Annual Groundwater Monitoring Report

Kentucky Power Company

Big Sandy Plant

Fly Ash Pond CCR Management Unit

Louisa, Kentucky

January 2022

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KENTUCKY POWER
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I. Overview

This *Annual Groundwater Monitoring Report* has been prepared to report the status of activities for the preceding year for an existing CCR unit at Kentucky Power Company's Big Sandy Power Plant. Kentucky Power Company is a wholly owned subsidiary of American Electric Power Company (AEP). The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31.

In general, the following activities were completed:

- The CCR unit was in Assessment monitoring at the beginning and end of 2021;
- All monitoring wells that were installed and developed to establish a certified groundwater monitoring system around the CCR unit, in accordance with the requirements of 40 CFR 257.91 and documented in AEP's *Groundwater Monitoring Network Evaluation (Geosyntec, December 2016)* were sampled pursuant to 40 CFR 257.95(b) on March 9, 2021 and March 10, 2021, pursuant to 40 CFR 257.95(d)(1) on June 8, 2021 and June 9, 2021, and pursuant to 40 CFR 257.95(d)(1) on October 5, 2021 and October 6, 2021. All samples collected during the March 2021 sampling event were analyzed for all constituents in Appendix IV of the CCR rules. All samples collected during the June 2021 sampling event were analyzed for all constituents in Appendix III of the CCR rules and for those Appendix IV constituents detected during the March 2021 sampling event. All samples collected during the October 2021 sampling event were analyzed for all constituents in Appendix III of the CCR rules and for those Appendix IV constituents detected during the March 2021 sampling event. All sampling and analyses were in accordance with 40 CFR 257.94 *et seq.*, AEP's *Groundwater Sampling and Analysis Plan (AEP and EHS Support, October 2016), and AEP's Statistical Analysis Plan (Geosyntec, January 2017)*. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009);
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Statistical analysis of the background and assessment monitoring data was conducted in accordance with *AEP's Statistical Analysis Plan (Geosyntec, January 2017)* to establish groundwater protection standards and to determine whether or not one or more Appendix IV constituents were detected at statistically significant levels (SSLs) above the corresponding groundwater protection standards in assessment monitoring samples collected during the October 2020 and the March and June 2021 sampling events. The corresponding statistical analyses were completed on February 3, 2021 and October 7, 2021, respectively. Statistical analyses of samples collected during the October 2021 sampling event will be completed in 2022;

- The statistical evaluation of data collected during the October 2020 sampling event concluded that three Appendix IV constituents were detected at SSLs above the corresponding groundwater protection standard at the same well (beryllium, cobalt, and lithium, at monitoring well, MW-1603). The statistical evaluation of data collected during the March and June 2021 sampling events concluded that three Appendix IV constituents were detected at SSLs above the corresponding groundwater protection standard at the same well (beryllium, cobalt, and lithium, at monitoring well, MW-1603). These statistical evaluations are discussed further in Section V of this report;
- Because Appendix IV constituents were found to be detected at SSLs above the corresponding groundwater protection standard statistical limits during the October 2020 sampling event and corresponding February 2021 statistical evaluation, an alternative source demonstration (ASD) study was conducted resulting in an April 2021 ASD report. Because Appendix IV constituents were found to be detected at SSLs above the corresponding groundwater protection standard statistical limits during the March and June 2021 sampling events and corresponding statistical evaluation, an alternative source demonstration (ASD) study was conducted resulting in a November 2021 ASD report. These ASD studies are discussed further in Section VI of this report.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A figure showing the CCR unit, all groundwater monitoring wells, and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs (attached as Appendixes 1 and 2);
- Results of the required statistical analysis of groundwater monitoring results (Attached as Appendix 3, where applicable);
- Results of alternate source demonstrations (Attached as Appendix 4, where applicable);
- A summary of any transition between monitoring programs or an alternate monitoring frequency (Notices attached as Appendix 5, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement regarding the rationale for the installation/decommission (Attached as Appendix 6, where applicable); and
- Other information required in the annual report such as an assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

A figure depicting the PE-certified groundwater monitoring network, with the monitoring well locations and their corresponding identification numbers, is in Appendix 2.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2021. The network design, as summarized in the *Groundwater Monitoring Network Evaluation* (*Geosyntec, December 2016*) and as posted at the CCR web site for Big Sandy Plant, did not change. That report, viewable on the publicly accessible AEP CCR Rule Compliance Data and Information Internet site at the following link: http://www.aep.com/about/codeofconduct/ccrrule/, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations, and upgradient monitoring well locations.

IV. Groundwater Quality Data, Static Water Elevation Data, Flow Rate, and Direction

Appendix 1 contains Table 1 showing the data analyzed from the samples collected during the assessment monitoring events in 2021, including the number of samples collected per well, the sample collection dates, and the groundwater velocities for each sampling event. Table 1 also includes background data collected during the eight background sampling events and previous detection and assessment monitoring data. Static water elevation data and groundwater flow directions, in the form of potentiometric surface maps, from each monitoring event in 2021 are shown in Appendix 2.

V. Statistical Analysis of Groundwater Monitoring Data

Statistical analyses of data collected during the October 2020 sampling events for determination of SSLs detected above (or outside for pH) the corresponding groundwater protection standard statistical limits were completed and documented in the February 3, 2020 *Statistical Analysis Summary (Geosyntec, February 2021)*. Statistical analyses of data collected during the March and June 2021 sampling events for determination of SSLs detected above (or outside for pH) the corresponding groundwater protection standard statistical limits were completed and documented in the October 7, 2021 *Statistical Analysis Summary (Geosyntec, October 2021)*. The statistical analysis summaries contain full statistical evaluations in Attachment B of each corresponding

summary and are provided in Appendix 3 of this report. SSLs of beryllium, cobalt, and lithium were identified above the corresponding groundwater protection standard statistical limits at one monitoring well, MW-1603, in both statistical evaluations.

VI. Alternative Source Demonstration

In an attempt to demonstrate that a source other than the CCR unit caused the SSLs detected in samples collected during the October 2020 sampling events, or that the SSLs resulted from errors in sampling, analysis, statistical evaluation, or natural variations in groundwater quality, an alternative source evaluation including an assessment of site and regional geochemistry along with historical data for the CCR unit was conducted by EHS Support LLC (EHS Support). This evaluation resulted in the *Alternative Source Demonstration Addendum Report for the October 2020 Monitoring Data (EHS Support, April 2021)*. In an attempt to demonstrate that a source other than the CCR unit caused the SSLs detected in samples collected during the March and June 2021 sampling events, or that the SSLs resulted from errors in sampling, analysis, statistical evaluation, or natural variations in groundwater quality, an alternative source evaluation including an assessment of site and regional geochemistry along with historical data for the CCR unit was conducted by EHS Support LLC (EHS Support). This evaluation resulted in the *Alternative Source Demonstration Addendum Report for the March and June 2021 Monitoring Data (EHS Support, November 2021)*. The alternative source demonstration reports are included in Appendix 4. The reports concluded that the elevated concentrations of beryllium, cobalt, and lithium in the monitoring well are "due to the oxidation of sulfide minerals present in coal seams that have been intersected by well MW-1603, including organic material within the screened interval that is identified as having 'a slight coaly texture.'"

VII. Discussion about Transition between Monitoring Requirements or Alternate Monitoring Frequency

No transition between monitoring requirements occurred in 2021; the CCR unit remained in assessment monitoring. A statement to this effect is provided in Appendix 5.

Because the alternative source demonstrations were successful in demonstrating that the Appendix IV SSLs detected in samples collected from Monitoring Well MW-1603 were not derived from the CCR constituents within the CCR unit, the assessment monitoring program was continued. The fly ash pond would return to a detection monitoring program if all Appendix III and IV constituents are below background values for two consecutive monitoring events.

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production are high enough at this facility that no modification to the semiannual assessment monitoring frequency is needed at this time.

VIII. Other Information Required

The CCR unit has progressed from detection monitoring to its current status in assessment monitoring. All required information has been included in this annual groundwater monitoring report. At the appropriate time, hydrogeological, geochemical, and statistical analyses of the groundwater assessment monitoring data will continue to attempt demonstrations of whether or not an alternative source or sources other than the CCR unit are causing the detection of SSLs above (or outside for pH) the corresponding groundwater protection standard statistical limits, or if the SSLs resulted from error in sampling, analysis, statistical evaluation or natural variation in groundwater quality. In those cases where an alternative source demonstration is made, the analyses and supporting information will be presented as well. This is likely to continue occurring at Monitoring Well MW-1603 because the well was screened across highly organic layers of rock with a coal-like texture that results in groundwater samples with a much lower pH than any other compliance well in the groundwater monitoring network. This well has not remained downgradient of the CCR unit because static water elevations in the well were found to be lower than the elevation of surface water remaining in the fly ash pond since March 2020 during the pond's closure. The unit was dewatered of all ponded surface water prior to completion of the geomembrane liner installation within the final cover system on November 24, 2020. Since ponded surface water no longer remains within the CCR unit, the well is currently under consideration for removal from the CCR groundwater monitoring network.

IX. Description of Any Problems Encountered in 2021 and Actions Taken

No significant problems were encountered. Through previous, proper construction of monitoring wells and use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater, with low turbidity, were obtained and the schedule to support preparation of this annual groundwater monitoring report was met. It is possible, however, that future necessary monitoring wells may not encounter earth materials with grain sizes coarse enough to produce low turbidity monitoring well samples no matter how carefully the monitoring wells are constructed and the groundwater samples are collected.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2022 include the following:

- Continued assessment monitoring sampling of CCR wells for all Appendix IV constituents annually pursuant to 40 CFR 257.95(b) and, pursuant to 40 CFR 257.95(d)(1), for all Appendix III constituents and those Appendix IV constituents detected during the previous sampling performed pursuant to 40 CFR 257.95(b);

- Continued establishment of groundwater protection standard statistical limits for all Appendix IV constituents and statistical comparison of Appendix IV concentrations in downgradient monitoring wells to those standards;
- If a groundwater protection standard is exceeded in a downgradient well that is not demonstrated to be due to a source other than the CCR unit or resulting from errors in sampling, analysis, statistical evaluation, or natural variations in groundwater quality by a successful alternative source demonstration, the following activities will be undertaken:
    - Prepare a notification identifying the constituents in Appendix IV that have exceeded the groundwater protection standard and place the notification in the facility's operating record;
    - Characterize the nature and extent of the potential release by installing additional monitoring wells as necessary, including at least one additional monitoring well at the facility boundary in the direction of potential contaminant migration;
    - Sample all wells in accordance with 40 CFR 257.95(d)(1) to characterize the nature and extent of the potential release.
    - Estimate the quantity of material potentially released including specific information on the Appendix IV constituents and the levels at which they are present in the material;
    - If contaminants have migrated off-site, notify all persons who own or reside on land that directly overlies any part of the plume of contamination and place the notification in the facility's operating record;
    - Initiate an assessment of corrective measures to prevent further releases, to remediate any releases, and to restore affected areas to original conditions;
- Respond to any new data received in light of CCR rule requirements;
- Prepare a sixth annual groundwater monitoring report documenting activities that were undertaken in 2022.

APPENDIX 1—Tables

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program.

Table 1 - Groundwater Data Summary: MW-1011
Big Sandy - FAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.071	79.1	3.39	0.19	7.0	79.5	388
11/9/2016	Background	0.081	74.6	3.43	0.21	7.0	74.4	360
1/12/2017	Background	0.103	75.4	2.83	0.25	6.9	72.8	363
2/21/2017	Background	0.098	75.8	2.68	0.21	7.1	72.5	371
4/25/2017	Background	0.148	78.0	2.71	0.23	6.7	74.7	358
5/24/2017	Background	0.156	85.2	2.86	0.20	6.7	73.8	370
6/21/2017	Background	0.129	72.6	2.19	0.22	6.7	69.4	338
7/13/2017	Background	0.111	78.1	2.31	0.21	7.1	78.2	371
9/18/2017	Detection	0.146	80.1	2.85	0.18	6.9	78.0	372
4/26/2018	Assessment	0.139	105	4.71	0.20	6.3	106	456
9/20/2018	Assessment	0.165	72.7	3.43	0.28	7.0	76.3	386
3/13/2019	Assessment	0.101	80.5	5.22	0.24	6.5	84.2	411
6/27/2019	Assessment	0.119	75.3	4.20	0.27	7.0	75.2	386
8/21/2019	Assessment	0.117	86.2	4.41	0.26	7.1	76.2	385
3/17/2020	Assessment	--	--	--	0.24	7.5	--	--
6/29/2020	Assessment	0.111	82.8	5.10	0.24	6.9	82.8	--
8/26/2020	Assessment	--	--	--	--	4.3	--	443
10/5/2020	Assessment	0.105	82.7	4.86	0.26	7.2	81.5	388
3/9/2021	Assessment	--	--	--	0.29	6.9	--	--
6/9/2021	Assessment	0.092	81.2	5.02	0.28	6.8	82.0	380
10/5/2021	Assessment	0.118	79.0	3.74	0.28	6.9	78.1	380

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1011
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	1.01	17.8	52.0	< 0.005 U1	0.02	0.5	2.85	2.56	0.19	0.214	0.011	< 0.002 U1	1.80	0.09 J1	0.229
11/9/2016	Background	0.75	9.93	48.1	< 0.005 U1	0.02 J1	0.744	1.12	3.56	0.21	0.297	0.017	< 0.002 U1	1.51	0.07 J1	0.162
1/12/2017	Background	0.36	10.5	47.7	< 0.005 U1	0.01 J1	0.369	1.47	5.24	0.25	0.026	0.009	< 0.002 U1	1.39	0.03 J1	0.160
2/21/2017	Background	0.28	11.1	49.5	< 0.005 U1	0.008 J1	0.189	1.09	3.43	0.21	0.024	0.016	< 0.002 U1	1.21	< 0.03 U1	0.153
4/25/2017	Background	0.26	11.9	53.0	< 0.004 U1	0.01 J1	0.223	1.23	2.65	0.23	0.035	0.003	< 0.002 U1	1.23	< 0.03 U1	0.102
5/24/2017	Background	0.22	9.46	54.7	< 0.004 U1	0.008 J1	0.318	1.15	2.566	0.20	0.020	0.005	< 0.002 U1	0.99	< 0.03 U1	0.134
6/21/2017	Background	0.24	5.57	45.7	< 0.004 U1	0.006 J1	0.294	0.413	2.576	0.22	0.01 J1	0.014	0.004 J1	1.34	0.05 J1	0.098
7/13/2017	Background	0.24	5.92	46.0	< 0.004 U1	0.01 J1	0.223	0.444	2.353	0.21	0.054	0.010	< 0.002 U1	1.39	0.03 J1	0.091
4/26/2018	Assessment	0.16	13.5	63.1	< 0.004 U1	< 0.005 U1	0.207	3.25	5.69	0.20	0.095	0.010	< 0.002 U1	0.82	< 0.03 U1	0.121
9/20/2018	Assessment	0.18	7.25	44.8	< 0.02 U1	< 0.01 U1	0.588	0.683	2.56	0.28	0.08	0.009	--	0.8	< 0.03 U1	< 0.1 U1
10/23/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/13/2019	Assessment	0.15	7.53	49.2	< 0.02 U1	< 0.01 U1	0.576	0.709	2.425	0.24	0.217	0.02 J1	< 0.002 U1	0.9 J1	< 0.03 U1	< 0.1 U1
6/27/2019	Assessment	0.15	5.17	47.5	< 0.02 U1	< 0.01 U1	0.304	0.438	2.582	0.27	0.181	< 0.009 U1	< 0.002 U1	0.7 J1	< 0.03 U1	< 0.1 U1
8/21/2019	Assessment	0.18	5.31	49.2	< 0.02 U1	0.01 J1	0.341	0.421	2.54	0.26	0.1 J1	0.00973	< 0.002 U1	0.7 J1	< 0.03 U1	< 0.1 U1
3/17/2020	Assessment	0.14	6.96	51.5	< 0.02 U1	< 0.01 U1	0.253	0.724	4.44	0.24	< 0.05 U1	0.00871	< 0.002 U1	0.7 J1	< 0.03 U1	< 0.1 U1
6/29/2020	Assessment	0.18	6.72	49.2	< 0.02 U1	0.01 J1	0.203	0.339	3.02	0.24	0.05 J1	0.00993	< 0.002 U1	0.8 J1	0.06 J1	< 0.1 U1
10/5/2020	Assessment	0.18	5.31	46.3	< 0.02 U1	< 0.01 U1	0.09 J1	0.321	2.57	0.26	< 0.05 U1	0.00926	< 0.002 U1	0.8 J1	0.04 J1	< 0.1 U1
3/9/2021	Assessment	0.14	7.71	50.0	< 0.007 U1	< 0.004 U1	0.481	0.438	2.81	0.29	0.06 J1	0.00977	< 0.002 U1	0.7 J1	< 0.09 U1	0.06 J1
6/9/2021	Assessment	0.17	4.84	46.4	< 0.007 U1	0.012 J1	0.35	0.452	4.09	0.28	0.10 J1	0.00852	< 0.002 U1	0.8	< 0.09 U1	0.06 J1
10/5/2021	Assessment	0.19	4.42	46.1	< 0.007 U1	0.012 J1	0.22	0.305	3.19	0.28	0.10 J1	0.00987	< 0.002 U1	0.9	< 0.09 U1	0.06 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1012
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.176	1.48	1.19	0.71	8.9	35.2	547
11/9/2016	Background	0.159	1.21	1.15	0.70	9.1	35.6	535
1/12/2017	Background	0.182	1.19	1.24	0.73	9.1	40.1	553
2/22/2017	Background	0.171	1.45	1.14	0.68	9.4	36.8	554
4/26/2017	Background	0.183	1.20	1.17	0.71	8.7	37.4	546
5/24/2017	Background	0.244	1.20	1.24	0.71	8.8	36.8	540
6/22/2017	Background	0.174	1.07	1.14	0.64	8.9	38.1	547
7/13/2017	Background	0.172	1.16	1.12	0.66	9.0	38.0	558
9/19/2017	Detection	0.205	1.11	1.10	0.67	9.1	38.5	546
4/26/2018	Assessment	0.227	1.13	1.34	0.82	9.0	36.6	541
9/20/2018	Assessment	0.236	1.11	1.27	0.75	9.1	36.6	561
3/13/2019	Assessment	0.189	1.15	1.26	0.73	8.8	35.6	572
6/25/2019	Assessment	0.169	1.10	1.19	0.74	9.3	35.9	559
8/21/2019	Assessment	0.176	1.38	1.26	0.79	9.4	36.8	583
3/18/2020	Assessment	--	--	--	0.76	10.9	--	--
6/30/2020	Assessment	0.181	1.72	5.21	0.72	9.2	36.7	--
8/27/2020	Assessment	--	--	--	--	9.3	--	582
10/6/2020	Assessment	0.175	1.37	1.32	0.68	9.2	37.0	577
3/10/2021	Assessment	--	--	--	0.85	9.0	--	--
6/9/2021	Assessment	0.174	1.2	1.32	0.80	9.3	35.4	550
10/6/2021	Assessment	0.192	1.2	1.40	0.80	9.2	33.5	570

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1012
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.79	24.0	37.6	0.044	0.05	1.1	0.346	1.592	0.71	1.84	0.006	< 0.002 U1	3.25	0.2	0.03 J1
11/9/2016	Background	1.20	28.9	24.4	0.027	0.04	0.903	0.113	0.548	0.70	0.872	0.014	0.002 J1	1.68	0.05 J1	0.02 J1
1/12/2017	Background	0.79	24.7	23.8	0.01 J1	0.04	0.395	0.066	0.542	0.73	0.439	0.008	< 0.002 U1	1.12	0.04 J1	0.02 J1
2/22/2017	Background	0.99	28.8	29.5	0.026	0.14	0.578	0.184	0.452	0.68	1.17	0.009	0.002 J1	1.52	0.07 J1	0.04 J1
4/26/2017	Background	0.89	22.9	29.9	0.025	0.02	0.512	0.131	0.148	0.71	0.632	0.004	0.003 J1	1.25	0.04 J1	0.02 J1
5/24/2017	Background	0.97	23.2	23.7	0.01 J1	0.01 J1	7.84	0.078	1.72	0.71	0.334	< 0.0002 U1	0.004 J1	1.41	0.07 J1	0.01 J1
6/22/2017	Background	0.91	21.6	21.1	0.008 J1	0.007 J1	0.293	0.046	0.3575	0.64	0.261	0.018	< 0.002 U1	1.18	0.04 J1	0.02 J1
7/13/2017	Background	0.96	22.1	25.7	0.022	0.008 J1	0.449	0.102	1.301	0.66	0.546	0.004	< 0.002 U1	1.43	0.09 J1	0.02 J1
4/26/2018	Assessment	0.65	15.8	24.1	0.01 J1	0.006 J1	0.262	0.062	1.135	0.82	0.287	0.006	0.003 J1	0.89	0.05 J1	0.02 J1
9/20/2018	Assessment	0.62	14.0	24.2	0.02	< 0.01 U1	0.442	0.079	0.291	0.75	0.346	< 0.009 U1	0.013	0.8	0.08 J1	< 0.1 U1
3/13/2019	Assessment	0.60	15.2	27.2	0.03 J1	< 0.01 U1	0.459	0.106	0.3959	0.73	0.354	0.01 J1	< 0.004 U1	0.9 J1	0.09 J1	< 0.1 U1
6/25/2019	Assessment	0.67	13.4	28.0	0.03 J1	< 0.01 U1	0.252	0.097	0.506	0.74	0.352	< 0.009 U1	< 0.002 U1	0.8 J1	0.08 J1	< 0.1 U1
8/21/2019	Assessment	0.77	19.0	41.9	0.06 J1	< 0.01 U1	0.625	0.260	0.354	0.79	0.924	0.00536	< 0.002 U1	1 J1	0.3	< 0.1 U1
3/18/2020	Assessment	0.60	19.6	61.7	0.130	0.01 J1	0.850	0.519	3.47	0.76	1.97	0.00588	0.002 J1	1 J1	0.3	< 0.1 U1
6/30/2020	Assessment	0.58	19.1	68.2	0.116	0.01 J1	0.912	0.527	2.62	0.72	1.86	0.00593	0.002 J1	1 J1	0.4	< 0.1 U1
10/6/2020	Assessment	0.89	23.0	34.7	0.06 J1	0.02 J1	0.468	0.229	1.04	0.68	0.851	0.00531	< 0.002 U1	1 J1	0.2 J1	< 0.1 U1
3/10/2021	Assessment	0.76	21.2	30.5	0.03 J1	0.01 J1	0.489	0.159	0.815	0.85	0.629	0.00552	0.002 J1	2.87	0.1 J1	< 0.04 U1
6/9/2021	Assessment	0.74	18.6	30.6	0.024 J1	0.014 J1	0.44	0.117	0.58	0.80	0.47	0.00540	< 0.002 U1	1.6	< 0.09 U1	< 0.04 U1
10/6/2021	Assessment	0.77	17.8	30.5	0.026 J1	0.010 J1	0.25	0.113	0.98	0.80	0.48	0.00564	< 0.002 U1	1.8	< 0.09 U1	0.05 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1203
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.097	60.5	5.72	0.15	7.8	28.4	261
11/9/2016	Background	0.088	56.8	5.35	0.13	6.9	26.5	273
1/12/2017	Background	0.110	59.9	5.69	0.13	7.0	33.4	278
2/21/2017	Background	0.092	55.8	5.23	0.12	7.0	30.2	248
4/26/2017	Background	0.122	55.6	5.18	0.12	6.6	29.0	265
5/23/2017	Background	0.160	55.6	5.08	0.12	6.5	29.6	279
6/21/2017	Background	0.137	62.3	4.74	0.11	6.7	28.0	264
7/13/2017	Background	0.089	56.7	5.05	0.10	6.7	33.0	261
9/18/2017	Detection	0.116	57.0	4.92	0.13	6.8	29.3	255
4/26/2018	Assessment	0.147	57.4	5.66	0.14	6.0	37.5	253
9/20/2018	Assessment	0.125	53.4	5.37	0.12	6.7	32.3	253
3/14/2019	Assessment	0.09 J1	54.9	5.53	0.11	6.2	38.7	259
6/27/2019	Assessment	0.1 J1	54.3	5.28	0.12	6.8	39.0	273
8/21/2019	Assessment	0.097	60.8	5.14	0.13	7.0	32.4	283
3/17/2020	Assessment	--	--	--	0.12	7.4	--	--
6/30/2020	Assessment	0.104	64.9	5.17	0.12	6.7	30.6	--
8/27/2020	Assessment	--	--	--	--	6.9	--	263
10/5/2020	Assessment	0.100	64.2	5.24	0.14	7.1	30.4	266
3/9/2021	Assessment	--	--	--	0.15	6.7	--	--
6/9/2021	Assessment	0.096	57.8	5.32	0.15	6.6	29.4	260
10/6/2021	Assessment	0.099	59.1	5.13	0.14	6.9	27.8	270

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1203
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.02 J1	0.26	95.3	0.022	< 0.004 U1	0.4	1.04	1.334	0.15	0.103	0.011	< 0.002 U1	0.21	0.04 J1	0.01 J1
11/9/2016	Background	0.03 J1	0.43	110	0.126	0.009 J1	1.50	1.04	1.473	0.13	1.28	0.017	< 0.002 U1	0.28	0.2	0.02 J1
1/12/2017	Background	0.03 J1	0.42	102	0.089	< 0.004 U1	0.718	1.15	1.657	0.13	0.748	0.014	< 0.002 U1	0.15	0.2	0.03 J1
2/21/2017	Background	0.02 J1	0.39	94.8	0.077	< 0.004 U1	0.365	0.989	2.509	0.12	0.509	0.017	< 0.002 U1	0.20	0.1	0.063
4/26/2017	Background	0.03 J1	0.45	113	0.099	< 0.005 U1	0.648	1.05	1.293	0.12	0.697	0.009	< 0.002 U1	0.20	0.2	0.02 J1
5/23/2017	Background	0.05 J1	0.61	99.9	0.149	< 0.005 U1	0.960	1.07	3.44	0.12	1.22	0.020	0.002 J1	0.15	0.3	0.02 J1
6/21/2017	Background	0.04 J1	0.63	101	0.116	< 0.005 U1	0.422	0.994	3.224	0.11	0.793	0.020	< 0.002 U1	0.62	0.3	0.03 J1
7/13/2017	Background	0.02 J1	0.44	93.8	0.062	< 0.005 U1	0.377	1.16	1.707	0.10	0.312	0.011	< 0.002 U1	0.59	0.05 J1	0.01 J1
4/26/2018	Assessment	0.03 J1	0.30	89.1	0.033	< 0.005 U1	0.171	0.886	2.476	0.14	0.034	0.013	< 0.002 U1	0.12	< 0.03 U1	0.03 J1
9/20/2018	Assessment	0.03 J1	0.51	90.1	0.08	< 0.01 U1	0.240	0.916	1.252	0.12	0.05	0.01	--	< 0.4 U1	< 0.03 U1	< 0.1 U1
10/22/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/14/2019	Assessment	0.03 J1	0.23	88.0	0.02 J1	< 0.01 U1	0.391	0.953	1.399	0.11	0.124	< 0.009 U1	< 0.004 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
6/27/2019	Assessment	< 0.02 U1	0.34	86.8	0.06 J1	< 0.01 U1	0.1 J1	0.909	1.341	0.12	0.1 J1	0.01 J1	< 0.002 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
8/21/2019	Assessment	< 0.02 U1	0.27	95.4	0.04 J1	< 0.01 U1	0.304	0.774	1.471	0.13	0.06 J1	0.0118	< 0.002 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
3/17/2020	Assessment	0.02 J1	0.35	91.0	0.06 J1	< 0.01 U1	0.265	0.859	7.524	0.12	0.08 J1	0.0130	< 0.002 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
6/30/2020	Assessment	0.02 J1	0.47	101	0.08 J1	< 0.01 U1	0.1 J1	0.547	2.29	0.12	0.1 J1	0.0121	< 0.002 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
10/5/2020	Assessment	0.02 J1	0.59	94.6	0.08 J1	< 0.01 U1	0.2 J1	0.672	1.539	0.14	0.212	0.0114	< 0.002 U1	< 0.4 U1	< 0.03 U1	< 0.1 U1
3/9/2021	Assessment	< 0.02 U1	0.39	93.9	0.05 J1	< 0.004 U1	0.390	0.849	1.287	0.15	0.2 J1	0.0120	< 0.002 U1	< 0.1 U1	< 0.09 U1	< 0.04 U1
6/9/2021	Assessment	0.03 J1	0.22	89.5	0.037 J1	< 0.004 U1	0.11 J1	0.603	1.98	0.15	0.06 J1	0.0109	< 0.002 U1	< 0.1 U1	< 0.09 U1	< 0.04 U1
10/6/2021	Assessment	0.02 J1	0.23	92.7	0.041 J1	< 0.004 U1	0.11 J1	0.677	2.1	0.14	0.08 J1	0.0122	< 0.002 U1	< 0.1 U1	< 0.09 U1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1601
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.317	63.0	25.6	0.32	7.6	122	448
11/9/2016	Background	0.263	55.7	31.2	0.33	7.3	120	438
1/12/2017	Background	0.283	63.5	25.0	0.32	7.5	128	474
2/22/2017	Background	0.241	61.0	23.9	0.29	7.4	111	430
4/26/2017	Background	0.216	50.9	23.8	0.33	6.9	97.4	372
5/24/2017	Background	0.240	55.9	21.5	0.29	7.0	91.7	370
6/22/2017	Background	0.196	47.5	21.0	0.27	7.3	90.6	367
7/13/2017	Background	0.175	51.3	17.4	0.27	7.1	84.6	364
9/18/2017	Detection	0.183	51.5	15.8	0.29	7.2	82.7	362
1/31/2018	Detection	--	--	15.4	--	7.5	84.4	--
4/25/2018	Assessment	0.177	50.4	15.2	0.36	6.9	72.6	326
9/20/2018	Assessment	0.196	68.8	16.1	0.22	7.1	167	448
3/12/2019	Assessment	0.117	54.3	9.09	0.18	6.3	88.5	316
6/25/2019	Assessment	0.1 J1	50.7	8.23	0.15	7.0	86.4	312
8/21/2019	Assessment	0.097	52.1	8.43	0.15	7.1	82.9	326
3/18/2020	Assessment	--	--	--	0.17	8.3	--	--
3/9/2021	Assessment	--	--	--	0.18	6.8	--	--
6/9/2021	Assessment	0.109	62.5	6.58	0.18	6.8	98.0	340
10/6/2021	Assessment	0.069	59.7	3.00	0.24	7.1	105	360

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1601
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.13	5.03	81.7	0.026	0.009 J1	0.7	1.96	1.22	0.32	0.143	0.040	< 0.002 U1	27.7	0.2	0.124
11/9/2016	Background	0.08	5.49	85.4	0.01 J1	0.01 J1	0.863	1.46	2.335	0.33	0.321	0.035	< 0.002 U1	20.5	0.2	0.02 J1
1/12/2017	Background	0.05 J1	5.24	79.1	0.009 J1	0.01 J1	0.390	1.78	1.695	0.32	0.050	0.038	< 0.002 U1	37.5	0.08 J1	0.03 J1
2/22/2017	Background	0.08	5.15	74.0	0.009 J1	0.006 J1	0.380	1.54	1.603	0.29	0.044	0.037	< 0.002 U1	31.5	0.1	0.02 J1
4/26/2017	Background	0.17	5.48	80.4	0.009 J1	0.006 J1	0.411	1.23	1.3	0.33	0.034	0.025	< 0.002 U1	27.3	0.2	0.02 J1
5/24/2017	Background	0.09	4.30	68.1	0.007 J1	0.006 J1	0.807	0.941	1.317	0.29	0.037	0.026	< 0.002 U1	27.0	0.09 J1	0.01 J1
6/22/2017	Background	0.08	4.19	60.1	< 0.004 U1	< 0.005 U1	0.247	0.926	0.802	0.27	0.02 J1	0.037	< 0.002 U1	27.1	0.07 J1	0.01 J1
7/13/2017	Background	0.11	5.18	64.5	0.009 J1	0.008 J1	0.300	1.02	1.077	0.27	0.081	0.023	< 0.002 U1	28.3	0.07 J1	0.01 J1
4/25/2018	Assessment	0.17	4.58	56.4	0.005 J1	< 0.005 U1	0.245	0.794	2.783	0.36	0.024	0.033	< 0.002 U1	20.6	0.1	0.02 J1
9/20/2018	Assessment	0.29	3.54	75.9	< 0.02 U1	< 0.01 U1	0.378	1.21	0.698	0.22	0.04	0.031	--	19.6	0.2	< 0.1 U1
10/23/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/12/2019	Assessment	0.20	1.39	49.0	< 0.02 U1	< 0.01 U1	0.438	0.395	0.769	0.18	0.05 J1	0.009 J1	< 0.002 U1	7.00	0.2 J1	< 0.1 U1
6/25/2019	Assessment	0.17	1.04	55.5	< 0.02 U1	< 0.01 U1	0.2 J1	0.629	0.689	0.15	< 0.02 U1	< 0.009 U1	< 0.002 U1	4.89	0.2	< 0.1 U1
8/21/2019	Assessment	0.09 J1	1.58	56.6	< 0.02 U1	0.02 J1	0.351	0.831	0.855	0.15	< 0.05 U1	0.0172	< 0.002 U1	5.64	0.09 J1	< 0.1 U1
3/18/2020	Assessment	0.59	0.63	62.9	< 0.02 U1	0.01 J1	0.298	0.152	1.25	0.17	0.07 J1	0.0302	< 0.002 U1	15.6	0.5	< 0.1 U1
3/9/2021	Assessment	0.61	0.76	44.7	0.02 J1	0.02 J1	0.768	0.329	1.227	0.18	0.2 J1	0.0206	< 0.002 U1	10.0	1.0	< 0.04 U1
6/9/2021	Assessment	0.61	0.41	41.6	< 0.007 U1	0.022	0.33	0.195	0.87	0.18	0.06 J1	0.0229	< 0.002 U1	12.1	0.54	< 0.04 U1
10/6/2021	Assessment	0.92	0.53	41.4	< 0.007 U1	0.022	0.49	0.051	1.7	0.24	0.10 J1	0.0132	< 0.002 U1	4.3	0.37 J1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1602
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.054	72.5	10.6	0.19	7.7	106	400
11/9/2016	Background	0.037	63.1	8.77	0.18	7.5	86.1	360
1/12/2017	Background	0.039	65.4	7.20	0.17	7.8	81.6	362
2/22/2017	Background	0.041	69.4	8.13	0.14	7.7	96.3	399
4/26/2017	Background	0.052	73.8	7.74	0.13	6.8	83.6	382
5/24/2017	Background	0.074	74.7	9.90	0.12	6.9	103	394
6/21/2017	Background	--	--	--	--	7.5	--	--
6/22/2017	Background	0.062	70.4	10.7	0.11	--	106	416
7/13/2017	Background	0.052	81.9	12.1	0.09 J1	7.0	132	484
10/19/2017	Detection	0.058	72.5	13.0	0.11	7.1	110	434
1/31/2018	Detection	--	--	15.3	--	7.5	128	--
4/26/2018	Assessment	0.143	75.2	13.9	0.14	8.0	106	416
9/20/2018	Assessment	0.070	72.1	15.2	0.11	7.0	150	492
3/13/2019	Assessment	0.07 J1	79.4	12.6	0.10	6.9	133	444
6/25/2019	Assessment	0.06 J1	69.8	12.2	0.11	7.5	111	436
8/20/2019	Assessment	0.04 J1	74.5	13.2	0.10	7.5	117	434
3/18/2020	Assessment	--	--	--	0.09	8.8	--	--
6/30/2020	Assessment	0.05 J1	79.0	17.6	0.09	7.2	--	--
8/26/2020	Assessment	--	--	--	--	4.8	121	454
10/6/2020	Assessment	0.05 J1	82.5	19.2	0.10	7.7	143	479
3/9/2021	Assessment	--	--	--	0.11	7.4	--	--
6/9/2021	Assessment	0.050	83.9	17.1	0.11	7.5	165	500
10/6/2021	Assessment	0.057	86.1	18.3	0.10	7.5	167	510

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1602
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.16	0.50	50.7	< 0.005 U1	0.005 J1	0.8	0.060	1.233	0.19	0.067	0.008	0.002 J1	3.41	2.0	0.02 J1
11/9/2016	Background	0.13	0.42	51.1	< 0.005 U1	0.01 J1	0.590	0.028	1.143	0.18	0.059	0.013	0.002 J1	2.63	2.2	0.01 J1
1/12/2017	Background	0.10	0.45	50.2	< 0.005 U1	0.01 J1	0.666	0.043	1.545	0.17	0.030	0.004	< 0.002 U1	2.44	2.2	0.03 J1
2/22/2017	Background	0.09	0.42	48.2	< 0.005 U1	0.009 J1	0.547	0.020	0.712	0.14	0.02 J1	0.008	< 0.002 U1	2.79	2.0	0.02 J1
4/26/2017	Background	0.10	0.47	59.2	< 0.004 U1	0.01 J1	0.692	0.024	0.534	0.13	0.026	0.006	0.002 J1	1.88	2.2	0.03 J1
5/24/2017	Background	0.08	0.37	54.6	< 0.004 U1	0.009 J1	0.703	0.01 J1	1.68	0.12	0.239	0.002	0.004 J1	1.51	1.5	0.02 J1
6/22/2017	Background	0.07	0.50	55.0	< 0.004 U1	0.01 J1	0.566	0.205	0.812	0.11	0.047	0.021	0.002 J1	2.12	1.3	0.02 J1
7/13/2017	Background	0.07	0.71	57.6	< 0.004 U1	< 0.005 U1	0.482	0.850	1.138	0.09 J1	0.031	0.005	0.003 J1	2.29	1.0	0.01 J1
4/26/2018	Assessment	0.05 J1	3.15	60.9	< 0.004 U1	< 0.005 U1	0.290	0.552	1.754	0.14	0.049	0.008	0.003 J1	1.64	0.4	0.01 J1
9/20/2018	Assessment	0.03 J1	3.92	55.1	< 0.02 U1	< 0.01 U1	0.328	0.312	1.044	0.11	0.03	< 0.009 U1	< 0.004 U1	1	0.4	< 0.1 U1
3/13/2019	Assessment	0.06 J1	1.06	52.5	< 0.02 U1	< 0.01 U1	1.03	0.03 J1	0.504	0.10	0.122	0.009 J1	< 0.002 U1	2 J1	1.6	< 0.1 U1
6/25/2019	Assessment	0.07 J1	1.06	52.5	< 0.02 U1	< 0.01 U1	0.632	0.02 J1	0.5359	0.11	0.05 J1	< 0.009 U1	< 0.002 U1	1 J1	1.4	< 0.1 U1
8/20/2019	Assessment	0.06 J1	1.16	49.3	< 0.02 U1	0.01 J1	1.15	0.080	0.543	0.10	0.1 J1	0.00637	< 0.002 U1	1 J1	1.1	< 0.1 U1
3/18/2020	Assessment	0.06 J1	1.36	55.4	< 0.02 U1	< 0.01 U1	0.511	0.04 J1	1.517	0.09	0.08 J1	0.00736	< 0.002 U1	1 J1	1.1	< 0.1 U1
6/30/2020	Assessment	0.04 J1	1.59	55.9	< 0.02 U1	< 0.01 U1	0.679	0.04 J1	0.488	0.09	0.07 J1	0.00717	< 0.002 U1	1 J1	1.0	< 0.1 U1
10/6/2020	Assessment	0.04 J1	1.53	52.4	< 0.02 U1	< 0.01 U1	1.05	0.04 J1	2.003	0.10	< 0.05 U1	0.00707	< 0.002 U1	1 J1	1.1	< 0.1 U1
3/9/2021	Assessment	0.06 J1	1.72	56.9	< 0.007 U1	0.006 J1	1.26	0.075	1.018	0.11	0.1 J1	0.00787	< 0.002 U1	1 J1	2.0	< 0.04 U1
6/9/2021	Assessment	0.06 J1	0.92	53.2	< 0.007 U1	< 0.004 U1	0.62	0.014 J1	2.31	0.11	< 0.05 U1	0.00629	< 0.002 U1	1.2	2.57	< 0.04 U1
10/6/2021	Assessment	0.08 J1	0.99	61.9	< 0.007 U1	< 0.004 U1	0.59	0.009 J1	0.95	0.10	0.11 J1	0.00815	< 0.002 U1	1.3	3.19	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1603
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.054	105	3.37	1.24	4.3	801	1,060
11/9/2016	Background	0.053	94.7	3.22	1.10	5.6	733	1,010
1/12/2017	Background	0.037	92.7	3.45	1.11	3.6	636	948
2/21/2017	Background	0.085	91.9	2.93	0.90	4.5	720	1,020
4/26/2017	Background	0.052	90.5	3.28	1.04	3.3	678	994
5/24/2017	Background	0.096	93.9	3.34	0.98	3.3	646	936
6/22/2017	Background	0.051	90.6	3.10	0.98	3.0	873	1,040
7/13/2017	Background	0.039	90.2	3.32	0.93	3.2	694	1,000
10/19/2017	Detection	< 0.002 U1	91.0	3.24	0.93	3.5	784	962
1/31/2018	Detection	--	82.2	--	0.94	3.5	714	915
4/26/2018	Assessment	0.088	83.6	4.12	1.16	2.9	661	926
9/20/2018	Assessment	0.08	97.5	3.92	1.15	3.1	747	974
3/13/2019	Assessment	0.05 J1	84.6	4.42	0.92	3.2	709	896
6/27/2019	Assessment	0.05 J1	83.3	4.13	0.87	3.7	658	954
8/20/2019	Assessment	< 0.1 U1	95.8	3.93	0.84	3.5	704	1,010
3/17/2020	Assessment	--	--	--	0.85	3.5	--	--
6/30/2020	Assessment	0.05 J1	96.6	4.18	0.71	3.4	--	--
8/26/2020	Assessment	--	--	--	--	3.3	798	1,040
10/6/2020	Assessment	0.05 J1	94.5	4.10	0.47	4.1	794	1,020
3/9/2021	Assessment	--	--	--	0.82	3.4	--	--
6/9/2021	Assessment	0.036 J1	79.0	4.16	0.76	3.6	618	880
10/6/2021	Assessment	0.054	93.1	3.93	0.96	3.3	735	1,040

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1603
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.01 J1	1.51	13.4	18.6	0.84	1.1	101	6.04	1.24	9.75	0.242	< 0.002 U1	0.15	5.4	1.29
11/9/2016	Background	< 0.01 U1	1.19	15.4	18.3	0.93	1.12	94.4	6.6	1.10	8.18	0.237	< 0.002 U1	0.17	4.8	1.55
1/12/2017	Background	< 0.01 U1	1.40	11.4	17.1	0.79	0.731	89.6	5.86	1.11	6.11	0.225	< 0.002 U1	0.06 J1	5.6	1.39
2/21/2017	Background	< 0.01 U1	1.26	10.3	18.9	0.75	0.771	93.2	4.03	0.90	6.30	0.208	< 0.002 U1	0.11	4.9	1.20
4/26/2017	Background	0.01 J1	1.30	12.4	16.7	0.87	0.829	97.1	5.72	1.04	6.41	0.216	0.002 J1	0.18	6.1	1.41
5/24/2017	Background	< 0.01 U1	1.34	11.5	16.4	0.77	0.620	85.3	6.4	0.98	4.96	0.221	< 0.002 U1	0.07 J1	6.3	1.35
6/22/2017	Background	< 0.01 U1	1.29	11.4	16.4	0.86	0.821	92.4	6	0.98	6.47	0.263	< 0.002 U1	0.32	6.1	1.43
7/13/2017	Background	< 0.01 U1	0.89	11.3	18.0	0.80	0.485	92.5	6.36	0.93	3.72	0.217	< 0.002 U1	0.22	2.7	1.43
4/26/2018	Assessment	0.04 J1	1.60	10.5	18.7	0.74	0.771	91.1	5.09	1.16	5.27	0.187	< 0.002 U1	0.03 J1	8.1	1.39
9/20/2018	Assessment	< 0.02 U1	1.40	11.4	19.6	0.83	0.713	93.8	6.75	1.15	4.39	0.255	--	< 0.4 U1	6.3	1.70
10/23/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/13/2019	Assessment	< 0.2 U1	1.26	12.0	24.4	0.78	1 J1	87.9	4.8	0.92	4.28	0.209	< 0.002 U1	< 4 U1	4.0	1 J1
6/27/2019	Assessment	< 0.04 U1	1.36	11.0	21.8	0.70	0.618	84.7	7.149	0.87	3.68	0.192	< 0.002 U1	< 0.8 U1	4.9	1.40
8/20/2019	Assessment	< 0.1 U1	1.39	13.6	25.0	0.89	0.8 J1	96.6	10.92	0.84	4.17	0.226	< 0.002 U1	< 2 U1	5.6	2 J1
3/17/2020	Assessment	< 0.02 U1	0.83	9.92	16.4	0.64	0.560	72.0	7.19	0.85	3.95	0.156	< 0.002 U1	< 0.4 U1	4.0	1.34
6/30/2020	Assessment	< 0.04 U1	1.12	12.2	21.1	0.85	0.694	93.2	6.22	0.71	4.67	0.192	< 0.002 U1	< 0.8 U1	6.2	1.57
10/6/2020	Assessment	< 0.02 U1	1.12	14.6	17.5	0.87	0.743	90.5	2.681	0.47	4.85	0.165	< 0.002 U1	< 0.4 U1	5.8	1.82
3/9/2021	Assessment	< 0.02 U1	0.84	10.1	14.0	0.62	0.659	71.4	3.73	0.82	3.37	0.125	0.002 J1	< 0.1 U1	3.9	1.39
6/9/2021	Assessment	0.04 J1	0.69	13.1	13.3	0.709	0.51	76.8	7.18	0.76	3.39	0.135	0.002 J1	< 0.1 U1	3.30	1.62
10/6/2021	Assessment	< 0.02 U1	1.01	17.1	17.4 M1	0.913	0.59	95.1 M1	10.51	0.96	6.10	0.186 M1	0.003 J1	< 0.1 U1	4.26	2.20

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.
M1: The associated matrix spike (MS) or matrix spike duplicate (MSD) recovery was outside acceptance limits.

