Domestic Wells and Spring Sampling and Analysis
Heglar-Kronquist Site
Mead, Washington

Prepared for
Kaiser Aluminum & Chemical
Corporation, LLC

February 13, 2009
17524-00

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DOMESTIC WELLS AND SPRING SAMPLING AND ANALYSIS
HEGLAR-KRONQUIST SITE
MEAD, WASHINGTON

1.0 INTRODUCTION

In November 2008, after discussions with the Washington State Department of Ecology (Ecology) related to drinking water concerns raised by residents in the vicinity, Kaiser Aluminum & Chemical Corporation, LLC (Kaiser) volunteered to collect and analyze groundwater samples from 16 private domestic water supply wells and one spring on properties within an approximate 1/2-mile radius of a closed landfill located near Mead, Washington (Figure 1). The closed landfill formerly received black dross originating from Kaiser's Trentwood Facility located in Spokane Valley, Washington. Potential environmental contaminants associated with black dross include sodium, potassium, aluminum, magnesium, chloride, ammonia, nitrite, nitrate, and fluoride.

Hart Crowser field personnel, accompanied by Ecology representatives, performed the domestic well sampling on December 11 and 12, 2008. The spring was sampled by Hart Crowser field personnel on January 22, 2009.

Kaiser and Ecology are currently working on an Agreed Order under the Washington State Model Toxics Control Act (MTCA) that lays out the steps Kaiser will take to investigate potential environmental impacts potentially caused by the landfill. Sampling and analysis of nearby domestic wells and the spring represent an initial effort to assess the quality of area groundwater used for drinking water. This report is not intended to determine whether constituents present in area wells and the spring are related to former landfill operations. Determining the source(s) of groundwater constituents will be a goal of the remedial investigation. Additional information, such as potential soil and groundwater contaminant levels due to the landfill, fate and transport of potential contaminants, local geology, local hydrogeology (i.e., groundwater flow direction(s), infiltration rates), background sources of contaminants, and other potential contaminant sources would be needed to make this assessment.

1.1 Objectives

The sampling and analysis of domestic water supplies and the spring in the vicinity of the former Heglar Kronquist landfill were undertaken to accomplish the following objectives:

- Sample domestic water supply wells screened in the underlying groundwater and one area spring identified by Ecology; and

- Determine the concentrations of selected chemical constituents in the groundwater used as a drinking water source.

1.2 Report Organization

This report describes the procedures employed to collect domestic well water and spring samples and presents the laboratory analytical results with comparison to available drinking water regulatory levels. The report organization includes the following:

- **1.0 Introduction.** This section provides introductory details of the sampling program and a brief site background;

- **2.0 Domestic Wells and Spring Sampling Activities.** This section describes the domestic water supply and spring sampling methods and equipment that was used;

- **3.0 Domestic Wells and Spring Samples Analysis and Analytical Results.** This section describes the domestic water supply and spring samples analysis and analytical results and provides a comparison of results to available drinking water regulatory levels; and

- **4.0 References.** This section presents the references cited in this report or relied upon to produce this report.

These sections are supported by tables and figures that are presented at the end of the main text of the report. Further, the report contains the following appendix:

- **A – Chemical Data Quality Review and Certificates of Analysis** contains a quality review of laboratory analytical results and laboratory certificates of analysis received from Columbia Analytical Services (CAS).

1.3 Background

The former Heglar Kronquist landfill is an approximately 4-acre site located about 10 miles north of Spokane, Washington, near the intersection of East Heglar and East Kronquist Roads. The site lies in a rural area within the Deadman Creek drainage and is located less than a mile southeast of Deadman Creek

(Figure 1). Initially, the landfill site was developed as a basalt quarry. By 1969, the quarry had been abandoned.

Between 1969 and 1974, the former quarry operated as a landfill. During that time, the Kaiser Trentwood facility reportedly disposed of as much as 55,000 cubic yards (60,000 tons) of black dross in the landfill. It is not clear whether any other material was disposed of at the landfill. Black dross is a by product of an aluminum production process and generally consists of sodium chloride, potassium chloride, aluminum, aluminum oxide, carbides, and nitrides.

In 1974, the Spokane County Health Department (SCHD) sampled and analyzed several springs and private wells in the area, detecting elevated concentrations of sodium and chloride in samples collected from a spring located about 1,000 feet south-southwest of the site and a residential well located about 800 feet southwest of the site. In response to the SCHD findings, landfill operations were discontinued, and the site was covered with soil in 1974. Between 1974 and 1979, SCHD and the U.S. Environmental Protection Agency (EPA) continued to periodically sample and analyze wells and springs near the site (Sweet Edwards and Associates, 1979 and 1980).

In 1984, Kaiser installed a 2-foot-thick clay cover, drainage ditches, and a passive gas venting system at the landfill. Kaiser subsequently purchased the property and continued to periodically monitor water quality in the spring located about 1,000 feet south-southwest of the site until 2004 (Ecology 2009). Water quality data from this spring, the only location for which records are available from both before and after construction of the cover, show a decrease in average concentrations of chloride, sodium, nitrate, and electrical conductivity in the year or two following installation of the cover.

