to the sample collection time. For example, a sample collected at monitoring location MW-1 at a collection time of 10:00 will have a corresponding duplicate sample labeled MW-100 at a collection time of 10:30.

### 5.7.2 Sample Transport

Haley & Aldrich will transport the samples accompanied by the COC as described above. The laboratory will provide an Analytical Laboratory Project Manager to accept custody of the samples, sign the COC, and verify samples on the COC match the samples provided. After the Analytical Laboratory Project Manager accepts custody of the samples, they will be responsible for care, custody, and proper disposal of sample containers/zip-top bags after analyses are complete. The Analytical Laboratory Project Manager will assign the samples received with a unique, sequential identification number for tracking and reporting purposes.

### 5.7.3 Investigation-Derived Waste

Haley & Aldrich will discharge monitoring well purge water directly from plastic tubing to the ground at wellheads to allow it infiltrate back into the ground. Waste paper, plastic tubing, personal protective equipment (PPE), and other solid waste generated during sampling are not regulated waste. Haley & Aldrich will collect and dispose of waste accordingly.

## References

1. Exponent 2011., Final Remedial Investigation Report Mead, Washington. 9 September.

2. Hart Crowser 2015., Cleanup Construction Completion Report Heglar Kronquist Landfill Mead, Washington. 4 August.

3. Hart Crowser 2013a., Final Institutional Controls Plan Mead Washington., 12 August.

4. Hart Crowser 2013b., Final Sampling and Analysis Plan and Quality Assurance Project Plan Mead, Washington. 12 August.

5. Washington State Department of Ecology, Consent Decree No. 13202067-4. 6 June.

# TABLES

**TABLE 1**
**HEGLAR KRONQUIST MONITORING SCHEDULE**
KAISER ALUMINUM
SPOKANE VALLEY, WASHINGTON

| **2024 Monitoring Period** | | |
|---|---|---|
| **Activity** | **Project Tasks** | **Schedule** |
| Field Activities | Institutional Control Monitoring | Quarterly |
| | Groundwater Monitoring | |
| | Surface Water Monitoring | |
| Laboratory Analysis | Validate and report analytical data to Kaiser | |
| Data Processing | Upload and process data into EQuIS and EIM | |
| Reporting | Prepare and submit Compliance Monitoring Report to Ecology | |

***Notes***

*DTW = Depth to Water*

*EQuIS = Environmental Quality Information System*

*Ecology = Washington State Department of Ecology*

*Monitoring period = 1 January to 30 December*

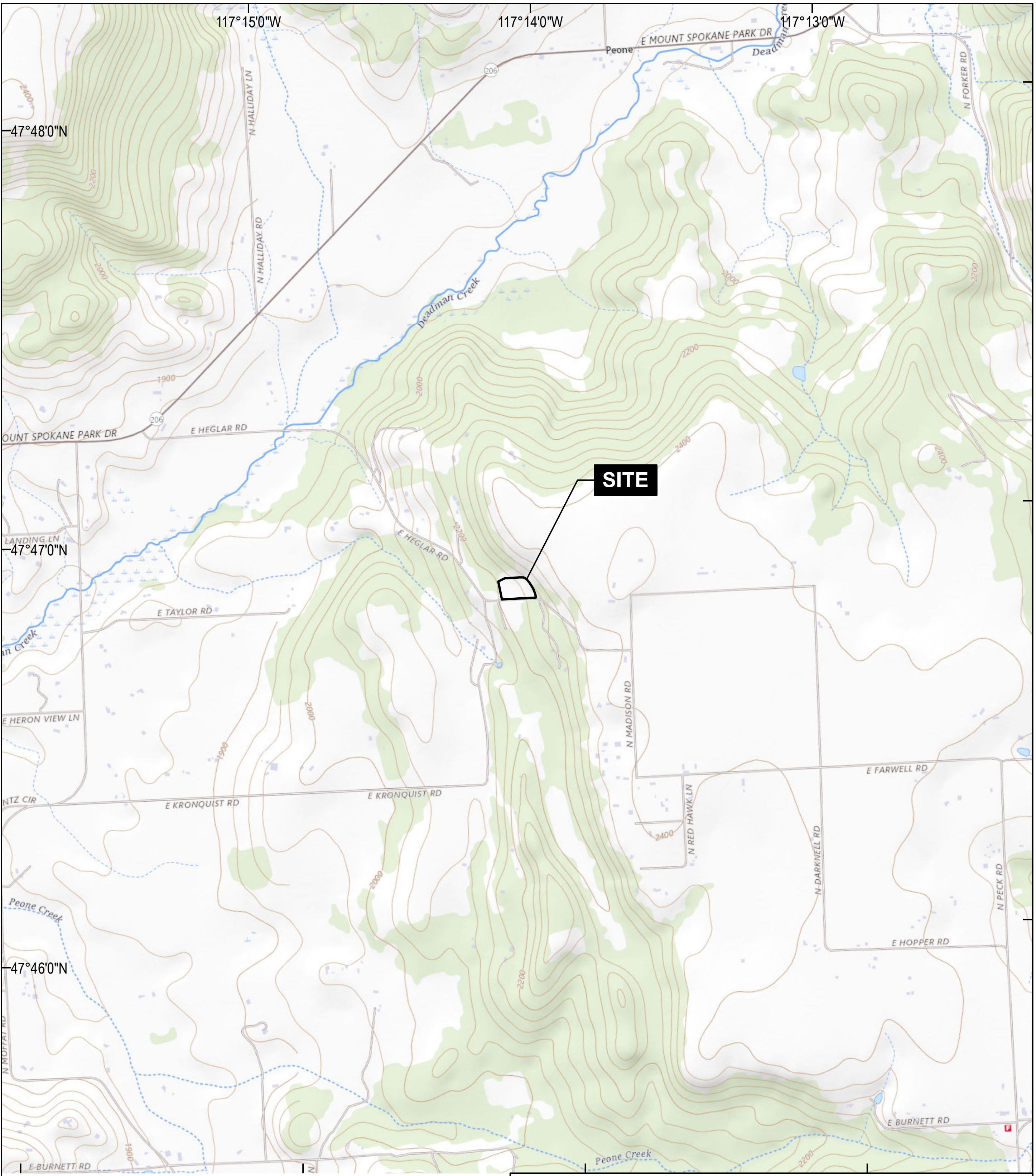
**TABLE 2**
**PROJECT ROLES AND RESPONSIBILITIES**
KAISER ALUMINUM
SPOKANE VALLEY, WASHINGTON