Table 1 - Groundwater Data Summary: MW-1604
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.031	6.48	6.20	0.27	7.5	16.6	182
11/8/2016	Background	0.030	4.26	6.22	0.29	3.4	9.1	180
1/11/2017	Background	0.016	3.27	4.07	0.23	6.2	5.9	186
2/21/2017	Background	0.040	3.21	2.60	0.12	6.5	5.7	102
4/25/2017	Background	0.010	3.15	1.71	0.08	5.9	8.6	78
5/23/2017	Background	0.038	2.93	1.56	0.06	5.8	8.2	68
6/21/2017	Background	0.017	2.88	1.41	0.03 J1	5.6	10.5	49
7/12/2017	Background	0.054	3.06	1.84	0.06	5.5	9.8	85
9/18/2017	Detection	0.034	2.81	2.22	0.12	6.5	4.0	124
4/25/2018	Assessment	0.052	2.96	1.58	0.06	5.4	8.4	52
9/18/2018	Assessment	0.056	2.69	1.43	0.06 J1	6.1	7.8	62
3/12/2019	Assessment	0.02 J1	3.55	1.34	0.04 J1	5.2	10.0	46
6/25/2019	Assessment	0.02 J1	2.97	1.21	0.05 J1	6.0	9.5	50
8/20/2019	Assessment	< 0.02 U1	3.42	1.17	0.03 J1	5.4	10.5	50 J1
3/17/2020	Assessment	--	--	--	0.03 J1	5.8	--	--
6/29/2020	Assessment	< 0.02 U1	3.56	1.03	< 0.01 U1	5.2	11.1	--
8/27/2020	Assessment	--	--	--	--	5.7	--	63
10/5/2020	Assessment	< 0.02 U1	3.31	1.09	0.03 J1	6.8	10.3	50 J1
3/10/2021	Assessment	--	--	--	0.03 J1	5.1	--	--
6/8/2021	Assessment	0.018 J1	3.4	1.15	0.03 J1	5.7	10.4	60
10/5/2021	Assessment	0.016 J1	3.2	1.11	0.03 J1	5.7	9.42	60

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1604
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.05 J1	2.74	67.1	0.029	0.007 J1	0.6	3.47	1.105	0.27	0.154	0.004	< 0.002 U1	3.48	0.2	0.01 J1
11/8/2016	Background	0.04 J1	3.61	59.0	0.048	0.008 J1	0.583	1.55	1.277	0.29	0.265	0.005	< 0.002 U1	2.34	0.1	< 0.01 U1
1/11/2017	Background	0.08	4.28	54.8	0.027	0.06	0.551	2.02	0.707	0.23	0.188	0.005	< 0.002 U1	2.23	0.2	0.119
2/21/2017	Background	0.02 J1	3.64	52.9	0.028	0.009 J1	0.427	2.78	0.927	0.12	0.103	0.009	< 0.002 U1	1.51	0.1	0.175
4/25/2017	Background	0.03 J1	3.54	65.1	0.034	0.006 J1	0.365	5.59	0.478	0.08	0.01 J1	< 0.0002 U1	< 0.002 U1	0.57	0.08 J1	< 0.01 U1
5/23/2017	Background	0.02 J1	2.24	54.8	0.040	0.03	0.401	4.18	6.707	0.06	0.062	< 0.0002 U1	< 0.002 U1	0.51	0.2	0.01 J1
6/21/2017	Background	0.03 J1	1.28	66.1	0.063	0.05	0.183	5.61	16.848	0.03 J1	0.049	0.002	0.003 J1	0.57	0.2	0.01 J1
7/12/2017	Background	0.04 J1	1.73	59.8	0.041	0.02	0.322	3.67	0.636	0.06	0.097	0.004	< 0.002 U1	15.9	0.1	< 0.01 U1
4/25/2018	Assessment	0.08	0.74	58.9	0.053	0.09	0.285	3.75	0.1535	0.06	0.263	0.010	< 0.002 U1	0.54	0.3	0.04 J1
9/18/2018	Assessment	0.06	1.47	63.5	0.061	0.07	0.388	4.53	0.951	0.06 J1	0.092	0.003	--	0.86	0.2	0.04 J1
10/22/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/12/2019	Assessment	0.03 J1	0.16	66.8	0.06 J1	0.08	0.547	0.844	0.458	0.04 J1	0.04 J1	< 0.009 U1	< 0.002 U1	< 0.4 U1	0.3	< 0.1 U1
6/25/2019	Assessment	0.03 J1	0.12	68.3	0.07 J1	0.09	0.231	0.503	0.799	0.05 J1	0.03 J1	< 0.009 U1	< 0.002 U1	< 0.4 U1	0.2	< 0.1 U1
8/20/2019	Assessment	< 0.02 U1	0.09 J1	78.3	0.117	0.08	0.612	0.246	0.641	0.03 J1	< 0.05 U1	0.00104	< 0.002 U1	< 0.4 U1	0.4	< 0.1 U1
3/17/2020	Assessment	< 0.02 U1	0.05 J1	82.7	0.159	0.08	0.632	0.119	2.93	0.03 J1	< 0.05 U1	0.00113	< 0.002 U1	< 0.4 U1	0.4	< 0.1 U1
6/29/2020	Assessment	< 0.02 U1	0.05 J1	90.0	0.182	0.09	0.681	0.130	1.121	< 0.01 U1	< 0.05 U1	0.00106	< 0.002 U1	< 0.4 U1	0.5	< 0.1 U1
10/5/2020	Assessment	< 0.02 U1	0.10	75.8	0.149	0.09	0.589	0.289	0.491	0.03 J1	0.2 J1	0.000964	< 0.002 U1	< 0.4 U1	0.4	< 0.1 U1
3/10/2021	Assessment	< 0.02 U1	0.07 J1	75.3	0.129	0.09	0.850	0.148	0.2279	0.03 J1	< 0.05 U1	0.000944	< 0.002 U1	< 0.1 U1	0.4	< 0.04 U1
6/8/2021	Assessment	0.02 J1	0.07 J1	82.3	0.167	0.086	0.77	0.257	1.07	0.03 J1	0.06 J1	0.00095	< 0.002 U1	< 0.1 U1	0.36 J1	< 0.04 U1
10/5/2021	Assessment	< 0.02 U1	0.06 J1	70.2	0.143	0.079	0.61	0.154	1.67	0.03 J1	0.06 J1	0.00101	< 0.002 U1	0.1 J1	0.31 J1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1605
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.008	1.00	0.43	< 0.02 U1	5.7	5.2	30 J1
11/8/2016	Background	0.005	1.01	0.43	< 0.02 U1	2.3	4.2	40
1/11/2017	Background	< 0.002 U1	0.979	0.62	< 0.02 U1	4.6	5.7	35
2/21/2017	Background	0.061	1.37	1.49	< 0.02 U1	5.1	7.4	74
4/25/2017	Background	0.025	1.31	1.21	< 0.02 U1	4.9	6.0	30 J1
5/23/2017	Background	0.063	1.21	1.00	< 0.02 U1	4.8	5.4	30 J1
6/21/2017	Background	0.017	1.15	0.90	< 0.02 U1	4.9	5.8	25
7/12/2017	Background	0.075	1.11	1.32	< 0.02 U1	4.7	4.5	37
9/14/2017	Detection	0.102	1.01	1.72	< 0.02 U1	4.7	4.9	20 J1
4/25/2018	Assessment	0.070	1.30	0.69	< 0.02 U1	4.6	6.5	37
9/18/2018	Assessment	0.036	0.930	0.62	< 0.02 U1	4.0	4.3	29
3/12/2019	Assessment	0.02 J1	1.27	0.53	0.02 J1	4.3	7.2	33
6/25/2019	Assessment	< 0.02 U1	1.20	0.43	< 0.01 U1	5.2	5.7	37
8/20/2019	Assessment	< 0.02 U1	1.01	0.46	0.01 J1	5.5	5.5	30 J1
3/17/2020	Assessment	--	--	--	0.01 J1	5.0	--	--
6/29/2020	Assessment	< 0.02 U1	1.24	0.43	< 0.01 U1	5.0	5.3	--
8/27/2020	Assessment	--	--	--	--	5.1	--	30 J1
10/5/2020	Assessment	< 0.02 U1	1.04	0.39	< 0.01 U1	5.6	5.3	40 J1
3/10/2021	Assessment	--	--	--	0.02 J1	4.6	--	--
6/8/2021	Assessment	0.009 J1	1.2	0.59	0.01 J1	5.2	5.08	50
10/5/2021	Assessment	0.011 J1	1.2	0.41	< 0.02 U1	5.1	4.59	40 J1

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1605
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	< 0.01 U1	0.04 J1	30.3	0.091	0.06	2.7	0.897	0.679	< 0.02 U1	0.126	0.002	< 0.002 U1	0.08 J1	0.2	0.01 J1
11/8/2016	Background	0.01 J1	0.08	30.5	0.121	0.06	2.50	0.917	1.986	< 0.02 U1	0.210	0.007	< 0.002 U1	0.05 J1	0.2	0.01 J1
1/11/2017	Background	0.01 J1	0.07	32.2	0.111	0.07	2.53	1.64	0.1382	< 0.02 U1	0.190	0.008	< 0.002 U1	0.1 J1	0.2	0.01 J1
2/21/2017	Background	< 0.01 U1	0.03 J1	42.6	0.138	0.09	2.61	1.45	0.904	< 0.02 U1	0.107	0.005	< 0.002 U1	0.10	0.2	0.03 J1
4/25/2017	Background	0.01 J1	0.06	39.1	0.119	0.09	2.57	0.991	0.2779	< 0.02 U1	0.121	< 0.0002 U1	< 0.002 U1	0.13	0.2	0.01 J1
5/23/2017	Background	< 0.01 U1	0.03 J1	35.0	0.114	0.07	2.39	0.667	6.077	< 0.02 U1	0.104	0.008	< 0.002 U1	0.07 J1	0.2	0.01 J1
6/21/2017	Background	< 0.01 U1	0.05 J1	33.4	0.105	0.07	2.44	0.592	10.864	< 0.02 U1	0.110	0.002	< 0.002 U1	0.09 J1	0.3	< 0.01 U1
7/12/2017	Background	< 0.01 U1	0.23	31.7	0.103	0.07	2.33	0.495	0.3796	< 0.02 U1	0.107	0.0003 J1	< 0.002 U1	23.7	0.2	0.01 J1
4/25/2018	Assessment	0.04 J1	0.07	37.1	0.123	0.08	2.70	0.434	0.421	< 0.02 U1	0.193	0.009	< 0.002 U1	0.07 J1	0.3	0.03 J1
9/18/2018	Assessment	0.02 J1	0.04 J1	29.7	0.104	0.06	2.58	0.265	0.694	< 0.02 U1	0.092	0.002	--	0.04 J1	0.2	0.03 J1
10/22/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/12/2019	Assessment	< 0.02 U1	0.17	36.6	0.131	0.08	2.91	0.483	0.2025	0.02 J1	0.305	< 0.009 U1	0.003 J1	< 0.4 U1	0.3	< 0.1 U1
6/25/2019	Assessment	< 0.02 U1	0.05 J1	34.8	0.123	0.08	2.53	0.253	0.9023	< 0.01 U1	0.164	< 0.009 U1	< 0.002 U1	< 0.4 U1	0.2	< 0.1 U1
8/20/2019	Assessment	< 0.02 U1	0.03 J1	29.1	0.09 J1	0.06	2.41	0.215	0.268	0.01 J1	0.09 J1	0.000637	< 0.002 U1	< 0.4 U1	0.2	< 0.1 U1
3/17/2020	Assessment	< 0.02 U1	< 0.03 U1	40.9	0.130	0.08	2.47	0.272	1.1942	0.01 J1	0.1 J1	0.000757	< 0.002 U1	< 0.4 U1	0.3	< 0.1 U1
6/29/2020	Assessment	< 0.02 U1	< 0.03 U1	36.5	0.119	0.07	2.41	0.222	0.11	< 0.01 U1	0.05 J1	0.000694	< 0.002 U1	< 0.4 U1	0.3	< 0.1 U1
10/5/2020	Assessment	< 0.02 U1	0.04 J1	33.7	0.113	0.07	2.55	0.219	4.041	< 0.01 U1	0.1 J1	0.000695	< 0.002 U1	< 0.4 U1	0.3	< 0.1 U1
3/10/2021	Assessment	< 0.02 U1	0.06 J1	56.7	0.160	0.11	2.71	0.398	2.826	0.02 J1	0.2 J1	0.000806	0.002 J1	< 0.1 U1	0.2	< 0.04 U1
6/8/2021	Assessment	< 0.02 U1	< 0.03 U1	34.8	0.102	0.067	2.27	0.236	1.12	0.01 J1	0.08 J1	0.00063	< 0.002 U1	< 0.1 U1	0.20 J1	< 0.04 U1
10/5/2021	Assessment	< 0.02 U1	0.04 J1	36.9	0.118	0.074	2.68	0.184	0.97	< 0.02 U1	0.1 J1	0.00075	< 0.004 U1	< 0.1 U1	0.24 J1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1606
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	1.92	78.6	31.3	0.17	7.4	54.0	362
11/8/2016	Background	1.80	75.9	31.5	0.19	7.2	54.5	400
1/12/2017	Background	1.77	75.1	31.2	0.21	7.3	58.8	396
2/22/2017	Background	1.63	76.7	30.4	0.18	7.2	53.9	358
4/26/2017	Background	1.78	73.8	31.7	0.19	6.7	56.1	380
5/23/2017	Background	1.87	78.1	31.7	0.19	6.8	56.2	360
6/21/2017	Background	1.89	78.1	31.1	0.17	6.7	55.3	369
7/12/2017	Background	1.79	75.7	31.4	0.17	6.5	57.0	382
9/18/2017	Detection	1.83	77.0	31.3	0.19	6.9	58.1	380
1/31/2018	Detection	1.63	--	32.0	--	7.2	--	--
4/25/2018	Assessment	1.81	73.7	31.3	0.26	6.6	56.0	350
9/19/2018	Assessment	1.82	71.8	31.1	0.24	6.6	56.9	380
3/13/2019	Assessment	1.93	74.2	31.7	0.22	6.9	58.8	389
6/25/2019	Assessment	1.84	74.5	30.8	0.23	7.1	58.7	384
8/20/2019	Assessment	1.74	75.1	31.4	0.21	7.0	58.3	385
3/18/2020	Assessment	--	--	--	0.20	9.1	--	--
6/30/2020	Assessment	2.04	79.7	31.8	0.18	6.8	61.2	--
8/26/2020	Assessment	--	--	--	--	6.5	--	392
10/6/2020	Assessment	2.00	78.7	32.0	0.22	6.7	62.8	363
3/10/2021	Assessment	--	--	--	0.26	6.9	--	--
6/8/2021	Assessment	1.99	74.1	31.8	0.24	7.5	61.6	370
10/5/2021	Assessment	2.04	74.5	31.4	0.22	7.0	60.7	400

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1606
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.03 J1	0.85	1,030	0.064	0.009 J1	1.7	0.814	2.76	0.17	1.19	0.006	< 0.002 U1	0.68	0.2	0.04 J1
11/8/2016	Background	0.04 J1	1.24	994	0.114	0.01 J1	2.34	1.26	4.082	0.19	1.88	0.014	< 0.002 U1	0.51	0.3	0.03 J1
1/12/2017	Background	0.07	1.19	883	0.058	0.06	1.52	0.919	3.35	0.21	1.02	0.010	< 0.002 U1	0.67	0.2	0.110
2/22/2017	Background	< 0.01 U1	0.97	875	0.025	< 0.004 U1	0.747	0.381	2.289	0.18	0.330	0.008	0.002 J1	0.91	0.2	0.01 J1
4/26/2017	Background	0.03 J1	1.40	1,080	0.053	0.007 J1	1.33	0.951	2.398	0.19	0.862	0.003	< 0.002 U1	0.84	0.1	0.02 J1
5/23/2017	Background	0.01 J1	1.03	949	0.023	< 0.005 U1	0.790	0.411	3.37	0.19	0.341	0.006	0.002 J1	0.54	0.09 J1	< 0.01 U1
6/21/2017	Background	< 0.01 U1	0.98	884	0.01 J1	< 0.005 U1	0.385	0.209	2.79	0.17	0.159	0.004	0.003 J1	0.60	0.06 J1	< 0.01 U1
7/12/2017	Background	0.01 J1	1.14	773	0.01 J1	< 0.005 U1	0.353	0.153	3.37	0.17	0.103	0.008	< 0.002 U1	7.56	0.06 J1	< 0.01 U1
4/25/2018	Assessment	0.05	0.97	767	0.008 J1	< 0.005 U1	0.301	0.101	3.71	0.26	0.077	0.014	< 0.002 U1	0.58	0.06 J1	0.01 J1
9/19/2018	Assessment	0.03 J1	0.97	797	0.01 J1	< 0.005 U1	0.366	0.155	3.28	0.24	0.126	0.001	--	0.58	0.07 J1	0.03 J1
10/22/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/13/2019	Assessment	< 0.02 U1	1.22	764	< 0.02 U1	< 0.01 U1	0.535	0.208	2.63	0.22	0.123	< 0.009 U1	< 0.002 U1	2.60	0.05 J1	< 0.1 U1
6/25/2019	Assessment	< 0.02 U1	0.94	843	< 0.02 U1	< 0.01 U1	0.1 J1	0.055	2.366	0.23	0.05 J1	< 0.009 U1	< 0.002 U1	0.6 J1	0.06 J1	< 0.1 U1
8/20/2019	Assessment	< 0.02 U1	0.85	768	< 0.02 U1	< 0.01 U1	0.304	0.05 J1	3.12	0.21	< 0.05 U1	0.00301	< 0.002 U1	0.6 J1	0.05 J1	< 0.1 U1
3/18/2020	Assessment	< 0.02 U1	1.00	828	< 0.02 U1	< 0.01 U1	0.343	0.196	2.49	0.20	0.1 J1	0.00340	< 0.002 U1	0.6 J1	0.08 J1	< 0.1 U1
6/30/2020	Assessment	< 0.02 U1	0.92	816	< 0.02 U1	< 0.01 U1	0.2 J1	0.068	3.16	0.18	0.1 J1	0.00364	< 0.002 U1	0.5 J1	0.07 J1	< 0.1 U1
10/6/2020	Assessment	< 0.02 U1	1.00	750	< 0.02 U1	< 0.01 U1	0.1 J1	0.060	2.91	0.22	< 0.05 U1	0.00329	< 0.002 U1	0.5 J1	0.07 J1	< 0.1 U1
3/10/2021	Assessment	< 0.02 U1	1.04	739	0.009 J1	< 0.004 U1	0.433	0.100	1.92	0.26	0.08 J1	0.00306	< 0.002 U1	0.5 J1	< 0.09 U1	< 0.04 U1
6/8/2021	Assessment	< 0.02 U1	0.96	768 M1, P3	< 0.007 U1	< 0.004 U1	0.59	0.066	4.12	0.24	0.08 J1	0.00317	< 0.002 U1	0.6	< 0.09 U1	< 0.04 U1
10/5/2021	Assessment	< 0.02 U1	0.98	757 M1, P3	0.007 J1	< 0.004 U1	0.16 J1	0.086	4.15	0.22	0.08 J1	0.00354	< 0.002 U1	0.5	< 0.09 U1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.
M1: The associated matrix spike (MS) or matrix spike duplicate (MSD) recovery was outside acceptance limits.
P3: The precision on the matrix spike duplicate (MSD) was above acceptance limits.

Table 1 - Groundwater Data Summary: MW-1607
Big Sandy - FAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.159	97.6	3.34	0.04 J1	6.9	132	406
11/8/2016	Background	0.202	76.3	15.5	0.06	6.8	88.4	368
1/11/2017	Background	0.171	99.0	5.96	0.06	6.0	171	474
2/21/2017	Background	0.195	105	3.47	0.06	6.5	150	470
4/25/2017	Background	0.273	80.8	10.2	0.07	6.3	85.3	332
5/23/2017	Background	0.186	89.4	3.24	0.06 J1	6.3	114	338
6/21/2017	Background	0.164	92.5	2.42	0.05 J1	6.3	119	368
7/12/2017	Background	0.167	86.0	2.28	0.05 J1	5.8	105	358
9/18/2017	Detection	0.155	90.7	2.73	0.07	6.4	125	398
1/31/2018	Detection	--	110	--	--	6.6	159	--
4/25/2018	Assessment	0.234	101	3.66	0.08	6.2	137	430
9/19/2018	Assessment	0.255	95.6	7.52	0.08	6.0	144	428
3/13/2019	Assessment	0.209	93.7	5.17	0.06	6.1	135	415
6/25/2019	Assessment	0.208	91.9	5.22	0.08	6.6	120	388
8/20/2019	Assessment	0.160	101	3.84	0.07	6.5	141	419
3/18/2020	Assessment	--	--	--	0.06	8.1	--	--
6/30/2020	Assessment	0.195	85.4	8.26	0.06 J1	6.3	94.1	--
8/26/2020	Assessment	--	--	--	--	6.0	--	372
10/6/2020	Assessment	0.155	99.4	4.76	0.07	6.9	129	381
3/10/2021	Assessment	--	--	--	0.08	6.4	--	--
6/8/2021	Assessment	0.151	81.2	3.56	0.09	6.9	89.2	330
10/5/2021	Assessment	0.161	97.0	4.05	0.08	6.5	112	420

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1607
Big Sandy - FAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.02 J1	7.36	34.3	0.01 J1	< 0.004 U1	0.6	1.41	1.551	0.04 J1	0.156	0.003	< 0.002 U1	0.52	0.1 J1	0.03 J1
11/8/2016	Background	0.02 J1	11.6	42.3	0.025	0.007 J1	0.619	1.45	1.683	0.06	0.376	0.002	< 0.002 U1	0.62	0.1	0.02 J1
1/11/2017	Background	0.06	12.5	53.5	0.01 J1	0.05	0.456	1.31	0.577	0.06	0.129	0.007	< 0.002 U1	0.83	0.1	0.119
2/21/2017	Background	0.01 J1	8.71	34.3	0.01 J1	< 0.004 U1	0.359	1.24	1.339	0.06	0.030	0.005	< 0.002 U1	0.54	0.05 J1	0.055
4/25/2017	Background	0.03 J1	15.4	38.1	0.028	0.006 J1	0.682	1.34	1.08	0.07	0.416	0.003	< 0.002 U1	0.53	0.2	0.02 J1
5/23/2017	Background	0.02 J1	8.87	33.9	0.01 J1	0.008 J1	0.350	1.30	6.76	0.06 J1	0.081	0.009	0.004 J1	0.42	0.1	0.02 J1
6/21/2017	Background	0.02 J1	9.22	27.5	0.01 J1	< 0.005 U1	0.324	1.39	1.274	0.05 J1	0.123	0.004	< 0.002 U1	0.45	0.1	0.02 J1
7/12/2017	Background	0.02 J1	7.59	25.0	0.01 J1	< 0.005 U1	0.293	1.13	0.33	0.05 J1	0.070	0.004	< 0.002 U1	9.02	0.1	0.02 J1
4/25/2018	Assessment	0.27	68.5	37.2	0.111	< 0.005 U1	0.851	1.57	3.217	0.08	0.799	0.012	< 0.002 U1	0.90	0.7	0.04 J1
9/19/2018	Assessment	0.04 J1	23.6	42.6	0.02 J1	< 0.005 U1	0.423	1.59	0.611	0.08	0.159	0.001	--	0.59	0.1	0.04 J1
10/22/2018	Assessment	--	--	--	--	--	--	--	--	--	--	--	< 0.002 U1	--	--	--
3/13/2019	Assessment	< 0.02 U1	7.67	31.6	< 0.02 U1	< 0.01 U1	0.424	1.43	0.18541	0.06	0.05 J1	< 0.009 U1	< 0.002 U1	1 J1	0.08 J1	< 0.1 U1
6/25/2019	Assessment	0.02 J1	19.3	38.1	< 0.02 U1	< 0.01 U1	0.250	1.39	0.501	0.08	0.09 J1	< 0.009 U1	< 0.002 U1	0.7 J1	0.1 J1	< 0.1 U1
8/20/2019	Assessment	< 0.02 U1	14.4	29.1	< 0.02 U1	< 0.01 U1	0.347	1.19	0.685	0.07	< 0.05 U1	0.0001 J1	< 0.002 U1	0.6 J1	0.09 J1	< 0.1 U1
3/18/2020	Assessment	0.02 J1	14.2	34.6	< 0.02 U1	< 0.01 U1	0.305	1.34	2.1757	0.06	0.1 J1	0.000332	< 0.002 U1	0.8 J1	0.2 J1	0.1 J1
6/30/2020	Assessment	0.03 J1	17.7	25.7	< 0.02 U1	< 0.01 U1	0.209	1.33	1.398	0.06 J1	0.08 J1	0.0001 J1	< 0.002 U1	0.6 J1	0.1 J1	< 0.1 U1
10/6/2020	Assessment	0.16	24.9	30.2	< 0.02 U1	< 0.01 U1	0.352	1.22	1.017	0.07	0.1 J1	0.0002 J1	< 0.002 U1	0.6 J1	0.1 J1	< 0.1 U1
3/10/2021	Assessment	< 0.02 U1	12.3	54.7	0.01 J1	0.009 J1	0.276	1.75	0.2646	0.08	0.09 J1	0.000310	< 0.002 U1	0.6 J1	0.1 J1	< 0.04 U1
6/8/2021	Assessment	0.02 J1	14.3	24.3	0.009 J1	< 0.004 U1	0.23	0.946	0.88	0.09	0.05 J1	0.00012 J1	< 0.002 U1	0.6	< 0.09 U1	0.05 J1
10/5/2021	Assessment	0.03 J1	16.7	32.4	0.012 J1	0.004 J1	0.20	1.05	2.2	0.08	0.07 J1	0.00018 J1	< 0.002 U1	0.7	< 0.09 U1	< 0.04 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1: Residence Time Calculation Summary
Big Sandy Fly Ash Pond

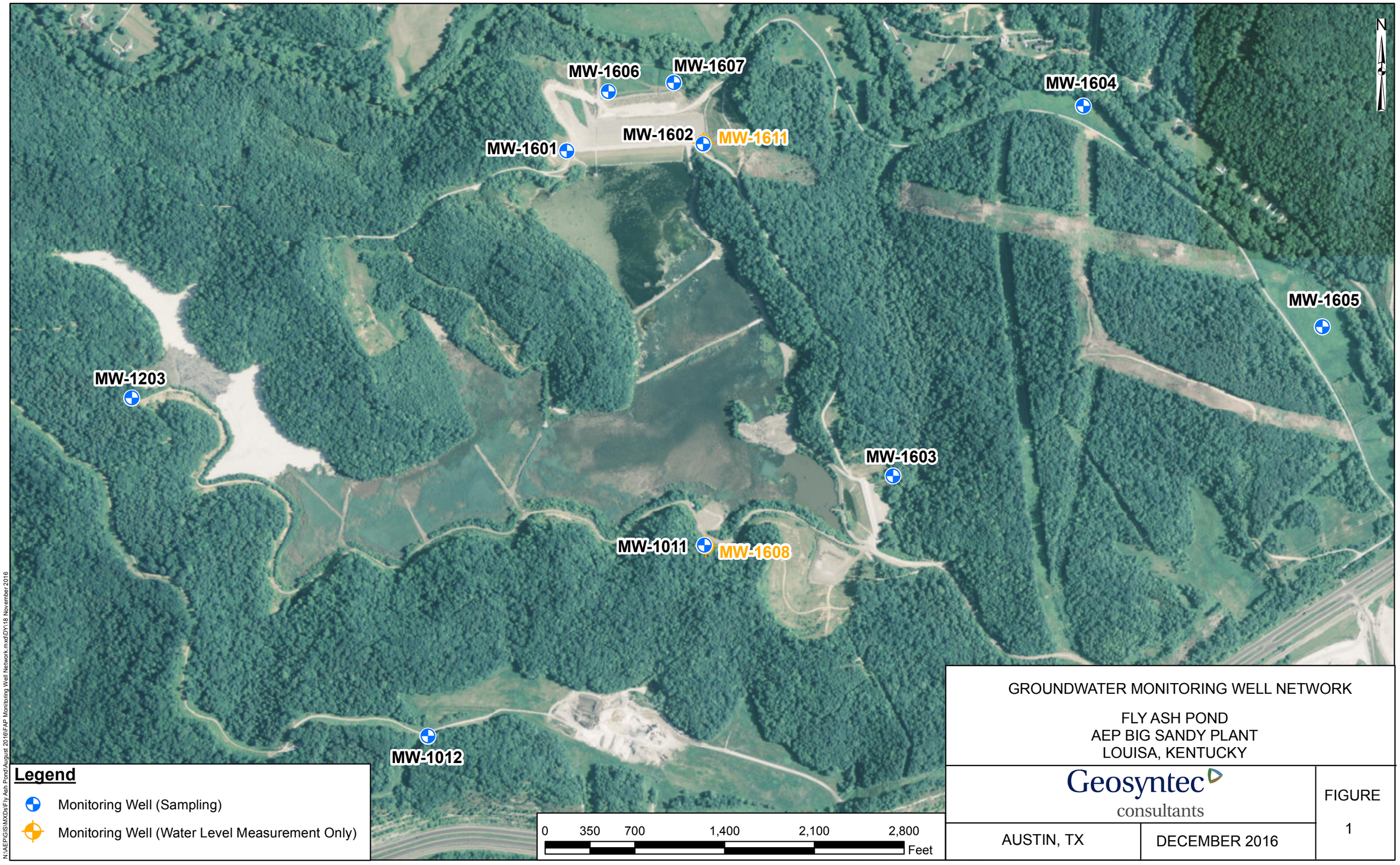
Geosyntec Consultants, Inc.

			2021-03		2021-06		2021-10	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Fly Ash Pond	MW-1011 [1]	2.0	33.0	1.8	33.0	1.8	33.0	1.8
	MW-1012 [1]	2.0	33.0	1.8	33.0	1.8	33.0	1.8
	MW-1203 [1]	2.0	33.0	1.8	33.0	1.8	33.0	1.8
	MW-1601 [2]	4.0	33.0	3.7	33.0	3.7	33.0	3.7
	MW-1602 [2]	4.0	33.0	3.7	33.0	3.7	33.0	3.7
	MW-1603 [2]	4.0	33.0	3.7	33.0	3.7	33.0	3.7
	MW-1604 [3]	4.0	6.5	18.6	4.1	29.8	6.7	18.1
	MW-1605 [3]	4.0	6.5	18.6	4.1	29.8	6.7	18.1
	MW-1606 [2]	4.0	6.5	18.6	4.1	29.8	6.7	18.1
	MW-1607 [2]	4.0	6.5	18.6	4.1	29.8	6.7	18.1

Notes:
[1] - Upgradient Well
[2] - Downgradient Well
[3] - Background Well

APPENDIX 2—Figures

Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.



Legend

- Monitoring Well (Sampling)
- Monitoring Well (Water Level Measurement Only)

GROUNDWATER MONITORING WELL NETWORK

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

FIGURE 1

N:\AEP\GIS\MXDs\Fly Ash Pond\August 2016\FAP Monitoring Well Network.mxd\DY\18 November 2016

Legend

- Groundwater Monitoring Well
- Inferred Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on March 8, 2021) provided by AEP.
- Site features based on information available in Groundwater Monitoring Network Evaluation - Big Sandy Fly Ash Pond (Geosyntec, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (ft amsl).
- Fly Ash Pond cap liner construction completed in November 2020. Surface water elevation measurements are not applicable.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer
March 2021
AEP Big Sandy Plant - Fly Ash Pond
Louisa, Kentucky

Geosyntec consultants

Columbus, Ohio | 2021/06/28

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Big Sandy\2021\AEP-BigSandy_FAP_GW_2021-03-March.mxd. ARevezzo. 6/28/2021. CHA8423/05/08.

Legend

- Groundwater Monitoring Well
- Inferred Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on June 7, 2021) provided by AEP.
- Site features based on information available in Groundwater Monitoring Network Evaluation - Big Sandy Fly Ash Pond (Geosyntec, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (ft amsl).
- FAP: Fly Ash Pond

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer
June 2021
AEP Big Sandy Plant - Fly Ash Pond
Louisa, Kentucky

Geosyntec consultants

Columbus, Ohio | 2021/09/14

Figure **3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Big Sandy\2021\AEP-BigSandy_FAP_GW_2021-06-June.mxd. ASoltero. 9/14/2021. CHA8423/05/08.

Legend

- Groundwater Monitoring Well
- Inferred Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on October 4, 2021) provided by AEP.
- Site features based on information available in Groundwater Monitoring Network Evaluation - Big Sandy Fly Ash Pond (Geosyntec, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (ft amsl).

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer
October 2021

AEP Big Sandy Plant - Fly Ash Pond
Louisa, Kentucky

Geosyntec consultants

Columbus, Ohio | 2022/01/11

Figure **4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Big Sandy\2021\AEP-BigSandy_FAP_GW_2021-10-October.mxd. ASoltero. 1/11/2022. CHA8423/05/08.

APPENDIX 3—Statistical Analysis Summaries

The February 2021and October 2021 statistical analysis summaries concluding that SSLs were identified at the CCR unit follow.

STATISTICAL ANALYSIS SUMMARY
FLY ASH POND
Big Sandy Plant
Louisa, Kentucky

Submitted to

AMERICAN ELECTRIC POWER℠

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

February 3, 2021
CHA8500

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
FAP	Fly Ash Pond
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Fly Ash Pond (FAP), an existing CCR unit at the Big Sandy Power Plant located in Louisa, Kentucky.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, fluoride, total dissolved solids (TDS), and sulfate at the FAP. An alternative source was not identified at the time, so the FAP initiated assessment monitoring in April 2018. Groundwater protection standards (GWPS) were set in accordance with 40 CFR 257.95(d)(2) and a statistical evaluation of the assessment monitoring data was conducted. During the most recent assessment monitoring event, statistically significant levels (SSLs) were observed for beryllium, cobalt, combined radium, and lithium (Geosyntec, 2020a). An alternative source demonstration (ASD) was successfully completed (EHS, 2021); thus, the unit remained in assessment monitoring. One assessment monitoring event was conducted at the FAP in October 2020 in accordance with 40 CFR 257.95. The results of this assessment event are documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact data usability.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether SSLs of Appendix IV parameters were present above the GWPS. SSLs were identified for beryllium, cobalt, and lithium. Thus, either the unit will move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

FLY ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 257.95(d)(1) in October 2020. Samples from October 2020 were analyzed for all Appendix IV and select Appendix III parameters. Well MW-1601 could not be sampled during the October 2020 sampling event due to insufficient water. A summary of data collected during this assessment monitoring event is presented in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.26 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the FAP were conducted in accordance with the October 2020 *Statistical Analysis Plan* (Geosyntec, 2020b), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in October 2020 were screened for potential outliers. No outliers were identified for this event.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (Geosyntec, 2020b). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Tolerance limits were calculated parametrically with 95% coverage and 95%

confidence for barium, cobalt, combined radium, lead, and lithium. Non-parametric tolerance limits were calculated for antimony, arsenic, cadmium, chromium, fluoride, molybdenum, selenium, and thallium due to apparent non-normal distributions and for mercury due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs were identified at the Big Sandy FAP:

- The LCL for beryllium exceeded the GWPS of 0.00400 mg/L at MW-1603 (0.0167 mg/L).
- The LCL for cobalt exceeded the GWPS of 0.00600 mg/L at MW-1603 (0.0870 mg/L).
- The LCL for lithium exceeded the GWPS of 0.0400 mg/L at MW-1603 (0.194 mg/L).

As a result, the Big Sandy FAP will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

2.2.3 Establishment of Appendix III Prediction Limits

Upper prediction limits (UPLs) were previously established for all Appendix III parameters following the background monitoring period (Geosyntec, 2018). Intrawell tests were used to evaluate potential SSIs for pH, whereas interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS. Interwell and intrawell prediction limits are updated periodically during the assessment monitoring period as sufficient data became available.

Mann-Whitney (Wilcoxon rank-sum) tests were performed to determine whether the newer data are affected by a release from the FAP. Because the interwell Appendix III limits and the Appendix IV GWPSs are based on data from upgradient wells which we would not expect to have been impacted by a release, these tests were used for intrawell Appendix III tests only. Mann-Whitney tests were used to compare the medians of historical data (September 2016 – March 2019) to the new compliance samples (June 2019 – August 2020) for pH. Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have

been caused by a release, then the previous background dataset would have continued to be used. The complete Mann-Whitney test results and a summary of the significant findings can be found in Attachment B. No significant differences were found between the two groups.

After the revised background set was established, a parametric or non-parametric analysis was selected based on the distribution of the data and the frequency of non-detect data. Estimated results less than the practical quantitation limit (PQL) – i.e., "J-flagged" data – were considered detections and the estimated results were used in the statistical analyses. Non-parametric analyses were selected for datasets with at least 50% non-detect data or datasets that could not be normalized. Parametric analyses were selected for datasets (either transformed or untransformed) that passed the Shapiro-Wilk / Shapiro-Francía test for normality. The Kaplan-Meier non-detect adjustment was applied to datasets with between 15% and 50% non-detect data. For datasets with fewer than 15% non-detect data, non-detect data were replaced with one half of the PQL. The selected analysis (i.e., parametric or non-parametric) and transformation (where applicable) for each background dataset are shown in Attachment B.

Interwell UPLs were updated for boron, calcium, chloride, fluoride, sulfate, and TDS using historical data through October 2020, and intrawell UPLs and LPLs were updated for pH using all the historical data through August 2020 to represent background values, except for well MW-1601, which did not have data in 2020 because there was insufficient water for sampling. The updated prediction limits are summarized in Table 3. The intrawell UPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample was not collected. The retesting procedures allowed achieving an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

2.2.4 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results was also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the October 2020 assessment monitoring event from each compliance well were compared to the re-calculated prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.242 mg/L at MW-1606 (2.00 mg/L).
- Chloride concentrations exceeded the interwell UPL of 6.22 mg/L at MW-1602 (19.2 mg/L) and MW-1606 (32.0 mg/L).

- Sulfate concentrations exceeded the interwell UPL of 106 mg/L at MW-1602 (143 mg/L), MW-1603 (794 mg/L), and MW-1607 (129 mg/L).

- TDS concentrations exceeded the interwell UPL of 583 mg/L at MW-1603 (1,020 mg/L).

While the prediction limits were calculated for a one-of-two retesting procedure, SSIs were conservatively assumed if the October 2020 sample was above the UPL or below the LPL. Based on these results, concentrations of Appendix III constituents appear to be above background levels at compliance wells.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the October 2020 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for beryllium, cobalt, and lithium. Appendix III parameters were compared to established prediction limits, with exceedances identified for boron, chloride, sulfate, and TDS.

Based on this evaluation, the Big Sandy FAP CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

EHS Support. 2021. Alternative Source Demonstration Addendum Report for the March and June 2020 Monitoring Data. Big Sandy Fly Ash Pond. January 2021.

Geosyntec Consultants (Geosyntec). 2020. Statistical Analysis Summary – Fly Ash Pond, Big Sandy Plant, Louisa, Kentucky. October 27, 2020.

Geosyntec. 2020b. Statistical Analysis Plan. October 2020.

TABLES

Table 1 - Groundwater Data Summary
Big Sandy Plant - Fly Ash Pond

Geosyntec Consultants, Inc.

Parameter	Unit	MW-1011	MW-1012	MW-1203	MW-1602	MW-1603	MW-1604	MW-1605	MW-1606	MW-1607
		10/5/2020	10/6/2020	10/5/2020	10/6/2020	10/6/2020	10/5/2020	10/5/2020	10/6/2020	10/6/2020
Antimony	µg/L	0.18	0.89	0.02 J	0.04 J	0.1 U	0.1 U	0.1 U	0.1 U	0.16
Arsenic	µg/L	5.31	23.0	0.59	1.53	1.12	0.10	0.04 J	1.00	24.9
Barium	µg/L	46.3	34.7	94.6	52.4	14.6	75.8	33.7	750	30.2
Beryllium	µg/L	0.1 U	0.06 J	0.08 J	0.1 U	17.5	0.149	0.113	0.1 U	0.1 U
Boron	mg/L	0.105	0.175	0.100	0.05 J	0.05 J	0.05 U	0.05 U	2.00	0.155
Cadmium	µg/L	0.05 U	0.02 J	0.05 U	0.05 U	0.87	0.09	0.07	0.05 U	0.05 U
Calcium	mg/L	82.7	1.37	64.2	82.5	94.5	3.31	1.04	78.7	99.4
Chloride	mg/L	4.86	1.32	5.24	19.2	4.10	1.09	0.39	32.0	4.76
Chromium	µg/L	0.09 J	0.468	0.2 J	1.05	0.743	0.589	2.55	0.1 J	0.352
Cobalt	µg/L	0.321	0.229	0.672	0.04 J	90.5	0.289	0.219	0.060	1.22
Combined Radium	pCi/L	2.57	1.04	1.539	2.003	2.681	0.491	4.041	2.91	1.017
Fluoride	mg/L	0.26	0.68	0.14	0.10	0.47	0.03 J	0.06 U	0.22	0.07
Lead	µg/L	0.2 U	0.851	0.212	0.2 U	4.85	0.2 J	0.1 J	0.2 U	0.1 J
Lithium	mg/L	0.00926	0.00531	0.0114	0.00707	0.165	0.000964	0.000695	0.00329	0.0002 J
Mercury	µg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Molybdenum	µg/L	0.8 J	1 J	2 U	1 J	2 U	2 U	2 U	0.5 J	0.6 J
Selenium	µg/L	0.04 J	0.2 J	0.2 U	1.1	5.8	0.4	0.3	0.07 J	0.1 J
Sulfate	mg/L	81.5	37.0	30.4	143	794	10.3	5.3	62.8	129
Thallium	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	1.82	0.5 U	0.5 U	0.5 U	0.5 U
Total Dissolved Solids	mg/L	388	577	266	479	1,020	50 J	40 J	363	381
pH	SU	7.2	9.2	7.1	7.7	4.1	6.8	5.6	6.7	6.9

Notes:
mg/L: milligrams per liter
µg/L: micrograms per liter
SU: standard unit
pCi/L: picocuries per liter
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit
All samples were collected as part of the assessment monitoring program in accordance with 40 CFR 257.90(e)(3).

Table 2: Groundwater Protection Standards
Big Sandy Plant - Fly Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Calculated UTL
Antimony, Total (mg/L)	0.006		0.0012
Arsenic, Total (mg/L)	0.01		0.029
Barium, Total (mg/L)	2		0.11
Beryllium, Total (mg/L)	0.004		0.00015
Cadmium, Total (mg/L)	0.005		0.00014
Chromium, Total (mg/L)	0.1		0.0029
Cobalt, Total (mg/L)	n/a	0.006	0.0054
Combined Radium, Total (pCi/L)	5		4.60
Fluoride, Total (mg/L)	4		0.82
Lead, Total (mg/L)	n/a	0.015	0.0016
Lithium, Total (mg/L)	n/a	0.04	0.02
Mercury, Total (mg/L)	0.002		0.000013
Molybdenum, Total (mg/L)	n/a	0.1	0.0035
Selenium, Total (mg/L)	0.05		0.0005
Thallium, Total (mg/L)	0.002		0.0005

Notes:
Grey cell indicates calculated UTL is higher than MCL or CCR Rule-specified value.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3 - Appendix III Data Summary
Big Sandy Plant - Fly Ash Pond

Geosyntec Consultants, Inc.

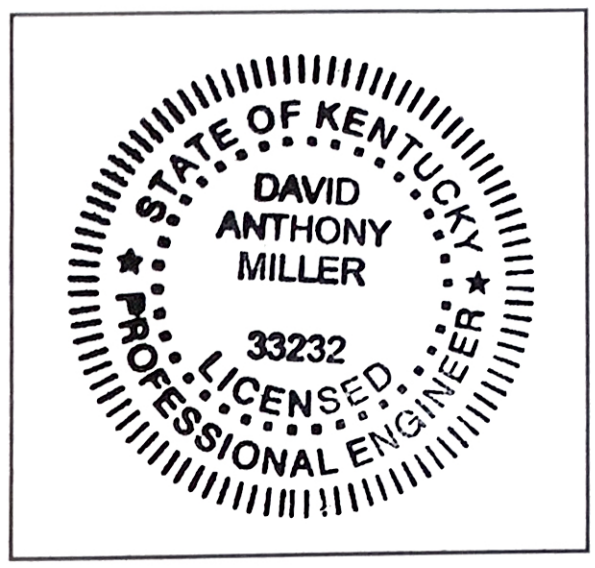
Analyte	Unit	Description	MW-1602	MW-1603	MW-1606	MW-1607
			10/6/2020	10/6/2020	10/6/2020	10/6/2020
Boron	mg/L	Interwell Background Value (UPL)	0.242			
		Analytical Result	0.05	0.05	**2.00**	0.155
Calcium	mg/L	Interwell Background Value (UPL)	105			
		Analytical Result	82.5	94.5	78.7	99.4
Chloride	mg/L	Interwell Background Value (UPL)	6.22			
		Analytical Result	**19.2**	4.10	**32.0**	4.76
Fluoride	mg/L	Interwell Background Value (UPL)	0.820			
		Analytical Result	0.10	0.47	0.22	0.07
pH	SU	Intrawell Background Value (UPL)	8.7	5.6	7.5	7.5
		Intrawell Background Value (LPL)	5.6	2.9	6.3	5.5
		Analytical Result	7.7	4.1	6.7	6.9
Sulfate	mg/L	Interwell Background Value (UPL)	106			
		Analytical Result	**143**	**794**	62.8	**129**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	583			
		Analytical Result	479	**1,020**	363	381

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A
Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Big Sandy Fly Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

33232

License Number

KENTUCKY

Licensing State

02.03.2021

Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING

January 27, 2021

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Big Sandy Fly Ash Pond
Assessment Monitoring & Background Update – October 2020

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the background update and analysis of groundwater data for American Electric Power Company's Big Sandy Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1011, MW-1012, MW-1203, MW-1604, and MW-1605
- **Downgradient wells:** MW-1601, MW-1602, MW-1603, MW-1606, and MW-1607

Note that no data was available for downgradient well MW-1601 for Detection Monitoring parameters during the Spring and Fall 2020 sampling events and for Assessment Monitoring during the Fall 2020 sampling event. Data from this well were plotted on time series and box plots, but did not require formal statistics.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The analysis was reviewed by Andrew Collins, Project Manager of Groundwater Stats Consulting.

The CCR program consists of the following constituents listed below. The terms "constituent" and "parameter" are interchangeable.

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS
- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium

Note that when there are no detections present in downgradient wells for a given constituent, statistical analyses are not required. A summary of well/constituent pairs with 100% nondetects follows this letter. A substitution of the most recent reporting limit is used for nondetect data.

For all constituents, a substitution of the most recent reporting limit is used for nondetect data. In the time series plots, a single reporting limit substitution is used across all wells for a given parameter since the wells are plotted as a group. For calculating intrawell prediction limits, the substitution is performed for individual wells and may differ across wells. This generally gives the most conservative limit in each case.

Time series and box plots for Appendix III and IV parameters are provided for all wells and constituents, and are used to evaluate concentrations over the entire record (Figures A & B, respectively). A summary of the values identified as outliers in this report and through previous screenings follows this letter. These values are deselected prior to the statistical analysis. All flagged values may also be seen in a lighter font and disconnected symbol on the time series graphs (Figure C).

For regulatory comparison of current observations against statistical limits for Appendix III constituents, the annual site-wide false positive rate is based on the USEPA Unified Guidance (2009) recommendation of 10% (5% for each semi-annual sample event or 2.5% for quarterly sample events). Power curves are included with this report to demonstrate that the selected statistical method provides sufficient power to detect a change at any of the downgradient wells which complies with the USEPA Unified Guidance recommendation. The EPA suggests the selected statistical method should provide at

least 55% power at 3 standard deviations or at least 80% power at 4 standard deviations. Power curves were based on the following:

Semi-Annual Sampling
1-of-2 resample plan
Constituents: 7
Downgradient wells: 5

Data at all wells were evaluated during the initial background screening conducted in December 2017 for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves are provided in this report to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Methods – Appendix III Parameters

Based on the original background screening described below, the following statistical methods were selected for Appendix III parameters:

- Intrawell prediction limits, combined with a 1-of-2 resample plan for pH
- Interwell prediction limits combined with a 1-of-2 resample plan for boron, calcium, chloride, fluoride, sulfate and TDS

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are nondetects, a nonparametric test is utilized. While the annual false positive rate associated with parametric limits is fixed at 10% as recommended by the EPA Unified Guidance (2009), the false positive rate associated with nonparametric limits is not fixed and depends upon the available background sample size, number of future comparisons, and verification resample plan. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits as appropriate. Nondetects are handled as follows:

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit

utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.

- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits is necessary to accommodate these types of changes. In the intrawell case, data for all wells and constituents may be re-evaluated when a minimum of 4 new data points are available to determine whether earlier concentrations are representative of present-day groundwater quality. In the interwell case, prediction limits are updated with upgradient well data following each sampling event after careful screening for any new outliers. In some cases, deselecting the earlier portion of data may be necessary prior to construction of limits so that resulting statistical limits are conservative (lower) from a regulatory perspective and capable of rapidly detecting changes in groundwater quality. Even though the data are excluded from the calculation, the values will continue to be reported and shown in tables and graphs.

Summary of Background Screening Conducted in December 2017

All proposed background data were screened for outliers and trends during the background screening. The findings of those reports were submitted with that analysis. Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. Intrawell prediction limits utilized the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data sets are evaluated for the purpose of updating statistical limits, as described below, using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

No true seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation

or a release. It was noted that for each constituent evaluated, the highest concentrations are reported in the upgradient wells.

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends. In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed several statistically significant decreasing trends, as may be seen on the Trend Test Summary table. These trends were similar in magnitude to the average reported concentrations. One exception is fluoride in upgradient well MW-1604 which appears to be developing a pattern of lower concentrations than previously reported. If future concentrations continue at these lower levels, earlier data will be deselected prior to construction of statistical limits so that resulting limits are more conservative from a regulatory perspective. No other adjustments were required for any other data sets.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) was used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach. Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation; when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; and when downgradient water quality is unimpacted compared to upgradient water quality for the same parameter.

The results of the 2017 screening demonstrated that intrawell background limits, based on a 1-of-2 resample plan, were appropriate for pH and that interwell background limits,

based on a 1-of-2 resample plan, were appropriate for boron, calcium, chloride, fluoride, sulfate, and TDS. A summary of the ANOVA results was included with the 2017 screening.

Appendix III Background Update – Conducted in January 2021

Prior to updating background data, samples were re-evaluated using Tukey's outlier test and visual screening with the October 2020 samples. All Appendix III parameters except for pH are tested using interwell prediction limits; therefore, only upgradient wells were tested for outliers for these constituents (Figure C). Tukey's outlier test was used to evaluate all wells for pH, which is tested using intrawell prediction limits (Figure C). Tukey's identified new outliers for pH in wells MW-1012 and MW-1606 and these values were appropriately flagged as outliers in the database.

Tukey's outlier test on pooled upgradient well data for interwell constituents did not identify any potential outliers, and no values were flagged in upgradient wells for Appendix III parameters requiring interwell methods. A summary of all flagged outliers follows this report (Figure C).

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through March 2019 to the new compliance samples at each well through August 2020 to evaluate whether the groups are statistically similar at the 99% confidence level, in which case background data may be updated with compliance data (Figure D). As mentioned above, well MW-1601 did not have any samples from the 2020 sample events, and therefore, did not have sufficient data to update its respective background dataset. No statistically significant differences were found between the two groups for pH among wells that were tested.

When the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background data may not updated to include newer data, but will be reconsidered in the future. Complete graphical results of the Mann-Whitney test follow this letter.

Intrawell prediction limits using all historical data through August 2020, with the exception of well MW-1601, combined with a 1-of-2 resample plan, were constructed for pH and a summary of the updated limits follows this letter (Figure E). Intrawell prediction limits for well MW-1601 utilized overall date ranges (Date Ranges Table) so compliance data beyond its respective background would not be compared to established statistical limits.

The Sen's Slope/Mann Kendall trend test was used to evaluate data at upgradient wells for boron, calcium, chloride, fluoride, sulfate and TDS to identify statistically significant

increasing or decreasing trends (Figure F). The results of the trend analyses showed no statistically significant increasing trends. Statistically significant decreasing trends were noted for chloride, fluoride and TDS in upgradient well MW-1604. However, the magnitudes of the trends are low relative to average concentrations within this well and reported measurements are consistent with those reported at one or more neighboring upgradient wells. Therefore, no adjustments were made to the records at this time. All records will be re-evaluated during the next background update and, if earlier measurements are no longer representative of present-day conditions, the historical portion of the records will be deselected prior to construction of statistical limits.

Interwell prediction limits, combined with a 1-of-2 resample plan, were updated using all available data from upgradient wells through October 2020 for boron, calcium, chloride, fluoride, sulfate and TDS (Figure G). Interwell prediction limits pool upgradient well data to establish a background limit for an individual constituent. A summary table of the updated limits may be found following this letter in the Prediction Limit Summary Tables.

Evaluation of Appendix IV Parameters – October 2020

Prior to evaluating Appendix IV parameters, all background data are screened through visual screening and Tukey's outlier test for potential outliers and extreme trending patterns that would lead to artificially elevated statistical limits.

Tukey's outlier test on pooled upgradient well data for Appendix IV parameters did not identify any potential outliers. Although not identified by Tukey's outlier test, the highest values for combined radium 226 + 228 in well MW-1203, and two highest values for combined radium 226 + 228 in wells MW-1604 and MW-1605 exceeded the MCL of 5 pCi/L. Additionally, the highest values for chromium in well MW-1012 and for molybdenum in wells MW-1604 and MW-1605 were uncharacteristically high relative to other concentrations within their respective wells. These values were flagged as outliers to construct limits that are conservative (i.e. lower) from a regulatory perspective. Any flagged values may be seen on the Outlier Summary following this letter as mentioned above.

Interwell upper tolerance limits were used to calculate background limits from all available pooled upgradient well data through October 2020 (Figure H).

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels, as shown in the Groundwater Protection Standards

(GWPS) table following this letter (Figure I), to determine the highest limit for use as the GWPS in the Confidence Interval comparisons.

Confidence intervals were then constructed for each Appendix IV constituent and each downgradient well using data through October 2020, with the exception of well MW-1601. The confidence intervals were then compared against the GWPS for each constituent to assess compliance. Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. Complete results of the confidence interval analysis follow this letter (Figure J). The following confidence interval exceedances were identified:

- Beryllium: MW-1603
- Cobalt: MW-1603
- Lithium: MW-1603

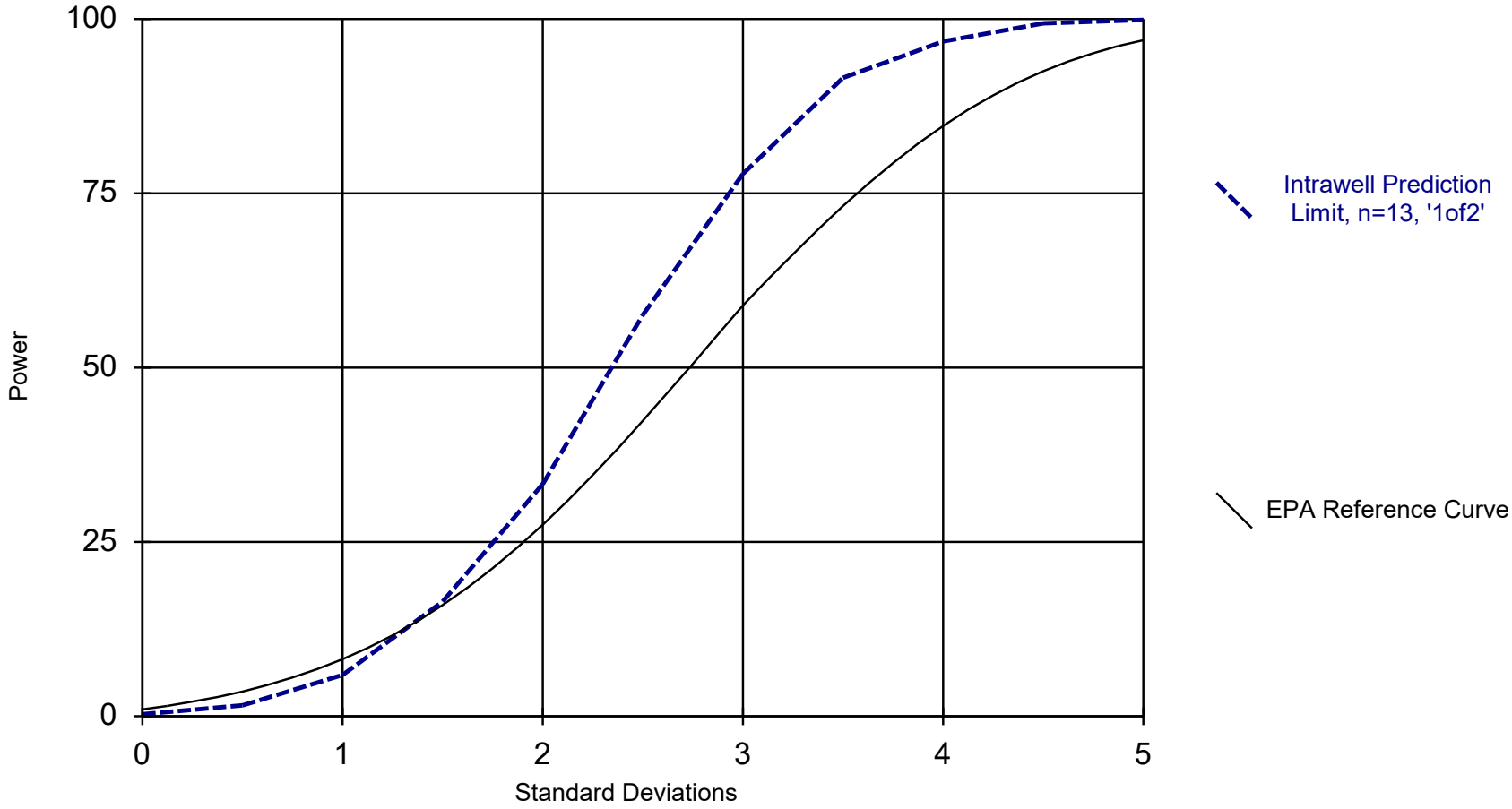
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for Big Sandy Fly Ash Pond. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

Easton Rayner
Groundwater Analyst

Andrew Collins
Project Manager

Intrawell Power Curve

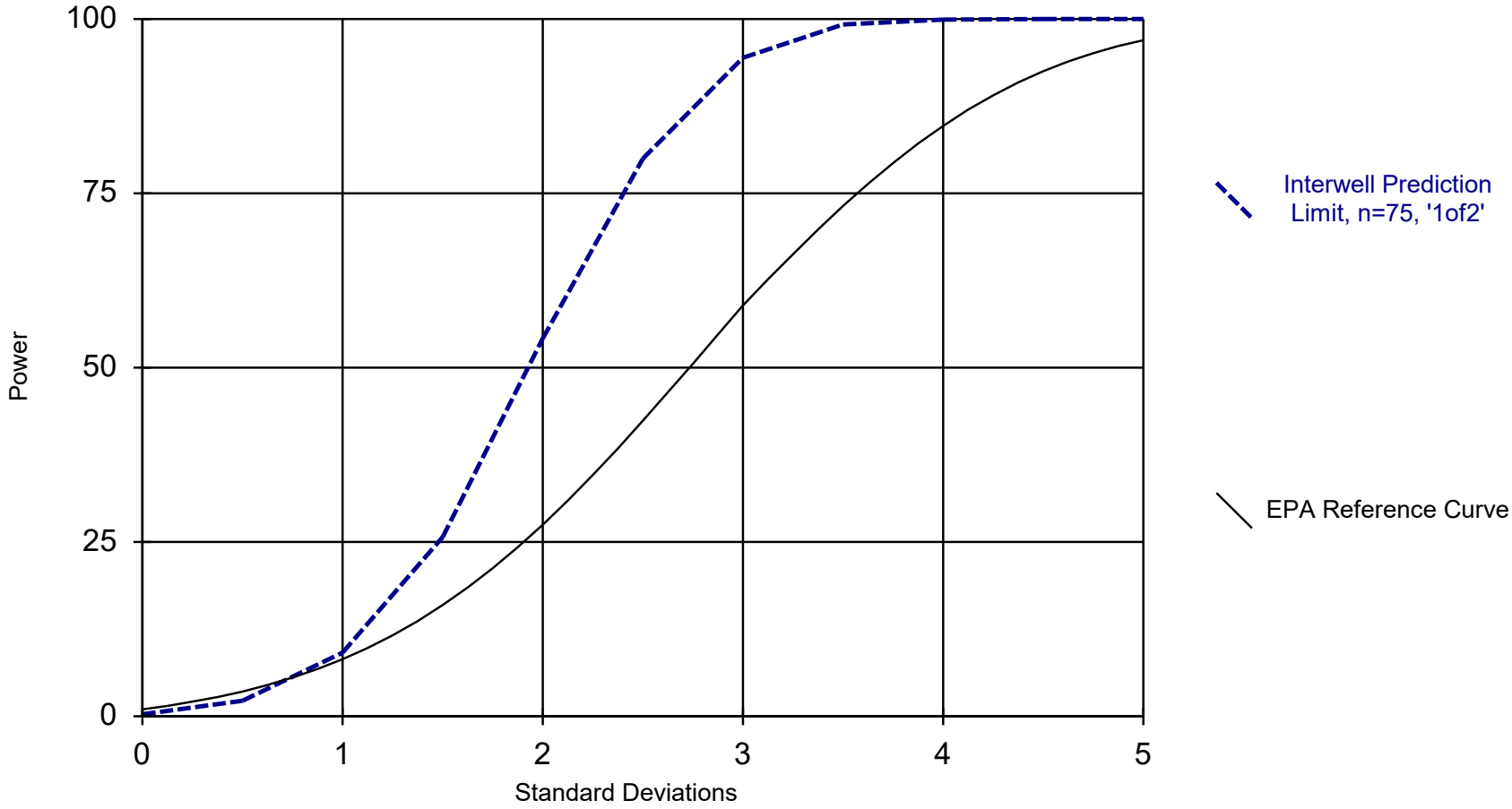


Kappa = 2.279, based on 5 compliance wells and 7 constituents, evaluated semi-annually (this report reflects annual total).

