2024 ANNUAL GROUNDWATER MONITORING REPORT

And Surface Maintenance Report

WEST SURFACE IMPOUNDMENT
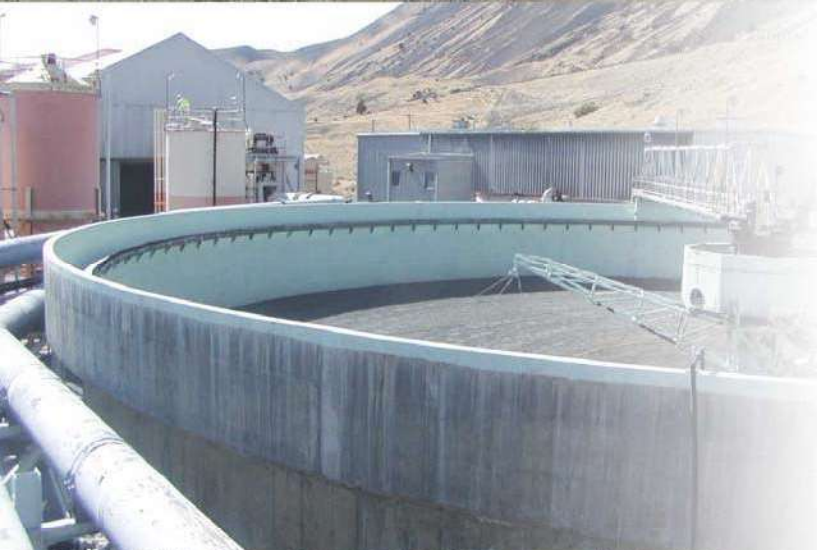
Columbia Gorge Aluminum Smelter Site

85 John Day Dam Road, Goldendale WA

Facility Site ID #95415874

October 30, 2024

On behalf of:

NSC Smelter LLC
3313 West Second Street
The Dalles OR 97058

Prepared by:

Blue Mountain Environmental Consulting Inc.
125 Main Street
Waitsburg WA 99361

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1   INTRODUCTION

1.1 SCOPE AND PURPOSE

This report represents the results of the 2024 annual groundwater monitoring and evaluation following closure of the former Columbia Gorge Aluminum Smelter West Surface Impoundment (WSI). Statistical evaluation of the groundwater monitoring data was conducted to assess natural attenuation in the concentration of dissolved-phase groundwater contaminants. This monitoring and statistical evaluation was conducted in accordance with the Groundwater Sampling Data Analysis and Evaluation Plan (GSDAEP) for the WSI facility (Parametrix, 2004b). Groundwater sampling was performed on July 23, 2024 by Blue Mountain Environmental & Consulting Co., Inc. (BMEC) personnel.

1.2 SITE DESCRIPTION

The approximately 10-acre WSI was constructed as an earthen impoundment with Hypalon liner in 1981. It was used through 2001 to dispose of various types of waste generated from plant pollution controls. A map of the location is illustrated on **Figure 1**.

The WSI contains approximately 89,000 cubic yards of sludge comprised primarily of alumina, dust, and particulates from wastewater and residual waste generated from plant emission control systems. The WSI managed waste through evaporation of wastewater and disposal of emission control sludge (DOE, 2014). The WSI discontinued accepting waste and was closed in September 2004 (Parametrix, 2004a). Closure of the WSI included placement of an engineered Resource Conservation and Control Act (RCRA) cap consisting of soils and geosynthetic materials and development of a post-closure maintenance and groundwater monitoring plan (Parametrix, 2004b). The annual surface maintenance report prepared by others is supplemented in **Appendix D.**

1.3 HYDROGEOLOGIC SETTING

The geologic materials present beneath the WSI consist of unconsolidated alluvial deposits of Quaternary age, underlain by a series of basalt flows and sedimentary interbeds of the Columbia River Basalt Group [CRBG] (CH2M Hill, 1995; Golder, 1989). The groundwater gradient flattens beneath the WSI; south of the WSI, groundwater flows southwestward toward the Columbia River. The following aquifer zones have been defined for the Smelter Site in the Remedial Investigation (RI) Report:

- Unconsolidated Aquifer (UA) – shallow water-bearing zone in the colluvium, alluvium, and fill that overlies the basalt bedrock in most areas. The unit is thicker and more laterally extensive on the western side of the Site. Groundwater occurring locally within the upper 2 – 3 feet of weathered flow top and fractured bedrock is part of the UA.
- Basalt Aquifer Upper Zone (BAU) – occurs within the basalt flow sequence commonly within a flow interior within a flow top.

- Basalt Aquifer Lower Zone (BAL) – includes saturated zones beneath the BAU near the Columbia River elevation to the bottom elevation of the John Day Dam reservoir.

1.4 PREVIOUS GROUNDWATER MONITORING

The current monitoring network at the WSI Site consists of 16 monitoring wells, including some shallow and deep well clusters. The initial monitoring wells were installed in 1984, and another set of wells were installed in 1989. An additional monitoring well, MW-18, was installed in October 2004 near the down-gradient property boundary, about 2,500 feet from the WSI.

Sampling and analysis of groundwater has been conducted since 1984, and followed a quarterly schedule from 1991 through 2004. One additional pre-closure sampling event was conducted in September 2004 for the five monitoring wells included in the post-closure monitoring plan to establish groundwater quality before the wells could be affected by subsurface disturbances from WSI closure construction. Post-closure sampling and analysis was conducted quarterly from 2005 – 2007, semi-annually from 2008 – 2010, and annually beginning in 2011. Previous samples were analyzed for pH, conductivity, total organic carbon, sulfate, fluoride, chloride, sodium, iron, manganese, free cyanide, total cyanide, and total phenols. Sulfate and fluoride were determined to be representative indicator parameters for the WSI wastes, since sulfate concentrations showed direct response to periods of waste discharge into the pond. Pre-closure maximum sulfate concentrations were observed in 2000 and 2001 (Parametrix, 2004a).

2   GROUNDWATER INVESTIGATION

The post-closure groundwater investigation was described in the GSDAEP (Parametrix, 2004b) and is summarized in the following section.

2.1 MONITORING WELL LOCATIONS

The post-closure monitoring well locations include the following up-gradient and down-gradient monitoring wells:
- Up-gradient well: MW-8A
- Down-gradient wells near WSI: MW-10, MW-12A, and MW-14A
- Down-gradient wells further from WSI: MW-3B and MW-18

Monitoring well construction details are shown below in **Table 1**. Prior to the most recent groundwater monitoring event conducted on July 23, 2024, monitoring well MW-12A had been reported as dry from July 26, 2018 - July20, 2023. Monitoring well locations are illustrated on **Figures 2 and 3**.

TABLE 1 – MONITORING WELL CONSTRUCTION DATA

WELL #	DATE OF INSTALL	TOTAL WELL DEPTH (feet bgs)	WELL SCREEN INTERVAL (feet bgs)	PVC CASING DIA. (inches)	GROUND SURFACE ELEVATION (feet amsl)	TOP OF PVC ELEVATION (feet amsl)	LOCATION
MW-8A	May 1989	41	22-32	4	490	492.97	Up-gradient
MW-3B	April 1984	51	46-51	4	408	410.90	Down-gradient
MW-10A	April 1989	26	13-25.5	4	425	427.95	Down-gradient
MW-12A	May 1989	55	40-54	4	439	441.38	Down-gradient
MW-14A	May 1989	30.5	8.5-29.5	4	429	431.65	Down-gradient
MW-18	October 2004	51	35-50	4	346	348.40	Down-gradient

Notes: bgs = below ground surface
DIA. = diameter
amsl = above mean sea level
PVC = polyvinylchloride
Elevations from Parametrix 2004b

2.2 SAMPLING PROCEDURES

Groundwater samples were collected on July 23, 2024 by BMEC personnel using a submersible pump and dedicated polyethylene tubing. Sample collection procedures are summarized below.

- The static water level (i.e., depth to groundwater from PVC top of casing) was measured via a Solinst interface probe prior to sampling.
- Each monitoring well was purged of stagnant water in the casing and filter by slowly setting the pump in the approximate middle of the screened interval or slightly above the middle, until the pH, temperature, and conductivity stabilized.
- Samples were collected by placing the pump within the approximate middle of the screened interval with a low-flow pumping rate.
- Groundwater samples were collected within appropriate containers prepared by the laboratory. The containers were filled to prevent air entrapment, sealed, labeled, and placed in an ice chest at approximately 4° for transport to OnSite Environmental (OnSite) in Redmond, Washington. The samples were accompanied by a completed and signed chain-of-custody form. Subsequent to arrival, the samples were relinquished by OnSite to AmTest laboratory for cyanide analysis.

2.3 SAMPLE ANALYSES

The laboratory report from OnSite for the analysis of the groundwater samples collected on July 23, 2024, is included in **Appendix A2**.

2.4 MONITORING SCHEDULE

Groundwater monitoring and sampling follows the schedule outlined in the post-closure plan (Parametrix, 2007c). Beginning in 2005, the plan specified quarterly sampling for the first two years, semi-annually for years three through seven, and annual sampling thereafter until concentrations drop below groundwater protection standards, or for a maximum of 30 years. One of two scheduled semi-annual sampling events was not completed in 2011.

2.5 DATA EVALUATION

The statistical approach for evaluating the post-closure groundwater monitoring data collected at the WSI is described in the GSDAEP (Parametrix, 2004b). The objectives of the post-closure data evaluation for the WSI are to demonstrate the effectiveness of the correction action, that is, evaluate whether groundwater quality is improving, deteriorating, or remaining unchanged relative to pre-closure conditions, and determine compliance with the groundwater protection standards. The data evaluation schedule is summarized below in **Table 2**.

TABLE 2 – DATA EVALUATION SCHEDULE FOR WSI

FREQUENCY OF EVALUATION	STATISTICAL PROCEDURE	PURPOSE
Quarterly or Semi-annually Years 1 - 7	Time-Series Plots	Visually Identify Increasing or Decreasing Concentration Trends
Annually After Year 7	Trend Analyses Using Mann-Kendall Test	Quantitatively Identify Increasing or Decreasing Concentration Trends
	Upper Confidence Limit Evaluation	Compare Concentrations to the Groundwater Protection Standards
	Time-Series Plots	Visually Identify Increasing or Decreasing Concentration Trends

Groundwater cleanup standards are Model Toxics Control Act (MTCA) Method B Cleanup Levels (CULs) and Maximum Contaminant Levels (MCLs). The groundwater protection standards are presented in the following **Table 3**.

TABLE 3 – GROUNDWATER PROTECTION STANDARDS FOR WSI

PARAMETER	MTCA METHOD B CLEANUP LEVEL (mg/L)	MCL (mg/L)	
		Primary	Secondary
Fluoride	0.96	4	2
Chloride	-	-	250
Sulfate	-	-	250
Total Cyanide	0.32	0.2	-

The analysis for total cyanide is to be discontinued, if not detected for four consecutive sampling events.

The GSDAEP (Parametrix, 2004b) also recommended using Upper Prediction Limit (UPL) comparisons to evaluate post-closure data. However, Environmental Protection Agency (EPA 2004) guidance does not recommend that UPL comparisons be used for sites such as the WSI with pre-existing contamination.

Three years of quarterly data (2005 – 2007), three years of semi-annual data (2008 – 2010), and fourteen years of annual data (2011 – 2024) from groundwater sampling were used for analysis (**Appendix A1**). The concentrations of chloride, fluoride, sulfate, and total cyanide, in each well, were evaluated and prepared to satisfy the semi-annual requirements. The time-series plots, Mann-Kendall test, and UCL comparisons were conducted to satisfy the annual evaluation requirements. With approval from Paul Skyllingskad of the State of Washington DOE (personal communication, June 28, 2012), both the DOE and EPA ProUCL calculator were used to calculate UCLs for the data.

Time-series plots were created using Microsoft Excel graphing functions. The Mann-Kendall test was conducted using the EPA's ProUCL calculator. ProUCL did not directly create all of the statistical outputs for the Mann-Kendall analysis. VAR(S) was computed using equation [1], Z was computed using equation [2], and probability was computed using **Table A21** (Hollander and Wolfe 1973).

[1]   Standard Deviation of $S = \sqrt{VAR(S)}$

[2] $Z = \dfrac{|S| - 1}{\sqrt{VAR(S)}}$

The State of Washington DOE UCL (DOE 2012) calculator was used to calculate the 95 percent UCL for normal and lognormal data sets, as well as the mean, minimum value, and maximum value for each data set. For data sets that were neither normal nor lognormal, the UCL was calculated using the EPA's ProUCL calculator (ProUCL, 2012). The data sets were calculated using ProUCL. Raw calculations for the DOE and EPA ProUCL calculators are presented in **Appendix B**.

3   RESULTS

3.1 SUMMARY

Post-closure data has been collected during 12 quarterly events between February 2005 and November 2007; six semi-annual events between May 2008 and October 2010; and 14 annual events in July 2011, April 2012, June 2013, April 2014, July 2015, August 2016, August 2017, July 2018, July 2019, June 2020, July 2021, June 2022, July 2023, and July 2024. The post-closure data are summarized in **Appendix A1** and individual results that exceed the groundwater protection level are highlighted.

3.2 STATISTICAL EVALUATION

3.2.1 Time-Series Plots

During the post-closure period beginning in February 2005, groundwater samples were analyzed for sulfate, fluoride, chloride, and total cyanide. Time-series plots of data collected since 2005 are presented in **Appendix B1**. For the time-series non-detected data, points were plotted using one half of the laboratory practical quantitative limit (PQL).

The time-series plots indicate the following trends since closing of the WSI in 2004 and compared to the prior year concentrations. Please note that during the July 2024 groundwater monitoring event, groundwater was noted in well MW-12A with slow recharge which is the first time since 2017 that measureable groundwater was detected in the well.

Sulfate
Sulfate concentrations since the prior year have increased slightly in well MW-14A and slightly decreased in other wells. The sulfate concentrations remain above the groundwater protection standard of 250 mg/L, except in up-gradient well MW-8A, which remains below the standard. The sulfate concentration in well MW-12A during the July 23, 2024 groundwater monitoring event was 510 mg/L which is above the standard.

Fluoride
Fluoride concentrations since the prior year are slightly decreasing in wells MW-3B and MW-14A. Fluoride concentrations remain below the groundwater protection standard of 0.96 mg/L, except in wells MW-10A and MW-14A in which fluoride concentrations continue to be above the standard. The fluoride concentration in well MW-12A during the July 23, 2024 groundwater monitoring event was 1.9 mg/L which is above the standard.

Chloride
Chloride concentrations since the prior year are decreasing in wells MW-3B, MW-10A, and MW-18A. Chloride concentrations since the prior year are slightly increasing in wells MW-8A and MW-14A. The chloride concentrations in all five of the afore-mentioned wells have not exceeded

the groundwater protection standard of 250 mg/L since 2005. The chloride concentration in well MW-12A during the July 23, 2024 groundwater monitoring event was 37 mg/L which is below the standard.

Total Cyanide

Total cyanide was not detected in wells MW-8A, MW-12A, MW-3B, and MW-18. The groundwater protection standard for total cyanide is 0.2 mg/L. The cyanide concentrations in MW-10A and 14-A were 0.009 mg/L and 0.019 mg/L, respectively, which are both below the standard.

3.2.2 Mann-Kendall Test

The Mann-Kendall test (Gilbert, 1987; Hollander and Wolfe, 1973) was used to evaluate temporal trends in the concentrations of analytes. The nonparametric Mann-Kendall test evaluates the direction and significance of trends in the data at the 95 percent UCL. The GSDAEP specified that Sen's slope tests were to be used to evaluate trends in the data but have not been used because they provide information similar to the Mann-Kendall test and are less conservative since they evaluate the significance of the data at the 90 percent UCL.

The Mann-Kendall test was conducted using the post-closure data. Results of the Mann-Kendall test are presented in **Appendix B2** and summarized below in **Table 4**.

TABLE 4 – POST-CLOSURE SIGNIFICANT TRENDS USING THE MANN-KENDALL TEST

WELL #	SULFATE	FLUORIDE	CHLORIDE	TOTAL CYANIDE
UP-GRADIENT				
MW-8A	-	↓	-	+
DOWN-GRADIENT				
MW-3B	↓	↓	↓	+
MW-10A	↑	+	+	↓
MW-12A	NA	NA	NA	NA
MW-14A	↓	↓	-	↓
MW-18	-	↓	↓	+

NOTES: ↑ = significant increasing trend
  ↓ = significant decreasing trend
  - = negative trend
  + = positive trend
  NA = trend could not be calculated; only one data point available since 2017

The Mann-Kendall test results indicate the following:
- Sulfate concentrations are significantly increasing in down-gradient well MW-10A yet are significantly decreasing in down-gradient wells MW-3B and MW-14A.
- Fluoride concentrations are significantly decreasing in up-gradient well MW-8A and down-gradient wells MW3B, MW-14A, and MW-18.

- Chloride concentrations are significantly decreasing in down-gradient wells MW-3B and MW-18.
- Total cyanide concentrations are significantly decreasing in down-gradient wells MW-10A and MW-14A.
- Trend data assessment for groundwater samples obtained from MW-12A cannot be calculated at this time due to a hiatus of consecutive groundwater monitoring events from 2018 through 2023.

3.2.3 Upper Confidence Limits

The primary tool cited in MTCA (WAC 173-34-720 [9]) for assessing whether data exceeds established CULs is by comparing data to established UCLs calculated on the mean. The UCL for each parameter at each well was calculated using the post-closure data, and the calculated UCL was compared to the MTCA CUL and MCL for each analyte to assess whether groundwater protection standards are being met. The results of the UCL comparisons are presented in **Appendix B** and summarized below in **Table 5**.

TABLE 5 – UPPER CONFIDENCE LIMITS OF POST-CLOSURE GROUNDWATER DATA

	UPPER CONFIDENCE LIMIT (mg/L)			
	SULFATE	**CHLORIDE**	**FLUORIDE**	**TOTAL CYANIDE**
LOWEST GROUNDWATER PROTECTION STANDARD	**250**	**250**	**0.96**	**0.2**
UP-GRADIENT WELL				
MW-8A	9.641	4.674	0.824	0.15
DOWN-GRADIENT WELL				
MW-3B	**2248**	108.7	**3.212**	0.01
MW-10A	**2942**	79.66	**4.862**	0.0296
MW-12A*	NA	NA	NA	NA
MW-14A	**3990**	118.9	**19.81**	0.135
MW-18	**1493**	82.8	**4.097**	0.086

NOTES: * No UCL calculated. Well was dry during most sampling events.
                 BOLD indicates UCL exceeds lowest groundwater protection standard.

Aside from well MW-12A, all of the wells down-gradient of the WSI that were sampled have post-closure UCL concentrations above the groundwater protection standards for sulfate and fluoride; however, all of the wells down-gradient of the WSI that were sampled have post-closure UCL concentrations below the groundwater protection standards for chloride and total cyanide. Up-gradient well MW-8A has a UCL below the groundwater protection standard for sulfate, chloride, fluoride, and total cyanide.

No UCL calculations are available for groundwater obtained from down-gradient well MW-12A due to lack of sufficient data.

3.3 GROUNDWATER FLOW

Groundwater elevations were measured once during 2004, quarterly from 2005 - 2007, semi-annually from 2008 – 2010, and annually from 2011 – 2024. The groundwater elevation data and hydrograph showing changes in groundwater surface elevation during post-closure are presented in **Appendix C**. A groundwater surface elevation contour map was prepared using groundwater surface elevations collected during the most recent July 23, 2024 groundwater monitoring event and is presented as **Figure 3**. Groundwater flow direction and hydraulic gradient are consistent with historical data and the overall flow direction down-gradient of the WSI is to the southwest.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The following is concluded based on the July 23, 2024 groundwater sampling results, trends, and statistical evaluation of historic data.
- Sulfate and fluoride concentrations in down-gradient wells, based on the calculated UCLs, exceed the groundwater protection standards. Sulfate and fluoride in the up-gradient well (MW-8A) are below groundwater protection standards.
- Sulfate concentrations in down-gradient well MW-10A are significantly increasing.
- Sulfate concentrations in down-gradient wells MW-14A and MW-18 are significantly decreasing.
- Fluoride concentrations are significantly decreasing in all wells except down-gradient well MW-10A.
- Chloride concentrations remain below groundwater protection standards, based on calculated UCLs, since the last reporting period. There are significant decreasing trends for chloride concentrations in down-gradient wells MW-3B and MW-18.
- Total cyanide concentrations are below groundwater protection standards, based on calculated UCLs, since the last reporting period. A significant decreasing trend continues since the last reporting period for total cyanide in down-gradient wells MW-10A and MW-14A.