In 2006, Ecology conducted a Site Hazard Assessment and assigned the site a ranking of 2 (on a scale of 1 to 5, with 1 representing sites with the highest hazard). In 2008, Ecology identified Kaiser as a Potentially Liable Person (PLP) under the state's Model Toxics Control Act (MTCA) and began negotiations for an Agreed Order to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the site.

2.0 DOMESTIC WELLS AND SPRING SAMPLING ACTIVITIES

This section presents the activities, observations, and the procedures used during the sampling of 16 domestic water supply wells in December 2008 and the spring in January 2009. The field procedures and field Quality Assurance/Quality

Control (QA/QC) measures followed were defined in the Sampling and Analysis Plan (SAP) prepared for this work (Hart Crowser 2008).

2.1 Sampling Locations

Ecology selected the private domestic water supply wells to be sampled during this study. Ecology's selection of the private wells to be tested was based on proximity to the landfill and requests from the residents around the study area. As shown on Figure 2, the wells are located on properties within an approximate 1/2-mile radius of the landfill. To protect the privacy of the well owners, names are not included in this report.

The locations on the individual well systems where samples were collected are summarized in Table 1. At each household, the Hart Crowser field representative reviewed the water supply system with the home owner (if present) to determine the proper sampling location. For the majority of wells, the samples were collected from a frost free hydrant or spigot close to the wellhead prior to entering a pressure or holding tank, the household distribution system, and/or any filtration or conditioning systems.

Samples collected from Well Nos. 3, 5, 6, 10, 12, and 13 were collected from spigots and/or frost free hydrants located at varying distances from the wellhead either on the houses or near the houses. The Well No. 6 sample was collected from a spigot on the house. It is not known where in the distribution system this spigot is located but the homeowner stated that there is no water filtration or conditioners installed on this distribution system. The Well No. 3 sample was collected from a spigot located next to the front door of the house. It is not known where in the distribution system this spigot is located or whether there is any filtration or conditioner devices installed on this system.

Samples collected from Well Nos. 9 and 10 share a common well located on the Well No. 9 property. The sample from Well No. 9 was collected from a spigot located on the upstream side of the pressure tank in the well house. A separate sample was collected for Well No. 10 from a frost free hydrant located on the Well No. 10 property and, therefore, downstream of the pressure tanks in the Well No. 9 well house.

There are two wells that supply the household on the Well No. 5 site. The sample from this property was collected from a frost free hydrant downstream from the two well collection tank and, therefore, represents a composite of the two wells. This sample location is upstream of the household distribution system.

The Heglar Spring sample was collected from the discharge of the spring impoundment adjacent to the roadside approximately 1,000 feet south-southwest of the landfill. The spring impoundment is a man-made feature assumed to be intended to provide a source of water for livestock or other non-potable uses. The Heglar Spring sample was collected from the water that is discharging through a corrugated pipe, which drains the overflow from the spring impoundment to a roadside ditch. This is the same spring that has been historically sampled by SCHD and Kaiser. It should be noted that we did not observe groundwater seeping from the ground at this location.

2.2 Sample Collection

Domestic well samples from Well Nos. 1 through 5 were collected on December 11, 2008. The other domestic well samples were collected on December 12, 2008. The Heglar Spring sample was collected on January 22, 2009.

The wells were purged for a time period estimated to be sufficient to purge at least one system volume from the wellhead to the sample location prior to sampling. It was assumed that operable, in-use wells were essentially purged prior to sampling and that the one system volume purge was sufficient to remove any deposits accumulated in system low points.

We were informed that the Well No. 11 had not been in use for some period of time due to the homeowner's absence. Considerable turbidity was noted in the water upon initial purging of this well from the hydrant adjacent to the wellhead. The well was purged for approximately 15 minutes before the water began to clear. The water sample from this well was collected after the water became clear.

Following purging of well systems, the flow was slowed as needed and directed to a flow-through cell using dedicated Teflon tubing for the collection of field parameters—temperature, electrical conductivity (EC), and pH. The field parameter readings were recorded for each well sampled and are presented in Table 2. Due to cold temperatures during well sample collection on December 11 and 12, 2008, the pH meter was not functioning properly; therefore, water samples were analyzed at the laboratory for pH. Sample bottles were then filled following collection of field parameters.

The spring sample was collected with a peristaltic pump using dedicated Teflon tubing. The inlet line to the pump was inserted into the flow of water discharging from a culvert at the outlet of the spring impoundment. The water flow was directed to the flow-through cell for field parameter reading of temperature, EC, and pH prior to filling the sample bottles. Field parameter readings for the spring sample are also presented in Table 2.

Following collection, labeled sample containers were placed in ZipLock™ bags and placed in a cooler in preparation for shipment. Double-bagged ice was placed in the cooler for sample preservation. Copies of the chain of custody forms were placed in a ZipLock™ bag and taped to the inside cover of each cooler. Custody seals were placed on the front and back of the cooler lid and the lid was taped shut. All sample coolers were shipped via UPS overnight express to Columbia Analytical Services (CAS) located in Kelso, Washington.

3.0 DOMESTIC WELLS AND SPRING SAMPLE ANALYSIS AND ANALYTICAL RESULTS

This section presents the analytical methods used and results for the December 2008 and January 2009 samples. Water samples were analyzed for constituents of concern related to the black dross disposal as well as additional priority pollutant metals. Comparisons of the results are made to available drinking water regulatory standards.