Analysis Run 1/26/2021 6:13 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Interwell Power Curve



Kappa = 1.823, based on 5 compliance wells and 7 constituents, evaluated semi-annually (this report reflects annual total).

Analysis Run 1/26/2021 6:12 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Date Ranges

Date: 1/26/2021 2:40 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

pH (SU)

MW-1601 overall:9/26/2016-3/14/2019

100% Non-Detects

Analysis Run 1/26/2021 6:02 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Beryllium (mg/L)
MW-1602

Tukey's Outlier Test - Intrawell - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:08 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
pH (SU)	**MW-1012 (bg)**	**Yes**	**10.85**	**3/18/2020**	**NP**	**NaN**	**18**	**9.169**	**0.4732**	**ln(x)**	**ShapiroWilk**
pH (SU)	**MW-1606**	**Yes**	**9.11**	**3/18/2020**	**NP**	**NaN**	**19**	**7.001**	**0.5786**	**ln(x)**	**ShapiroWilk**

Tukey's Outlier Test - Intrawell - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:08 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
pH (SU)	MW-1011 (bg)	No	n/a	n/a	NP	NaN	18	6.775	0.6869	x^6	ShapiroWilk
pH (SU)	**MW-1012 (bg)**	**Yes**	**10.85**	**3/18/2020**	**NP**	**NaN**	**18**	**9.169**	**0.4732**	**ln(x)**	**ShapiroWilk**
pH (SU)	MW-1203 (bg)	No	n/a	n/a	NP	NaN	18	6.819	0.3955	ln(x)	ShapiroWilk
pH (SU)	MW-1601	No	n/a	n/a	NP	NaN	16	7.218	0.4375	ln(x)	ShapiroWilk
pH (SU)	MW-1602	No	n/a	n/a	NP	NaN	19	7.309	0.762	x^3	ShapiroWilk
pH (SU)	MW-1603	No	n/a	n/a	NP	NaN	19	3.614	0.6278	ln(x)	ShapiroWilk
pH (SU)	MW-1604 (bg)	No	n/a	n/a	NP	NaN	18	5.783	0.8373	x^2	ShapiroWilk
pH (SU)	MW-1605 (bg)	No	n/a	n/a	NP	NaN	18	4.768	0.7545	x^4	ShapiroWilk
pH (SU)	**MW-1606**	**Yes**	**9.11**	**3/18/2020**	**NP**	**NaN**	**19**	**7.001**	**0.5786**	**ln(x)**	**ShapiroWilk**
pH (SU)	MW-1607	No	n/a	n/a	NP	NaN	19	6.452	0.5095	ln(x)	ShapiroWilk

Tukey's Outlier Test - Upgradient - All Results (No Significant)

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/19/2021, 10:12 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0002531	0.0003217	ln(x)	ShapiroFrancia
Arsenic (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.006361	0.008436	ln(x)	ShapiroFrancia
Barium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.05608	0.0253	ln(x)	ShapiroFrancia
Beryllium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.00008017	0.00004124	normal	ShapiroFrancia
Boron (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.09741	0.06295	sqrt(x)	ShapiroFrancia
Cadmium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.00004639	0.00002885	normal	ShapiroFrancia
Calcium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	28.84	34.12	ln(x)	ShapiroFrancia
Chloride (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	2.678	1.889	ln(x)	ShapiroFrancia
Chromium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0009619	0.001169	ln(x)	ShapiroFrancia
Cobalt (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.001049	0.001237	ln(x)	ShapiroFrancia
Combined Radium 226 + 228 (pCi/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	2.107	2.506	ln(x)	ShapiroFrancia
Fluoride (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	84	0.2457	0.2504	ln(x)	ShapiroFrancia
Lead (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0003136	0.0004251	ln(x)	ShapiroFrancia
Lithium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.009121	0.005467	normal	ShapiroFrancia
Mercury (mg/L)	MW-1011,MW-1012,M...	n/a	n/a	n/a w/combined bg	NP	NaN	80	0.000004787	0.00000125	unknown	ShapiroFrancia
Molybdenum (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.001612	0.003097	ln(x)	ShapiroFrancia
Selenium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0001867	0.000102	sqrt(x)	ShapiroFrancia
Sulfate (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	32.38	26.6	x^(1/3)	ShapiroFrancia
Thallium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0002423	0.0002269	ln(x)	ShapiroFrancia
Total Dissolved Solids (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	75	265.9	193.5	sqrt(x)	ShapiroFrancia

Welch's t-test/Mann-Whitney - All Results (No Significant)

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:35 PM

Constituent	Well	Calc.	0.01	Method
pH (SU)	MW-1011 (bg)	0.7401	No	Mann-W
pH (SU)	MW-1012 (bg)	2.365	No	Mann-W
pH (SU)	MW-1203 (bg)	1.477	No	Mann-W
pH (SU)	MW-1602	-0.1971	No	Mann-W
pH (SU)	MW-1603	0.5927	No	Mann-W
pH (SU)	MW-1604 (bg)	-1.003	No	Mann-W
pH (SU)	MW-1605 (bg)	2.32	No	Mann-W
pH (SU)	MW-1606	-0.5102	No	Mann-W
pH (SU)	MW-1607	0.6904	No	Mann-W

Intrawell Prediction Limits - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/27/2021, 1:41 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH (SU)	MW-1011	7.587	5.497	n/a	1 future	n/a	17	15079	4730	0	None	x^5	0.000752	Param Intra 1 of 2
pH (SU)	MW-1012	9.552	8.568	n/a	1 future	n/a	16	9.06	0.229	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1203	7.664	5.948	n/a	1 future	n/a	17	6.806	0.4033	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1601	7.969	6.349	n/a	1 future	n/a	13	7.159	0.3554	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1602	8.718	5.606	n/a	1 future	n/a	18	53.72	10.6	0	None	x^2	0.000752	Param Intra 1 of 2
pH (SU)	MW-1603	5.56	2.91	n/a	1 future	n/a	18	n/a	n/a	0	n/a	n/a	0.01075	NP Intra (normality) 1 of 2
pH (SU)	MW-1604	7.478	3.972	n/a	1 future	n/a	17	5.725	0.8241	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1605	5.962	3.174	n/a	1 future	n/a	17	22.81	5.987	0	None	x^2	0.000752	Param Intra 1 of 2
pH (SU)	MW-1606	7.499	6.288	n/a	1 future	n/a	17	6.894	0.2847	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1607	7.509	5.473	n/a	1 future	n/a	18	1.858	0.07518	0	None	ln(x)	0.000752	Param Intra 1 of 2

Upgradient Wells Trend Test - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 2:02 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Chloride (mg/L)	**MW-1604 (bg)**	**-0.5941**	**-83**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride (mg/L)	**MW-1604 (bg)**	**-0.03608**	**-74**	**-58**	**Yes**	**16**	**6.25**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids (mg/L)	**MW-1604 (bg)**	**-30.37**	**-50**	**-48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Upgradient Wells Trend Test - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 2:02 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron (mg/L)	MW-1011 (bg)	0.008548	24	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1012 (bg)	0.003033	16	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1203 (bg)	0.001484	8	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1604 (bg)	0.001686	7	53	No	15	13.33	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1605 (bg)	0.003842	17	53	No	15	26.67	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1011 (bg)	2.087	31	53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1012 (bg)	-0.03076	-25	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1203 (bg)	-0.3871	-6	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1604 (bg)	-0.2413	-23	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1605 (bg)	0.003453	4	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1011 (bg)	0.5799	42	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1012 (bg)	0.03588	29	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1203 (bg)	-0.1088	-25	-53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	**MW-1604 (bg)**	**-0.5941**	**-83**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride (mg/L)	MW-1605 (bg)	-0.1192	-22	-53	No	15	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1011 (bg)	0.0122	37	58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1012 (bg)	0.01482	38	58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1203 (bg)	0	-26	-58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	**MW-1604 (bg)**	**-0.03608**	**-74**	**-58**	**Yes**	**16**	**6.25**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride (mg/L)	MW-1605 (bg)	0	-30	-53	No	15	80	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1011 (bg)	1.552	29	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1012 (bg)	-0.02982	-6	-53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1203 (bg)	1.966	43	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1604 (bg)	0.5493	20	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1605 (bg)	0.02662	2	53	No	15	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1011 (bg)	11.62	37	48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1012 (bg)	9.101	41	48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1203 (bg)	-0.3138	-4	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	**MW-1604 (bg)**	**-30.37**	**-50**	**-48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids (mg/L)	MW-1605 (bg)	-0.7143	-16	-48	No	14	0	n/a	n/a	0.01	NP

Interwell Prediction Limits - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:52 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron (mg/L)	n/a	0.2424	n/a	n/a	5 future	n/a	80	0.2923	0.11	10	None	sqrt(x)	0.001504	Param Inter 1 of 2
Calcium (mg/L)	n/a	105	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Chloride (mg/L)	n/a	6.22	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Fluoride (mg/L)	n/a	0.82	n/a	n/a	5 future	n/a	84	n/a	n/a	16.67	n/a	n/a	0.0002746	NP Inter (normality) 1 of 2
Sulfate (mg/L)	n/a	106	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Total Dissolved Solids (mg/L)	n/a	583	n/a	n/a	5 future	n/a	75	n/a	n/a	0	n/a	n/a	0.0003436	NP Inter (normality) 1 of 2

Upper Tolerance Limit Summary Table

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:55 PM

Constituent	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	0.0012	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Arsenic (mg/L)	0.0289	n/a	n/a	80	n/a	n/a	2.5	n/a	n/a	0.01652	NP Inter(normality)
Barium (mg/L)	0.1118	n/a	n/a	80	0.2309	0.05269	0	None	sqrt(x)	0.05	Inter
Beryllium (mg/L)	0.0001465	n/a	n/a	80	0.00005513	0.00004654	20	Kaplan-Meier	No	0.05	Inter
Cadmium (mg/L)	0.00014	n/a	n/a	80	n/a	n/a	30	n/a	n/a	0.01652	NP Inter(normality)
Chromium (mg/L)	0.00291	n/a	n/a	79	n/a	n/a	0	n/a	n/a	0.01738	NP Inter(normality)
Cobalt (mg/L)	0.005433	n/a	n/a	80	-7.442	1.135	0	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	4.6	n/a	n/a	75	1.168	0.4951	0	None	sqrt(x)	0.05	Inter
Fluoride (mg/L)	0.82	n/a	n/a	84	n/a	n/a	16.67	n/a	n/a	0.01345	NP Inter(normality)
Lead (mg/L)	0.001584	n/a	n/a	80	-8.741	1.169	6.25	None	ln(x)	0.05	Inter
Lithium (mg/L)	0.01985	n/a	n/a	80	0.009121	0.005467	13.75	None	No	0.05	Inter
Mercury (mg/L)	0.000013	n/a	n/a	80	n/a	n/a	85	n/a	n/a	0.01652	NP Inter(NDs)
Molybdenum (mg/L)	0.00348	n/a	n/a	78	n/a	n/a	23.08	n/a	n/a	0.0183	NP Inter(normality)
Selenium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Thallium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	42.5	n/a	n/a	0.01652	NP Inter(normality)

BIG SANDY FAP GWPS				
Constituent Name	**MCL**	**CCR-Rule**	**Background**	**GWPS**
Antimony, Total (mg/L)	0.006		0.0012	0.006
Arsenic, Total (mg/L)	0.01		0.029	0.029
Barium, Total (mg/L)	2		0.11	2
Beryllium, Total (mg/L)	0.004		0.00015	0.004
Cadmium, Total (mg/L)	0.005		0.00014	0.005
Chromium, Total (mg/L)	0.1		0.0029	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0054	0.006
Combined Radium, Total (pCi/L)	5		4.6	5
Fluoride, Total (mg/L)	4		0.82	4
Lead, Total (mg/L)	0.015		0.0016	0.015
Lithium, Total (mg/L)	n/a	0.04	0.02	0.04
Mercury, Total (mg/L)	0.002		0.000013	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0035	0.1
Selenium, Total (mg/L)	0.05		0.0005	0.05
Thallium, Total (mg/L)	0.002		0.0005	0.002

**Grey cell indicates Background is higher than MCL or CCR-Rule Specified Level*

**GWPS = Groundwater Protection Standard*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

Confidence Intervals - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:17 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium (mg/L)	**MW-1603**	**0.0218**	**0.0167**	**0.004**	**Yes**	**16**	**0.01906**	**0.002719**	**0**	**None**	**No**	**0.01**	**NP (normality)**
Cobalt (mg/L)	**MW-1603**	**0.09515**	**0.08702**	**0.006**	**Yes**	**16**	**0.09096**	**0.006567**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium (mg/L)	**MW-1603**	**0.2325**	**0.1939**	**0.04**	**Yes**	**16**	**0.2132**	**0.0297**	**0**	**None**	**No**	**0.01**	**Param.**

Confidence Intervals - All Results

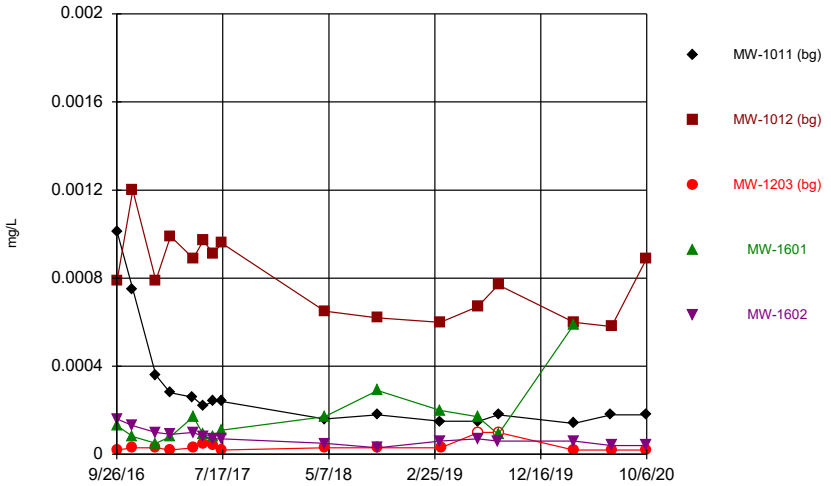
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:17 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	MW-1602	0.00009791	0.00005334	0.006	No	16	0.00007563	0.00003425	0	None	No	0.01	Param.
Antimony (mg/L)	MW-1603	0.0001	0.00002	0.006	No	16	0.00008	0.00003633	75	None	No	0.01	NP (NDs)
Antimony (mg/L)	MW-1606	0.0001	0.00003	0.006	No	16	0.00006687	0.00003683	50	None	No	0.01	NP (normality)
Antimony (mg/L)	MW-1607	0.0001	0.00002	0.006	No	16	0.00005875	0.00006985	12.5	None	No	0.01	NP (normality)
Arsenic (mg/L)	MW-1602	0.001425	0.0005439	0.029	No	16	0.001167	0.001024	0	None	ln(x)	0.01	Param.
Arsenic (mg/L)	MW-1603	0.001398	0.001134	0.029	No	16	0.001266	0.000203	0	None	No	0.01	Param.
Arsenic (mg/L)	MW-1606	0.001142	0.0009421	0.029	No	16	0.001042	0.0001533	0	None	No	0.01	Param.
Arsenic (mg/L)	MW-1607	0.0236	0.00767	0.029	No	16	0.01697	0.01482	0	None	No	0.01	NP (normality)
Barium (mg/L)	MW-1602	0.05611	0.05146	2	No	16	0.05379	0.003574	0	None	No	0.01	Param.
Barium (mg/L)	MW-1603	0.01302	0.01102	2	No	16	0.01202	0.001534	0	None	No	0.01	Param.
Barium (mg/L)	MW-1606	0.9293	0.7959	2	No	16	0.8626	0.1025	0	None	No	0.01	Param.
Barium (mg/L)	MW-1607	0.0396	0.03015	2	No	16	0.03488	0.007265	0	None	No	0.01	Param.
Beryllium (mg/L)	**MW-1603**	**0.0218**	**0.0167**	**0.004**	**Yes**	**16**	**0.01906**	**0.002719**	**0**	**None**	**No**	**0.01**	**NP (normality)**
Beryllium (mg/L)	MW-1606	0.0001	0.00001	0.004	No	16	0.00006094	0.00004112	37.5	None	No	0.01	NP (normality)
Beryllium (mg/L)	MW-1607	0.0001	0.00001	0.004	No	16	0.00005275	0.00004488	37.5	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1602	0.00005	0.000009	0.005	No	16	0.00002956	0.00002114	50	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1603	0.0008561	0.0007577	0.005	No	16	0.0008069	0.00007561	0	None	No	0.01	Param.
Cadmium (mg/L)	MW-1606	0.00006	0.00001	0.005	No	16	0.00004287	0.00001716	75	None	No	0.01	NP (NDs)
Cadmium (mg/L)	MW-1607	0.00005	0.000008	0.005	No	16	0.00004194	0.00001734	75	None	No	0.01	NP (NDs)
Chromium (mg/L)	MW-1602	0.0008272	0.0005123	0.1	No	16	0.0006698	0.000242	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1603	0.0008891	0.0006579	0.1	No	16	0.0007735	0.0001776	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1606	0.001008	0.000283	0.1	No	16	0.0007134	0.0006602	0	None	sqrt(x)	0.01	Param.
Chromium (mg/L)	MW-1607	0.0005414	0.0003141	0.1	No	16	0.0004278	0.0001746	0	None	No	0.01	Param.
Cobalt (mg/L)	MW-1602	0.0001386	0.00002638	0.006	No	16	0.0001471	0.0002367	0	None	ln(x)	0.01	Param.
Cobalt (mg/L)	**MW-1603**	**0.09515**	**0.08702**	**0.006**	**Yes**	**16**	**0.09096**	**0.006567**	**0**	**None**	**x^2**	**0.01**	**Param.**
Cobalt (mg/L)	MW-1606	0.000507	0.0001169	0.006	No	16	0.0003744	0.0003887	0	None	x^(1/3)	0.01	Param.
Cobalt (mg/L)	MW-1607	0.001434	0.00127	0.006	No	16	0.001352	0.0001257	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602	1.404	0.7431	5	No	16	1.074	0.5081	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603	7.168	4.931	5	No	16	6.113	1.737	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606	3.339	2.67	5	No	16	3.005	0.5142	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607	2.039	0.6193	5	No	16	1.524	1.592	0	None	x^(1/3)	0.01	Param.
Fluoride (mg/L)	MW-1602	0.1383	0.1022	4	No	17	0.1224	0.03173	0	None	ln(x)	0.01	Param.
Fluoride (mg/L)	MW-1603	1.06	0.8426	4	No	18	0.9511	0.1794	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1606	0.2176	0.1848	4	No	17	0.2012	0.02619	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1607	0.07051	0.05654	4	No	17	0.06353	0.01115	0	None	No	0.01	Param.
Lead (mg/L)	MW-1602	0.00009454	0.00003666	0.015	No	16	0.00006969	0.00005431	6.25	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1603	0.006415	0.00436	0.015	No	16	0.005448	0.001689	0	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1606	0.00102	0.0001	0.015	No	16	0.0004163	0.0005355	12.5	None	No	0.01	NP (normality)
Lead (mg/L)	MW-1607	0.0002108	0.00007261	0.015	No	16	0.0001787	0.0001971	6.25	None	ln(x)	0.01	Param.
Lithium (mg/L)	MW-1602	0.01086	0.005458	0.04	No	16	0.008436	0.00455	6.25	None	sqrt(x)	0.01	Param.
Lithium (mg/L)	**MW-1603**	**0.2325**	**0.1939**	**0.04**	**Yes**	**16**	**0.2132**	**0.0297**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium (mg/L)	MW-1606	0.009937	0.003882	0.04	No	16	0.007334	0.004845	12.5	None	sqrt(x)	0.01	Param.
Lithium (mg/L)	MW-1607	0.007312	0.001264	0.04	No	16	0.005046	0.005143	12.5	None	sqrt(x)	0.01	Param.
Mercury (mg/L)	MW-1602	0.000005	0.000002	0.002	No	16	0.000003937	0.00000134	56.25	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1603	0.000005	0.000002	0.002	No	16	0.000004812	7.5e-7	93.75	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1606	0.000005	0.000003	0.002	No	16	0.0000045	0.00000109	81.25	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1607	0.000005	0.000004	0.002	No	16	0.000004937	2.5e-7	93.75	None	No	0.01	NP (NDs)
Molybdenum (mg/L)	MW-1602	0.002305	0.001317	0.1	No	16	0.001811	0.0007593	0	None	No	0.01	Param.
Molybdenum (mg/L)	MW-1603	0.001	0.00006	0.1	No	16	0.0004594	0.0004383	37.5	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1606	0.00091	0.00051	0.1	No	16	0.001179	0.001775	0	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1607	0.0009	0.00052	0.1	No	16	0.00117	0.0021	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1602	0.001793	0.00102	0.05	No	16	0.001406	0.0005938	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1603	0.006228	0.004622	0.05	No	16	0.005425	0.001234	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1606	0.0002	0.00006	0.05	No	16	0.0001075	0.0000747	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1607	0.0002	0.00009	0.05	No	16	0.000145	0.0001529	0	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1602	0.0005	0.00001	0.002	No	16	0.0001994	0.0002406	37.5	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1603	0.001609	0.001299	0.002	No	16	0.001454	0.0002382	0	None	No	0.01	Param.
Thallium (mg/L)	MW-1606	0.0005	0.00002	0.002	No	16	0.0002969	0.0002389	56.25	None	No	0.01	NP (NDs)
Thallium (mg/L)	MW-1607	0.0005	0.00002	0.002	No	16	0.0001865	0.0002201	31.25	None	No	0.01	NP (normality)

FIGURE A.

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

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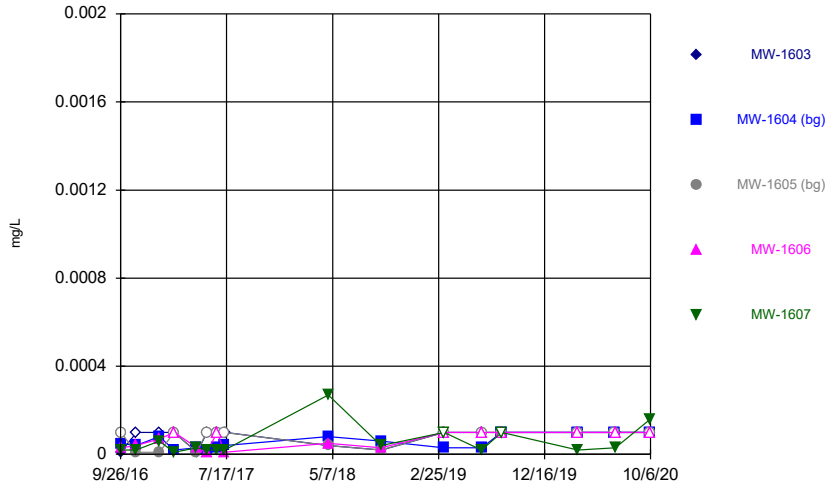

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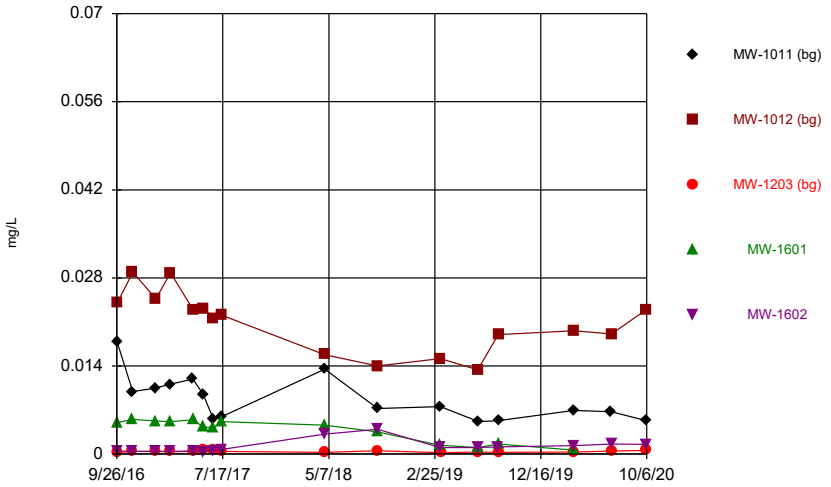

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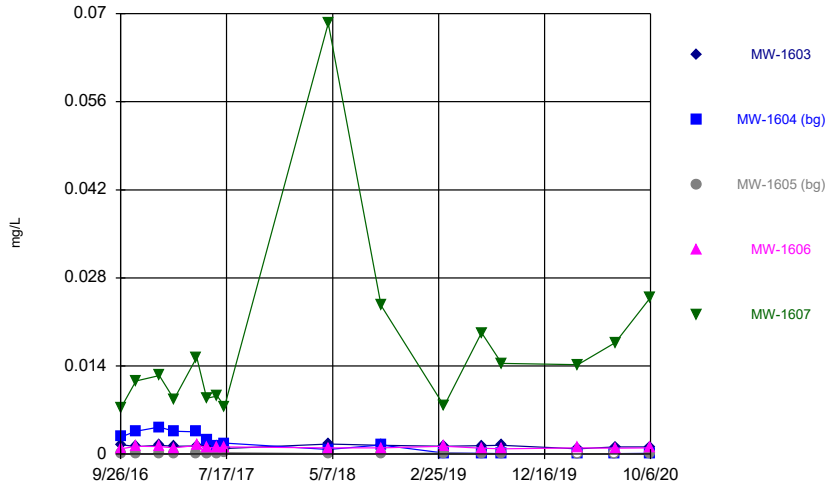
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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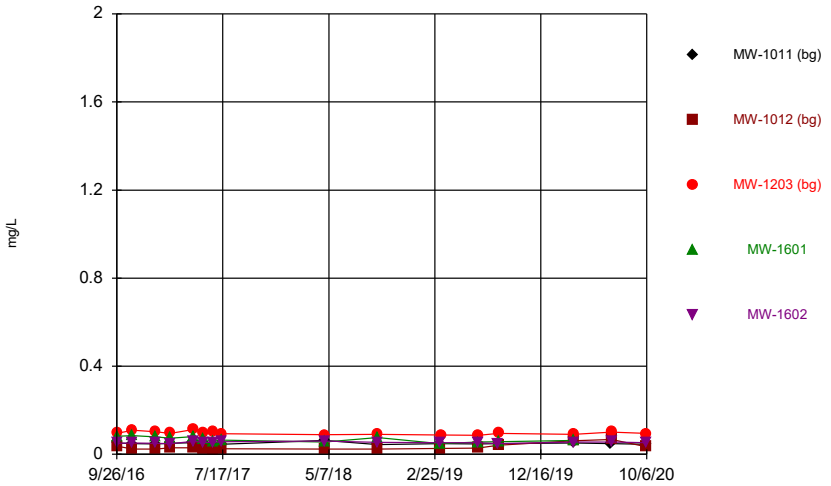
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series



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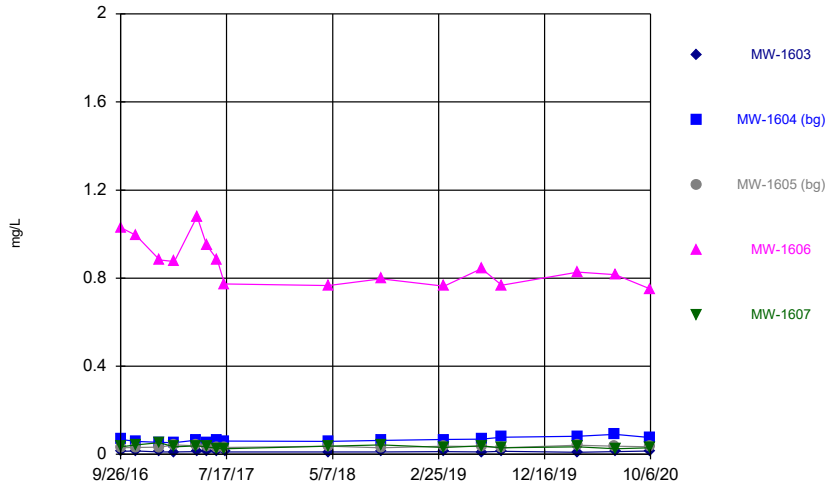
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series



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Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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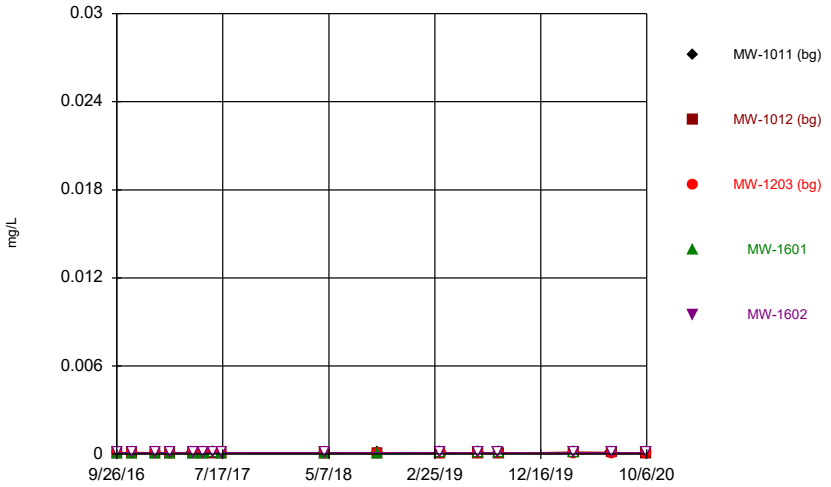

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Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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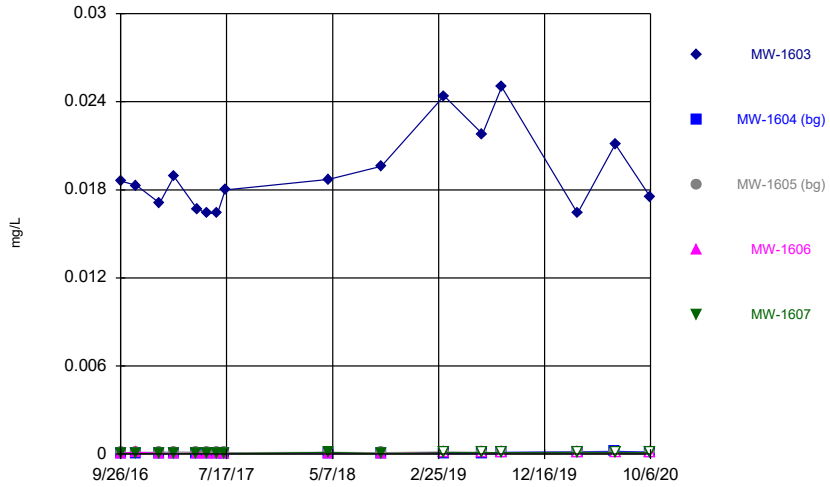
Hollow symbols indicate censored values.

Time Series



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Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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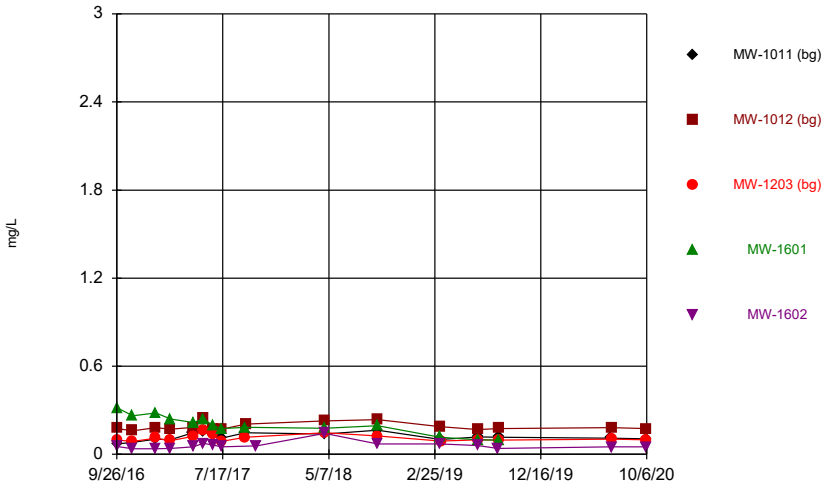
Time Series



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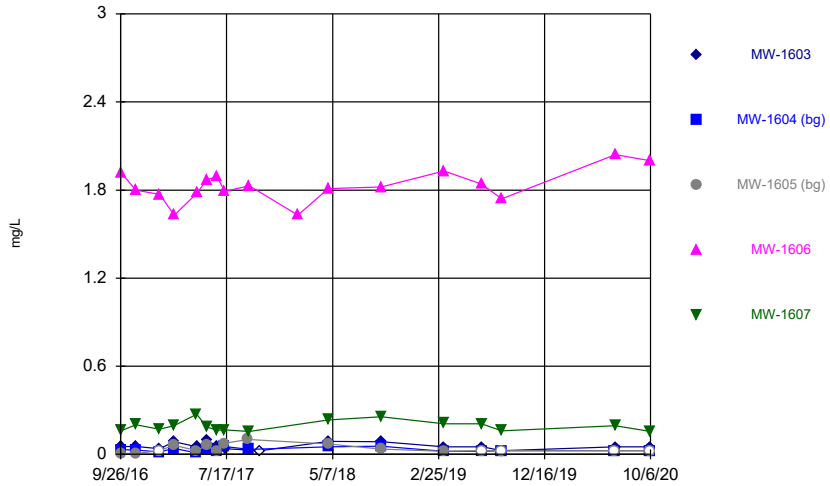
Time Series



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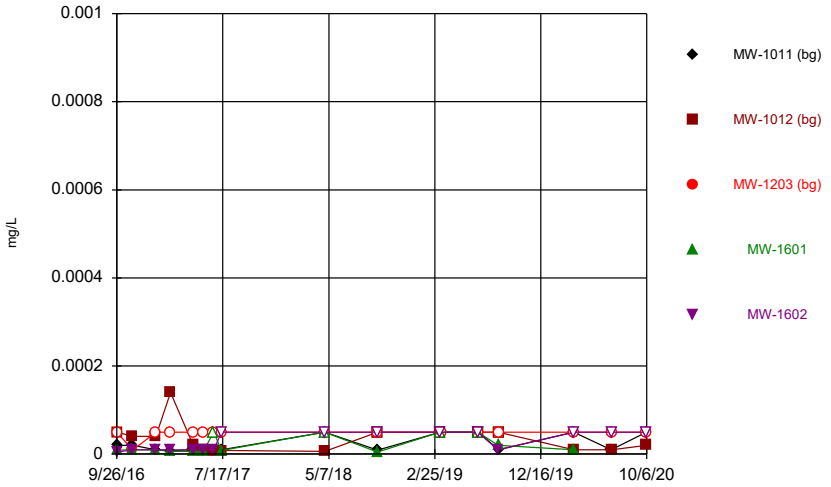
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



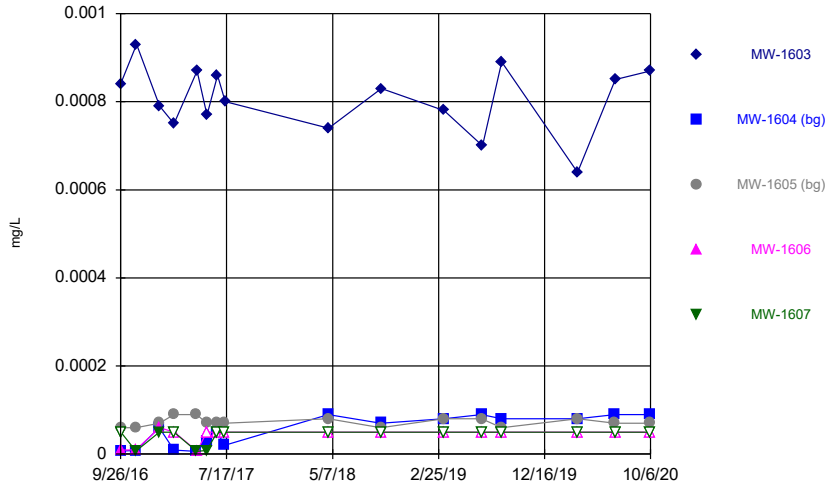
Constituent: Cadmium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

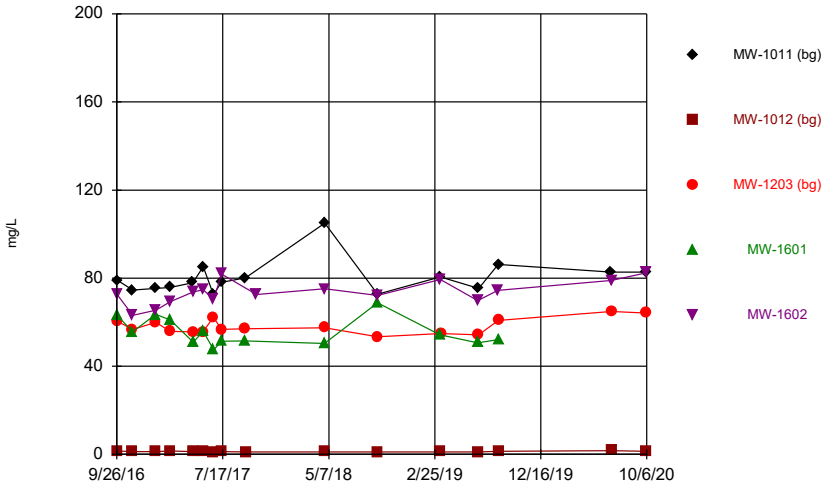


Constituent: Cadmium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

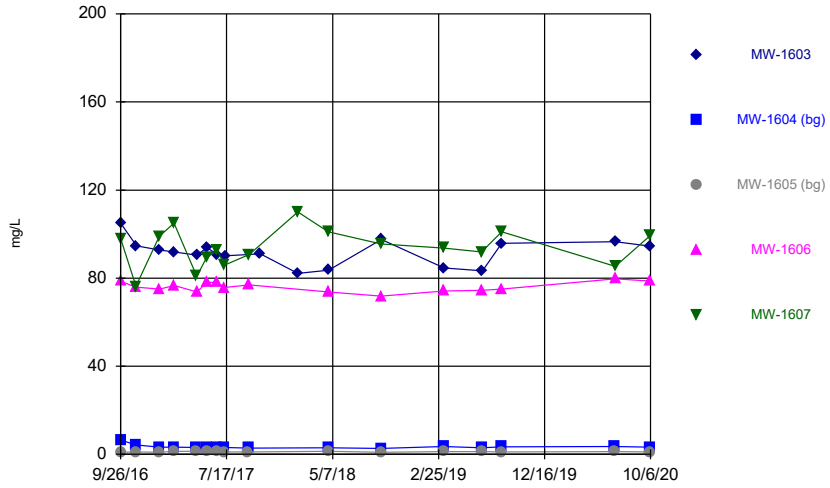


Constituent: Calcium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

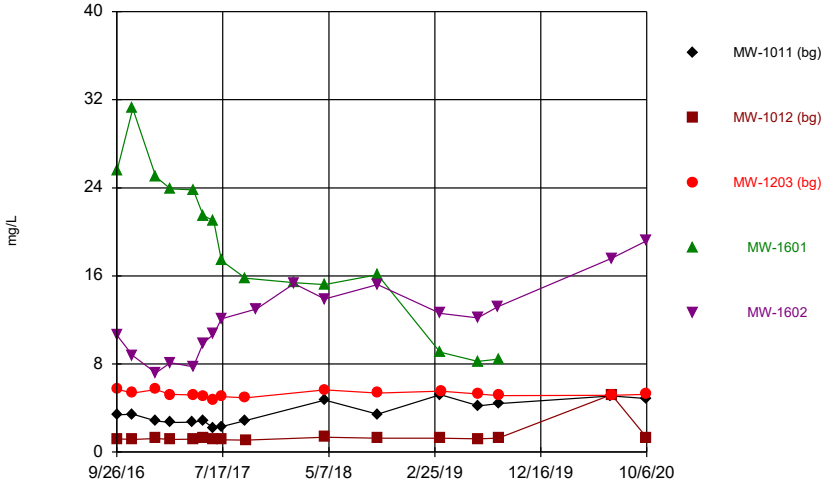


Constituent: Calcium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

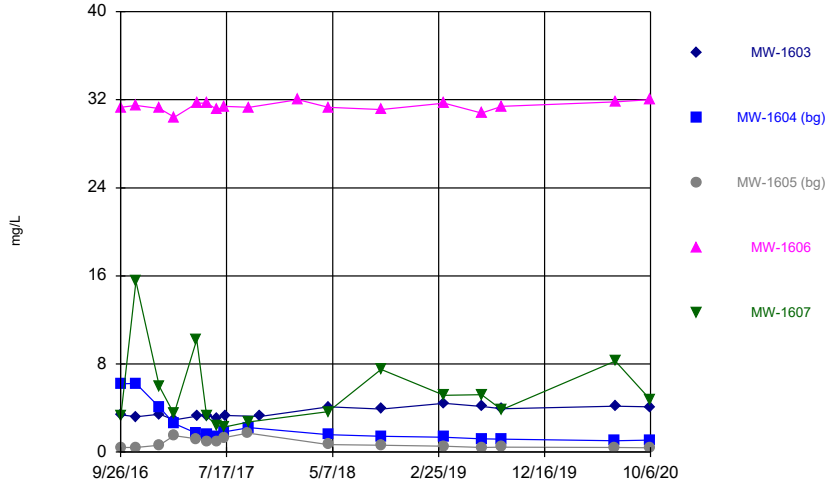


Constituent: Chloride Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

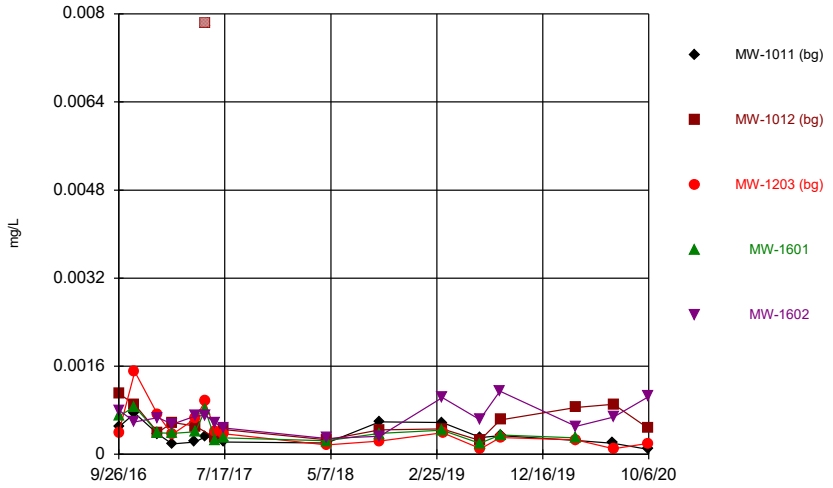


Constituent: Chloride Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

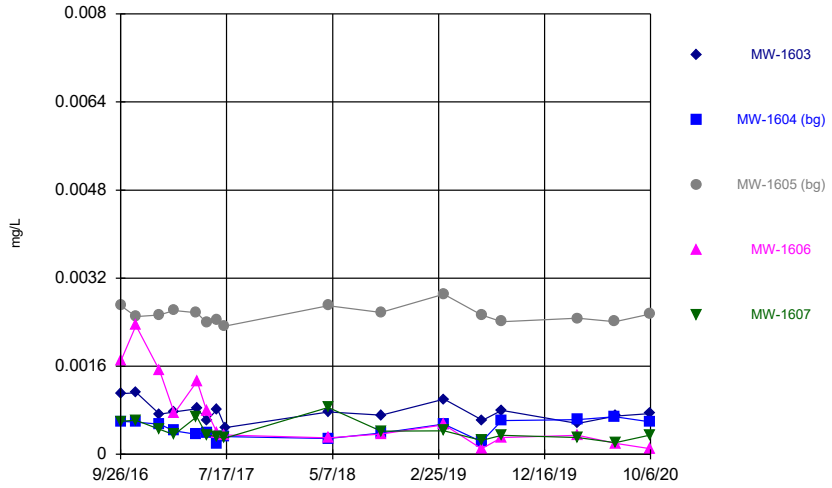


Constituent: Chromium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

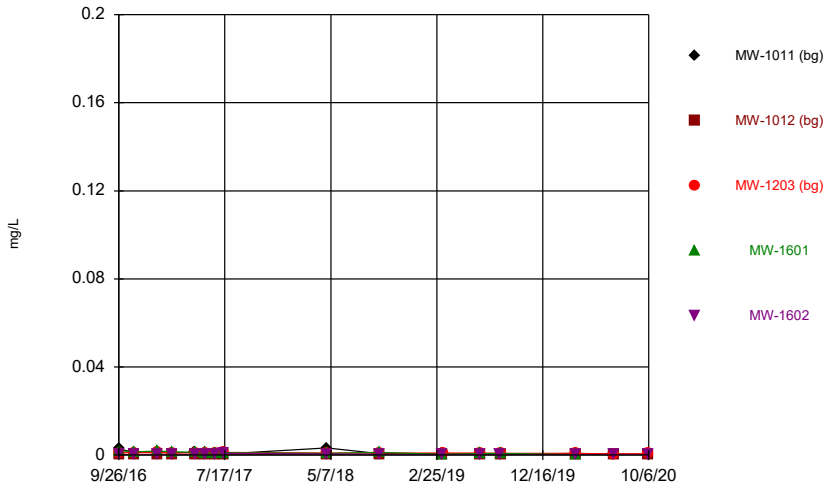


Constituent: Chromium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

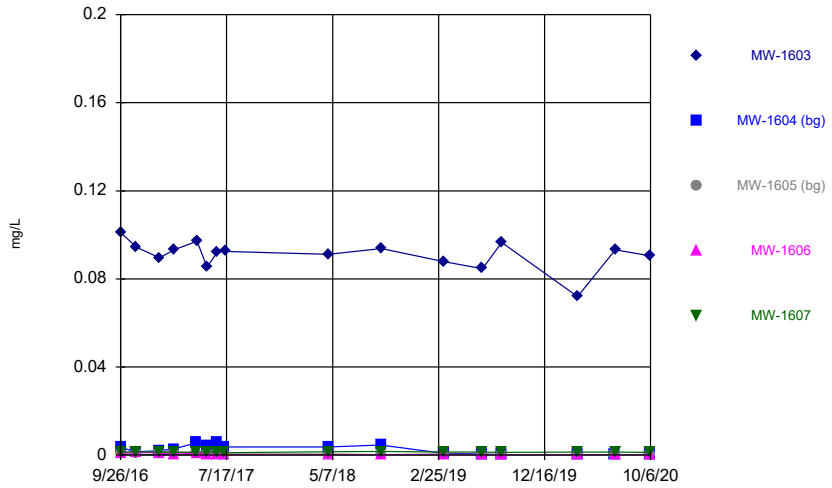


Constituent: Cobalt Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

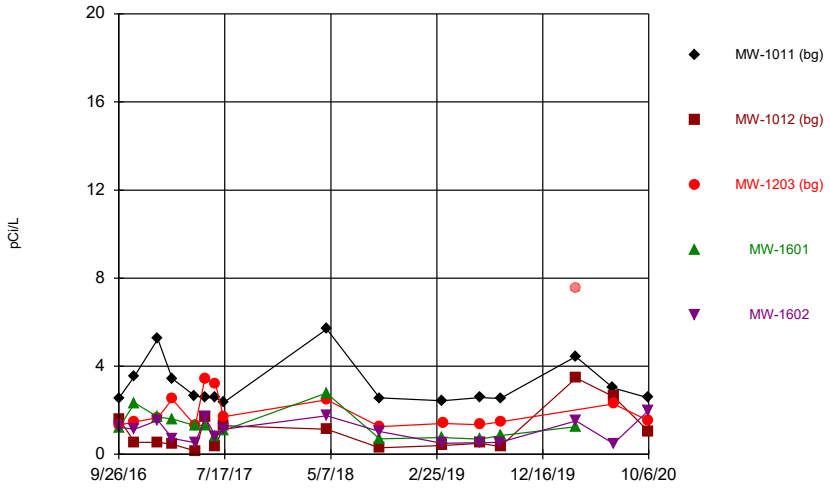
Time Series



Constituent: Cobalt Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Time Series