4.2 RECOMMENDATIONS

Post-closure sulfate and fluoride concentrations are lower than pre-closure concentrations. However, the lack of significant reduction in their concentrations during the post-closure period may indicate that the WSI is continuing to contribute these contaminants to the groundwater. Continued sampling and data evaluation will be required to determine whether the concentrations of sulfate and fluoride decrease below the lowest groundwater protection standard.

As specified in the GSDAEP, the WSI groundwater monitoring frequency is on an annual basis. Also specified, future reports will continue time-series plots, Mann-Kendall tests for trend and a comparison of the UCLs of the most recent sampling data to the groundwater protection standards.

5 REFERENCES

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Skyllingstad, Paul, WA DOE, Personal Communication, June 28, 2012.

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6 SURFACE MAINTENANCE

The quarterly surface maintenance reports for the year are included in **Appendix D** pursuant to Section 6.5 of the WSI Closure and Post Closure Plan (Parametrix, 2004c). The reports include visual inspection of the cover, stormwater conveyance system, and any correction action. Quarterly photographs are included in each report.

7 LIMITATIONS

The enclosed JULY 2024 ANNUAL GROUNDWATER MONITORING REPORT has been performed for the exclusive use of Washington DOE and the NSC Smelter LLC, for the subject property, located at 85 John Day Dam Road in Goldendale, Washington.

The purpose of the JULY 2024 ANNUAL GROUNDWATER MONITORING activities was to evaluate potential or actual effects of past or current practices at the given Site. In performing the referenced field activities, a balance was struck between reasonable inquiry into environmental issues and an exhaustive analysis of every conceivable issue of possible concern. This GWSE report contains BMEC opinion(s) regarding environmental issues of concern and/or additional issues that may need to be addressed. In rendering our professional opinion(s), BMEC warrants that the services provided within the scope of these field activities were performed, within the limits described, in accordance with generally accepted environmental consulting principles and practices. No other warranty, expressed or implied, is made. The following paragraphs describe the assumptions and standard parameters under which such an opinion is rendered.

Any opinions and/or recommendations presented in this report apply to site conditions existing at the time of performance of services. BMEC is unable to report on or accurately predict events that may affect the Site after the performance of services, whether occurring naturally or caused by human forces. BMEC assumes no responsibility for conditions BMEC did not investigate, or conditions not generally recognized as environmentally unacceptable at the time services were performed.

Except where there is expressed concern of our client, or where specific environmental contaminants have previously been reported by others, naturally occurring toxic substances, potential environmental contaminants located inside buildings, or contaminant concentrations not of current environmental concern, may not be addressed in this document.

No assessment is thorough enough to exclude the presence of hazardous materials at a given site. Therefore, if specific hazardous materials have not been identified during this investigation, the lack of such identifications should not be construed as a guarantee of the absence of hazardous materials, but merely as the result of services performed within the scope, limitations, and cost of work done.

BMEC is not responsible for the effects of changes in applicable environmental standards,

BMEC is not responsible for the effects of changes in applicable environmental standards, practices, or regulations after the performance of services.

The services provided for this investigation were performed in accordance with Washington DOE's requests and BMEC's agreement and understanding with our client, which may not be fully disclosed in this report. Opinions and/or recommendations are intended for the client, purpose, site, location, time frame, and project parameters indicated.

This report was prepared solely for the use of Washington DOE and the NSC Smelter LLC and should be reviewed in its entirety; BMEC is not responsible for subsequent separation, detachment, or partial use of this document. Any reliance on this report by a third party shall be at such party's sole risk.

Brent Bergeron

Brent N. Bergeron, LHG

Expires 1/3/25

Statement of Quality Control

The objective of these JULY 2024 ANNUAL GROUNDWATER MONITORING field activities was to ascertain the potential presence or absence of environmental problems that could impact the subject property. The purpose of the field activities was to perform reasonable steps in accordance with the existing regulations, currently available technology, and generally accepted engineering practices in order to accomplish the desired objectives. To the best of our knowledge, these field activities have been performed in compliance with BMEC's Standard Operating Procedures protocol for Environmental Site Assessments and/or Groundwater Monitoring Reports.

Blue Mountain Environmental Consulting, Inc.

P Trabusiner

Peter H. Trabusiner, Engineer

WASHINGTON

QUADRANGLE LOCATION

Production Buildings Area

Area Shown on Figures 2 & 3

West Surface Impoundment

N

0   1/2   1   2

SCALE IN MILES
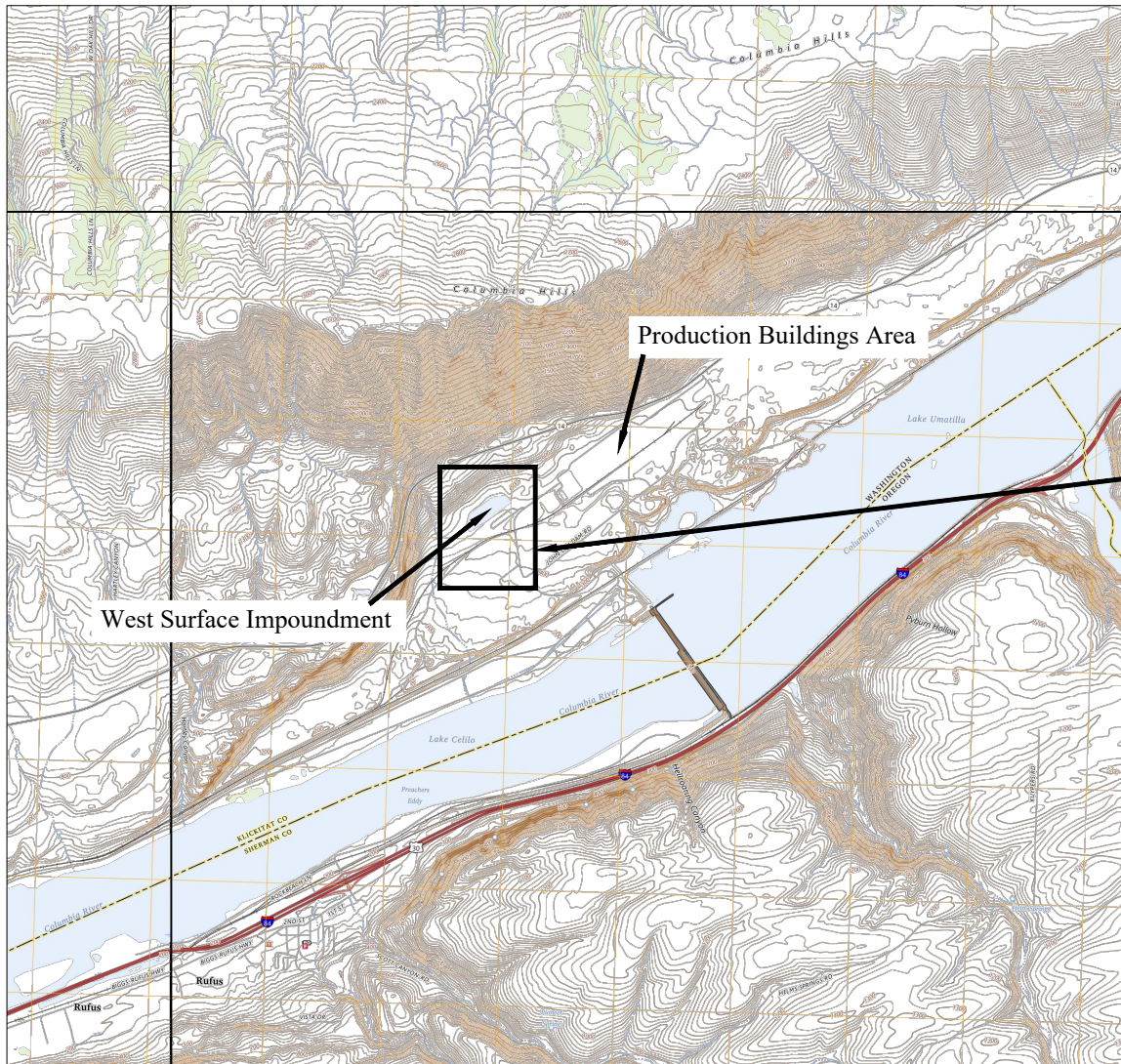
Source: USGS 7.5' Quadrangles:
Biggs Junction, 2023
Goldendale, 2023
Luna Butte, 2023
Rufus, 2024

SMD: 08/01/2024

BLUE MOUNTAIN ENVIRONMENTAL
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Columbia Gorge Aluminum Corporation
Former Columbia Gorge Aluminum Smelter
Goldendale, Washington

Figure 1

Site Location Map

West Surface Impoundment

MW-17A
MW-8A
MW-16A
MW-6B.
MW-15A
MW-14A
MW-10A
MW-12A
MW-3B
MW-18

N

0   250   500   1,000
SCALE IN FEET

SMD: 08/01/2024

Source: Google Earth
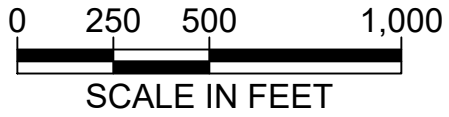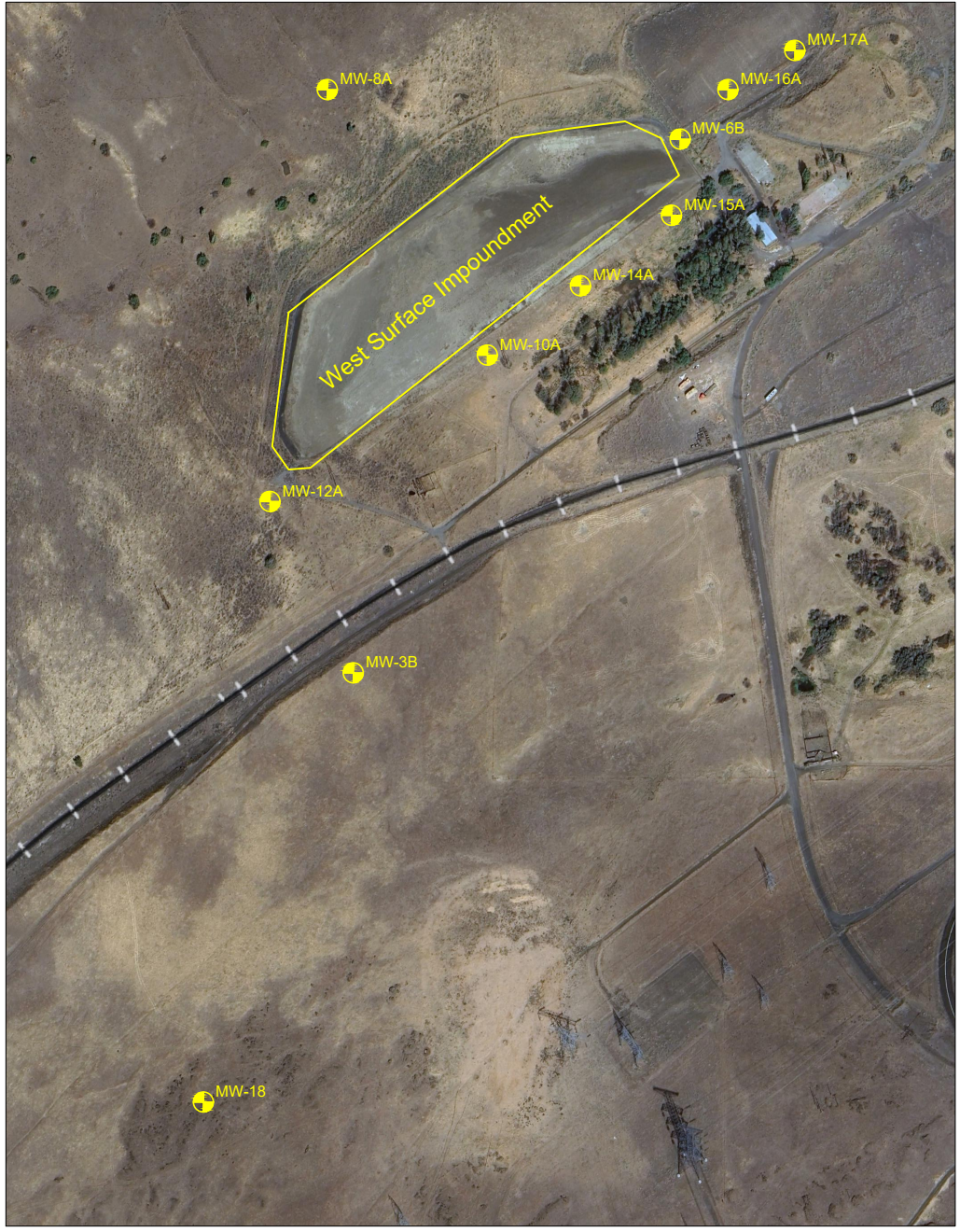
Figure 2

West Surface Impoundment
Groundwater Monitoring Wells
Location Map

BLUE MOUNTAIN ENVIRONMENTAL
& CONSULTING COMPANY INC

Columbia Gorge Aluminum Corporation
Former Columbia Gorge Aluminum Smelter
Goldendale, Washington

Legend:
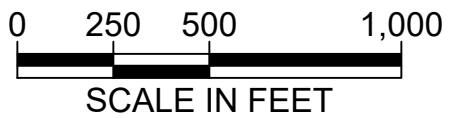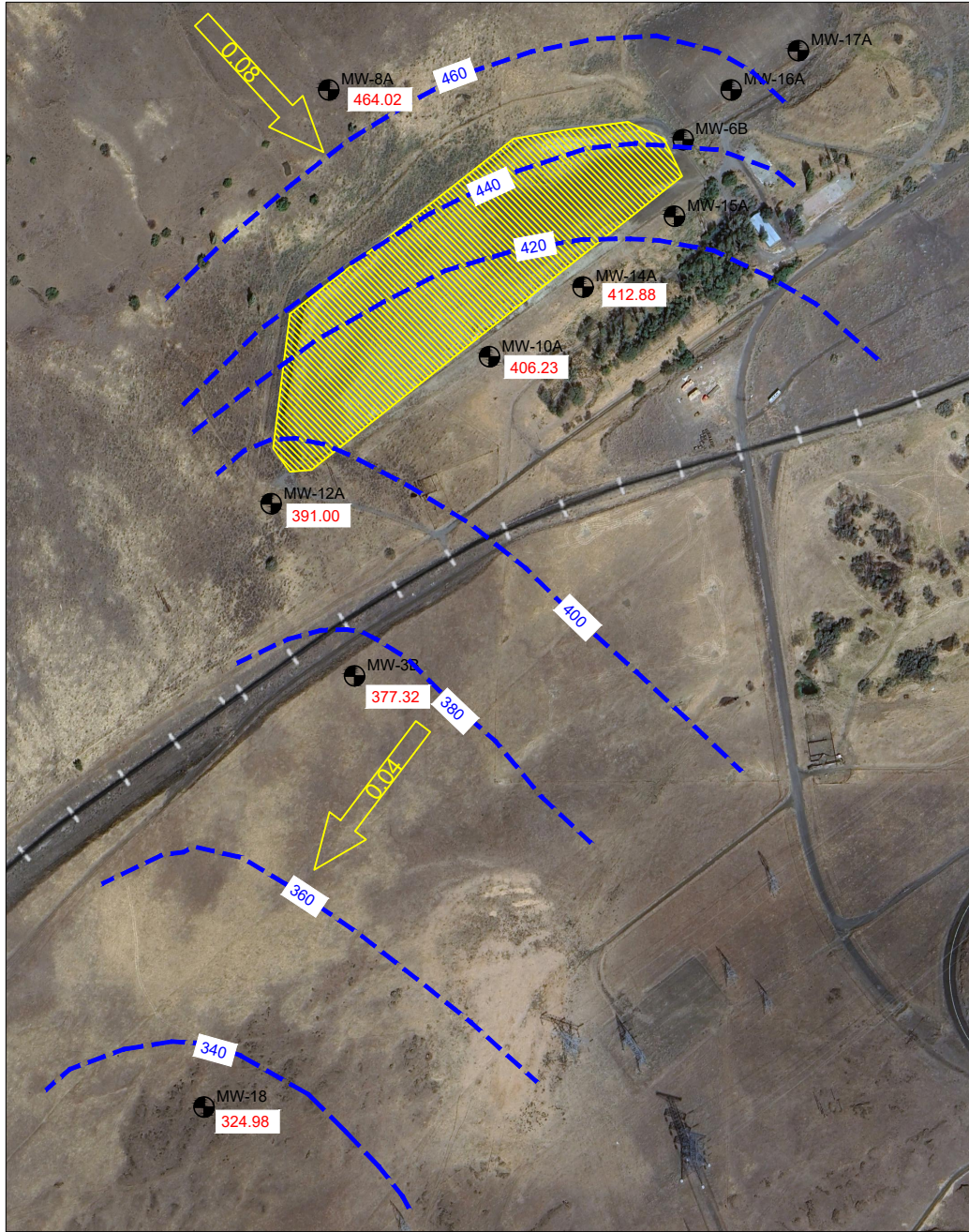
324.98 — Groundwater Elevation at MW, ft MSL

— — 340 — — — Groundwater Surface Contour, ft MSL

← 0.08 — Groundwater Flow Direction and Gradient

SCALE IN FEET
0 250 500 1,000

SMD: 08/01/2024

Source: GeoPro LLC

Figure 3

West Surface Impoundment
Groundwater Contour Map,
July 23, 2024

BLUE MOUNTAIN ENVIRONMENTAL
& CONSULTING COMPANY INC
P.O. Box 545 / 125 Main Street, Waitsburg WA 99361 / (509) 520-6519

Columbia Gorge Aluminum Corporation
Former Columbia Gorge Aluminum Smelter
Goldendale, Washington

Map labels:
- MW-17A
- MW-16A
- MW-8A 464.02
- 460
- MW-6B
- 440
- MW-15A
- 420
- MW-14A 412.88
- MW-10A 406.23
- MW-12A 391.00
- 400
- MW-3B 377.32
- 380
- 0.04
- 360
- 340
- MW-18 324.98
- 0.08
- N

APPENDICES

APPENDIX A – GROUNDWATER ANALYSES

APPENDIX A1

Analyses Summary Table

GROUNDWATER ANALYSES SUMMARY TABLE (mg/L)
West Surface Impoundment - Former Columbia Gorge Aluminum Smelter in Goldendale, Washington

