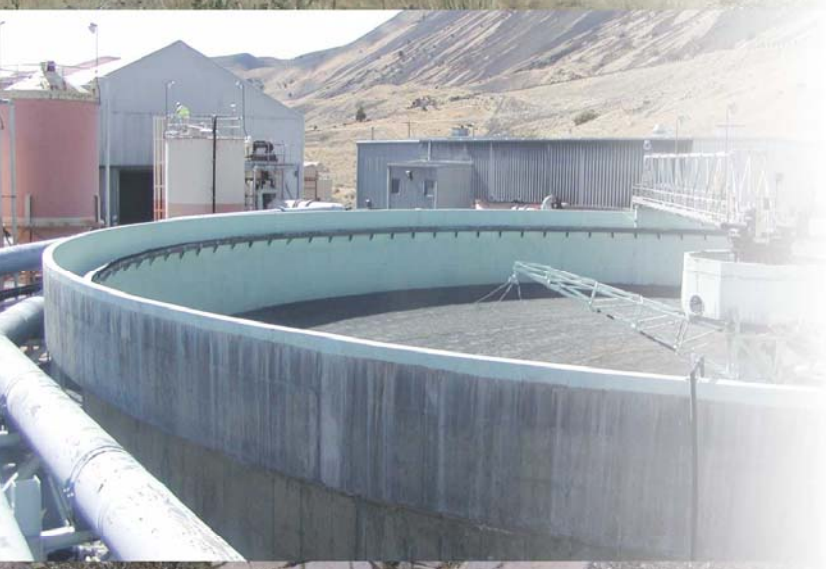

2023 ANNUAL GROUNDWATER MONITORING REPORT

And Surface Maintenance Report

WEST SURFACE IMPOUNDMENT

Columbia Gorge Aluminum Smelter Site

85 John Day Dam Road, Goldendale WA

Facility Site ID #95415874

September 8, 2023

On behalf of:

NSC Smelter LLC
3313 West Second Street
The Dalles OR 97058

In Cooperation With:

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

Prepared by:

GeoPro LLC
P. O. Box 26
Battle Ground WA 98604

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APPENDICES

1 INTRODUCTION

1.1 SCOPE AND PURPOSE

This report presents the results of the 2023 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 evaluate natural attenuation in the concentration of groundwater contaminates. 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 20, 2023, by GeoPro LLC, Battle Ground, Washington.

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 shown in 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 by 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 RCRA cap consisting of soil 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 (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 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 basalt bedrock is part of the UA.
- Basalt Aquifer Upper zone (BAU) – occurs within the basalt flow sequence commonly beneath a flow interior within a flow top.
- Basalt Aquifer Lower Zone (BAL) – includes saturated zones beneath 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 sixteen 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 downgradient property boundary about 2,500-feet from the WSI.

Sampling and analysis of groundwater has been conducted since 1984 and followed a quarterly schedule between 1991 and 2004. One additional pre-closure sampling event was conducted in September 2004 for the five 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, semiannually 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 show 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 monitoring investigation was described in the GSDAEP (Parametrix 2004b) and is summarized in this section.

2.1 MONITORING WELL LOCATIONS

The post-closure monitoring well locations include the following upgradient and downgradient wells:

- Upgradient well: MW-8A
- Downgradient wells near WSI: MW-10A, MW-12A, and MW-14A
- Downgradient wells farther from WSI: MW-3B and MW-18

The aquifer in which each well is screened was determined as part of implementing the Remedial Investigation work plan pursuant to the Agreed Order (DOE 2014). Monitoring well construction details are shown below in Table 1. Monitor well 12A has been dry except for the March 13, 2007 sampling event. Well locations are shown on Figure 2.

Table 1. Monitoring Well Construction Data

Well Number	Installed	Total Well Depth (ft bgs)	Well Screen Interval (ft bgs)	PVC Casing Diameter (inches)	Ground Surface Elevation (ft)	Top of PVC Elevation (ft)	Location
MW-8A	May 1989	41	22-32	4	490	492.97	Upgradient
MW-3B	April 1984	51	46-51	4	408	410.90	Downgradient
MW-10A	April 1989	26	13-25.5	4	425	427.95	Downgradient
MW-12A	May 1989	55	40-54	4	439	441.38	Downgradient
MW-14A	May 1989	30.5	8.5-29.5	4	429	431.65	Downgradient
MW-18	October 2004	51	35-50	4	346	348.40	Downgradient
Notes: bgs = below ground surface; elevations from Parametrix (2004b)							

2.2 SAMPLING PROCEDURES

Samples were collected on July 20, 2023, by GeoPro LLC using a submersible pump. Sampling collection procedures are summarized below.

- The static water level was measured prior to sampling.
- Each monitor well was purged of stagnant water in the casing and filter by slowly setting the pump within the approximate middle of the screened interval or slightly above the middle until the temperature, conductivity and pH stabilized.
- Samples were collected by setting the pump within the approximate middle of the screened interval with a low flow pumping rate.
- Water samples were placed in 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°C for transport to OnSite Laboratory. The samples were accompanied by a completed and signed chain-of-custody form. The samples were submitted by OnSite to AmTest laboratory for cyanide analysis.

2.3 SAMPLE ANALYSES

The laboratory report from Onsite Environmental, Inc., Redmond, Washington for analysis of the groundwater samples was reported on August 2, 2023. The laboratory report is included in Appendix A2.

2.4 MONITORING SCHEDULE

Groundwater sampling follows the schedule outlined in the post-closure plan (Parametric 2007c). Beginning in 2005, the plan specified quarterly sampling for the first two years, semiannually for years 3 through 7, and annual sampling thereafter until

concentrations drop below groundwater protection standards, or for a maximum of 30 years. One semiannual sampling event 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 to 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 semiannually Years 1-7	Time-series plots	Visually identify increasing or decreasing trends in concentrations
Annually After Year 7	Trend analyses using Mann-Kendall test	Quantitatively identify increasing or decreasing trends in concentrations
	Upper Confidence Limit Evaluation	Compare concentrations to the groundwater protection standards
	Time-series plots	Visually identify increasing or decreasing trends in concentrations

Groundwater protection standards are MTCA[1] Method B cleanup standards and Maximum Contaminant Levels (MCLs). The groundwater protection standards for these parameters are presented in the following Table 3.

Table 3. Groundwater Protection Standards for WSI

Parameter	MTCA 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, EPA guidance (EPA 2004) does not recommend that UPL comparisons be used for sites such as WSI with pre-existing contamination.

[1] State of Washington Department of Ecology Model Toxics Control Act, Cleanup Regulations, Chapter 173-340 WAC, as revised.

Three years of quarterly data (2005-2007), three years of semiannual data (2008-2010), and thirteen years of annual data (2011-2023) from ground water sampling were used for analysis evaluation (see Appendix A1). The concentrations of fluoride, chloride, sulfate, and total cyanide in each well were evaluated and prepared to satisfy the quarterly and semiannual requirements. The time-series plots, Mann-Kendall test and UCL comparisons were conducted to satisfy the annual evaluation requirements. With approval from Paul Skyllingstad, DOE (personal communication, June 28, 2012) both the Washington Department of Ecology UCL calculator and the Environmental Protection Agency ProUCL calculator were used to calculate UCLs for the data.

Time-series plots were created using the Microsoft Excel graphing functions. The Mann-Kendall test was conducted using the EPA's ProUCL calculator. ProUCL did not directly create all the statistical outputs needed for the Mann-Kendall analysis. VAR(S) was computed using equation (1), Z was computed using equation (2), and probability was computed using Table A.21 (Hollander and Wolfe, 1973).

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

(2) $$Z = \frac{|S|-1}{\sqrt{VAR(S)}}$$

The Washington DOE UCL (DOE, 2012) calculator was used to calculate the 95 percent UCL for normal and lognormal datasets as well as the mean, minimum value, and maximum value for each dataset. For datasets that were neither normal nor lognormal, the UCL was calculated using the EPA's ProUCL Calculator (ProUCL, 2012). The datasets were evaluated 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, 6 semiannual events between May 2008 and October 2010, and 13 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, and July 2023. 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.

The time-series plots indicate the following trends since closing of the WSI in 2004 and compared to the prior year concentrations.

Sulfate

Sulfate concentrations since the prior year have slightly increased in well MW-14A and slightly decreased in the other wells. The sulfate concentrations remain above the groundwater protection standard of 250 mg/L except in upgradient well MW-8A which remains below 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.

Chloride

Chloride concentrations since the prior year are decreasing in wells MW-3B, MW-10A and MW-18. Chloride concentrations since the prior year are slightly increasing in wells MW-8A and MW-14A. The chloride concentrations in all wells have not exceeded the groundwater protection standard of 250 mg/L since 2005.

Total Cyanide

Total cyanide was not detected in any wells at concentrations below the standard of 0.2 mg/L.

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 GWSDAEP specified that Sen's slope tests were to be used to evaluate trends in the data but have not been used because they provide similar information 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 tests are presented in Appendix B2 and summarized in Table 4.

Table 4. Post-Closure Significant Trends Using the Mann-Kendall Test

Well	**Sulfate**	**Fluoride**	**Chloride**	**Total Cyanide**
Upgradient				
MW-8A	-	↓	-	-
Downgradient				
MW-3B	-	↓	↓	-
MW-10A	↑	+	+	↓
MW-12A	n/a	n/a	n/a	n/a
MW-14A	↓	↓	↓	-
MW-18	↓	↓	↓	+

Table 4 Notes:

↑	Significant Increasing Trend
↓	Significant Decreasing Trend
-	Negative Trend
+	Positive Trend
n/a	Trend could not be calculated. Only one data point available or the well was dry.

The Mann-Kendall Trend test results indicate the following:

- Sulfate levels are significantly increasing in downgradient well MW-10A and are significantly decreasing in downgradient wells MW-14A and MW-18.
- Fluoride levels are significantly decreasing in upgradient well MW-8A and downgradient wells MW-3B, MW-14A, and MW-18.
- Chloride levels are significantly decreasing downgradient wells MW-3B, MW-14A and MW-18.
- Total cyanide levels are significantly decreasing in downgradient well MW-10A.

3.2.3 Upper Confidence Limits

The primary tool cited in MTCA (WAC 173-340-720[9]) for assessing whether data exceeds established cleanup levels is by comparing data to 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 cleanup level 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 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 (mg/L)	250	250	0.96	0.2
Upgradient Well				
MW-8A	9.04	4.39	0.54	0.01
Downgradient Wells				
MW-3B	**2134.53**	104.53	**1.88**	0.01
MW-10A	**2241.72**	66.28	**3.5**	0.02
MW-12A[1]	**1800**	150	**6.3**	0.01
MW-14A	**3435.86**	98.97	**17.13**	0.09
MW-18	**1450.33**	80.17	**2.3**	0.01

Table 5 Notes:
[1]No UCL calculated. Well was dry during most sampling events.
Bold indicates UCL exceeds lowest groundwater protection standard.

All the sampled wells downgradient of the WSI have post-closure UCL concentrations above the groundwater protection standards for sulfate and fluoride and below the groundwater protection standard for chloride and total cyanide. Upgradient well MW-8A has a UCL below the groundwater protection standard for sulfate, chloride fluoride and total cyanide.

3.3 GROUNDWATER FLOW

Groundwater elevations were measured once during 2004, quarterly between 2005 and 2007, semiannually between 2008 and 2010, and annually during 2011 through 2023 in the five sampled wells. The groundwater elevation data and a hydrograph showing changes in groundwater elevation during post-closure are presented in Appendix C. A groundwater elevation contour map was prepared using groundwater levels measured in July 2023 and is provided in Figure 3. Groundwater flow is consistent with historical data and the overall flow direction downgradient from the WSI is toward the southwest.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The following is concluded based on the July 2023 groundwater sampling results, trends, and statistical evaluation of historic data.

- Sulfate and fluoride concentrations in downgradient wells, based on the calculated UCLs, are above groundwater protection standards. Sulfate and fluoride in the upgradient well are below groundwater protection standards.
- Sulfate concentration is significantly increasing in downgradient well MW-10A.
- Sulfate concentration is significantly decreasing in downgradient wells MW-14A and MW-18.
- Fluoride concentrations are significantly decreasing in concentration in all wells except downgradient 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 concentration in upgradient well MW-8A and downgradient wells MW-14A 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 downgradient well MW-10A.

4.2 RECOMMENDATIONS

Post-closure fluoride and sulfate 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 contaminates to groundwater. Continued sampling and data evaluation will be required to determine whether the concentrations of fluoride and sulfate decrease below the lowest groundwater protection standards.

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

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ProUCL 7/12/11 U.S. Environmental Protection Agency 6/11/2012: http://www.epa.gov/osp/hstl/tsc/setup_v41.zip

6 SURFACE MAINTENANCE

The quarterly surface maintenance reports for the past annual 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

This report has been prepared for use by the landowner and is not intended for use by others except the landowner(s), landowner's agents and appropriate government agencies. All others should contact GeoPro LLC before applying or interpreting any information in this report. Each project and project site is unique and the information contained in this report is not applicable to other sites. This report has been prepared pursuant to a post-closure work plan prepared by others and the work plan approved by the State of Washington Department of Ecology.

GeoPro LLC does not accept liability or responsibility for use of this report by third parties, including but not limited to, detachment, partial use, separation, or reproduction without color, if used, which may depict significant information. Such use shall be at user's sole risk.

Records, documentation, and personal communication have been relied upon in good faith; however, GeoPro LLC accepts no responsibility for errors or omissions of work by others. Services are performed in accordance with generally accepted professional practices, in the same or similar localities, related to the nature of the work accomplished, at the time services are rendered. GeoPro LLC is not responsible for references to regulatory terms, practices, numeric data, or conditions that may lead to other conclusions if such references are not in final form.

Conclusions and findings apply only to present conditions, and opinions expressed are subject to revision when additional or new information is presented and reviewed. This warranty is in lieu of all other warranties, either expressed or implied. It is possible that explorations failed to reveal the presence of hazardous materials at areas where hazardous materials were assumed, suspected or expected to exist (hazardous as used herein shall also mean contaminated and polluted). Through use of this report it is understand that failure to sample soil or water, or install groundwater monitor wells at locations through appropriate and mutually agreed-upon techniques does not guarantee that hazardous materials have, or will be, detected at such locations. Similarly, areas which in fact are unaffected by hazardous materials at the time of this report, may later, due to natural causes or human intervention, become contaminated. GeoPro LLC is not responsible for failing to locate hazardous materials which have not been discovered at the time of this report or in the future. In the event of changes in future development plans as understood at the time of this report, the conclusions and recommendations made herein shall be invalid until GeoPro LLC is given the opportunity to review and modify this report in writing. Portions of an Agreement to perform professional services may or may not be disclosed in this report.

Respectfully submitted,

Richard C. Kent, L.G.