3.1 Sample Analysis

The well supply and spring samples were submitted to CAS for the following chemical analyses:

- Fluoride and Chloride (EPA Method 300.0);
- Nitrate and Nitrite (EPA Methods 300.0 and 353.2);
- Total Priority Pollutant List metals including aluminum, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, potassium, selenium, silver, sodium, thallium, and zinc (EPA Methods 200.7, 200.8, and 245.1);
- Ammonia (EPA Method 350.1); and
- pH (well samples only).

Per the SAP prepared for this sampling, we had intended to analyze the water samples separately for nitrate and nitrite via EPA Method 300.0. Water samples to be analyzed for nitrate and nitrite via EPA Method 300.0 have a 48-hour holding time due to the generally rapid conversion of nitrite to nitrate in the presence of oxygen. Due to a miscommunication with the laboratory, the December samples were analyzed for nitrate-nitrite using EPA Method 353.2, which reports the combined total of nitrate and nitrite rather than individual analytes. It is not possible to separate the individual contribution of nitrate or nitrite from the reported combined concentration via Method 353.2. As the samples were also analyzed for chloride and fluoride using EPA Method 300.0, an ion chromatography method, instrument raw data, and ion chromatograms were examined to determine whether both nitrite and nitrate were present in samples. No evidence for the presence of nitrite was observed; only nitrate peaks were present in the ion chromatograms.

While nitrate and nitrite samples exceeded the Method 300.0 recommended holding time (48 hours) by 25 to 57 hours, impacts would likely be minimal since samples were collected with no headspace and were refrigerated. The lack of nitrite is not unexpected since nitrite is generally not present in groundwater unless conditions are anaerobic and reducing. Nitrate results from the Method 300.0 analysis were comparable to combined nitrate/nitrite results obtained by Method 353.2 indicating that the Method 353.2 results are likely representative of nitrate concentrations in the samples.

The Heglar Spring sample, collected on January 22, 2009, was analyzed for nitrate and nitrite using Method 300.0 within the required 48-hour holding time. The reported analytical result for nitrate was 15.9 mg/L and 0.023 mg/L for nitrite.

The other data from the December and January sampling met the requirements of the SAP and the laboratory testing methods without additional qualifiers.

3.2 Comparison of Results to Maximum Contaminant Levels

The laboratory analytical results from the domestic wells and the spring are presented in Table 3. These results were compared to state and federal drinking water standards for primary and secondary contaminants, which are presented in Table 4. A chemical data quality review and laboratory analytical documentation for the samples are presented in Appendix A.

In Washington State, drinking water standards are promulgated by the Environmental Protection Agency (EPA) under the federal Safe Drinking Water Act (SDWA) (40 CFR parts 141 through 149) and by the Washington State Department of Health Water Systems Regulations (Chapters 246-290 through 246-296 WAC). These drinking water regulations set standards for the highest levels of contaminants permissible in drinking water and are termed Maximum Contaminant Levels (MCLs). The two classes of established MCLs are Primary MCLs and Secondary MCLs. Primary MCLs are enforceable levels for select contaminants where exceedance of the MCLs would cause adverse public health effects. Secondary MCLs are guidelines for select contaminants related to cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water. The applicable primary and secondary MCLs for the constituents tested for this investigation are presented in Table 4.

Two well samples and the spring exceeded one MCL each—Well No. 1 for arsenic, Well No. 16 for nitrate, and the Heglar Spring sample for nitrate. Other analytes were below the available MCLs. For the chemical constituents analyzed for during this sampling, only ammonia and potassium do not have any MCLs under state or federal standards. Ammonia was non-detect in the samples analyzed. Potassium is a naturally occurring element present in groundwater and is generally not a health concern. Common water softener systems will remove minerals such as calcium or magnesium ions present in the water and replace them with potassium or sodium ions depending on whether potassium chloride or sodium chloride is used in the system.

3.2.1 Arsenic

Well No. 1 is located approximately 0.75 mile northwest of the former landfill. The concentration of arsenic in the Well No. 1 sample was 11.6 µg/L, slightly above the Primary MCL for arsenic of 10 µg/L and one to two orders of magnitude higher than any other sample collected during the December and January sampling efforts. We believe that the arsenic concentration in this well is unrelated to the landfill for the following reasons:

- Arsenic is not a significant component of black dross;
- Well No. 1 is located 0.75 mile from the landfill and none of the other wells and springs sampled—including those located much closer to the landfill—contain elevated arsenic concentrations; and
- Well No. 1 is located in a different geologic setting and taps a different aquifer from the one tapped by wells and springs in the vicinity of the landfill. Examination of the well log for Well No. 1, in conjunction with geological maps of the area, indicate that the well penetrates a thick sequence of fine-grained lacustrine deposits before encountering the contact with the underlying weathered granitic bedrock. The well is screened in the weathered bedrock and is quite productive. In contrast, wells and springs in the vicinity of the landfill tap thin, low-yield water-bearing zones within the predominantly fine-grained, overlying mass-wasting deposits (Griggs 1966, and Boleneus and Derkey 1996).