Analyte			Sulfate	Fluoride	Chloride	Total Cyanide
Lowest Groundwater Protection Standard			**250**	**0.96**	**250**	**0.2**
Monitoring Well ID	Location To WSI	Date Collected				
MW-8A	Up-Gradient	2/16/05	10	0.9	5.6	< 0.01
		5/11/05	9.8	0.3	4.6	< 0.01
		8/29/05	8.9	0.4	4.2	< 0.01
		11/1/05	9.6	0.9	4.7	< 0.01
		2/27/06	9.27	2.8	4.2	< 0.01
		6/5/06	9.8	0.2	4.9	< 0.05
		7/31/06	9.8	0.1	4.6	< 0.01
		10/9/06	9.7	< 0.2	4.5	< 0.01
		3/13/07	10	< 0.1	6.6	< 0.01
		6/22/07	1	< 10	4.89	< 0.01
		9/24/07	10	< 1	4.2	< 0.01
		11/14/07	-	-	-	-
		5/8/08	10	< 1	4	< 0.01
		10/14/08	10	0.1	4.5	< 0.01
		5/29/09	9	< 1	3	< 0.02
		10/27/09	10	< 1	5.5	< 0.02
		5/26/10	9.3	< 1	4.4	< 0.02
		10/6/10	8.9	< 1	3.6	< 0.02
		7/26/11	7.8	< 1	3.6	< 0.02
		4/19/12	10	0.18	3.8	< 0.005
		6/20/13	9.4	0.16	4.8	< 0.005
		4/25/14	9.5	0.19	4.9	< 0.005
		7/20/15	9.5	0.16	4.2	< 0.005
		8/2/16	9.3	0.13	4.1	< 0.005
		8/9/17	9.6	0.15	4.1	< 0.005
		7/26/18	9.5	0.15	3.2	< 0.005
		7/24/19	5.4	0.14	4.1	< 0.005
		6/20/20	11	0.16	3.9	< 0.005
		7/28/21	9	0.15	4.4	< 0.004
		6/30/22	9.2	0.15	3.7	< 0.005
		7/20/23	7.4	0.15	5	< 0.005
		7/23/24	10	0.15	5.9	<0.005
MW-3B	Down-Gradient	2/16/05	**2300**	0.6	130	< 0.01
		5/11/05	**2500**	0.4	140	< 0.01
		8/29/05	**2700**	0.6	120	< 0.01
		11/1/05	**2600**	0.9	130	< 0.01
		2/27/06	**2610**	0.7	118	< 0.01
		6/5/06	**2220**	0.2	113	< 0.01
		7/31/06	**2000**	3.7	110	< 0.01
		10/9/06	**2500**	3.8	110	< 0.01
		3/13/07	**2500**	3.8	110	< 0.01
		6/22/07	**2500**	< 10	97	< 0.01
		9/24/07	**2200**	< 1	124.79	< 0.01
		11/14/07	-	-	-	-
		5/8/08	**2200**	< 50	100	< 0.01
		10/14/08	**2600**	< 10	100	< 0.01
		5/29/09	**2200**	< 1	96	< 0.01
		10/27/09	**2606**	< 1	110	< 0.02
		5/26/10	**2300**	2.3	120	< 0.02
		10/6/10	**2400**	< 1	120	< 0.02
		7/26/11	**2000**	< 1	98	< 0.02
		4/19/12	**2200**	0.16	90	< 0.005
		6/20/13	**1900**	0.16	91	0.006
		4/25/14	**2000**	0.18	91	< 0.006
		7/20/15	**1900**	0.14	80	< 0.005
		8/2/16	**1900**	0.12	98	< 0.005
		8/9/17	**1700**	0.15	95	0.01
		7/26/18	**1800**	0.16	95	< 0.005
		7/24/19	**1500**	0.15	93	< 0.005
		6/20/20	**1700**	0.14	88	< 0.005
		7/28/21	**1500**	0.17	93	< 0.005
		6/30/22	**1600**	0.17	99	< 0.005
		7/20/23	**1400**	0.13	86	< 0.005
		7/23/24	**2100**	0.17	89	<0.005

MW-10A	**Down-Gradient**	2/16/05	**940**	**1.8**	29	0.04
		5/11/05	**910**	**1.5**	31	0.05
		8/29/05	**670**	**1.2**	28	0.04
		11/1/05	**670**	**2.7**	28	0.03
		2/27/06	**1570**	**2.3**	43	0.03
		6/5/06	**1650**	**3.2**	48	0.03
		7/31/06	**860**	**2.3**	35	0.08
		10/9/06	**850**	**1.9**	30	0.03
		3/13/07	**1100**	**3.4**	45	0.04
		6/22/07	**1100**	**< 10**	36	< 0.01
		9/24/07	**760**	**1.2**	30	0.04
		11/14/07	**-**	**-**	-	0.043
		5/8/08	**2700**	**< 50**	100	0.05
		10/14/08	**860**	**< 10**	30	0.04
		5/29/09	**2000**	**2**	68	0.03
		10/27/09	**760**	**< 1**	79	< 0.02
		5/26/10	**2200**	**4.4**	83	0.032
		10/6/10	**710**	**1**	23	0.022
		7/26/11	**1800**	**3.3**	62	0.028
		4/19/12	**5800**	**1.9**	180	0.007
		6/20/13	**4700**	**3.1**	99	0.008
		4/25/14	**6100**	**2**	190	< 0.005
		7/20/15	**1900**	**2**	58	< 0.005
		8/2/16	**3500**	**2.1**	82	< 0.005
		8/9/17	**2900**	**3.2**	170	< 0.005
		7/26/18	**4800**	**4.1**	71	< 0.005
		7/24/19	**4000**	**3.7**	82	< 0.006
		6/20/20	**5700**	**4.4**	77	< 0.006
		7/28/21	DRY	DRY	DRY	DRY
		6/30/22	**2100**	**3.2**	47	< 0.005
		7/20/23	**1400**	**4.0**	38	< 0.005
		7/23/24	**3550**	**5**	50	<0.005
MW-12A	**Down-Gradient**	2/16/05	DRY	DRY	DRY	DRY
		5/11/05	DRY	DRY	DRY	DRY
		8/29/05	DRY	DRY	DRY	DRY
		11/1/05	DRY	DRY	DRY	DRY
		2/27/06	DRY	DRY	DRY	DRY
		6/5/06	DRY	DRY	DRY	DRY
		7/31/06	DRY	DRY	DRY	DRY
		10/9/06	DRY	DRY	DRY	DRY
		3/13/07	**1800**	**6.3**	150	< 0.01
		6/22/07	DRY	DRY	DRY	DRY
		9/24/07	DRY	DRY	DRY	DRY
		11/14/07	DRY	DRY	DRY	DRY
		5/8/08	DRY	DRY	DRY	DRY
		10/14/08	DRY	DRY	DRY	DRY
		5/29/09	DRY	DRY	DRY	DRY
		10/27/09	DRY	DRY	DRY	DRY
		5/26/10	DRY	DRY	DRY	DRY
		10/6/10	DRY	DRY	DRY	DRY
		7/26/11	DRY	DRY	DRY	DRY
		4/19/12	DRY	DRY	DRY	DRY
		6/20/13	DRY	DRY	DRY	DRY
		4/25/14	DRY	DRY	DRY	DRY
		7/20/15	DRY	DRY	DRY	DRY
		8/2/16	DRY	DRY	DRY	DRY
		8/9/17	DRY	DRY	DRY	DRY
		7/26/18	DRY	DRY	DRY	DRY
		7/24/19	DRY	DRY	DRY	DRY
		6/20/20	DRY	DRY	DRY	DRY
		7/28/21	DRY	DRY	DRY	DRY
		6/30/22	DRY	DRY	DRY	DRY
		7/20/23	DRY	DRY	DRY	DRY
		7/23/24	**510**	**1.9**	37	<0.005

		Date				
MW-14A	Down-Gradient	2/16/05	**4000**	**9.6**	110	0.35
		5/11/05	**3500**	**8.6**	90	0.24
		8/29/05	**3600**	**30**	71	0.27
		11/1/05	**2800**	**25**	75	0.19
		2/27/06	**2170**	**31**	53	0.19
		6/5/06	**2380**	**27**	63	0.2
		7/31/06	**3300**	**30**	98	0.17
		10/9/06	**3900**	**24**	130	0.01
		3/13/07	**4400**	**16**	140	0.12
		6/22/07	**7900**	**19**	170	< 0.01
		9/24/07	**6400**	**< 50**	200	0.03
		11/14/07	-	-	-	-
		5/8/08	**5500**	**< 50**	100	0.19
		10/14/08	**6500**	**20**	180	0.12
		5/29/09	**7000**	**30**	210	0.14
		10/27/09	**5900**	**24**	160	0.044
		5/26/10	**5200**	**32**	170	0.14
		10/6/10	**4000**	**18**	120	0.086
		7/26/11	**3900**	**23**	130	0.066
		4/19/12	DRY	DRY	DRY	DRY
		6/20/13	**2300**	**17**	66	0.028
		4/25/14	**2100**	**18**	61	0.037
		7/20/15	**1100**	**6.8**	47	0.008
		8/2/16	**1400**	**3.5**	61	0.019
		8/9/17	**1700**	**2.5**	68	0.017
		7/26/18	**1800**	**3.6**	66	< 0.005
		7/24/19	**1700**	**2.8**	64	0.018
		6/20/20	**2000**	**7**	49	0.018
		7/28/21	**1100**	**7.8**	36	< 0.004
		6/30/22	**990**	**7.8**	32	0.008
		7/20/23	**1100**	**2.9**	50	< 0.005
		7/23/24	**1700**	**1.8**	64	<0.005
MW-18	Down-Gradient	2/16/05	**1500**	0.6	86	< 0.01
		5/11/05	**1300**	0.4	91	< 0.01
		8/29/05	**1500**	0.4	75	< 0.01
		11/1/05	**1300**	**1.8**	84	< 0.01
		2/27/06	**1520**	0.9	83	< 0.01
		6/5/06	**1490**	0.2	91	< 0.01
		7/31/06	**1500**	**2.6**	89	< 0.01
		10/9/06	**1600**	**2.4**	80	< 0.01
		3/13/07	**1600**	**2.6**	93	< 0.01
		6/22/07	**1700**	**< 1**	77	< 0.01
		9/24/07	**1400**	**< 50**	100	< 0.01
		11/14/07	-	-	-	-
		5/8/08	**1300**	**< 50**	70	< 0.01
		10/14/08	**1600**	**< 1**	80	< 0.01
		5/29/09	**1500**	**1**	81	< 0.01
		10/27/09	**1200**	**< 1**	70	< 0.01
		5/26/10	**1500**	**2**	100	< 0.02
		10/6/10	**1600**	**< 1**	84	< 0.02
		7/26/11	**1600**	**< 1**	89	< 0.02
		4/19/12	**1700**	0.2	79	< 0.005
		6/20/13	**1500**	0.13	84	< 0.005
		4/25/14	**1700**	0.12	79	< 0.005
		7/20/15	**1300**	0.11	86	< 0.005
		8/2/16	**1700**	0.12	79	< 0.005
		8/9/17	**1300**	0.11	59	0.086
		7/26/18	**1400**	0.11	69	< 0.005
		7/24/19	**1200**	0.12	68	< 0.005
		6/20/20	**1400**	0.13	67	< 0.005
		7/28/21	**1200**	0.11	71	< 0.004
		6/30/22	**1300**	0.15	72	< 0.005
		7/20/23	**1100**	0.16	69	< 0.005
		7/23/24	**1100**	0.14	66	<0.005

NOTES:

mg/L - milligrams per liter or parts per million

< = not detected above laboratory practical quantitation limit (PQL)

BOLD = detected at concentration above PQL

- = not analyzed

| **500** | Gray shading implies detection above the PQL and **BOLD BLACK** text implies concentration exceeds the Lowest Groundwater Protection Standard. |

APPENDIX A2

Laboratory Report

August 7, 2024

Peter Trabusiner
Blue Mountain Environmental, Inc.
1500 Adair Drive
Richland, WA 99352

Re: Analytical Data for Project E2023/1007; Goldendale WSI
          Laboratory Reference No. 2407-287

Dear Peter:

Enclosed are the analytical results and associated quality control data for samples submitted on July 25, 2024.

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

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

Sincerely,

David Baumeister
Project Manager

Enclosures

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

This report pertains to the samples analyzed in accordance with the chain of custody,
and is intended only for the use of the individual or company to whom it is addressed.

Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

Case Narrative

Samples were collected on July 23, 2024 and received by the laboratory on July 25, 2024. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below. However the soil results for the QA/QC samples are reported on a wet-weight basis.

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

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Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

CHLORIDE
SM 4500-Cl E

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW8A-7-23-24-GW**					
Laboratory ID:	07-287-01					
Chloride	**5.9**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW12A-7-23-24-GW**					
Laboratory ID:	07-287-02					
Chloride	**37**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW3B-7-23-24-GW**					
Laboratory ID:	07-287-03					
Chloride	**89**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW10A-7-23-24-GW**					
Laboratory ID:	07-287-04					
Chloride	**47**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW10A-7-23-24-GW-DUP**					
Laboratory ID:	07-287-05					
Chloride	**53**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW14A-7-23-24-GW**					
Laboratory ID:	07-287-06					
Chloride	**64**	2.0	SM 4500-Cl E	7-31-24	7-31-24	
Client ID:	**MW18-7-23-24-GW**					
Laboratory ID:	07-287-07					
Chloride	**66**	2.0	SM 4500-Cl E	7-31-24	7-31-24	

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Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

CHLORIDE
SM 4500-Cl E
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0731W1					
Chloride	**ND**	2.0	SM 4500-Cl E	7-31-24	7-31-24	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	07-282-02								
	ORIG	DUP							
Chloride	**5970**	**5710**	NA	NA	NA	NA	4	21	
MATRIX SPIKE									
Laboratory ID:	07-282-02								
	MS		MS		MS				
Chloride	**16400**		10000	5970	104	81-115	NA	NA	
SPIKE BLANK									
Laboratory ID:	SB0731W1								
	SB		SB		SB				
Chloride	**53.5**		50.0	NA	107	77-115	NA	NA	

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Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

FLUORIDE
SM 4500-F C

Matrix: Water
Units: mg F- /L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW8A-7-23-24-GW**					
Laboratory ID:	07-287-01					
Fluoride	**0.15**	0.020	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW12A-7-23-24-GW**					
Laboratory ID:	07-287-02					
Fluoride	**1.9**	0.020	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW3B-7-23-24-GW**					
Laboratory ID:	07-287-03					
Fluoride	**0.17**	0.020	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW10A-7-23-24-GW**					
Laboratory ID:	07-287-04					
Fluoride	**5.0**	0.080	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW10A-7-23-24-GW-DUP**					
Laboratory ID:	07-287-05					
Fluoride	**4.9**	0.080	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW14A-7-23-24-GW**					
Laboratory ID:	07-287-06					
Fluoride	**1.8**	0.020	SM 4500-F C	8-2-24	8-2-24	
Client ID:	**MW18-7-23-24-GW**					
Laboratory ID:	07-287-07					
Fluoride	**0.14**	0.020	SM 4500-F C	8-2-24	8-2-24	

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Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

FLUORIDE
SM 4500-F C
QUALITY CONTROL

Matrix: Water
Units: mg F- /L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0802W1					
Fluoride	**ND**	0.020	SM 4500-F C	8-2-24	8-2-24	

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE								
Laboratory ID:	07-328-01							
	ORIG DUP							
Fluoride	**0.0344 0.0363**	NA	NA	NA	NA	5	30	
MATRIX SPIKE								
Laboratory ID:	07-328-01							
	MS	MS		MS				
Fluoride	**0.566**	0.500	0.0344	106	81-123	NA	NA	
SPIKE BLANK								
Laboratory ID:	SB0802W1							
	SB	SB		SB				
Fluoride	**0.512**	0.500	NA	102	75-122	NA	NA	

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Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

SULFATE
ASTM D516-11

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW8A-7-23-24-GW**					
Laboratory ID:	07-287-01					
Sulfate	**10**	5.0	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW12A-7-23-24-GW**					
Laboratory ID:	07-287-02					
Sulfate	**510**	500	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW3B-7-23-24-GW**					
Laboratory ID:	07-287-03					
Sulfate	**2100**	1000	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW10A-7-23-24-GW**					
Laboratory ID:	07-287-04					
Sulfate	**3700**	1000	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW10A-7-23-24-GW-DUP**					
Laboratory ID:	07-287-05					
Sulfate	**3400**	1000	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW14A-7-23-24-GW**					
Laboratory ID:	07-287-06					
Sulfate	**1700**	1000	ASTM D516-11	8-5-24	8-5-24	
Client ID:	**MW18-7-23-24-GW**					
Laboratory ID:	07-287-07					
Sulfate	**1100**	1000	ASTM D516-11	8-5-24	8-5-24	

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Date of Report: August 7, 2024
Samples Submitted: July 25, 2024
Laboratory Reference: 2407-287
Project: E2023/1007; Goldendale WSI

SULFATE
ASTM D516-11
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0805W1					
Sulfate	**ND**	5.0	ASTM D516-11	8-5-24	8-5-24	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	07-296-04								
	ORIG	DUP							
Sulfate	**ND**	**ND**	NA	NA	NA	NA	NA	11	
MATRIX SPIKE									
Laboratory ID:	07-296-04								
	MS		MS		MS				
Sulfate	**7.50**		10.0	ND	75	69-134	NA	NA	
SPIKE BLANK									
Laboratory ID:	SB0805W1								
	SB		SB		SB				
Sulfate	**10.1**		10.0	NA	101	81-106	NA	NA	

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

This report pertains to the samples analyzed in accordance with the chain of custody,
and is intended only for the use of the individual or company to whom it is addressed.

Data Qualifiers and Abbreviations

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

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

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

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

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

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

I - Compound recovery is outside of the control limits.

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

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

L - The RPD is outside of the control limits.

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

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

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

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

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

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

Q - Surrogate recovery is outside of the control limits.

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

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

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

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

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

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

X - Sample extract treated with a mercury cleanup procedure.

X1 - Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

X2 - Sample extract treated with a silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in methods 8260 & 8270, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Y1 - Negative effects of the matrix from this sample on the instrument caused values for this analyte in the bracketing continuing calibration verification standard (CCVs) to be outside of 20% acceptance criteria. Because of this, quantitation limits and sample concentrations should be considered estimates.

Z -

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

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Am Test Inc.
13600 NE 126th Place Suite C
Kirkland, WA
(425) 885-1664
www.amtestlab.com

Professional
Analytical
Services

July 30, 2024

David Baumeister
14648 NE 95th ST
Redmond, WA 98052

Project: OSE
Project Number: E2023/1007
Project Manager: David Baumeister
RE: OSE

Enclosed are the results of analyses for samples received by our laboratory on 7/26/2024.
Please feel free to contact me with any questions or considerations regarding this report.

Sincerely,

Aaron Young
President

Am Test Inc.

13600 NE 126th Place Suite C
Kirkland, WA
(425) 885-1664
www.amtestlab.com

ANALYSIS REPORT

Professional
Analytical
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Date Received: 07/26/24
Date Reported: 07/30/24

OnSite Environmental Inc.

14648 NE 95th ST

Redmond, WA 98052

Attention: David Baumeister

Project Name: OSE

Project #: E2023/1007

All results reported on an as received basis.

Reported Samples

Lab ID	Sample	Matrix	Qualifiers	Date Sampled	Date Received
A24G0490-01	MW8A-7-23-24-GW	Water		07/23/2024	07/26/2024
A24G0490-02	MW12A-7-23-24-GW	Water		07/23/2024	07/26/2024
A24G0490-03	MW3B-7-23-24-GW	Water		07/23/2024	07/26/2024
A24G0490-04	MW10A-7-23-24-GW	Water		07/23/2024	07/26/2024
A24G0490-05	MW10A-7-23-24-GW-DUP	Water		07/23/2024	07/26/2024
A24G0490-06	MW14A-7-23-24-GW	Water		07/23/2024	07/26/2024
A24G0490-07	MW18-7-23-24-GW	Water		07/23/2024	07/26/2024

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
No duplication of this report is allowed, except in its entirety.

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ANALYSIS REPORT

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Date Received: 07/26/24
Date Reported: 07/30/24

OnSite Environmental Inc.

14648 NE 95th ST

Redmond, WA 98052

Attention: David Baumeister

Project Name: OSE

Project #: E2023/1007

All results reported on an as received basis.

AMTEST Identification Number: A24G0490-01
Client Identification: MW8A-7-23-24-GW
Sampling Date: 07/23/24 09:10

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	ND	mg/L	U	0.005	SM 4500CN-E_2011	EZ	07/30/2024

AMTEST Identification Number: A24G0490-02
Client Identification: MW12A-7-23-24-GW
Sampling Date: 07/23/24 10:02

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	ND	mg/L	U	0.005	SM 4500CN-E_2011	EZ	07/30/2024

AMTEST Identification Number: A24G0490-03
Client Identification: MW3B-7-23-24-GW
Sampling Date: 07/23/24 11:24

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	ND	mg/L	U	0.005	SM 4500CN-E_2011	EZ	07/30/2024

AMTEST Identification Number: A24G0490-04
Client Identification: MW10A-7-23-24-GW
Sampling Date: 07/23/24 12:18

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	0.009	mg/L		0.005	SM 4500CN-E_2011	EZ	07/30/2024

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ANALYSIS REPORT

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Date Received: 07/26/24
Date Reported: 07/30/24

OnSite Environmental Inc.

14648 NE 95th ST

Redmond, WA 98052

Attention: David Baumeister

Project Name: OSE

Project #: E2023/1007

All results reported on an as received basis.