GeoPro LLC

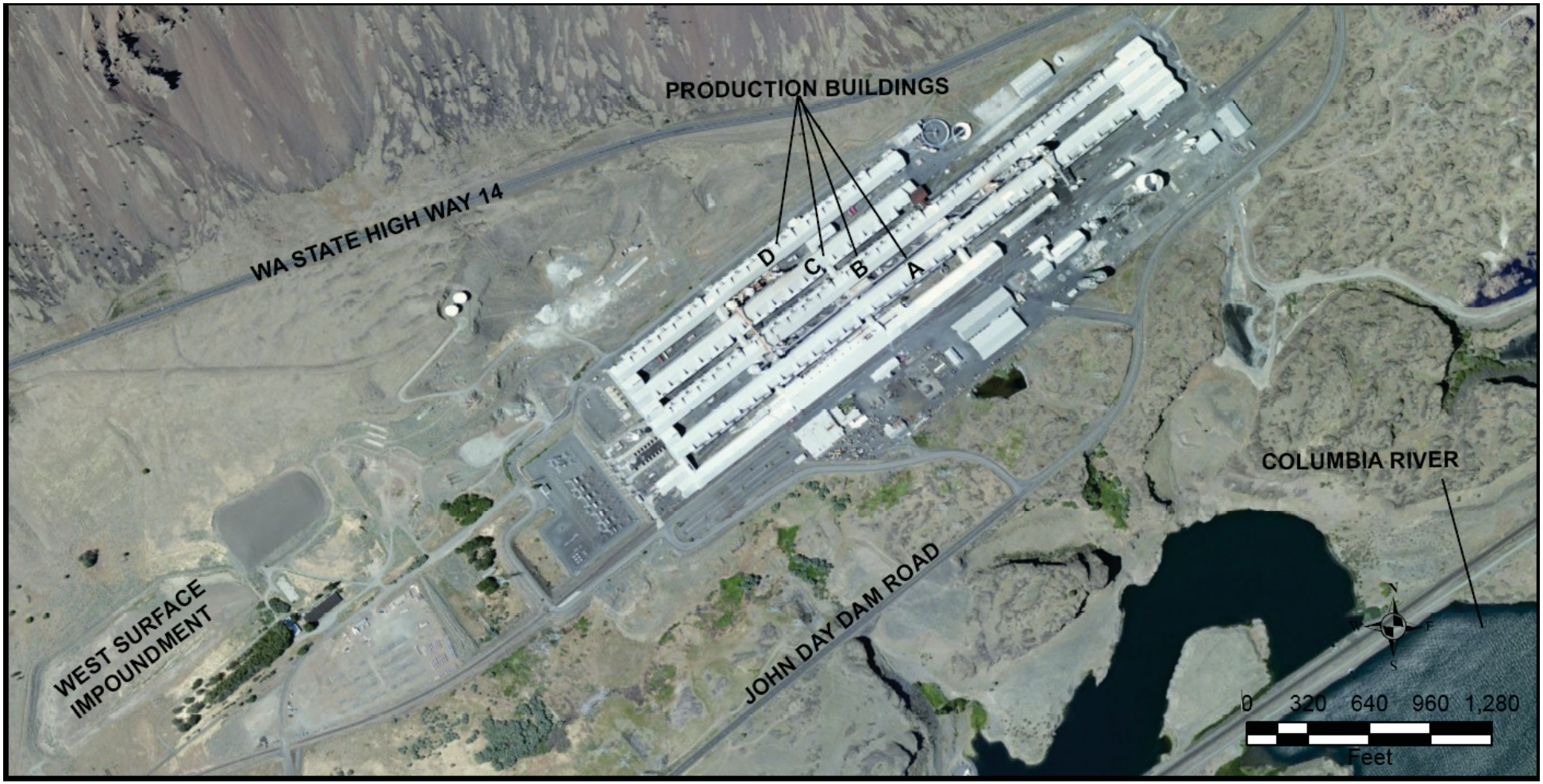


FIGURE 1

LOCATION MAP

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

GeoPro LLC
PO Box 26
Battle Ground, WA 98604

July 2023

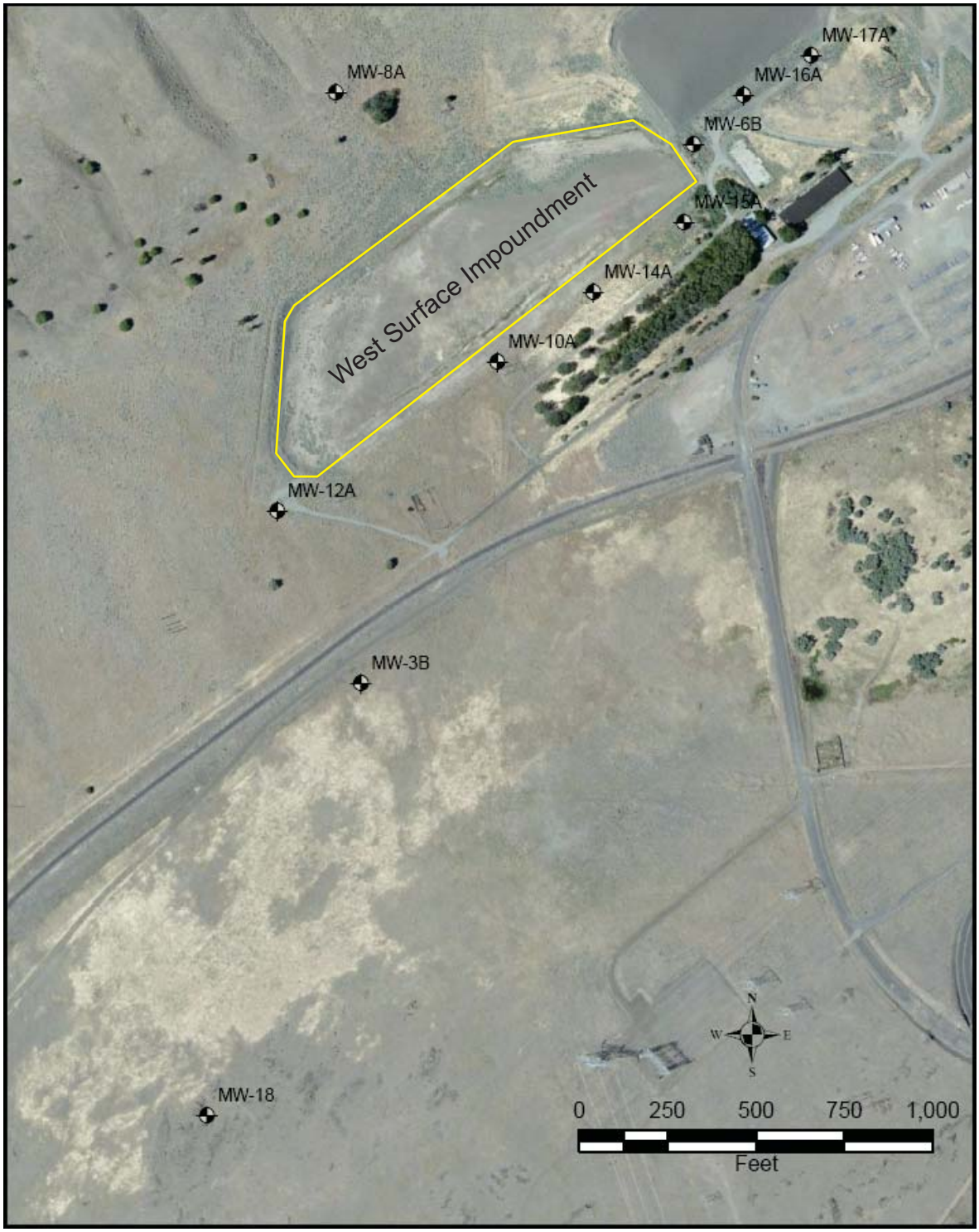


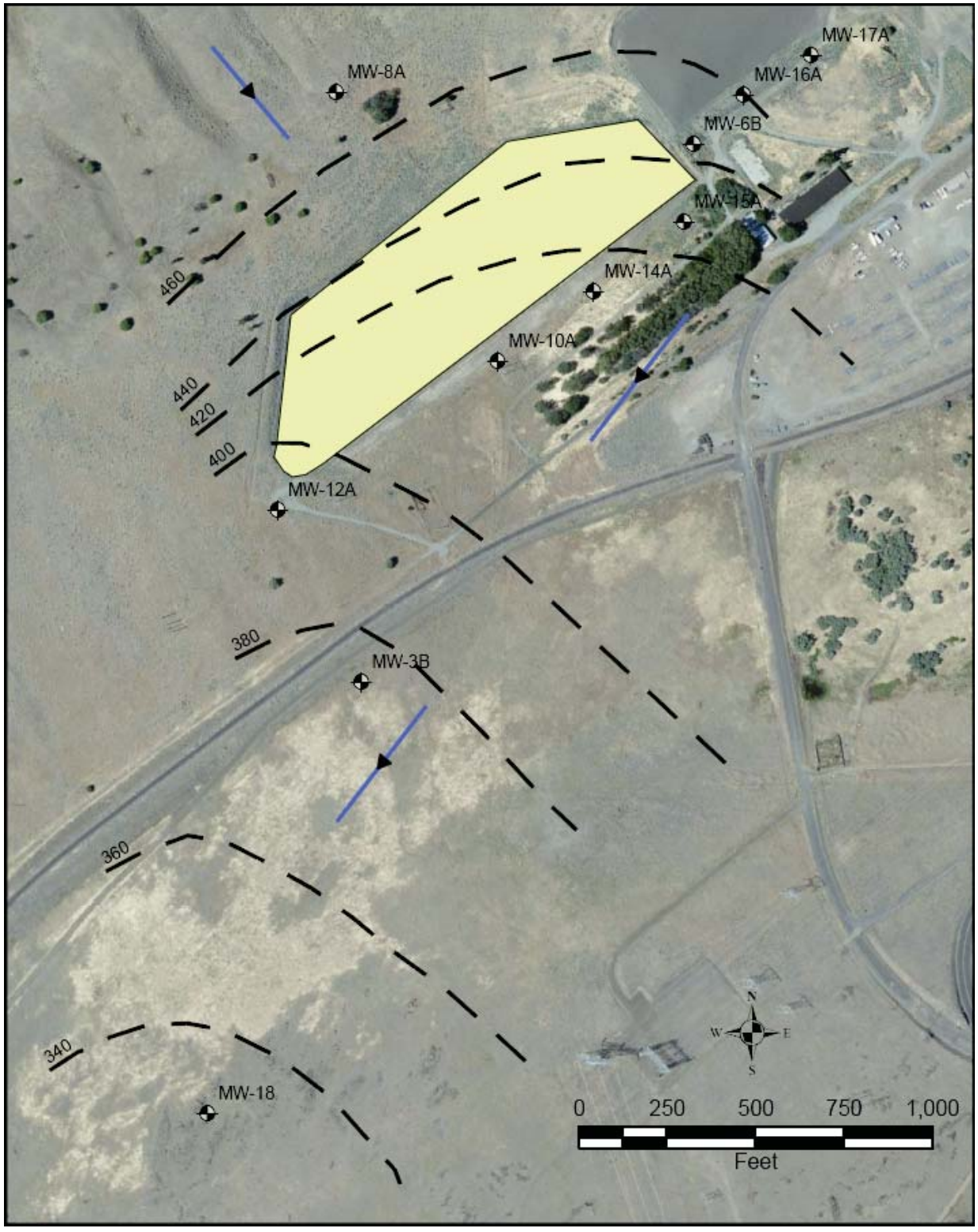
FIGURE 2

WEST SURFACE IMPOUNDMENT GROUNDWATER MONITOR WELLS LOCATION MAP

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

GeoPro LLC
PO Box 26
Battle Ground, WA 98604

July 2023



contour interval 20 feet
contours in feet MSL

flow direction

FIGURE 3

WEST SURFACE IMPOUNDMENT GROUNDWATER CONTOUR MAP

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

GeoPro LLC
PO Box 26
Battle Ground, WA 98604

July 2023

APPENDICES

Appendix A – Groundwater Analyses

Appendix A1
Analyses Summary Table

Analyses Summary Table (mg/L): page 1 of 2

	Upgradient Well MW-8A				**Downgradient Well MW-3B**				**Downgradient Well MW-10A**			
	Sulfate	Fluoride	Chloride	CN (total)	Sulfate	Fluoride	Chloride	CN (total)	Sulfate	Fluoride	Chloride	CN (total)
Lowest Groundwater Protection Standard	250	0.96	250	0.2	250	0.96	250	0.2	250	0.96	250	0.2
Sample Date												
2/16/2005	10	0.9	5.6	<0.01	2300	0.6	130	<0.01	940	1.8	29	0.04
5/11/2005	9.8	0.3	4.6	<0.01	2500	0.4	140	<0.01	910	1.5	31	0.05
8/29/2005	8.9	0.4	4.2	<0.01	2700	0.6	120	<0.01	670	1.2	28	0.04
11/1/2005	9.6	0.9	4.7	<0.01	2600	0.9	130	<0.01	670	2.7	28	0.03
2/27/2006	9.27	2.8	4.2	<0.01	2610	0.7	118	<0.01	1570	2.3	43	0.03
6/5/2006	9.8	0.2	4.9	<0.05	2220	0.2	113	<0.01	1650	3.2	48	0.03
7/31/2006	9.8	0.1	4.6	<0.01	2000	3.7	110	<0.01	860	2.3	35	0.08
10/9/2006	9.7	<0.2	4.5	<0.01	2500	3.8	110	<0.01	850	1.9	30	0.03
3/13/2007	10	<0.1	6.6	<0.01	2500	3.8	110	<0.01	1100	3.4	45	0.04
6/22/2007	1	<10	4.89	<0.01	2500	<10	97	<0.01	1100	<10	36	<0.01
9/24/2007	10	<1	4.2	<0.01	2200	<1	124.79	<0.01	760	1.2	30	0.04
11/14/2007	-	-	-	<0.01	-	-	-	<0.01	-	-	-	0.043
5/8/2008	10	<1	4	<0.01	2200	<50	100	<0.01	2700	<50	100	0.05
10/14/2008	10	0.1	4.5	<0.01	2600	<10	100	<0.01	860	<10	30	0.04
5/29/2009	9	<1	3	<0.02	2200	<1	96	<0.02	2000	2	68	0.03
10/27/2009	10	<1	5.5	<0.02	2606	<1	110	<0.02	760	<1	79	<0.02
5/26/2010	9.3	<1	4.4	<0.02	2300	2.3	120	<0.02	2200	4.4	83	0.032
10/6/2010	8.9	<1	3.6	<0.02	2400	<1	110	<0.02	710	1	23	0.022
7/26/2011	7.8	<1	3.6	<0.02	2000	<1	98	<0.02	1800	3.3	62	0.028
4/19/2012	10	0.18	3.8	<0.005	2200	0.16	90	<0.005	5800	1.9	180	0.007
6/20/2013	9.4	0.16	4.8	<0.005	1900	0.16	91	0.006	4700	3.1	99	0.008
4/25/2014	9.5	0.19	4.9	<0.005	2000	0.18	91	<0.006	6100	2	190	<0.005
7/20/2015	9.5	0.16	4.2	<0.005	1900	0.14	80	<0.005	1900	2	58	<0.005
8/2/2016	9.3	0.13	4.1	<0.005	1900	0.12	98	<0.005	3500	2.1	82	<0.005
8/9/2017	9.6	0.15	4.1	<0.005	1700	0.15	95	0.01	2900	3.2	170	<0.005
7/26/2018	9.5	0.15	3.2	<0.005	1800	0.16	95	<0.005	4800	4.1	71	<0.005
7/24/2019	5.4	0.14	4.1	<0.005	1500	0.15	93	<0.005	4000	3.7	82	<0.006
6/20/2020	11	0.16	3.9	<0.005	1700	0.14	88	<0.005	5700	4.4	77	<0.006
7/28/2021	9	0.15	4.4	<0.004	1500	0.17	93	<0.005	Dry	Dry	Dry	Dry
6/30/2022	9.2	0.15	3.7	<0.005	1600	0.17	99	<0.005	2100	3.2	47	<0.005
7/20/2023	7.4	0.15	5	<0.005	1400	0.13	86	<0.005	1400	4.0	38	<0.005

Analyses Summary Table (mg/L): page 2 of 2

	Downgradient Well MW-12A				Downgradient Well MW-14A				Downgradient Well MW-18			
	Sulfate	Fluoride	Chloride	CN (total)	Sulfate	Fluoride	Chloride	CN (total)	Sulfate	Fluoride	Chloride	CN (total)
Lowest Groundwater Protection Standard	250	0.96	250	0.2	250	0.96	250	0.2	250	0.96	250	0.2
Sample Date												
2/16/2005	Dry	Dry	Dry	Dry	4000	9.6	110	0.35	1500	0.6	86	<0.01
5/11/2005	Dry	Dry	Dry	Dry	3500	8.6	90	0.24	1300	0.4	91	<0.01
8/29/2005	Dry	Dry	Dry	Dry	3600	30	71	0.27	1500	0.4	75	<0.01
11/1/2005	Dry	Dry	Dry	Dry	2800	25	75	0.19	1300	1.8	84	<0.01
2/27/2006	Dry	Dry	Dry	Dry	2170	31	53	0.19	1520	0.9	83	<0.01
6/5/2006	Dry	Dry	Dry	Dry	2380	27	63	0.2	1490	0.2	91	<0.01
7/31/2006	Dry	Dry	Dry	Dry	3300	30	98	0.17	1500	2.6	89	<0.01
10/9/2006	Dry	Dry	Dry	Dry	3900	24	130	0.01	1600	2.4	80	<0.01
3/13/2007	1800	6.3	150	<0.01	4400	16	140	0.12	1600	2.6	93	<0.01
6/22/2007	Dry	Dry	Dry	Dry	7900	19	170	<0.01	1700	<1	77	<0.01
9/24/2007	Dry	Dry	Dry	Dry	6400	<50	200	0.03	1400	<50	100	<0.01
11/14/2007	Dry	Dry	Dry	Dry	-	-	-	<0.01	-	-	-	<0.01
5/8/2008	Dry	Dry	Dry	Dry	5500	<50	100	0.19	1300	<50	70	<0.01
10/14/2008	Dry	Dry	Dry	Dry	6500	20	180	0.12	1600	<1	80	<0.01
5/29/2009	Dry	Dry	Dry	Dry	7000	30	210	0.14	1500	1	81	<0.01
10/27/2009	Dry	Dry	Dry	Dry	5900	24	160	0.044	1200	<1	70	<0.01
5/26/2010	Dry	Dry	Dry	Dry	5200	32	170	0.14	1500	2	100	<0.02
10/6/2010	Dry	Dry	Dry	Dry	4000	18	120	0.086	1600	<1	84	<0.02
7/26/2011	Dry	Dry	Dry	Dry	3900	23	130	0.066	1600	<1	89	<0.02
4/19/2012	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1700	0.2	79	<0.005
6/20/2013	Dry	Dry	Dry	Dry	2300	17	66	0.028	1500	0.13	84	<0.005
4/25/2014	Dry	Dry	Dry	Dry	2100	18	61	0.037	1700	0.12	79	<0.005
7/20/2015	Dry	Dry	Dry	Dry	1100	6.8	47	0.008	1300	0.11	86	<0.005
8/2/2016	Dry	Dry	Dry	Dry	1400	3.5	61	0.019	1700	0.12	79	<0.005
8/9/2017	Dry	Dry	Dry	Dry	1700	2.5	68	0.017	1300	0.11	59	0.086
7/26/2018	Dry	Dry	Dry	Dry	1800	3.6	66	<0.005	1400	0.11	69	<0.005
7/24/2019	Dry	Dry	Dry	Dry	1700	2.8	64	0.018	1200	0.12	68	<0.005
6/20/2020	Dry	Dry	Dry	Dry	2000	7	49	0.018	1400	0.13	67	<0.005
7/28/2021	Dry	Dry	Dry	Dry	1100	7.8	36	<0.004	1200	0.11	71	<0.004
6/30/2022	Dry	Dry	Dry	Dry	990	7.8	32	0.008	1300	0.15	72	<0.005
7/20/2023	Dry	Dry	Dry	Dry	1100	2.9	50	<0.005	1100	0.16	69	<0.005

Appendix A2
Laboratory Report

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

August 2, 2023

Richard Kent
GeoPro, LLC
PO Box 26
Battle Ground, WA 98604

Re: Analytical Data for Project 230720
Laboratory Reference No. 2307-192

Dear Richard:

Enclosed are the analytical results and associated quality control data for samples submitted on July 25, 2023.

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

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

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

Case Narrative

Samples were collected on July 20, 2023 and received by the laboratory on July 25, 2023. They were maintained at the laboratory at a temperature of 2°C to 6°C.

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

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

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

FLUORIDE
SM 4500-F C

Matrix: Water
Units: mg F- /L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW-3B**					
Laboratory ID:	07-192-01					
Fluoride	**0.13**	0.020	SM 4500-F C	7-27-23	7-27-23	
Client ID:	**MW-8A**					
Laboratory ID:	07-192-02					
Fluoride	**0.15**	0.020	SM 4500-F C	7-27-23	7-27-23	
Client ID:	**MW-10A**					
Laboratory ID:	07-192-03					
Fluoride	**4.0**	0.040	SM 4500-F C	7-27-23	7-27-23	
Client ID:	**MW-10A Dup**					
Laboratory ID:	07-192-04					
Fluoride	**4.0**	0.040	SM 4500-F C	7-27-23	7-27-23	
Client ID:	**MW-14A**					
Laboratory ID:	07-192-05					
Fluoride	**2.9**	0.040	SM 4500-F C	7-27-23	7-27-23	
Client ID:	**MW-18**					
Laboratory ID:	07-192-06					
Fluoride	**0.15**	0.020	SM 4500-F C	7-27-23	7-27-23	

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

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:	MB0727W1					
Fluoride	**ND**	0.020	SM 4500-F C	7-27-23	7-27-23	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	07-192-02								
	ORIG	DUP							
Fluoride	**0.145**	**0.133**	NA	NA	NA	NA	9	17	
MATRIX SPIKE									
Laboratory ID:	07-192-02								
	MS		MS		MS				
Fluoride	**0.659**		0.500	0.145	103	63-131	NA	NA	
SPIKE BLANK									
Laboratory ID:	SB0727W1								
	SB		SB		SB				
Fluoride	**0.457**		0.500	NA	91	73-111	NA	NA	

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

SULFATE
ASTM D516-11

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW-3B**					
Laboratory ID:	07-192-01					
Sulfate	**1400**	500	ASTM D516-11	7-20-23	7-20-23	
Client ID:	**MW-8A**					
Laboratory ID:	07-192-02					
Sulfate	**7.4**	5.0	ASTM D516-11	7-20-23	7-20-23	
Client ID:	**MW-10A**					
Laboratory ID:	07-192-03					
Sulfate	**1400**	1000	ASTM D516-11	7-20-23	7-20-23	
Client ID:	**MW-10A Dup**					
Laboratory ID:	07-192-04					
Sulfate	**1400**	1000	ASTM D516-11	7-20-23	7-20-23	
Client ID:	**MW-14A**					
Laboratory ID:	07-192-05					
Sulfate	**1100**	500	ASTM D516-11	7-20-23	7-20-23	
Client ID:	**MW-18**					
Laboratory ID:	07-192-06					
Sulfate	**1100**	500	ASTM D516-11	7-20-23	7-20-23	

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

SULFATE
ASTM D516-11
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0726W1					
Sulfate	**ND**	5.0	ASTM D516-11	7-20-23	7-20-23	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	07-192-02								
	ORIG	DUP							
Sulfate	**7.44**	**7.62**	NA	NA	NA	NA	2	10	
MATRIX SPIKE									
Laboratory ID:	07-192-02								
	MS		MS		MS				
Sulfate	**18.6**		10.0	7.44	112	73-127	NA	NA	
SPIKE BLANK									
Laboratory ID:	SB0726W1								
	SB		SB		SB				
Sulfate	**9.67**		10.0	NA	97	85-114	NA	NA	

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

CHLORIDE
SM 4500-Cl E

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**MW-3B**					
Laboratory ID:	07-192-01					
Chloride	**86**	2.0	SM 4500-Cl E	7-25-23	7-25-23	
Client ID:	**MW-8A**					
Laboratory ID:	07-192-02					
Chloride	**5.0**	2.0	SM 4500-Cl E	7-25-23	7-25-23	
Client ID:	**MW-10A**					
Laboratory ID:	07-192-03					
Chloride	**38**	2.0	SM 4500-Cl E	7-25-23	7-25-23	
Client ID:	**MW-10A Dup**					
Laboratory ID:	07-192-04					
Chloride	**38**	2.0	SM 4500-Cl E	7-25-23	7-25-23	
Client ID:	**MW-14A**					
Laboratory ID:	07-192-05					
Chloride	**50**	2.0	SM 4500-Cl E	7-25-23	7-25-23	
Client ID:	**MW-18**					
Laboratory ID:	07-192-06					
Chloride	**69**	2.0	SM 4500-Cl E	7-25-23	7-25-23	

Date of Report: August 2, 2023
Samples Submitted: July 25, 2023
Laboratory Reference: 2307-192
Project: 230720

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:	MB0725W1					
Chloride	**ND**	2.0	SM 4500-Cl E	7-25-23	7-25-23	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	07-192-02								
	ORIG	DUP							
Chloride	**5.04**	**4.21**	NA	NA	NA	NA	18	12	C
MATRIX SPIKE									
Laboratory ID:	07-192-02								
	MS		MS		MS				
Chloride	**54.8**		50.0	5.04	100	83-120	NA	NA	
SPIKE BLANK									
Laboratory ID:	SB0725W1								
	SB		SB		SB				
Chloride	**45.8**		50.0	NA	92	83-119	NA	NA	

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

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

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

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

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

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

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

I - Compound recovery is outside of the control limits.