Anthropogenic sources of arsenic are attributed to past uses of arsenic-containing pesticides or herbicides. It is also possible that the elevated arsenic concentrations in Well No. 1 are associated with the granitic bedrock. Although no regional water quality studies have been performed in this area, studies from other regions (e.g., New England, Arizona, and India) have documented elevated concentrations of arsenic in association with some granitic bedrock formations (Acharyya 2002 and USGS 1999).

3.2.2 Nitrates

Well No. 16 and the Heglar Spring samples exceeded the Primary MCL for nitrate with concentrations of 13.5 and 15.9 mg/L, respectively. Referring to Figure 2, these sample locations are approximately 1,000 feet south of the landfill. The next highest detections of nitrate, while below the MCL of 10 mg/L, occurred in the following samples; Well No. 5, located approximately 2,000 feet to the northwest of the landfill with a nitrate concentration of 7.04 mg/L; Well No. 14, located approximately 4,100 feet southwest of the landfill with a nitrate concentration of 6.77 mg/L; and Well No. 4, located approximately 2,500 feet northwest of the landfill with a nitrate concentration of 2.18 mg/L. Other wells sampled were either non-detect for nitrate or at least two orders of magnitude less than the MCL.

The spring where the Heglar Spring sample was collected surfaces into a man-made impoundment. The spring sample was collected from the overflow discharge of this impoundment. As the Heglar Spring sample was collected from the overflow of the spring impoundment, it may not be truly representative of groundwater conditions due to the residence time in the surface impoundment. During the spring sample collection in January, Hart Crowser field representatives noted animal tracks, including coyote and deer tracks, in the snow surrounding the impoundment, which indicates that this impoundment serves as a water source for area animals. It is not known whether area livestock are currently allowed to water at this impoundment. Surface sources of nitrates from the animals using this water should be examined to attempt to quantify surface inputs of nitrates in comparison to nitrates present in the groundwater discharging at the surface from this spring.

3.2.3 Chloride

Past chloride MCL exceedances in select area wells and springs have been historically correlated to releases of the salts contained in the black dross. Chloride falls under the Secondary Standards with a MCL of 250 mg/L. It has been shown that chloride in excess of the MCL may cause a detectable taste in the water. Samples collected during the December and January sampling tested below the MCL for chloride. The Heglar Spring sample, with a chloride concentration of 242 mg/L had the highest detected concentration of chloride.

The highest detections of chloride from the 16 domestic wells were one order of magnitude lower than the Secondary MCL; Well No. 16 with a chloride concentration of 19.3 mg/L and Well No. 5 with a chloride concentration of 12.5 mg/L. Other wells sampled had detectable concentrations of chloride two to three orders of magnitude lower than the MCL.

3.2.4 Sodium

The highest level of sodium detected from the December and January samples was in the Heglar Spring sample with a concentration of 106 mg/L. The maximum level detected in the domestic wells was in Well No. 16 with a concentration of 35.5 mg/L. The average concentration of sodium in all domestic wells was 12.7 mg/L.

Sodium is listed as a primary contaminant under both state and federal regulations due to health concerns of sodium intake for certain individuals, though a MCL has not been specified. The EPA has established a recommended level of 20 mg/L for sodium in drinking water as a level of concern for individuals that may be restricted for daily sodium intake in their diets (WAC 246-290-310).

3.2.5 Aluminum

Aluminum was only detected in two samples; Well No. 4 with a concentration of 0.036 mg/L, and the Heglar Spring sample with a concentration of 0.009 mg/L. Both are well below the Secondary MCL range of 50 to 200 mg/L.

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Table 1 - Domestic Wells and Spring Sampling Locations

Sample	Sample Collection Location
Well No. 1	Frost free hydrant next to wellhead. Sampled more recently installed well. Older well on site not used for potable water.
Well No. 2	Frost free hydrant next to wellhead.
Well No. 3	Spigot next to front door. Unknown as to where in the household distribution system this spigot is located. Unknown if there is a filtration or conditioning system installed.
Well No. 4	Accessible frost free hydrant near workshop/garage approximately 50 feet from wellhead. Directly piped from the well prior to household distribution system.
Well No. 5	Frost free hydrant in front of house. Directly piped from a two well collection point. Sample represents water from both wells.
Well No. 6	Spigot next to deck. Unknown as to where in the household distribution system this spigot is located. Owner indicated there is no filtration or conditioning system installed.
Well No. 7	Frost free hydrant next to wellhead.
Well No. 8	Frost free hydrant next to wellhead.
Well No. 9	Spigot before the pressure tank located in the wellhouse.
Well No. 10	Frost free hydrant northeast of Kronquist Rd Site 6 well house. Note this is the same well for Kronquist Rd Site 6.
Well No. 11	Frost free hydrant next to wellhead.
Well No. 12	Frost free hydrant in driveway. Directly piped from the well prior to household distribution system.
Well No. 13	Spigot on the deck. Directly piped from the well prior to household distribution system.
Well No. 14	Frost free hydrant next to wellhead.
Well No. 15	Frost free hydrant next to wellhead.
Well No. 16	Frost free hydrant next to well head.
Heglar Spring	Dicharge culvert along roadside. Spring located approximately 1000 feet south-southwest of former landill.