AMTEST Identification Number: A24G0490-05
Client Identification: MW10A-7-23-24-GW-DUP
Sampling Date: 07/23/24 12:22

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	0.009	mg/L		0.005	SM 4500CN-E_2011	EZ	07/30/2024

AMTEST Identification Number: A24G0490-06
Client Identification: MW14A-7-23-24-GW
Sampling Date: 07/23/24 13:13

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	0.019	mg/L		0.005	SM 4500CN-E_2011	EZ	07/30/2024

AMTEST Identification Number: A24G0490-07
Client Identification: MW18-7-23-24-GW
Sampling Date: 07/23/24 15:02

Conventional Chemistry Parameters by APHA/EPA Methods

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	ND	mg/L	U	0.005	SM 4500CN-E_2011	EZ	07/30/2024

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
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Page 4 of 7

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ANALYSIS REPORT

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Date Received: 07/26/24
Date Reported: 07/30/24

OnSite Environmental Inc.

14648 NE 95th ST

Redmond, WA 98052

Attention: David Baumeister

Project Name: OSE

Project #: E2023/1007

All results reported on an as received basis.

Quality Control

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBG0416 - No Prep - WetChem										
Blank (BBG0416-BLK1)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	ND	U	0.005	mg/L						
LCS (BBG0416-BS1)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.052			mg/L	0.05000		103%	80-120%		
Calibration Blank (BBG0416-CCB1)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	-0.0005	U		mg/L						
Calibration Blank (BBG0416-CCB2)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	-0.001	U		mg/L						
Calibration Blank (BBG0416-CCB3)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	-0.0009	U		mg/L						
Calibration Blank (BBG0416-CCB4)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	-0.0005	U		mg/L						
Calibration Check (BBG0416-CCV1)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.104			mg/L	0.1000		104%	85-115%		
Calibration Check (BBG0416-CCV2)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.102			mg/L	0.1000		102%	85-115%		
Calibration Check (BBG0416-CCV3)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.101			mg/L	0.1000		101%	85-115%		
Calibration Check (BBG0416-CCV4)					Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.101			mg/L	0.1000		101%	85-115%		
Duplicate (BBG0416-DUP1)			**Source: A24G0508-01**		Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	ND	U	0.0008	mg/L		ND				20
Duplicate (BBG0416-DUP2)			**Source: A24G0490-01**		Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	ND	U	0.0008	mg/L		ND				20

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ANALYSIS REPORT

Professional
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Date Received: 07/26/24
Date Reported: 07/30/24

OnSite Environmental Inc.
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister
Project Name: OSE
Project #: E2023/1007

All results reported on an as received basis.

Quality Control
(Continued)

Conventional Chemistry Parameters by APHA/EPA Methods   (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBG0416 - No Prep - WetChem (Continued)										
Matrix Spike (BBG0416-MS1)			**Source: A24G0508-01**		Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.051			mg/L	0.05000	-0.0009	102%	55-145%		
Matrix Spike (BBG0416-MS2)			**Source: A24G0490-01**		Prepared: 07/29/24 Analyzed: 07/30/24					
Total Cyanide	0.042			mg/L	0.05000	-0.0001	84%	55-145%		

Notes and Definitions

Item	Definition
U	The compound was analyzed for but was not detected (Non-detect) at or above the MRL/MDL.
Dry	Sample results reported on a dry weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was matrix spiked or duplicated.

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
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A2460460

Page 1 of 1

OnSite Environmental Inc.

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

Laboratory Reference #: 07-287

Laboratory: AmTest Laboratories

Attention: Aaron Young

13600 NE 126th Pl Kirkland, WA 98034

Phone Number: (425) 885-1664

Turnaround Request

1 Day   2 Day   3 Day

Standard

Other: _____

Project Manager: David Baumeister

email: dbaumeister@onsite-env.com

Project Number: E2023/1007

Project Name: _____

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	Requested Analyses
01	MW8A-7-23-24-GW	7/23/24	9:10	W	1	Total Cyanide
02	MW12A-7-23-24-GW	7/23/24	10:02	W	1	Total Cyanide
03	MW3B-7-23-24-GW	7/23/24	11:24	W	1	Total Cyanide
04	MW10A-7-23-24-GW	7/23/24	12:18	W	1	Total Cyanide
05	MW10A-7-23-24-GW-DUP	7/23/24	12:22	W	1	Total Cyanide
06	MW14A-7-23-24-GW	7/23/24	13:13	W	1	Total Cyanide
07	MW18-7-23-24-GW	7/23/24	15:02	W	1	Total Cyanide

	Company	Date	Time	Comments/Special Instructions
Relinquished by:	OSE	7-26-24	10:20	
Received by:	Amtest	7/26/24	1020	6.4°
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

EIM

OnSite Environmental Inc.

Analytical Laboratory Testing Services
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Chain of Custody

Laboratory Number: 07-287

Page 1 of 1

Company: BMEC

Project Number: E2023/1007

Project Name: GOLDENDALE WSI

Project Manager: R. RABUSHKE/B. BELLEDIN

Sampled by: B. BELLEDIN/K MEYER

Turnaround Request (in working days)

(Check One)

- [ ] Same Day
- [ ] 2 Days
- [x] Standard (7 Days)
- [ ] 1 Day
- [ ] 3 Days
- [ ] (other)

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX (8021☐ 8260☐)	NWTPH-Gx	NWTPH-Dx (SG Clean-up ☐)	Volatiles 8260	Halogenated Volatiles 8260	EDB EPA 8011 (Waters Only)	Semivolatiles 8270/SIM (with low-level PAHs)	PAHs 8270/SIM (low-level)	PCBs 8082	Organochlorine Pesticides 8081	Organophosphorus Pesticides 8270/SIM	Chlorinated Acid Herbicides 8151	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664	TOTAL CYANIDE	CHLORIDE	FLUORIDE	SULFATE	% Moisture
1	MW8A-7-23-24-GW	7-23-24	0910	H2O	3																		X	X	X	X	
2	MW12A-7-23-24-GW	↓	1002	↓	↓																						
3	MW3B-7-23-24-GW		1124																								
4	MW10A-7-23-24-GW		1218																								
5	MW10A-7-23-24-GW-DUP		1222																								
6	MW14A-7-23-24-GW		1313																								
7	MW18-7-23-24-GW	↓	1502	↓	↓																	↓	↓	↓	↓	

Signatures

	Signature	Company	Date	Time
Relinquished	[signature]	BMEC	7-24-24	1000
Received	[signature]	OSE	7/24/24	1330
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date			Reviewed/Date	

Comments/Special Instructions

Data Package: Standard ☐ Level III ☐ Level IV ☐

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

Appendix B – UCL and Trends

Appendix B1
Time-Series Graphs: Sulfate, Fluoride,
Chloride, Cyanide

FLUORIDE
Time-Series Graph

CHLORIDE
Time-Series Graph

CYANIDE
Time-Series Graph
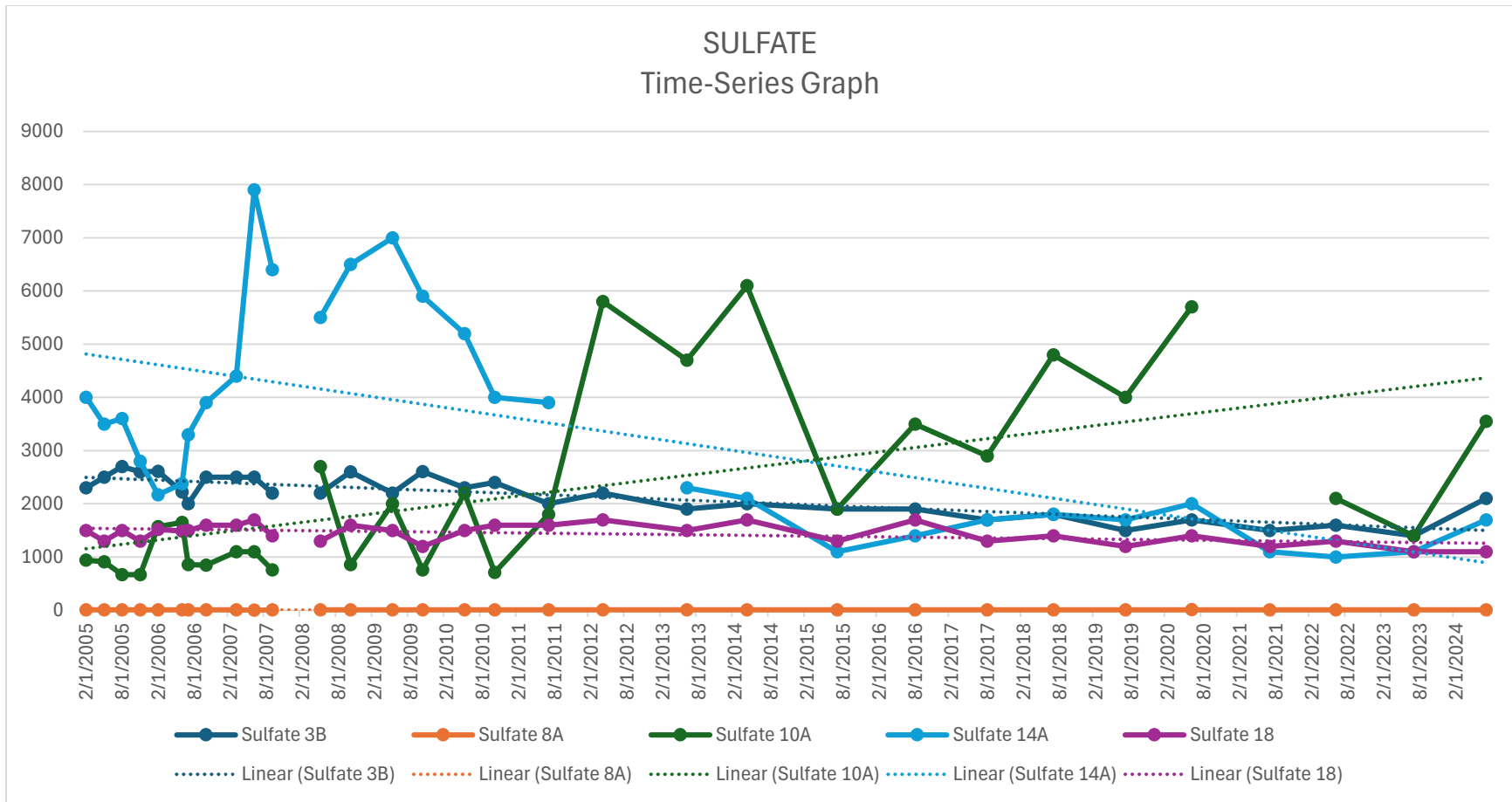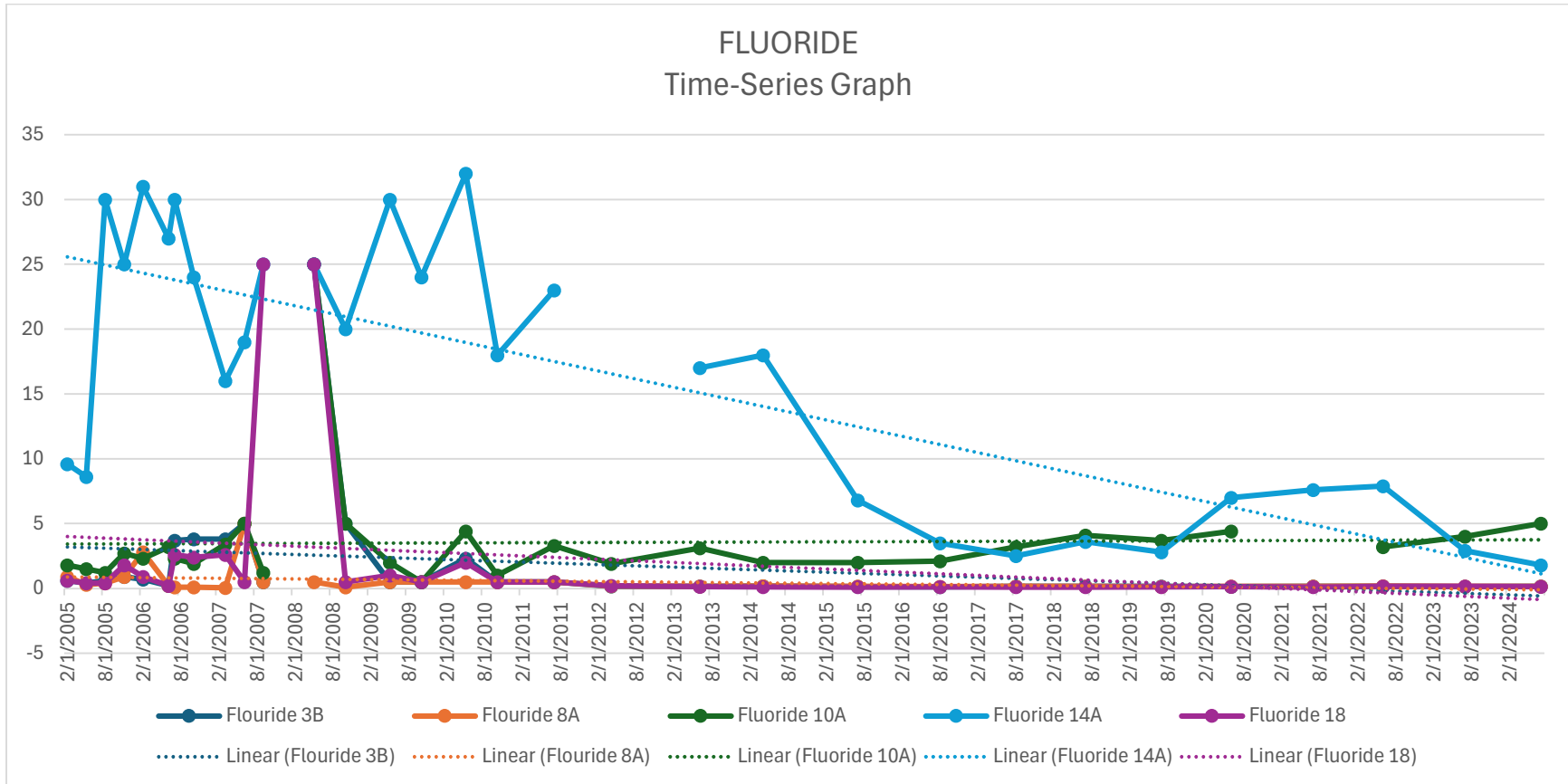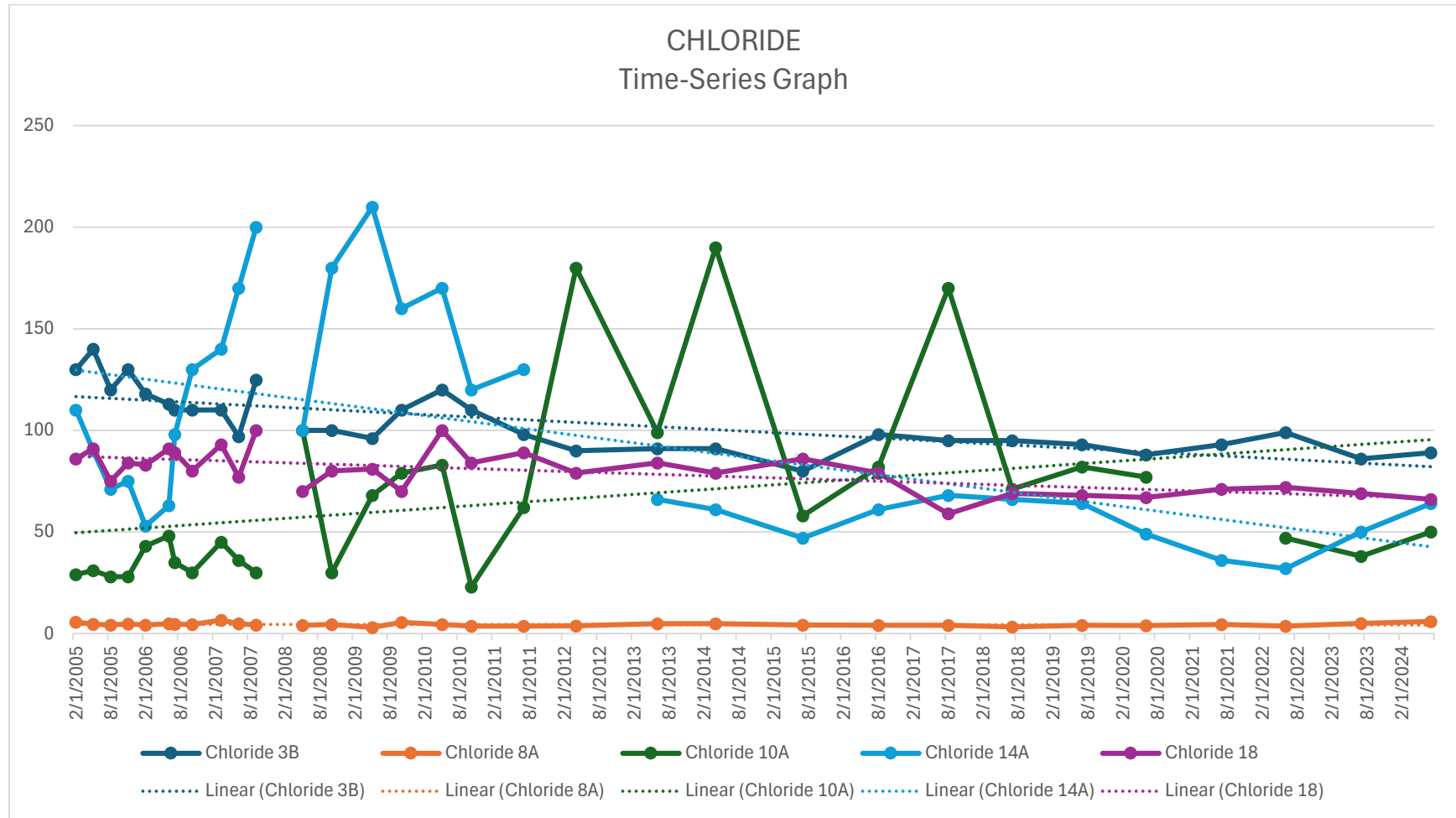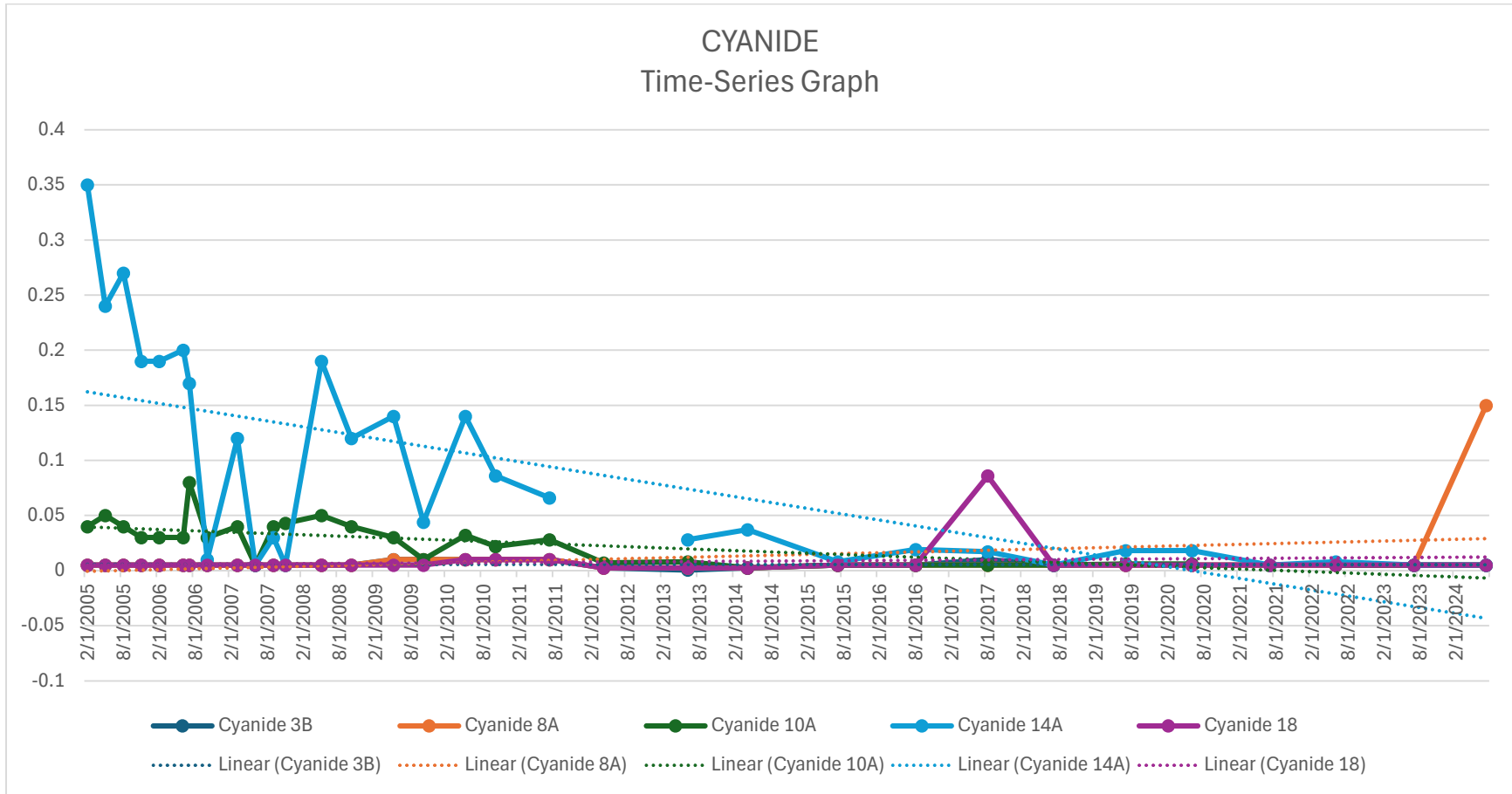
Appendix B2
Mann-Kendall Trend Analysis