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

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

L - The RPD is outside of the control limits.

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

M1 - Hydrocarbons in the gasoline range (toluene-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

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Jul 28 2023
On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister

Dear David Baumeister:

Enclosed please find the analytical data for your project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
MW-3B	Water	23-A012684	CN- Shim
MW-8A	Water	23-A012685	CN- Shim
MW-10A	Water	23-A012686	CN- Shim
MW-10A DUP	Water	23-A012687	CN- Shim
MW-14A	Water	23-A012688	CN- Shim
MW-18	Water	23-A012689	CN- Shim

Your samples were received on Tuesday, July 25, 2023. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Aaron Young
Vice President

Project #: 230720
SDG #: 2330520
PO Number: 07-192

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister
SDG Number: 2330520
Project #: 230720
PO Number: 07-192
All results reported on an as received basis.

Date Received: 07/25/23
Date Reported: 7/28/23

AMTEST Identification Number **23-A012684**
Client Identification **MW-3B**
Sampling Date **07/20/23, 11:25**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23

AMTEST Identification Number **23-A012685**
Client Identification **MW-8A**
Sampling Date **07/20/23, 07:45**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23

AMTEST Identification Number **23-A012686**
Client Identification **MW-10A**
Sampling Date **07/20/23, 10:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23

AMTEST Identification Number **23-A012687**
Client Identification **MW-10A DUP**
Sampling Date **07/20/23, 10:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23

AMTEST Identification Number **23-A012688**
Client Identification **MW-14A**
Sampling Date **07/20/23, 08:55**

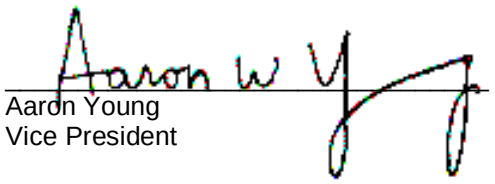
Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23

AMTEST Identification Number **23-A012689**
Client Identification **MW-18**
Sampling Date **07/20/23, 12:33**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Cyanide	< 0.005	mg/l		0.005	SM 4500CN-E99	AE	07/27/23



Aaron Young
Vice President

Am Test Inc.
13600 NE 126th PL
Suite C
Kirkland, WA, 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

QC Summary for sample numbers: 23-A012684 to 23-A012689

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
23-A011979	Total Cyanide	mg/l	< 0.005	< 0.005	
23-A012032	Total Cyanide	mg/l	< 0.005	< 0.005	
23-A012712	Total Cyanide	mg/l	< 0.005	< 0.005	

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
23-A011979	Total Cyanide	mg/l	< 0.005	0.023	0.025	92.00 %
23-A012032	Total Cyanide	mg/l	< 0.005	0.035	0.025	140.00 %
23-A012712	Total Cyanide	mg/l	< 0.005	0.029	0.025	116.00 %

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Cyanide	mg/l	0.10	0.10	100. %
Total Cyanide	mg/l	0.10	0.099	99.0 %
Total Cyanide	mg/l	0.10	0.099	99.0 %

BLANKS

ANALYTE	UNITS	RESULT
Total Cyanide	mg/l	< 0.005
Total Cyanide	mg/l	< 0.005
Total Cyanide	mg/l	< 0.005

OnSite Environmental Inc.

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

Laboratory Reference #: 07-192

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: 230720

Project Name: _____

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	Requested Analyses
	MW-3B 12684	7/20/23	11:25	Water	1	Total Cyanide
	MW-8A 12685	7/20/23	7:45	Water	1	Total Cyanide
	MW-10A 12686	7/20/23	10:00	Water	1	Total Cyanide
	MW-10A Dup 12687	7/20/23	10:00	Water	1	Total Cyanide
	MW-14A 12688	7/20/23	8:55	Water	1	Total Cyanide
	MW-18 12689	7/20/23	12:33	Water	1	Total Cyanide

	Company	Date	Time	Comments/Special Instructions
Relinquished by: Nichelle Arnold SF	OSE	7/25/23	1210	EIM
Received by:	AmTest	7/25/23	1210	
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

8.5°C

APPENDIX A2

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

Chain of Custody

Page 1 of 1

Company: GeoPro LLC
Project Number: ~~220630~~ 230720
Project Name: WSI Columbia Gorge Aluminum
Project Manager: Richard Kent
Sampled by: Patrick Kent

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

Laboratory Number: 07-192

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	Cyanide Total	Fluoride	Sulfate	Chloride	% Moisture
1	MW-3B-2023	7/20/23	1125	W	2																		X	X	X	X	
2	MW-8A-2023	↓	0745	↓	2																		↓	↓	↓	↓	
3	MW-10A-2023	↓	1000	↓	2																		↓	↓	↓	↓	
4	MW-10A Dup-2023	↓	1000	↓	2																		↓	↓	↓	↓	
5	MW-14A-2023	↓	0855	↓	2																		↓	↓	↓	↓	
6	MW-18-2023	↓	1233	↓	2																		↓	↓	↓	↓	

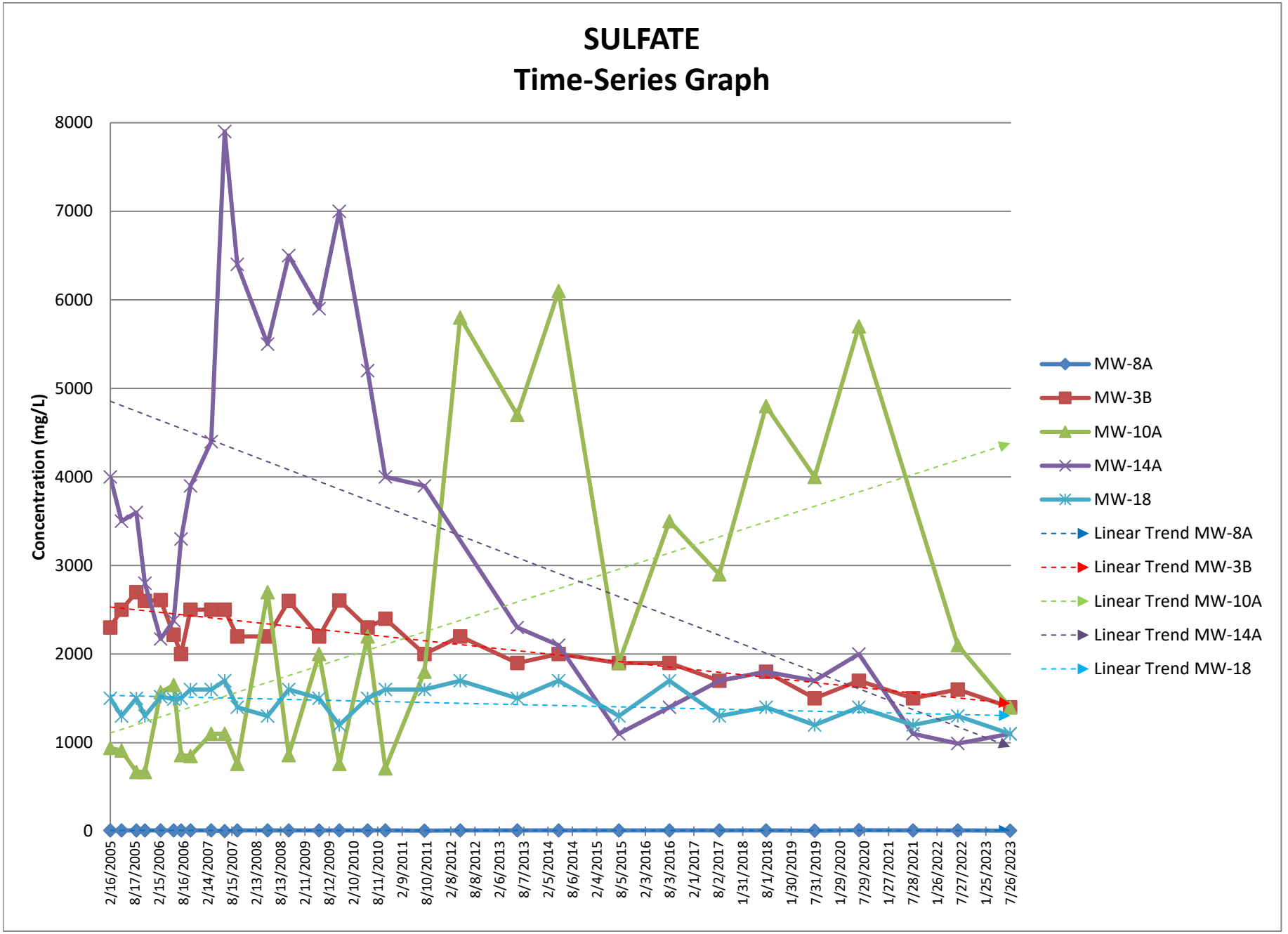
	Signature	Company	Date	Time
Relinquished	[signature]	GeoPro LLC	7/24/23	1000
Received	Nichelle Boffman	OSE	7/25/23	1050
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

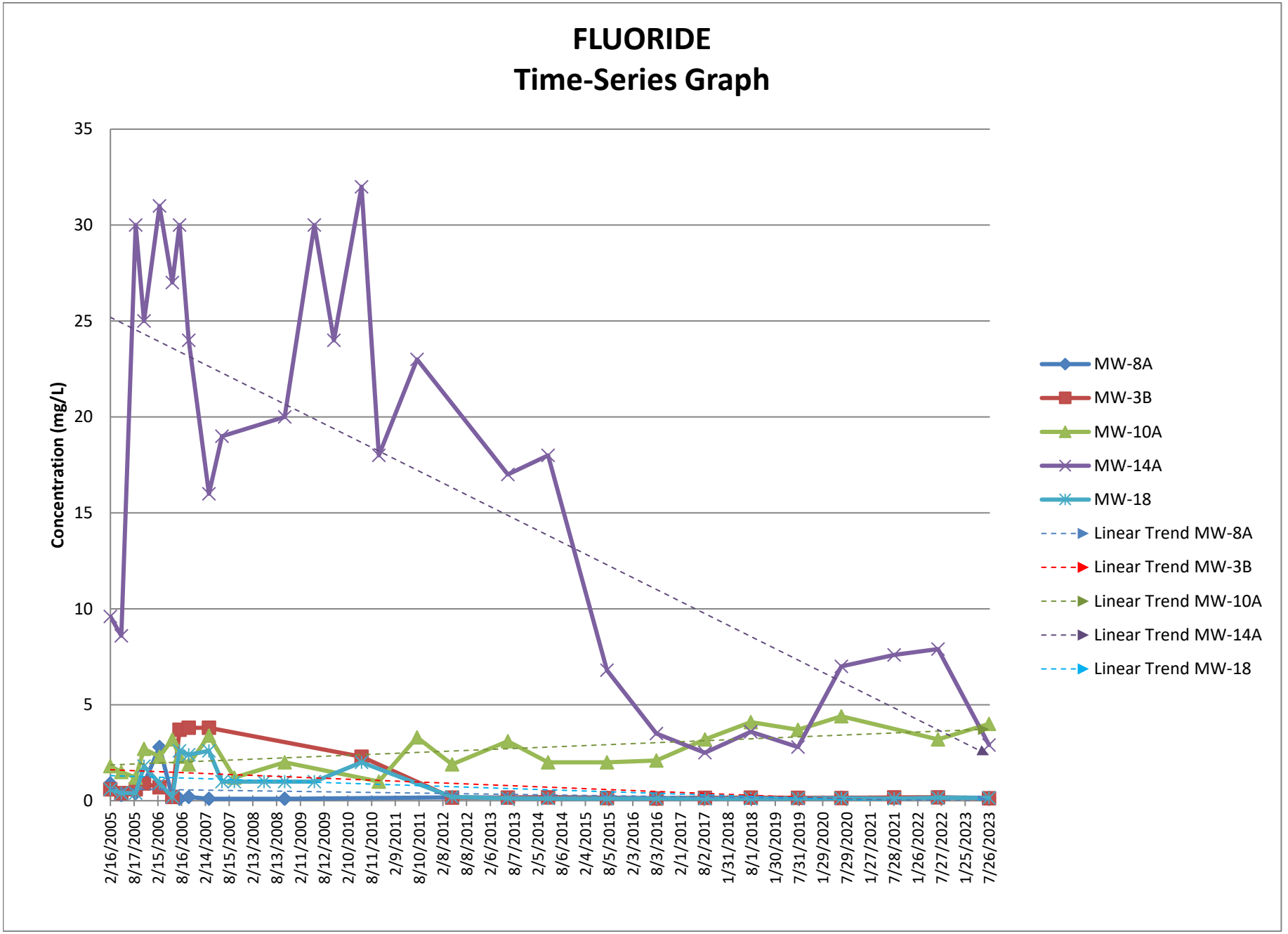
Comments/Special Instructions
Invoice BMEC

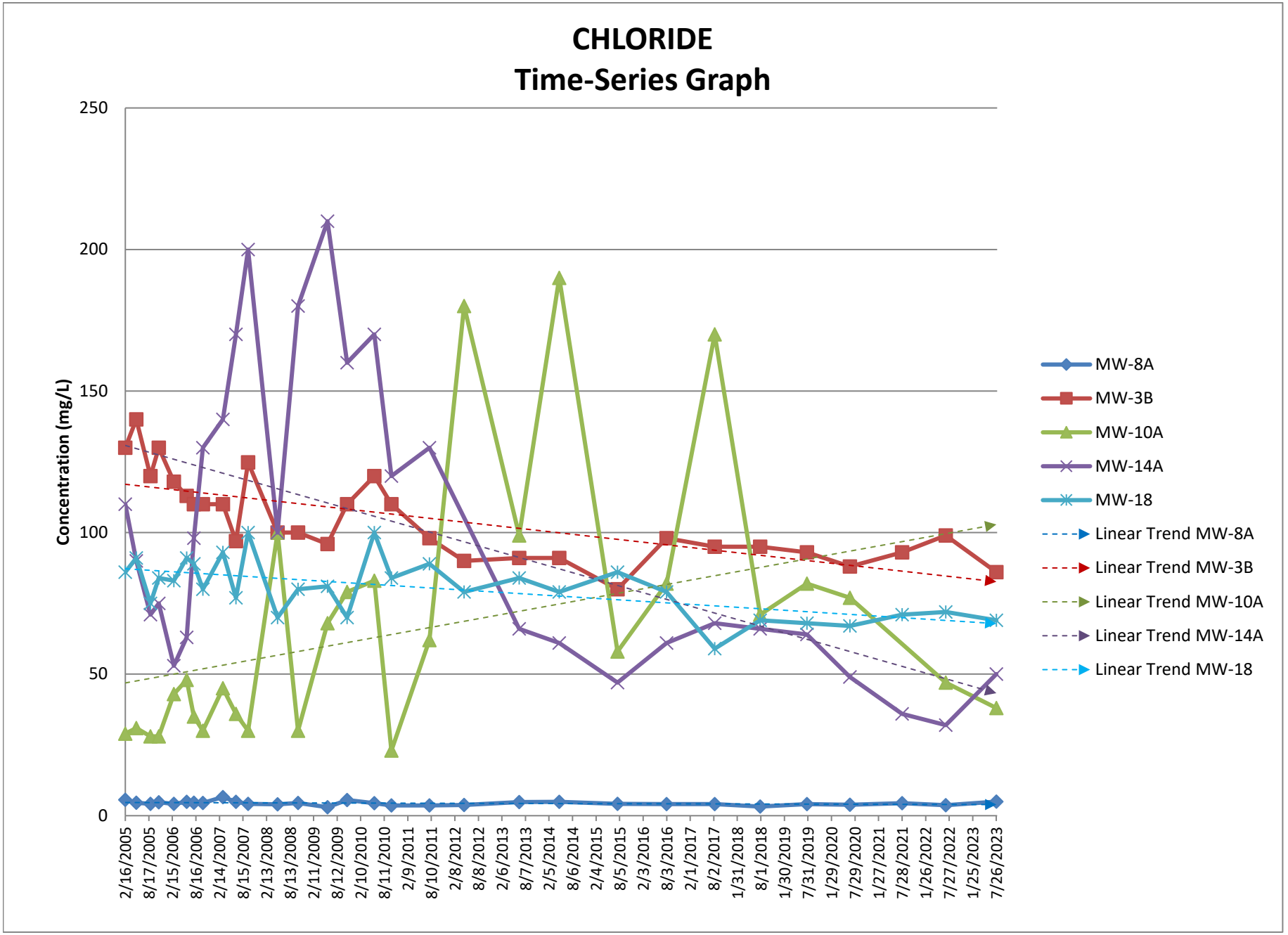
Data Package: Standard ☒ Level III ☐ Level IV ☐
Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