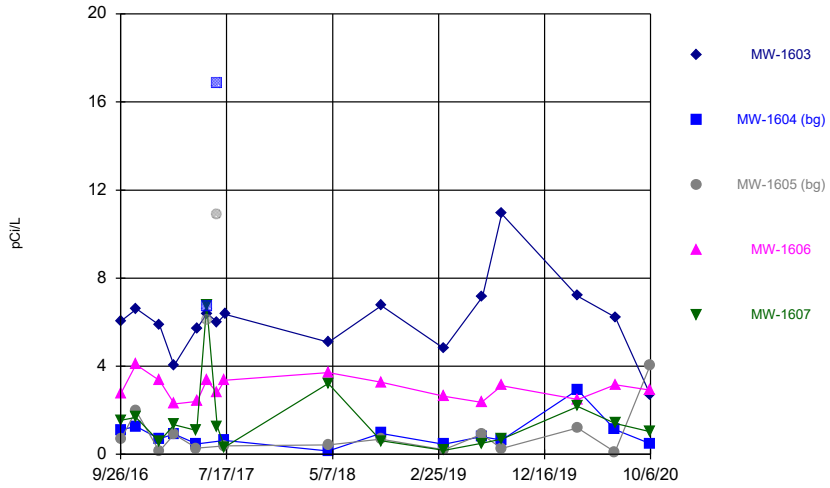


Constituent: Combined Radium 226 + 228 Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

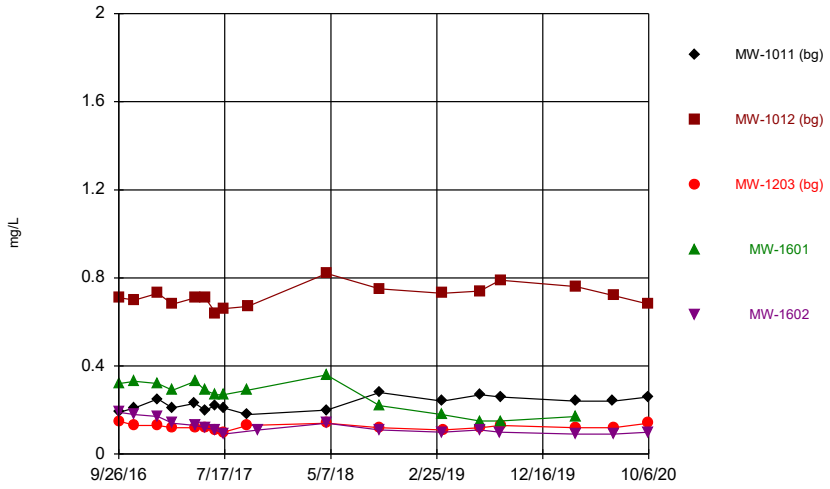


Constituent: Combined Radium 226 + 228 Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series



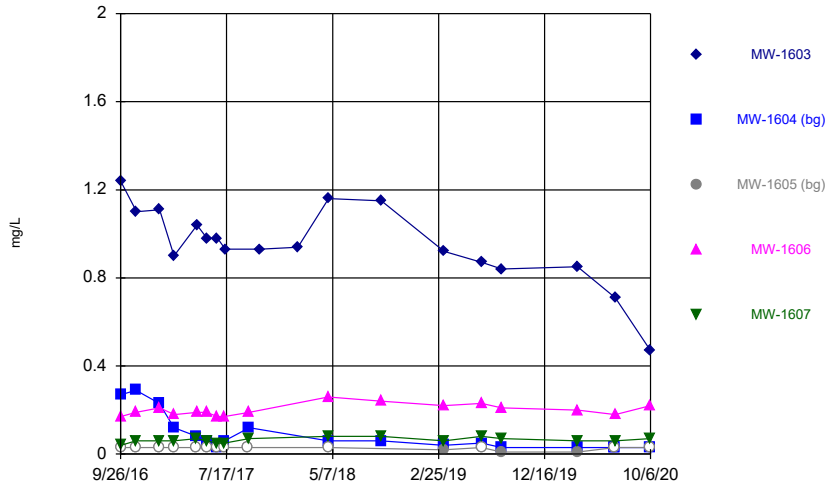
Constituent: Fluoride Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

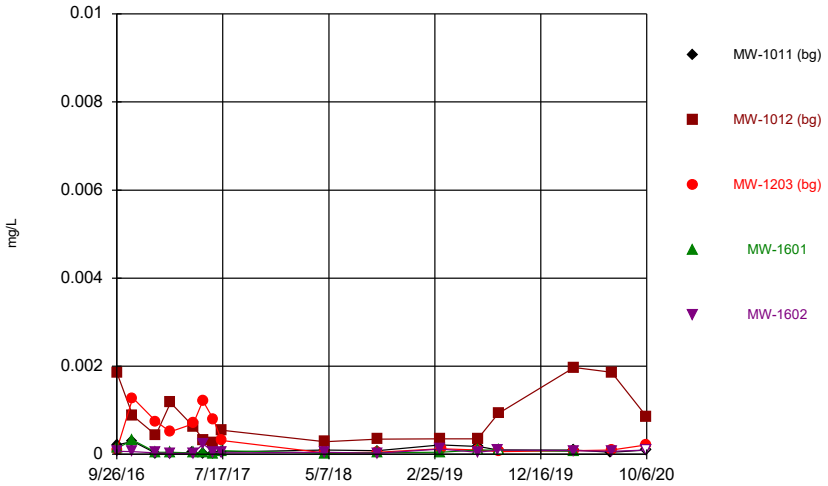


Constituent: Fluoride Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

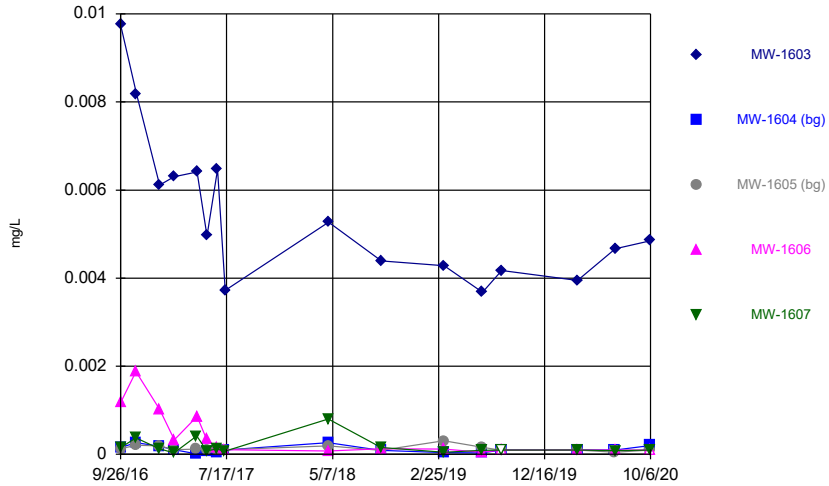
Time Series



Constituent: Lead Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

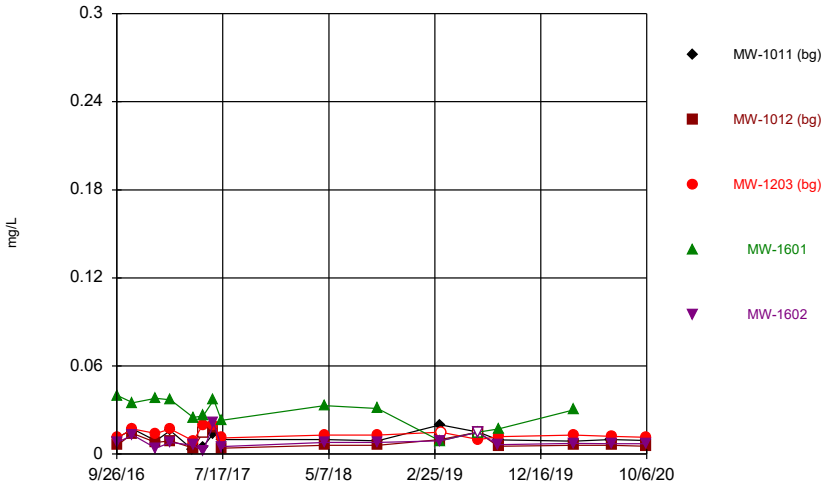
Time Series



Constituent: Lead Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

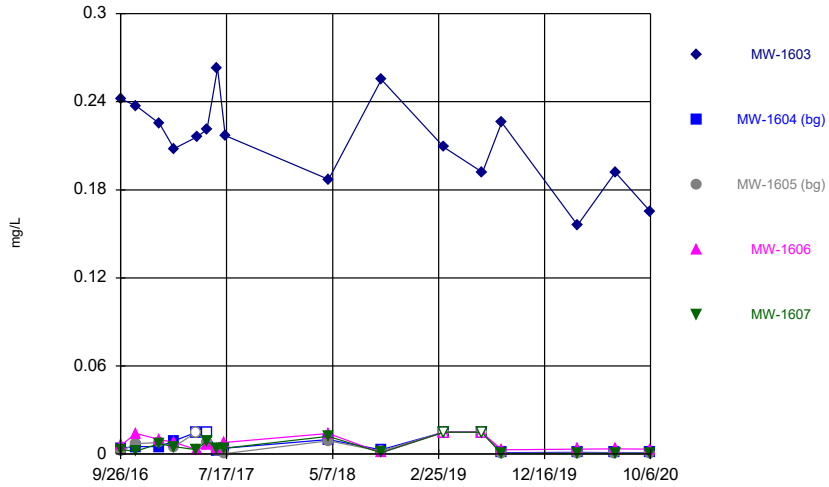
Time Series



Constituent: Lithium Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

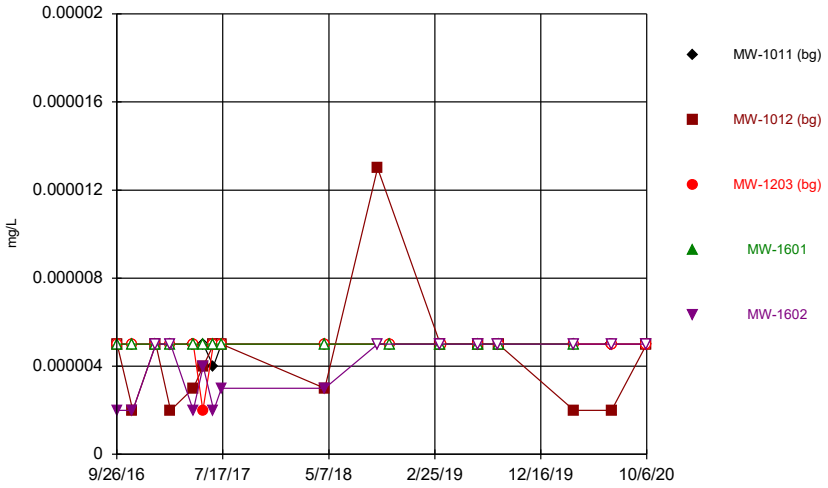
Time Series



Constituent: Lithium Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

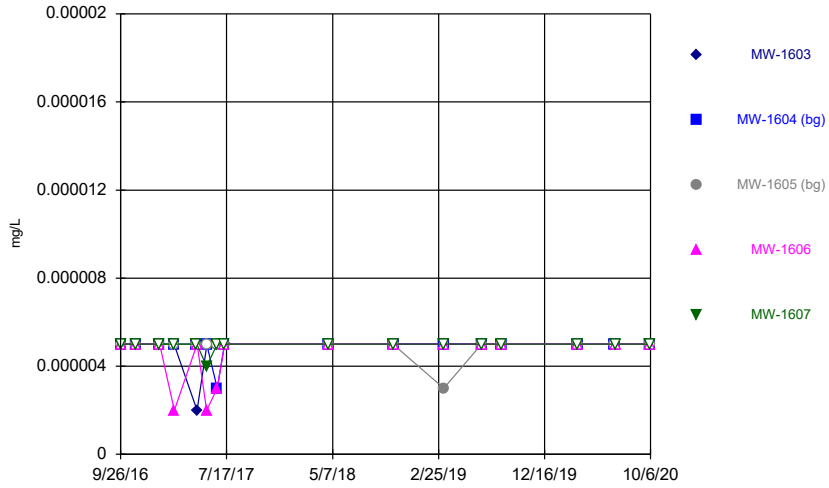
Time Series



Constituent: Mercury Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

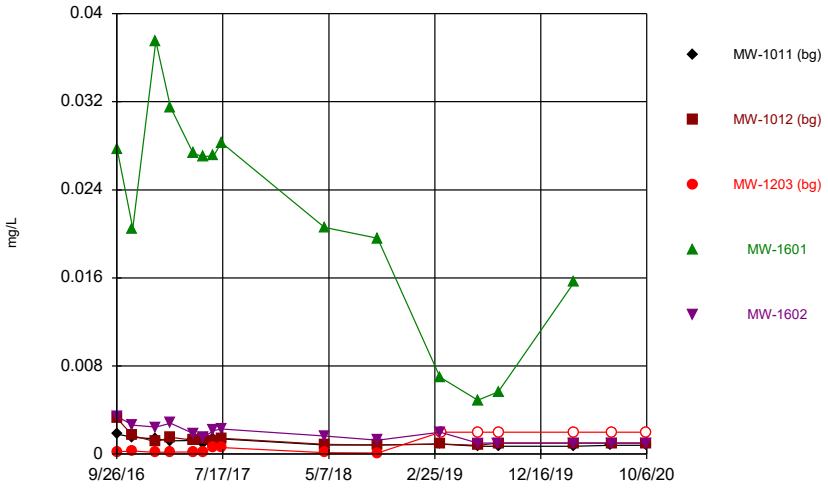
Time Series



Constituent: Mercury Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

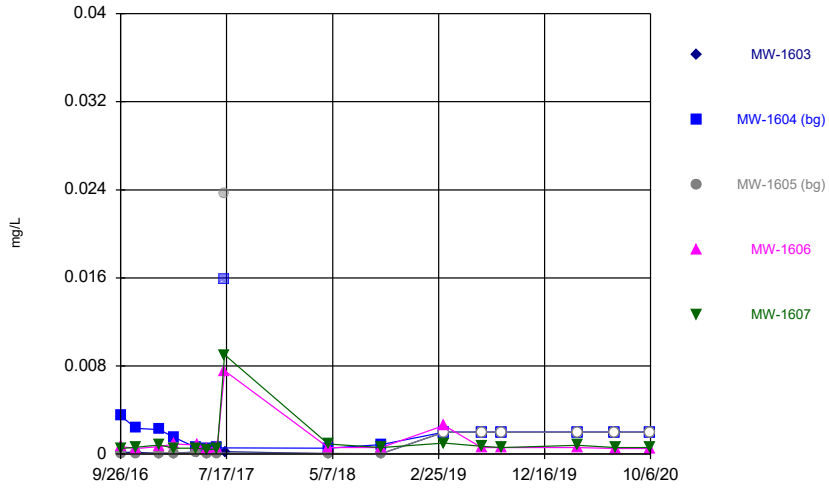
Time Series



Constituent: Molybdenum Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

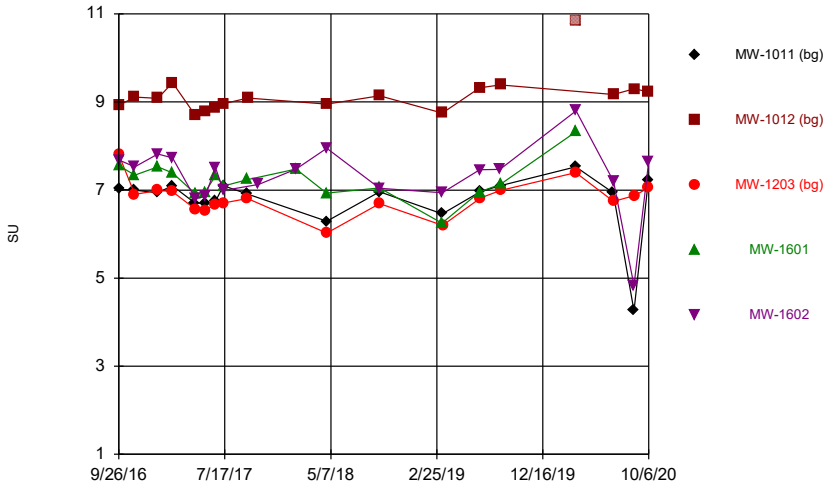
Time Series



Constituent: Molybdenum Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

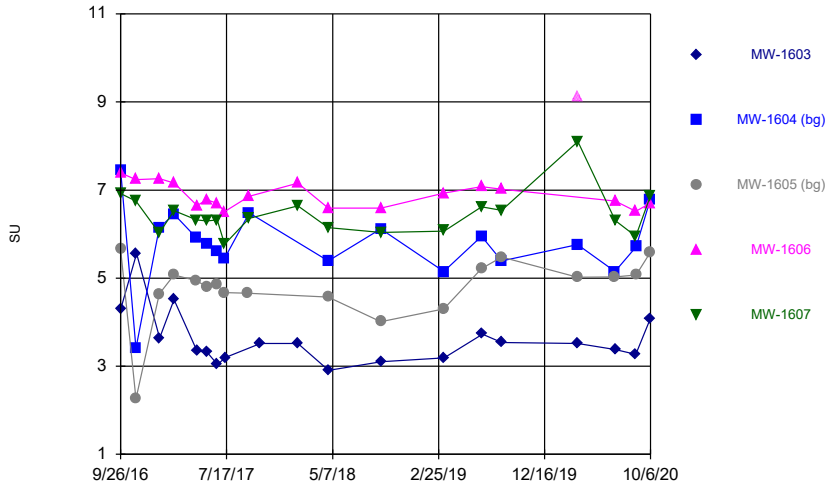


Constituent: pH Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

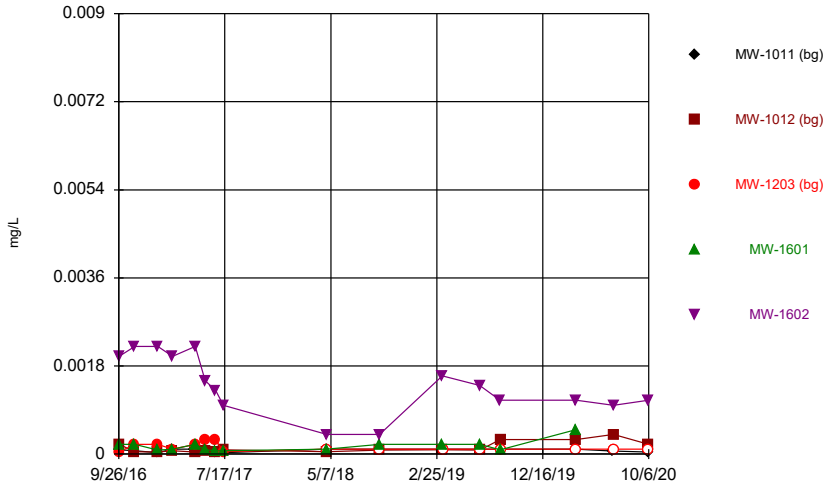


Constituent: pH Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series

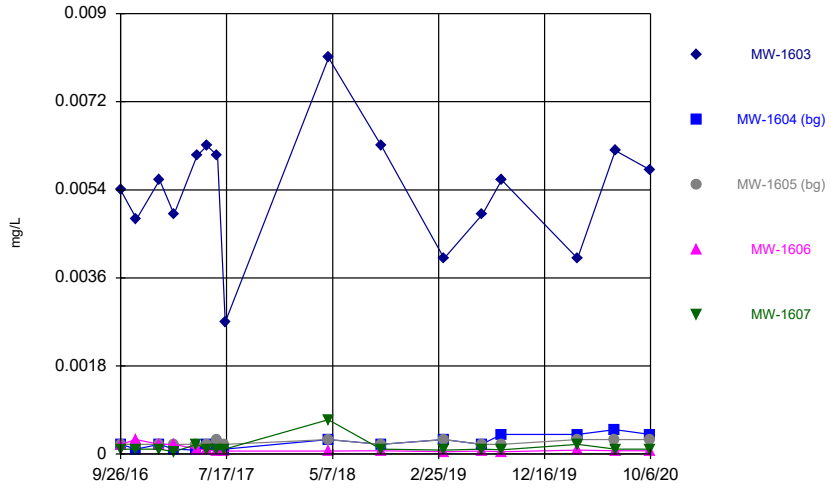


Constituent: Selenium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

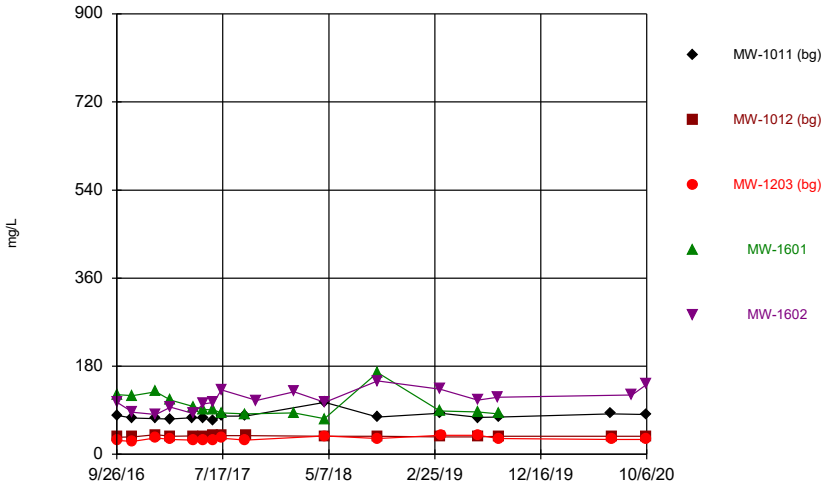


Constituent: Selenium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

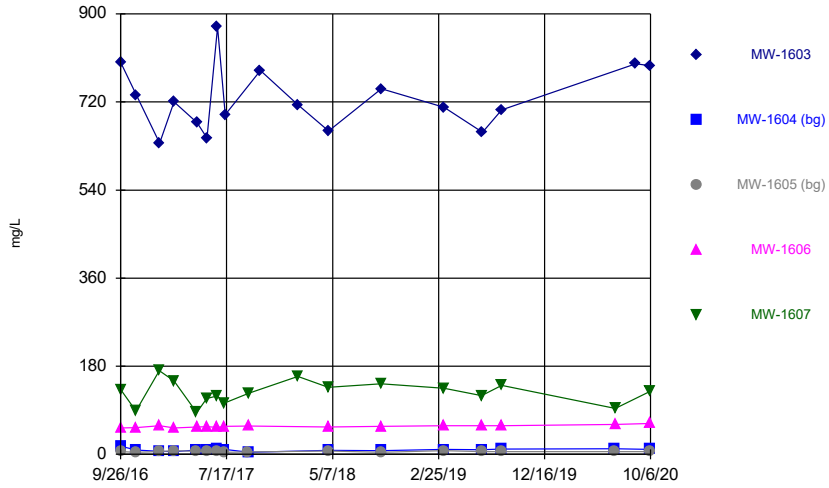


Constituent: Sulfate Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series



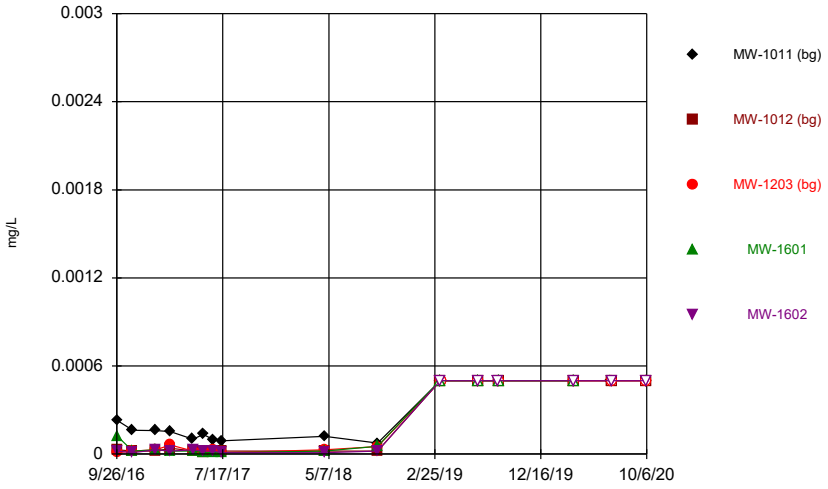
Constituent: Sulfate Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



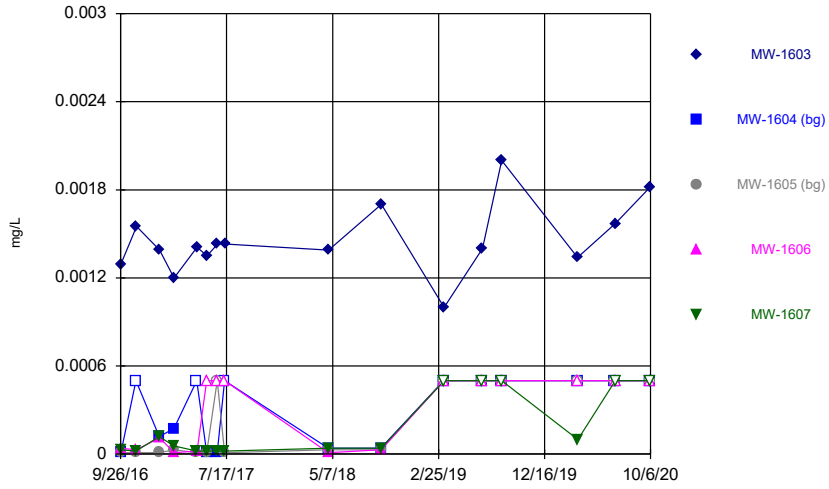
Constituent: Thallium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

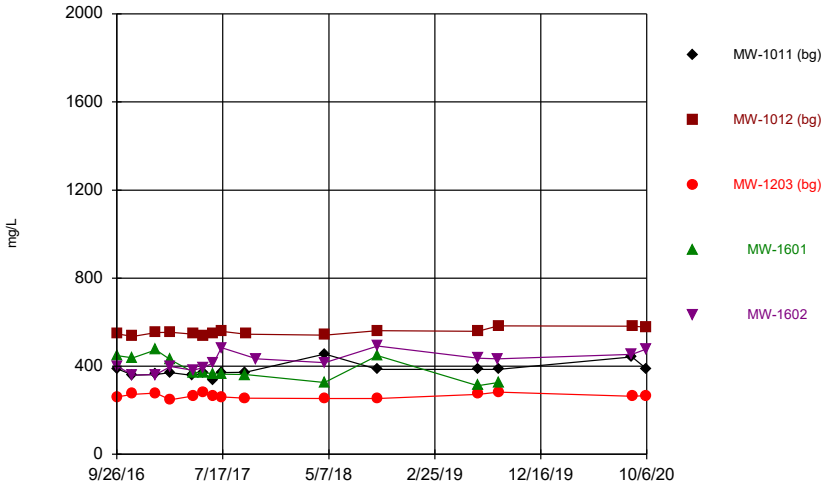
Time Series



Constituent: Thallium Analysis Run 1/26/2021 5:23 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

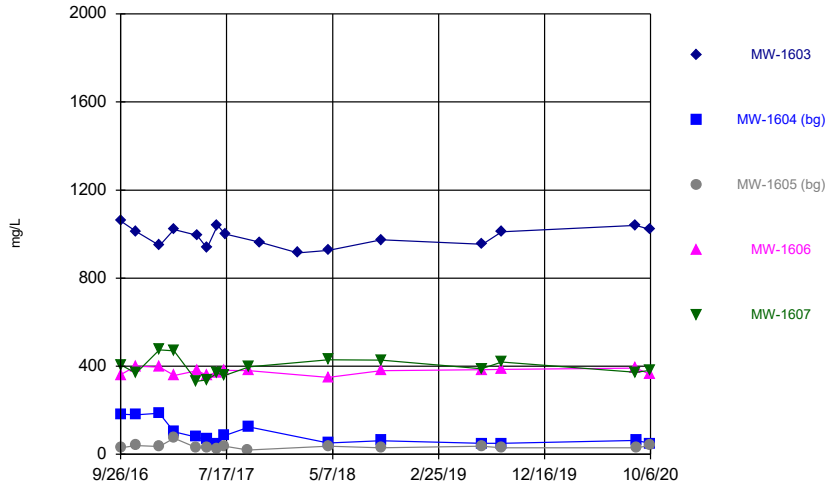
Time Series



Constituent: Total Dissolved Solids Analysis Run 1/26/2021 5:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Time Series

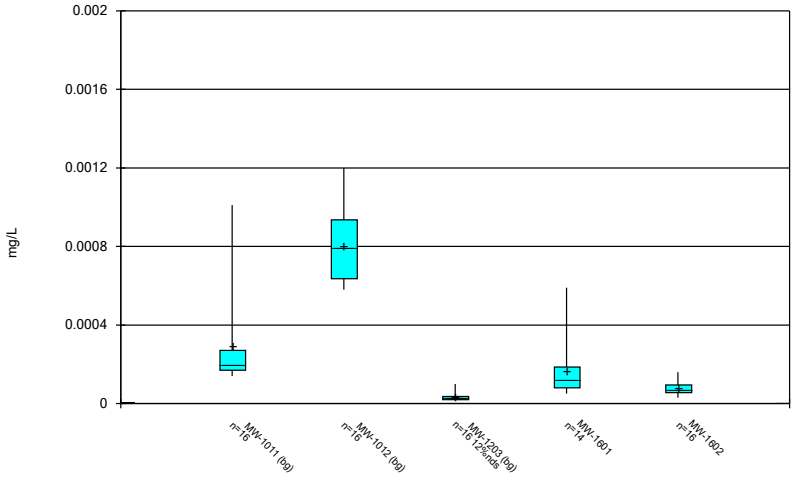


Constituent: Total Dissolved Solids Analysis Run 1/26/2021 5:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE B.

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

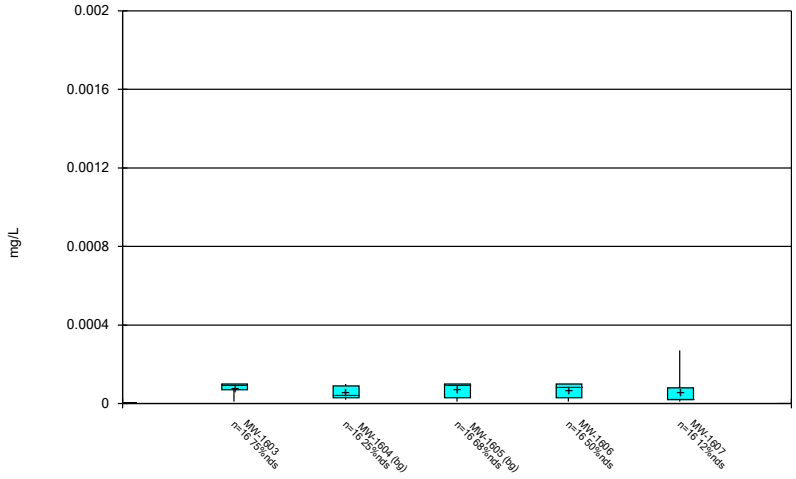


Constituent: Antimony Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

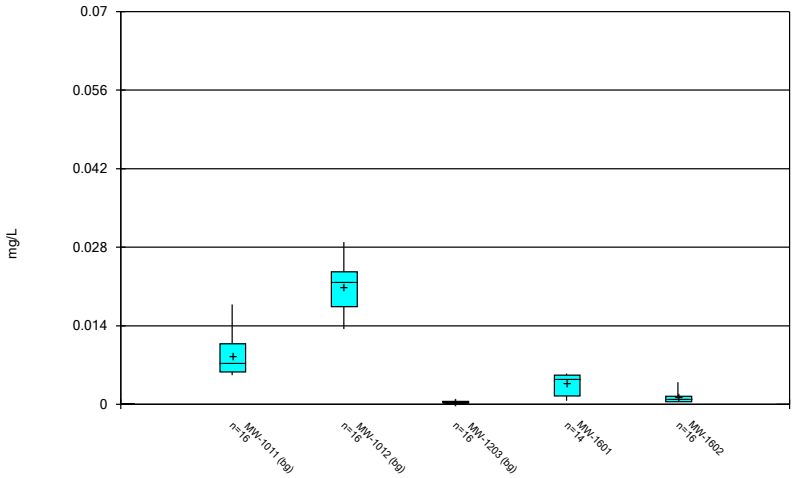


Constituent: Antimony Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

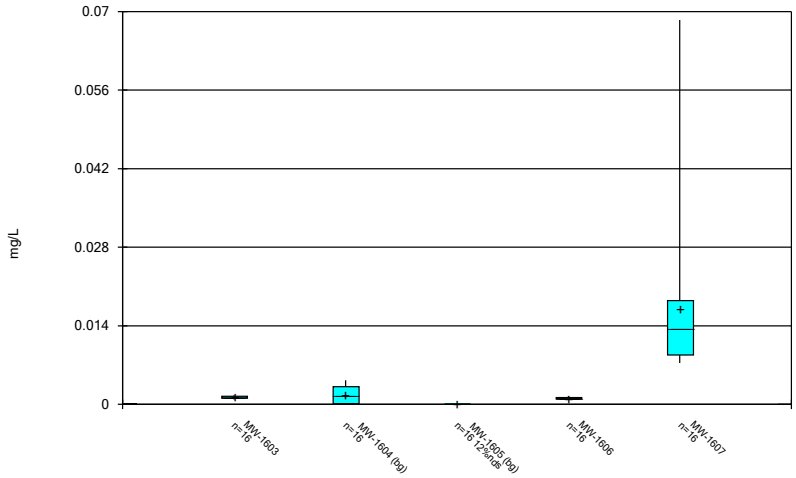


Constituent: Arsenic Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

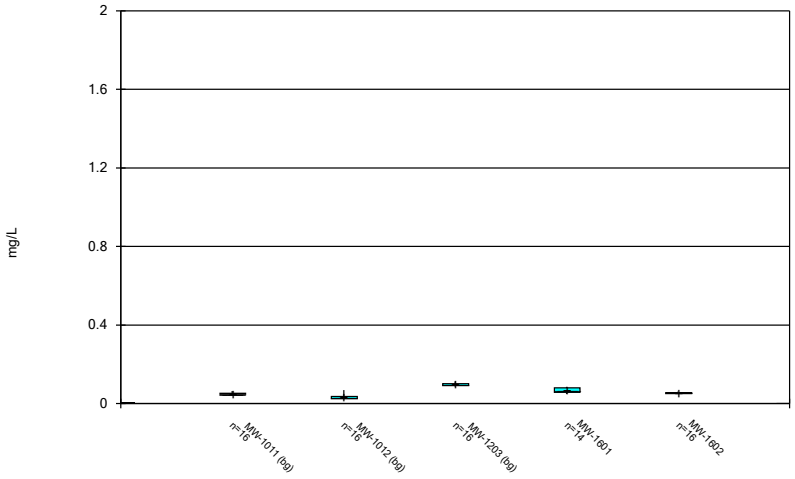
Box & Whiskers Plot



Constituent: Arsenic Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

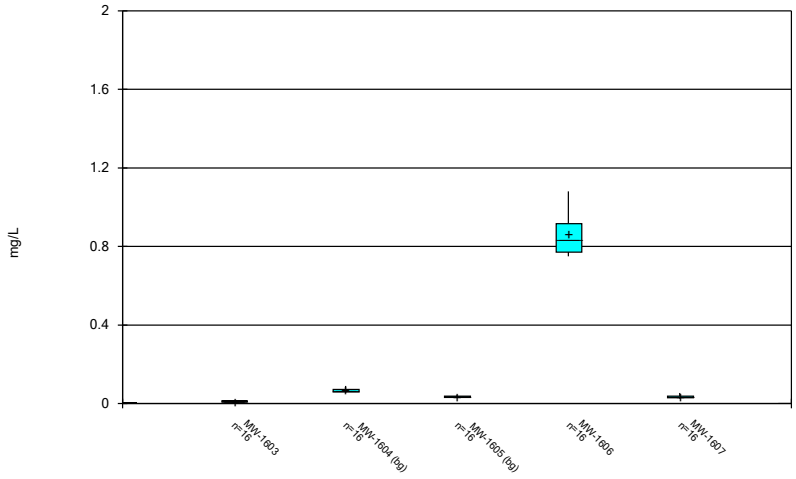


Constituent: Barium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

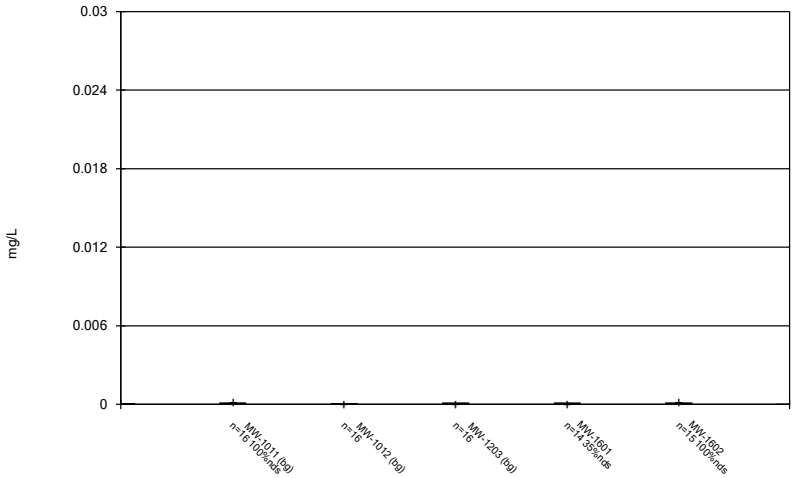


Constituent: Barium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

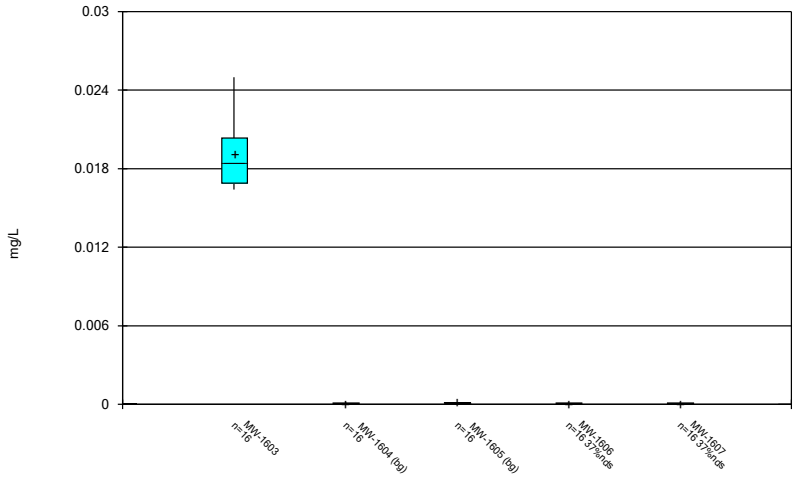


Constituent: Beryllium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

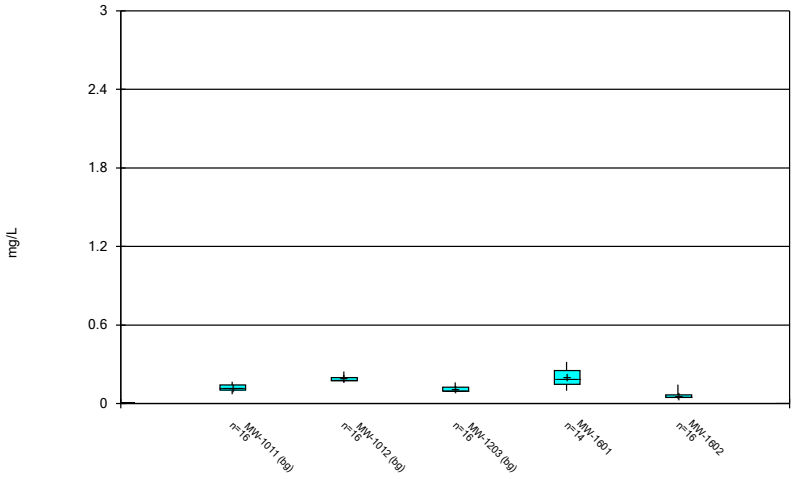
Box & Whiskers Plot



Constituent: Beryllium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

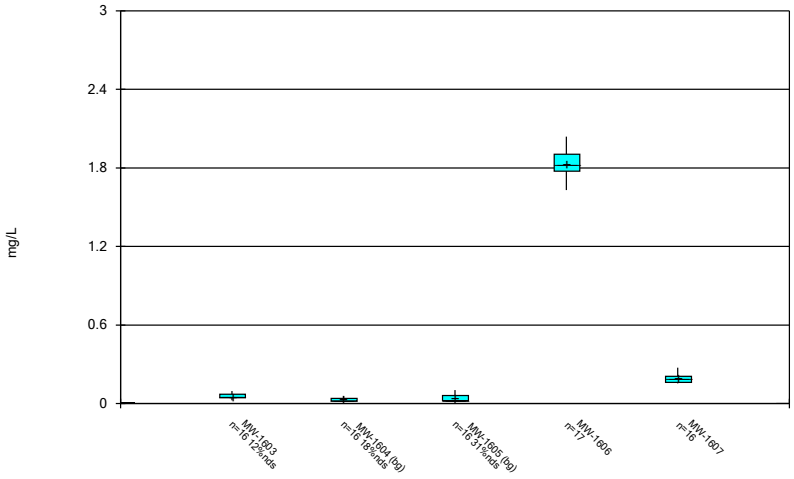


Constituent: Boron Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

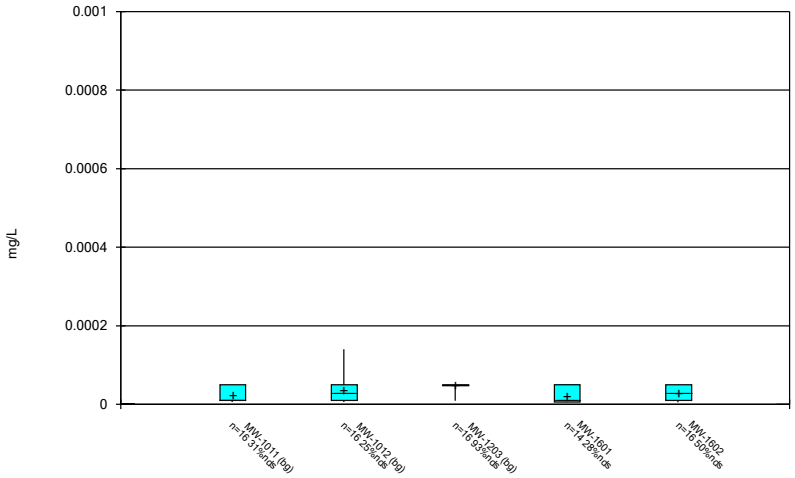


Constituent: Boron Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

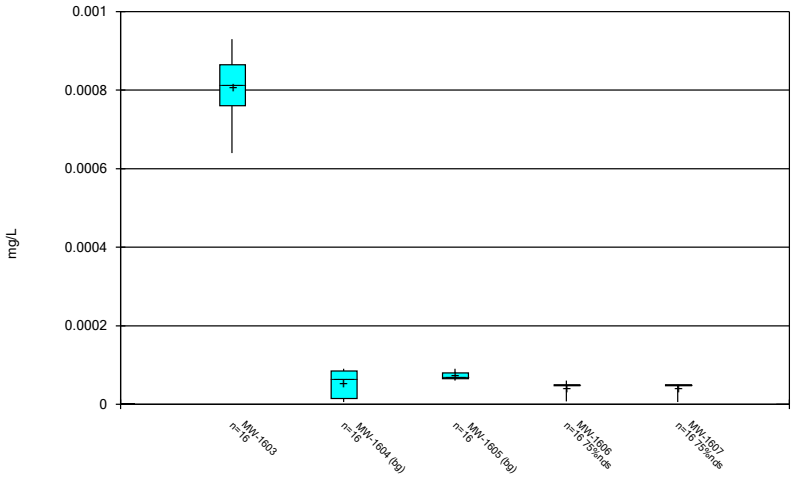


Constituent: Cadmium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

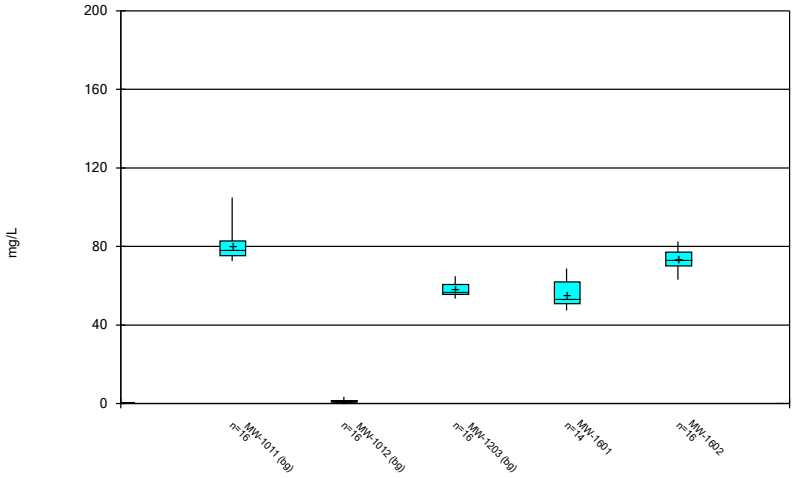
Box & Whiskers Plot



Constituent: Cadmium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

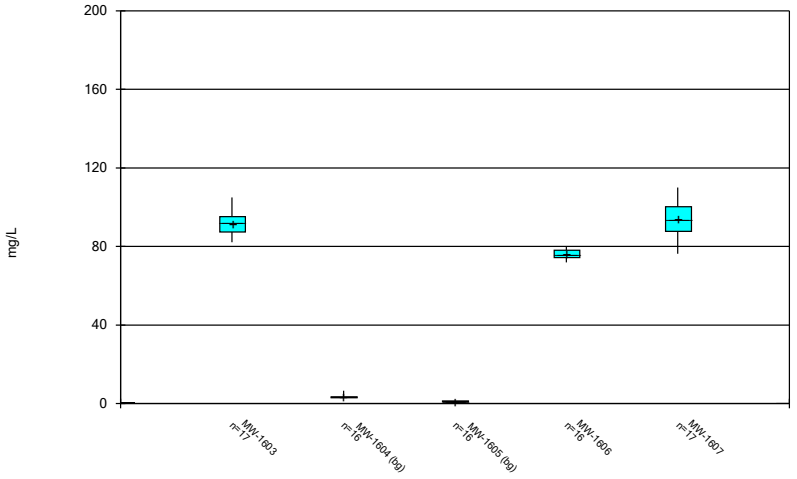
Box & Whiskers Plot



Constituent: Calcium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

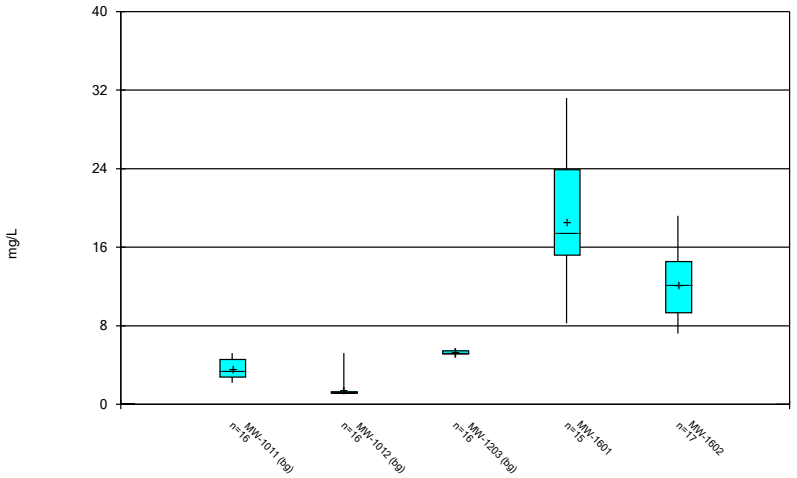
Box & Whiskers Plot



Constituent: Calcium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

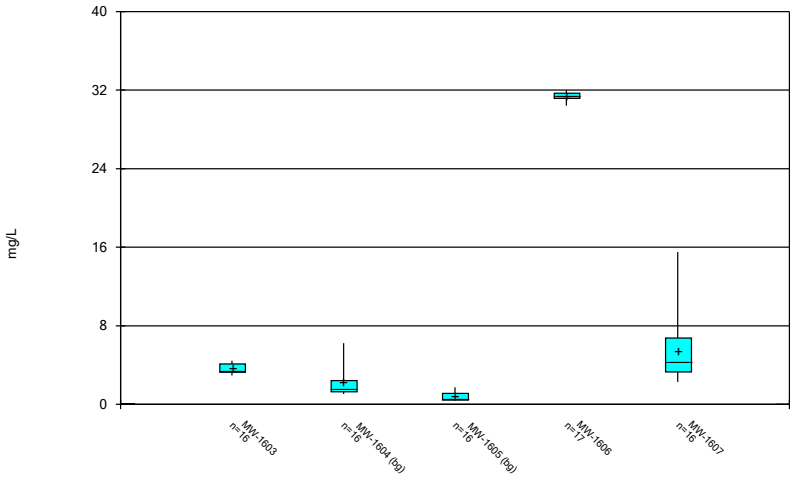
Box & Whiskers Plot



Constituent: Chloride Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

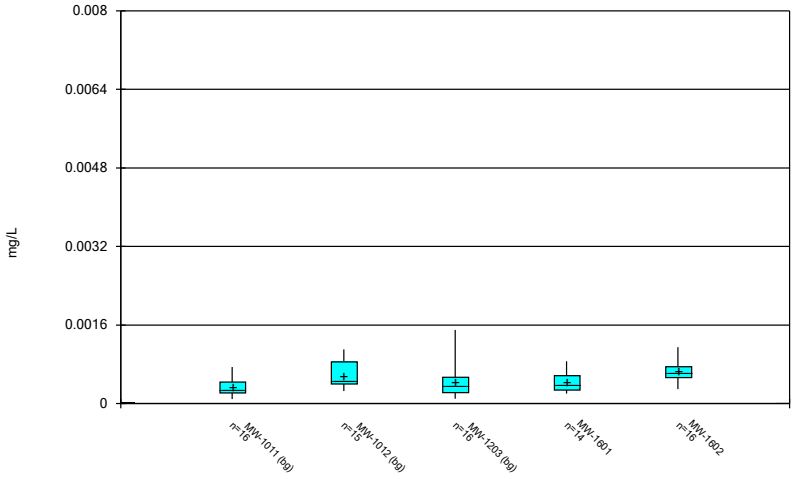
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Chloride Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