SUMMARY MANN-KENDALL TEST FOR TREND RESULTS

Well ID	Analyte	n	s	Variance	Z	Probability	Trend
MW-3B	Sulfate	31	-297	3432	5.05	2.19E-7	Significantly Negative
	Fluoride	31	-220	3432	3.74	9.27E-5	Significantly Negative
	Chloride	31	-300	3437	5.10	1.70E-7	Significantly Negative
	Total Cyanide	31	7	2340	0.124	0.451	Positive
MW-8A	Sulfate	30	-61	3384	1.03	0.151	Negative
	Fluoride	30	-148	3392	2.54	0.0058	Significantly Negative
	Chloride	30	-91	3445	1.53	0.0626	Negative
	Total Cyanide	30	26	2348	0.516	0.303	Positive
MW-10A	Sulfate	30	197	3137	3.50	2.33E-4	Significantly positive
	Fluoride	30	128	3129	2.27	0.0116	Positive
	Chloride	30	156	3136	2.77	0.0028	Positive
	Total Cyanide	30	-263	3361	4.52	3.1E-6	Significantly Negative
MW-12A[1]	Sulfate	2	NA	NA	NA	NA	NA
	Fluoride	2	NA	NA	NA	NA	NA
	Chloride	2	NA	NA	NA	NA	NA
	Total Cyanide	2	NA	NA	NA	NA	NA
MW-14A	Sulfate	30	-185	3132	3.29	5.05E-6	Significantly Negative
	Fluoride	30	-217	3133	3.86	5.68E-5	Significantly Negative
	Chloride	30	-142	3137	2.52	0.0059	Negative
	Total Cyanide	30	-289	3426	4.92	4.31E-7	Significantly Negative
MW-18	Sulfate	31	-98	3370	1.67	0.0474	Negative
	Fluoride	31	-212	3427	3.61	1.56E-4	Significantly Negative
	Chloride	31	-200	3447	3.39	3.50E-4	Significantly Negative
	Total Cyanide	31	8	1962	0.158	0.437	Positive

Notes:

[1] No UCL calculated. Not enough sampling events

n = number of sample events

S = Mann-Kendall test statistic, calculated based on S with sample events greater than 10

Variance = Standard deviation of S squared

Z = approximate normal test statistic, calculated based on S with sample events greater than 10

Probability from Table A.21 [Hollander and Wolfe (1973)]

Trends significant at alpha = 0.05 or less are highlighted

Appendix B3
Mann-Kendall Trend Test Analysis Output

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 8/14/2024 9:16:28 AM
From File	WSI2024_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate MW3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	1400
Maximum	2700
Mean	2133
Geometric Mean	2099
Median	2200
Standard Deviation	375.3
Coefficient of Variation	0.176

Mann-Kendall Test

M-K Test Value (S)	-297
Critical Value (0.05)	-1.645
Standard Deviation of S	58.59
Standardized Value of S	-5.052
Approximate p-value	2.1872E-7

Statistically significant evidence of a decreasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 8/14/2024 2:46:01 PM
From File	WSI2024_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate MW8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.5
Maximum	11
Mean	9.07
Geometric Mean	8.455
Median	9.5
Standard Deviation	1.874
Coefficient of Variation	0.207

Mann-Kendall Test

M-K Test Value (S)	-61
Critical Value (0.05)	-1.645
Standard Deviation of S	58.18
Standardized Value of S	-1.031
Approximate p-value	0.151

Insufficient evidence to identify a significant trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 8/14/2024 3:22:36 PM
From File	WSI2024_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate MW10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	32
Number Values Missing	2
Number Values Used	30
Minimum	670
Maximum	6100
Mean	2285
Geometric Mean	1763
Median	1725
Standard Deviation	1707
Coefficient of Variation	0.747

Mann-Kendall Test

M-K Test Value (S)	197
Critical Value (0.05)	1.645
Standard Deviation of S	56.01
Standardized Value of S	3.499
Approximate p-value	2.3344E-4

Statistically significant evidence of an increasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:44:30 PM
From File	WSI2024_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate MW12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	2
Number Values Reported (n)	32
Number Values Missing	30
Number Values Used	2
Minimum	510
Maximum	1800
Mean	1155
Geometric Mean	958.1
Median	1155
Standard Deviation	912.2
Coefficient of Variation	0.79
Coefficient of Variation	0.79

Not enough reported values (n) to provide Mann-Kendall Statistics

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation   ProUCL 5.2 8/27/2024 3:02:56 PM

From File   WSI2024_1.0.xls

Full Precision   OFF

Confidence Coefficient   0.95

Level of Significance   0.05

Sulfate MW14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	33
Number Values Missing	3
Number Values Used	30
Minimum	1000
Maximum	7900
Mean	3378
Geometric Mean	2840
Median	3050
Standard Deviation	1971
Coefficient of Variation	0.583

Mann-Kendall Test

M-K Test Value (S)	-185
Critical Value (0.05)	-1.645
Standard Deviation of S	55.97
Standardized Value of S	-3.288
Approximate p-value	5.0516E-4

Statistically significant evidence of a decreasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/5/2024 12:16:57 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate MW18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	1100
Maximum	1700
Mean	1439
Geometric Mean	1428
Median	1500
Standard Deviation	178.4
Coefficient of Variation	0.124

Mann-Kendall Test

M-K Test Value (S)	-98
Critical Value (0.05)	-1.645
Standard Deviation of S	58.06
Standardized Value of S	-1.671
Approximate p-value	0.0474

Statistically significant evidence of a decreasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/5/2024 12:38:31 PM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.12
Maximum	25
Mean	1.823
Geometric Mean	0.514
Median	0.5
Standard Deviation	4.559
Coefficient of Variation	2.502

Mann-Kendall Test

M-K Test Value (S)	-220
Critical Value (0.05)	-1.645
Standard Deviation of S	58.59
Standardized Value of S	-3.738
Approximate p-value	9.2780E-5

Statistically significant evidence of a decreasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/5/2024 1:03:16 PM
From File	WorkSheet_b.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.05
Maximum	5
Mean	0.529
Geometric Mean	0.274
Median	0.18
Standard Deviation	0.969
Coefficient of Variation	1.832

Mann-Kendall Test

M-K Test Value (S)	-148
Critical Value (0.05)	-1.645
Standard Deviation of S	58.24
Standardized Value of S	-2.524
Approximate p-value	0.0058

Statistically significant evidence of a decreasing trend at the specified level of significance.

<p style="color:red; text-align:center;">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 7:19:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	32
Number Values Missing	2
Number Values Used	30
Minimum	0.5
Maximum	25
Mean	3.56
Geometric Mean	2.691
Median	2.9
Standard Deviation	4.241
Coefficient of Variation	1.191

Mann-Kendall Test

M-K Test Value (S)	128
Critical Value (0.05)	1.645
Standard Deviation of S	55.94
Standardized Value of S	2.27
Approximate p-value	0.0116

<p style="color:#1f77b4;">Statistically significant evidence of an increasing
trend at the specified level of significance.</p>

<p style="text-align:center;color:red;">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:39:45 PM
From File	WorkSheet_h.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	2
Number Values Reported (n)	32
Number Values Missing	30
Number Values Used	2
Minimum	1.9
Maximum	3.6
Mean	2.75
Geometric Mean	2.615
Median	2.75
Standard Deviation	1.202
Coefficient of Variation	0.437

<p style="color:red;">Not enough reported values (n) to provide Mann-Kendall Statistics!</p>

<p style="text-align:center; color:red">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 7:47:51 PM
From File	WorkSheet_b.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	32
Number Values Missing	2
Number Values Used	30
Minimum	1.8
Maximum	32
Mean	16.62
Geometric Mean	12.34
Median	18
Standard Deviation	10.29
Coefficient of Variation	0.619

Mann-Kendall Test

M-K Test Value (S)	-217
Critical Value (0.05)	-1.645
Standard Deviation of S	55.97
Standardized Value of S	-3.859
Approximate p-value	5.6833E-5

<p style="color:#1F77D0">Statistically significant evidence of a decreasing trend at the specified level of significance.</p>

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 7:56:44 PM
From File	WorkSheet_c.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride MW18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.11
Maximum	25
Mean	2.229
Geometric Mean	0.466
Median	0.4
Standard Deviation	6.128
Coefficient of Variation	2.749

Mann-Kendall Test

M-K Test Value (S)	-212
Critical Value (0.05)	-1.645
Standard Deviation of S	58.54
Standardized Value of S	-3.605
Approximate p-value	1.5637E-4

Statistically significant evidence of a decreasing
trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:07:08 PM
From File	WorkSheet_d.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Chloride MW3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	80
Maximum	140
Mean	104
Geometric Mean	103
Median	99
Standard Deviation	14.84
Coefficient of Variation	0.143

Mann-Kendall Test

M-K Test Value (S)	-300
Critical Value (0.05)	-1.645
Standard Deviation of S	58.63
Standardized Value of S	-5.099
Approximate p-value	1.7037E-7

Statistically significant evidence of a decreasing
trend at the specified level of significance.

<p style="color:red; text-align:center">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:15:57 PM
From File	WorkSheet_e.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Chloride MW8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	3
Maximum	6.6
Mean	4.442
Geometric Mean	4.38
Median	4.4
Standard Deviation	0.764
Coefficient of Variation	0.172

Mann-Kendall Test

M-K Test Value (S)	-91
Critical Value (0.05)	-1.645
Standard Deviation of S	58.69
Standardized Value of S	-1.534
Approximate p-value	0.0626

<p style="color:red">Insufficient evidence to identify a significant
 trend at the specified level of significance.</p>

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:23:29 PM
From File	WorkSheet_f.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Chloride MW10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	32
Number Values Missing	2
Number Values Used	30
Minimum	23
Maximum	190
Mean	65.73
Geometric Mean	54.92
Median	49
Standard Deviation	44.88
Coefficient of Variation	0.683

Mann-Kendall Test

M-K Test Value (S)	156
Critical Value (0.05)	1.645
Standard Deviation of S	56
Standardized Value of S	2.768
Approximate p-value	0.00282

Statistically significant evidence of an increasing
trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation   ProUCL 5.2 9/10/2024 8:32:46 PM

From File   WorkSheet_g.xls

Full Precision   OFF

Confidence Coefficient   0.95

Level of Significance   0.05

Chloride MW12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	2
Number Values Reported (n)	32
Number Values Missing	30
Number Values Used	2
Minimum	37
Maximum	150
Mean	93.5
Geometric Mean	74.5
Median	93.5
Standard Deviation	79.9
Coefficient of Variation	0.855

Not enough reported values (n) to provide Mann-Kendall Statistics!

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 8:50:53 PM
From File	WorkSheet_j.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Chloride MW14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	32
Number Values Missing	2
Number Values Used	30
Minimum	32
Maximum	210
Mean	97.8
Geometric Mean	85.84
Median	73
Standard Deviation	51.33
Coefficient of Variation	0.525

Mann-Kendall Test

M-K Test Value (S)	-142
Critical Value (0.05)	-1.645
Standard Deviation of S	56.01
Standardized Value of S	-2.518
Approximate p-value	0.00591

Statistically significant evidence of a decreasing trend at the specified level of significance.

<p style="text-align:center; color:red;">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 9:15:38 PM
From File	WorkSheet_k.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

<p style="text-align:center;">Chloride MW18</p>

<p style="text-align:center;">General Statistics</p>

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	59
Maximum	100
Mean	79.71
Geometric Mean	79.08
Median	80
Standard Deviation	10.12
Coefficient of Variation	0.127

<p style="text-align:center;">Mann-Kendall Test</p>

M-K Test Value (S)	-200
Critical Value (0.05)	-1.645
Standard Deviation of S	58.71
Standardized Value of S	-3.389
Approximate p-value	3.5034E-4

Statistically significant evidence of a decreasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 9:28:22 PM
From File	WorkSheet_l.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	32
Number Values Reported (n)	32
Minimum	6.0000E-4
Maximum	0.01
Mean	0.00564
Geometric Mean	0.0051
Median	0.005
Standard Deviation	0.00233
Coefficient of Variation	0.413

Mann-Kendall Test

M-K Test Value (S)	7
Critical Value (0.05)	1.645
Standard Deviation of S	48.37
Standardized Value of S	0.124
Approximate p-value	0.451

Insufficient evidence to identify a significant
trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 9:36:53 PM
From File	WorkSheet_m.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	32
Number Values Reported (n)	32
Minimum	0.0025
Maximum	0.15
Mean	0.0101
Geometric Mean	0.00581
Median	0.005
Standard Deviation	0.0256
Coefficient of Variation	2.542

Mann-Kendall Test

M-K Test Value (S)	26
Critical Value (0.05)	1.645
Standard Deviation of S	48.46
Standardized Value of S	0.516
Approximate p-value	0.303

Insufficient evidence to identify a significant
trend at the specified level of significance.

<p style="color:red; text-align:center">Mann-Kendall Trend Test Analysis</p>

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 9:47:02 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.0025
Maximum	0.08
Mean	0.0237
Geometric Mean	0.0155
Median	0.028
Standard Deviation	0.0193
Coefficient of Variation	0.813

Mann-Kendall Test

M-K Test Value (S)	-263
Critical Value (0.05)	-1.645
Standard Deviation of S	57.97
Standardized Value of S	-4.519
Approximate p-value	3.1029E-6

<p style="color:#1a73c7">Statistically significant evidence of a decreasing
trend at the specified level of significance.</p>

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 9:54:13 PM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	2
Number Values Reported (n)	32
Number Values Missing	30
Number Values Used	2
Minimum	0.005
Maximum	0.005
Mean	0.005
Geometric Mean	0.005
Median	0.005
Standard Deviation	0
Coefficient of Variation	N/A

Not enough reported values (n) to provide Mann-Kendall Statistics!

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 10:06:12 PM
From File	WorkSheet_b.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	32
Number Values Missing	1
Number Values Used	31
Minimum	0.005
Maximum	0.35
Mean	0.0884
Geometric Mean	0.0383
Median	0.037
Standard Deviation	0.0957
Coefficient of Variation	1.083

Mann-Kendall Test

M-K Test Value (S)	-289
Critical Value (0.05)	-1.645
Standard Deviation of S	58.53
Standardized Value of S	-4.921
Approximate p-value	4.3135E-7

Statistically significant evidence of a decreasing rend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options

Date/Time of Computation	ProUCL 5.2 9/10/2024 10:14:56 PM
From File	WorkSheet_c.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Arsenic MW18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	32
Number Values Reported (n)	32
Minimum	0.0025
Maximum	0.086
Mean	0.00777
Geometric Mean	0.00546
Median	0.005
Standard Deviation	0.0144
Coefficient of Variation	1.852

Mann-Kendall Test

M-K Test Value (S)	8
Critical Value (0.05)	1.645
Standard Deviation of S	44.29
Standardized Value of S	0.158
Approximate p-value	0.437

Insufficient evidence to identify a significant
trend at the specified level of significance.

Appendix B4

UCL Calculations

SUMMARY OF UCL CALCULATIONS

	Sulfate						Fluoride					
	MW-3B	MW-8A	MW-10A	MW-12A	MW-14A	MW-18	MW-3B	MW-8A	MW-10A	MW-12A	MW-14A	MW-18
Num data pts	31	31	30	2	30	31	31	31	30	2	30	31
Num Non-Detect	0	0	0	0	0	0	8	8	4	0	2	8
Percent Non-Detect	0	0	0	0	0	0	25.8	25.8	13.3	0	6.6	25.8
Min.	1400	0.5	670	510	1000	1100	0.12	0.05	0.5	1.9	1.8	0.11
Max.	2700	11	6100	1800	7900	1700	25	5	25	3.6	32	25
Mean	2133	9.07	2285	1155	3378	1439	1.823	0.529	3.547	2.75	16.62	2.229
Max Conc (>50% ND)				NA						NA		
Log Normal				NA						NA		
Normal	2248			NA	3990	1493				NA	19.81	
Non-parametric		9.641	2924	NA			3.212	0.824	4.862	NA		4.097
Distribution	Normal	Neither	Gamma	NA	Normal	Normal	Neither	Neither	Neither	NA	Normal	Neither

	Chloride						Cyanide					
	MW-3B	MW-8A	MW-10A	MW-12A	MW-14A	MW-18	MW-3B	MW-8A	MW-10A	MW-12A	MW-14A	MW-18
Num data pts	31	31	30	2	30	31	32	32	31	2	31	32
Num Non-Detect	0	0	0	0	0	0	30	32	9	2	4	31
Percent Non-Detect	0	0	0	0	0	0	93.75	100	29	100	12.9	96.87
Min.	80	3	23	37	32	59	0.0006	0.0025	0.0025	0.005	0.005	0.0025
Max.	140	6.6	190	150	210	100	0.01	0.15	0.08	0.005	0.35	0.086
Mean	104	4.442	65.73	93.5	97.8	79.71	0.00564	0.0101	0.0237	0.005	0.0084	0.00777
Max Conc (>50% ND)				NA			0.01	0.15		NA		0.086
Log Normal	108.7			NA	118.9					NA		
Normal		4.674	79.66	NA		82.8				NA		
Non-parametric				NA					0.0296	NA	0.135	
Distribution	Log normal	Normal	Normal	NA	Log normal	Normal	Non-Detect (>50%)	Non-Detect (>50%)	Neither	NA	Gamma	Non-Detect (>50%)

BMEC, Inc.