Table 2 - Groundwater Parameters

Sample	Temperature in ^{O}C	Specific Conductivity in mS/cm	pH[a]
Well No. 1	8.49	0.600	7.86
Well No. 2	8.78	0.353	7.37
Well No. 3	9.82	0.424	7.20
Well No. 4	9.92	0.330	7.07
Well No. 5	8.42	0.545	7.14
Well No. 6	10.36	0.041	6.78
Well No. 7	11.31	0.240	6.86
Well No. 8	8.64	0.306	7.47
Well No. 9	10.95	0.521	7.07
Well No. 10	10.64	0.524	7.07
Well No. 11	12.15	0.518	6.89
Well No. 12	9.18	0.274	6.85
Well No. 13	10.68	0.402	6.95
Well No. 14	10.16	0.824	7.50
Well No. 15	8.63	0.337	6.81
Well No. 16	9.78	0.999	7.41
Heglar Spring	3.23	0.864	7.45

Notes:

Temperature, conductivity, and pH measured during sample collection with a flow-through cell water quality meter.

[a] With the exception of the "Heglar Spring" sample, all pH measurements were conducted by the laboratory due to a malfunctioning pH meter.

Table 3. Analytical Results for Well and Spring Samples.

Sample ID	Well No. 1	Welll No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6	Well No. 7
Sampling Date	12/11/2008	12/11/2008	12/11/2008	12/11/2008	12/11/2008	12/12/2008	12/12/2008
pH	7.86	7.37	7.2	7.07	7.14	6.78	6.86
Metals in ug/L							
Aluminum	50 U	50 U	50 U	36 T	50 U	50 U	50 U
Antimony	0.098	0.032 T	0.009 T	0.058	0.044 T	0.04 T	0.032 T
Arsenic	11.6	2.2	0.5 U	1.4	0.46 T	0.77	0.51
Beryllium	0.02 U	0.02 U	0.028	0.033	0.028	0.02 U	0.02 U
Cadmium	0.025	0.007 T	0.03	0.024	0.047	0.02 U	0.016 T
Chromium	0.2 U	0.249 U	0.203 U	0.2 U	0.2 U	0.275 U	0.897
Copper	10 U	10 U	18.5	5.4 T	10 U	43.6	10 U
Lead	0.17	0.064	0.648	0.989	1.76	0.27	0.639
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	0.69	0.4	0.45	0.73	0.99	6.23	0.17 T
Potassium	2550	1200	869	3880	2560	4900	3480
Selenium	1 U	1 U	1 U	1 U	3.1	0.9 T	0.5 T
Silver	0.005 T	0.02 U	0.007 T	0.02 U	0.02 U	0.02 U	0.019 T
Sodium	11600	8970	7560	9660	13600	15200	7810
Thallium	0.02 U	0.02 U	0.02 U	0.02 U	0.002 T	0.02 U	0.004 T
Zinc	339	57.2	532	68	1190	15.2	50.6
Conventionals in mg/L							
Chloride	1.9	2.3	6	6	12.5	2.7	0.9
Fluoride	0.3	0.13 T	0.087 T	0.2	0.163 T	0.3	0.3
Ammonia (NH_3) as Nitrogen(N	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrate-Nitrite as N	0.05 U	0.2	0.58	2.18	7.04	0.76	0.05 U
Nitrate							
Nitrite							

Table 3. Analytical Results for Well and Spring Samples.

Sample ID	Well No. 8	Well No. 9	Well No. 10	Well No. 11	Well No. 12	Well No. 13	Well No. 14
Sampling Date	12/12/2008	12/12/2008	12/12/2008	12/12/2008	12/12/2008	12/12/2008	12/12/2008
pH	7.47	7.07	7.07	6.89	6.85	6.95	7.5
Metals in ug/L							
Aluminum	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Antimony	0.034 T	0.038 T	0.034 T	0.006 T	0.05 U	0.05 U	0.082
Arsenic	0.35 T	1.6	1.4	0.5	0.32 T	0.21 T	2.4
Beryllium	0.02 T	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Cadmium	0.027	0.016 T	0.018 T	0.011 T	0.02 U	0.02 U	0.034
Chromium	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.49
Copper	10 U	10 U	6.3 T	10 U	10 U	20.7	10 U
Lead	0.237	0.048	3.19	0.092	0.051	0.045	2.49
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	0.3	0.46	0.54	0.32	0.2 T	0.39	0.81
Potassium	1460	5440	5300	5010	4390	5370	6040
Selenium	0.6 T	1 U	1 U	1 U	1 U	1 U	0.9 T
Silver	0.015 T	0.007 T	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Sodium	7630	19400	18500	10900	8150	11100	13400
Thallium	0.007 T	0.005 T	0.006 T	0.02 U	0.02 U	0.02 U	0.02 U
Zinc	66.8	15.1	40.6	45.3	110	5.4 T	573
Conventionals in mg/L							
Chloride	0.7	1.6	1.6	1.8	1.3	1.8	1.6
Fluoride	0.3	0.4	0.4	0.5	0.4	0.4	0.2
Ammonia (NH_3) as Nitrogen(N	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrate-Nitrite as N	0.09	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	6.77
Nitrate							
Nitrite							

Table 3. Analytical Results for Well and Spring Samples.