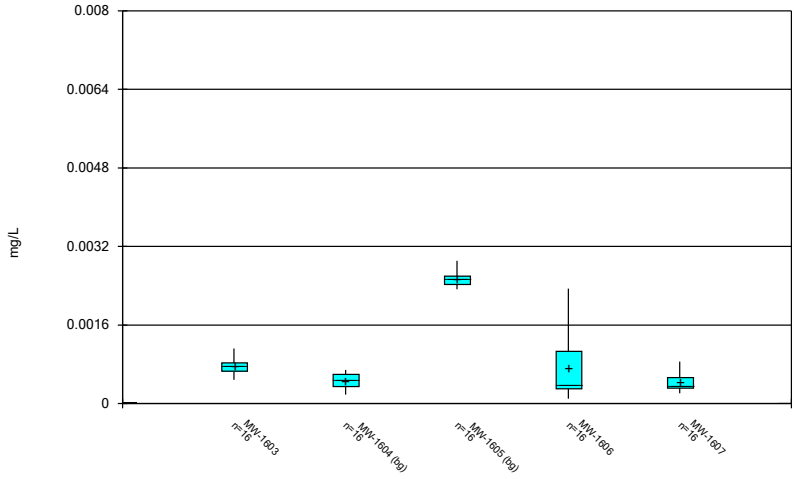
Box & Whiskers Plot



Constituent: Chromium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

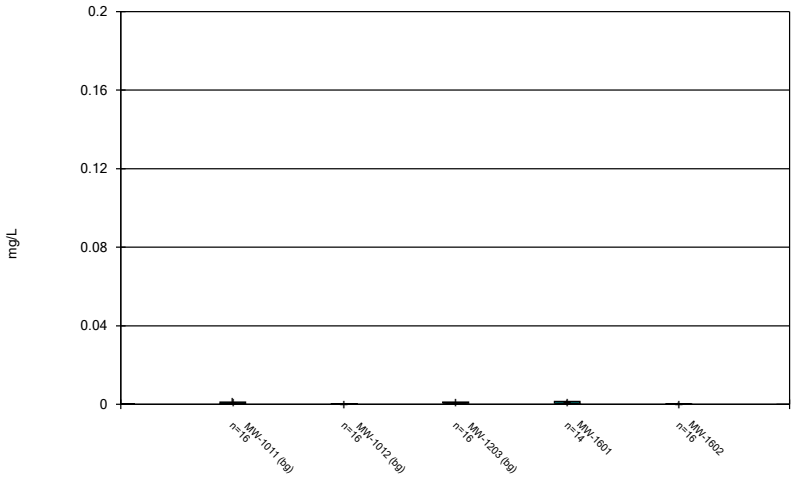
Box & Whiskers Plot



Constituent: Chromium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

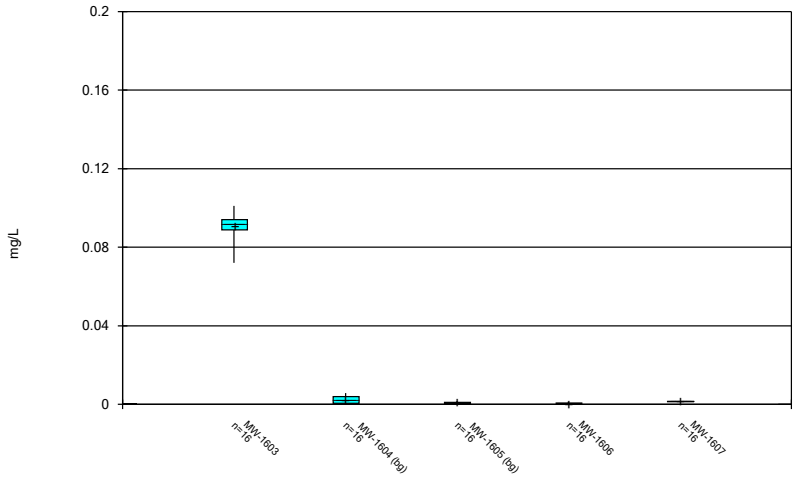
Box & Whiskers Plot



Constituent: Cobalt Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



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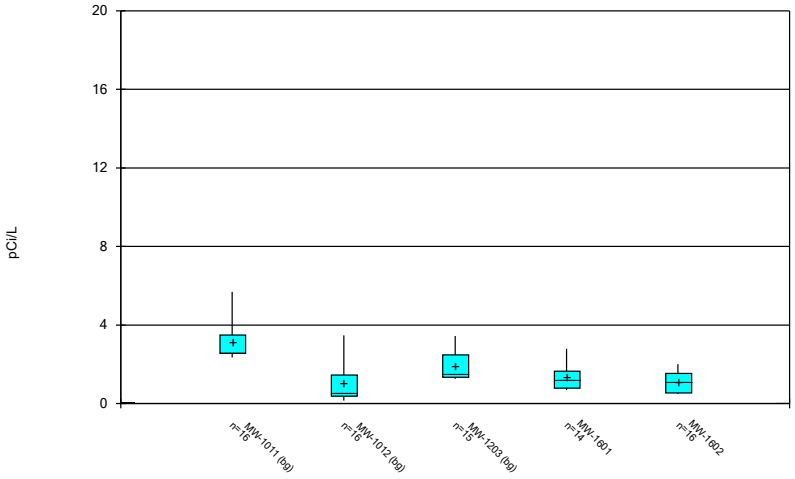
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

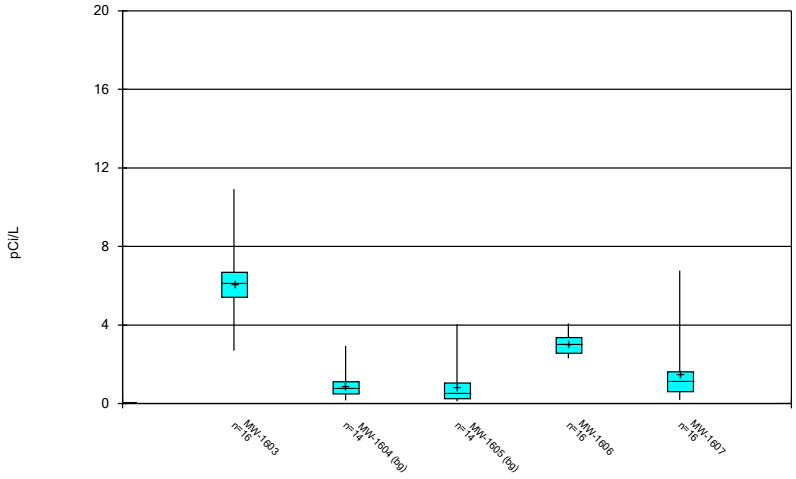


Constituent: Combined Radium 226 + 228 Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

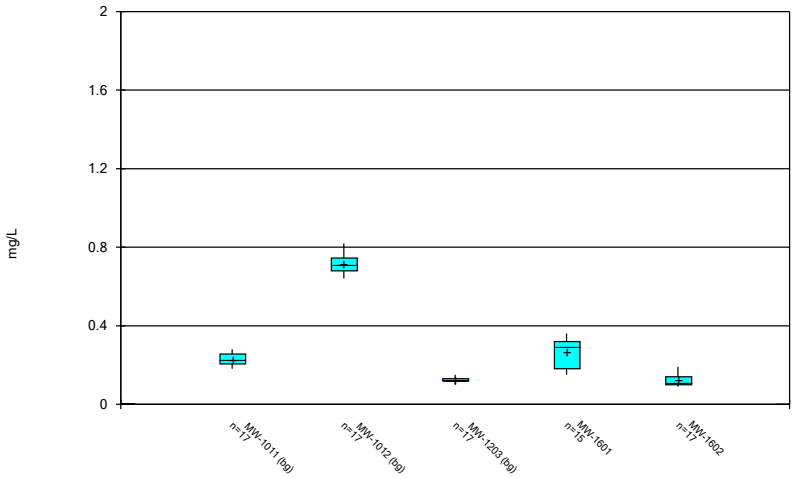


Constituent: Combined Radium 226 + 228 Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

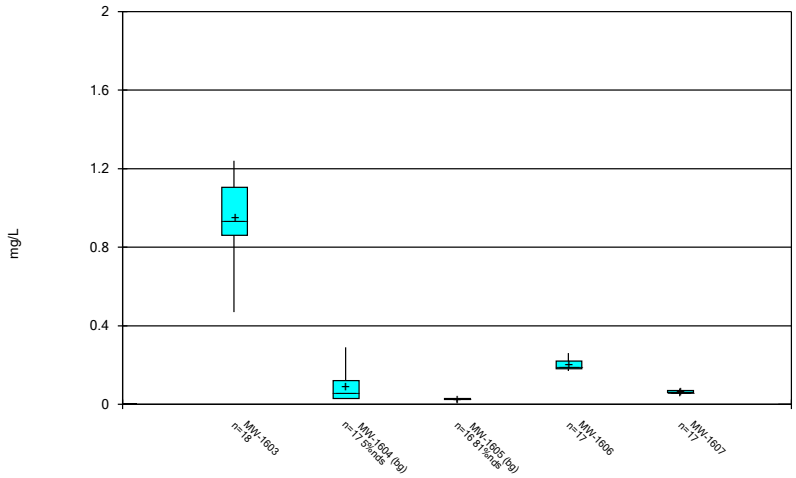


Constituent: Fluoride Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

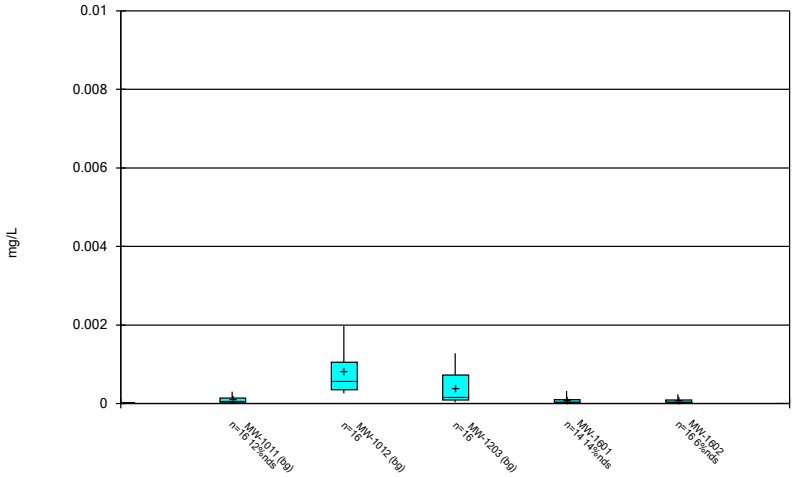
Box & Whiskers Plot



Constituent: Fluoride Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

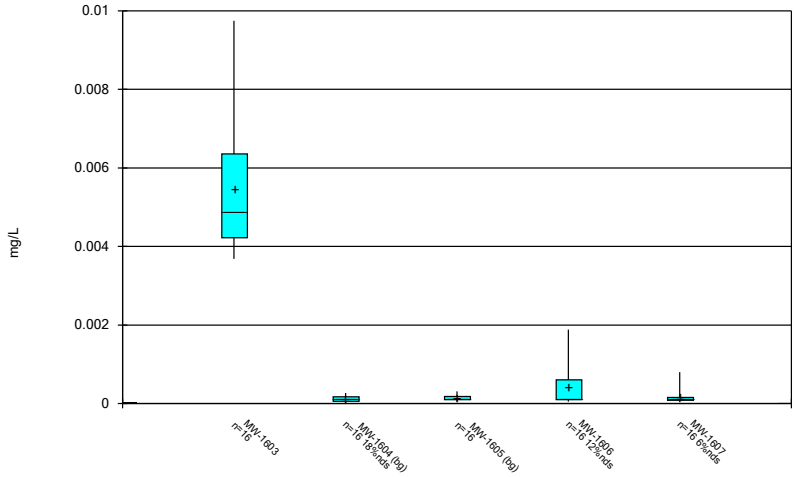


Constituent: Lead Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

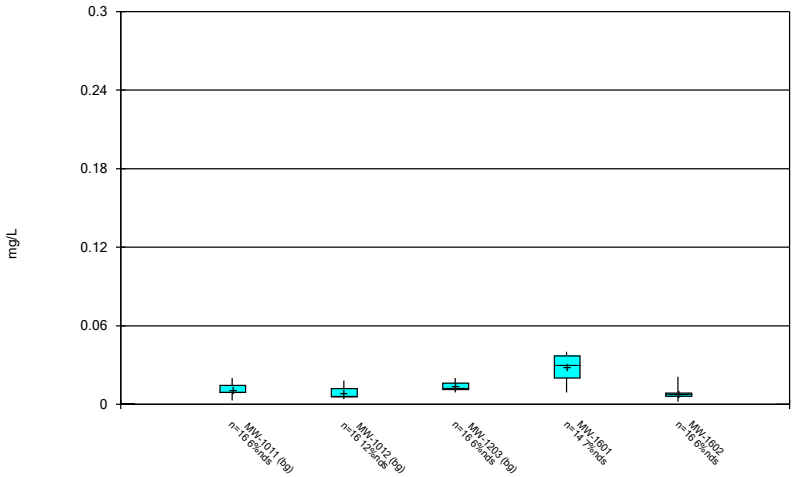


Constituent: Lead Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot

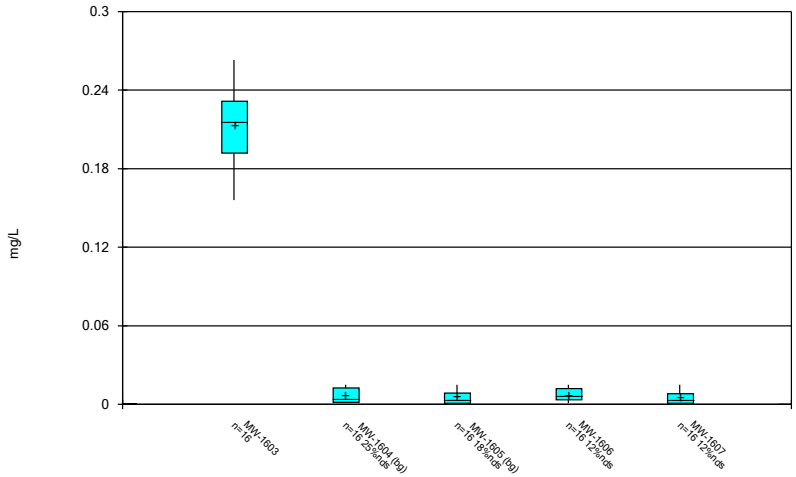


Constituent: Lithium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

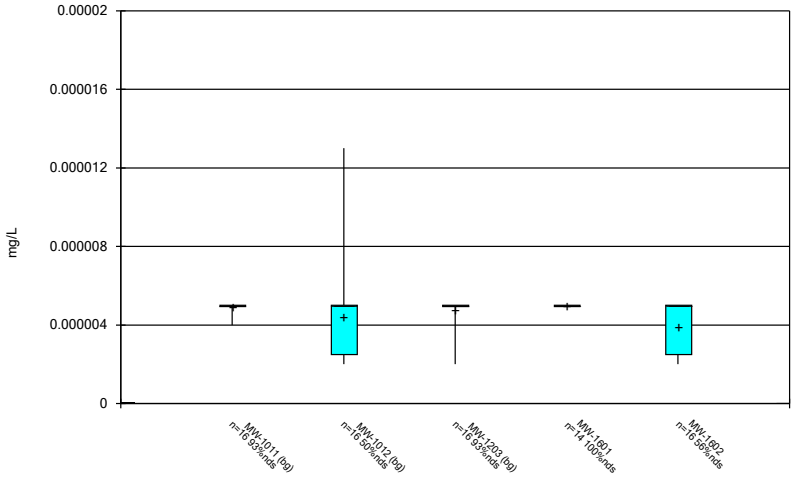
Box & Whiskers Plot



Constituent: Lithium Analysis Run 1/26/2021 5:45 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot



Constituent: Mercury Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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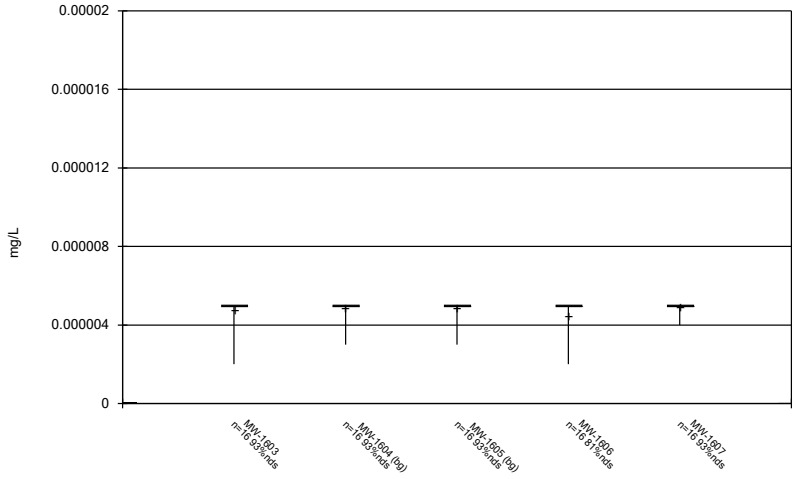
Box & Whiskers Plot



Constituent: Mercury Analysis Run 1/26/2021 5:45 PM
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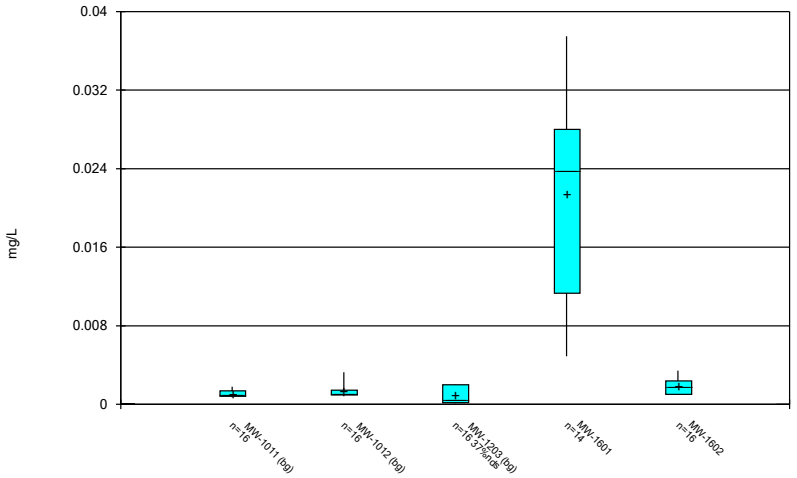
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

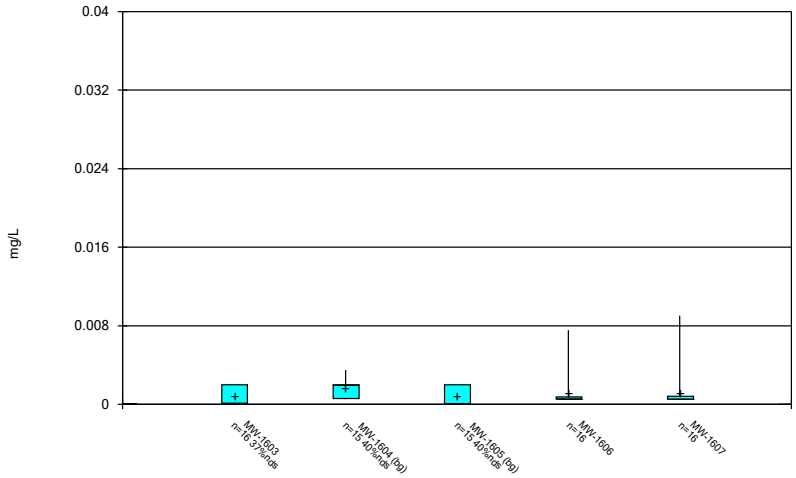
Box & Whiskers Plot



Constituent: Molybdenum Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

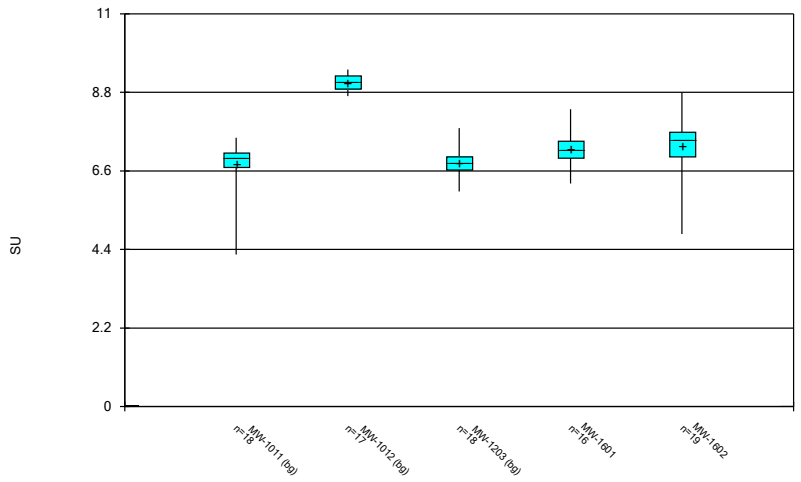
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Molybdenum Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

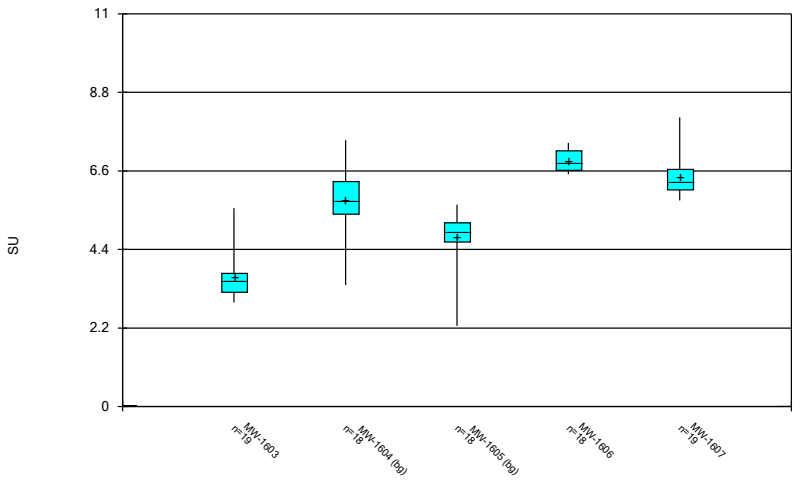
Box & Whiskers Plot



Constituent: pH Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

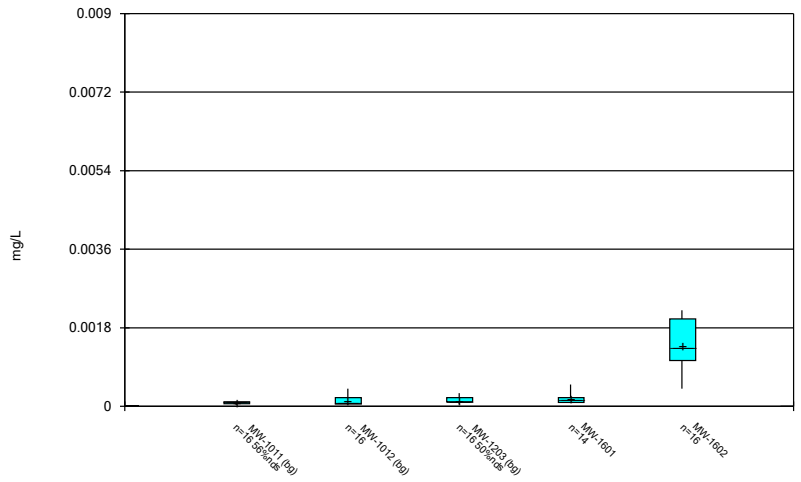
Box & Whiskers Plot



Constituent: pH Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

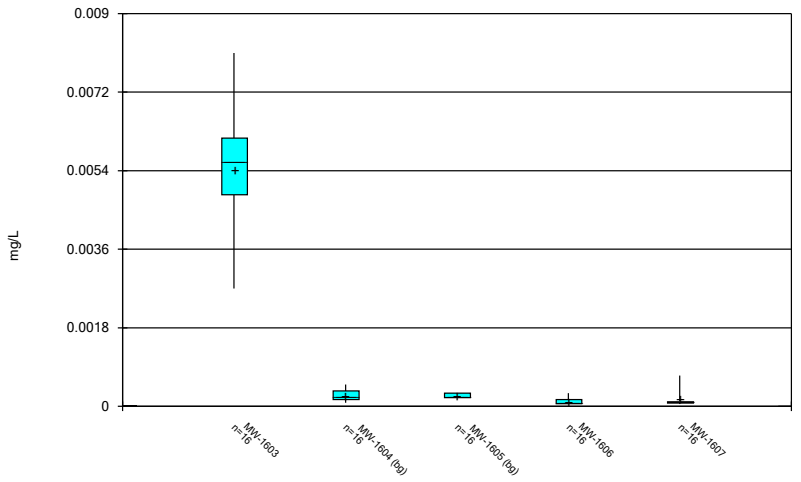
Box & Whiskers Plot



Constituent: Selenium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

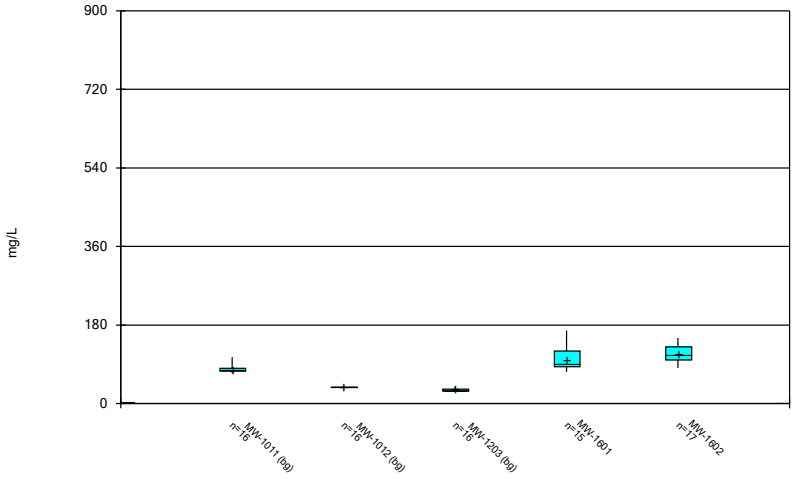
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Selenium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

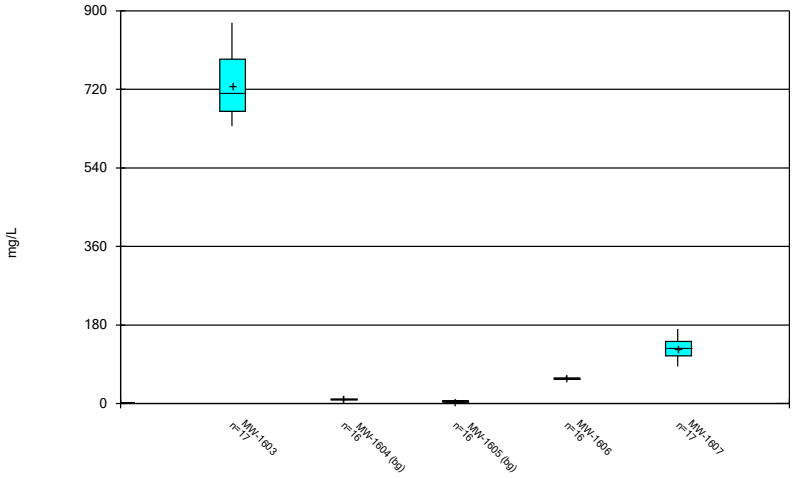
Box & Whiskers Plot



Constituent: Sulfate Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

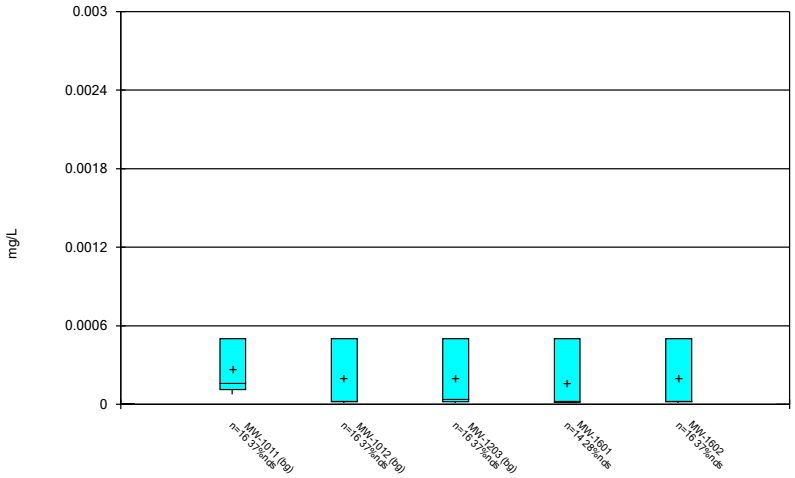
Box & Whiskers Plot



Constituent: Sulfate Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

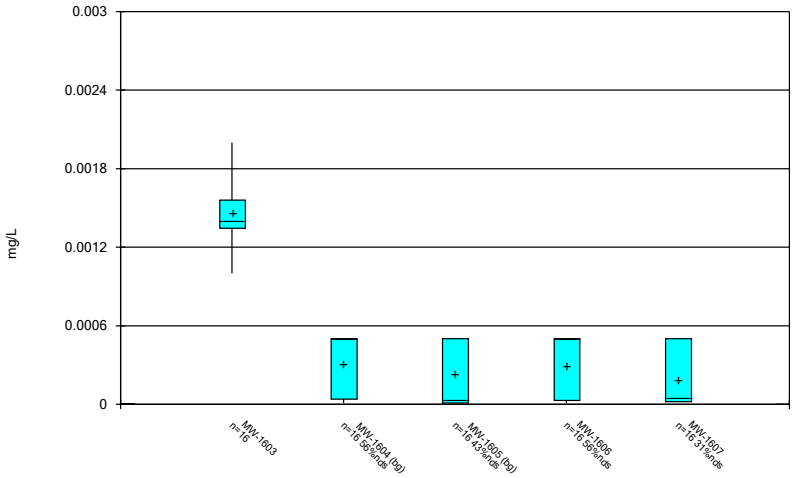
Box & Whiskers Plot



Constituent: Thallium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

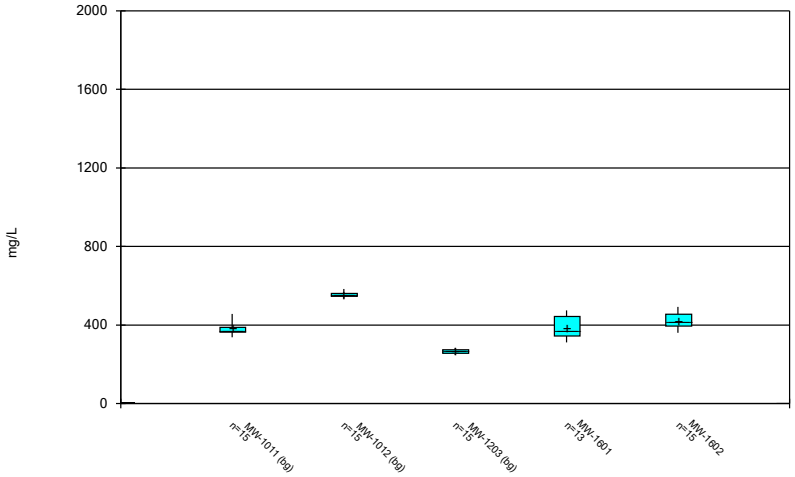
Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Thallium Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

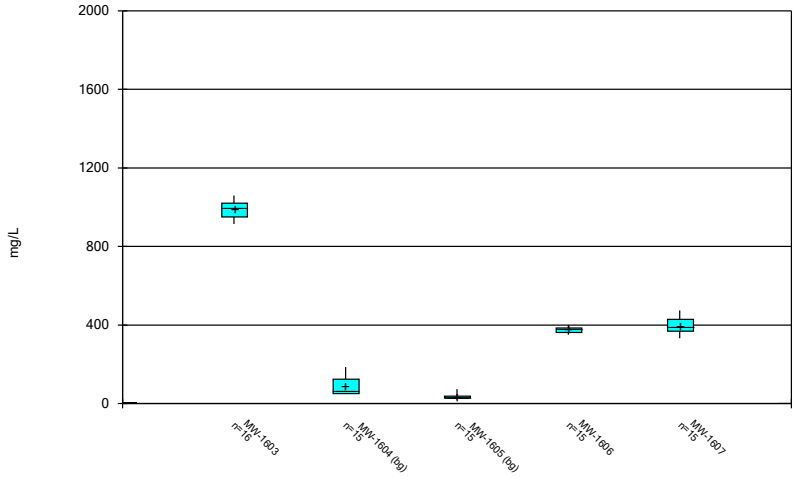
Box & Whiskers Plot



Constituent: Total Dissolved Solids Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Total Dissolved Solids Analysis Run 1/26/2021 5:45 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE C.

Outlier Summary

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:48 PM

	MW-1012 Chromium (mg/L)	MW-1203 Combined Radium 226 + 228 (pCi/L)	MW-1604 Combined Radium 226 + 228 (pCi/L)	MW-1605 Combined Radium 226 + 228 (pCi/L)	MW-1604 Molybdenum (mg/L)	MW-1605 Molybdenum (mg/L)	MW-1012 pH (SU)	MW-1606 pH (SU)
5/23/2017			6.707 (o)	6.077 (o)				
5/24/2017	0.00784 (o)							
6/21/2017			16.848 (o)	10.864 (o)				
7/12/2017					0.0159 (o)	0.0237 (o)		
3/17/2020		7.524 (o)						
3/18/2020							10.85 (o)	9.11 (o)

Tukey's Outlier Test - Intrawell- Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:08 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
pH (SU)	**MW-1012 (bg)**	**Yes**	**10.85**	**3/18/2020**	**NP**	**NaN**	**18**	**9.169**	**0.4732**	**ln(x)**	**ShapiroWilk**
pH (SU)	**MW-1606**	**Yes**	**9.11**	**3/18/2020**	**NP**	**NaN**	**19**	**7.001**	**0.5786**	**ln(x)**	**ShapiroWilk**

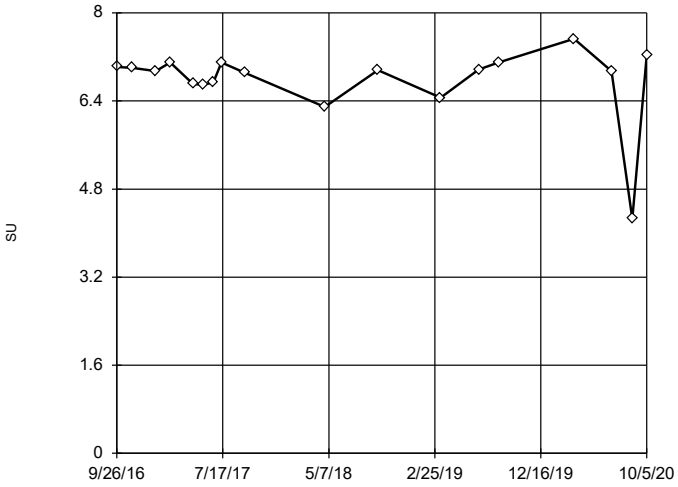
Tukey's Outlier Test - Intrawell- All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:08 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
pH (SU)	MW-1011 (bg)	No	n/a	n/a	NP	NaN	18	6.775	0.6869	x^6	ShapiroWilk
pH (SU)	**MW-1012 (bg)**	**Yes**	**10.85**	**3/18/2020**	**NP**	**NaN**	**18**	**9.169**	**0.4732**	**ln(x)**	**ShapiroWilk**
pH (SU)	MW-1203 (bg)	No	n/a	n/a	NP	NaN	18	6.819	0.3955	ln(x)	ShapiroWilk
pH (SU)	MW-1601	No	n/a	n/a	NP	NaN	16	7.218	0.4375	ln(x)	ShapiroWilk
pH (SU)	MW-1602	No	n/a	n/a	NP	NaN	19	7.309	0.762	x^3	ShapiroWilk
pH (SU)	MW-1603	No	n/a	n/a	NP	NaN	19	3.614	0.6278	ln(x)	ShapiroWilk
pH (SU)	MW-1604 (bg)	No	n/a	n/a	NP	NaN	18	5.783	0.8373	x^2	ShapiroWilk
pH (SU)	MW-1605 (bg)	No	n/a	n/a	NP	NaN	18	4.768	0.7545	x^4	ShapiroWilk
pH (SU)	**MW-1606**	**Yes**	**9.11**	**3/18/2020**	**NP**	**NaN**	**19**	**7.001**	**0.5786**	**ln(x)**	**ShapiroWilk**
pH (SU)	MW-1607	No	n/a	n/a	NP	NaN	19	6.452	0.5095	ln(x)	ShapiroWilk

Tukey's Outlier Screening

MW-1011 (bg)



n = 18

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.889, low cutoff = -5.312, based on IQR multiplier of 3.

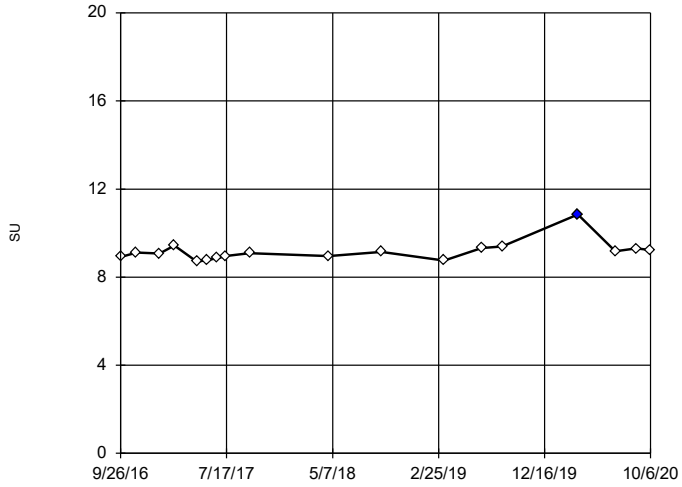
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1012 (bg)



n = 18

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 10.69, low cutoff = 7.74, based on IQR multiplier of 3.

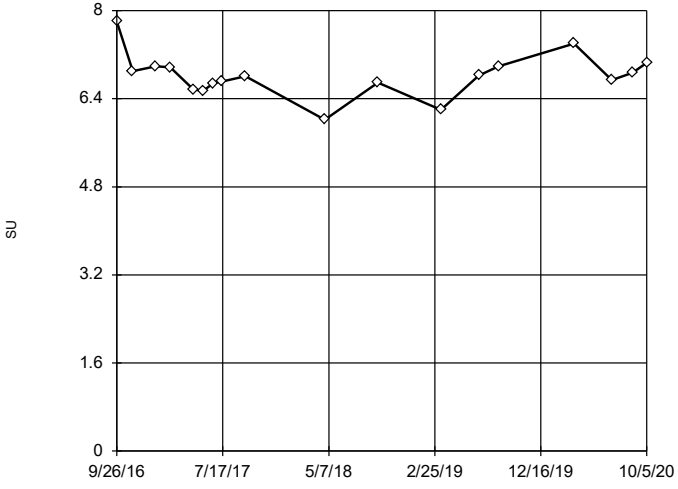
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1203 (bg)



n = 18

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.211, low cutoff = 5.64, based on IQR multiplier of 3.

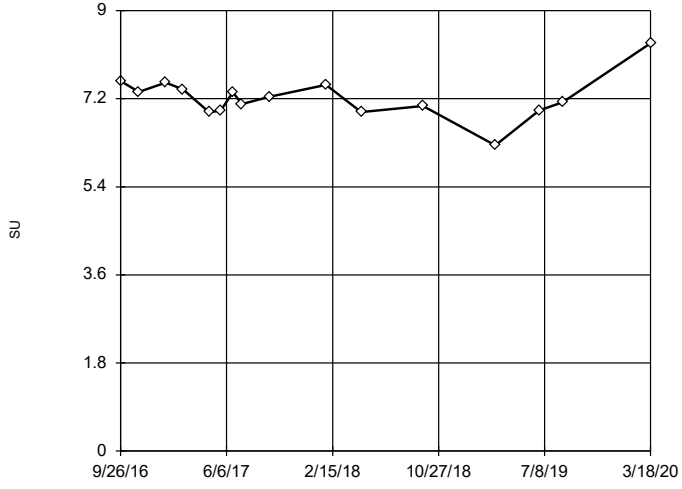
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1601



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

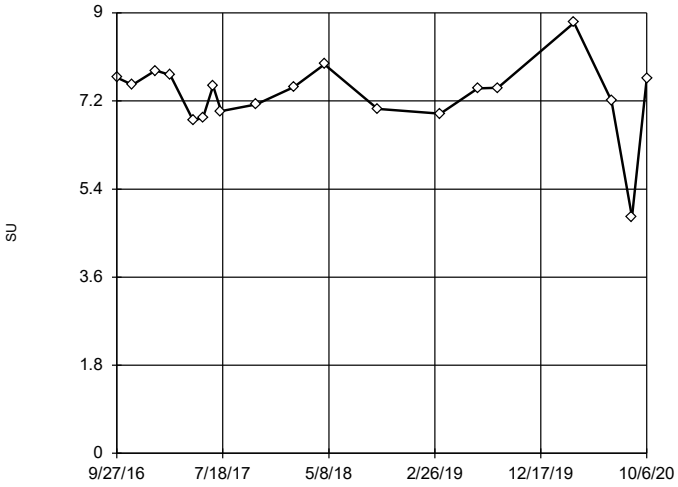
High cutoff = 9.063, low cutoff = 5.71, based on IQR multiplier of 3.

Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Tukey's Outlier Screening

MW-1602



n = 19

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.234, low cutoff = 1.929, based on IQR multiplier of 3.

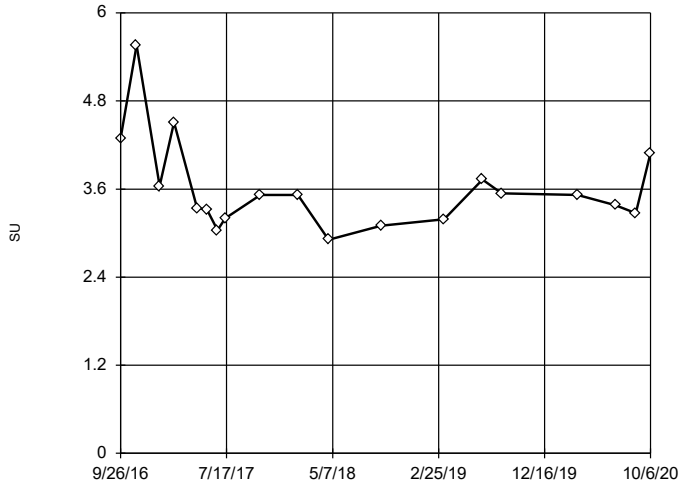
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603



n = 19

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5.907, low cutoff = 2.021, based on IQR multiplier of 3.

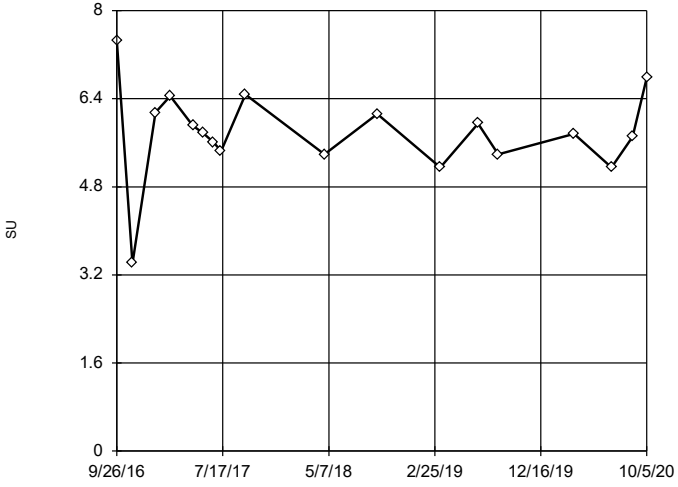
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604 (bg)



n = 18

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.467, low cutoff = -1.711, based on IQR multiplier of 3.

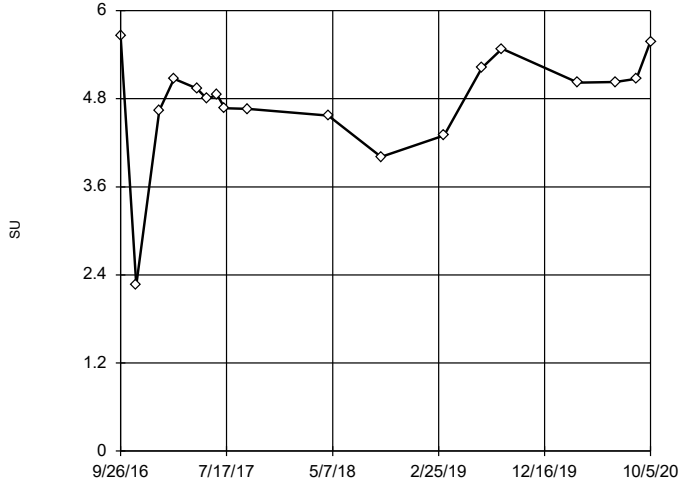
Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605 (bg)



n = 18

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

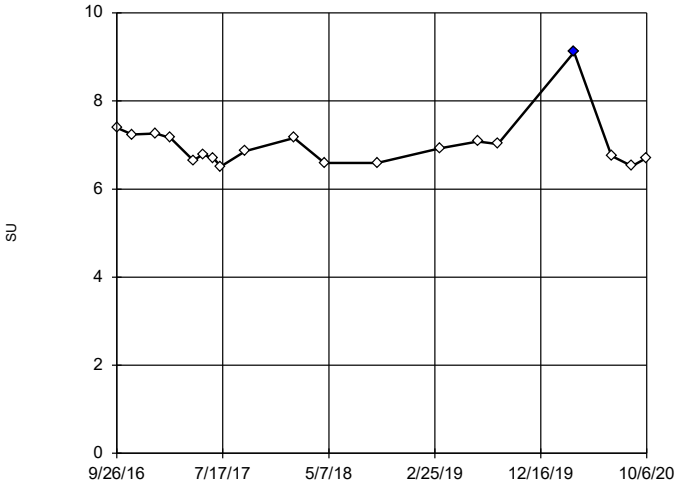
High cutoff = 6.178, low cutoff = -4.18, based on IQR multiplier of 3.

Constituent: pH Analysis Run 1/26/2021 5:03 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Tukey's Outlier Screening

MW-1606



n = 19

Outlier is drawn as solid. Tukey's method select-ed by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.937, low cutoff = 5.328, based on IQR multiplier of 3.

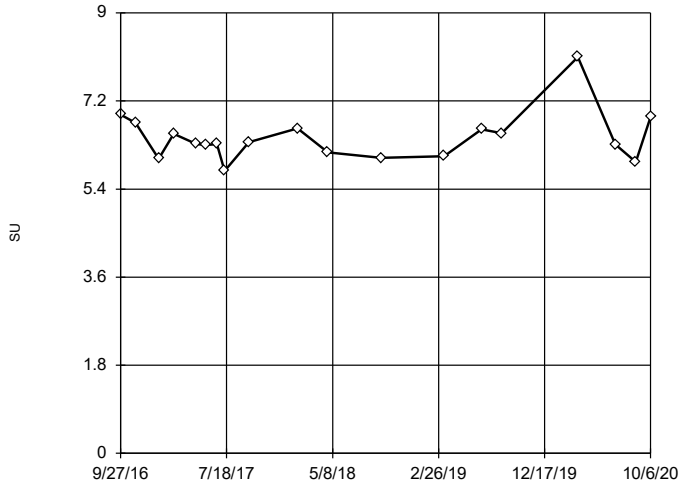
Constituent: pH Analysis Run 1/26/2021 5:04 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607



n = 19

No outliers found. Tukey's method select-ed by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.692, low cutoff = 4.637, based on IQR multiplier of 3.

Constituent: pH Analysis Run 1/26/2021 5:04 PM View: Outlier Tests

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Tukey's Outlier Test - Upgradient - All Results (No Significant)

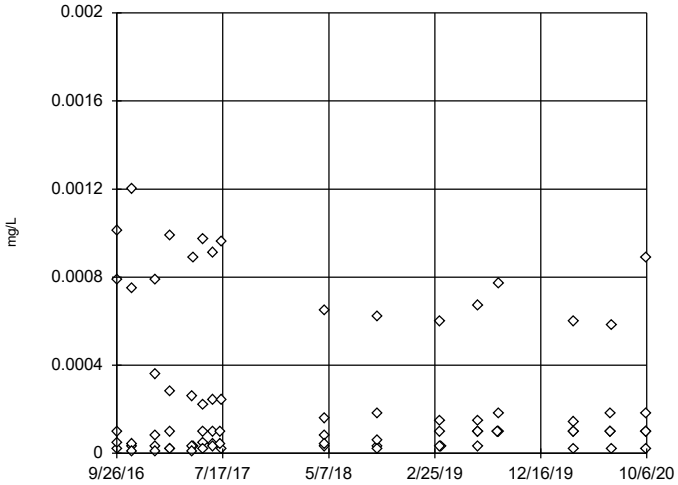
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/19/2021, 10:12 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0002531	0.0003217	ln(x)	ShapiroFrancia
Arsenic (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.006361	0.008436	ln(x)	ShapiroFrancia
Barium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.05608	0.0253	ln(x)	ShapiroFrancia
Beryllium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.00008017	0.00004124	normal	ShapiroFrancia
Boron (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.09741	0.06295	sqrt(x)	ShapiroFrancia
Cadmium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.00004639	0.00002885	normal	ShapiroFrancia
Calcium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	28.84	34.12	ln(x)	ShapiroFrancia
Chloride (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	2.678	1.889	ln(x)	ShapiroFrancia
Chromium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0009619	0.001169	ln(x)	ShapiroFrancia
Cobalt (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.001049	0.001237	ln(x)	ShapiroFrancia
Combined Radium 226 + 228 (pCi/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	2.107	2.506	ln(x)	ShapiroFrancia
Fluoride (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	84	0.2457	0.2504	ln(x)	ShapiroFrancia
Lead (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0003136	0.0004251	ln(x)	ShapiroFrancia
Lithium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.009121	0.005467	normal	ShapiroFrancia
Mercury (mg/L)	MW-1011,MW-1012,M...	n/a	n/a	n/a w/combined bg	NP	NaN	80	0.000004787	0.00000125	unknown	ShapiroFrancia
Molybdenum (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.001612	0.003097	ln(x)	ShapiroFrancia
Selenium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0001867	0.000102	sqrt(x)	ShapiroFrancia
Sulfate (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	32.38	26.6	x^(1/3)	ShapiroFrancia
Thallium (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	80	0.0002423	0.0002269	ln(x)	ShapiroFrancia
Total Dissolved Solids (mg/L)	MW-1011,MW-1012,M...	No	n/a	n/a w/combined bg	NP	NaN	75	265.9	193.5	sqrt(x)	ShapiroFrancia

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1963, low cutoff = 4.1e-8, based on IQR multiplier of 3.

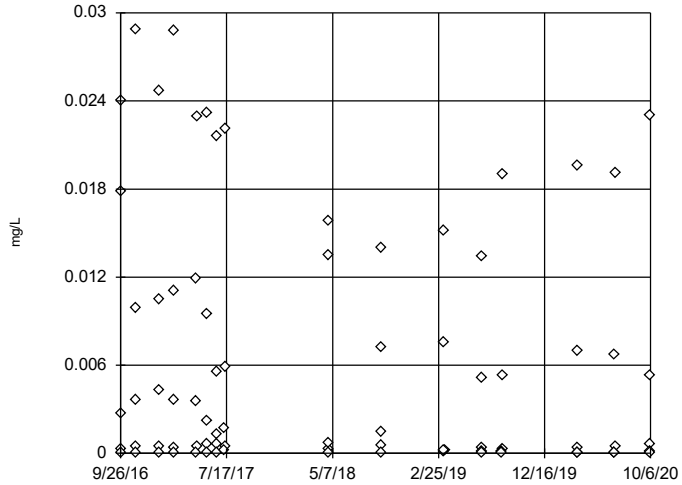
Constituent: Antimony Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 3028, low cutoff = 5.9e-10, based on IQR multiplier of 3.

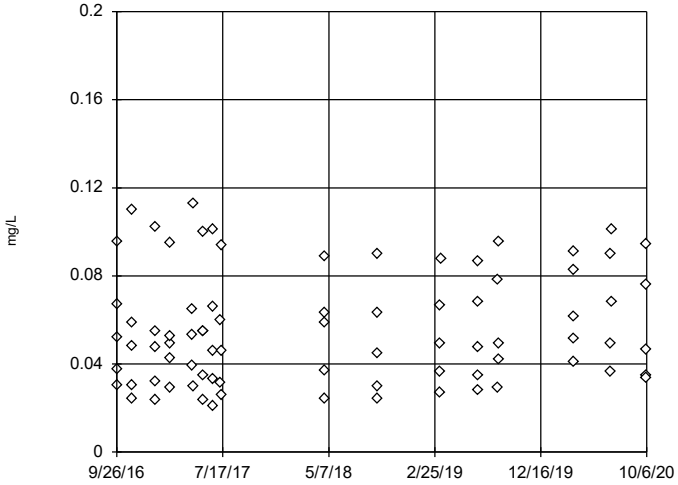
Constituent: Arsenic Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.6387, low cutoff = 0.003915, based on IQR multiplier of 3.

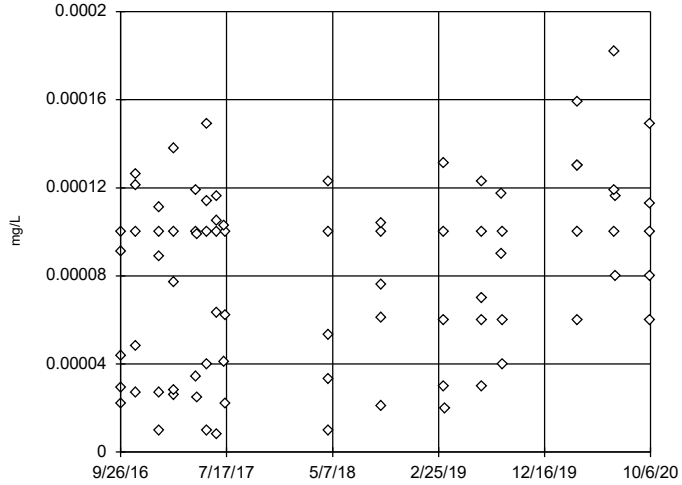
Constituent: Barium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.0003105, low cutoff = -0.000162, based on IQR multiplier of 3.