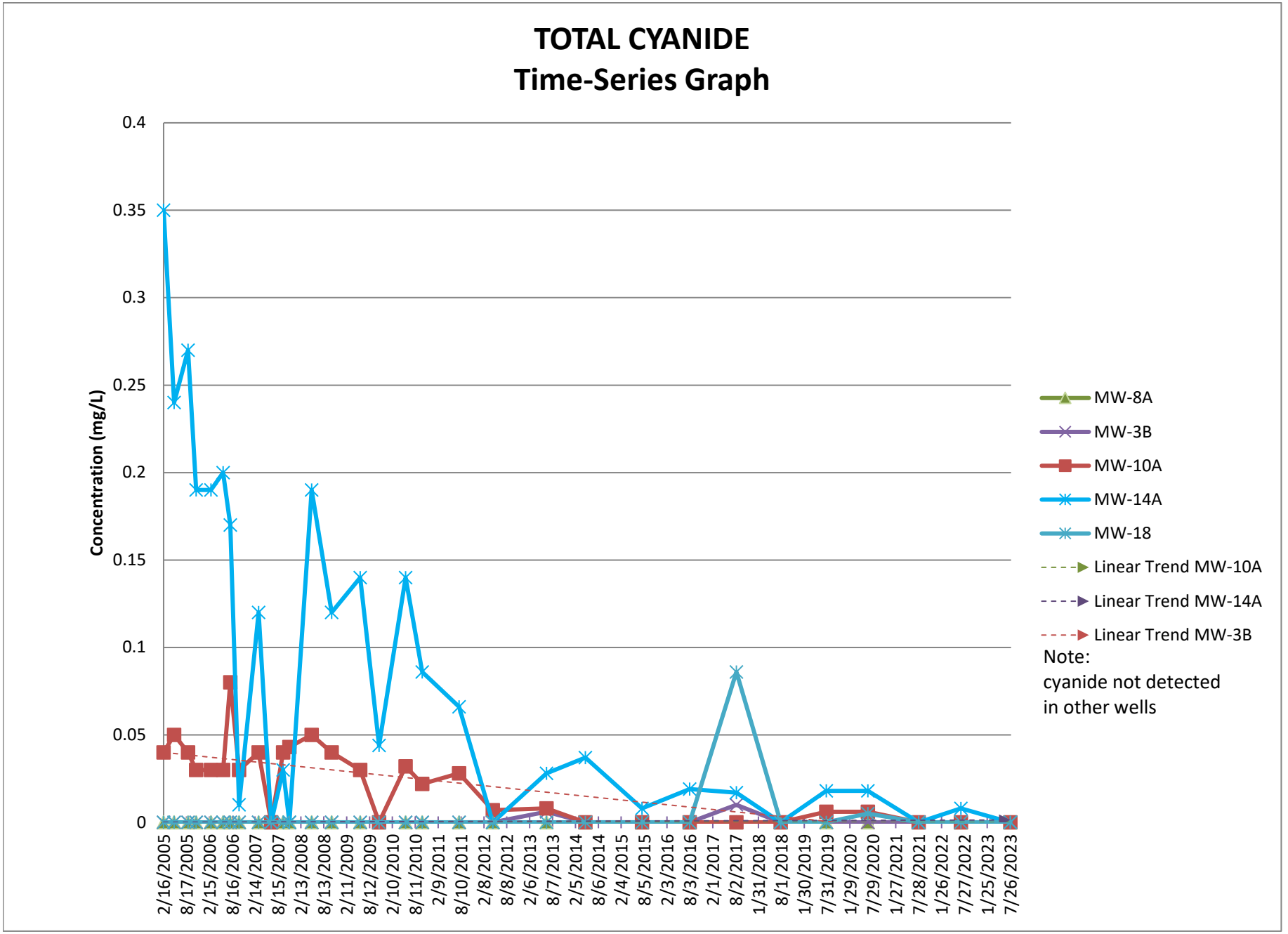
Appendix B - UCL and Trends

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


SULFATE
Time-Series Graph
Concentration (mg/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
2/16/2005
8/17/2005
2/15/2006
8/16/2006
2/14/2007
8/15/2007
2/13/2008
8/13/2008
2/11/2009
8/12/2009
2/10/2010
8/11/2010
2/9/2011
8/10/2011
2/8/2012
8/8/2012
2/6/2013
8/7/2013
2/5/2014
8/6/2014
2/4/2015
8/5/2015
2/3/2016
8/3/2016
2/1/2017
8/2/2017
1/31/2018
8/1/2018
1/30/2019
7/31/2019
1/29/2020
7/29/2020
1/27/2021
7/28/2021
1/26/2022
7/27/2022
1/25/2023
7/26/2023
MW-8A
MW-3B
MW-10A
MW-14A
MW-18
Linear Trend MW-8A
Linear Trend MW-3B
Linear Trend MW-10A
Linear Trend MW-14A
Linear Trend MW-18


FLUORIDE
Time-Series Graph
Concentration (mg/L)
35
30
25
20
15
10
5
0
2/16/2005
8/17/2005
2/15/2006
8/16/2006
2/14/2007
8/15/2007
2/13/2008
8/13/2008
2/11/2009
8/12/2009
2/10/2010
8/11/2010
2/9/2011
8/10/2011
2/8/2012
8/8/2012
2/6/2013
8/7/2013
2/5/2014
8/6/2014
2/4/2015
8/5/2015
2/3/2016
8/3/2016
2/1/2017
8/2/2017
1/31/2018
8/1/2018
1/30/2019
7/31/2019
1/29/2020
7/29/2020
1/27/2021
7/28/2021
1/26/2022
7/27/2022
1/25/2023
7/26/2023
MW-8A
MW-3B
MW-10A
MW-14A
MW-18
Linear Trend MW-8A
Linear Trend MW-3B
Linear Trend MW-10A
Linear Trend MW-14A
Linear Trend MW-18


CHLORIDE
Time-Series Graph
Concentration (mg/L)
250
200
150
100
50
0
2/16/2005
8/17/2005
2/15/2006
8/16/2006
2/14/2007
8/15/2007
2/13/2008
8/13/2008
2/11/2009
8/12/2009
2/10/2010
8/11/2010
2/9/2011
8/10/2011
2/8/2012
8/8/2012
2/6/2013
8/7/2013
2/5/2014
8/6/2014
2/4/2015
8/5/2015
2/3/2016
8/3/2016
2/1/2017
8/2/2017
1/31/2018
8/1/2018
1/30/2019
7/31/2019
1/29/2020
7/29/2020
1/27/2021
7/28/2021
1/26/2022
7/27/2022
1/25/2023
7/26/2023
MW-8A
MW-3B
MW-10A
MW-14A
MW-18
Linear Trend MW-8A
Linear Trend MW-3B
Linear Trend MW-10A
Linear Trend MW-14A
Linear Trend MW-18


TOTAL CYANIDE
Time-Series Graph
Concentration (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2/16/2005
8/17/2005
2/15/2006
8/16/2006
2/14/2007
8/15/2007
2/13/2008
8/13/2008
2/11/2009
8/12/2009
2/10/2010
8/11/2010
2/9/2011
8/10/2011
2/8/2012
8/8/2012
2/6/2013
8/7/2013
2/5/2014
8/6/2014
2/4/2015
8/5/2015
2/3/2016
8/3/2016
2/1/2017
8/2/2017
1/31/2018
8/1/2018
1/30/2019
7/31/2019
1/29/2020
7/29/2020
1/27/2021
7/28/2021
1/26/2022
7/27/2022
1/25/2023
7/26/2023
MW-8A
MW-3B
MW-10A
MW-14A
MW-18
Linear Trend MW-10A
Linear Trend MW-14A
Linear Trend MW-3B
Note:
cyanide not detected
in other wells

Appendix B2
Mann-Kendall Trend Test Results

SUMMARY MANN-KENDALL TEST FOR TREND RESULTS

Well ID	Analyte	n	s	variance	Z	Probability	Trend
MW-3B	Sulfate	19	-145	810.3333	5.0586	4.22E-07	Negative
	Fluoride	19	-94	809.3333	3.2690	0.0011	Significantly Negative
	Chloride	19	-85	813	2.9460	0.0032	Significantly Negative
	Total Cyanide	10	-1	111.6667	0	1	Negative
MW-8A	Sulfate	19	-56	804.6667	1.9389	0.0525	Negative
	Fluoride	19	-81	787	2.8517	0.0043	Significantly Negative
	Chloride	19	-35	812.3333	1.1929	0.2329	Negative
	Total Cyanide	19	-9	541	0.3439	0.7309	Negative
MW-10A	Sulfate	18	67	697	2.4999	0.0124	Significantly Positive
	Fluoride	18	51	695	1.8966	0.0579	Positive
	Chloride	18	30	696	1.0992	0.2717	Positive
	Total Cyanide	18	-88	666.6667	3.3695	0.0008	Significantly Negative
MW-12A[1]	Sulfate	1	NA	NA	NA	NA	NA
	Fluoride	1	NA	NA	NA	NA	NA
	Chloride	1	NA	NA	NA	NA	NA
	Total Cyanide	1	NA	NA	NA	NA	NA
MW-14A	Sulfate	18	-97	3.6485	692.3333	0.0003	Significantly Negative
	Fluoride	18	-77	697	2.8787	0.0040	Significantly Negative
	Chloride	18	-93	695	3.4898	0.0005	Significantly Negative
	Total Cyanide	18	-106	691.3333	3.9934	6.51E-05	Negative
MW-18	Sulfate	19	-62	804	2.1513	0.0315	Significantly Negative
	Fluoride	19	-85	801.6667	2.9668	0.0030	Significantly Negative
	Chloride	19	-82	811.3333	2.8437	0.0045	Significantly Negative
	Total Cyanide	19	3	543.6667	0.0858	0.9316	Positive

Notes:
[1] No UCL calculated. Well was dry during most sampling events.
n = sample size
S = Mann-Kendall test statistic; calculated based on S and the estimated variance when the sample size is greater than 10.
Variance = Standard deviation of S squared
Z = Approximate normal test statistic; calculated based on S and the estimated variance when the sample size is 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 Test Output

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.2 9/7/2023 12:12:28 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	1400
Maximum	2700
Mean	2135
Geometric Mean	2099
Median	2200
Standard Deviation	381.7
Coefficient of Variation	0.179

Mann-Kendall Test

M-K Test Value (S)	-293
Critical Value (0.05)	-1.645
Standard Deviation of S	55.79
Standardized Value of S	-5.234
Approximate p-value	8.3159E-8

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 9/6/2023 6:05:04 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.5
Maximum	11
Mean	9.039
Geometric Mean	8.408
Median	9.5
Standard Deviation	1.898
Coefficient of Variation	0.21

Mann-Kendall Test

M-K Test Value (S)	-82
Critical Value (0.05)	-1.645
Standard Deviation of S	55.55
Standardized Value of S	-1.458
Approximate p-value	0.0724

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 9/6/2023 6:06:03 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	670
Maximum	6100
Mean	2242
Geometric Mean	1721
Median	1650
Standard Deviation	1720
Coefficient of Variation	0.767

Mann-Kendall Test

M-K Test Value (S)	180
Critical Value (0.05)	1.645
Standard Deviation of S	53.27
Standardized Value of S	3.36
Approximate p-value	3.8963E-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 9/6/2023 6:06:25 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	1
Number Values Reported (n)	9
Number Values Missing	8
Number Values Used	1
Minimum	1800
Maximum	1800
Mean	1800
Geometric Mean	1800
Median	1800
Standard Deviation	N/A
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 9/6/2023 6:06:50 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	990
Maximum	7900
Mean	3436
Geometric Mean	2890
Median	3300
Standard Deviation	1980
Coefficient of Variation	0.576

Mann-Kendall Test

M-K Test Value (S)	-168
Critical Value (0.05)	-1.645
Standard Deviation of S	53.25
Standardized Value of S	-3.136
Approximate p-value	8.5554E-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 9/6/2023 6:07:10 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

S18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	1100
Maximum	1700
Mean	1450
Geometric Mean	1440
Median	1500
Standard Deviation	169.8
Coefficient of Variation	0.117

Mann-Kendall Test

M-K Test Value (S)	-69
Critical Value (0.05)	-1.645
Standard Deviation of S	55.25
Standardized Value of S	-1.231
Approximate p-value	0.109

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 9/6/2023 6:07:30 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.12
Maximum	25
Mean	1.878
Geometric Mean	0.533
Median	0.5
Standard Deviation	4.627
Coefficient of Variation	2.464

Mann-Kendall Test

M-K Test Value (S)	-210
Critical Value (0.05)	-1.645
Standard Deviation of S	55.82
Standardized Value of S	-3.745
Approximate p-value	9.0376E-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 9/6/2023 6:07:52 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.05
Maximum	5
Mean	0.542
Geometric Mean	0.28
Median	0.185
Standard Deviation	0.983
Coefficient of Variation	1.815

Mann-Kendall Test

M-K Test Value (S)	-134
Critical Value (0.05)	-1.645
Standard Deviation of S	55.49
Standardized Value of S	-2.397
Approximate p-value	0.00827

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 9/6/2023 6:08:12 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	0.5
Maximum	25
Mean	3.497
Geometric Mean	2.624
Median	2.7
Standard Deviation	4.308
Coefficient of Variation	1.232

Mann-Kendall Test

M-K Test Value (S)	97
Critical Value (0.05)	1.645
Standard Deviation of S	53.19
Standardized Value of S	1.805
Approximate p-value	0.0356

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 9/6/2023 6:08:32 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	1
Number Values Reported (n)	9
Number Values Missing	8
Number Values Used	1
Minimum	6.3
Maximum	6.3
Mean	6.3
Geometric Mean	6.3
Median	6.3
Standard Deviation	N/A
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 9/6/2023 6:08:54 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	2.5
Maximum	32
Mean	17.13
Geometric Mean	13.18
Median	18
Standard Deviation	10.08
Coefficient of Variation	0.588

Mann-Kendall Test

M-K Test Value (S)	-188
Critical Value (0.05)	-1.645
Standard Deviation of S	53.22
Standardized Value of S	-3.514
Approximate p-value	2.2110E-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 9/6/2023 6:09:14 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

F18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.11
Maximum	25
Mean	2.299
Geometric Mean	0.485
Median	0.45
Standard Deviation	6.22
Coefficient of Variation	2.706

Mann-Kendall Test

M-K Test Value (S)	-200
Critical Value (0.05)	-1.645
Standard Deviation of S	55.74
Standardized Value of S	-3.57
Approximate p-value	1.7828E-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 9/6/2023 6:09:32 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	80
Maximum	140
Mean	104.5
Geometric Mean	103.5
Median	99.5
Standard Deviation	14.83
Coefficient of Variation	0.142

Mann-Kendall Test

M-K Test Value (S)	-276
Critical Value (0.05)	-1.645
Standard Deviation of S	55.84
Standardized Value of S	-4.925
Approximate p-value	4.2209E-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 9/6/2023 6:09:51 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	3
Maximum	6.6
Mean	4.393
Geometric Mean	4.337
Median	4.3
Standard Deviation	0.727
Coefficient of Variation	0.165

Mann-Kendall Test

M-K Test Value (S)	-119
Critical Value (0.05)	-1.645
Standard Deviation of S	55.9
Standardized Value of S	-2.111
Approximate p-value	0.0174

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 9/6/2023 6:10:53 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	23
Maximum	190
Mean	66.28
Geometric Mean	55.09
Median	48
Standard Deviation	45.57
Coefficient of Variation	0.688

Mann-Kendall Test

M-K Test Value (S)	155
Critical Value (0.05)	1.645
Standard Deviation of S	53.26
Standardized Value of S	2.892
Approximate p-value	0.00192

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 9/6/2023 6:11:14 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	1
Number Values Reported (n)	9
Number Values Missing	8
Number Values Used	1
Minimum	150
Maximum	150
Mean	150
Geometric Mean	150
Median	150
Standard Deviation	N/A
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 9/6/2023 6:11:37 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	29
Number Values Reported (n)	31
Number Values Missing	2
Number Values Used	29
Minimum	32
Maximum	210
Mean	98.97
Geometric Mean	86.71
Median	75
Standard Deviation	51.83
Coefficient of Variation	0.524

Mann-Kendall Test

M-K Test Value (S)	-132
Critical Value (0.05)	-1.645
Standard Deviation of S	53.27
Standardized Value of S	-2.459
Approximate p-value	0.00697

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 9/6/2023 6:11:58 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CH18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	59
Maximum	100
Mean	80.17
Geometric Mean	79.56
Median	80
Standard Deviation	9.966
Coefficient of Variation	0.124

Mann-Kendall Test

M-K Test Value (S)	-172
Critical Value (0.05)	-1.645
Standard Deviation of S	55.92
Standardized Value of S	-3.058
Approximate p-value	0.00111

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 9/6/2023 6:12:21 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY3B

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	31
Minimum	0.0025
Maximum	0.01
Mean	0.00584
Geometric Mean	0.0055
Median	0.005
Standard Deviation	0.00217
Coefficient of Variation	0.372

Mann-Kendall Test

M-K Test Value (S)	22
Critical Value (0.05)	1.645
Standard Deviation of S	46.63
Standardized Value of S	0.45
Approximate p-value	0.326

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 9/6/2023 6:12:44 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY8A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	31
Minimum	0.0025
Maximum	0.025
Mean	0.00621
Geometric Mean	0.00551
Median	0.005
Standard Deviation	0.00408
Coefficient of Variation	0.656

Mann-Kendall Test

M-K Test Value (S)	-27
Critical Value (0.05)	-1.645
Standard Deviation of S	46.73
Standardized Value of S	-0.556
Approximate p-value	0.289

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 9/6/2023 6:10:12 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY10A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.0025
Maximum	0.08
Mean	0.0243
Geometric Mean	0.0161
Median	0.029
Standard Deviation	0.0193
Coefficient of Variation	0.792

Mann-Kendall Test

M-K Test Value (S)	-242
Critical Value (0.05)	-1.645
Standard Deviation of S	55.34
Standardized Value of S	-4.355
Approximate p-value	6.6453E-6

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 9/6/2023 6:13:10 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY12A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	1
Number Values Reported (n)	9
Number Values Missing	8
Number Values Used	1
Minimum	0.005
Maximum	0.005
Mean	0.005
Geometric Mean	0.005
Median	0.005
Standard Deviation	N/A
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 9/6/2023 6:13:32 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY14A

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	30
Number Values Reported (n)	31
Number Values Missing	1
Number Values Used	30
Minimum	0.005
Maximum	0.35
Mean	0.0911
Geometric Mean	0.041
Median	0.0405
Standard Deviation	0.096
Coefficient of Variation	1.054

Mann-Kendall Test

M-K Test Value (S)	-264
Critical Value (0.05)	-1.645
Standard Deviation of S	55.83
Standardized Value of S	-4.71
Approximate p-value	1.2357E-6

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 9/6/2023 6:13:53 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

CY18

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	31
Number Values Reported (n)	31
Minimum	0.0025
Maximum	0.086
Mean	0.00785
Geometric Mean	0.00548
Median	0.005
Standard Deviation	0.0146
Coefficient of Variation	1.86

Mann-Kendall Test

M-K Test Value (S)	9
Critical Value (0.05)	1.645
Standard Deviation of S	42.77
Standardized Value of S	0.187
Approximate p-value	0.426