Sample ID	Well No. 15	Kronquist Rd Site 9	Well No. 16	Heglar Spring	Well Site 11 Blind Blank
Sampling Date	12/12/2008	12/12/2008	12/12/2008	1/22/2009	12/12/2008
		Dup of Well No. 15			
pH	6.81	6.64	7.41	7.45	7.37
Metals in ug/L					
Aluminum	50 U	50 U	50 U	8.8	50 U
Antimony	0.007 T	0.008 T	0.064	0.074	0.05 U
Arsenic	0.23 T	0.25 T	1.1	2	0.5 U
Beryllium	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Cadmium	0.009 T	0.014 T	0.034	0.005 T	0.02 U
Chromium	0.2 U	0.2 U	1.03	5 U	0.2 U
Copper	7.2 T	6.7 T	4.1 T	0.65	10 U
Lead	0.159	0.256	0.442	0.014 T	0.02 U
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	0.23	0.28	1.07	20 U	0.2 U
Potassium	4520	4480	3930	10900	400 U
Selenium	1 U	1 U	0.8 T	0.9 T	1 U
Silver	0.02 U	0.02 U	0.011 T	10 U	0.02 U
Sodium	8800	8540	35500	106000	100 U
Thallium	0.02 U	0.02 U	0.004 T	0.009 T	0.02 U
Zinc	115	118	43	3.1 T	2.4 T
Conventionals in mg/L					
Chloride	2	1.9	19.3	242	0.2 U
Fluoride	0.4	0.4	0.5	0.3	0.2 U
Ammonia (NH_3) as Nitrogen(N	0.05 U	0.05 U	0.05 U	0.08 U	0.05 U
Nitrate-Nitrite as N	0.05 U	0.05 UJ	13.5		0.05 U
Nitrate				15.9	
Nitrite				0.023 T	

U = Not detected at reporting limit indicated.
J = Estimated value.
T = Value is between the MDL and MRL.

Table 4 - State and Federal Maximum Contaminant Levels (MCLs) for Primary and Secondary Contaminants.

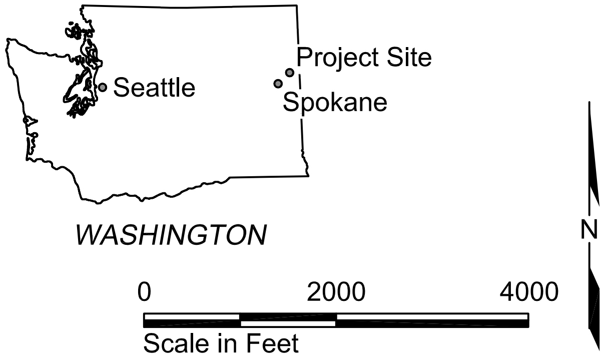
Substance	Primary MCLs in μg/L (except as noted)
Antimony	6
Arsenic	10
Beryllium	4
Cadmium	5
Chromium	100
Copper	**
Fluoride	4 mg/L
Lead	**
Mercury	2
Nickel	100
Nitrate (as N)	10 mg/L
Nitrite (as N)	1 mg/L
Selenium	50
Sodium	**
Thallium	2

Substance	Secondary MCLs in μg/L (except as noted)
Aluminum	50 to 200
Chloride	250 mg/L
Silver	100
Zinc	5000

Substances with no MCLs	
Potassium	**Not Applicable**
Ammonia (NH3) as Nitrogen(N)	**Not Applicable**

** Although the state board of health has not established MCLs for copper, lead, and sodium, there is sufficient public health significance connected with copper, lead, and sodium concentrations to require inclusion in inorganic chemical and physical source monitoring. For lead and copper, the EPA has established distribution system related levels at which a system is required to consider corrosion control. These levels, called "action levels," are 0.015 mg/L for lead and 1.3 mg/L for copper and are applied to the highest concentration in 10 percent of all samples collected from the distribution system. The EPA has also established a recommended level of 20 mg/L for sodium as a level of concern for those consumers that may be restricted for daily sodium intake in their diets (from WAC 246-290-310).

Source: Base map prepared from DeLorme Topo 7.0, 2007.