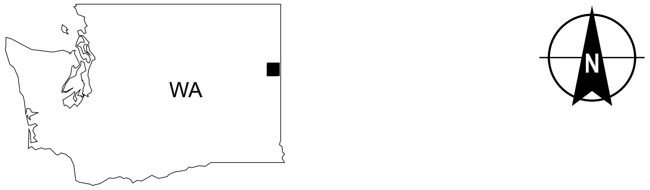
| Project Role | Personnel Assignment | Responsibility |
|---|---|---|
| Project Manager | Ward McDonald<br>(206) 972-6521 | Perform overall project review of procedures and documents relative to contractual commitments.<br>Develop project QA specifications.<br>Ensure that all QA components for sampling and analysis, data management, and document preparation are performed in accordance with project specifications.<br>Coordinate all chemistry and chemical analyses for the project. |
| Field Coordinator | McKynzie Clark (509) 944-5344 or Keylin Huddleston (253) 370-1152 | Ensure that samples are collected and transferred to the laboratories under appropriate chain of custody procedures.<br>Coordinate with Project QA Manager on issues concerning quality control.<br>Ensure chain of custody is followed. |
| Eurofins - Analytical Laboratory Project Manager | Randee Arrington (509) 928-5715 | Receive samples from Haley & Aldrich field personnel.<br>Oversee performance of laboratory QA/QC on analysis and reporting. |
| Data Validation and Review Specialist | Melanie Satanek (216) 706-1320 | Evaluate quality of the analytical data.<br>Perform data validation.<br>Perform data uploads into EIM.<br>Ensure continuous data is QC with raw data. |

***Notes***

*EQuIS = Environmental Quality Information System*
*QA = Quality Assurance*
*QC = Quality Control*