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	30.00	30.00	29.00	1.00	29.00	30.00	30.00	30.00	29.00	1.00	29.00	30.00
Num Non-Detect	0.00	1.00	0.00	0.00	0.00	0.00	8.00	8.00	4.00	0.00	2.00	8.00
Percent Non-Detect	0.00	3.33	0.00	0.00	0.00	0.00	26.67	26.67	13.79	0.00	6.90	26.67
Min.	1400.00	0.50	670.00	1800.00	990.00	1100.00	0.12	0.05	0.50	6.30	2.50	0.11
Max.	2700.00	11.00	6100.00	1800.00	7900.00	1700.00	25.00	5.00	25.00	6.30	32.00	25.00
Mean	2134.53	9.04	2241.72	1800.00	3435.86	1450.33	1.88	0.54	3.50	6.30	17.13	2.30
Max Conc (>50% ND)				NA						NA		
Log Normal				NA	3438.15					NA		
Normal	2136.18			NA		1451.98				NA		
Non-parametric		10.59	3669.32	NA			5.65	1.34	7.07	NA	25.49	7.37
Distribution	Normal	Neither	Neither	NA	Log-Normal	Normal	Neither	Neither	Neither	NA	Neither	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	30.00	30.00	29.00	1.00	29.00	30.00	31.00	31.00	30.00	1.00	30.00	31.00
Num Non-Detect	0.00	0.00	0.00	0.00	0.00	0.00	29.00	30.00	8.00	1.00	4.00	30.00
Percent Non-Detect	0.00	0.00	0.00	0.00	0.00	0.00	93.55	96.77	26.67	100.00	13.33	96.77
Min.	80.00	3.00	23.00	150.00	32.00	59.00	0.00	0.00	0.00	0.01	0.01	0.00
Max.	140.00	6.60	190.00	150.00	210.00	100.00	0.01	0.03	0.08	0.01	0.35	0.09
Mean	104.53	4.39	66.28	150.00	98.97	80.17	0.01	0.01	0.02	0.01	0.09	0.01
Max Conc (>50% ND)				NA			0.01	0.03		0.01		0.09
Log Normal			68.60	NA	101.41							
Normal	106.19	6.55		NA		81.84						
Non-parametric				NA					0.04		0.17	
Distribution	Normal	Normal	Log-Normal	NA	Log-Normal	Normal	Non-Detect (>50%)	Non-Detect (>50%)	Neither	Non-Detect (>50%)	Neither	Non-Detect (>50%)

Appendix B5
DOE Groundwater UCL Output

2300	MW-3B	Sulfate MW-3B
2500	MW-3B	
2700	MW-3B	
2600	MW-3B	
2610	MW-3B	
2220	MW-3B	
2000	MW-3B	
2500	MW-3B	
2500	MW-3B	
2500	MW-3B	
2200	MW-3B	
	MW-3B	
2200	MW-3B	
2600	MW-3B	
2200	MW-3B	
2606	MW-3B	
2300	MW-3B	
2400	MW-3B	
2000	MW-3B	
2200	MW-3B	
1900	MW-3B	
2000	MW-3B	
1900	MW-3B	
1900	MW-3B	
1700	MW-3B	
1800	MW-3B	
1500	MW-3B	
1700	MW-3B	
1500	MW-3B	
1600	MW-3B	

Number of samples			Uncensored values	
Uncensored	30		Mean	2134.53
Censored			Lognormal mean	3454.60
Detection limit or PQL			Std. devn.	381.682277
Method detection limit			Median	2200
TOTAL	30		Min.	1400
			Max.	2700

Lognormal distribution?		Normal distribution?	
r-squared is:	0.275	r-squared is:	0.823

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 2247.337

10	MW-8A	Sulfate MW-8A
9.8	MW-8A	
8.9	MW-8A	
9.6	MW-8A	
9.27	MW-8A	
9.8	MW-8A	
9.8	MW-8A	
9.7	MW-8A	
10	MW-8A	
0.5	MW-8A	
10	MW-8A	
	MW-8A	
10	MW-8A	
10	MW-8A	
9	MW-8A	
10	MW-8A	
9.3	MW-8A	
8.9	MW-8A	
7.8	MW-8A	
10	MW-8A	
9.4	MW-8A	
9.5	MW-8A	
9.5	MW-8A	
9.3	MW-8A	
9.6	MW-8A	
9.5	MW-8A	
5.4	MW-8A	
11	MW-8A	
9	MW-8A	
9.2	MW-8A	

Number of samples		Uncensored values		
Uncensored	30	Mean	9.04	
Censored		Lognormal mean	9.86	
Detection limit or PQL		Std. devn.	1.89843193	
Method detection limit		Median	9.5	
TOTAL	30	Min.	0.5	
		Max.	11	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.204	r-squared is:	0.523

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 9.544

940	MW-10A	Sulfate MW-10A
910	MW-10A	
670	MW-10A	
670	MW-10A	
1570	MW-10A	
1650	MW-10A	
860	MW-10A	
850	MW-10A	
1100	MW-10A	
1100	MW-10A	
760	MW-10A	
	MW-10A	
2700	MW-10A	
860	MW-10A	
2000	MW-10A	
760	MW-10A	
2200	MW-10A	
710	MW-10A	
1800	MW-10A	
5800	MW-10A	
4700	MW-10A	
6100	MW-10A	
1900	MW-10A	
3500	MW-10A	
2900	MW-10A	
4800	MW-10A	
4000	MW-10A	
5700	MW-10A	
	MW-10A	

Number of samples			Uncensored values	
Uncensored	29		Mean	2241.72
Censored			Lognormal mean	2292.28
Detection limit or PQL			Std. devn.	1719.87763
Method detection limit			Median	1650
TOTAL	29		Min.	670
			Max.	6100

Lognormal distribution?		Normal distribution?	
r-squared is:	0.693	r-squared is:	0.860

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 2673.91

4000 MW-14A Sulfate MW-14A
3500 MW-14A
3600 MW-14A
2800 MW-14A
2170 MW-14A

Number of samples		Uncensored values		
Uncensored	29	Mean	3435.86	
Censored		Lognormal mean	3666.57	
Detection limit or PQL		Std. devn.	1979.8458	
Method detection limit		Median	3300	
TOTAL	29	Min.	990	
		Max.	7900	

2380 MW-14A
3300 MW-14A
3900 MW-14A
4400 MW-14A
7900 MW-14A
6400 MW-14A
MW-14A
5500 MW-14A
6500 MW-14A
7000 MW-14A
5900 MW-14A

Lognormal distribution?		Normal distribution?	
r-squared is:	0.705	r-squared is:	0.968

5200 MW-14A
4000 MW-14A
3900 MW-14A
MW-14A
2300 MW-14A
2100 MW-14A
1100 MW-14A
1400 MW-14A
1700 MW-14A
1800 MW-14A
1700 MW-14A
2000 MW-14A
1100 MW-14A

Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 4022.52072167236

1500	MW-18	Sulfate MW-18
1300	MW-18	
1500	MW-18	
1300	MW-18	
1520	MW-18	
1490	MW-18	
1500	MW-18	
1600	MW-18	
1600	MW-18	
1700	MW-18	
1400	MW-18	
	MW-18	
1300	MW-18	
1600	MW-18	
1500	MW-18	
1200	MW-18	
1500	MW-18	
1600	MW-18	
1600	MW-18	
1700	MW-18	
1500	MW-18	
1700	MW-18	
1300	MW-18	
1700	MW-18	
1300	MW-18	
1400	MW-18	
1200	MW-18	
1400	MW-18	
1200	MW-18	
1300	MW-18	

Number of samples			Uncensored values	
Uncensored	30		Mean	1450.33
Censored			Lognormal mean	1462.81
Detection limit or PQL			Std. devn.	169.837312
Method detection limit			Median	1500
TOTAL	30		Min.	1100
			Max.	1700

Lognormal distribution?		Normal distribution?	
r-squared is:	0.785	r-squared is:	0.627

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 1506.603

0.6	MW-3B	Fluoride MW-3B
0.4	MW-3B	
0.6	MW-3B	
0.9	MW-3B	
0.7	MW-3B	
0.2	MW-3B	
3.7	MW-3B	
3.8	MW-3B	
3.8	MW-3B	
5	MW-3B	
0.5	MW-3B	
	MW-3B	
25	MW-3B	
5	MW-3B	
0.5	MW-3B	
0.5	MW-3B	
2.3	MW-3B	
0.5	MW-3B	
0.5	MW-3B	
0.16	MW-3B	
0.16	MW-3B	
0.18	MW-3B	
0.14	MW-3B	
0.12	MW-3B	
0.15	MW-3B	
0.16	MW-3B	
0.15	MW-3B	
0.14	MW-3B	
0.17	MW-3B	
0.17	MW-3B	

Number of samples			Uncensored values	
Uncensored	30		Mean	1.88
Censored			Lognormal mean	1.55
Detection limit or PQL			Std. devn.	4.62692099
Method detection limit			Median	0.5
TOTAL	30		Min.	0.12
			Max.	25

Lognormal distribution?		Normal distribution?	
r-squared is:	0.754	r-squared is:	0.372

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 3.263

0.9	MW-8A	Fluoride MW-8A
0.3	MW-8A	
0.4	MW-8A	
0.9	MW-8A	
2.8	MW-8A	
0.2	MW-8A	
0.1	MW-8A	
0.1	MW-8A	
0.05	MW-8A	
5	MW-8A	
0.5	MW-8A	
	MW-8A	
0.5	MW-8A	
0.1	MW-8A	
0.5	MW-8A	
0.5	MW-8A	
0.5	MW-8A	
0.5	MW-8A	
0.5	MW-8A	
0.18	MW-8A	
0.16	MW-8A	
0.19	MW-8A	
0.16	MW-8A	
0.13	MW-8A	
0.15	MW-8A	
0.15	MW-8A	
0.14	MW-8A	
0.16	MW-8A	
0.15	MW-8A	
0.18	MW-8A	

Number of samples			Uncensored values	
Uncensored	30		Mean	0.54
Censored			Lognormal mean	0.48
Detection limit or PQL			Std. devn.	0.98321458
Method detection limit			Median	0.185
TOTAL	30		Min.	0.05
			Max.	5

Lognormal distribution?		Normal distribution?	
r-squared is:	0.768	r-squared is:	0.443

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 0.833

1.8	MW-10A	Fluoride MW-10A
1.5	MW-10A	
1.2	MW-10A	
2.7	MW-10A	
2.3	MW-10A	
3.2	MW-10A	
2.3	MW-10A	
1.9	MW-10A	
3.4	MW-10A	
5	MW-10A	
1.2	MW-10A	
	MW-10A	
25	MW-10A	
5	MW-10A	
2	MW-10A	
0.5	MW-10A	
4.4	MW-10A	
1	MW-10A	
3.3	MW-10A	
1.9	MW-10A	
3.1	MW-10A	
2	MW-10A	
2	MW-10A	
2.1	MW-10A	
3.2	MW-10A	
4.1	MW-10A	
3.7	MW-10A	
4.4	MW-10A	
	MW-10A	

Number of samples			Uncensored values	
Uncensored	29		Mean	3.50
Censored			Lognormal mean	3.28
Detection limit or PQL			Std. devn.	4.30767444
Method detection limit			Median	2.7
TOTAL	29		Min.	0.5
			Max.	25

Lognormal distribution?		Normal distribution?	
r-squared is:	0.645	r-squared is:	0.437

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 4.592

9.6	MW-14A	Fluoride MW-14A
8.6	MW-14A	
30	MW-14A	
25	MW-14A	
31	MW-14A	Number of samples
27	MW-14A	Uncensored
30	MW-14A	Censored
24	MW-14A	Detection limit or PQL
16	MW-14A	Method detection limit
19	MW-14A	TOTAL
25	MW-14A	
	MW-14A	
25	MW-14A	
20	MW-14A	
30	MW-14A	Lognormal distribution?
24	MW-14A	r-squared is: 0.591
32	MW-14A	Recommendations:
18	MW-14A	Use normal distribution.
23	MW-14A	
	MW-14A	
17	MW-14A	
18	MW-14A	
6.8	MW-14A	
3.5	MW-14A	
2.5	MW-14A	UCL (based on t-statistic) is 20.102373064997
3.6	MW-14A	
2.8	MW-14A	
7	MW-14A	
7.6	MW-14A	

		Uncensored values		
	29	Mean	17.13	
		Lognormal mean	19.63	
		Std. devn.	10.0756816	
		Median	18	
	29	Min.	2.5	
		Max.	32	

Normal distribution?			
r-squared is:	0.933		

0.6	MW-18	Fluoride MW-18
0.4	MW-18	
0.4	MW-18	
1.8	MW-18	
0.9	MW-18	
0.2	MW-18	
2.6	MW-18	
2.4	MW-18	
2.6	MW-18	
0.5	MW-18	
25	MW-18	
	MW-18	
25	MW-18	
0.5	MW-18	
1	MW-18	
0.5	MW-18	
2	MW-18	
0.5	MW-18	
0.5	MW-18	
0.2	MW-18	
0.13	MW-18	
0.12	MW-18	
0.11	MW-18	
0.12	MW-18	
0.11	MW-18	
0.11	MW-18	
0.12	MW-18	
0.13	MW-18	
0.11	MW-18	
0.15	MW-18	

Number of samples			Uncensored values	
Uncensored	30		Mean	2.30
Censored			Lognormal mean	1.61
Detection limit or PQL			Std. devn.	6.22008523
Method detection limit			Median	0.45
TOTAL	30		Min.	0.11
			Max.	25

Lognormal distribution?		Normal distribution?	
r-squared is:	0.754	r-squared is:	0.353

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 4.162

130	MW-3B	Chloride MW-3B
140	MW-3B	
120	MW-3B	
130	MW-3B	
118	MW-3B	
113	MW-3B	
110	MW-3B	
110	MW-3B	
110	MW-3B	
97	MW-3B	
124.79	MW-3B	
	MW-3B	
100	MW-3B	
100	MW-3B	
96	MW-3B	
110	MW-3B	
120	MW-3B	
110	MW-3B	
98	MW-3B	
90	MW-3B	
91	MW-3B	
91	MW-3B	
80	MW-3B	
98	MW-3B	
95	MW-3B	
95	MW-3B	
93	MW-3B	
88	MW-3B	
93	MW-3B	
99	MW-3B	

Number of samples			Uncensored values	
Uncensored	30		Mean	104.53
Censored			Lognormal mean	105.19
Detection limit or PQL			Std. devn.	14.8288085
Method detection limit			Median	99.5
TOTAL	30		Min.	80
			Max.	140

Lognormal distribution?		Normal distribution?	
r-squared is:	0.818	r-squared is:	0.734

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 108.87

5.6	MW-8A	Chloride MW-8A
4.6	MW-8A	
4.2	MW-8A	
4.7	MW-8A	
4.2	MW-8A	
4.9	MW-8A	
4.6	MW-8A	
4.5	MW-8A	
6.6	MW-8A	
4.89	MW-8A	
4.2	MW-8A	
	MW-8A	
4	MW-8A	
4.5	MW-8A	
3	MW-8A	
5.5	MW-8A	
4.4	MW-8A	
3.6	MW-8A	
3.6	MW-8A	
3.8	MW-8A	
4.8	MW-8A	
4.9	MW-8A	
4.2	MW-8A	
4.1	MW-8A	
4.1	MW-8A	
3.2	MW-8A	
4.1	MW-8A	
3.9	MW-8A	
4.4	MW-8A	
3.7	MW-8A	

Number of samples		Uncensored values		
Uncensored	30	Mean	4.39	
Censored		Lognormal mean	4.37	
Detection limit or PQL		Std. devn.	0.72655612	
Method detection limit		Median	4.3	
TOTAL	30	Min.	3	
		Max.	6.6	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.809	r-squared is:	0.791

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 4.549

29 MW-10A Chloride MW-10A
31 MW-10A
28 MW-10A
28 MW-10A
43 MW-10A
48 MW-10A
35 MW-10A
30 MW-10A
45 MW-10A
36 MW-10A
30 MW-10A
MW-10A
100 MW-10A
30 MW-10A
68 MW-10A
79 MW-10A
83 MW-10A
23 MW-10A
62 MW-10A
180 MW-10A
99 MW-10A
190 MW-10A
58 MW-10A
82 MW-10A
170 MW-10A
71 MW-10A
82 MW-10A
77 MW-10A
MW-10A

Number of samples		Uncensored values		
Uncensored	29	Mean	66.28	
Censored		Lognormal mean	67.82	
Detection limit or PQL		Std. devn.	45.5716834	
Method detection limit		Median	48	
TOTAL	29	Min.	23	
		Max.	190	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.702	r-squared is:	0.851

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 78.121

110 MW-14A Chloride MW-14A
90 MW-14A
71 MW-14A
75 MW-14A
53 MW-14A
63 MW-14A
98 MW-14A
130 MW-14A
140 MW-14A
170 MW-14A
200 MW-14A
MW-14A
100 MW-14A
180 MW-14A
210 MW-14A
160 MW-14A
170 MW-14A
120 MW-14A
130 MW-14A
MW-14A
66 MW-14A
61 MW-14A
47 MW-14A
61 MW-14A
68 MW-14A
66 MW-14A
64 MW-14A
49 MW-14A
36 MW-14A

Number of samples		Uncensored values	
Uncensored	29	Mean	98.97
Censored		Lognormal mean	103.84
Detection limit or PQL		Std. devn.	51.8311012
Method detection limit		Median	75
TOTAL	29	Min.	32
		Max.	210

Lognormal distribution?		Normal distribution?	
r-squared is:	0.705	r-squared is:	0.956

Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 113.81518596958

86	MW-18	Chloride MW-18
91	MW-18	
75	MW-18	
84	MW-18	
83	MW-18	
91	MW-18	
89	MW-18	
80	MW-18	
93	MW-18	
77	MW-18	
100	MW-18	
	MW-18	
70	MW-18	
80	MW-18	
81	MW-18	
70	MW-18	
100	MW-18	
84	MW-18	
89	MW-18	
79	MW-18	
84	MW-18	
79	MW-18	
86	MW-18	
79	MW-18	
59	MW-18	
69	MW-18	
68	MW-18	
67	MW-18	
71	MW-18	
72	MW-18	

Number of samples			Uncensored values	
Uncensored	30		Mean	80.17
Censored			Lognormal mean	80.58
Detection limit or PQL			Std. devn.	9.96574593
Method detection limit			Median	80
TOTAL	30		Min.	59
			Max.	100

Lognormal distribution?		Normal distribution?	
r-squared is:	0.815	r-squared is:	0.693

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 83.164

0.005	MW-3B	Cyanide MW-3B
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.01	MW-3B	
0.01	MW-3B	
0.01	MW-3B	
0.01	MW-3B	
0.01	MW-3B	
0.0025	MW-3B	
0.006	MW-3B	
0.0025	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.01	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	
0.005	MW-3B	

Number of samples		Uncensored values		
Uncensored	31	Mean	0.01	
Censored		Lognormal mean	0.01	
Detection limit or PQL		Std. devn.	0.00217327	
Method detection limit		Median	0.005	
TOTAL	31	Min.	0.0025	
		Max.	0.01	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.689	r-squared is:	0.647

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 0.006

0.005	MW-8A	Cyanide MW-8A
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.025	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.01	MW-8A	
0.01	MW-8A	
0.01	MW-8A	
0.01	MW-8A	
0.01	MW-8A	
0.01	MW-8A	
0.0025	MW-8A	
0.0025	MW-8A	
0.0025	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	
0.005	MW-8A	