Heglar Kronquist Site
Mead, Washington

Vicinity Map

17524-00

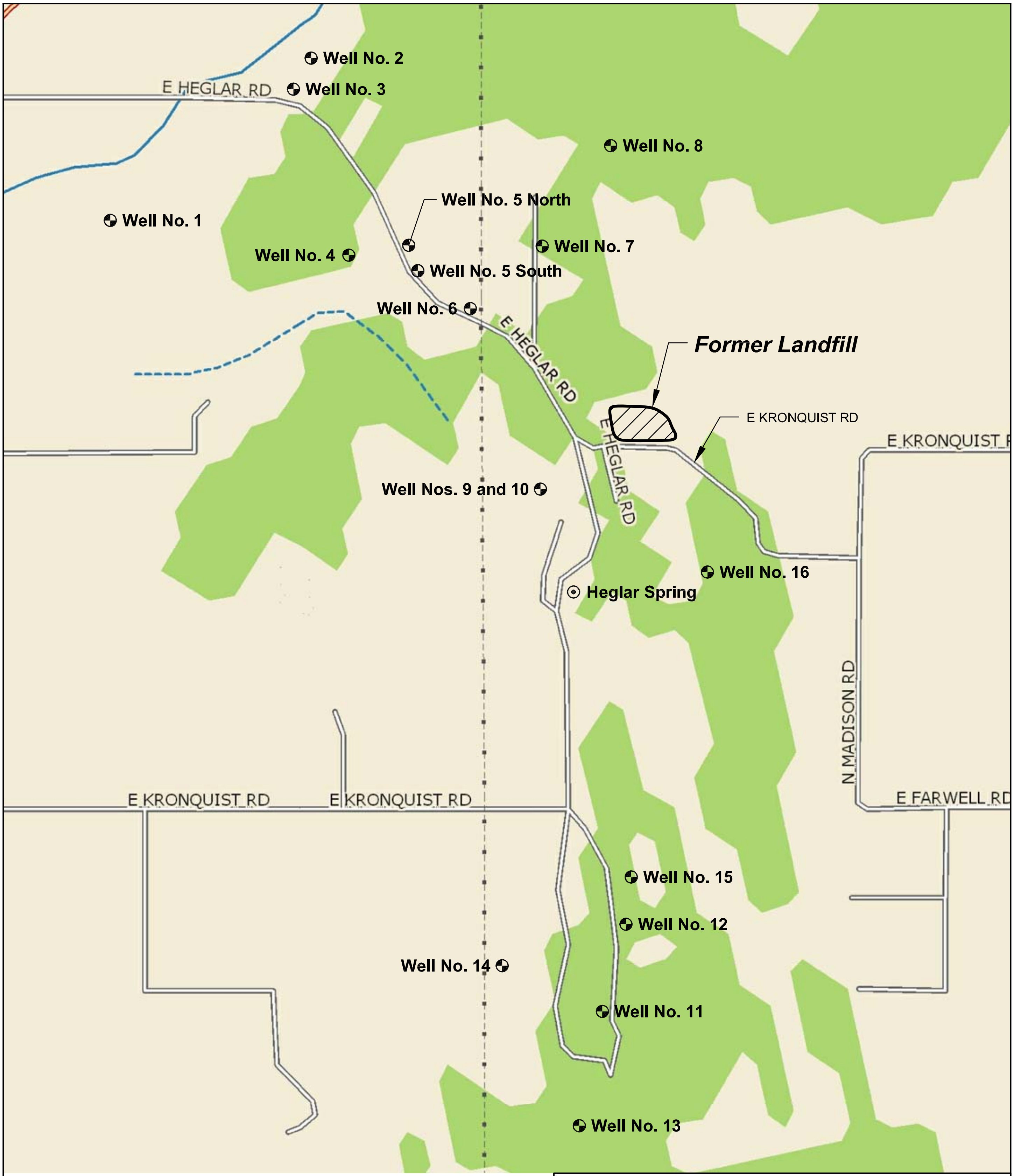
2/09

HARTCROWSER

Figure

1

EAL 02/5/09 1752400-001.dwg



Source: Base map prepared from DeLorme Topo 7.0, 2007.

Well No. 5 ⊕ Well Location and Designation

Heglar Spring ⊙ Spring Location and Designation

0 1000 2000

Scale in Feet

N

Heglar Kronquist Site
Mead, Washington

Wells and Spring Location Plan

17524-00 2/09

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Figure

2

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APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS

APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND LABORATORY CERTIFICATES OF ANALYSIS

Chemical Data Quality Review

Five water samples were collected on December 11, 2008, and submitted to Columbia Analytical Services, Inc. (CAS). Thirteen water samples were collected on December 12, 2008, and submitted to CAS. The samples were analyzed for sodium, potassium, aluminum, chloride, fluoride, ammonia, nitrate, nitrite, pH, and total metals (antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, lead, selenium, silver, thallium, and zinc). The laboratory reported results as service request numbers K0812068 and K0812127. Sample designations from the reports for K0812068 and K0812127 were changed to bring our designations inline with Ecology's designations that were released to the public on February 6, 2009. The text, tables, and figures associated with this report have been changed to match the sample designation with Ecology's. The laboratory Certificates of Analysis in this Appendix have been annotated to help the reader in identifying samples.

One water sample was collected on January 22, 2009, and submitted to CAS. The sample was analyzed for sodium, potassium, aluminum, chloride, fluoride, ammonia, nitrate, nitrite, and total metals (antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, lead, selenium, silver, thallium, and zinc). The laboratory reported results as service request number K0900609.

Receiving temperatures for coolers were generally below the recommended temperature acceptance criteria of 2 to 6 °C. No results were qualified.

Quality assurance/quality control (QA/QC) reviews of laboratory procedures were performed on an ongoing basis by the laboratory. Hart Crowser performed the data review, using laboratory quality control results summary sheets, to ensure they met data quality objectives for the project. The following criteria were evaluated in the standard data quality review process:

- Holding times;
- Method blanks;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries;
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries;
- Laboratory duplicate relative percent differences (RPDs); and
- Reporting limits.

The data were determined to be acceptable for use, with certain qualifiers. Full laboratory results are presented at the end of this appendix. Results of the data review follow.

Chloride and Fluoride

The samples were analyzed by Ion Chromatograph (IC) following EPA Method 300.0. The holding times and reporting limits were acceptable. The laboratory qualified values between the Method Detection Limit (MDL) and the Reporting Limit (RL) with a "J." "J" qualifiers were changed to "T." The method blanks were non-detect. LCS and MS recoveries were within control limits. The sample and duplicate RPDs were within the control limits or not applicable due to low levels in the sample and duplicate.