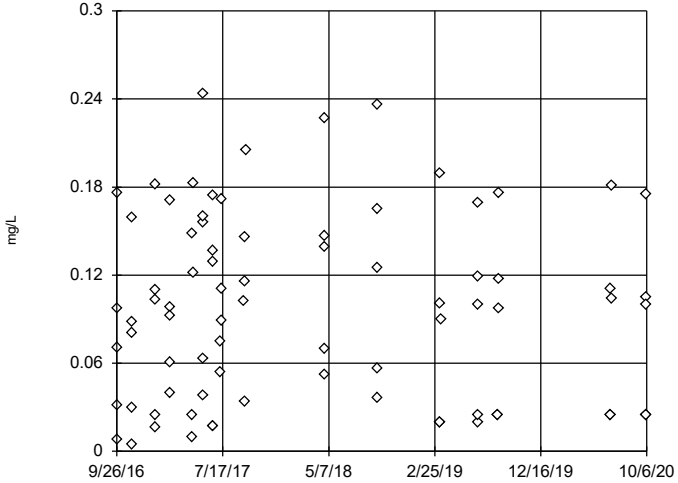
Constituent: Beryllium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.9911, low cutoff = -0.186, based on IQR multiplier of 3.

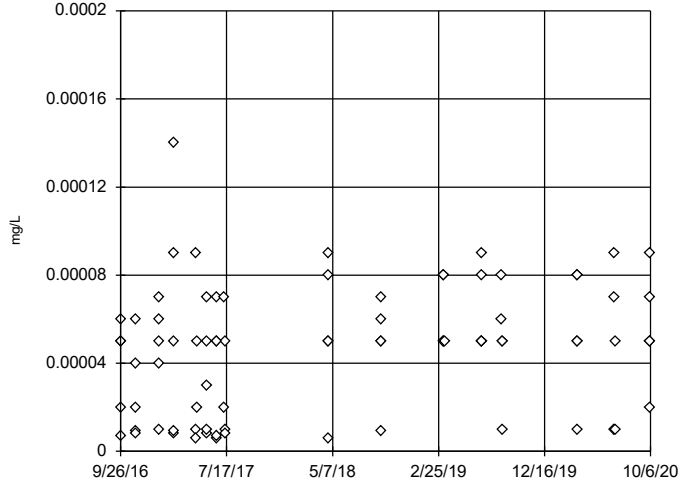
Constituent: Boron Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.000235, low cutoff = -0.00015, based on IQR multiplier of 3.

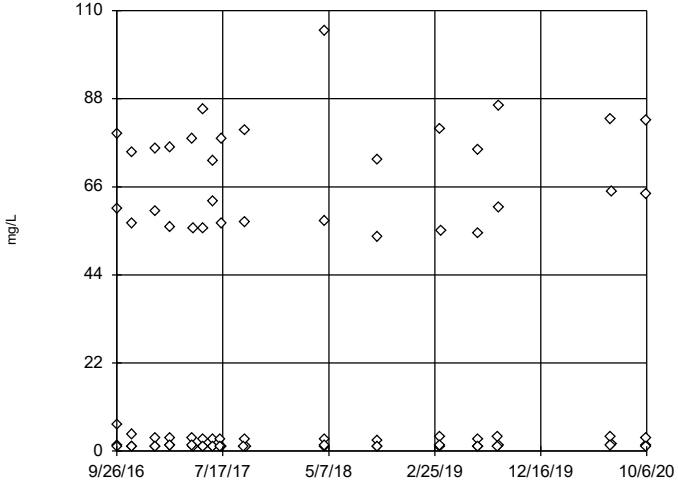
Constituent: Cadmium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7733356, low cutoff = 0.00000945, based on IQR multiplier of 3.

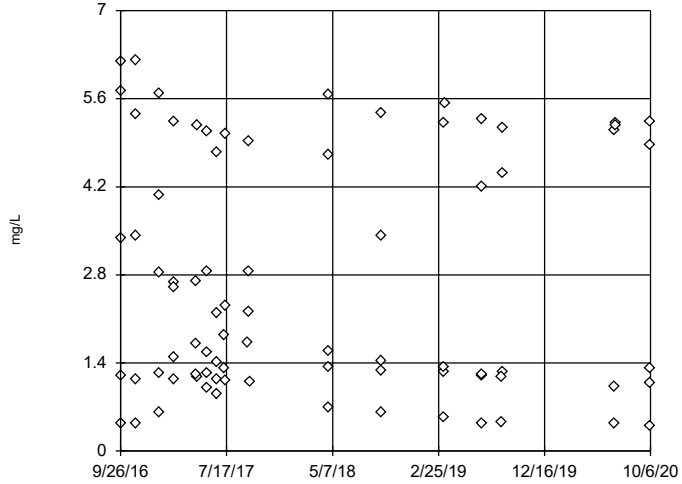
Constituent: Calcium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 357, low cutoff = 0.01603, based on IQR multiplier of 3.

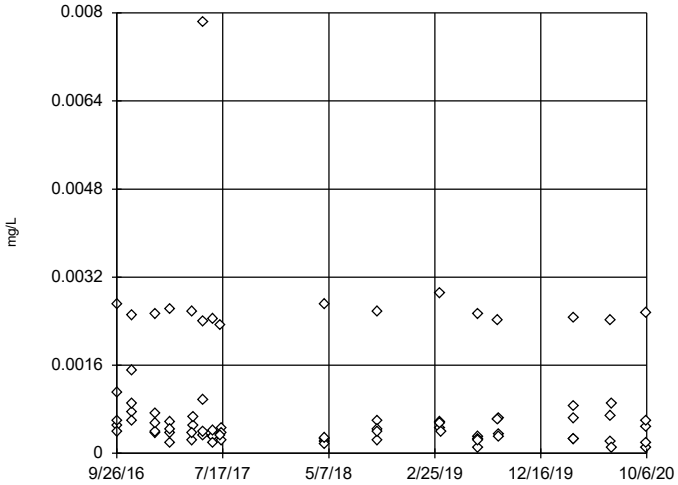
Constituent: Chloride Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02869, low cutoff = 0.000009751, based on IQR multiplier of 3.

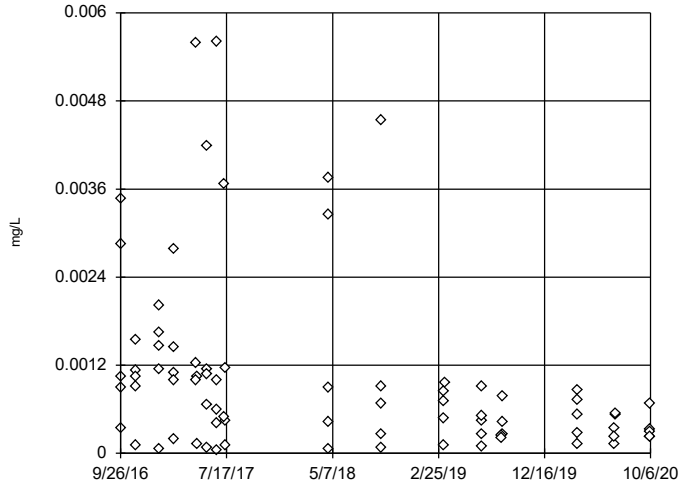
Constituent: Chromium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08241, low cutoff = 0.000003519, based on IQR multiplier of 3.

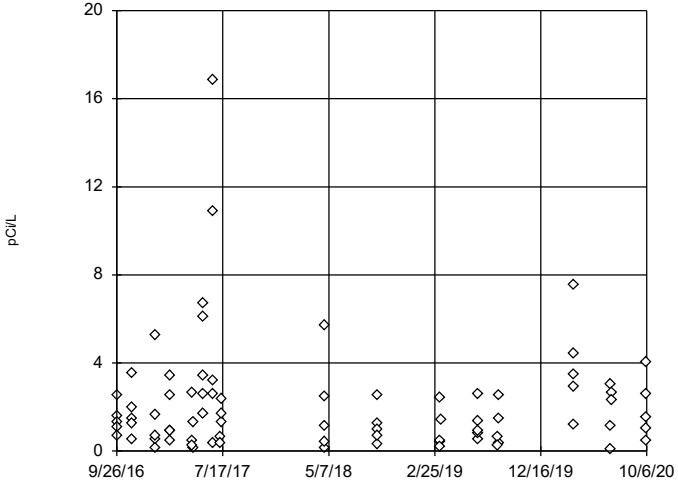
Constituent: Cobalt Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 213, low cutoff = 0.007131, based on IQR multiplier of 3.

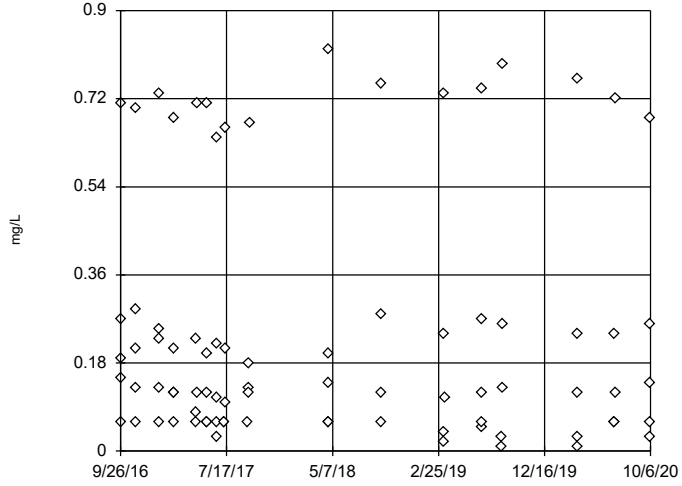
Constituent: Combined Radium 226 + 228 Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 84

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 22.82, low cutoff = 0.0006968, based on IQR multiplier of 3.

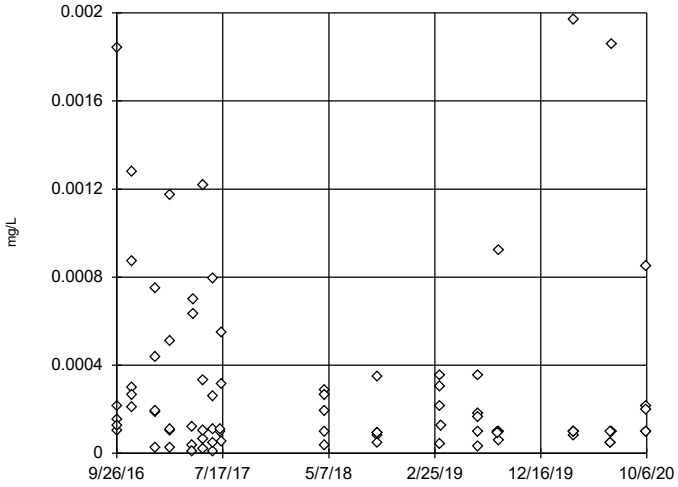
Constituent: Fluoride Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01395, low cutoff = 0.00000213, based on IQR multiplier of 3.

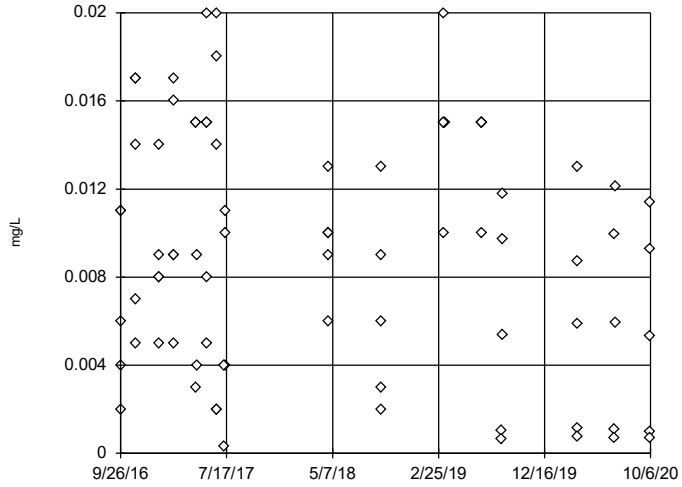
Constituent: Lead Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.041, low cutoff = -0.022, based on IQR multiplier of 3.

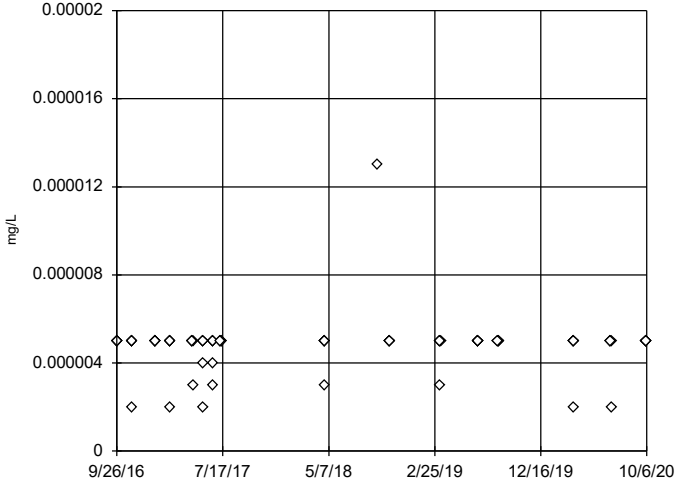
Constituent: Lithium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

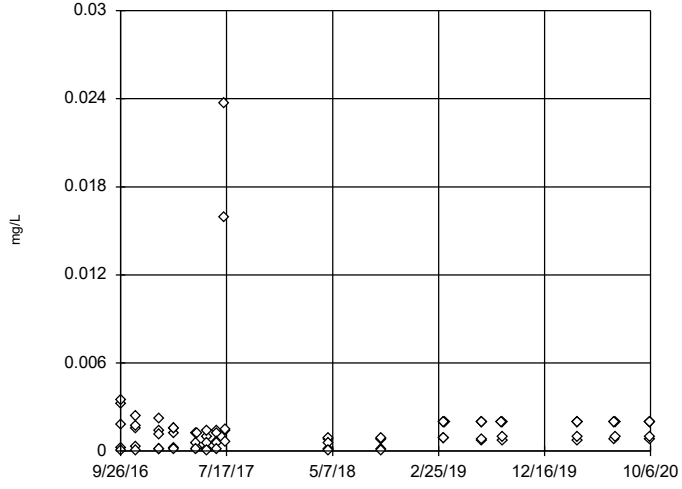
Constituent: Mercury Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0864, low cutoff = 0.00001319, based on IQR multiplier of 3.

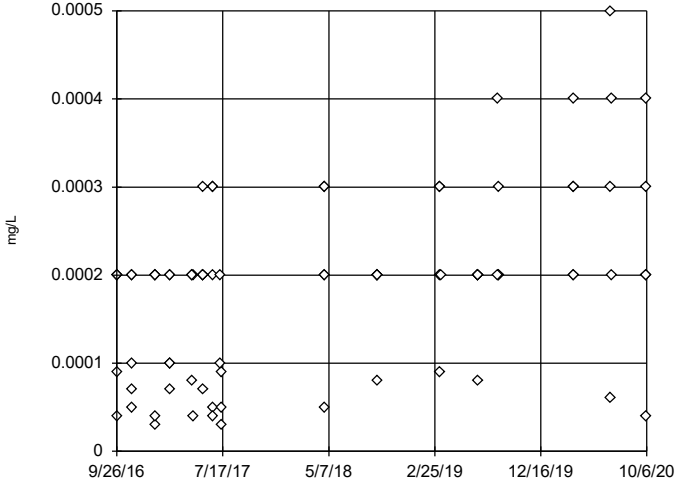
Constituent: Molybdenum Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0007901, low cutoff = -0.00002006, based on IQR multiplier of 3.

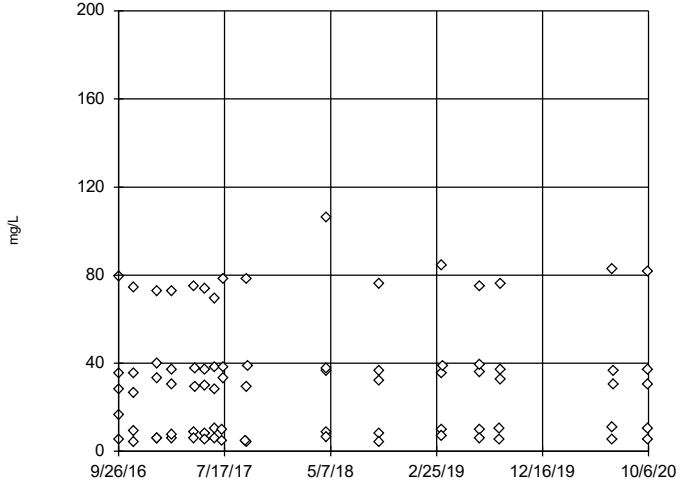
Constituent: Selenium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 419.1, low cutoff = -9.433, based on IQR multiplier of 3.

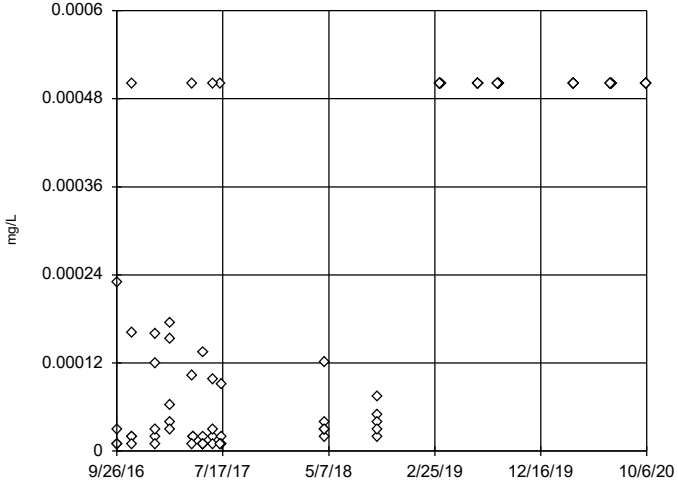
Constituent: Sulfate Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 80

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.813, low cutoff = 1.3e-9, based on IQR multiplier of 3.

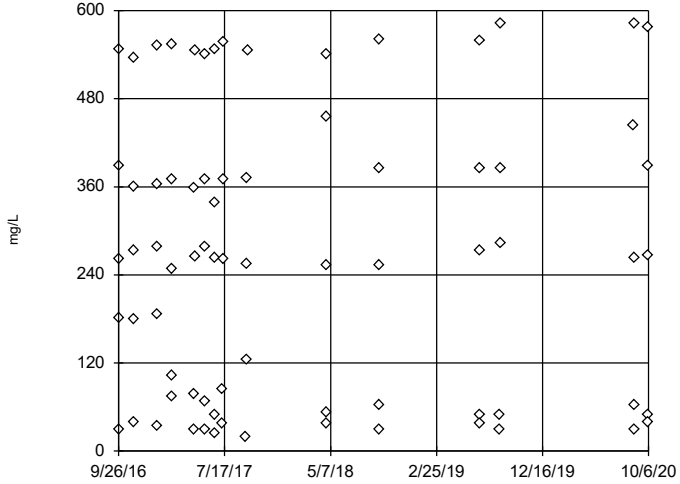
Constituent: Thallium Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Appendix IV

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Tukey's Outlier Screening, Pooled Background

MW-1011,MW-1012,MW-1203,MW-1604,MW-16...



n = 75

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 3267, low cutoff = -915, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 1/19/2021 10:11 AM View: Interwell Appendix III and Ap

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE D.

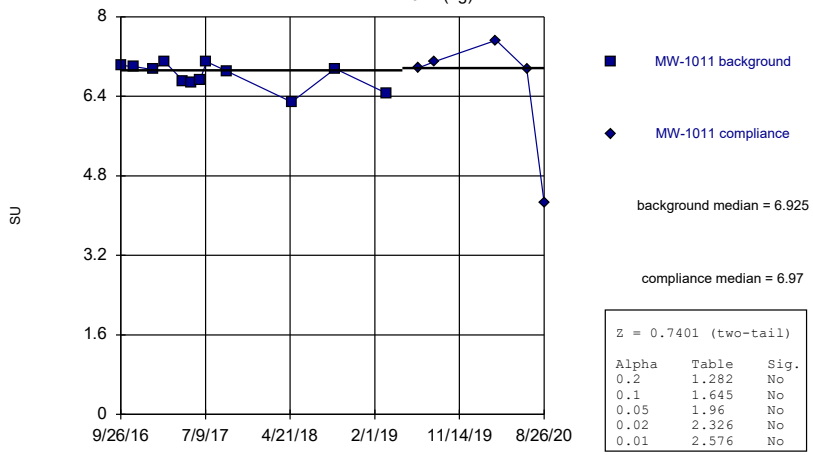
Welch's t-test/Mann-Whitney - All Results (No Significant)

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:35 PM

Constituent	Well	Calc.	0.01	Method
pH (SU)	MW-1011 (bg)	0.7401	No	Mann-W
pH (SU)	MW-1012 (bg)	2.365	No	Mann-W
pH (SU)	MW-1203 (bg)	1.477	No	Mann-W
pH (SU)	MW-1602	-0.1971	No	Mann-W
pH (SU)	MW-1603	0.5927	No	Mann-W
pH (SU)	MW-1604 (bg)	-1.003	No	Mann-W
pH (SU)	MW-1605 (bg)	2.32	No	Mann-W
pH (SU)	MW-1606	-0.5102	No	Mann-W
pH (SU)	MW-1607	0.6904	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)

MW-1011 (bg)

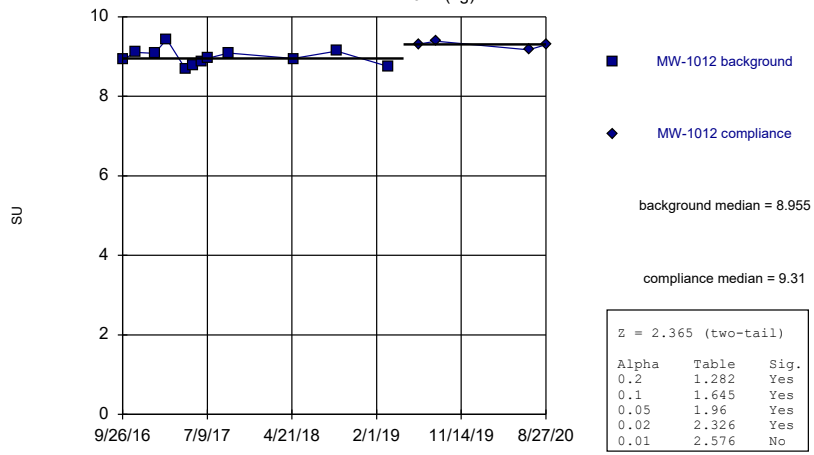


Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1012 (bg)

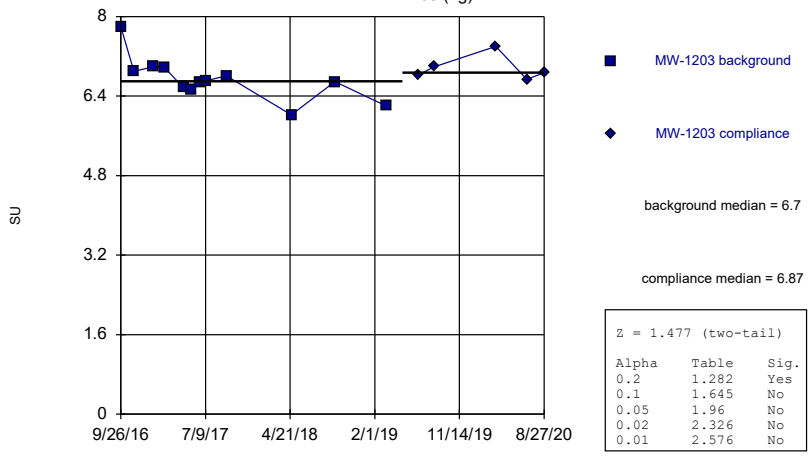


Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1203 (bg)

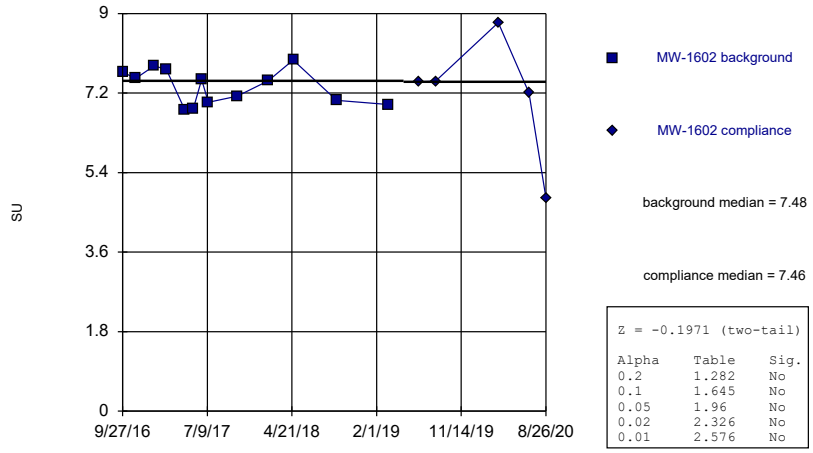


Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

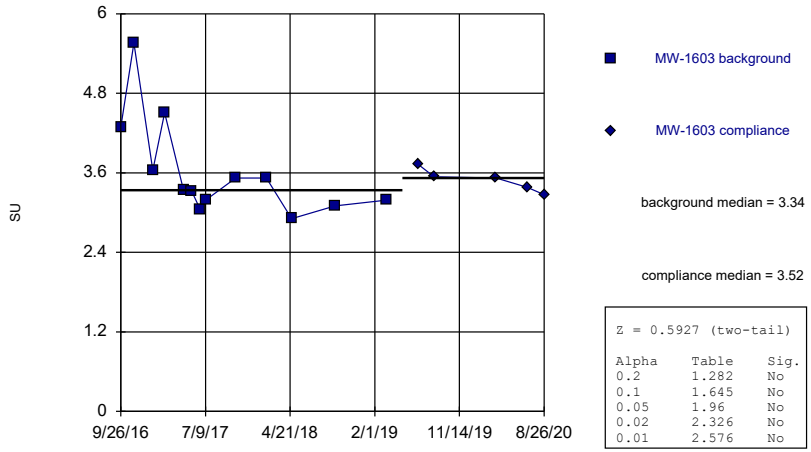
MW-1602



Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Mann-Whitney (Wilcoxon Rank Sum)

MW-1603



Z = 0.5927 (two-tail)

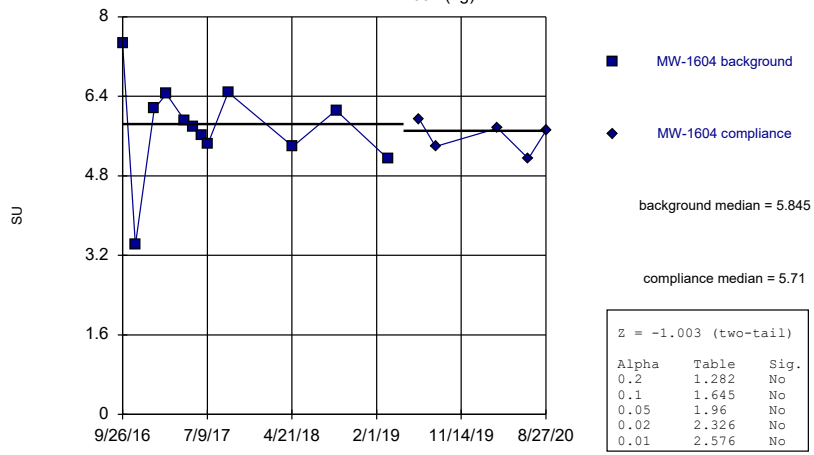
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1604 (bg)



Z = -1.003 (two-tail)

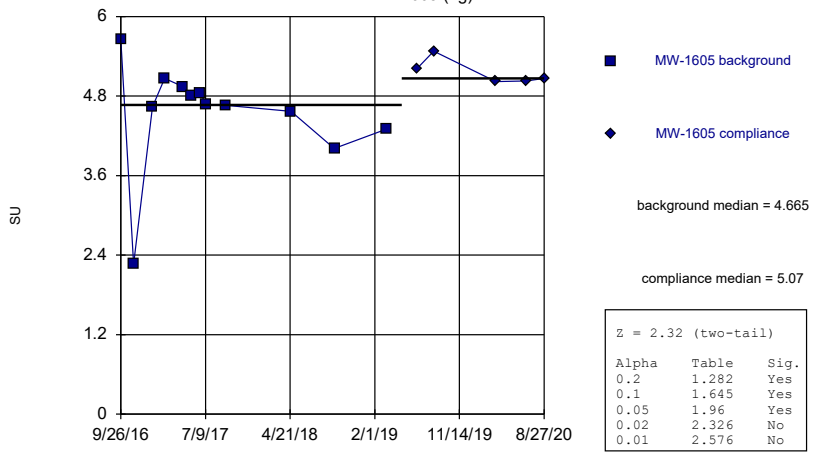
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1605 (bg)



Z = 2.32 (two-tail)

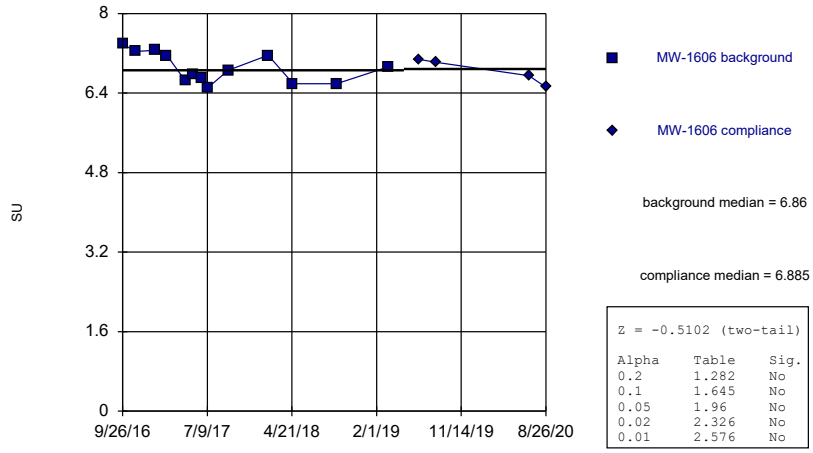
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	Yes
0.02	2.326	No
0.01	2.576	No

Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1606



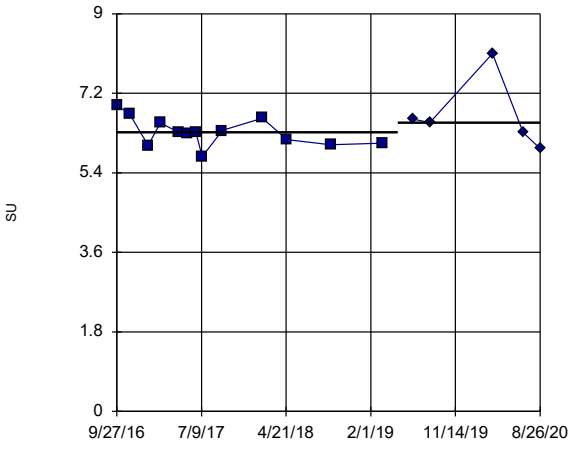
Z = -0.5102 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Mann-Whitney (Wilcoxon Rank Sum)

MW-1607



MW-1607 background

MW-1607 compliance

background median = 6.32

compliance median = 6.54

Z = 0.6904 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH Analysis Run 1/26/2021 6:34 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1011	MW-1011
9/26/2016	7.02	
11/9/2016	7	
1/12/2017	6.94	
2/21/2017	7.1	
4/25/2017	6.71	
5/24/2017	6.69	
6/21/2017	6.74	
7/13/2017	7.1	
9/18/2017	6.91	
4/26/2018	6.29	
9/20/2018	6.96	
3/13/2019	6.46	
6/27/2019		6.97
8/21/2019		7.1
3/17/2020		7.53
6/29/2020		6.94
8/26/2020		4.26

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1012	MW-1012
9/26/2016	8.92	
11/9/2016	9.11	
1/12/2017	9.08	
2/22/2017	9.44	
4/26/2017	8.7	
5/24/2017	8.78	
6/22/2017	8.86	
7/13/2017	8.96	
9/19/2017	9.09	
4/26/2018	8.95	
9/20/2018	9.14	
3/13/2019	8.75	
6/25/2019		9.32
8/21/2019		9.39
3/18/2020	10.85 (o)	
6/30/2020		9.17
8/27/2020		9.3

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1203	MW-1203
9/26/2016	7.8	
11/9/2016	6.9	
1/12/2017	6.99	
2/21/2017	6.97	
4/26/2017	6.57	
5/23/2017	6.54	
6/21/2017	6.68	
7/13/2017	6.71	
9/18/2017	6.81	
4/26/2018	6.02	
9/20/2018	6.69	
3/14/2019	6.2	
6/27/2019		6.82
8/21/2019		6.99
3/17/2020		7.4
6/30/2020		6.74
8/27/2020		6.87

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1602	MW-1602
9/27/2016	7.68	
11/9/2016	7.53	
1/12/2017	7.82	
2/22/2017	7.73	
4/26/2017	6.81	
5/24/2017	6.85	
6/21/2017	7.51	
7/13/2017	6.99	
10/19/2017	7.13	
1/31/2018	7.48	
4/26/2018	7.95	
9/20/2018	7.04	
3/13/2019	6.94	
6/25/2019		7.46
8/20/2019		7.47
3/18/2020		8.8
6/30/2020		7.2
8/26/2020		4.83

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1603	MW-1603
9/26/2016	4.29	
11/9/2016	5.56	
1/12/2017	3.64	
2/21/2017	4.51	
4/26/2017	3.34	
5/24/2017	3.32	
6/22/2017	3.04	
7/13/2017	3.2	
10/19/2017	3.52	
1/31/2018	3.52	
4/26/2018	2.91	
9/20/2018	3.1	
3/13/2019	3.19	
6/27/2019		3.73
8/20/2019		3.54
3/17/2020		3.52
6/30/2020		3.38
8/26/2020		3.27

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1604	MW-1604
9/26/2016	7.46	
11/8/2016	3.41	
1/11/2017	6.15	
2/21/2017	6.45	
4/25/2017	5.91	
5/23/2017	5.78	
6/21/2017	5.61	
7/12/2017	5.45	
9/18/2017	6.48	
4/25/2018	5.39	
9/18/2018	6.12	
3/12/2019	5.15	
6/25/2019		5.95
8/20/2019		5.39
3/17/2020		5.76
6/29/2020		5.15
8/27/2020		5.71

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1605	MW-1605
9/26/2016	5.66	
11/8/2016	2.26	
1/11/2017	4.64	
2/21/2017	5.07	
4/25/2017	4.94	
5/23/2017	4.8	
6/21/2017	4.85	
7/12/2017	4.67	
9/14/2017	4.66	
4/25/2018	4.57	
9/18/2018	4.01	
3/12/2019	4.3	
6/25/2019		5.22
8/20/2019		5.48
3/17/2020		5.02
6/29/2020		5.03
8/27/2020		5.07

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1606	MW-1606
9/26/2016	7.39	
11/8/2016	7.24	
1/12/2017	7.26	
2/22/2017	7.16	
4/26/2017	6.65	
5/23/2017	6.78	
6/21/2017	6.7	
7/12/2017	6.51	
9/18/2017	6.86	
1/31/2018	7.16	
4/25/2018	6.59	
9/19/2018	6.59	
3/13/2019	6.93	
6/25/2019		7.08
8/20/2019		7.02
3/18/2020	9.11 (o)	
6/30/2020		6.75
8/26/2020		6.52

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: pH (SU) Analysis Run 1/26/2021 6:35 PM View: Appendix III - Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

	MW-1607	MW-1607
9/27/2016	6.92	
11/8/2016	6.75	
1/11/2017	6.02	
2/21/2017	6.53	
4/25/2017	6.32	
5/23/2017	6.3	
6/21/2017	6.32	
7/12/2017	5.77	
9/18/2017	6.36	
1/31/2018	6.64	
4/25/2018	6.15	
9/19/2018	6.04	
3/13/2019	6.07	
6/25/2019		6.62
8/20/2019		6.54
3/18/2020		8.1
6/30/2020		6.31
8/26/2020		5.95

FIGURE E.

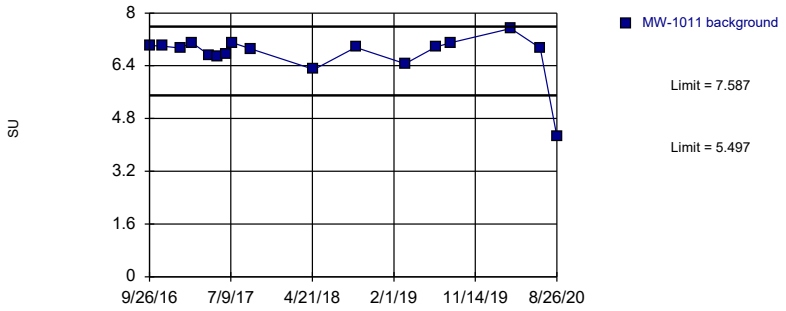
Intrawell Prediction Limits - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/27/2021, 1:41 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH (SU)	MW-1011	7.587	5.497	n/a	1 future	n/a	17	15079	4730	0	None	x^5	0.000752	Param Intra 1 of 2
pH (SU)	MW-1012	9.552	8.568	n/a	1 future	n/a	16	9.06	0.229	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1203	7.664	5.948	n/a	1 future	n/a	17	6.806	0.4033	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1601	7.969	6.349	n/a	1 future	n/a	13	7.159	0.3554	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1602	8.718	5.606	n/a	1 future	n/a	18	53.72	10.6	0	None	x^2	0.000752	Param Intra 1 of 2
pH (SU)	MW-1603	5.56	2.91	n/a	1 future	n/a	18	n/a	n/a	0	n/a	n/a	0.01075	NP Intra (normality) 1 of 2
pH (SU)	MW-1604	7.478	3.972	n/a	1 future	n/a	17	5.725	0.8241	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1605	5.962	3.174	n/a	1 future	n/a	17	22.81	5.987	0	None	x^2	0.000752	Param Intra 1 of 2
pH (SU)	MW-1606	7.499	6.288	n/a	1 future	n/a	17	6.894	0.2847	0	None	No	0.000752	Param Intra 1 of 2
pH (SU)	MW-1607	7.509	5.473	n/a	1 future	n/a	18	1.858	0.07518	0	None	ln(x)	0.000752	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, MW-1011 (bg)



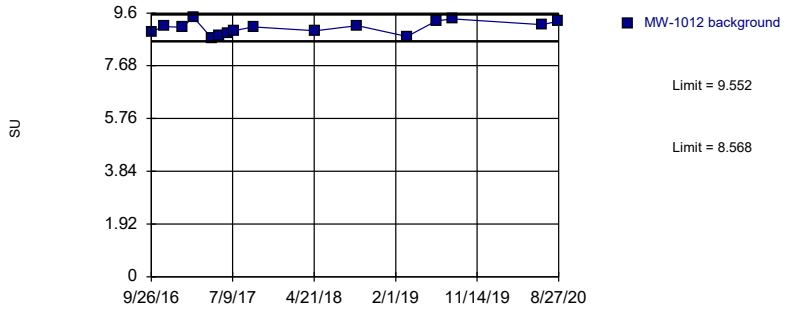
Background Data Summary (based on x^5 transformation): Mean=15079, Std. Dev.=4730, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8619, critical = 0.851. Kappa = 2.127 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1012 (bg)



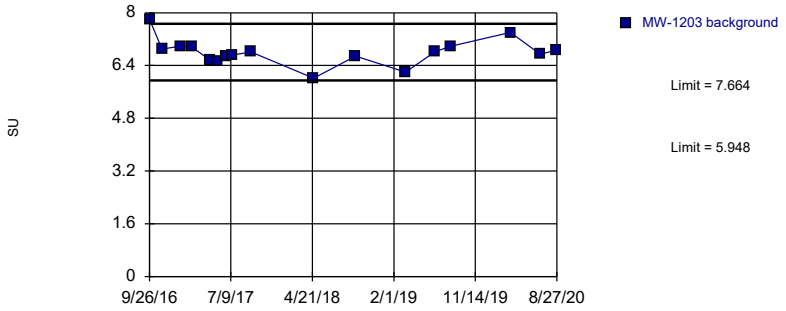
Background Data Summary: Mean=9.06, Std. Dev.=0.229, n=16. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9634, critical = 0.844. Kappa = 2.15 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1203 (bg)



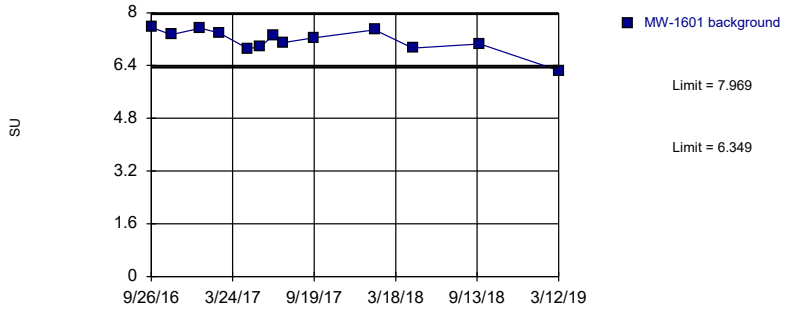
Background Data Summary: Mean=6.806, Std. Dev.=0.4033, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9311, critical = 0.851. Kappa = 2.127 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601

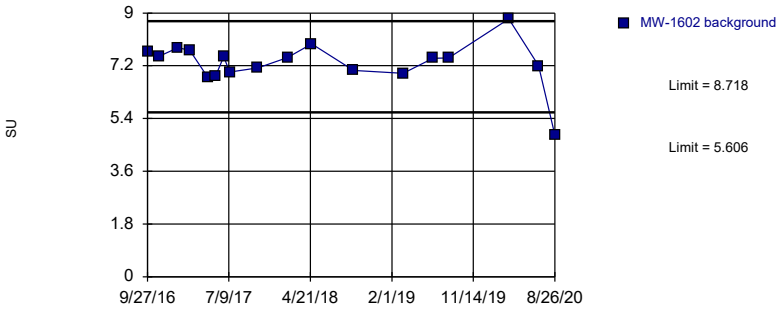


Background Data Summary: Mean=7.159, Std. Dev.=0.3554, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8814, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Intrawell Parametric, MW-1602



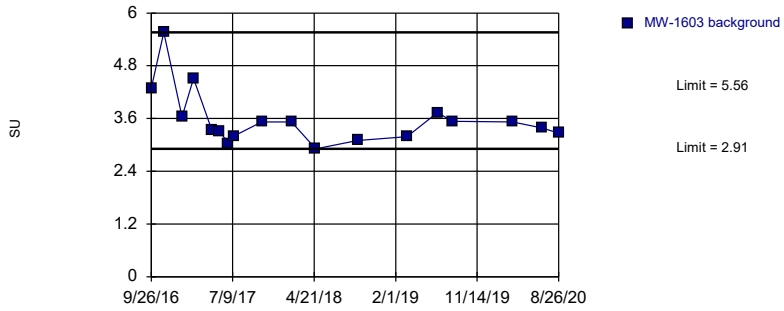
Background Data Summary (based on square transformation): Mean=53.72, Std. Dev.=10.6, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.882, critical = 0.858. Kappa = 2.104 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW-1603



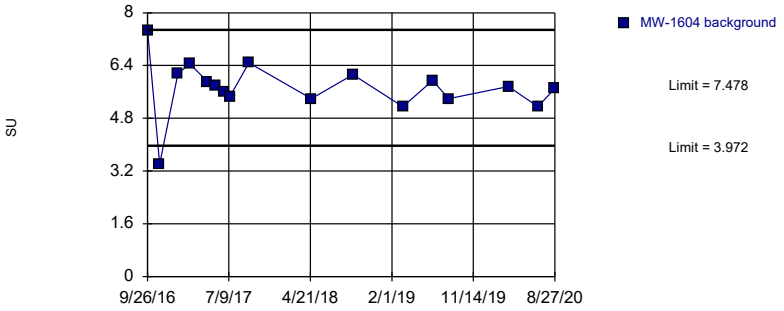
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 18 background values. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01075 (1 of 2). Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604 (bg)



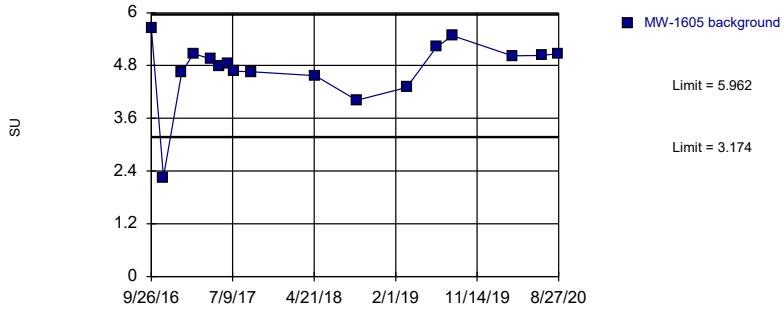
Background Data Summary: Mean=5.725, Std. Dev.=0.8241, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8957, critical = 0.851. Kappa = 2.127 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605 (bg)

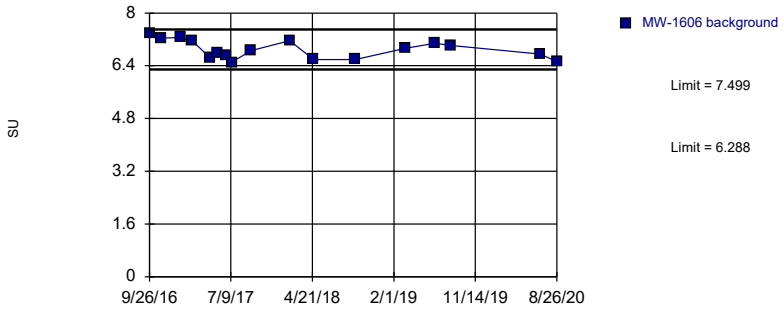


Background Data Summary (based on square transformation): Mean=22.81, Std. Dev.=5.987, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8791, critical = 0.851. Kappa = 2.127 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Intrawell Parametric, MW-1606



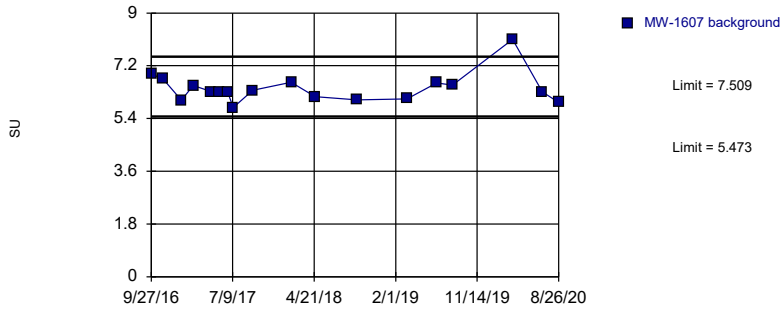
Background Data Summary: Mean=6.894, Std. Dev.=0.2847, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9372, critical = 0.851. Kappa = 2.127 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1607



Background Data Summary (based on natural log transformation): Mean=1.858, Std. Dev.=0.07518, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8619, critical = 0.858. Kappa = 2.104 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH Analysis Run 1/27/2021 1:40 PM View: Appendix III - Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE F.

Upgradient Wells Trend Test - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 2:02 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Chloride (mg/L)	**MW-1604 (bg)**	**-0.5941**	**-83**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride (mg/L)	**MW-1604 (bg)**	**-0.03608**	**-74**	**-58**	**Yes**	**16**	**6.25**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids (mg/L)	**MW-1604 (bg)**	**-30.37**	**-50**	**-48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Upgradient Wells Trend Test - All Results

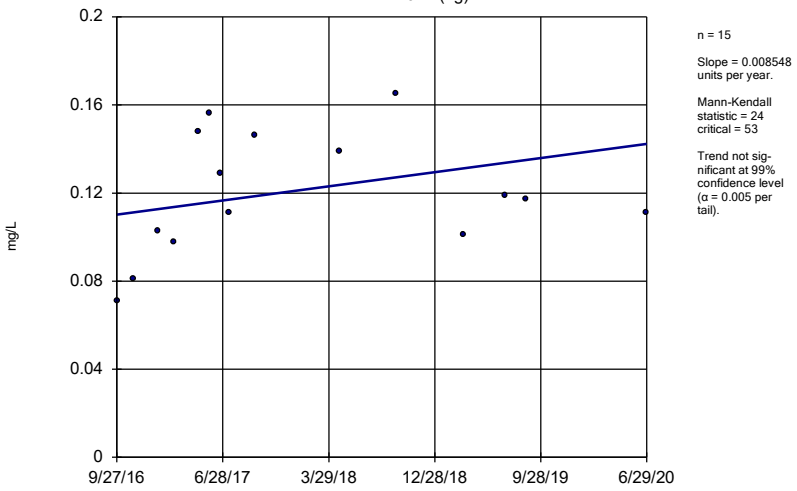
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 2:02 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron (mg/L)	MW-1011 (bg)	0.008548	24	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1012 (bg)	0.003033	16	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1203 (bg)	0.001484	8	53	No	15	0	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1604 (bg)	0.001686	7	53	No	15	13.33	n/a	n/a	0.01	NP
Boron (mg/L)	MW-1605 (bg)	0.003842	17	53	No	15	26.67	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1011 (bg)	2.087	31	53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1012 (bg)	-0.03076	-25	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1203 (bg)	-0.3871	-6	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1604 (bg)	-0.2413	-23	-53	No	15	0	n/a	n/a	0.01	NP
Calcium (mg/L)	MW-1605 (bg)	0.003453	4	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1011 (bg)	0.5799	42	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1012 (bg)	0.03588	29	53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	MW-1203 (bg)	-0.1088	-25	-53	No	15	0	n/a	n/a	0.01	NP
Chloride (mg/L)	**MW-1604 (bg)**	**-0.5941**	**-83**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride (mg/L)	MW-1605 (bg)	-0.1192	-22	-53	No	15	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1011 (bg)	0.0122	37	58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1012 (bg)	0.01482	38	58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	MW-1203 (bg)	0	-26	-58	No	16	0	n/a	n/a	0.01	NP
Fluoride (mg/L)	**MW-1604 (bg)**	**-0.03608**	**-74**	**-58**	**Yes**	**16**	**6.25**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride (mg/L)	MW-1605 (bg)	0	-30	-53	No	15	80	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1011 (bg)	1.552	29	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1012 (bg)	-0.02982	-6	-53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1203 (bg)	1.966	43	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1604 (bg)	0.5493	20	53	No	15	0	n/a	n/a	0.01	NP
Sulfate (mg/L)	MW-1605 (bg)	0.02662	2	53	No	15	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1011 (bg)	11.62	37	48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1012 (bg)	9.101	41	48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	MW-1203 (bg)	-0.3138	-4	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids (mg/L)	**MW-1604 (bg)**	**-30.37**	**-50**	**-48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids (mg/L)	MW-1605 (bg)	-0.7143	-16	-48	No	14	0	n/a	n/a	0.01	NP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 15

Slope = 0.008548 units per year.

Mann-Kendall statistic = 24 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

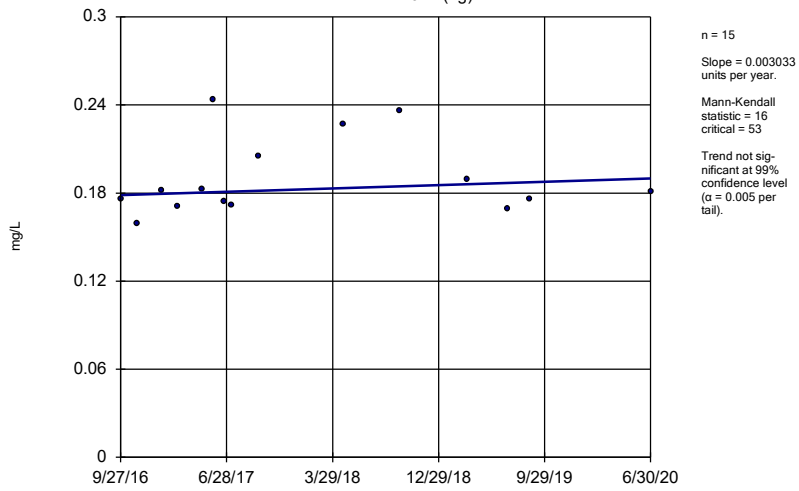
Constituent: Boron Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 15

Slope = 0.003033 units per year.