Appendix B5

EPA Groundwater UCL Output

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 9/11/2024 8:54:18 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Sulfate MW-3B

General Statistics

Total Number of Observations	31
Number of Distinct Observations	17
Number of Missing Observations	1
Minimum	1400
Mean	2133
Maximum	2700
Median	2200
SD	375.3
Std. Error of Mean	67.41
Coefficient of Variation	0.176
Skewness	-0.319

Normal GOF Test

Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.902	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.126	Lilliefors GOF Test
1% Lilliefors Critical Value	0.182	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	2248
95% Adjusted-CLT UCL (Chen-1995)	2240
95% Modified-t UCL (Johnson-1978)	2247

Gamma GOF Test

A-D Test Statistic   0.597   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value 0.745   Detected data appear Gamma Distributed at 5%
Significance Level

K-S Test Statistic   0.14   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value 0.157   Detected data appear Gamma Distributed at 5%
Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)   31.36   k star (bias corrected MLE)   28.35

Theta hat (MLE)   68.03   Theta star (bias corrected MLE)   75.26

nu hat (MLE)   1944   nu star (bias corrected)   1757

MLE Mean (bias corrected) 2133   MLE Sd (bias corrected)   400.7

Approximate Chi Square Value (0.05)   1661

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   1656

Assuming Gamma Distribution

95% Approximate Gamma UCL   2257   95% Adjusted Gamma UCL   2264

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.929   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.94   Data Not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.148   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143 Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.244	Mean of logged Data	7.649
Maximum of Logged Data	7.901	SD of logged Data	0.185

Assuming Lognormal Distribution

95% H-UCL	2265	90% Chebyshev (MVUE) UCL	2349
95% Chebyshev (MVUE) UCL	2446	97.5% Chebyshev (MVUE) UCL	2581
99% Chebyshev (MVUE) UCL	2846		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2244	95% BCA Bootstrap UCL	2241
95% Standard Bootstrap UCL	2242	95% Bootstrap-t UCL	2242
95% Hall's Bootstrap UCL	2238	95% Percentile Bootstrap UCL	2243
90% Chebyshev(Mean, Sd) UCL	2336	95% Chebyshev(Mean, Sd) UCL	2427
97.5% Chebyshev(Mean, Sd) UCL	2554	99% Chebyshev(Mean, Sd) UCL	2804

Suggested UCL to Use

95% Student's-t UCL   2248

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Sulfate MW-8A

General Statistics

Total Number of Observations	31
Number of Distinct Observations	16
Number of Missing Observations	1
Minimum	0.5
Mean	9.07
Maximum	11
Median	9.5
SD	1.874
Std. Error of Mean	0.337
Coefficient of Variation	0.207
Skewness	-3.624

Normal GOF Test

Shapiro Wilk Test Statistic	0.571	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.641	95% Adjusted-CLT UCL (Chen-1995)	9.39
		95% Modified-t UCL (Johnson-1978)	9.605

Gamma GOF Test

A-D Test Statistic	6.87	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.4	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.158	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.283	k star (bias corrected MLE)	6.6
Theta hat (MLE)	1.245	Theta star (bias corrected MLE)	1.374
nu hat (MLE)	451.6	nu star (bias corrected)	409.2
MLE Mean (bias corrected)	9.07	MLE Sd (bias corrected)	3.53
		Approximate Chi Square Value (0.05)	363.3
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	360.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	10.22	95% Adjusted Gamma UCL	10.28

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.333	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.94	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.409	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.143	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data   -0.693   Mean of logged Data   2.135

Maximum of Logged Data   2.398   SD of logged Data   0.54

Assuming Lognormal Distribution

95% H-UCL   11.86   90% Chebyshev (MVUE) UCL   12.7

95% Chebyshev (MVUE) UCL   14.05   97.5% Chebyshev (MVUE) UCL 15.92

99% Chebyshev (MVUE) UCL   19.59

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   9.624   95% BCA Bootstrap UCL   9.459

95% Standard Bootstrap UCL   9.621   95% Bootstrap-t UCL   9.49

95% Hall's Bootstrap UCL   9.455   95% Percentile Bootstrap UCL 9.548

90% Chebyshev(Mean, Sd) UCL   10.08   95% Chebyshev(Mean, Sd) UCL 10.54

97.5% Chebyshev(Mean, Sd) UCL 11.17   99% Chebyshev(Mean, Sd) UCL 12.42

Suggested UCL to Use

95% Student's-t UCL   9.641

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Sulfate MW-10A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	26
Number of Missing Observations	2
Minimum	670
Mean	2285
Maximum	6100
Median	1725
SD	1707
Std. Error of Mean	311.6
Coefficient of Variation	0.747
Skewness	1.039

Normal GOF Test

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2815	95% Adjusted-CLT UCL (Chen-1995)	2861
		95% Modified-t UCL (Johnson-1978)	2825

Gamma GOF Test

A-D Test Statistic	0.919	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.157	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.162	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.077	k star (bias corrected MLE)	1.892
Theta hat (MLE)	1100	Theta star (bias corrected MLE)	1208
nu hat (MLE)	124.6	nu star (bias corrected)	113.5
MLE Mean (bias corrected)	2285	MLE Sd (bias corrected)	1662
		Approximate Chi Square Value (0.05)	89.9
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	88.69

Assuming Gamma Distribution

95% Approximate Gamma UCL	2885	95% Adjusted Gamma UCL	2924

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.507	Mean of logged Data	7.475
Maximum of Logged Data	8.716	SD of logged Data	0.731

Assuming Lognormal Distribution

95% H-UCL	3090	90% Chebyshev (MVUE) UCL	3269
95% Chebyshev (MVUE) UCL	3718	97.5% Chebyshev (MVUE) UCL	4342
99% Chebyshev (MVUE) UCL	5567		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2798	95% BCA Bootstrap UCL	2897
95% Standard Bootstrap UCL	2801	95% Bootstrap-t UCL	2937
95% Hall's Bootstrap UCL	2865	95% Percentile Bootstrap UCL	2824
90% Chebyshev(Mean, Sd) UCL	3220	95% Chebyshev(Mean, Sd) UCL	3644
97.5% Chebyshev(Mean, Sd) UCL	4231	99% Chebyshev(Mean, Sd) UCL	5386

Suggested UCL to Use

95% Adjusted Gamma UCL	2924

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Sulfate MW-12A

General Statistics

Total Number of Observations	2
Number of Distinct Observations	2
Number of Missing Observations	30
Minimum	510
Mean	1155
Maximum	1800
Median	1155

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for MW-12A was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods! If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sulfate MW-14A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	24
Number of Missing Observations	2
Minimum	1000
Mean	3378
Maximum	7900
Median	3050
SD	1971
Std. Error of Mean	359.8
Coefficient of Variation	0.583
Skewness	0.713

Normal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3990	95% Adjusted-CLT UCL (Chen-1995)	4020
		95% Modified-t UCL (Johnson-1978)	3997

Gamma GOF Test

A-D Test Statistic	0.438	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogorov-Smirnov Gamma GOF Test** 5%
K-S Critical Value	0.161	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.037	k star (bias corrected MLE)	2.756
Theta hat (MLE)	1112	Theta star (bias corrected MLE)	1226
nu hat (MLE)	182.2	nu star (bias corrected)	165.3
MLE Mean (bias corrected) 3378		MLE Sd (bias corrected)	2035
		Approximate Chi Square Value (0.05)	136.6
Adjusted Level of Significance 0.041		Adjusted Chi Square Value	135.1

Assuming Gamma Distribution

95% Approximate Gamma UCL 4089   95% Adjusted Gamma UCL   4134

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0998	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.908	Mean of logged Data	7.952
Maximum of Logged Data	8.975	SD of logged Data	0.614

Assuming Lognormal Distribution

95% H-UCL	4334	90% Chebyshev (MVUE) UCL	4624
95% Chebyshev (MVUE) UCL	5176	97.5% Chebyshev (MVUE) UCL	5943
99% Chebyshev (MVUE) UCL	7449		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	3970	95% BCA Bootstrap UCL	4039
95% Standard Bootstrap UCL	3963	95% Bootstrap-t UCL	4045
95% Hall's Bootstrap UCL	4014	95% Percentile Bootstrap UCL	3972
90% Chebyshev(Mean, Sd) UCL	4458	95% Chebyshev(Mean, Sd) UCL	4947
97.5% Chebyshev(Mean, Sd) UCL	5625	99% Chebyshev(Mean, Sd) UCL	6958

Suggested UCL to Use

95% Student's-t UCL	3990

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Sulfate MW-18

General Statistics

Total Number of Observations	31
Number of Distinct Observations	9
Number of Missing Observations	1
Minimum	1100
Mean	1439
Maximum	1700
Median	1500
SD	178.4
Std. Error of Mean	32.05
Coefficient of Variation	0.124
Skewness	-0.259

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1493	95% Adjusted-CLT UCL (Chen-1995)	1490
		95% Modified-t UCL (Johnson-1978)	1493

Gamma GOF Test

A-D Test Statistic	0.753	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	64.99	k star (bias corrected MLE)	58.72
Theta hat (MLE)	22.14	Theta star (bias corrected MLE)	24.5
nu hat (MLE)	4030	nu star (bias corrected)	3641
MLE Mean (bias corrected)	1439	MLE Sd (bias corrected)	187.8
		Approximate Chi Square Value (0.05)	3502
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	3494

Assuming Gamma Distribution

95% Approximate Gamma UCL 1496   95% Adjusted Gamma UCL   1499

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.94	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.143	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.003	Mean of logged Data	7.264
Maximum of Logged Data	7.438	SD of logged Data	0.127

Assuming Lognormal Distribution

95% H-UCL	1498	90% Chebyshev (MVUE) UCL	1538
95% Chebyshev (MVUE) UCL	1583	97.5% Chebyshev (MVUE) UCL	1646
99% Chebyshev (MVUE) UCL	1768		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1492	95% BCA Bootstrap UCL	1485
95% Standard Bootstrap UCL	1491	95% Bootstrap-t UCL	1494
95% Hall's Bootstrap UCL	1491	95% Percentile Bootstrap UCL	1490
90% Chebyshev(Mean, Sd) UCL	1535	95% Chebyshev(Mean, Sd) UCL	1579
97.5% Chebyshev(Mean, Sd) UCL	1639	99% Chebyshev(Mean, Sd) UCL	1758

Suggested UCL to Use

95% Student's-t UCL   1493

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Chloride MW-3B

General Statistics

Total Number of Observations	31
Number of Distinct Observations	20
Number of Missing Observations	1
Minimum	80
Mean	104
Maximum	140
Median	99
SD	14.84
Std. Error of Mean	2.666
Coefficient of Variation	0.142
Skewness	0.688

Normal GOF Test

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2248	95% Adjusted-CLT UCL (Chen-1995)	2240
		95% Modified-t UCL (Johnson-1978)	2247

Gamma GOF Test

A-D Test Statistic	0.661	**Anderson-Darling Gamma GOF Test**

5% A-D Critical Value 0.744   Detected data appear Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.175   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value 0.157   Detected not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	52.95	k star (bias corrected MLE)	47.85
Theta hat (MLE)	1.964	Theta star (bias corrected MLE)	2.184
nu hat (MLE)	3283	nu star (bias corrected)	2967
MLE Mean (bias corrected)	104	MLE Sd (bias corrected)	15.04

Approximate Chi Square Value (0.05)   2841

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   2834

Assuming Gamma Distribution

95% Approximate Gamma UCL   108.6   95% Adjusted Gamma UCL   108.9

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.957   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.94   Data Appear Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.166   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143   Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.382	Mean of logged Data	4.635
Maximum of Logged Data	4.942	SD of logged Data	0.139

Assuming Lognormal Distribution

95% H-UCL	108.7	90% Chebyshev (MVUE) UCL	111.8
95% Chebyshev (MVUE) UCL	115.3	97.5% Chebyshev (MVUE) UCL	120.2
99% Chebyshev (MVUE) UCL	129.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	108.4	95% BCA Bootstrap UCL	108.6
95% Standard Bootstrap UCL	108.4	95% Bootstrap-t UCL	109.1
95% Hall's Bootstrap UCL	108.9	95% Percentile Bootstrap UCL	108.4
90% Chebyshev(Mean, Sd) UCL	112	95% Chebyshev(Mean, Sd) UCL	115.6
97.5% Chebyshev(Mean, Sd) UCL	120.7	99% Chebyshev(Mean, Sd) UCL	130.6

Suggested UCL to Use

95% Student's-t UCL   108.6

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloride MW-8A

General Statistics

Total Number of Observations	31
Number of Distinct Observations	21
Number of Missing Observations	1
Minimum	3
Mean	4.442
Maximum	6.6
Median	4.4
SD	0.764
Std. Error of Mean	0.137
Coefficient of Variation	0.172
Skewness	0.738

Normal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.113	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	4.674	95% Adjusted-CLT UCL (Chen-1995)	4.687
		95% Modified-t UCL (Johnson-1978)	4.678

Gamma GOF Test

A-D Test Statistic	0.289	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0946	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	36.24	k star (bias corrected MLE)	32.75
Theta hat (MLE)	0.123	Theta star (bias corrected MLE)	0.136
nu hat (MLE)	2247	nu star (bias corrected)	2031
MLE Mean (bias corrected)	4.442	MLE Sd (bias corrected)	0.776
	Approximate Chi Square Value (0.05)	1927	
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	1921

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.681	95% Adjusted Gamma UCL	4.694

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.94	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.918	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.143	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data   1.099   Mean of logged Data   1.477

Maximum of Logged Data   1.887   SD of logged Data   0.169

Assuming Lognormal Distribution

95% H-UCL   4.686   90% Chebyshev (MVUE) UCL   4.847

95% Chebyshev (MVUE) UCL   5.03   97.5% Chebyshev (MVUE) UCL 5.285

99% Chebyshev (MVUE) UCL   5.786

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   4.667   95% BCA Bootstrap UCL   4.686

95% Standard Bootstrap UCL   4.661   95% Bootstrap-t UCL   4.709

95% Hall's Bootstrap UCL   4.715   95% Percentile Bootstrap UCL 4.667

90% Chebyshev(Mean, Sd) UCL   4.853   95% Chebyshev(Mean, Sd) UCL 5.04

97.5% Chebyshev(Mean, Sd) UCL 5.298   99% Chebyshev(Mean, Sd) UCL 5.807

Suggested UCL to Use

95% Student's-t UCL   4.674

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloride MW-10A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	26
Number of Missing Observations	2
Minimum	23
Mean	65.73
Maximum	190
Median	49
SD	44.88
Std. Error of Mean	8.193
Coefficient of Variation	0.683
Skewness	1.681

Normal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	79.66	95% Adjusted-CLT UCL (Chen-1995)	81.9
		95% Modified-t UCL (Johnson-1978)	80.07

Gamma GOF Test

A-D Test Statistic	0.925	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value Level	0.753	Data Not Gamma Distributed at 5% Significance
K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.161	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.937	k star (bias corrected MLE)	2.665
Theta hat (MLE)	22.38	Theta star (bias corrected MLE)	24.66
nu hat (MLE)	176.2	nu star (bias corrected)	159.9
MLE Mean (bias corrected)	65.73	MLE Sd (bias corrected)	40.26
		Approximate Chi Square Value (0.05)	131.7
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	130.2

Assuming Gamma Distribution

95% Approximate Gamma UCL	79.83	95% Adjusted Gamma UCL	80.73

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.102	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.135	Mean of logged Data	4.006
Maximum of Logged Data	5.247	SD of logged Data	0.586

Assuming Lognormal Distribution

95% H-UCL	81.3	90% Chebyshev (MVUE) UCL	86.81
95% Chebyshev (MVUE) UCL	96.79	97.5% Chebyshev (MVUE) UCL	110.6
99% Chebyshev (MVUE) UCL	137.8		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	79.21	95% BCA Bootstrap UCL	82.47
95% Standard Bootstrap UCL	78.83	95% Bootstrap-t UCL	83.36
95% Hall's Bootstrap UCL	81.08	95% Percentile Bootstrap UCL	79.77
90% Chebyshev(Mean, Sd) UCL	90.31	95% Chebyshev(Mean, Sd) UCL	101.4
97.5% Chebyshev(Mean, Sd) UCL	116.9	99% Chebyshev(Mean, Sd) UCL	147.3

Suggested UCL to Use

95% Adjusted Gamma UCL   79.66

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloride MW-12A

General Statistics

Total Number of Observations   2

Number of Distinct Observations   2

Number of Missing Observations 30

Minimum   37

Mean   93.5

Maximum   150

Median   93.5

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for MW-12A was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods! If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Chloride MW-14A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	25
Number of Missing Observations	2
Minimum	32
Mean	97.8
Maximum	210
Median	73
SD	51.33
Std. Error of Mean	9.371
Coefficient of Variation	0.525
Skewness	0.785

Normal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	113.7	95% Adjusted-CLT UCL (Chen-1995)	114.7
		95% Modified-t UCL (Johnson-1978)	113.9

Gamma GOF Test

A-D Test Statistic	0.718	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.161	Data not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.993	k star (bias corrected MLE)	3.616
Theta hat (MLE)	24.5	Theta star (bias corrected MLE)	27.05
nu hat (MLE)	239.6	nu star (bias corrected)	216.9
MLE Mean (bias corrected)	97.8	MLE Sd (bias corrected)	51.43
		Approximate Chi Square Value (0.05)	183.8
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	182.1

Assuming Gamma Distribution

95% Approximate Gamma UCL 115.4   95% Adjusted Gamma UCL   116.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.466	Mean of logged Data	4.452
Maximum of Logged Data	5.347	SD of logged Data	0.521

Assuming Lognormal Distribution

95% H-UCL	118.9	90% Chebyshev (MVUE) UCL	127
95% Chebyshev (MVUE) UCL	140.3	97.5% Chebyshev (MVUE) UCL	158.6
99% Chebyshev (MVUE) UCL	194.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	113.2	95% BCA Bootstrap UCL	116.2
95% Standard Bootstrap UCL	112.9	95% Bootstrap-t UCL	115.2
95% Hall's Bootstrap UCL	113.9	95% Percentile Bootstrap UCL	113.9
90% Chebyshev(Mean, Sd) UCL	125.9	95% Chebyshev(Mean, Sd) UCL	138.6
97.5% Chebyshev(Mean, Sd) UCL	156.3	99% Chebyshev(Mean, Sd) UCL	191

Suggested UCL to Use

95% Adjusted Gamma UCL   116.5

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloride MW-18

General Statistics

Total Number of Observations	31
Number of Distinct Observations	20
Number of Missing Observations	1
Minimum	59
Mean	79.71
Maximum	100
Median	80
SD	10.12
Std. Error of Mean	1.818
Coefficient of Variation	0.127
Skewness	0.126

Normal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.0994	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	82.8	95% Adjusted-CLT UCL (Chen-1995)	82.74
		95% Modified-t UCL (Johnson-1978)	82.8

Gamma GOF Test

A-D Test Statistic	0.297	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.101	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	63.66	k star (bias corrected MLE)	57.52
Theta hat (MLE)	1.252	Theta star (bias corrected MLE)	1.386
nu hat (MLE)	3947	nu star (bias corrected)	3566
MLE Mean (bias corrected)	79.71	MLE Sd (bias corrected)	10.51
		Approximate Chi Square Value (0.05)	3428
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	3421

Assuming Gamma Distribution

95% Approximate Gamma UCL	82.91	95% Adjusted Gamma UCL	83.09

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.94	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.143	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	4.371
Maximum of Logged Data	4.605	SD of logged Data	0.128

Assuming Lognormal Distribution

95% H-UCL   82.99   90% Chebyshev (MVUE) UCL   85.23

95% Chebyshev (MVUE) UCL   87.73   97.5% Chebyshev (MVUE) UCL 91.2

99% Chebyshev (MVUE) UCL   98.01

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   82.7   95% BCA Bootstrap UCL   82.71

95% Standard Bootstrap UCL   82.66   95% Bootstrap-t UCL   82.78

95% Hall's Bootstrap UCL   82.73   95% Percentile Bootstrap UCL 82.71

90% Chebyshev(Mean, Sd) UCL   85.16   95% Chebyshev(Mean, Sd) UCL 87.63

97.5% Chebyshev(Mean, Sd) UCL 91.06   99% Chebyshev(Mean, Sd) UCL 97.8

Suggested UCL to Use

95% Student's-t UCL   82.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride MW-3B

General Statistics

Total Number of Observations	31
Number of Distinct Observations	18
Number of Missing Observations	1
Minimum	0.12
Mean	1.823
Maximum	25
Median	0.5
SD	4.559
Std. Error of Mean	0.819
Coefficient of Variation	2.502
Skewness	4.681

Normal GOF Test

Shapiro Wilk Test Statistic	0.398	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.212	95% Adjusted-CLT UCL (Chen-1995)	3.905
		95% Modified-t UCL (Johnson-1978)	3.327

Gamma GOF Test

A-D Test Statistic   3.113   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value 0.81   Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.278   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value 0.167   Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)   0.501   k star (bias corrected MLE)   0.474

Theta hat (MLE)   3.635   Theta star (bias corrected MLE)   3.842

nu hat (MLE)   31.09   nu star (bias corrected)   29.41

MLE Mean (bias corrected) 1.823   MLE Sd (bias corrected)   2.646

Approximate Chi Square Value (0.05)   18.03

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   17.54

Assuming Gamma Distribution

95% Approximate Gamma UCL   2.973   95% Adjusted Gamma UCL   3.057

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.846   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.94   Data Appear Lognormal at 10% Significance
Level

Lilliefors Test Statistic   0.199   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143   Data Not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.12	Mean of logged Data	-0.666
Maximum of Logged Data	3.219	SD of logged Data	1.418

Assuming Lognormal Distribution

95% H-UCL	3.021	90% Chebyshev (MVUE) UCL	2.584
95% Chebyshev (MVUE) UCL	3.154	97.5% Chebyshev (MVUE) UCL	3.947
99% Chebyshev (MVUE) UCL	5.504		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	3.17	95% BCA Bootstrap UCL	4.334
95% Standard Bootstrap UCL	3.161	95% Bootstrap-t UCL	5.607
95% Hall's Bootstrap UCL	7.637	95% Percentile Bootstrap UCL	3.381
90% Chebyshev(Mean, Sd) UCL	4.279	95% Chebyshev(Mean, Sd) UCL	5.392
97.5% Chebyshev(Mean, Sd) UCL	6.937	99% Chebyshev(Mean, Sd) UCL	9.971

Suggested UCL to Use

95% Student's-t UCL	3.212

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride MW-8A

General Statistics

Total Number of Observations	31
Number of Distinct Observations	15
Number of Missing Observations	1
Minimum	0.05
Mean	0.529
Maximum	5
Median	0.18
SD	0.969
Std. Error of Mean	0.174
Coefficient of Variation	1.832
Skewness	3.918

Normal GOF Test

Shapiro Wilk Test Statistic	0.456	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.824	95% Adjusted-CLT UCL (Chen-1995)	0.946
		95% Modified-t UCL (Johnson-1978)	0.845

Gamma GOF Test

A-D Test Statistic   2.728   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.781   Data not Gamma Distributed at 5%
                                           Significance Level

K-S Test Statistic   0.251   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.157   Data not Gamma Distributed at 5%
                                           Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)   0.89   k star (bias corrected MLE)   0.825

Theta hat (MLE)   0.595   Theta star (bias corrected MLE)   0.641

nu hat (MLE)   55.16   nu star (bias corrected)   51.16

MLE Mean (bias corrected) 0.529   MLE Sd (bias corrected)   0.582

                    Approximate Chi Square Value (0.05)   35.73

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   35.01

Assuming Gamma Distribution

95% Approximate Gamma UCL   0.757   95% Adjusted Gamma UCL   0.773

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.89   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value 0.94   Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.205   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143   Data not Lognormal at 10% Significance
                                                  Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data   -2.996   Mean of logged Data   -1.295

Maximum of Logged Data   1.609   SD of logged Data   0.993

Assuming Lognormal Distribution

95% H-UCL   0.695   90% Chebyshev (MVUE) UCL   0.708

95% Chebyshev (MVUE) UCL   0.83   97.5% Chebyshev (MVUE) UCL 0.999

99% Chebyshev (MVUE) UCL   1.332

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   0.815   95% BCA Bootstrap UCL   0.979

95% Standard Bootstrap UCL   0.814   95% Bootstrap-t UCL   1.654

95% Hall's Bootstrap UCL   2.131   95% Percentile Bootstrap UCL 0.847

90% Chebyshev(Mean, Sd) UCL   1.051   95% Chebyshev(Mean, Sd) UCL 1.288

97.5% Chebyshev(Mean, Sd) UCL 1.616   99% Chebyshev(Mean, Sd) UCL 2.261

Suggested UCL to Use

95% Student's-t UCL   0.824

The calculated UCLs are based on assumptions that the data were collected in a
random and unbiased manner. Please verify the data were collected from random
locations. If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user
to select the most appropriate 95% UCL. Recommendations are based upon data size,
data distribution, and skewness using results from simulation studies. However,
simulations results will not cover all Real World data sets; for additional insight the user
may want to consult a statistician.