Number of samples		Uncensored values		
Uncensored	31	Mean	0.01	
Censored		Lognormal mean	0.01	
Detection limit or PQL		Std. devn.	0.00407589	
Method detection limit		Median	0.005	
TOTAL	31	Min.	0.0025	
		Max.	0.025	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.703	r-squared is:	0.504

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 0.007

0.04	MW-10A	Cyanide MW-10A
0.05	MW-10A	
0.04	MW-10A	
0.03	MW-10A	
0.03	MW-10A	
0.03	MW-10A	
0.08	MW-10A	
0.03	MW-10A	
0.04	MW-10A	
0.005	MW-10A	
0.04	MW-10A	
0.043	MW-10A	
0.05	MW-10A	
0.04	MW-10A	
0.03	MW-10A	
0.01	MW-10A	
0.032	MW-10A	
0.022	MW-10A	
0.028	MW-10A	
0.007	MW-10A	
0.008	MW-10A	
0.0025	MW-10A	
0.005	MW-10A	
0.005	MW-10A	
0.005	MW-10A	
0.005	MW-10A	
0.006	MW-10A	
0.006	MW-10A	
0.005	MW-10A	
0.005	MW-10A	

Number of samples			Uncensored values	
Uncensored	30		Mean	0.02
Censored			Lognormal mean	0.03
Detection limit or PQL			Std. devn.	0.01926963
Method detection limit			Median	0.029
TOTAL	30		Min.	0.0025
			Max.	0.08

Lognormal distribution?		Normal distribution?	
r-squared is:	0.870	r-squared is:	0.867

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 0.03

0.005	MW-14A	Cyanide MW-14A
0.005	MW-14A	
0.005	MW-14A	
0.005	MW-14A	
0.005	MW-14A	
0.008	MW-14A	
0.008	MW-14A	
0.01	MW-14A	
0.017	MW-14A	
0.018	MW-14A	
0.018	MW-14A	
0.019	MW-14A	
0.028	MW-14A	
0.03	MW-14A	
0.037	MW-14A	
0.044	MW-14A	
0.066	MW-14A	
0.086	MW-14A	
0.12	MW-14A	
0.12	MW-14A	
0.14	MW-14A	
0.14	MW-14A	
0.17	MW-14A	
0.19	MW-14A	
0.19	MW-14A	
0.19	MW-14A	
0.2	MW-14A	
0.24	MW-14A	
0.27	MW-14A	
0.35	MW-14A	

Number of samples		Uncensored values	
Uncensored	30	Mean	0.09
Censored		Lognormal mean	0.12
Detection limit or PQL		Std. devn.	0.09603043
Method detection limit		Median	0.0405
TOTAL	30	Min.	0.005
		Max.	0.35

Lognormal distribution?		Normal distribution?	
r-squared is:	0.920	r-squared is:	0.847

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.268284195294017

0.005	MW-18	Cyanide MW-18
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.01	MW-18	
0.01	MW-18	
0.01	MW-18	
0.0025	MW-18	
0.0025	MW-18	
0.0025	MW-18	
0.005	MW-18	
0.005	MW-18	
0.086	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	
0.005	MW-18	

Number of samples			Uncensored values	
Uncensored		31	Mean	0.01
Censored			Lognormal mean	0.01
Detection limit or PQL			Std. devn.	0.01460833
Method detection limit			Median	0.005
TOTAL		31	Min.	0.0025
			Max.	0.086

Lognormal distribution?		Normal distribution?	
r-squared is:	0.493	r-squared is:	0.220

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (based on Z-statistic) is 0.012

Appendix B6
EPA Groundwater UCL Output

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 9/7/2023 2:02:11 PM
From File	WSI2023_1.0.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

S3B

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	1400	Mean	
Maximum	2700	Median	
SD	381.7	Std. Error of Mean	
Coefficient of Variation	0.179	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.135	**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	2253	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.656	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.157	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	30.36	k star (bias corrected MLE)
Theta hat (MLE)	70.3	Theta star (bias corrected MLE)
nu hat (MLE)	1822	nu star (bias corrected)
MLE Mean (bias corrected)	2135	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.041	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	2263	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.165	**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	7.244	Mean of logged Data
Maximum of Logged Data	7.901	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	2272	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	2458	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	2872	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2249	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	2249	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	2250	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	2344	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	2570	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL 2253

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 statistici

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 positvely skewed data sets.

S8A

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	29	Number of Non-Detects	
Number of Distinct Detects	15	Number of Distinct Non-Detects	
Minimum Detect	5.4	Minimum Non-Detect	
Maximum Detect	11	Maximum Non-Detect	
Variance Detects	1.039	Percent Non-Detects	
Mean Detects	9.333	SD Detects	
Median Detects	9.5	CV Detects	
Skewness Detects	-2.348	Kurtosis Detects	
Mean of Logged Detects	2.226	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.898	Detected Data Not Normal at 1% Significance Leve
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.189	Detected Data Not Normal at 1% Significance Leve

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.039	KM Standard Error of Mean
90KM SD	1.867	95% KM (BCA) UCL
95% KM (t) UCL	9.628	95% KM (Percentile Bootstrap) UCL
95% KM (z) UCL	9.609	95% KM Bootstrap t UCL
90% KM Chebyshev UCL	10.08	95% KM Chebyshev UCL
97.5% KM Chebyshev UCL	11.2	99% KM Chebyshev UCL

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.756	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected Data Not Gamma Distributed at 5% Significance
K-S Test Statistic	0.258	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.162	Detected Data Not Gamma Distributed at 5% Significance

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	70.35	k star (bias corrected MLE)
Theta hat (MLE)	0.133	Theta star (bias corrected MLE)
nu hat (MLE)	4081	nu star (bias corrected)
Mean (detects)	9.333	

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	5.4	Mean	
Maximum	11	Median	
SD	1.062	CV	
k hat (MLE)	65.13	k star (bias corrected MLE)	
Theta hat (MLE)	0.142	Theta star (bias corrected MLE)	
nu hat (MLE)	3908	nu star (bias corrected)	
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (N/A, α)	3382	Adjusted Chi Square Value (N/A, β)	
95% Gamma Approximate UCL	9.644	95% Gamma Adjusted UCL	

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.039	SD (KM)	
Variance (KM)	3.484	SE of Mean (KM)	
k hat (KM)	23.45	k star (KM)	
nu hat (KM)	1407	nu star (KM)	
theta hat (KM)	0.385	theta star (KM)	
80% gamma percentile (KM)	10.64	90% gamma percentile (KM)	
95% gamma percentile (KM)	12.5	99% gamma percentile (KM)	

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1186	Adjusted Chi Square Value (N/A, β)	
95% KM Approximate Gamma UCL	9.661	95% KM Adjusted Gamma UCL	

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.679	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.937	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.148	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.263	Mean in Log Scale	
SD in Original Scale	1.074	SD in Log Scale	
95% t UCL (assumes normality of ROS data)	9.596	95% Percentile Bootstrap UCL	
95% BCA Bootstrap UCL	9.526	95% Bootstrap t UCL	
95% H-UCL (Log ROS)	9.681		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.129	KM Geo Mean	
KM SD (logged)	0.539	95% Critical H Value (KM-Log)	
KM Standard Error of Mean (logged)	0.1	95% H-UCL (KM -Log)	

KM SD (logged)	0.539	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.1	

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	9.031	Mean in Log Scale
SD in Original Scale	1.937	SD in Log Scale
95% t UCL (Assumes normality)	9.632	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	9.628

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 statistici

S10A

General Statistics

Total Number of Observations	29	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	670	Mean	
Maximum	6100	Median	
SD	1720	Std. Error of Mean	
Coefficient of Variation	0.767	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.898	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.189	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	2785	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.999	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Data Not Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.165	Detected data appear Gamma Distributed at 5% Significan

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

Gamma Statistics

k hat (MLE)	2.041	k star (bias corrected MLE)
Theta hat (MLE)	1098	Theta star (bias corrected MLE)
nu hat (MLE)	118.4	nu star (bias corrected)
MLE Mean (bias corrected)	2242	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.0407	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	2850	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.937	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.148	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
Maximum of Logged Data	8.716	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	3031	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	3654	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	5489	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2767	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	2761	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	2806	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	3200	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	4236	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Adjusted Gamma UCL	2891

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 statistici

S12A

General Statistics

Total Number of Observations	1	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	1800	Mean	
Maximum	1800	Median	

Warning: This data set only has 1 observations!

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

The data set for variable S12A 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.

S14A

General Statistics

Total Number of Observations	29	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	990	Mean	
Maximum	7900	Median	
SD	1980	Std. Error of Mean	
Coefficient of Variation	0.576	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.898	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.189	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	4061	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.381	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.106	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.164	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.045	k star (bias corrected MLE)
Theta hat (MLE)	1128	Theta star (bias corrected MLE)
nu hat (MLE)	176.6	nu star (bias corrected)
MLE Mean (bias corrected)	3436	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.0407	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	4173	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.937	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.148	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.898	Mean of logged Data	
Maximum of Logged Data	8.975	SD of logged Data	

Assuming Lognormal Distribution

95% H-UCL	4443	90% Chebyshev (MVUE) UCL	
95% Chebyshev (MVUE) UCL	5319	97.5% Chebyshev (MVUE) UCL	
99% Chebyshev (MVUE) UCL	7688		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4041	95% BCA Bootstrap UCL	
95% Standard Bootstrap UCL	4042	95% Bootstrap-t UCL	
95% Hall's Bootstrap UCL	4093	95% Percentile Bootstrap UCL	
90% Chebyshev(Mean, Sd) UCL	4539	95% Chebyshev(Mean, Sd) UCL	
97.5% Chebyshev(Mean, Sd) UCL	5732	99% Chebyshev(Mean, Sd) UCL	

Suggested UCL to Use

95% Student's-t UCL	4061

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 statistici

S18

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	1100	Mean	
Maximum	1700	Median	
SD	169.8	Std. Error of Mean	
Coefficient of Variation	0.117	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.9	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.159	**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	1503	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.754	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Lev	
K-S Test Statistic	0.173	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.16	Data Not Gamma Distributed at 5% Significance Lev	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	73.3	k star (bias corrected MLE)	
Theta hat (MLE)	19.79	Theta star (bias corrected MLE)	
nu hat (MLE)	4398	nu star (bias corrected)	
MLE Mean (bias corrected)	1450	MLE Sd (bias corrected)	
		Approximate Chi Square Value (0.05)	
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	

Assuming Gamma Distribution

95% Approximate Gamma UCL	1506	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.178	**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	7.003	Mean of logged Data
Maximum of Logged Data	7.438	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	1507	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	1589	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	1767	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1501	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	1500	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	1500	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	1543	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	1644	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL 1503

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 statistici

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 positvely skewed data sets.

F3B

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	22	Number of Non-Detects	
Number of Distinct Detects	15	Number of Distinct Non-Detects	
Minimum Detect	0.12	Minimum Non-Detect	
Maximum Detect	3.8	Maximum Non-Detect	
Variance Detects	1.631	Percent Non-Detects	
Mean Detects	0.856	SD Detects	
Median Detects	0.175	CV Detects	
Skewness Detects	1.822	Kurtosis Detects	
Mean of Logged Detects	-0.993	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.602	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.878	Detected Data Not Normal at 1% Significance Leve
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.214	Detected Data Not Normal at 1% Significance Leve

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.73	KM Standard Error of Mean
90KM SD	1.157	95% KM (BCA) UCL
95% KM (t) UCL	1.117	95% KM (Percentile Bootstrap) UCL
95% KM (z) UCL	1.105	95% KM Bootstrap t UCL
90% KM Chebyshev UCL	1.414	95% KM Chebyshev UCL
97.5% KM Chebyshev UCL	2.154	99% KM Chebyshev UCL

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.563	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.786	Detected Data Not Gamma Distributed at 5% Significance
K-S Test Statistic	0.307	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.193	Detected Data Not Gamma Distributed at 5% Significance

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.719	k star (bias corrected MLE)
Theta hat (MLE)	1.19	Theta star (bias corrected MLE)
nu hat (MLE)	31.64	nu star (bias corrected)
Mean (detects)	0.856	

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean
Maximum	3.8	Median
SD	1.129	CV
k hat (MLE)	0.61	k star (bias corrected MLE)
Theta hat (MLE)	1.143	Theta star (bias corrected MLE)
nu hat (MLE)	36.61	nu star (bias corrected)
Adjusted Level of Significance (β)	0.041	
Approximate Chi Square Value (34.28, α)	21.89	Adjusted Chi Square Value (34.28, β)
95% Gamma Approximate UCL	1.092	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.73	SD (KM)
Variance (KM)	1.339	SE of Mean (KM)
k hat (KM)	0.397	k star (KM)
nu hat (KM)	23.84	nu star (KM)
theta hat (KM)	1.836	theta star (KM)
80% gamma percentile (KM)	1.17	90% gamma percentile (KM)
95% gamma percentile (KM)	3.086	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.79, α)	12.93	Adjusted Chi Square Value (22.79, β)
95% KM Approximate Gamma UCL	1.286	95% KM Adjusted Gamma UCL

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.926	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.169	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.701	Mean in Log Scale
SD in Original Scale	1.12	SD in Log Scale
95% t UCL (assumes normality of ROS data)	1.048	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	1.118	95% Bootstrap t UCL
95% H-UCL (Log ROS)	1.023	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.142	KM Geo Mean

KM SD (logged)	1.127	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.224	95% H-UCL (KM -Log)
KM SD (logged)	1.127	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.224	

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	1.253	Mean in Log Scale
SD in Original Scale	2.438	SD in Log Scale
95% t UCL (Assumes normality)	2.009	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL 1.117

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 statistici

F8A

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	22	Number of Non-Detects	
Number of Distinct Detects	13	Number of Distinct Non-Detects	
Minimum Detect	0.05	Minimum Non-Detect	
Maximum Detect	2.8	Maximum Non-Detect	
Variance Detects	0.35	Percent Non-Detects	
Mean Detects	0.352	SD Detects	
Median Detects	0.16	CV Detects	
Skewness Detects	3.745	Kurtosis Detects	
Mean of Logged Detects	-1.591	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.456	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.878	Detected Data Not Normal at 1% Significance Leve
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.214	Detected Data Not Normal at 1% Significance Leve

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.307	KM Standard Error of Mean
90KM SD	0.511	95% KM (BCA) UCL
95% KM (t) UCL	0.473	95% KM (Percentile Bootstrap) UCL
95% KM (z) UCL	0.468	95% KM Bootstrap t UCL
90% KM Chebyshev UCL	0.6	95% KM Chebyshev UCL
97.5% KM Chebyshev UCL	0.916	99% KM Chebyshev UCL

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.832	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.77	Detected Data Not Gamma Distributed at 5% Significance
K-S Test Statistic	0.348	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.191	Detected Data Not Gamma Distributed at 5% Significance

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.049	k star (bias corrected MLE)
Theta hat (MLE)	0.336	Theta star (bias corrected MLE)
nu hat (MLE)	46.14	nu star (bias corrected)
Mean (detects)	0.352	

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean
Maximum	2.8	Median
SD	0.518	CV
k hat (MLE)	0.917	k star (bias corrected MLE)
Theta hat (MLE)	0.341	Theta star (bias corrected MLE)
nu hat (MLE)	55.05	nu star (bias corrected)
Adjusted Level of Significance (β)	0.041	
Approximate Chi Square Value (50.88, α)	35.5	Adjusted Chi Square Value (50.88, β)
95% Gamma Approximate UCL	0.448	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.307	SD (KM)
Variance (KM)	0.261	SE of Mean (KM)
k hat (KM)	0.361	k star (KM)
nu hat (KM)	21.67	nu star (KM)
theta hat (KM)	0.851	theta star (KM)
80% gamma percentile (KM)	0.486	90% gamma percentile (KM)
95% gamma percentile (KM)	1.34	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.84, α)	11.47	Adjusted Chi Square Value (20.84, β)
95% KM Approximate Gamma UCL	0.558	95% KM Adjusted Gamma UCL

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.926	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.169	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.31	Mean in Log Scale
SD in Original Scale	0.511	SD in Log Scale
95% t UCL (assumes normality of ROS data)	0.468	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	0.573	95% Bootstrap t UCL
95% H-UCL (Log ROS)	0.373	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.662	KM Geo Mean
KM SD (logged)	0.788	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.157	95% H-UCL (KM -Log)

KM SD (logged)	0.788	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.157	

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	0.4	Mean in Log Scale
SD in Original Scale	0.643	SD in Log Scale
95% t UCL (Assumes normality)	0.599	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.473

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 statistici

F10A

General Statistics

Total Number of Observations	29	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	25	Number of Non-Detects	
Number of Distinct Detects	17	Number of Distinct Non-Detects	
Minimum Detect	1	Minimum Non-Detect	
Maximum Detect	4.4	Maximum Non-Detect	
Variance Detects	1.048	Percent Non-Detects	
Mean Detects	2.636	SD Detects	
Median Detects	2.3	CV Detects	
Skewness Detects	0.215	Kurtosis Detects	
Mean of Logged Detects	0.889	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.886	Detected Data appear Normal at 1% Significance Lev	
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.201	Detected Data appear Normal at 1% Significance Lev	

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.554	KM Standard Error of Mean	
90KM SD	1.066	95% KM (BCA) UCL	
95% KM (t) UCL	2.917	95% KM (Percentile Bootstrap) UCL	
95% KM (z) UCL	2.905	95% KM Bootstrap t UCL	
90% KM Chebyshev UCL	3.194	95% KM Chebyshev UCL	
97.5% KM Chebyshev UCL	3.886	99% KM Chebyshev UCL	

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.448	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significan	
K-S Test Statistic	0.15	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.175	Detected data appear Gamma Distributed at 5% Significan	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.405	k star (bias corrected MLE)	
Theta hat (MLE)	0.412	Theta star (bias corrected MLE)	
nu hat (MLE)	320.3	nu star (bias corrected)	
Mean (detects)	2.636		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.715	Mean
Maximum	4.4	Median
SD	1.021	CV
k hat (MLE)	5.72	k star (bias corrected MLE)
Theta hat (MLE)	0.446	Theta star (bias corrected MLE)
nu hat (MLE)	331.8	nu star (bias corrected)
Adjusted Level of Significance (β)	0.0407	
Approximate Chi Square Value (298.78, α)	259.7	Adjusted Chi Square Value (298.78, β)
95% Gamma Approximate UCL	2.936	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.554	SD (KM)
Variance (KM)	1.136	SE of Mean (KM)
k hat (KM)	5.74	k star (KM)
nu hat (KM)	332.9	nu star (KM)
theta hat (KM)	0.445	theta star (KM)
80% gamma percentile (KM)	3.42	90% gamma percentile (KM)
95% gamma percentile (KM)	4.637	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (299.79, α)	260.7	Adjusted Chi Square Value (299.79, β)
95% KM Approximate Gamma UCL	2.937	95% KM Adjusted Gamma UCL

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.931	Detected Data appear Lognormal at 10% Significance l
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.159	Detected Data appear Lognormal at 10% Significance l

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.548	Mean in Log Scale
SD in Original Scale	1.014	SD in Log Scale
95% t UCL (assumes normality of ROS data)	2.869	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	2.865	95% Bootstrap t UCL
95% H-UCL (Log ROS)	3.016	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.828	KM Geo Mean
KM SD (logged)	0.507	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.101	95% H-UCL (KM -Log)

KM SD (logged)	0.507	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.101	

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	2.884	Mean in Log Scale
SD in Original Scale	2.125	SD in Log Scale
95% t UCL (Assumes normality)	3.556	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.917

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 statistici

F12A

General Statistics

Total Number of Observations	1	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	6.3	Mean	
Maximum	6.3	Median	

Warning: This data set only has 1 observations!