# FIGURES





MAP SOURCE: USGS
SITE COORDINATES: 47°46'51"N, 117°14'09"W

HALEY ALDRICH

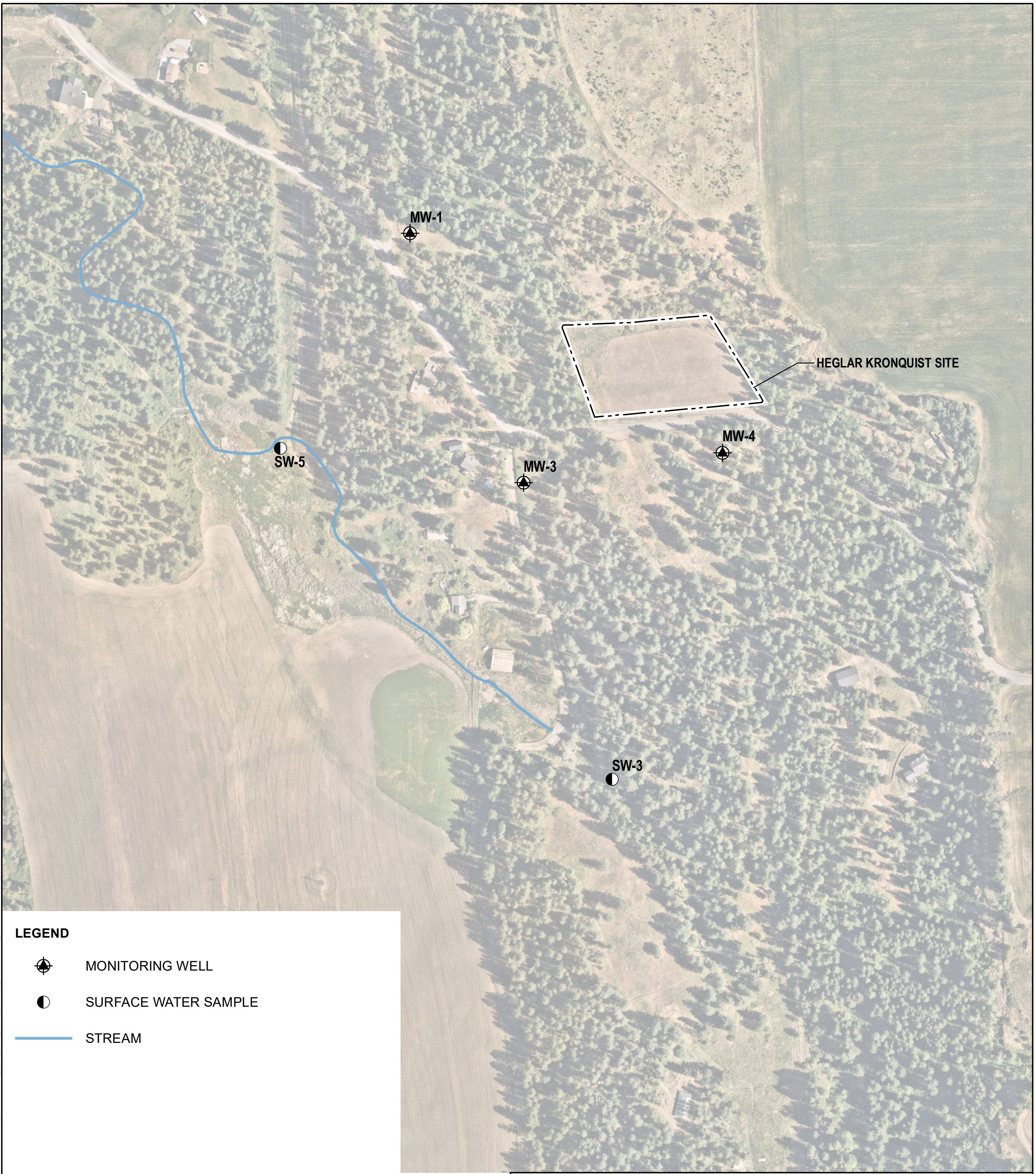
HEGLAR KRONQUIST SITE
MEAD, WASHINGTON

## VICINITY MAP

APPROXIMATE SCALE: 1 IN = 2000 FT
MAY 2023

FIGURE 1

GIS: \\haleyaldrich.com\share\sea_projects\Notebooks\1792605_Heglar_Kronquist_Compliance_Monitoring\GIS\MGIS\Maps\2023_05\202596_001_001_VICINITY_MAP.mxd - jday - 6/3/2022 4:36:32 PM



**LEGEND**

- MONITORING WELL
- ◐ SURFACE WATER SAMPLE
- STREAM

**NOTES**

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. MONITORING WELL AND SURFACE WATER SAMPLING LOCATIONS SURVEYED BY ADAMS AND CLARK, INC. 2011; REFERENCED TO NAD 83 WASHINGTON STATE PLANE NORTH (US FEET) AND NAVD 88.

3. AERIAL IMAGERY SOURCE: NEARMAP, 13 MAY 2021

HALEY ALDRICH

HEGLAR KRONQUIST SITE
MEAD, WASHINGTON

# SITE PLAN

DECEMBER 2023

FIGURE 2

GIS: \\haleyaldrich.com\share\CF\Projects\0202596\GIS\Maps\2023_12\202596_001_013_SITE_PLAN_EXISTING_MONITORING_NETWORK.mxd - khaskins - 12/14/2023 9:46:49 AM