Fluoride MW-10A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	20
Number of Missing Observations	2
Minimum	0.5
Mean	3.547
Maximum	25
Median	2.9
SD	4.242
Std. Error of Mean	0.774
Coefficient of Variation	1.196
Skewness	4.731

Normal GOF Test

Shapiro Wilk Test Statistic	0.454	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.862	95% Adjusted-CLT UCL (Chen-1995)	5.535
		95% Modified-t UCL (Johnson-1978)	4.974

Gamma GOF Test

A-D Test Statistic	1.43	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.759	Data not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.162	Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.936	k star (bias corrected MLE)	1.765
Theta hat (MLE)	1.832	Theta star (bias corrected MLE)	2.009
nu hat (MLE)	116.2	nu star (bias corrected)	105.9
MLE Mean (bias corrected)	3.547	MLE Sd (bias corrected)	2.67

Approximate Chi Square Value (0.05)   83.15

Adjusted Level of Significance	0.041	Adjusted Chi Square Value	81.99

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.517	95% Adjusted Gamma UCL	4.581

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.693	Mean of logged Data	0.986
Maximum of Logged Data	3.219	SD of logged Data	0.682

Assuming Lognormal Distribution

95% H-UCL	4.422	90% Chebyshev (MVUE) UCL	4.7
95% Chebyshev (MVUE) UCL	5.311	97.5% Chebyshev (MVUE) UCL	6.159
99% Chebyshev (MVUE) UCL	7.824		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4.82	95% BCA Bootstrap UCL	5.91
95% Standard Bootstrap UCL	4.826	95% Bootstrap-t UCL	6.96
95% Hall's Bootstrap UCL	9.889	95% Percentile Bootstrap UCL	5.043
90% Chebyshev(Mean, Sd) UCL	5.87	95% Chebyshev(Mean, Sd) UCL	6.922
97.5% Chebyshev(Mean, Sd) UCL	8.383	99% Chebyshev(Mean, Sd) UCL	11.25

Suggested UCL to Use

95% Student's-t UCL   4.862

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride MW-12A

General Statistics

Total Number of Observations   2

Number of Distinct Observations   2

Number of Missing Observations   30

Minimum   1.9

Mean   2.75

Maximum   3.6

Median   2.75

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for MW-12A was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods! If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Fluoride MW-14A

General Statistics

Total Number of Observations	30
Number of Distinct Observations	24
Number of Missing Observations	2
Minimum	1.8
Mean	16.62
Maximum	32
Median	18
SD	10.29
Std. Error of Mean	1.878
Coefficient of Variation	0.619
Skewness	-0.0696

Normal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Data appear Normal at 1% Significance Level

Data appear approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	19.81	95% Adjusted-CLT UCL (Chen-1995)	19.68
		95% Modified-t UCL (Johnson-1978)	19.81

Gamma GOF Test

A-D Test Statistic   1.294   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.76   Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.179   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.162   Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.827	k star (bias corrected MLE)	1.666
Theta hat (MLE)	9.098	Theta star (bias corrected MLE)	9.974
nu hat (MLE)	109.6	nu star (bias corrected)	99.98
MLE Mean (bias corrected)	16.62	MLE Sd (bias corrected)	12.88

Approximate Chi Square Value (0.05)   77.91

Adjusted Level of Significance 0.041   Adjusted Chi Square Value   76.79

Assuming Gamma Distribution

95% Approximate Gamma UCL 21.33   95% Adjusted Gamma UCL   21.64

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.858   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.939 Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.214   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.146 Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	2.513
Maximum of Logged Data	3.466	SD of logged Data	0.897

Assuming Lognormal Distribution

95% H-UCL	27.3	90% Chebyshev (MVUE) UCL	28.13
95% Chebyshev (MVUE) UCL	32.67	97.5% Chebyshev (MVUE) UCL	38.96
99% Chebyshev (MVUE) UCL	51.33		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	19.71	95% BCA Bootstrap UCL	19.65
95% Standard Bootstrap UCL	19.69	95% Bootstrap-t UCL	19.76
95% Hall's Bootstrap UCL	19.63	95% Percentile Bootstrap UCL	19.62
90% Chebyshev(Mean, Sd) UCL	22.26	95% Chebyshev(Mean, Sd) UCL	24.81
97.5% Chebyshev(Mean, Sd) UCL	28.35	99% Chebyshev(Mean, Sd) UCL	35.31

Suggested UCL to Use

95% Student's-t UCL   19.81

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Fluoride MW-18

General Statistics

Total Number of Observations	31
Number of Distinct Observations	16
Number of Missing Observations	1
Minimum	0.11
Mean	2.229
Maximum	25
Median	0.4
SD	6.128
Std. Error of Mean	1.101
Coefficient of Variation	2.749
Skewness	3.63

Normal GOF Test

Shapiro Wilk Test Statistic	0.362	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	4.097	95% Adjusted-CLT UCL (Chen-1995)	4.806
		95% Modified-t UCL (Johnson-1978)	4.217

Gamma GOF Test

A-D Test Statistic   3.748   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.828 Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.271   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.169 Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)   0.418   k star (bias corrected MLE)   0.399

Theta hat (MLE)   5.337   Theta star (bias corrected MLE)   5.59

nu hat (MLE)   25.89   nu star (bias corrected)   24.72

MLE Mean (bias corrected) 2.229   MLE Sd (bias corrected)   3.53

                                          Approximate Chi Square Value (0.05) 14.4

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   13.96

Assuming Gamma Distribution

95% Approximate Gamma UCL 3.827   95% Adjusted Gamma UCL   3.947

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.842   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.94 Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.169   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143 Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data   -2.207   Mean of logged Data   -0.763

Maximum of Logged Data   3.219   SD of logged Data   1.505

Assuming Lognormal Distribution

95% H-UCL	3.379	90% Chebyshev (MVUE) UCL	2.734
95% Chebyshev (MVUE) UCL	3.362	97.5% Chebyshev (MVUE) UCL	4.234
99% Chebyshev (MVUE) UCL	5.946		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4.039	95% BCA Bootstrap UCL	5.401
95% Standard Bootstrap UCL	4.072	95% Bootstrap-t UCL	15.87
95% Hall's Bootstrap UCL	13.63	95% Percentile Bootstrap UCL	4.285
90% Chebyshev(Mean, Sd) UCL	5.531	95% Chebyshev(Mean, Sd) UCL	7.026
97.5% Chebyshev(Mean, Sd) UCL	9.102	99% Chebyshev(Mean, Sd) UCL	13.18

Suggested UCL to Use

95% Student's-t UCL   4.097

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide MW-3B

General Statistics

Total Number of Observations	32
Number of Distinct Observations	4
Number of Missing Observations	0
Minimum	0.0006
Mean	0.00564
Maximum	0.01
Median	0.005
SD	0.00233
Std. Error of Mean	0.0004122
Coefficient of Variation	0.413
Skewness	0.812

Normal GOF Test

Shapiro Wilk Test Statistic	0.691	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.421	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00634	95% Adjusted-CLT UCL (Chen-1995)	0.00639
		95% Modified-t UCL (Johnson-1978)	0.00635

Gamma GOF Test

A-D Test Statistic 4.741 **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value 0.748 Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic 0.36 **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value 0.156 Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 5.125 k star (bias corrected MLE) 4.665

Theta hat (MLE) 0.0011 Theta star (bias corrected MLE) 0.00121

nu hat (MLE) 328 nu star (bias corrected) 298.6

MLE Mean (bias corrected) 0.00564 MLE Sd (bias corrected) 0.00261

Approximate Chi Square Value (0.05) 259.5

Adjusted Level of Significance 0.0416 Adjusted Chi Square Value 257.6

Assuming Gamma Distribution

95% Approximate Gamma UCL 0.00649 95% Adjusted Gamma UCL 0.00654

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.643 **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value 0.941 Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic 0.391 **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value 0.142 Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -7.419 Mean of logged Data -5.278

Maximum of Logged Data -4.605 SD of logged Data 0.518

Assuming Lognormal Distribution

95% H-UCL   0.007   90% Chebyshev (MVUE) UCL   0.00748

95% Chebyshev (MVUE) UCL   0.00824   97.5% Chebyshev (MVUE) UCL 0.00929

99% Chebyshev (MVUE) UCL   0.0114

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   0.00632   95% BCA Bootstrap UCL   N/A

95% Standard Bootstrap UCL N/A   95% Bootstrap-t UCL   N/A

95% Hall's Bootstrap UCL   N/A   95% Percentile Bootstrap UCL   N/A

90% Chebyshev(Mean, Sd) UCL 0.00688 95% Chebyshev(Mean, Sd) UCL   0.00744

97.5% Chebyshev(Mean, Sd) UCL 0.00822   99% Chebyshev(Mean, Sd) UCL 0.00975

Suggested UCL to Use

95% Student's-t UCL   0.00634

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide MW-8A

General Statistics

Total Number of Observations	32
Number of Distinct Observations	4
Number of Missing Observations	0
Minimum	0.0025
Mean	0.0101
Maximum	0.15
Median	0.005
SD	0.0256
Std. Error of Mean	0.00453
Coefficient of Variation	2.542
Skewness	5.598

Normal GOF Test

Shapiro Wilk Test Statistic	0.232	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.904	Data not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.47	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.18	Data not Normal at 1% Significance Level	

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0178	95% Adjusted-CLT UCL (Chen-1995)	0.0223
		95% Modified-t UCL (Johnson-1978)	0.0185

Gamma GOF Test

A-D Test Statistic   7.658   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.775 Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.429   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.16   Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.042	k star (bias corrected MLE)	0.965
Theta hat (MLE)	0.00967	Theta star (bias corrected MLE)	0.0104
nu hat (MLE)	66.69	nu star (bias corrected)	61.77
MLE Mean (bias corrected)	0.0101	MLE Sd (bias corrected)	0.0103

Approximate Chi Square Value (0.05)   44.69

Adjusted Level of Significance 0.0416   Adjusted Chi Square Value   0.0142

Assuming Gamma Distribution

95% Approximate Gamma UCL   0.0139   95% Adjusted Gamma UCL   0.0142

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.553   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value 0.941   Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.399   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.142   Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-5.149
Maximum of Logged Data	-1.897	SD of logged Data	0.689

Assuming Lognormal Distribution

95% H-UCL	0.00954	90% Chebyshev (MVUE) UCL	0.0102
95% Chebyshev (MVUE) UCL	0.0115	97.5% Chebyshev (MVUE) UCL	0.0133
99% Chebyshev (MVUE) UCL	0.0168		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0175	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	0.0237	95% Chebyshev(Mean, Sd) UCL	0.0298
97.5% Chebyshev(Mean, Sd) UCL	0.0384	99% Chebyshev(Mean, Sd) UCL	0.0551

Suggested UCL to Use

95% Student's-t UCL   0.0178

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide MW-10A

General Statistics

Total Number of Observations	31
Number of Distinct Observations	14
Number of Missing Observations	1
Minimum	0.0025
Mean	0.0237
Maximum	0.08
Median	0.028
SD	0.0193
Std. Error of Mean	0.00346
Coefficient of Variation	0.0813
Skewness	0.807

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0296	95% Adjusted-CLT UCL (Chen-1995)	0.0299
		95% Modified-t UCL (Johnson-1978)	0.0296

Gamma GOF Test

A-D Test Statistic	1.939	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.768	Data not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.203	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.161	Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.324	k star (bias corrected MLE)	1.217
Theta hat (MLE)	0.0179	Theta star (bias corrected MLE)	0.0195
nu hat (MLE)	82.09	nu star (bias corrected)	75.48
MLE Mean (bias corrected)	0.0237	MLE Sd (bias corrected)	0.0215
		Approximate Chi Square Value (0.05)	56.47
Adjusted Level of Significance	0.0413	Adjusted Chi Square Value	55.56

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.0317	95% Adjusted Gamma UCL	0.0322

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.94	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.143	Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-4.166
Maximum of Logged Data	-2.526	SD of logged Data	1.013

Assuming Lognormal Distribution

95% H-UCL	0.0407	90% Chebyshev (MVUE) UCL	0.0413
95% Chebyshev (MVUE) UCL	0.0485	97.5% Chebyshev (MVUE) UCL	0.0585
99% Chebyshev (MVUE) UCL	0.0782		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0294	95% BCA Bootstrap UCL	0.0297
95% Standard Bootstrap UCL	0.0293	95% Bootstrap-t UCL	0.0298
95% Hall's Bootstrap UCL	0.0298	95% Percentile Bootstrap UCL	0.0294
90% Chebyshev(Mean, Sd) UCL	0.0341	95% Chebyshev(Mean, Sd) UCL	0.0388
97.5% Chebyshev(Mean, Sd) UCL	0.0453	99% Chebyshev(Mean, Sd) UCL	0.0581

Suggested UCL to Use

95% Student's-t UCL   0.0296

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide MW-12A

General Statistics

Total Number of Observations   2

Number of Distinct Observations   1

Number of Missing Observations 30

Minimum   0.005

Mean   0.005

Maximum   0.005

Median   0.005

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for MW-12A was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods! If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Cyanide MW-14A

General Statistics

Total Number of Observations	31
Number of Distinct Observations	20
Number of Missing Observations	1
Minimum	0.005
Mean	0.0084
Maximum	0.35
Median	0.037
SD	0.0957
Std. Error of Mean	0.0172
Coefficient of Variation	1.083
Skewness	1.049

Normal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.902	Data not Normal at 1% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.182	Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	0.118	95% Adjusted-CLT UCL (Chen-1995)	0.12
		95% Modified-t UCL (Johnson-1978)	0.118

Gamma GOF Test

A-D Test Statistic   1.068   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.79   Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.151   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.164   Detected Data appear Gamma Distributed at 5% Significance Level

Detected Data follow Approximate Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)   0.72   k star (bias corrected MLE)   0.672

Theta hat (MLE)   0.123   Theta star (bias corrected MLE)   0.131

nu hat (MLE)   44.66   nu star (bias corrected)   41.68

MLE Mean (bias corrected) 0.0884   MLE Sd (bias corrected)   0.108

Approximate Chi Square Value (0.05)   27.88

Adjusted Level of Significance 0.0413   Adjusted Chi Square Value   27.25

Assuming Gamma Distribution

95% Approximate Gamma UCL 0.132   95% Adjusted Gamma UCL   0.135

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.888   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.94   Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.167   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.143 Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data   -5.298   Mean of logged Data   -3.262

Maximum of Logged Data   -1.05   SD of logged Data   1.48

Assuming Lognormal Distribution

95% H-UCL	0.261	90% Chebyshev (MVUE) UCL	0.215
95% Chebyshev (MVUE) UCL	0.264	97.5% Chebyshev (MVUE) UCL	0.331
99% Chebyshev (MVUE) UCL	0.464		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.117	95% BCA Bootstrap UCL	0.119
95% Standard Bootstrap UCL	0.116	95% Bootstrap-t UCL	0.123
95% Hall's Bootstrap UCL	0.121	95% Percentile Bootstrap UCL	0.116
90% Chebyshev(Mean, Sd) UCL	0.14	95% Chebyshev(Mean, Sd) UCL	0.163
97.5% Chebyshev(Mean, Sd) UCL	0.196	99% Chebyshev(Mean, Sd) UCL	0.259

Suggested UCL to Use

95% Adjusted Gamma UCL   0.135

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide MW-18

General Statistics

Total Number of Observations   32

Number of Distinct Observations   4

Number of Missing Observations   0

Minimum   0.0025

Mean   0.00777

Maximum   0.086

Median   0.005

SD   0.0144

Std. Error of Mean   0.00254

Coefficient of Variation   1.852

Skewness   5.531

Normal GOF Test

Shapiro Wilk Test Statistic   0.25   **Shapiro Wilk GOF Test**

1% Shapiro Wilk Critical Value   0.904 Data not Normal at 1% Significance Level

Lilliefors Test Statistic   0.451   **Lilliefors GOF Test**

1% Lilliefors Critical Value   0.18   Data not Normal at 1% Significance Level

Data not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL   **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL   0.0121   95% Adjusted-CLT UCL (Chen-1995)   0.0146

                                       95% Modified-t UCL (Johnson-1978)   0.0125

Gamma GOF Test

A-D Test Statistic   7.758   **Anderson-Darling Gamma GOF Test**

5% A-D Critical Value   0.764 Data not Gamma Distributed at 5% Significance Level

K-S Test Statistic   0.469   **Kolmogorov-Smirnov Gamma GOF Test**

5% K-S Critical Value   0.158 Data not Gamma Distributed at 5% Significance Level

Data not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.569	k star (bias corrected MLE)	1.443
Theta hat (MLE)	0.00495	Theta star (bias corrected MLE)	0.00538
nu hat (MLE)	100.4	nu star (bias corrected)	92.33
MLE Mean (bias corrected) 0.00777		MLE Sd (bias corrected)	0.00647
		Approximate Chi Square Value (0.05)	71.17
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	70.18

Assuming Gamma Distribution

95% Approximate Gamma UCL 0.0101   95% Adjusted Gamma UCL   0.0102

Lognormal GOF Test

Shapiro Wilk Test Statistic   0.525   **Shapiro Wilk Lognormal GOF Test**

10% Shapiro Wilk Critical Value   0.941 Data not Lognormal at 10% Significance Level

Lilliefors Test Statistic   0.435   **Lilliefors Lognormal GOF Test**

10% Lilliefors Critical Value   0.142 Data not Lognormal at 10% Significance Level