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

The data set for variable F12A 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.

F14A

General Statistics

Total Number of Observations	29	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	27	Number of Non-Detects	
Number of Distinct Detects	23	Number of Distinct Non-Detects	
Minimum Detect	2.5	Minimum Non-Detect	
Maximum Detect	32	Maximum Non-Detect	
Variance Detects	104.2	Percent Non-Detects	
Mean Detects	16.55	SD Detects	
Median Detects	18	CV Detects	
Skewness Detects	0.0238	Kurtosis Detects	
Mean of Logged Detects	2.532	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.894	Detected Data appear Normal at 1% Significance Lev
Lilliefors Test Statistic	0.159	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.194	Detected Data appear Normal at 1% Significance Lev

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	16.24	KM Standard Error of Mean
90KM SD	9.932	95% KM (BCA) UCL
95% KM (t) UCL	19.51	95% KM (Percentile Bootstrap) UCL
95% KM (z) UCL	19.4	95% KM Bootstrap t UCL
90% KM Chebyshev UCL	22	95% KM Chebyshev UCL
97.5% KM Chebyshev UCL	28.23	99% KM Chebyshev UCL

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.017	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.757	Detected Data Not Gamma Distributed at 5% Significance
K-S Test Statistic	0.169	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.171	Detected data appear Gamma Distributed at 5% Significan

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

Gamma Statistics on Detected Data Only

k hat (MLE)	1.97	k star (bias corrected MLE)
Theta hat (MLE)	8.398	Theta star (bias corrected MLE)
nu hat (MLE)	106.4	nu star (bias corrected)
Mean (detects)	16.55	

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.5	Mean
Maximum	32	Median
SD	9.943	CV
k hat (MLE)	2.065	k star (bias corrected MLE)
Theta hat (MLE)	7.848	Theta star (bias corrected MLE)
nu hat (MLE)	119.8	nu star (bias corrected)
Adjusted Level of Significance (β)	0.0407	
Approximate Chi Square Value (108.73, α)	85.67	Adjusted Chi Square Value (108.73, β)
95% Gamma Approximate UCL	20.57	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	16.24	SD (KM)
Variance (KM)	98.64	SE of Mean (KM)
k hat (KM)	2.674	k star (KM)
nu hat (KM)	155.1	nu star (KM)
theta hat (KM)	6.074	theta star (KM)
80% gamma percentile (KM)	23.77	90% gamma percentile (KM)
95% gamma percentile (KM)	36.31	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (140.38, α)	114	Adjusted Chi Square Value (140.38, β)
95% KM Approximate Gamma UCL	20	95% KM Adjusted Gamma UCL

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.935	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.153	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	16.07	Mean in Log Scale
SD in Original Scale	10.02	SD in Log Scale
95% t UCL (assumes normality of ROS data)	19.24	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	19.12	95% Bootstrap t UCL
95% H-UCL (Log ROS)	24.54	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.511	KM Geo Mean
KM SD (logged)	0.83	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.162	95% H-UCL (KM -Log)

KM SD (logged)	0.83	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.162	

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	16.27	Mean in Log Scale
SD in Original Scale	9.892	SD in Log Scale
95% t UCL (Assumes normality)	19.39	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	19.51

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 statistici

F18

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	22	Number of Non-Detects	
Number of Distinct Detects	13	Number of Distinct Non-Detects	
Minimum Detect	0.11	Minimum Non-Detect	
Maximum Detect	2.6	Maximum Non-Detect	
Variance Detects	0.819	Percent Non-Detects	
Mean Detects	0.739	SD Detects	
Median Detects	0.175	CV Detects	
Skewness Detects	1.264	Kurtosis Detects	
Mean of Logged Detects	-1.048	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.713	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.878	Detected Data Not Normal at 1% Significance Leve	
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.214	Detected Data Not Normal at 1% Significance Leve	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.615	KM Standard Error of Mean	
90KM SD	0.82	95% KM (BCA) UCL	
95% KM (t) UCL	0.885	95% KM (Percentile Bootstrap) UCL	
95% KM (z) UCL	0.876	95% KM Bootstrap t UCL	
90% KM Chebyshev UCL	1.091	95% KM Chebyshev UCL	
97.5% KM Chebyshev UCL	1.607	99% KM Chebyshev UCL	

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.917	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.781	Detected Data Not Gamma Distributed at 5% Significance	
K-S Test Statistic	0.265	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.796	k star (bias corrected MLE)	
Theta hat (MLE)	0.928	Theta star (bias corrected MLE)	
nu hat (MLE)	35.04	nu star (bias corrected)	
Mean (detects)	0.739		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean
Maximum	2.6	Median
SD	0.814	CV
k hat (MLE)	0.684	k star (bias corrected MLE)
Theta hat (MLE)	0.882	Theta star (bias corrected MLE)
nu hat (MLE)	41.06	nu star (bias corrected)
Adjusted Level of Significance (β)	0.041	
Approximate Chi Square Value (38.29, α)	25.12	Adjusted Chi Square Value (38.29, β)
95% Gamma Approximate UCL	0.921	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.615	SD (KM)
Variance (KM)	0.673	SE of Mean (KM)
k hat (KM)	0.562	k star (KM)
nu hat (KM)	33.7	nu star (KM)
theta hat (KM)	1.094	theta star (KM)
80% gamma percentile (KM)	1.012	90% gamma percentile (KM)
95% gamma percentile (KM)	2.316	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.66, α)	19.8	Adjusted Chi Square Value (31.66, β)
95% KM Approximate Gamma UCL	0.983	95% KM Adjusted Gamma UCL

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.926	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.169	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.605	Mean in Log Scale
SD in Original Scale	0.806	SD in Log Scale
95% t UCL (assumes normality of ROS data)	0.855	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	0.887	95% Bootstrap t UCL
95% H-UCL (Log ROS)	0.991	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.239	KM Geo Mean

KM SD (logged)	1.149	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.226	95% H-UCL (KM -Log)
KM SD (logged)	1.149	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.226	

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	1.42	Mean in Log Scale
SD in Original Scale	3.116	SD in Log Scale
95% t UCL (Assumes normality)	2.387	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.885

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 statistici

CH3B

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	80	Mean	
Maximum	140	Median	
SD	14.83	Std. Error of Mean	
Coefficient of Variation	0.142	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data appear 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 appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**
95% Student's-t UCL	109.1	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.6	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.16	Data Not Gamma Distributed at 5% Significance Lev

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

Gamma Statistics

k hat (MLE)	53.41	k star (bias corrected MLE)
Theta hat (MLE)	1.957	Theta star (bias corrected MLE)
nu hat (MLE)	3205	nu star (bias corrected)
MLE Mean (bias corrected)	104.5	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.041	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	109.2	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.146	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
Maximum of Logged Data	4.942	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	109.3	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	116.1	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	130.9	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	109	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	109	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	109.6	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	112.6	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	121.4	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	109.1

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 statistici

CH8A

General Statistics

Total Number of Observations	30	Number of Distinct Observations
		Number of Missing Observations
Minimum	3	Mean
Maximum	6.6	Median
SD	0.727	Std. Error of Mean
Coefficient of Variation	0.165	Skewness

Normal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.109	**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	4.618	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.291	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.0933	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	39.28	k star (bias corrected MLE)
Theta hat (MLE)	0.112	Theta star (bias corrected MLE)
nu hat (MLE)	2357	nu star (bias corrected)
MLE Mean (bias corrected)	4.393	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.041	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.624	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0976	**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	1.099	Mean of logged Data
Maximum of Logged Data	1.887	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	4.63	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	4.962	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	5.692	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4.611	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	4.606	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	4.67	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	4.791	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	5.221	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	4.618

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 statistici

CH10A

General Statistics

Total Number of Observations	29	Number of Distinct Observations
		Number of Missing Observations
Minimum	23	Mean
Maximum	190	Median
SD	45.57	Std. Error of Mean
Coefficient of Variation	0.688	Skewness

Normal GOF Test

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.898	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.189	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	80.67	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.933	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Data Not Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.141	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.164	Detected data appear Gamma Distributed at 5% Significan

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

Gamma Statistics

k hat (MLE)	2.861	k star (bias corrected MLE)
Theta hat (MLE)	23.16	Theta star (bias corrected MLE)
nu hat (MLE)	166	nu star (bias corrected)
MLE Mean (bias corrected)	66.28	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.0407	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	81.02	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.937	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.113	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.148	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
Maximum of Logged Data	5.247	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	82.72	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	98.79	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	141.7	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	80.2	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	79.97	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	83.15	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	91.66	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	119.1	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	80.67

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 statistici

CH12A

General Statistics

Total Number of Observations	1	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	150	Mean	
Maximum	150	Median	

Warning: This data set only has 1 observations!

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

The data set for variable CH12A 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.

CH14A

General Statistics

Total Number of Observations	29	Number of Distinct Observations
		Number of Missing Observations
Minimum	32	Mean
Maximum	210	Median
SD	51.83	Std. Error of Mean
Coefficient of Variation	0.524	Skewness

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.898	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.189	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	115.3	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.611	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.157	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.163	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.943	k star (bias corrected MLE)
Theta hat (MLE)	25.1	Theta star (bias corrected MLE)
nu hat (MLE)	228.7	nu star (bias corrected)
MLE Mean (bias corrected)	98.97	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.0407	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	117.3	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.937	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.131	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.148	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
Maximum of Logged Data	5.347	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	121.2	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	143.4	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	200.2	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	114.8	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	114.8	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	116.1	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	127.8	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	159.1	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	115.3

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 statistici

CH18

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Minimum	59	Mean	
Maximum	100	Median	
SD	9.966	Std. Error of Mean	
Coefficient of Variation	0.124	Skewness	

Normal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.0937	**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	83.26	95% Adjusted-CLT UCL (Chen-1995)
		95% Modified-t UCL (Johnson-1978)

Gamma GOF Test

A-D Test Statistic	0.282	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.102	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	66.28	k star (bias corrected MLE)	
Theta hat (MLE)	1.21	Theta star (bias corrected MLE)	
nu hat (MLE)	3977	nu star (bias corrected)	
MLE Mean (bias corrected)	80.17	MLE Sd (bias corrected)	
		Approximate Chi Square Value (0.05)	
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	

Assuming Gamma Distribution

95% Approximate Gamma UCL	83.38	95% Adjusted Gamma UCL

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.939	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.111	**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	4.078	Mean of logged Data
Maximum of Logged Data	4.605	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	83.48	90% Chebyshev (MVUE) UCL
95% Chebyshev (MVUE) UCL	88.21	97.5% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL	98.53	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	83.16	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	83.09	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	83.12	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	85.63	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	91.53	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	83.26

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 statistici

CY3B

General Statistics

Total Number of Observations	31	Number of Distinct Observations	
Number of Detects	2	Number of Non-Detects	
Number of Distinct Detects	2	Number of Distinct Non-Detects	
Minimum Detect	0.006	Minimum Non-Detect	
Maximum Detect	0.01	Maximum Non-Detect	
Variance Detects	8.0000E-6	Percent Non-Detects	
Mean Detects	0.008	SD Detects	
Median Detects	0.008	CV Detects	
Skewness Detects	N/A	Kurtosis Detects	
Mean of Logged Detects	-4.861	SD of Logged Detects	

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00288	KM Standard Error of Mean	
90KM SD	0.00147	95% KM (BCA) UCL	
95% KM (t) UCL	0.00352	95% KM (Percentile Bootstrap) UCL	
95% KM (z) UCL	0.0035	95% KM Bootstrap t UCL	
90% KM Chebyshev UCL	0.00402	95% KM Chebyshev UCL	
97.5% KM Chebyshev UCL	0.00525	99% KM Chebyshev UCL	

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	15.66	k star (bias corrected MLE)	
Theta hat (MLE)	5.1087E-4	Theta star (bias corrected MLE)	
nu hat (MLE)	62.64	nu star (bias corrected)	
Mean (detects)	0.008		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00288	SD (KM)	
Variance (KM)	2.1463E-6	SE of Mean (KM)	
k hat (KM)	3.858	k star (KM)	
nu hat (KM)	239.2	nu star (KM)	
theta hat (KM)	7.4590E-4	theta star (KM)	
80% gamma percentile (KM)	0.00403	90% gamma percentile (KM)	

95% gamma percentile (KM)	0.00578	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)
Approximate Chi Square Value (217.36, α)	184.2	Adjusted Chi Square Value (217.36, β)
95% KM Approximate Gamma UCL	0.00339	95% KM Adjusted Gamma UCL

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00179	Mean in Log Scale
SD in Original Scale	0.00197	SD in Log Scale
95% t UCL (assumes normality of ROS data)	0.00239	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	0.00251	95% Bootstrap t UCL
95% H-UCL (Log ROS)	0.00257	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.913	KM Geo Mean
KM SD (logged)	0.292	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.0767	95% H-UCL (KM -Log)
KM SD (logged)	0.292	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.0767	

Note: KM UCLs may be biased low with this dataset. Other substitution method recommended

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	0.00318	Mean in Log Scale
SD in Original Scale	0.00172	SD in Log Scale
95% t UCL (Assumes normality)	0.0037	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.00352

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 statistici

CY8A

General Statistics

Total Number of Observations	31	Number of Distinct Observations	
Number of Detects	0	Number of Non-Detects	
Number of Distinct Detects	0	Number of Distinct Non-Detects	

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV

The data set for variable CY8A was not processed!

CY10A

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	22	Number of Non-Detects	
Number of Distinct Detects	12	Number of Distinct Non-Detects	
Minimum Detect	0.005	Minimum Non-Detect	
Maximum Detect	0.08	Maximum Non-Detect	
Variance Detects	3.2371E-4	Percent Non-Detects	
Mean Detects	0.0312	SD Detects	
Median Detects	0.03	CV Detects	
Skewness Detects	0.508	Kurtosis Detects	
Mean of Logged Detects	-3.702	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.878	Detected Data appear Normal at 1% Significance Lev	
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.214	Detected Data appear Normal at 1% Significance Lev	

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0236	KM Standard Error of Mean	
90KM SD	0.0196	95% KM (BCA) UCL	
95% KM (t) UCL	0.0299	95% KM (Percentile Bootstrap) UCL	
95% KM (z) UCL	0.0297	95% KM Bootstrap t UCL	
90% KM Chebyshev UCL	0.0346	95% KM Chebyshev UCL	
97.5% KM Chebyshev UCL	0.0466	99% KM Chebyshev UCL	

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.441	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance	
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.188	Detected Data Not Gamma Distributed at 5% Significance	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.275	k star (bias corrected MLE)	
Theta hat (MLE)	0.0137	Theta star (bias corrected MLE)	
nu hat (MLE)	100.1	nu star (bias corrected)	
Mean (detects)	0.0312		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean
Maximum	0.08	Median
SD	0.018	CV
k hat (MLE)	1.959	k star (bias corrected MLE)
Theta hat (MLE)	0.0131	Theta star (bias corrected MLE)
nu hat (MLE)	117.5	nu star (bias corrected)
Adjusted Level of Significance (β)	0.041	
Approximate Chi Square Value (107.12, α)	84.23	Adjusted Chi Square Value (107.12, β)
95% Gamma Approximate UCL	0.0325	95% Gamma Adjusted UCL

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0236	SD (KM)
Variance (KM)	3.8592E-4	SE of Mean (KM)
k hat (KM)	1.446	k star (KM)
nu hat (KM)	86.75	nu star (KM)
theta hat (KM)	0.0163	theta star (KM)
80% gamma percentile (KM)	0.037	90% gamma percentile (KM)
95% gamma percentile (KM)	0.0642	99% gamma percentile (KM)

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (79.40, α)	59.87	Adjusted Chi Square Value (79.40, β)
95% KM Approximate Gamma UCL	0.0313	95% KM Adjusted Gamma UCL

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.926	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.169	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0243	Mean in Log Scale
SD in Original Scale	0.0193	SD in Log Scale
95% t UCL (assumes normality of ROS data)	0.0303	95% Percentile Bootstrap UCL
95% BCA Bootstrap UCL	0.0305	95% Bootstrap t UCL
95% H-UCL (Log ROS)	0.043	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.3	KM Geo Mean
KM SD (logged)	1.202	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.225	95% H-UCL (KM -Log)

KM SD (logged)	1.202	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.225	

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	0.0236	Mean in Log Scale
SD in Original Scale	0.02	SD in Log Scale
95% t UCL (Assumes normality)	0.0298	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0299

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 statistici

CY12A

General Statistics

Total Number of Observations	1	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	0	Number of Non-Detects	
Number of Distinct Detects	0	Number of Distinct Non-Detects	

Warning: This data set only has 1 observations!

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

The data set for variable CY12A 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.

CY14A

General Statistics

Total Number of Observations	30	Number of Distinct Observations	
		Number of Missing Observations	
Number of Detects	26	Number of Non-Detects	
Number of Distinct Detects	20	Number of Distinct Non-Detects	
Minimum Detect	0.005	Minimum Non-Detect	
Maximum Detect	0.35	Maximum Non-Detect	
Variance Detects	0.00933	Percent Non-Detects	
Mean Detects	0.104	SD Detects	
Median Detects	0.076	CV Detects	
Skewness Detects	0.835	Kurtosis Detects	
Mean of Logged Detects	-2.87	SD of Logged Detects	

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.891	Detected Data Not Normal at 1% Significance Leve
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.199	Detected Data appear Normal at 1% Significance Le

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0911	KM Standard Error of Mean
90KM SD	0.0944	95% KM (BCA) UCL
95% KM (t) UCL	0.121	95% KM (Percentile Bootstrap) UCL
95% KM (z) UCL	0.12	95% KM Bootstrap t UCL
90% KM Chebyshev UCL	0.144	95% KM Chebyshev UCL
97.5% KM Chebyshev UCL	0.201	99% KM Chebyshev UCL

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.696	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.776	Detected data appear Gamma Distributed at 5% Significan
K-S Test Statistic	0.147	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.177	Detected data appear Gamma Distributed at 5% Significan

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.951	k star (bias corrected MLE)	
Theta hat (MLE)	0.11	Theta star (bias corrected MLE)	
nu hat (MLE)	49.45	nu star (bias corrected)	
Mean (detects)	0.104		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	
Maximum	0.35	Median	
SD	0.0954	CV	
k hat (MLE)	0.828	k star (bias corrected MLE)	
Theta hat (MLE)	0.111	Theta star (bias corrected MLE)	
nu hat (MLE)	49.68	nu star (bias corrected)	
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (46.05, α)	31.48	Adjusted Chi Square Value (46.05, β)	
95% Gamma Approximate UCL	0.134	95% Gamma Adjusted UCL	

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0911	SD (KM)	
Variance (KM)	0.00891	SE of Mean (KM)	
k hat (KM)	0.932	k star (KM)	
nu hat (KM)	55.9	nu star (KM)	
theta hat (KM)	0.0978	theta star (KM)	
80% gamma percentile (KM)	0.148	90% gamma percentile (KM)	
95% gamma percentile (KM)	0.288	99% gamma percentile (KM)	

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (51.64, α)	36.14	Adjusted Chi Square Value (51.64, β)	
95% KM Approximate Gamma UCL	0.13	95% KM Adjusted Gamma UCL	

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.933	Detected Data Not Lognormal at 10% Significance Le
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.156	Detected Data Not Lognormal at 10% Significance Le

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0909	Mean in Log Scale	
SD in Original Scale	0.0962	SD in Log Scale	
95% t UCL (assumes normality of ROS data)	0.121	95% Percentile Bootstrap UCL	
95% BCA Bootstrap UCL	0.125	95% Bootstrap t UCL	
95% H-UCL (Log ROS)	0.333		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.194	KM Geo Mean	
KM SD (logged)	1.431	95% Critical H Value (KM-Log)	
KM Standard Error of Mean (logged)	0.266	95% H-UCL (KM -Log)	

KM SD (logged)	1.431	95% Critical H Value (KM-Log)
KM Standard Error of Mean (logged)	0.266	

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed
Mean in Original Scale	0.0908	Mean in Log Scale
SD in Original Scale	0.0963	SD in Log Scale
95% t UCL (Assumes normality)	0.121	95% H-Stat UCL

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.121

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 statistici

CY18

General Statistics

Total Number of Observations	31	Number of Distinct Observations	
Number of Detects	1	Number of Non-Detects	
Number of Distinct Detects	1	Number of Distinct Non-Detects	

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EI

The data set for variable CY18 was not processed!