Mann-Kendall statistic = 16 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

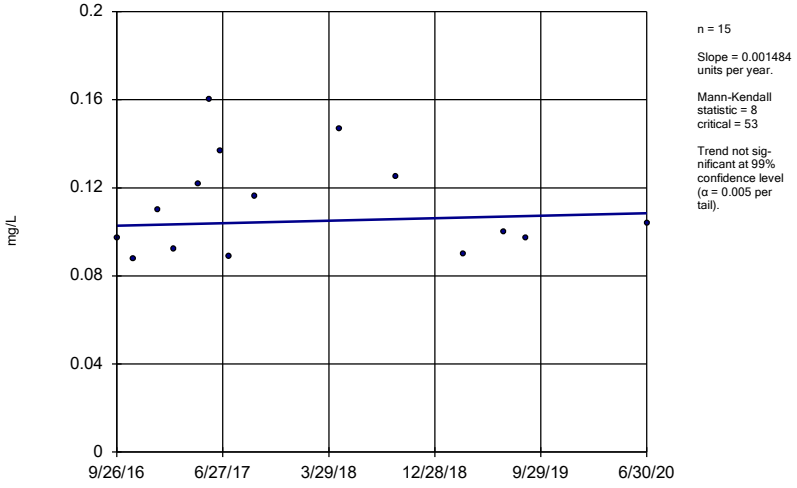
Constituent: Boron Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 15

Slope = 0.001484 units per year.

Mann-Kendall statistic = 8 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron Analysis Run 1/26/2021 2:01 PM View: Intrawell

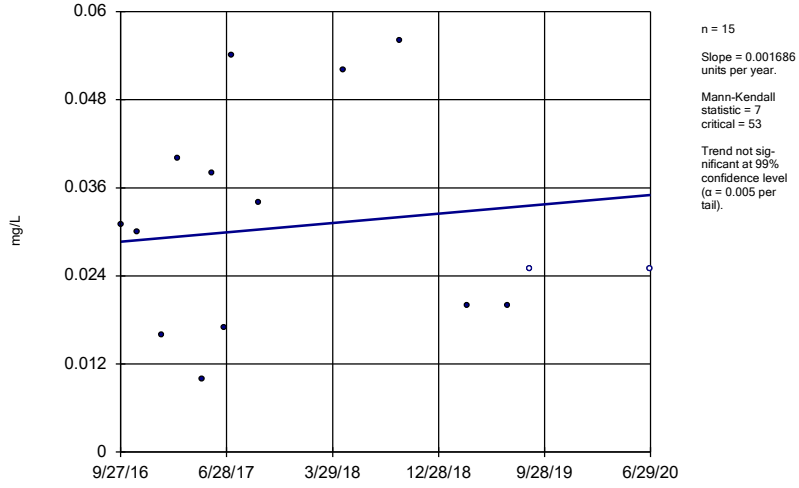
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-1604 (bg)



n = 15

Slope = 0.001686 units per year.

Mann-Kendall statistic = 7 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron Analysis Run 1/26/2021 2:01 PM View: Intrawell

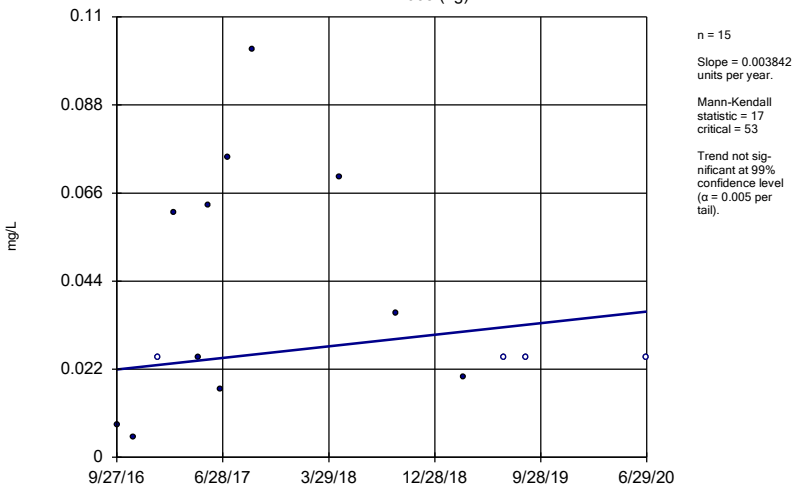
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-1605 (bg)



n = 15

Slope = 0.003842 units per year.

Mann-Kendall statistic = 17
critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

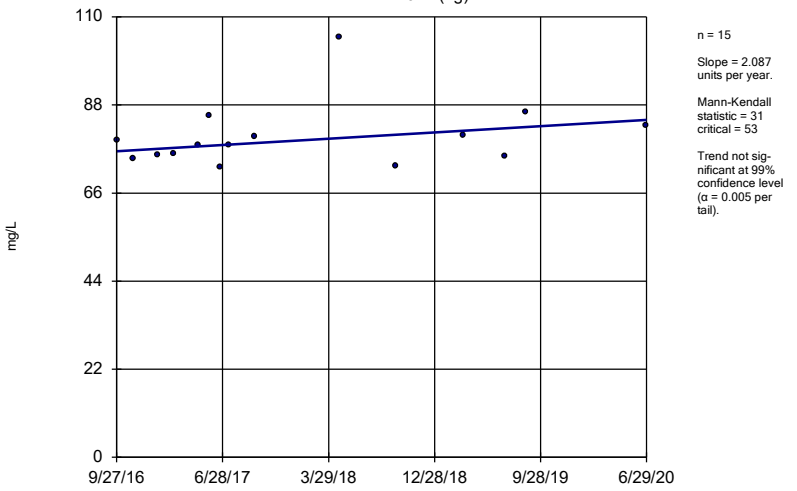
Constituent: Boron Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 15

Slope = 2.087 units per year.

Mann-Kendall statistic = 31
critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

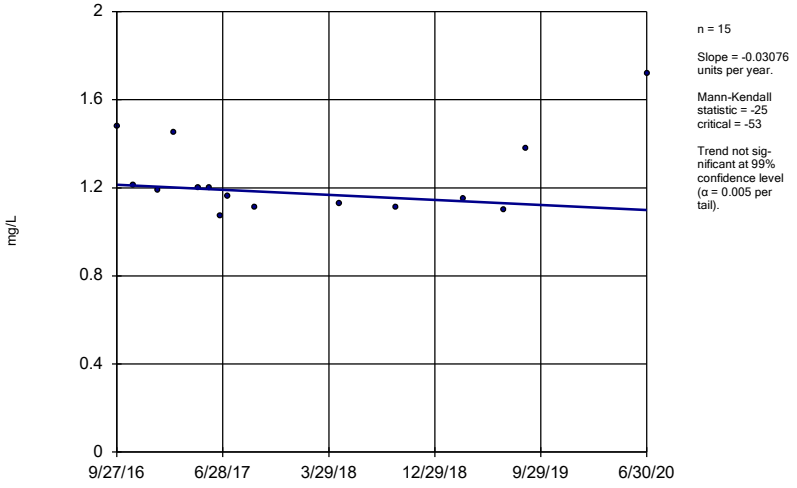
Constituent: Calcium Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 15

Slope = -0.03076 units per year.

Mann-Kendall statistic = -25
critical = -53

Trend not significant at 99% confidence level (α = 0.005 per tail).

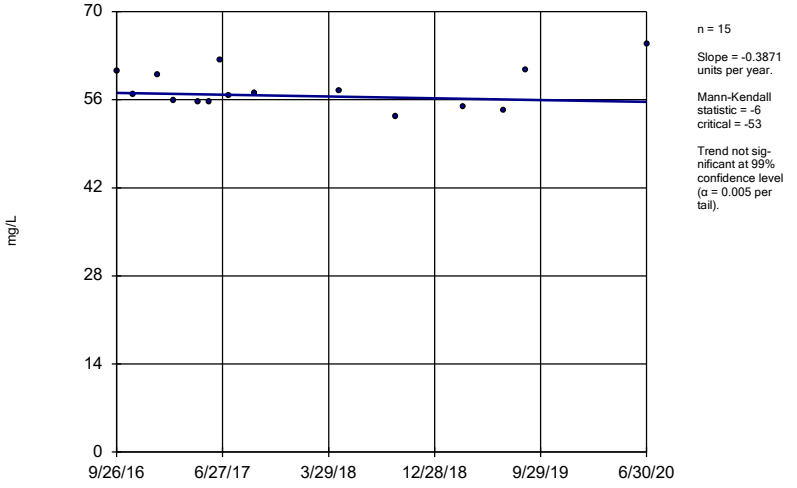
Constituent: Calcium Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 15

Slope = -0.3871 units per year.

Mann-Kendall statistic = -6
critical = -53

Trend not significant at 99% confidence level (α = 0.005 per tail).

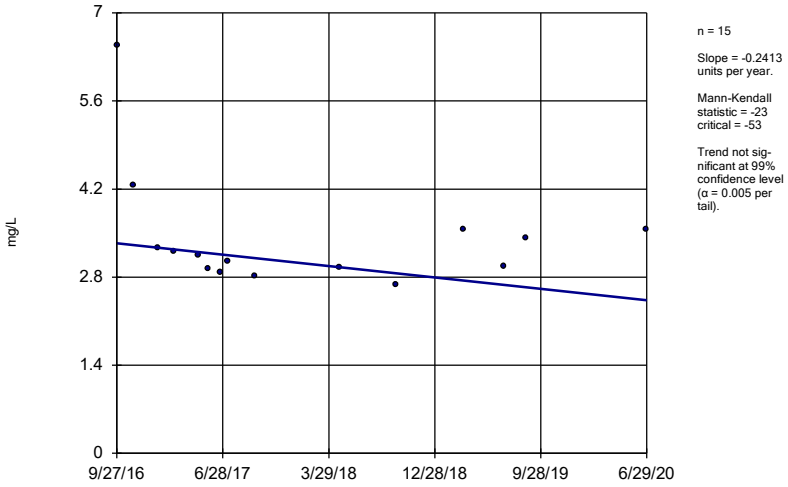
Constituent: Calcium Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1604 (bg)



n = 15

Slope = -0.2413 units per year.

Mann-Kendall statistic = -23
critical = -53

Trend not significant at 99% confidence level (α = 0.005 per tail).

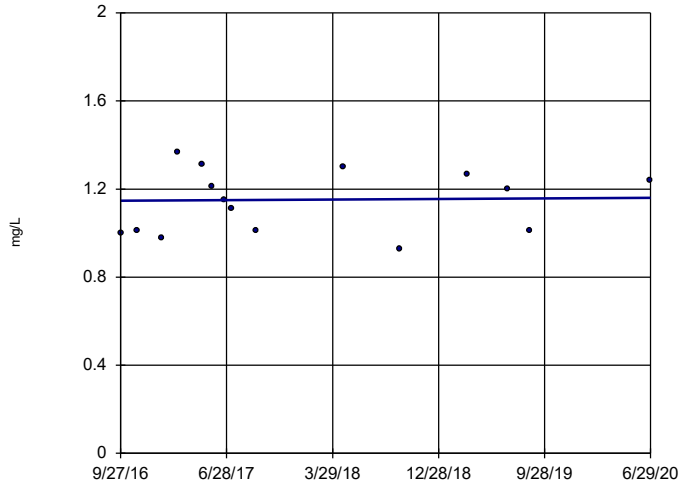
Constituent: Calcium Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1605 (bg)



n = 15

Slope = 0.003453 units per year.

Mann-Kendall statistic = 4
critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

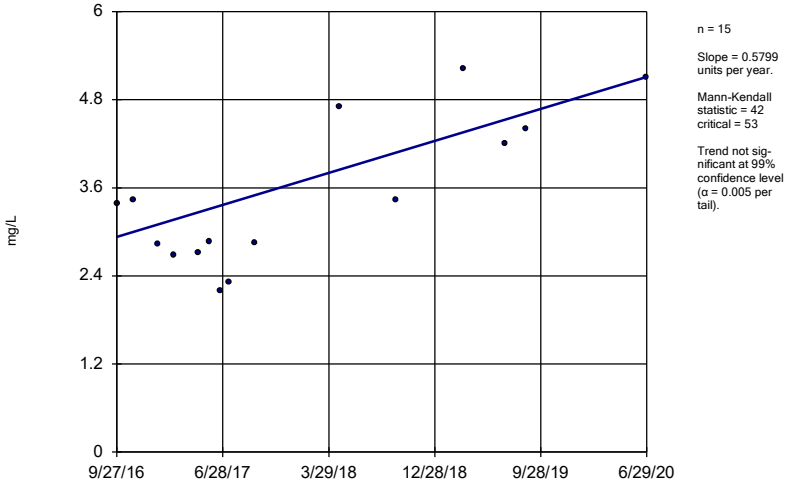
Constituent: Calcium Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 15

Slope = 0.5799 units per year.

Mann-Kendall statistic = 42
critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

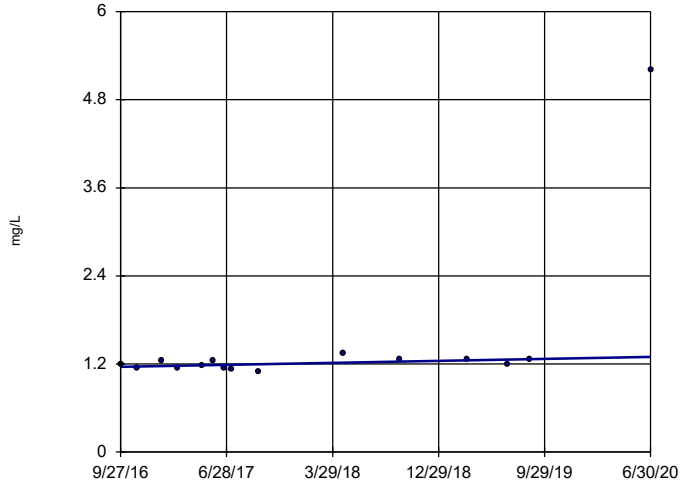
Constituent: Chloride Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 15

Slope = 0.03588 units per year.

Mann-Kendall statistic = 29
critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

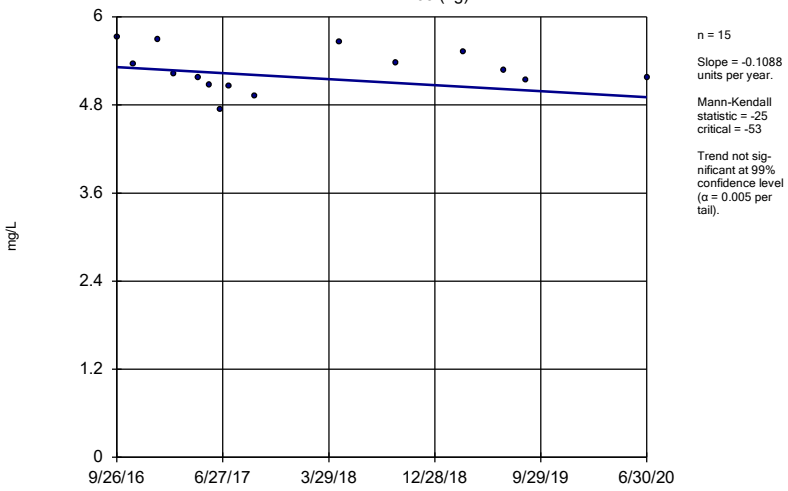
Constituent: Chloride Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 15

Slope = -0.1088 units per year.

Mann-Kendall statistic = -25
critical = -53

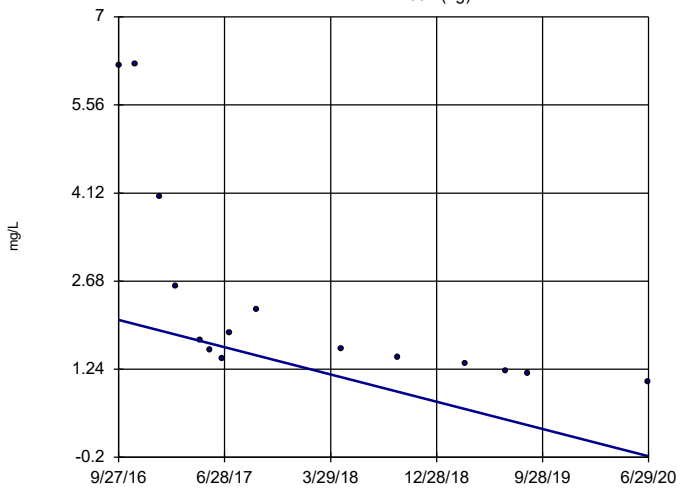
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1604 (bg)



n = 15

Slope = -0.5941 units per year.

Mann-Kendall statistic = -83
critical = -53

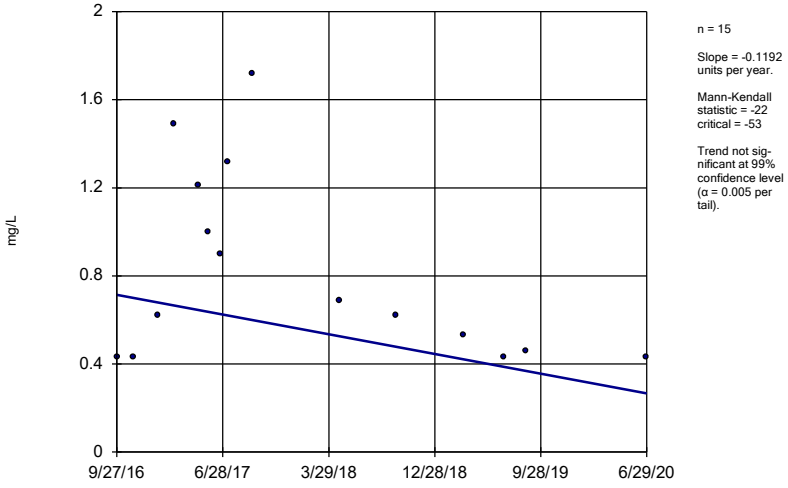
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1605 (bg)



n = 15

Slope = -0.1192 units per year.

Mann-Kendall statistic = -22
critical = -53

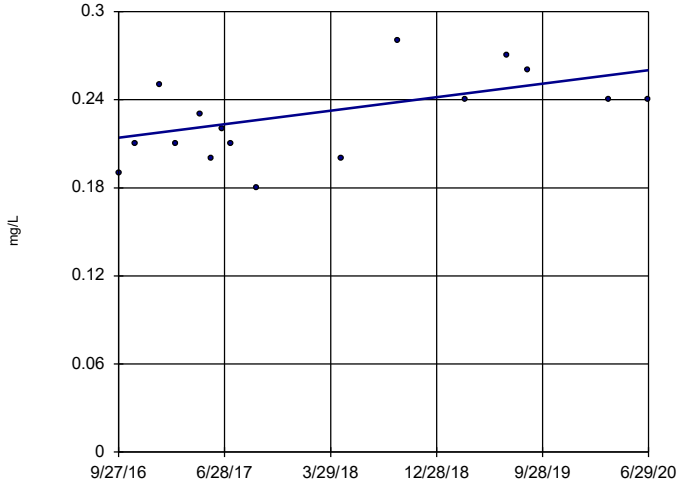
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 16

Slope = 0.0122 units per year.

Mann-Kendall statistic = 37
critical = 58

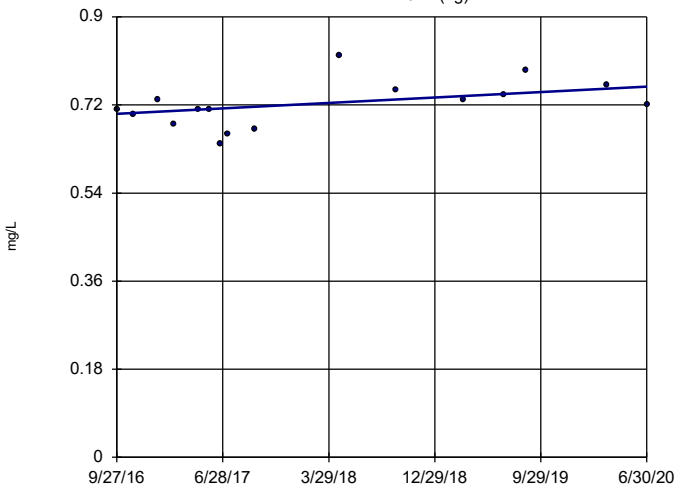
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 16

Slope = 0.01482 units per year.

Mann-Kendall statistic = 38
critical = 58

Trend not significant at 99% confidence level (α = 0.005 per tail).

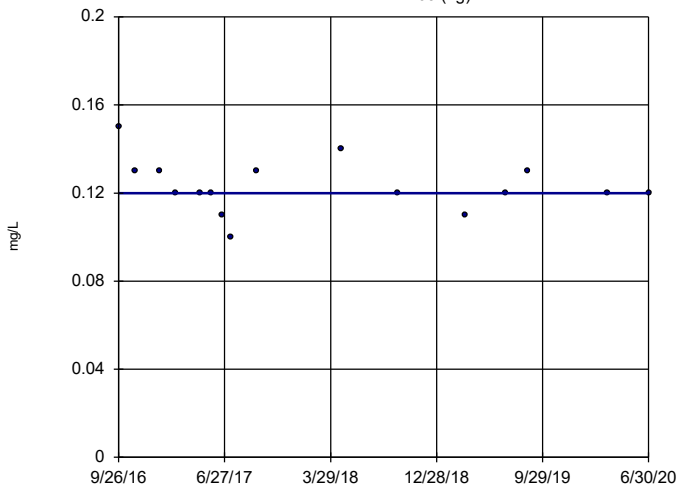
Constituent: Fluoride Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 16

Slope = 0 units per year.

Mann-Kendall statistic = -26
critical = -58

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride Analysis Run 1/26/2021 2:01 PM View: Intrawell

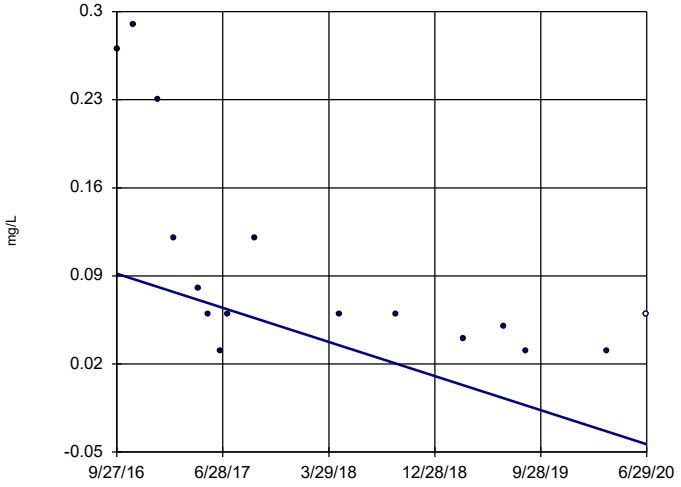
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-1604 (bg)



n = 16

Slope = -0.03608 units per year.

Mann-Kendall statistic = -74
critical = -58

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride Analysis Run 1/26/2021 2:01 PM View: Intrawell

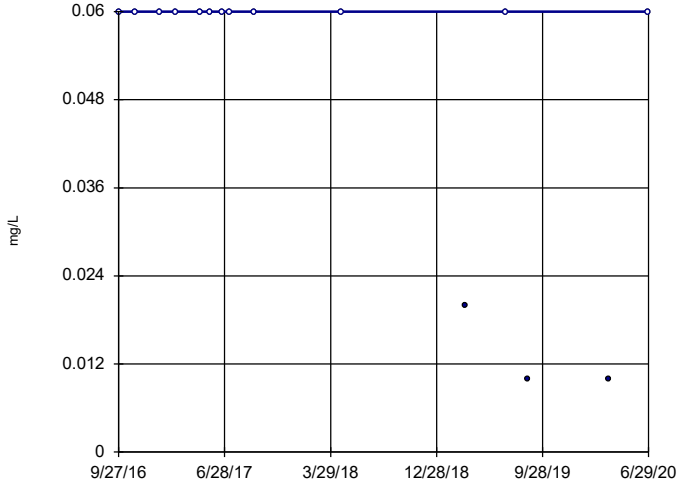
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-1605 (bg)



n = 15

Slope = 0 units per year.

Mann-Kendall statistic = -30
critical = -53

Trend not significant at 99% confidence level (α = 0.005 per tail).

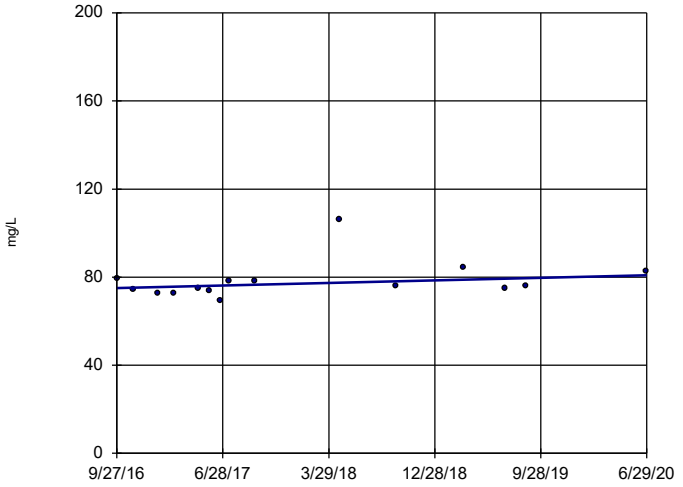
Constituent: Fluoride Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 15

Slope = 1.552 units per year.

Mann-Kendall statistic = 29 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

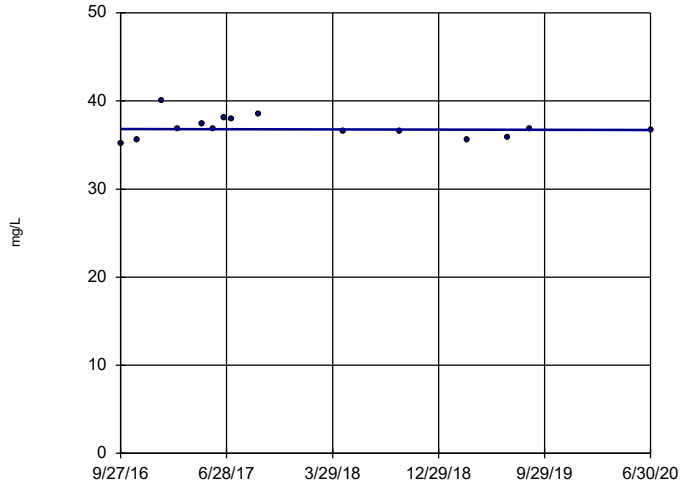
Constituent: Sulfate Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 15

Slope = -0.02982 units per year.

Mann-Kendall statistic = -6 critical = -53

Trend not significant at 99% confidence level (α = 0.005 per tail).

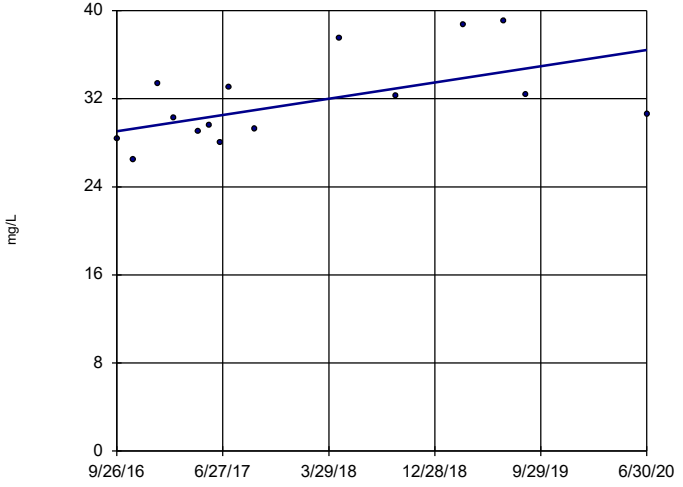
Constituent: Sulfate Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 15

Slope = 1.966 units per year.

Mann-Kendall statistic = 43 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

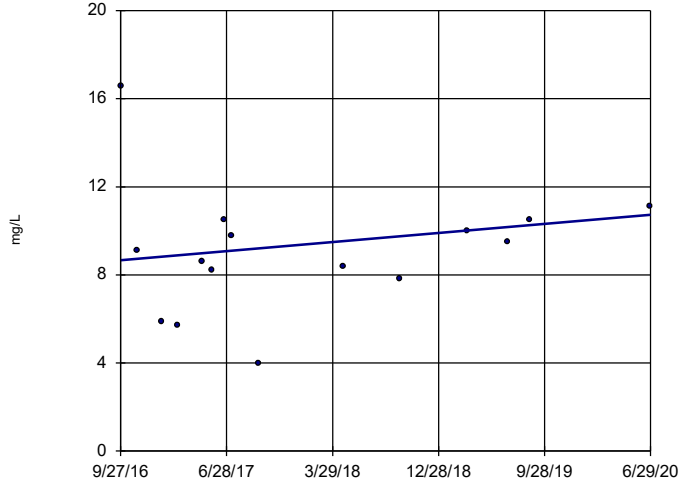
Constituent: Sulfate Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1604 (bg)



n = 15

Slope = 0.5493 units per year.

Mann-Kendall statistic = 20 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

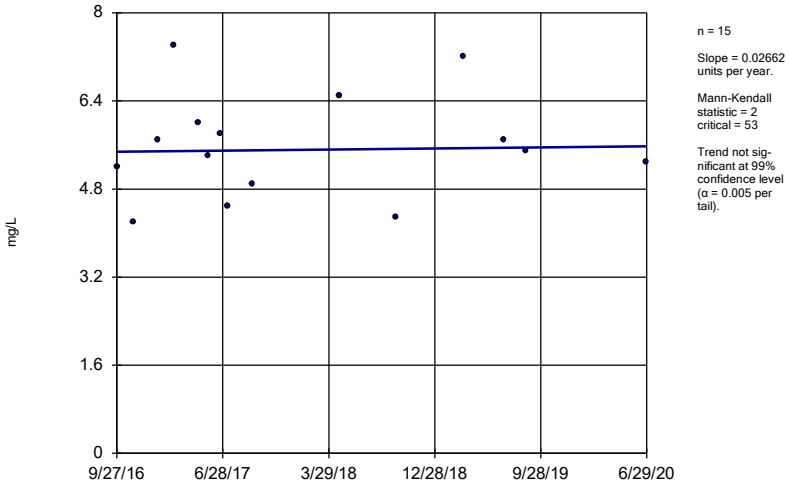
Constituent: Sulfate Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1605 (bg)



n = 15

Slope = 0.02662 units per year.

Mann-Kendall statistic = 2 critical = 53

Trend not significant at 99% confidence level (α = 0.005 per tail).

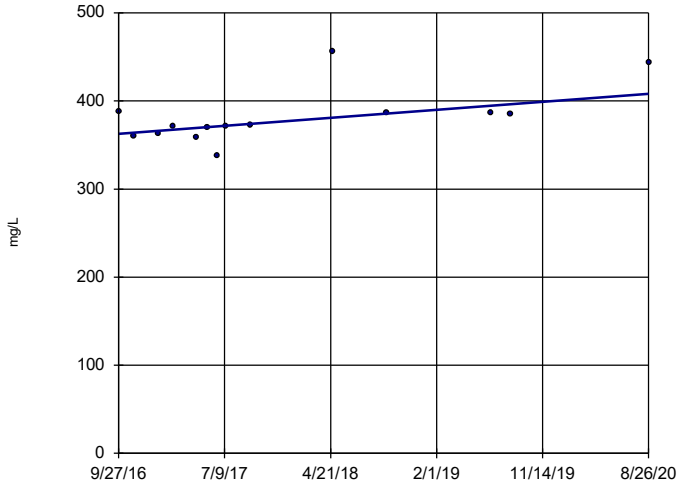
Constituent: Sulfate Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1011 (bg)



n = 14

Slope = 11.62 units per year.

Mann-Kendall statistic = 37 critical = 48

Trend not significant at 99% confidence level (α = 0.005 per tail).

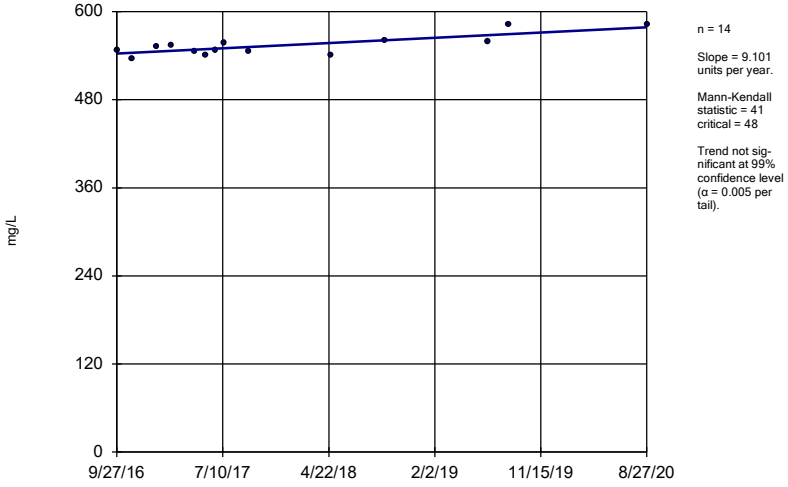
Constituent: Total Dissolved Solids Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1012 (bg)



n = 14

Slope = 9.101 units per year.

Mann-Kendall statistic = 41 critical = 48

Trend not significant at 99% confidence level (α = 0.005 per tail).

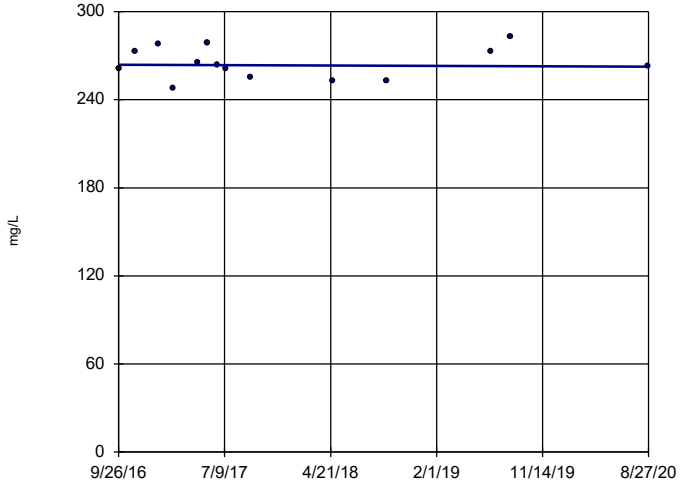
Constituent: Total Dissolved Solids Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1203 (bg)



n = 14

Slope = -0.3138 units per year.

Mann-Kendall statistic = -4 critical = -48

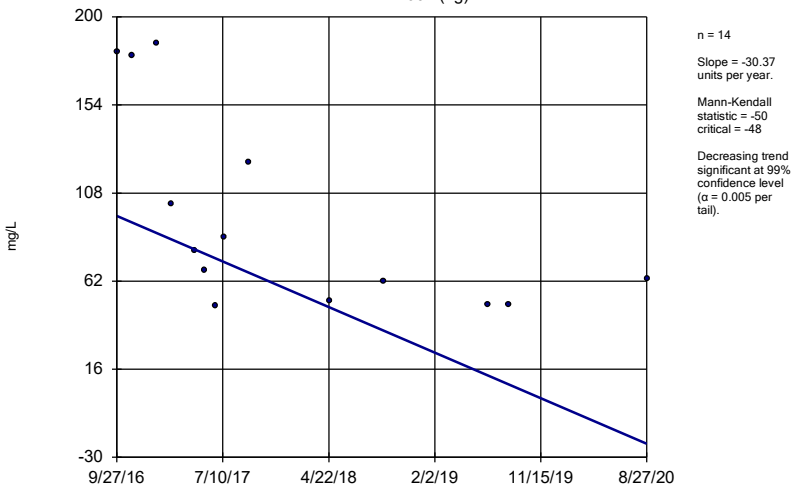
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids Analysis Run 1/26/2021 2:01 PM View: Intrawell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sen's Slope Estimator

MW-1604 (bg)



n = 14

Slope = -30.37 units per year.

Mann-Kendall statistic = -50
critical = -48

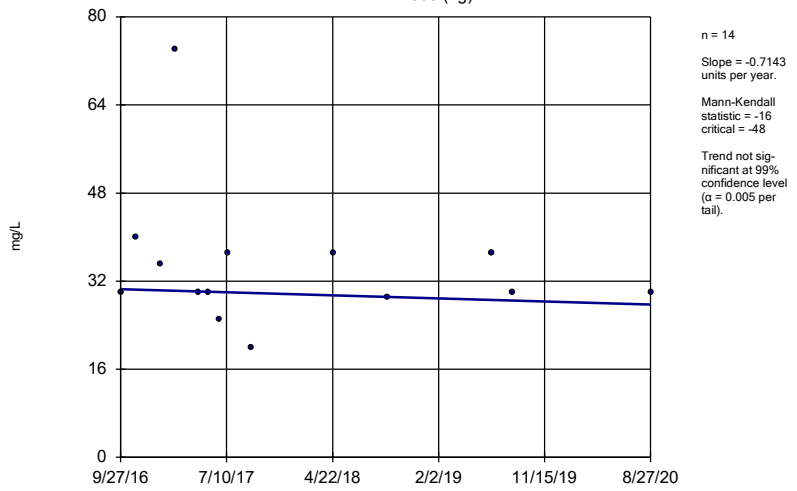
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27 . UG

Sen's Slope Estimator

MW-1605 (bg)



n = 14

Slope = -0.7143 units per year.

Mann-Kendall statistic = -16
critical = -48

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids Analysis Run 1/26/2021 2:01 PM View: Intrawell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE G.

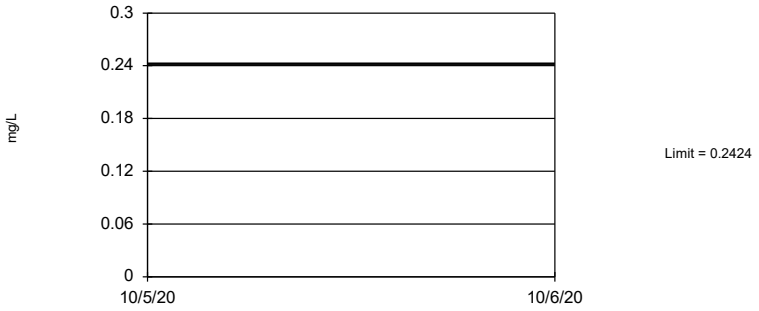
Interwell Prediction Limits - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:52 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron (mg/L)	n/a	0.2424	n/a	n/a	5 future	n/a	80	0.2923	0.11	10	None	sqrt(x)	0.001504	Param Inter 1 of 2
Calcium (mg/L)	n/a	105	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Chloride (mg/L)	n/a	6.22	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Fluoride (mg/L)	n/a	0.82	n/a	n/a	5 future	n/a	84	n/a	n/a	16.67	n/a	n/a	0.0002746	NP Inter (normality) 1 of 2
Sulfate (mg/L)	n/a	106	n/a	n/a	5 future	n/a	80	n/a	n/a	0	n/a	n/a	0.0002992	NP Inter (normality) 1 of 2
Total Dissolved Solids (mg/L)	n/a	583	n/a	n/a	5 future	n/a	75	n/a	n/a	0	n/a	n/a	0.0003436	NP Inter (normality) 1 of 2

Prediction Limit

Interwell Parametric

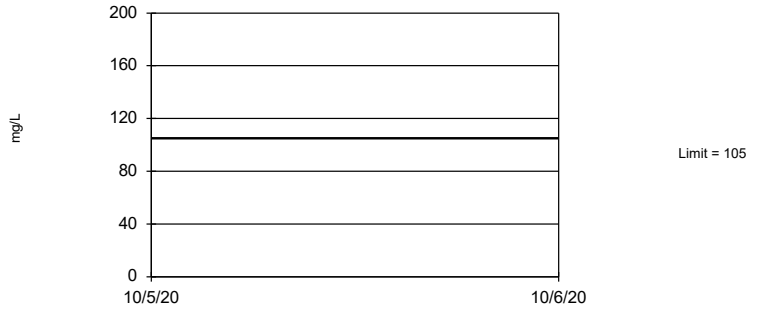


Background Data Summary (based on square root transformation): Mean=0.2923, Std. Dev.=0.11, n=80, 10% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9616, critical = 0.957. Kappa = 1.818 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Assumes 5 future values.

Constituent: Boron Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Interwell Non-parametric

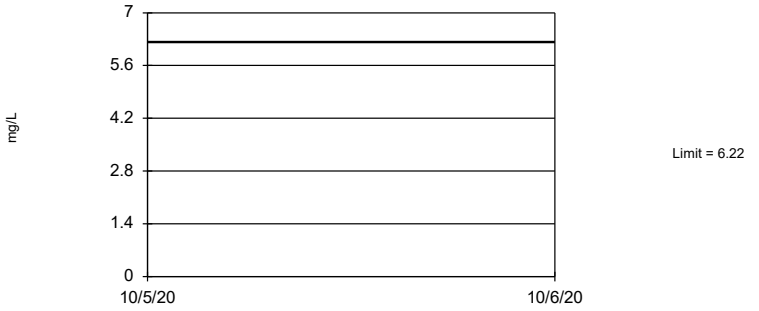


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 80 background values. Annual per-constituent alpha = 0.002988. Individual comparison alpha = 0.0002992 (1 of 2). Assumes 5 future values.

Constituent: Calcium Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Interwell Non-parametric

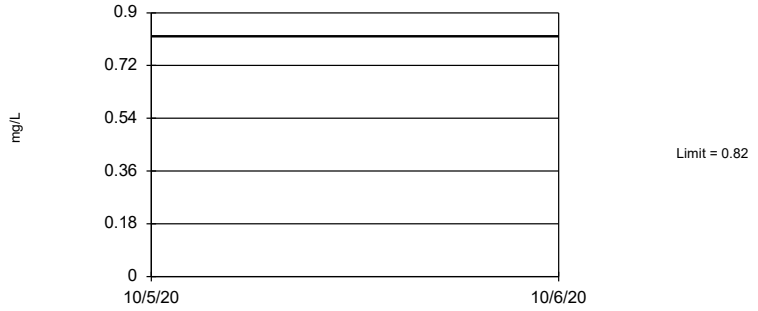


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 80 background values. Annual per-constituent alpha = 0.002988. Individual comparison alpha = 0.0002992 (1 of 2). Assumes 5 future values.

Constituent: Chloride Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Interwell Non-parametric

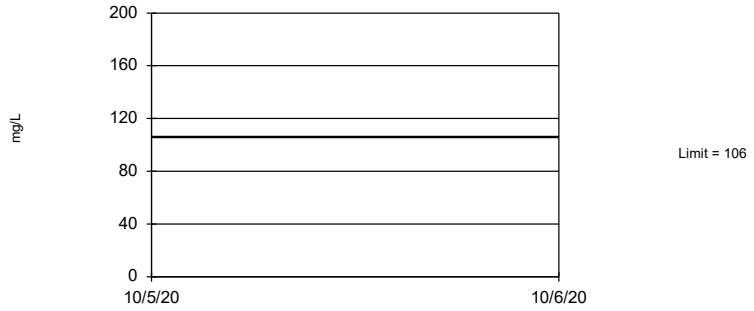


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 84 background values. 16.67% NDs. Annual per-constituent alpha = 0.002742. Individual comparison alpha = 0.0002746 (1 of 2). Assumes 5 future values.

Constituent: Fluoride Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 80 background values. Annual per-constituent alpha = 0.002988. Individual comparison alpha = 0.0002992 (1 of 2). Assumes 5 future values.

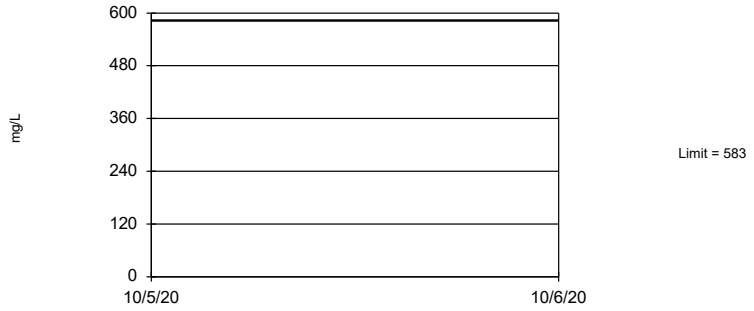
Constituent: Sulfate Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 75 background values. Annual per-constituent alpha = 0.003431. Individual comparison alpha = 0.0003436 (1 of 2). Assumes 5 future values.

Constituent: Total Dissolved Solids Analysis Run 1/26/2021 5:51 PM View: Appendix III - Interwell

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

FIGURE H.

Upper Tolerance Limit Summary Table

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:55 PM

Constituent	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	0.0012	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Arsenic (mg/L)	0.0289	n/a	n/a	80	n/a	n/a	2.5	n/a	n/a	0.01652	NP Inter(normality)
Barium (mg/L)	0.1118	n/a	n/a	80	0.2309	0.05269	0	None	sqrt(x)	0.05	Inter
Beryllium (mg/L)	0.0001465	n/a	n/a	80	0.00005513	0.00004654	20	Kaplan-Meier	No	0.05	Inter
Cadmium (mg/L)	0.00014	n/a	n/a	80	n/a	n/a	30	n/a	n/a	0.01652	NP Inter(normality)
Chromium (mg/L)	0.00291	n/a	n/a	79	n/a	n/a	0	n/a	n/a	0.01738	NP Inter(normality)
Cobalt (mg/L)	0.005433	n/a	n/a	80	-7.442	1.135	0	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	4.6	n/a	n/a	75	1.168	0.4951	0	None	sqrt(x)	0.05	Inter
Fluoride (mg/L)	0.82	n/a	n/a	84	n/a	n/a	16.67	n/a	n/a	0.01345	NP Inter(normality)
Lead (mg/L)	0.001584	n/a	n/a	80	-8.741	1.169	6.25	None	ln(x)	0.05	Inter
Lithium (mg/L)	0.01985	n/a	n/a	80	0.009121	0.005467	13.75	None	No	0.05	Inter
Mercury (mg/L)	0.000013	n/a	n/a	80	n/a	n/a	85	n/a	n/a	0.01652	NP Inter(NDs)
Molybdenum (mg/L)	0.00348	n/a	n/a	78	n/a	n/a	23.08	n/a	n/a	0.0183	NP Inter(normality)
Selenium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Thallium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	42.5	n/a	n/a	0.01652	NP Inter(normality)

FIGURE I.

BIG SANDY FAP GWPS				
Constituent Name	**MCL**	**CCR-Rule**	**Background**	**GWPS**
Antimony, Total (mg/L)	0.006		0.0012	0.006
Arsenic, Total (mg/L)	0.01		0.029	0.029
Barium, Total (mg/L)	2		0.11	2
Beryllium, Total (mg/L)	0.004		0.00015	0.004
Cadmium, Total (mg/L)	0.005		0.00014	0.005
Chromium, Total (mg/L)	0.1		0.0029	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0054	0.006
Combined Radium, Total (pCi/L)	5		4.6	5
Fluoride, Total (mg/L)	4		0.82	4
Lead, Total (mg/L)	0.015		0.0016	0.015
Lithium, Total (mg/L)	n/a	0.04	0.02	0.04
Mercury, Total (mg/L)	0.002		0.000013	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0035	0.1
Selenium, Total (mg/L)	0.05		0.0005	0.05
Thallium, Total (mg/L)	0.002		0.0005	0.002

**Grey cell indicates Background is higher than MCL or CCR-Rule Specified Level*

**GWPS = Groundwater Protection Standard*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

FIGURE J.