The data are acceptable for use with minor qualification.

Ammonia as Nitrogen

Ammonia was measured following EPA Method 350.1. The holding times and reporting limits were acceptable. LCS and MS recoveries were within laboratory control limits. The sample and duplicate results were non-detect; therefore, the RPD was not applicable.

The method blanks were non-detect with the following exception. The method blank associated with the sample Heglar Spring had a detection for ammonia between the MDL and RL. In addition, several laboratory continuing calibration blanks also had detections between the MDL and RL. The result for ammonia in the associated sample exceeded the RL, but was less than three times the level in the method blank. The result for ammonia in Heglar Spring was qualified as non-detect (U).

The data are acceptable for use with qualification.

Nitrate and Nitrite as Nitrogen by EPA Method 353.2

Nitrate and nitrite were measured following EPA Method 353.2 for all samples in service request numbers K0812068 and K0812127. The holding times and reporting limits were acceptable. No method blank contamination was detected. LCS recoveries were within control limits. The sample and duplicate RPDs were within the control limits, or not applicable.

MS recoveries were within control limits with the following exception:

- Kronquist Rd Site 9 MS/MSD: The recoveries for nitrate and nitrite were below the control limits due to a matrix effect. The recoveries were within control limits for the LCS. Nitrate and nitrite results in source sample Kronquist Rd Site 9 were qualified as estimated (J).

The data are acceptable for use with qualification.

Nitrate and Nitrite as Nitrogen by EPA Method 300.0

Nitrate and nitrite in sample Heglar Spring were analyzed by IC following EPA Method 300.0. The holding times were acceptable. No method blank contamination was detected. LCS and MS recoveries were within control limits. The sample and duplicate RPDs were within the control limits, or not applicable.

The RL for nitrite was elevated as the sample was analyzed at a five-fold dilution due to high levels of nitrate present. Sample results for nitrite fell below the RL and were qualified by the laboratory as estimated (J). The “J” qualifier was changed to a “T.” The sample was not reanalyzed undiluted within holding time.

The data are acceptable for use with qualification.

pH

pH was measured following SM 4500-H+ B. Samples were measured upon receipt at the laboratory, and results were not qualified due to holding time. LCS recoveries were within control limits. The sample and duplicate RPDs were within the control limits.

The data are acceptable for use as reported.

Total Metals

For service request numbers K0812068 and K0812127, analyses for antimony, arsenic, beryllium, cadmium, chromium, lead, nickel, selenium, silver, and thallium were conducted by Inductively Coupled Plasma fitted with a Mass Spectrometer (ICP/MS) following EPA Method 200.8. Analyses for aluminum, copper, potassium, sodium, and zinc were conducted by ICP following EPA Method 200.7. Analysis for mercury was conducted by Cold Vapor Atomic Absorption (CVAA) following EPA Method 245.1.

For service request number K0900609, analyses for aluminum, antimony, arsenic, beryllium, cadmium, copper, lead, selenium, and thallium were conducted by EPA Method 200.8. Analyses for chromium, nickel, potassium, silver, sodium, and zinc were conducted by EPA Method 200.7. Analysis for mercury was conducted by EPA Method 245.1. The holding times and reporting limits were acceptable. The laboratory qualified values between the MDL and the RL with a “B.” “B” qualifiers were changed to “T.”

The method blanks were non-detect with the following exception. One method blank had a detection for chromium between the MDL and the RL. Detections for chromium between the MDL and RL in the associated samples (Well Nos. 1, 4, 5, 8, 9, 10, 11, 12, 13, 15, Well Site 11, and Kronquist Rd Site 9) were raised to the RL and flagged as non-detect (U). Detections for chromium in samples Well Nos. 2, 3, and 6 above the RL, but less than five times the amount in the method blank, were qualified as non-detect (U). Detections for chromium greater than five times the amount in the method blank were not qualified.

LCS and MS recoveries were within control limits. The sample and duplicate RPDs were within the control limits or not applicable due to low levels in the sample and duplicate.

The data are acceptable for use with qualification.

Definitions

The following definitions will aid the reader in understanding the well sampling results:

MCL (Maximum Contaminant Level) is the highest level of a contaminant that is allowed in drinking water.

mg/L or ppm is parts per million (equivalent to one cent in $10,000).

µg/L or ppb is parts per billion (equivalent to one cent in $10,000,000).

Method Detection Limit (MDL). The minimum concentration that can be measured and reported with 99 percent confidence that the concentration is greater than zero, but the exact concentration cannot be reliably quantified. For instance, if the true concentration of an analyte in a sample is equal to the MDL, there is a 50 percent chance that the analyte will be detected.

Reporting Limit (RL). The RL is the lowest concentration at which an analyte can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

U Data Qualifier. Analyte was not detected at or above the reported result.

J Data Qualifier. Analyte was positively identified. The reported result is an estimate as quality control criteria were slightly exceeded.

T Data Qualifier. Reported result below the associated reporting limit (RL) but above the Method Detection Limit (MDL).

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COLUMBIA ANALYTICAL SERVICES
K0812068, K0812127 AND K0900609