Data not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-5.991	Mean of logged Data	-5.209
Maximum of Logged Data	-2.453	SD of logged Data	0.588

Assuming Lognormal Distribution

95% H-UCL   0.00803   90% Chebyshev (MVUE) UCL   0.00859

95% Chebyshev (MVUE) UCL   0.00956   97.5% Chebyshev (MVUE) UCL   0.0109

99% Chebyshev (MVUE) UCL   0.0135

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL   0.0119   95% BCA Bootstrap UCL   N/A

95% Standard Bootstrap UCL   N/A   95% Bootstrap-t UCL   N/A

95% Hall's Bootstrap UCL   N/A   95% Percentile Bootstrap UCL   N/A

90% Chebyshev(Mean, Sd) UCL   0.0154   95% Chebyshev(Mean, Sd) UCL 0.0188

97.5% Chebyshev(Mean, Sd) UCL 0.0236   99% Chebyshev(Mean, Sd) UCL   0.0331

Suggested UCL to Use

95% Student's-t UCL   0.0121

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner. Please verify the data were collected from random locations. If the data were collected using judgmental or other non-random methods, then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix B6

Calculator Input Table

2024 Annual Groundwater Monitoring Report
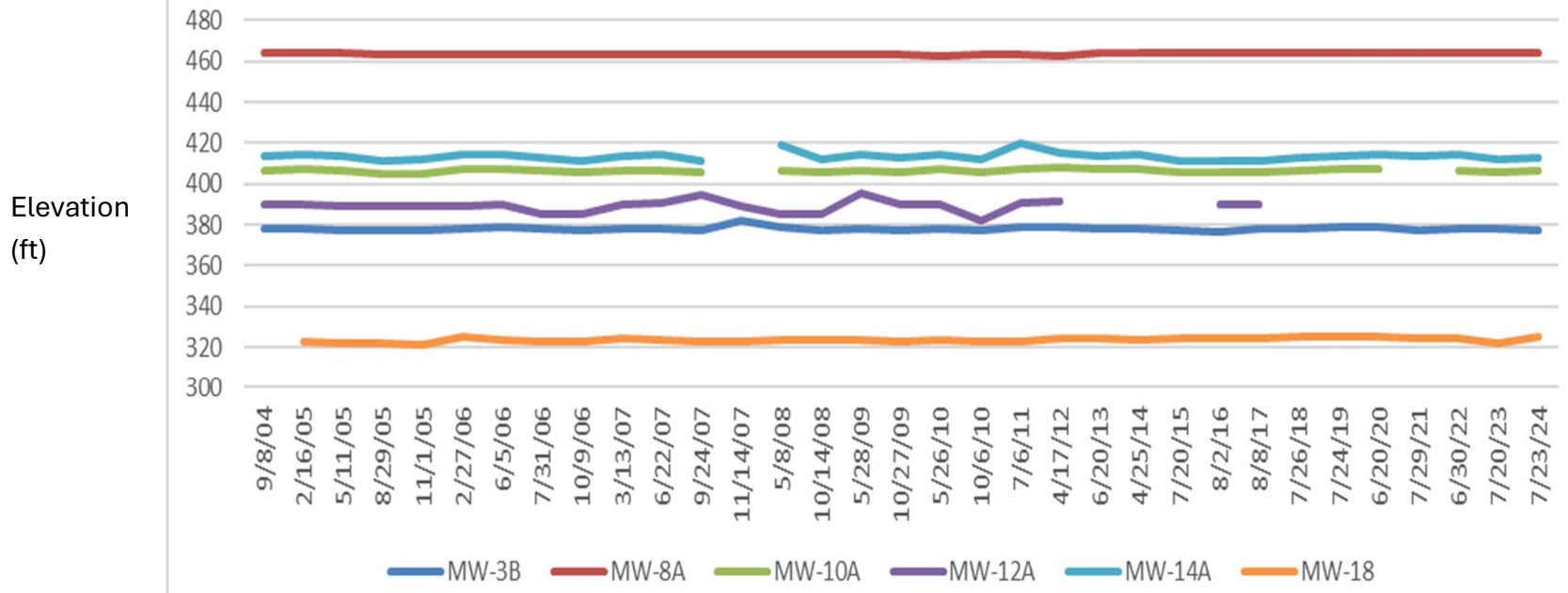## West Surface Impoundment   Former Columbia Gorge Aluminum Smelter

Date	Sulfate 3B	D-3B	Sulfate 8A	D-8A	Sulfate 10A	D-10A	Sulfate 12A	D-12A	Sulfate 14A	D-14A	Sulfate 18	D-18	Flouride 3B	D-3B	Flouride 8A	D-8A	Fluride 10A	D-10A	Fluoride 12A	D-12A	Fluoride 14A	D-14A	Fluoride 18	D-18	Chloride 3B	D-3B	Chloride 8A	D-8A	Chloride 10A	D-10A	Chloride 12A	D-12A	Chloride 14A	D-14A	Chloride 18	D-18	Cyanide 3B	D-3B	Cyanide 8A	D-8A	Cyanide 10A	D-10A	Cyanide 12A	D-12A	Cyanide 14A	D-14A	Cyanide 18	D-18
2/16/2005	2300	1	10	1	940	1			4000	1	1500	1	0.6	1	0.9	1	1.8	1			9.6	1	0.6	1	130	1	5.6	1	29	1			110	1	86	1	0.005	0	0.005	0	0.04	1			0.35	1	0.005	0
5/11/2005	2500	1	9.8	1	910	1			3500	1	1300	1	0.4	1	0.3	1	1.5	1			8.6	1	0.4	1	140	1	4.6	1	31	1			90	1	91	1	0.005	0	0.005	0	0.05	1			0.24	1	0.005	0
8/29/2005	2700	1	8.9	1	670	1			3600	1	1500	1	0.6	1	0.4	1	1.2	1			30	1	0.4	1	120	1	4.2	1	28	1			71	1	75	1	0.005	0	0.005	0	0.04	1			0.27	1	0.005	0
11/1/2005	2600	1	9.6	1	670	1			2800	1	1300	1	0.9	1	0.9	1	2.7	1			25	1	1.8	1	130	1	4.7	1	28	1			75	1	84	1	0.005	0	0.005	0	0.03	1			0.19	1	0.005	0
2/27/2006	2610	1	9.27	1	1570	1			2170	1	1520	1	0.7	1	2.8	1	2.3	1			31	1	0.9	1	118	1	4.2	1	43	1			53	1	83	1	0.005	0	0.005	0	0.03	1			0.19	1	0.005	0
6/5/2006	2220	1	9.8	1	1650	1			2380	1	1490	1	0.2	1	0.2	1	3.2	1			27	1	0.2	0	113	1	4.9	1	48	1			63	1	91	1	0.005	0	0.005	0	0.03	1			0.2	1	0.005	0
7/31/2006	2000	1	9.8	1	860	1			3300	1	1500	1	3.7	1	0.1	1	2.3	1			30	1	2.6	1	110	1	4.6	1	35	1			98	1	89	1	0.005	0	0.005	0	0.08	1			0.17	1	0.005	0
10/9/2006	2500	1	9.7	1	850	1			3900	1	1600	1	3.8	1	0.1	1	1.9	1			24	1	2.4	1	110	1	4.5	1	30	1			130	1	80	1	0.005	0	0.005	0	0.03	1			0.01	1	0.005	0
3/13/2007	2500	1	10	1	1100	1	1800	1	4400	1	1600	1	3.8	1	0.05	1	3.4	1	6.3	1	16	1	2.6	1	110	1	6.6	1	45	1	150	1	140	1	93	1	0.005	0	0.005	0	0.04	1	0.005	0	0.12	1	0.005	0
6/22/2007	2500	1	0.5	0	1100	1			7900	1	1700	1	5	0	5	0	5	0			19	1	0.5	0	97	1	4.89	1	36	1			170	1	77	1	0.005	0	0.005	0	0.005	1			0.005	0	0.005	0
9/24/2007	2200	1	10	1	760	1			6400	1	1400	1	0.5	0	0.5	0	1.2	1			25	0	25	0	124.79	1	4.2	1	30	1			200	1	100	1	0.005	0	0.005	0	0.04	1			0.03	1	0.005	0
11/14/2007																																					0.005	0	0.005	0	0.043	1			0.005	1	0.005	0
5/8/2008	2200	1	10	1	2700	1			5500	1	1300	1	25	0	0.5	0	25	0			25	0	25	0	100	1	4	1	100	1			100	1	70	1	0.005	0	0.005	0	0.05	1			0.19	1	0.005	0
10/14/2008	2600	1	10	1	860	1			6500	1	1600	1	5	0	0.1	1	5	0			20	1	0.5	0	100	1	4.5	1	30	1			180	1	80	1	0.005	0	0.005	0	0.04	1			0.12	1	0.005	0
5/29/2009	2200	1	9	1	2000	1			7000	1	1500	1	0.5	0	0.5	0	2	1			30	1	1	1	96	1	3	1	68	1			210	1	81	1	0.01	0	0.01	0	0.03	1			0.14	1	0.005	0
10/27/2009	2606	1	10	1	760	1			5900	1	1200	1	0.5	0	0.5	0	0.5	0			24	1	0.5	0	110	1	5.5	1	79	1			160	1	70	1	0.01	0	0.01	0	0.01	0			0.044	1	0.005	0
5/26/2010	2300	1	9.3	1	2200	1			5200	1	1500	1	2.3	1	0.5	0	4.4	1			32	1	2	1	120	1	4.4	1	83	1			170	1	100	1	0.01	0	0.01	0	0.032	1			0.14	1	0.01	0
10/6/2010	2400	1	8.9	1	710	1			4000	1	1600	1	0.5	0	0.5	0	1	1			18	1	0.5	0	110	1	3.6	1	23	1			120	1	84	1	0.01	0	0.01	0	0.022	1			0.086	1	0.01	0
7/26/2011	2000	1	7.8	1	1800	1			3900	1	1600	1	0.5	0	0.5	0	3.3	1			23	1	0.5	0	98	1	3.6	1	62	1			130	1	89	1	0.01	0	0.01	0	0.028	1			0.066	1	0.01	0
4/19/2012	2200	1	10	1	5800	1					1700	1	0.16	1	0.18	1	1.9	1					0.2	1	90	1	3.8	1	180	1					79	1	0.003	0	0.003	0	0.007	1					0.0025	0
6/20/2013	1900	1	9.4	1	4700	1			2300	1	1500	1	0.16	1	0.16	1	3.1	1			17	1	0.13	1	91	1	4.8	1	99	1			66	1	84	1	6E-04	1	0.003	0	0.008	1			0.028	1	0.0025	0
4/25/2014	2000	1	9.5	1	6100	1			2100	1	1700	1	0.18	1	0.19	1	2	1			18	1	0.12	1	91	1	4.9	1	190	1			61	1	79	1	0.003	0	0.003	0	0.003	0			0.037	1	0.0025	0
7/20/2015	1900	1	9.5	1	1900	1			1100	1	1300	1	0.14	1	0.16	1	2	1			6.8	1	0.11	1	80	1	4.2	1	58	1			47	1	86	1	0.005	0	0.005	0	0.005	0			0.008	1	0.005	0
8/2/2016	1900	1	9.3	1	3500	1			1400	1	1700	1	0.12	1	0.13	1	2.1	1			3.5	1	0.12	1	98	1	4.1	1	82	1			61	1	79	1	0.005	0	0.005	0	0.005	0			0.019	1	0.005	0
8/9/2017	1700	1	9.6	1	2900	1			1700	1	1300	1	0.15	1	0.15	1	3.2	1			2.5	1	0.11	1	95	1	4.1	1	170	1			68	1	59	1	0.01	1	0.005	0	0.005	0			0.017	1	0.086	1
7/26/2018	1800	1	9.5	1	4800	1			1800	1	1400	1	0.16	1	0.15	1	4.1	1			3.6	1	0.11	1	95	1	3.2	1	71	1			66	1	69	1	0.005	0	0.005	0	0.005	0			0.005	0	0.005	0
7/24/2019	1500	1	5.4	1	4000	1			1700	1	1200	1	0.15	1	0.14	1	3.7	1			2.8	1	0.12	1	93	1	4.1	1	82	1			64	1	68	1	0.005	0	0.005	0	0.006	1			0.018	1	0.005	0
6/20/2020	1700	1	11	1	5700	1			2000	1	1400	1	0.14	1	0.16	1	4.4	1			7	1	0.13	1	88	1	3.9	1	77	1			49	1	67	1	0.005	0	0.005	0	0.006	1			0.018	1	0.005	0
7/28/2021	1500	1	9	1					1100	1	1200	1	0.17	1	0.15	1					7.6	1	0.11	1	93	1	4.4	1					36	1	71	1	0.005	0	0.005	0					0.005	0	0.005	0
6/30/2022	1600	1	9.2	1	2100	1			1000	1	1300	1	0.17	1	0.18	1	3.2	1			7.9	1	0.15	1	99	1	3.7	1	47	1			32	1	72	1	0.005	0	0.005	0	0.005	0			0.008	1	0.005	0
7/20/2023	1400	1	7.4	1	1400	1			1100	1	1100	1	0.13	1	0.15	1	4	1			2.9	1	0.15	1	86	1	5	1	38	1			50	1	69	1	0.005	0	0.005	0	0.005	0			0.005	0	0.005	0
7/23/2024	2100	1	10	1	3550	1	510	1	1700	1	1100	1	0.17	1	0.15	1	5	1	1.9	1	1.8	1	0.14	1	89	1	5.9	1	50	1	37	1	64	1	66	1	0.005	0	0.15	0	0.005	0	0.005	0	0.005	0	0.005	0

APPENDIX C – GROUNDWATER LEVELS

APPENDIX C1

Static Water Level Hydrographs

STATIC WATER LEVEL HYDROGRAPHS

Elevation (ft)

Legend: MW-3B, MW-8A, MW-10A, MW-12A, MW-14A, MW-18

APPENDIX C2

Static Water Levels

APPENDIX C2
Monitoring Well Static Water Level Elevations
West Surface Impoundment
Former Columbia Gorge Aluminum Smelter

GROUNDWATER STATIC WATER LEVEL ELEVATIONS

		MONITORING WELL ID					
		MW–3B	MW–8A	MW–10A	MW–12A	MW–14A	MW–18
GROUNDWATER SURFACE ELEVATION (FEET MSL)	TOP OF CASING (FEET MSL)	410.97	492.97	427.95	441.38	431.65	348.40
WATER LEVEL ELEVATION FROM PVC TOP OF CASING (FEET)	9/8/04	378.1	463.7	406.6	390.2	413.2	NA [a]
	2/16/05	377.8	463.7	407.1	389.9	414.6	322.9
	5/11/05	377.6	463.7	406.3	389.3	413.7	322.0
	8/29/05	377.2	463.0	405.2	389.0	411.2	321.8
	11/1/05	377.0	463.1	405.1	388.9	411.6	321.6
	2/27/06	377.7	463.1	407.0	389.4	414.4	325.3
	6/5/06	378.5	463.1	407.3	390.1	414.2	323.6
	7/31/06	378.2	463.2	406.2	385.2	412.7	323.1
	10/9/06	377.6	463.0	405.6	384.9	411.5	322.5
	3/13/07	378.1	463.0	406.6	389.9	413.8	324.2
	6/22/07	378.3	463.0	406.7	390.3	414.6	323.3
	9/24/07	377.4	463.1	405.4	394.4	411.4	322.5
	11/14/07	381.9	463.0	NA [b]	389.2	NA [b]	322.6
	5/8/08	378.7	463.2	406.8	384.9	419.2	323.5
	10/14/08	377.4	463.1	405.5	384.8	412.0	323.3
	5/28/09	378.3	463.3	406.8	395.4	414.5	323.4
	10/27/09	377.5	463.3	405.4	389.9	412.5	322.8
	5/26/10	378.3	462.7	406.9	390.2	414.4	323.3
	10/6/10	377.5	463.2	405.4	381.9	412.2	322.8
	7/6/11	379.0	463.1	407.2	390.4	419.5	323.0
	4/17/12	378.7	462.1	407.9	391.3	415.5	324.6
	6/20/13	378.27	464.02	407.00	dry	413.85	324.18
	4/25/14	377.8	464.1	407.0	dry	414.2	323.9
	7/20/15	376.9	464.1	405.5	dry	411.4	324.1
	8/2/16	376.12	464.00	405.68	390.04	411.25	324.40
	8/8/17	378.17	464.00	405.68	390.04	411.25	324.40
	7/26/18	378.16	464.00	406.10	dry	412.72	324.85
	7/24/19	378.68	464.05	407.50	dry	413.93	325.50
	6/20/20	378.46	464.05	407.56	dry	414.35	324.98
	7/29/21	377.47	463.97	dry	dry	413.32	324.70
	6/30/22	377.79	464.02	406.56	dry	414.05	324.77
	7/20/23	378.04	463.66	405.81	dry	412.34	322.11
	7/23/24	377.32	464.02	406.23	391.00	412.88	324.98

Notes:

[a] Well was not in operation at this time

[b] Field sheets for MW–10A and MW–14A are missing for 5/8/2008

MSL = mean sea level

NA = not available.

Table 1

APPENDIX D – SURFACE MAINTENANCE ANNUAL REPORT

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: WINTER 2024 1ST QUARTER

QUARTERLY & YEARLY INSPECTIONS: 3/28/24

DATES and INITIALS: *(signature)*

COVER SYSTEM:

Rodent Holes	NO
Woody Vegetation	TOWARDS EAST SIDE
Security Fence	NO PROBLEMS
Signs of Erosion	GEOTEX EXPOSED AT SW CORNER

Storm Water Conveyance System

Blockage	NO
Settlement Buildup	NO

Corrective Action Taken: LOOSE T-WEEDS REMOVED/DISP. PRELIM. LIMITED REPAIR TO GTEX COVER

Additional Comments: COVER NEEDS TO BE REPLENISHED (GRAVEL) WEED CONTROL NEEDS TO BE INITIATED

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: SPRING 2024   2ND QUARTER

QUARTERLY & YEARLY INSPECTIONS: 7-23-2024

DATES and INITIALS:

COVER SYSTEM:	Rodent Holes	NO
	Woody Vegetation	YES (NEEDS PROFF. REMOVAL)
	Security Fence	NO PROBLEMS/LOCKED
	Signs of Erosion	SLIGHT SIGNS REPAIR NEEDED!
	Storm Water Conveyance System	NO
	Blockage	NO
	Settlement Buildup	NO

Corrective Action Taken: TUMBLE WEEDS AGAINST FENCE REMOVED

Additional Comments: NO EVIDENCE FOR VANDALISMUS.

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: SUMMER 2024

QUARTERLY & YEARLY INSPECTIONS:

DATES and INITIALS: 9-23-2024 /Thed.

COVER SYSTEM: Rodent Holes — NONE

Woody Vegetation — YES

Security Fence — NO PROBLEMS

Signs of Erosion — SOME ALONG EDGE OF CONTAINM,

Storm Water Conveyance System —

Blockage — NO

Settlement Buildup — NO

Corrective Action Taken: PICK UP T-WEEDS + CARDBOARD (BLOWN IN)

Additional Comments: MET ON SITE W. CONTRACTORS FOR ROOFT. WEED REMOVAL AND G. TEX COVER REPAIR

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: FALL 2024

QUARTERLY & YEARLY INSPECTIONS: 10/12/24 _RThl._

DATES and INITIALS:

COVER SYSTEM:		
	Rodent Holes	No
	Woody Vegetation	YES (REMOVAL INITIATET)
	Security Fence	CLEAN + NO CONCERN
	Signs of Erosion	REPAIRED

Storm Water Conveyance System		
	Blockage	NONE FOUND
	Settlement Buildup	— " —

Corrective Action Taken: PROFESSIONAL WEED REMOVAL UNDERWAY. G·TEX IS COVERED WITH RECOVERED GRAVEL MAT. FROM ON-SITE.

Additional Comments: ALL WEEDS REMOVED TO GROUND LEVEL. G-TEX COVER ·IS BROUGHT TO FORMER APPEARANCE

1st quarter east end with dry weeds

1st quarter looking west along the fence

2nd quarter

New growth along fence looking east

3rd quarter looking north

3rd quarter looking east   3rd quarter looking west   Southeast entrance

The following photos are all taken after the removal of all weeds from the site and after replacing the missing top cover at various locations.   4th quarter