16
1
2135
2200
69.69
-0.324

2245
2252

ce Level

ce Level

27.35
78.05
1641
408.2
1548
1543

2271

7.649
0.189

2358
2598

2242
2257
2243
2438
2828

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an.

16
1
1
1
0.5
0.5
3.333%
1.019
0.109
7.651
0.129

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l

0.347
9.522
9.529
9.486
10.55
12.49

e Level

e Level

63.1
0.148
3660

9.269
9.5
0.115
58.64
0.158
3518

3374
9.666

1.867
0.347
21.13
1268
0.428
11.63
14.23

1182
9.699

vel

vel

2.218
0.134
9.569
9.538

8.408
1.984
11.85

1.984

2.106

0.672

13.39

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an.

25
2
2242
1650
319.4
1.121

2838
2796

el

ce Level

1.853
1210
107.5
1647
84.55
83.34

2891

7.45
0.732

3208
4273

2833
2888
2777
3634
5419

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an.

1
8
1800
1800

24
2
3436
3300
367.6
0.659

4089
4069

ce Level

ce Level

2.753
1248
159.7
2071
131.5
129.9

4222

7.969
0.618

4742
6118

4147
4131
4068
5038
7094

..

an.

9
1
1450
1500
31.01
-0.231

1500
1503

el

el

65.99
21.98
3959
178.5
3814
3806

1509

7.273
0.12

1546
1649

1503
1502
1501
1585
1759

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an.

18
1
8
3
0.5
25
26.67%
1.277
1.492
1.841
1.22

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l

0.228
1.157
1.141
1.304
1.724
2.999

e Level

e Level

0.651
1.314
28.66

0.697
0.175
1.619
0.571
1.22
34.28

21.32
1.121

1.157
0.228
0.38
22.79
1.921
2.079
5.63

12.5
1.33

vel

vel

-1.111
1.099
1.038
1.256

0.319

2.641
1.047
2.641

-0.814
1.323
2.171

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an.

15
1
8
2
0.5
5
26.67%
0.592
1.68
15.18
0.881

ıl

ıl

0.0975
0.474
0.482
0.788
0.732
1.277

e Level

e Level

0.936
0.376
41.18

0.312
0.16
1.659
0.848
0.368
50.88

34.75
0.457

0.511
0.0975
0.347
20.84
0.885
0.888
2.492

11.07
0.578

vel

vel

-1.638
0.799
0.484
0.749

0.19
2.227
0.359

2.227

-1.459

0.878

0.5

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an.

20
2
4
3
0.5
25
13.79%
1.024
0.388
-1.048
0.422

vel

vel

0.213
2.921
2.914
2.933
3.484
4.677

ce Level

ce Level

5.663
0.465
283.2

2.552
2.3
0.4
5.151
0.495
298.8

257.6
2.96

1.066
0.213
5.169
299.8
0.494
4.057
5.861

258.5
2.962

_evel

_evel

0.85
0.439
2.857
2.896

2.289
1.952
3.139

1.952

0.869

0.658

3.838

..

an.

1
8
6.3
6.3

23
2
2
1
25
25
6.897%
10.21
0.617
-1.479
0.846

vel

vel

1.92
19.32
19.37
19.53
24.61
35.35

e Level

ce Level

1.776
9.317
95.91

16.21
17
0.613
1.875
8.646
108.7

84.45
20.87

9.932
1.92
2.42
140.4
6.71
30.22
49.67

112.6
20.25

vel

vel

2.51
0.823
19.15
19.43

12.32
2.266
24.81

2.266

2.531

0.816

24.79

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an.

15
1
8
3
0.2
25
26.67%
0.905
1.225
0.023
1.24

l

l

0.159
0.893
0.89
0.946
1.307
2.196

e Level

e Level

0.718
1.029
31.6

0.604
0.15
1.347
0.638
0.946
38.29

24.5
0.944

0.82
0.159
0.528
31.66
1.165
1.644
3.961

19.26
1.01

vel

vel

-1.199
1.128
0.841
0.939

0.29

2.67

0.991

2.67

-0.908

1.431

2.535

..

an.

19
1
104.5
99.5
2.707
0.645

109.3
109.2

ce Level

el

48.09
2.174
2885
15.07
2762
2755

109.5

4.64
0.138

112.5
121.1

109.7
109.7
109.2
116.3
131.5

..

an.

20
1
4.393
4.3
0.133
0.806

4.632
4.622

ce Level

ce Level

35.37
0.124
2122
0.739
2016
2010

4.638

1.467
0.162

4.784
5.208

4.629
4.644
4.61
4.971
5.713

..

an.

25
2
66.28
48
8.462
1.63

82.93
81.1

el

ce Level

2.588
25.6
150.1
41.19
122.8
121.3

82

4.009
0.596

88.36
113.3

83.28
85.04
80.66
103.2
150.5

..

an.

1
8
150
150

25
2
98.97
75
9.625
0.73

116.2
115.6

ce Level

ce Level

3.558
27.82
206.3
52.47
174.1
172.3

118.5

4.463
0.527

129.6
162.6

117.7
117.4
115.6
140.9
194.7

..

an.

19
1
80.17
80
1.819
0.0853

83.19
83.26

ce Level

ce Level

59.67
1.343
3580
10.38
3442
3435

83.57

4.377
0.126

85.71
91.69

83.17
83.17
83.07
88.1
98.27

..

an.

4
29
3
0.0025
0.01
93.55%
0.00283
0.354
N/A
0.361

3.7992E-4
N/A
N/A
N/A
0.00453
0.00666

N/A
N/A
N/A

0.00147
3.7992E-4
3.506
217.4
8.2075E-4
0.00494

0.00759

0.0413
182.5
0.00343

-6.726
0.885
0.00239
0.00284

0.0027
1.789
0.00311
1.789

-5.851
0.426
0.00364

..

an.

4
31
4

).

14
1
8
3
0.0025
0.01
26.67%
0.018
0.576
1.288
0.803

vel

vel

0.00367
0.0304
0.03
0.0297
0.0396
0.0602

e Level

e Level

1.995
0.0157
87.78

0.0256
0.029
0.706
1.785
0.0143
107.1

83.06
0.033

0.0196
0.00367
1.323
79.4
0.0178
0.0508
0.0948

58.9
0.0318

vel

vel

-4.136
1.017
0.0301
0.0309

0.0136
2.742
0.0516

2.742

-4.313

1.249

0.0561

..

an.

1
8
1
1

20
1
4
1
0.005
0.005
13.33%
0.0966
0.925
-0.0818
1.28

:l

vel

0.0176
0.118
0.121
0.126
0.168
0.266

ce Level

ce Level

0.867
0.12
45.07

0.0918
0.0405
1.039
0.767
0.12
46.05

30.78
0.137

0.0944
0.0176
0.861
51.64
0.106
0.218
0.453

35.39
0.133

vel

vel

-3.255
1.559
0.122
0.126

0.041
3.063
0.257

3.063

-3.287

1.605

0.365

..

an.

4
30
3

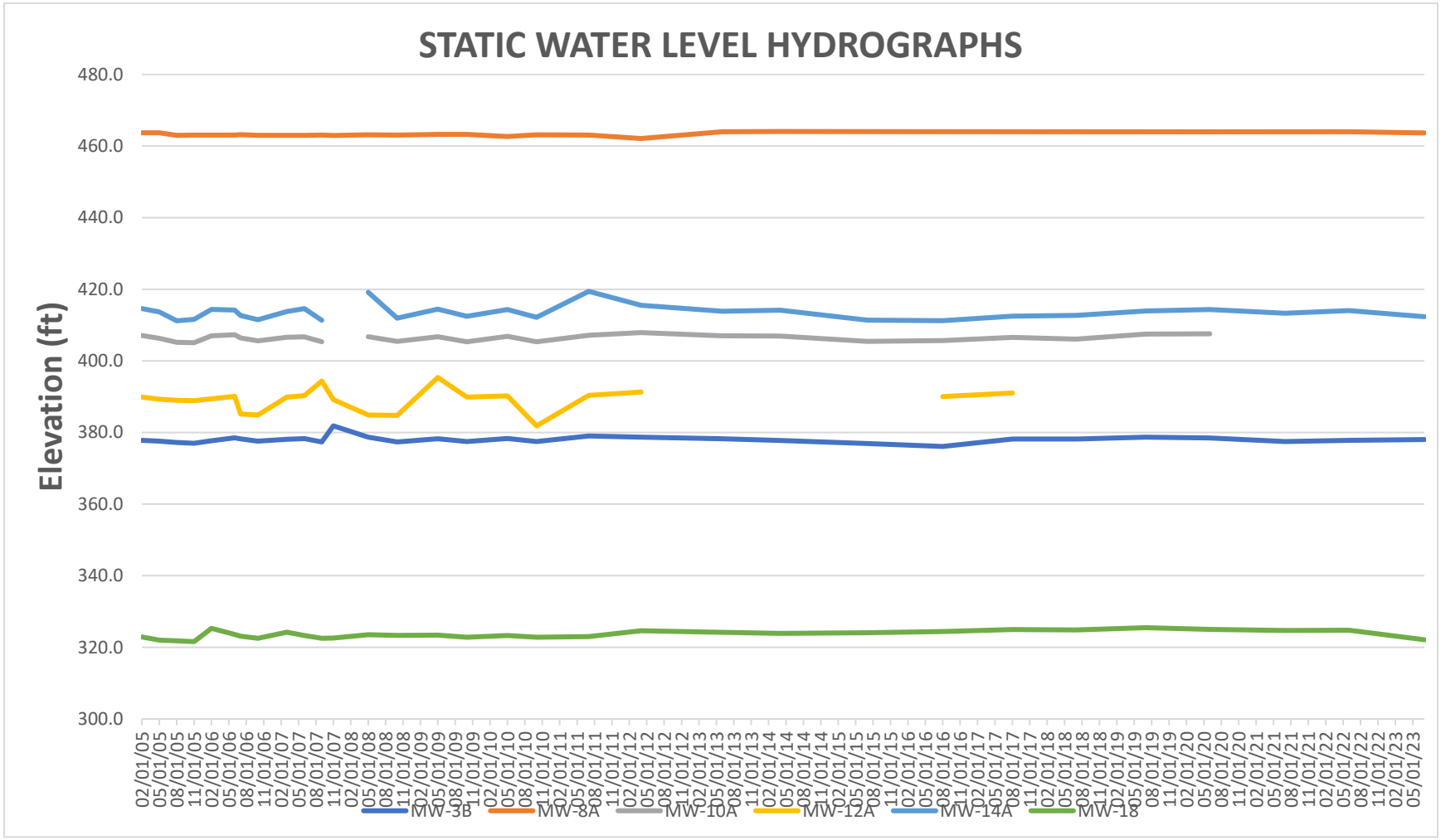
PC, BTV).

Appendix B7
Calculator Input Table

Date	S3B	D_S3B	S8A	D_S8A	S10A	D_S10A	S12A	D_S12A	S14A	D_S14A	S18	D_S18	F3B	D_F3B	F8A	D_F8A	F10A	D_F10A	F12A	D_F12A	F14A	D_F14A	F18	D_F18	CH3B	D_CH3B	CH8A	D_CH8A	CH10A	D_CH10A	CH12A	D_CH12A	CH14A	D_CH14A	CH18	D_CH18	CY3B	D_CY3B	CY8A	D_CY8A	CY10A	D_CY10A	CY12A	D_CY12A	CY14A	D_CY14A	CY18	D_CY18
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	0.025	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	0.0025	0	0.0025	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	0.006	1	0.0025	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	0.0025	0	0.0025	0	0.0025	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
6/30/2020	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
8/16/2021	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
7/15/2022	1600	1	9.2	1	2100	1			990	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
7/27/2023	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

Appendix C – Groundwater Levels

Appendix C1
Monitoring Wells Hydrographs


STATIC WATER LEVEL HYDROGRAPHS
Elevation (ft)
480.0
460.0
440.0
420.0
400.0
380.0
360.0
340.0
320.0
300.0
MW-3B
MW-8A
MW-10A
MW-12A
MW-14A
MW-18

Appendix C2
Static Water Levels

GROUNDWATER STATIC WATER LEVEL ELEVATIONS

		Well ID					
		MW-3B	MW-8A	MW-10A	MW-12A	MW-14A	MW-18
Elevation (ft.)	Ground	408	490	425	439	429	346
	PVC	410.97	492.97	427.95	441.38	431.65	348.40
Water Level Elevation from PVC (ft.)	09/08/04	378.1	463.7	406.6	390.2	413.2	NA [a]
	02/16/05	377.8	463.7	407.1	389.9	414.6	322.9
	05/11/05	377.6	463.7	406.3	389.3	413.7	322.0
	08/29/05	377.2	463.0	405.2	389.0	411.2	321.8
	11/01/05	377.0	463.1	405.1	388.9	411.6	321.6
	02/27/06	377.7	463.1	407.0	389.4	414.4	325.3
	06/05/06	378.5	463.1	407.3	390.1	414.2	323.6
	07/31/06	378.2	463.2	406.4	385.2	412.7	323.1
	10/09/06	377.6	463.0	405.6	384.9	411.5	322.5
	03/13/07	378.1	463.0	406.6	389.9	413.8	324.2
	06/22/07	378.3	463.0	406.7	390.3	414.6	323.3
	09/24/07	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
	05/08/08	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
	05/28/09	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
	05/26/10	378.3	462.7	406.9	390.2	414.4	323.3
	10/06/10	377.5	463.2	405.4	381.9	412.2	322.8
	07/06/11	379.0	463.1	407.2	390.4	419.5	323.0
	04/17/12	378.7	462.1	407.9	391.3	415.5	324.6
	6/20/2013	378.27	464.02	407	dry	413.85	324.18
	4/25/2014	377.8	464.1	407.0	dry	414.2	323.9
	7/20/2015	376.9	464.1	405.5	dry	411.4	324.1
	8/2/2016	376.12	464.00	405.68	390.04	411.25	324.40
	8/8/2017	378.17	463.97	406.55	391.05	412.50	324.96
	7/26/2018	378.16	464.00	406.10	dry	412.72	324.85
	7/24/2019	378.68	464.05	407.5	dry	413.93	325.5
	6/20/2020	378.46	463.97	407.56	dry	414.35	324.98
	7/29/2021	377.47	463.97	dry	dry	413.32	324.70
	6/30/2022	377.79	464.02	406.56	dry	414.05	324.77
	7/20/2023	378.04	463.66	405.81	dry	412.34	322.11

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.

Appendix D – Surface Maintenance Annual Report

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: 2022/2023 1st Quarter Inspection

QUARTERLY & YEARLY INSPECTIONS: 2022/2023 1st Quarter Inspection

DATES and INITIALS: 11/16/2022 C.K.

COVER SYSTEM:	Rodent Holes	None
	Woody Vegetation	None observed on cap
	Security Fence	Good Condition
	Signs of Erosion	
Storm Water Conveyance System		Good Condition
	Blockage	None Observed
	Settlement Buildup	None Observed

Corrective Action Taken: Cleared out the sagebrush at the gate

Additional Comments:

Looking west across the WSI.

Sagebrush at the entrance to the gate near the southeast corner of the WSI.

Cleared out sagebrush at the gated entrance in the southeast corner of the WSI.

View looking east across southern portion of the WSI.

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: 2022/2023 2nd Quarter Inspection

QUARTERLY & YEARLY INSPECTIONS: 2022/2023 2nd Quarter Inspection

DATES and INITIALS: 2/28/2023 C.K.

COVER SYSTEM:	Rodent Holes	None
	Woody Vegetation	None observed on cap
	Security Fence	Good Condition
	Signs of Erosion	
Storm Water Conveyance System		Good Condition
	Blockage	None Observed
	Settlement Buildup	None Observed

Corrective Action Taken: Cleared out the sagebrush at the gate

Additional Comments:

Looking west across the WSI.

Sagebrush at the entrance to the gate near the southeast corner of the WSI.

Cleared out sagebrush at the gated entrance in the southeast corner of the WSI.

View looking east across southern portion of the WSI.

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: 2022/2023 3rd Quarter Inspection

QUARTERLY & YEARLY INSPECTIONS: 2022/2023 3rd Quarter Inspection

DATES and INITIALS: 5/26/2023 C.K.

COVER SYSTEM:	Rodent Holes	None
	Woody Vegetation	None observed on cap
	Security Fence	Good Condition
	Signs of Erosion	
Storm Water Conveyance System		Good Condition
	Blockage	None Observed
	Settlement Buildup	None Observed

Corrective Action Taken: Cleared out the sagebrush at the gate

Cap of WSI was also recently sprayed

Additional Comments:

Looking west across the WSI.

Sagebrush at the entrance to the gate near the southeast corner of the WSI.

Cleared out sagebrush at the gated entrance in the southeast corner of the WSI.

View looking east across southern portion of the WSI.

WSI MAINTENACE AND INSPECTION ACTIVITIES

INSPECTIONS: 2022/2023 4th Quarter Inspection

QUARTERLY & YEARLY INSPECTIONS: 2022/2023 4th Quarter Inspection

DATES and INITIALS: 8/22/2023 C.K.

COVER SYSTEM:	Rodent Holes	None
	Woody Vegetation	None observed on cap
	Security Fence	Good Condition
	Signs of Erosion	
Storm Water Conveyance System		Good Condition
	Blockage	None Observed
	Settlement Buildup	None Observed

Corrective Action Taken:

Fixed rodent holes along fence line

Additional Comments:

Looking west across the WSI.

Sagebrush at the entrance to the gate near the southeast corner of the WSI.

Cleared out sagebrush at the gated entrance in the southeast corner of the WSI.

View looking east across southern portion of the WSI.