Confidence Intervals - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:17 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium (mg/L)	**MW-1603**	**0.0218**	**0.0167**	**0.004**	**Yes**	**16**	**0.01906**	**0.002719**	**0**	**None**	**No**	**0.01**	**NP (normality)**
Cobalt (mg/L)	**MW-1603**	**0.09515**	**0.08702**	**0.006**	**Yes**	**16**	**0.09096**	**0.006567**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium (mg/L)	**MW-1603**	**0.2325**	**0.1939**	**0.04**	**Yes**	**16**	**0.2132**	**0.0297**	**0**	**None**	**No**	**0.01**	**Param.**

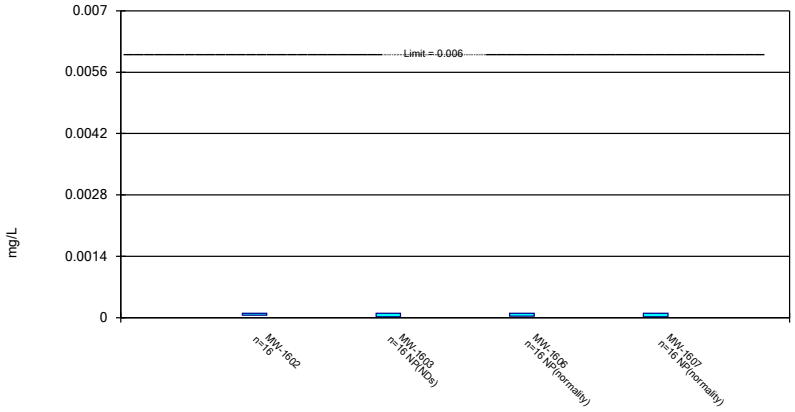
Confidence Intervals - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 6:17 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	MW-1602	0.00009791	0.00005334	0.006	No	16	0.00007563	0.00003425	0	None	No	0.01	Param.
Antimony (mg/L)	MW-1603	0.0001	0.00002	0.006	No	16	0.00008	0.00003633	75	None	No	0.01	NP (NDs)
Antimony (mg/L)	MW-1606	0.0001	0.00003	0.006	No	16	0.00006687	0.00003683	50	None	No	0.01	NP (normality)
Antimony (mg/L)	MW-1607	0.0001	0.00002	0.006	No	16	0.00005875	0.00006985	12.5	None	No	0.01	NP (normality)
Arsenic (mg/L)	MW-1602	0.001425	0.0005439	0.029	No	16	0.001167	0.001024	0	None	ln(x)	0.01	Param.
Arsenic (mg/L)	MW-1603	0.001398	0.001134	0.029	No	16	0.001266	0.000203	0	None	No	0.01	Param.
Arsenic (mg/L)	MW-1606	0.001142	0.0009421	0.029	No	16	0.001042	0.0001533	0	None	No	0.01	Param.
Arsenic (mg/L)	MW-1607	0.0236	0.00767	0.029	No	16	0.01697	0.01482	0	None	No	0.01	NP (normality)
Barium (mg/L)	MW-1602	0.05611	0.05146	2	No	16	0.05379	0.003574	0	None	No	0.01	Param.
Barium (mg/L)	MW-1603	0.01302	0.01102	2	No	16	0.01202	0.001534	0	None	No	0.01	Param.
Barium (mg/L)	MW-1606	0.9293	0.7959	2	No	16	0.8626	0.1025	0	None	No	0.01	Param.
Barium (mg/L)	MW-1607	0.0396	0.03015	2	No	16	0.03488	0.007265	0	None	No	0.01	Param.
Beryllium (mg/L)	**MW-1603**	**0.0218**	**0.0167**	**0.004**	**Yes**	**16**	**0.01906**	**0.002719**	**0**	**None**	**No**	**0.01**	**NP (normality)**
Beryllium (mg/L)	MW-1606	0.0001	0.00001	0.004	No	16	0.00006094	0.00004112	37.5	None	No	0.01	NP (normality)
Beryllium (mg/L)	MW-1607	0.0001	0.00001	0.004	No	16	0.00005275	0.00004488	37.5	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1602	0.00005	0.000009	0.005	No	16	0.00002956	0.00002114	50	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1603	0.0008561	0.0007577	0.005	No	16	0.0008069	0.00007561	0	None	No	0.01	Param.
Cadmium (mg/L)	MW-1606	0.00006	0.00001	0.005	No	16	0.00004287	0.00001716	75	None	No	0.01	NP (NDs)
Cadmium (mg/L)	MW-1607	0.00005	0.000008	0.005	No	16	0.00004194	0.00001734	75	None	No	0.01	NP (NDs)
Chromium (mg/L)	MW-1602	0.0008272	0.0005123	0.1	No	16	0.0006698	0.000242	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1603	0.0008891	0.0006579	0.1	No	16	0.0007735	0.0001776	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1606	0.001008	0.000283	0.1	No	16	0.0007134	0.0006602	0	None	sqrt(x)	0.01	Param.
Chromium (mg/L)	MW-1607	0.0005414	0.0003141	0.1	No	16	0.0004278	0.0001746	0	None	No	0.01	Param.
Cobalt (mg/L)	MW-1602	0.0001386	0.00002638	0.006	No	16	0.0001471	0.0002367	0	None	ln(x)	0.01	Param.
Cobalt (mg/L)	**MW-1603**	**0.09515**	**0.08702**	**0.006**	**Yes**	**16**	**0.09096**	**0.006567**	**0**	**None**	**x^2**	**0.01**	**Param.**
Cobalt (mg/L)	MW-1606	0.000507	0.0001169	0.006	No	16	0.0003744	0.0003887	0	None	x^(1/3)	0.01	Param.
Cobalt (mg/L)	MW-1607	0.001434	0.00127	0.006	No	16	0.001352	0.0001257	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602	1.404	0.7431	5	No	16	1.074	0.5081	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603	7.168	4.931	5	No	16	6.113	1.737	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606	3.339	2.67	5	No	16	3.005	0.5142	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607	2.039	0.6193	5	No	16	1.524	1.592	0	None	x^(1/3)	0.01	Param.
Fluoride (mg/L)	MW-1602	0.1383	0.1022	4	No	17	0.1224	0.03173	0	None	ln(x)	0.01	Param.
Fluoride (mg/L)	MW-1603	1.06	0.8426	4	No	18	0.9511	0.1794	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1606	0.2176	0.1848	4	No	17	0.2012	0.02619	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1607	0.07051	0.05654	4	No	17	0.06353	0.01115	0	None	No	0.01	Param.
Lead (mg/L)	MW-1602	0.00009454	0.00003666	0.015	No	16	0.00006969	0.00005431	6.25	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1603	0.006415	0.00436	0.015	No	16	0.005448	0.001689	0	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1606	0.00102	0.0001	0.015	No	16	0.0004163	0.0005355	12.5	None	No	0.01	NP (normality)
Lead (mg/L)	MW-1607	0.0002108	0.00007261	0.015	No	16	0.0001787	0.0001971	6.25	None	ln(x)	0.01	Param.
Lithium (mg/L)	MW-1602	0.01086	0.005458	0.04	No	16	0.008436	0.00455	6.25	None	sqrt(x)	0.01	Param.
Lithium (mg/L)	**MW-1603**	**0.2325**	**0.1939**	**0.04**	**Yes**	**16**	**0.2132**	**0.0297**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium (mg/L)	MW-1606	0.009937	0.003882	0.04	No	16	0.007334	0.004845	12.5	None	sqrt(x)	0.01	Param.
Lithium (mg/L)	MW-1607	0.007312	0.001264	0.04	No	16	0.005046	0.005143	12.5	None	sqrt(x)	0.01	Param.
Mercury (mg/L)	MW-1602	0.000005	0.000002	0.002	No	16	0.000003937	0.00000134	56.25	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1603	0.000005	0.000002	0.002	No	16	0.000004812	7.5e-7	93.75	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1606	0.000005	0.000003	0.002	No	16	0.0000045	0.00000109	81.25	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1607	0.000005	0.000004	0.002	No	16	0.000004937	2.5e-7	93.75	None	No	0.01	NP (NDs)
Molybdenum (mg/L)	MW-1602	0.002305	0.001317	0.1	No	16	0.001811	0.0007593	0	None	No	0.01	Param.
Molybdenum (mg/L)	MW-1603	0.001	0.00006	0.1	No	16	0.0004594	0.0004383	37.5	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1606	0.00091	0.00051	0.1	No	16	0.001179	0.001775	0	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1607	0.0009	0.00052	0.1	No	16	0.00117	0.0021	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1602	0.001793	0.00102	0.05	No	16	0.001406	0.0005938	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1603	0.006228	0.004622	0.05	No	16	0.005425	0.001234	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1606	0.0002	0.00006	0.05	No	16	0.0001075	0.0000747	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1607	0.0002	0.00009	0.05	No	16	0.000145	0.0001529	0	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1602	0.0005	0.00001	0.002	No	16	0.0001994	0.0002406	37.5	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1603	0.001609	0.001299	0.002	No	16	0.001454	0.0002382	0	None	No	0.01	Param.
Thallium (mg/L)	MW-1606	0.0005	0.00002	0.002	No	16	0.0002969	0.0002389	56.25	None	No	0.01	NP (NDs)
Thallium (mg/L)	MW-1607	0.0005	0.00002	0.002	No	16	0.0001865	0.0002201	31.25	None	No	0.01	NP (normality)

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Antimony Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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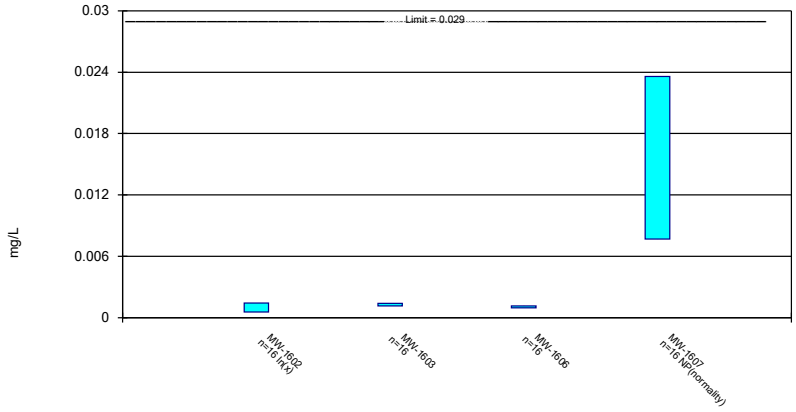
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

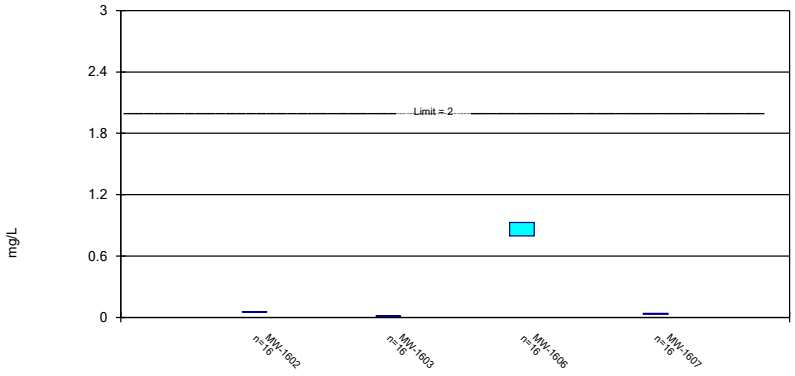


Constituent: Arsenic Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

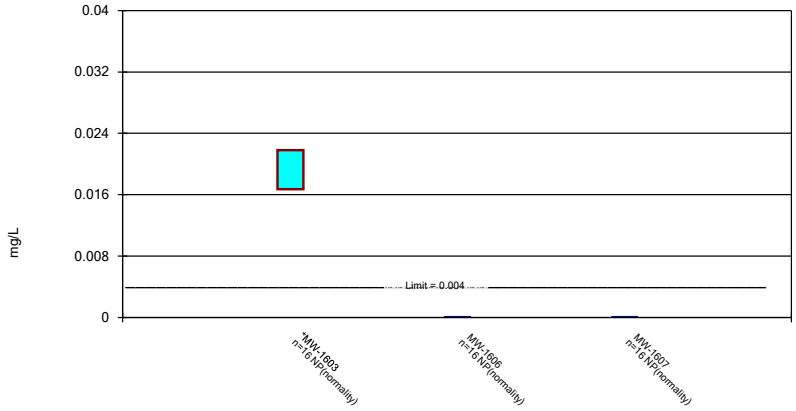


Constituent: Barium Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

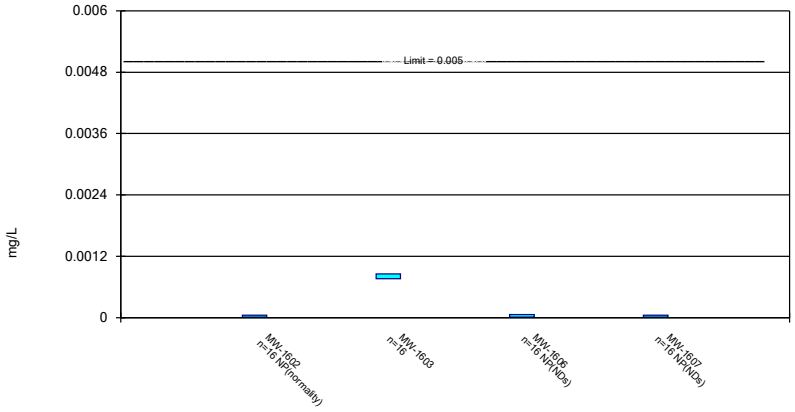
Compliance limit is exceeded.* Per-well alpha = 0.01.



Constituent: Beryllium Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

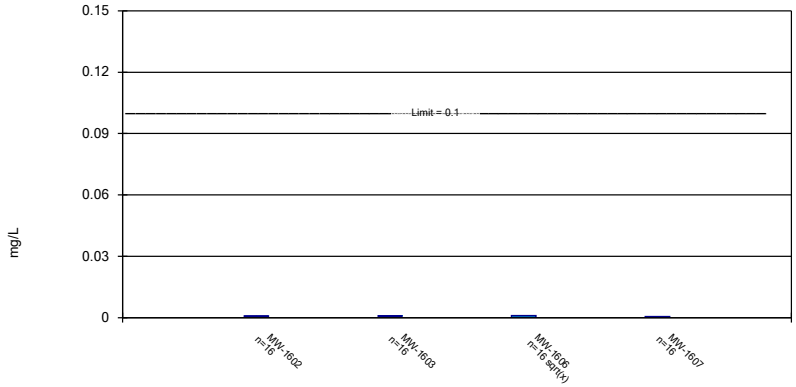
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cadmium Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric Confidence Interval

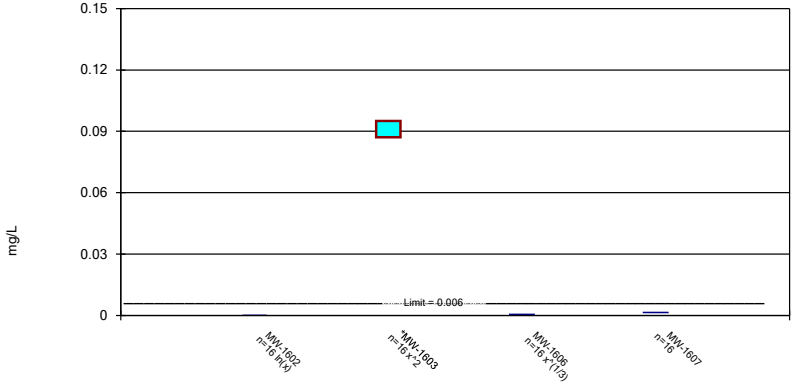
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric Confidence Interval

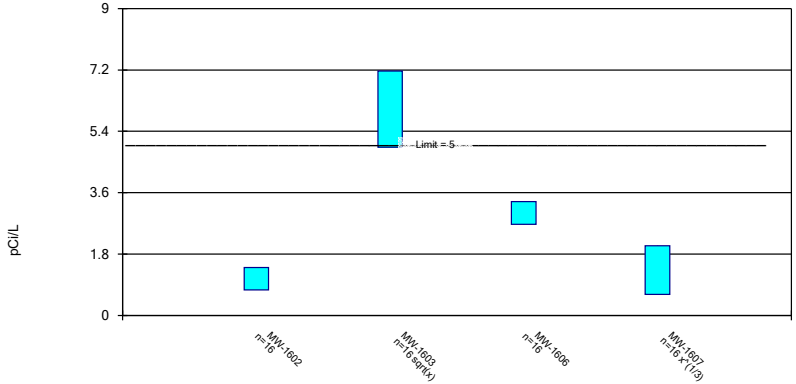
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric Confidence Interval

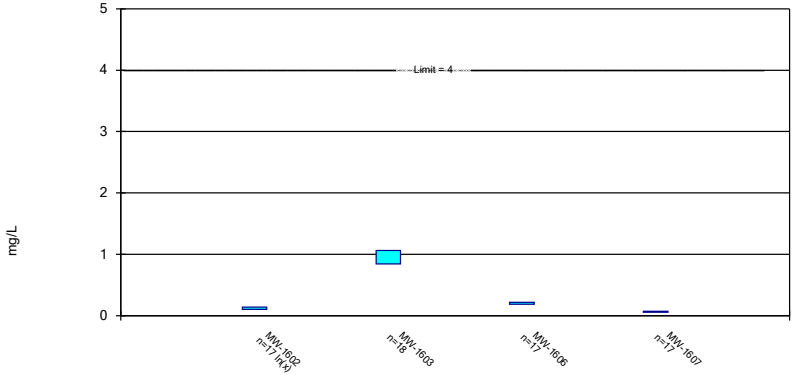
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric Confidence Interval

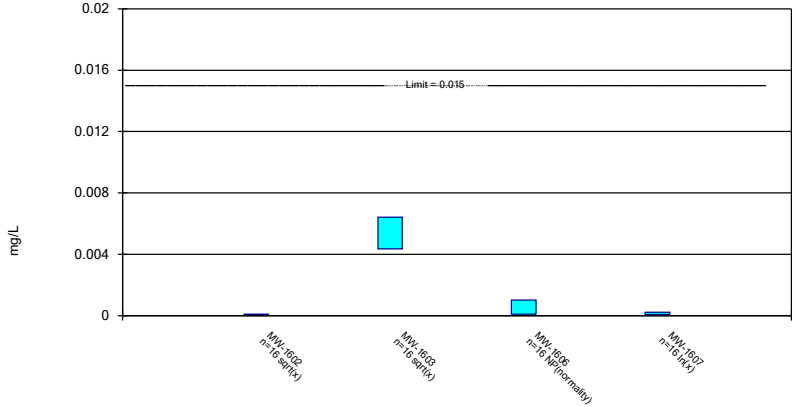
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

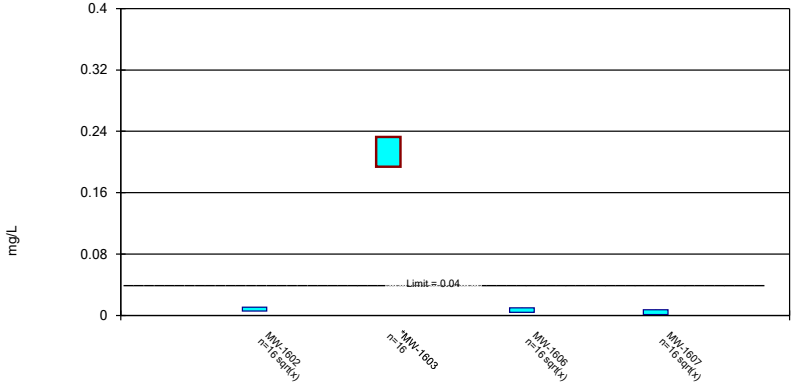
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lead Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric Confidence Interval

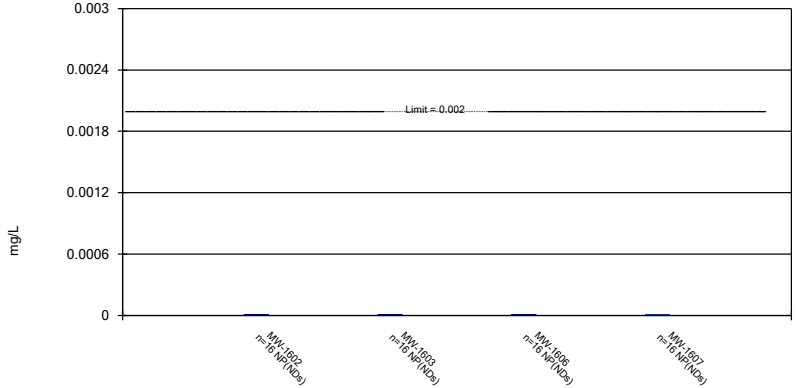
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Non-Parametric Confidence Interval

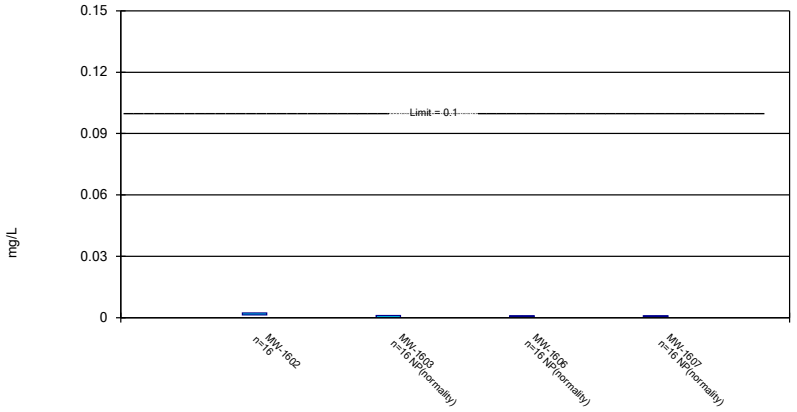
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Mercury Analysis Run 1/26/2021 6:15 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

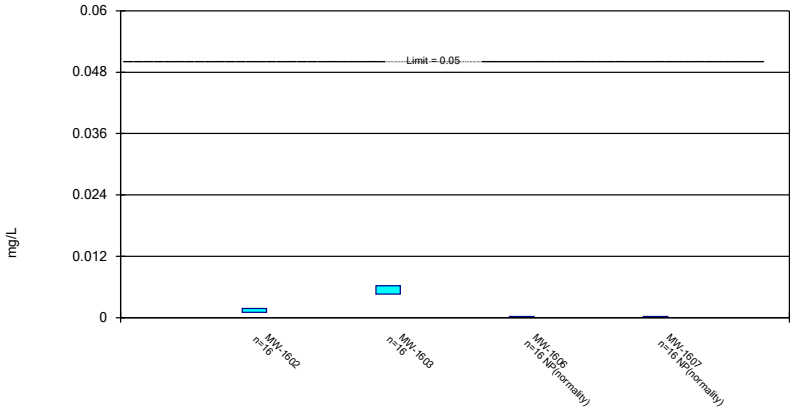


Constituent: Molybdenum Analysis Run 1/26/2021 6:16 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

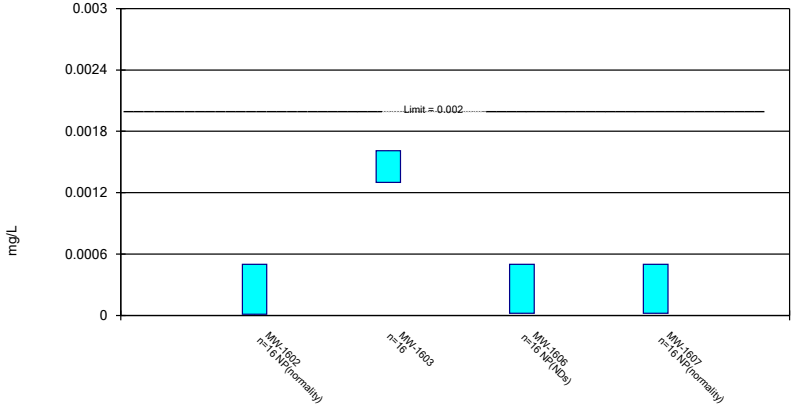


Constituent: Selenium Analysis Run 1/26/2021 6:16 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.27b Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium Analysis Run 1/26/2021 6:16 PM View: Appendix IV
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

STATISTICAL ANALYSIS SUMMARY
FLY ASH POND
Big Sandy Plant
Louisa, Kentucky

Submitted to

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Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
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October 7, 2021
CHA8500

TABLE OF CONTENTS

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LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
FAP	Fly Ash Pond
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Fly Ash Pond (FAP), an existing CCR unit at the Big Sandy Power Plant located in Louisa, Kentucky.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, fluoride, total dissolved solids (TDS), and sulfate at the FAP. An alternative source was not identified at the time, so the FAP initiated assessment monitoring in April 2018. Groundwater protection standards (GWPS) were set in accordance with 40 CFR 257.95(d)(2) and a statistical evaluation of the assessment monitoring data was conducted. During the most recent assessment monitoring event, statistically significant levels (SSLs) were observed for beryllium, cobalt, combined radium, and lithium (Geosyntec, 2021). An alternative source demonstration (ASD) was successfully completed (EHS, 2021); thus, the unit remained in assessment monitoring. Two assessment monitoring events were conducted at the FAP in March 2021 and June 2021 in accordance with 40 CFR 257.95. The results of these assessment sampling events are documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact data usability.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether SSLs of Appendix IV parameters were present above the GWPS. SSLs were identified for beryllium, cobalt, and lithium. Thus, either the unit will move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

FLY ASH POND EVALUATION

2.1 Data Validation & QA/QC

In accordance with the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95b (March 2021) and 257.95(d)(1) (June 2021). Samples from March 2021 were analyzed for Appendix IV parameters only, whereas samples from the June 2021 sample event were analyzed for all Appendix IV and Appendix III parameters. A summary of data collected during this assessment monitoring event is presented in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.27b statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the FAP were conducted in accordance with the October 2020 *Statistical Analysis Plan* (Geosyntec, 2020). Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in March and June 2021 were screened for potential outliers. No outliers were identified in either set of data (Attachment B).

2.2.1 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B. Calculated confidence limits were compared to the GWPSs provided in Table 2. The GWPSs were established during a previous

statistical analysis as either the greater value of the background concentration or the maximum contaminant level (MCL) and risk-based level specified in 40 CFR 257.95(h)(2) (Geosynte, 2021).

The following SSLs were identified at the Big Sandy FAP:

- The LCL for beryllium exceeded the GWPS of 0.00400 mg/L at MW-1603 (0.01658 mg/L).
- The LCL for cobalt exceeded the GWPS of 0.00600 mg/L at MW-1603 (0.08454 mg/L).
- The LCL for lithium exceeded the GWPS of 0.0400 mg/L at MW-1603 (0.1805 mg/L).

As a result, the Big Sandy FAP will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

2.2.2 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results was also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the June 2021 assessment monitoring event from each compliance well were compared to previously established prediction limits to assess whether the results are above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.242 mg/L at MW-1606 (1.99 mg/L).
- Chloride concentrations exceeded the interwell UPL of 6.22 mg/L at MW-1601 (6.58 mg/L), MW-1602 (17.1 mg/L), and MW-1606 (31.8 mg/L).
- Sulfate concentrations exceeded the interwell UPL of 106 mg/L at MW-1602 (165 mg/L) and MW-1603 (618 mg/L).
- TDS concentrations exceeded the interwell UPL of 583 mg/L at MW-1603 (880 mg/L).

While the prediction limits were calculated for a one-of-two retesting procedure, SSIs were conservatively assumed if the June 2021 sample was above the UPL or below the LPL. Based on these results, concentrations of Appendix III constituents appear to be above background levels at compliance wells.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the

March 2021 and June 2021 data. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for beryllium, cobalt, and lithium at MW-1603. Appendix III parameters were compared to established prediction limits with exceedances identified for boron, chloride, sulfate, and TDS at select downgradient wells.

Based on this evaluation, the Big Sandy FAP CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

EHS Support. 2021. Alternative Source Demonstration Addendum Report for the March and June 2020 Monitoring Data. Big Sandy Fly Ash Pond. January 2021.

Geosyntec. 2020. Statistical Analysis Plan. October 2020.

Geosyntec Consultants (Geosyntec). 2021. Statistical Analysis Summary – Fly Ash Pond, Big Sandy Plant, Louisa, Kentucky. February 3, 2021.

TABLES

Table 1 - Groundwater Data Summary
Big Sandy Plant - Fly Ash Pond

Geosyntec Consultants

Parameter	Unit	MW-1011		MW-1012		MW-1203		MW-1601		MW-1602	
		3/9/2021	6/9/2021	3/10/2021	6/9/2021	3/9/2021	6/9/2021	3/9/2021	6/9/2021	3/9/2021	6/9/2021
Antimony	µg/L	0.14	0.17	0.76	0.74	0.1 U	0.03 J	0.61	0.61	0.06 J	0.06 J
Arsenic	µg/L	7.71	4.84	21.2	18.6	0.39	0.22	0.76	0.41	1.72	0.92
Barium	µg/L	50.0	46.4	30.5	30.6	93.9	89.5	44.7	41.6	56.9	53.2
Beryllium	µg/L	0.1 U	0.05 U	0.03 J	0.024 J	0.05 J	0.037 J	0.02 J	0.05 U	0.1 U	0.05 U
Boron	mg/L	-	0.092	-	0.174	-	0.096	-	0.109	-	0.050
Cadmium	µg/L	0.05 U	0.012 J	0.01 J	0.014 J	0.05 U	0.02 U	0.02 J	0.022	0.006 J	0.02 U
Calcium	mg/L	-	81.2	-	1.2	-	57.8	-	62.5	-	83.9
Chloride	mg/L	-	5.02	-	1.32	-	5.32	-	6.58	-	17.1
Chromium	µg/L	0.481	0.35	0.489	0.44	0.390	0.11 J	0.768	0.33	1.26	0.62
Cobalt	µg/L	0.438	0.452	0.159	0.117	0.849	0.603	0.329	0.195	0.075	0.014 J
Combined Radium	pCi/L	2.81	4.09	0.815	0.58	1.287	1.98	1.227	0.87	1.018	2.31
Fluoride	mg/L	0.29	0.28	0.85	0.80	0.15	0.15	0.18	0.18	0.11	0.11
Lead	µg/L	0.06 J	0.10 J	0.629	0.47	0.2 J	0.06 J	0.2 J	0.06 J	0.1 J	0.2 U
Lithium	mg/L	0.00977	0.00852	0.00552	0.00540	0.0120	0.0109	0.0206	0.0229	0.00787	0.00629
Mercury	µg/L	0.005 U	0.005 U	0.002 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Molybdenum	µg/L	0.7 J	0.8	2.87	1.6	2 U	0.5 U	10.0	12.1	1 J	1.2
Selenium	µg/L	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	1.0	0.54	2.0	2.57
Sulfate	mg/L	-	82.0	-	35.4	-	29.4	-	98.0	-	165
Thallium	µg/L	0.06 J	0.06 J	0.5 U	0.2 U	0.5 U	0.2 U	0.5 U	0.2 U	0.5 U	0.2 U
Total Dissolved Solids	mg/L	-	380	-	550	-	260	-	340	-	500
pH	SU	6.9	6.8	9.0	9.3	6.7	6.6	6.8	6.8	7.4	7.5

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit.
-: Not sampled

Table 1 - Groundwater Data Summary
Big Sandy Plant - Fly Ash Pond

Parameter	Unit	MW-1603		MW-1604		MW-1605		MW-1606		MW-1607	
		3/9/2021	6/9/2021	3/10/2021	6/8/2021	3/10/2021	6/8/2021	3/10/2021	6/8/2021	3/10/2021	6/8/2021
Antimony	µg/L	0.1 U	0.04 J	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J
Arsenic	µg/L	0.84	0.69	0.07 J	0.07 J	0.06 J	0.1 U	1.04	0.96	12.3	14.3
Barium	µg/L	10.1	13.1	75.3	82.3	56.7	34.8	739	768	54.7	24.3
Beryllium	µg/L	14.0	13.3	0.129	0.167	0.160	0.102	0.009 J	0.05 U	0.01 J	0.009 J
Boron	mg/L	-	0.036 J	-	0.018 J	-	0.009 J	-	1.99	-	0.151
Cadmium	µg/L	0.62	0.709	0.09	0.086	0.11	0.067	0.05 U	0.02 U	0.009 J	0.02 U
Calcium	mg/L	-	79.0	-	3.4	-	1.2	-	74.1	-	81.2
Chloride	mg/L	-	4.16	-	1.15	-	0.59	-	31.8	-	3.56
Chromium	µg/L	0.659	0.51	0.850	0.77	2.71	2.27	0.433	0.59	0.276	0.23
Cobalt	µg/L	71.4	76.8	0.148	0.257	0.398	0.236	0.100	0.066	1.75	0.946
Combined Radium	pCi/L	3.73	7.18	0.2279	1.07	2.826	1.12	1.92	4.12	0.2646	0.88
Fluoride	mg/L	0.82	0.76	0.03 J	0.03 J	0.02 J	0.01 J	0.26	0.24	0.08	0.09
Lead	µg/L	3.37	3.39	0.2 U	0.06 J	0.2 J	0.08 J	0.08 J	0.08 J	0.09 J	0.05 J
Lithium	mg/L	0.125	0.135	0.000944	0.00095	0.000806	0.00063	0.00306	0.00317	0.000310	0.00012 J
Mercury	µg/L	0.002 J	0.002 J	0.005 U	0.005 U	0.002 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Molybdenum	µg/L	2 U	0.5 U	2 U	0.5 U	2 U	0.5 U	0.5 J	0.6	0.6 J	0.6
Selenium	µg/L	3.9	3.30	0.4	0.36 J	0.2	0.20 J	0.5 U	0.5 U	0.1 J	0.5 U
Sulfate	mg/L	-	618	-	10.4	-	5.08	-	61.6	-	89.2
Thallium	µg/L	1.39	1.62	0.5 U	0.2 U	0.5 U	0.2 U	0.5 U	0.2 U	0.5 U	0.05 J
Total Dissolved Solids	mg/L	-	880	-	60	-	50	-	370	-	330
pH	SU	3.4	3.6	5.1	5.7	4.6	5.2	6.9	7.5	6.4	6.9

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit.
-: Not sampled

Table 2: Appendix IV Groundwater Protection Standards
Big Sandy Plant - Fly Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Calculated UTL	GWPS
Antimony, Total (mg/L)	0.006		0.0012	0.006
Arsenic, Total (mg/L)	0.01		0.029	0.029
Barium, Total (mg/L)	2		0.11	2
Beryllium, Total (mg/L)	0.004		0.00015	0.004
Cadmium, Total (mg/L)	0.005		0.00014	0.005
Chromium, Total (mg/L)	0.1		0.0029	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0054	0.006
Combined Radium, Total (pCi/L)	5		4.60	5
Fluoride, Total (mg/L)	4		0.82	4
Lead, Total (mg/L)	n/a	0.015	0.0016	0.015
Lithium, Total (mg/L)	n/a	0.04	0.02	0.04
Mercury, Total (mg/L)	0.002		0.000013	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0035	0.1
Selenium, Total (mg/L)	0.05		0.0005	0.05
Thallium, Total (mg/L)	0.002		0.0005	0.002

Notes:
MCL = Maximum Contaminant Level
CCR = Coal Combustion Residual
GWPS = Groundwater Protection Standard
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
Grey cells indicate the GWPS is based on the calculated UTL, which is higher than the MCL or CCR-Rule specified value.

Table 3 - Appendix III Data Summary
Big Sandy Plant - Fly Ash Pond

Geosyntec Consultants, Inc.

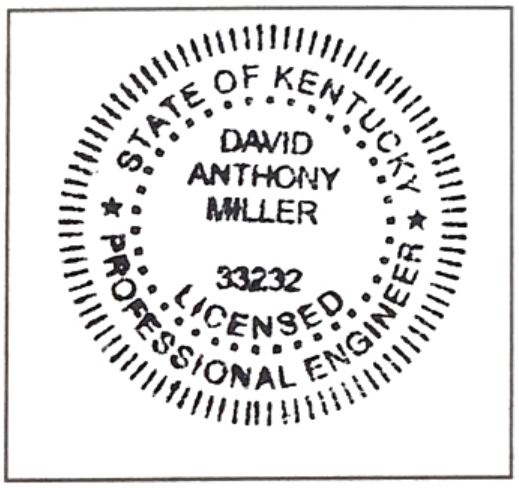
Analyte	Unit	Description	MW-1601	MW-1602	MW-1603	MW-1606	MW-1607
			6/9/2021	6/9/2021	6/9/2021	6/8/2021	6/8/2021
Boron	mg/L	Interwell Background Value (UPL)	0.242				
		Analytical Result	0.109	0.050	0.036	**1.99**	0.151
Calcium	mg/L	Interwell Background Value (UPL)	105				
		Analytical Result	62.5	83.9	79.0	74.1	81.2
Chloride	mg/L	Interwell Background Value (UPL)	6.22				
		Analytical Result	**6.58**	**17.1**	4.16	**31.8**	3.56
Fluoride	mg/L	Interwell Background Value (UPL)	0.820				
		Analytical Result	0.18	0.11	0.76	0.24	0.09
pH	SU	Intrawell Background Value (UPL)	8.0	8.7	5.6	7.5	7.5
		Intrawell Background Value (LPL)	6.3	5.6	2.9	6.3	5.5
		Analytical Result	6.8	7.5	3.6	7.5	6.9
Sulfate	mg/L	Interwell Background Value (UPL)	106				
		Analytical Result	98.0	**165**	**618**	61.6	89.2
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	583				
		Analytical Result	340	500	**880**	370	330

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A
Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Big Sandy Fly Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

33232	KENTUCKY	10.07.21
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING

September 1, 2021

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Big Sandy Fly Ash Pond
Assessment Monitoring Summary – June 2021

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the Assessment Monitoring statistical analysis of groundwater data through June 2021 at American Electric Power Company's Big Sandy Fly Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR Rule, 2015) as well as with the United States Environmental Protection Agency (USEPA) Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1011, MW-1012, MW-1203, MW-1604, and MW-1605
- **Downgradient wells:** MW-1601, MW-1602, MW-1603, MW-1606, and MW-1607

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The analysis was reviewed by Kristina Rayner, Groundwater Statistician and Founder of Groundwater Stats Consulting.

The CCR program consists of the following constituents:

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium

Time series and box plots for Appendix IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figures A and B, respectively). Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter (Figure C). While the reporting limits may vary from well to well, a single reporting limit substitution is used across all wells for a given parameter in the time series plots since the wells are plotted as a group.

Summary of Statistical Methods – Appendix IV Parameters

Parametric tolerance limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are non-detects, a nonparametric test is utilized. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (USEPA, 2009), data are analyzed using either parametric or non-parametric prediction limits as appropriate.

- No statistical analyses are required on wells and analytes containing 100% non-detects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% non-detects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for non-detects is the most recent practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% non-detects, the Kaplan-Meier non-detect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric tolerance limits are used on data containing greater than 50% non-detects.

Summary of Background Update – Conducted in January 2021

Outlier Analysis

Prior to evaluating Appendix IV parameters, background (upgradient) data were screened through visual screening and Tukey's outlier test for potential outliers and extreme trending patterns that would lead to artificially elevated statistical limits. High outliers are also 'cautiously' flagged in the downgradient wells when they are clearly much different from the rest of the data. This is intended to be a regulatory conservative approach in that it will reduce the variance and thus reduce the width of parametric confidence intervals; although it will also reduce the mean and thus lower the entire interval. The intent is to better represent the actual downgradient mean.

Tukey's outlier test results for Appendix IV parameters were included with the background update conducted in January 2021. As mentioned above, a list of flagged values follows this report (Figure C).

Tolerance Limits

Interwell upper tolerance limits were used to calculate background limits from all available pooled upgradient well data for each Appendix IV parameter through October 2020 (Figure D). Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure E). GWPS will be updated during Fall 2021.

Evaluation of Appendix IV Parameters – June 2021

Confidence intervals were then constructed with data through June 2021 on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified levels, or background limit as the GWPS as discussed above (Figure F). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. A summary of the confidence interval results follows this letter. The following confidence interval exceedances were identified:

- Beryllium: MW-1603
- Cobalt: MW-1603
- Lithium: MW-1603

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Big Sandy Fly Ash Pond. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

Andrew T. Collins
Project Manager

Kristina L. Rayner
Groundwater Statistician

100% Non-Detects

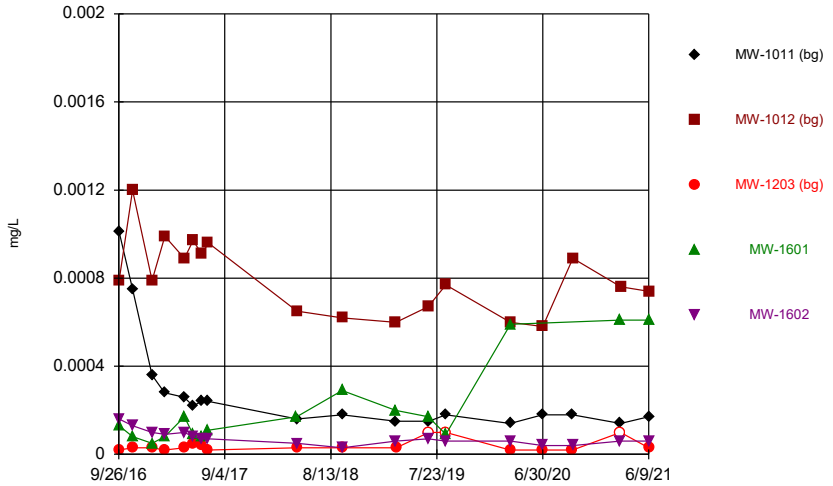
Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Beryllium (mg/L)
MW-1602

Mercury (mg/L)
MW-1601

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

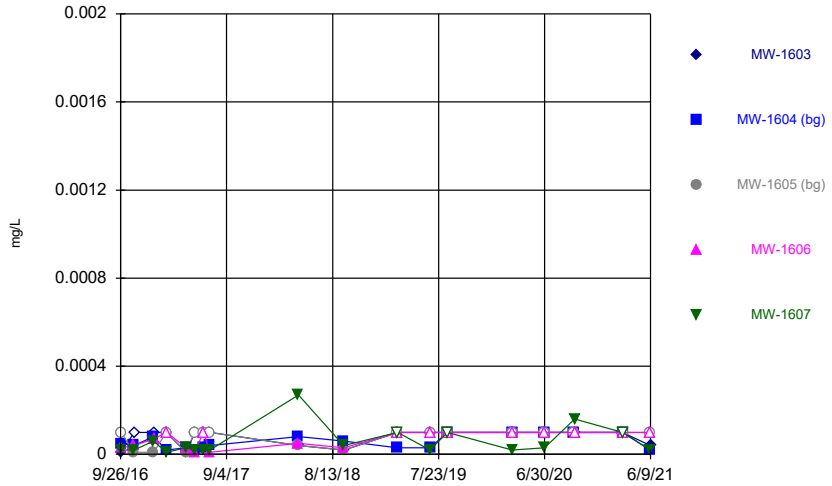
Time Series



Constituent: Antimony Analysis Run 8/31/2021 1:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

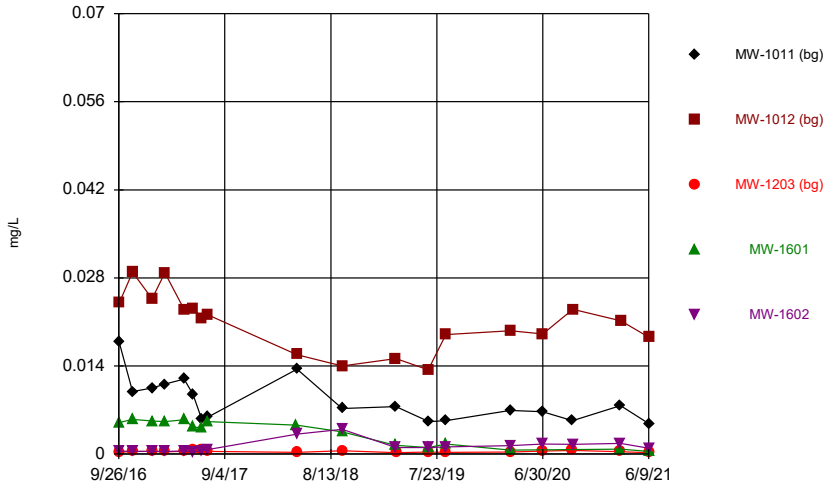
Time Series



Constituent: Antimony Analysis Run 8/31/2021 1:23 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series



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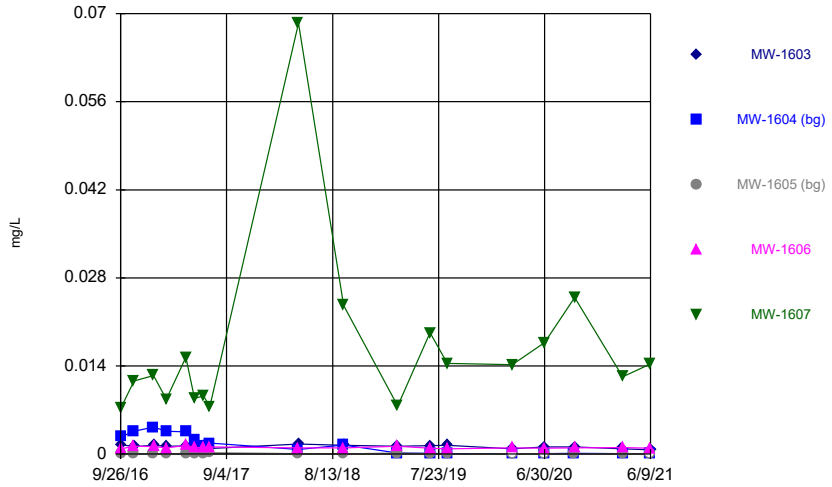
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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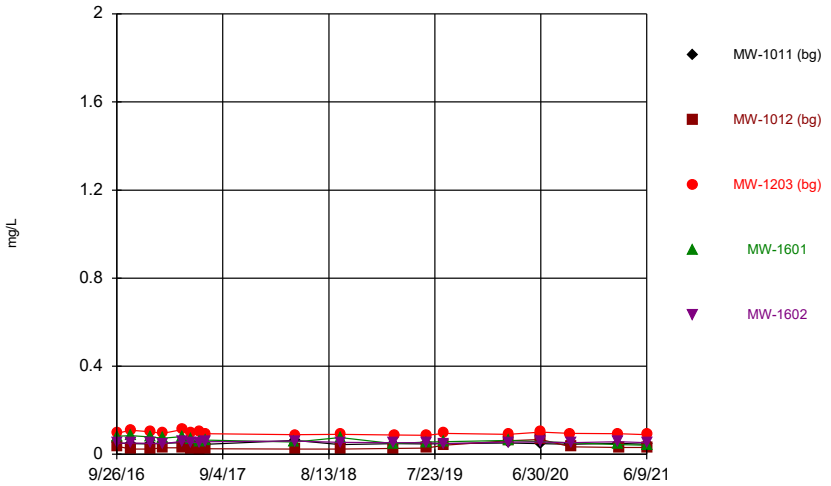
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series



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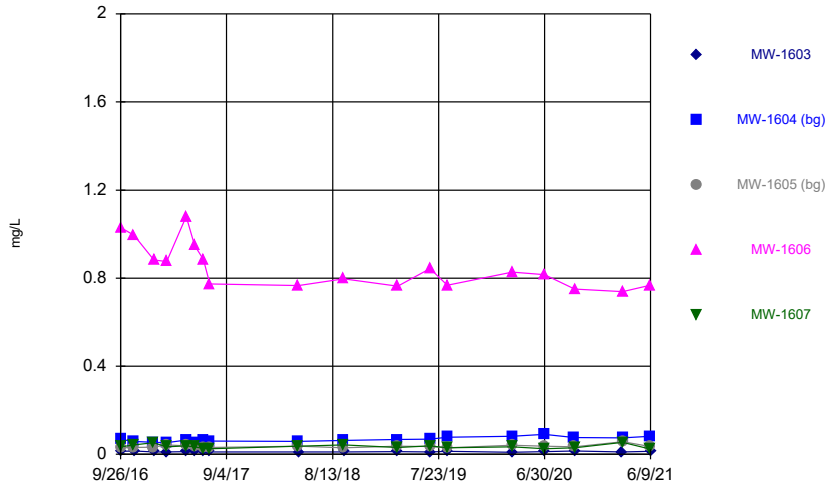
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series



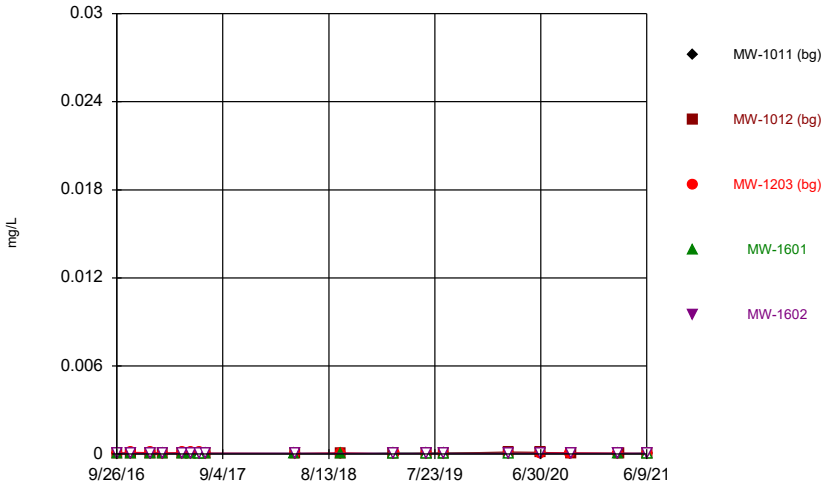
Constituent: Barium Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



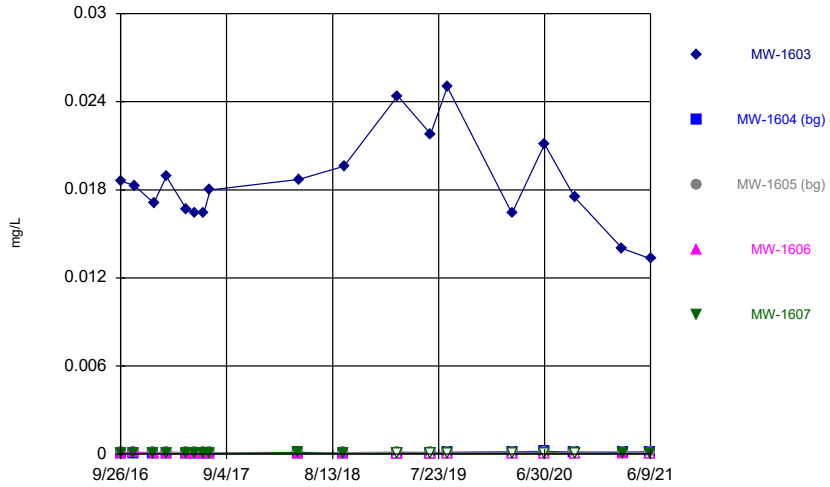
Constituent: Beryllium Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

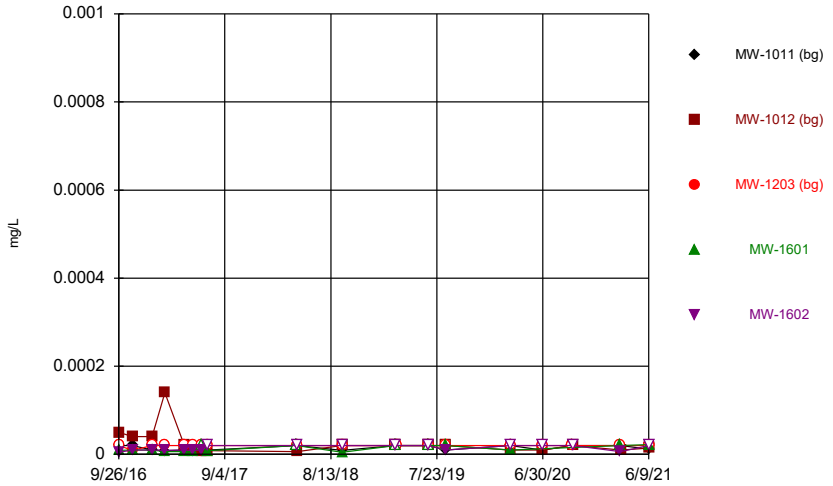


Constituent: Beryllium Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

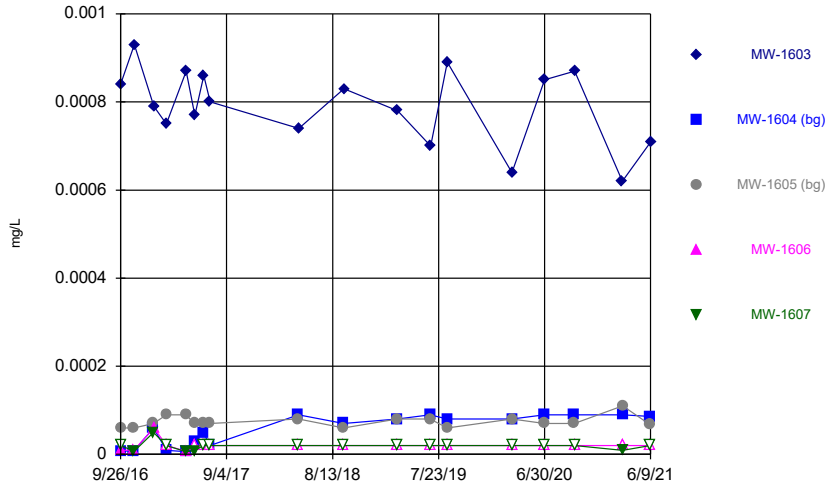
Time Series



Constituent: Cadmium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

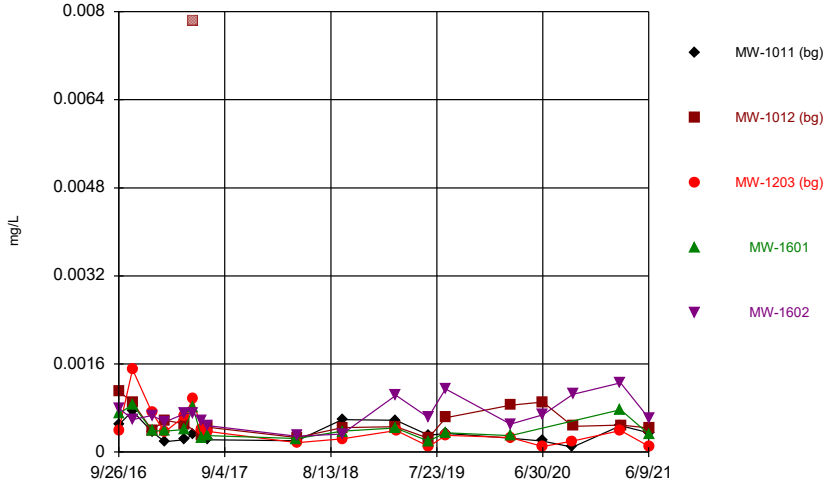
Time Series



Constituent: Cadmium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

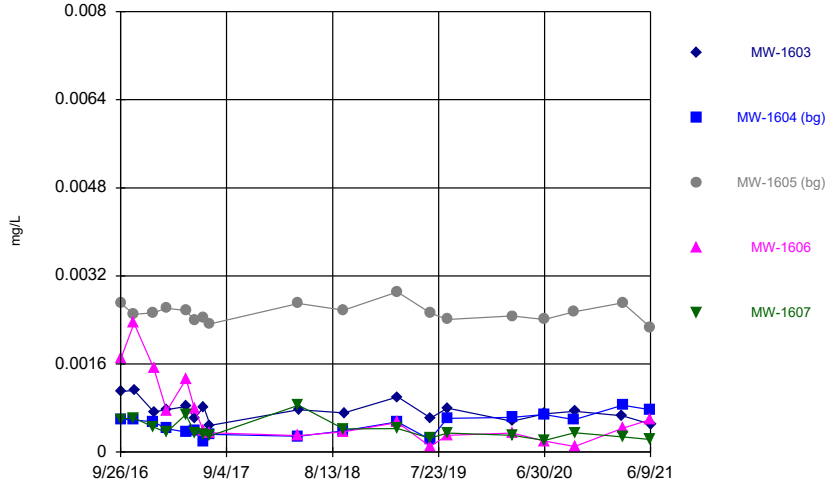
Time Series



Constituent: Chromium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

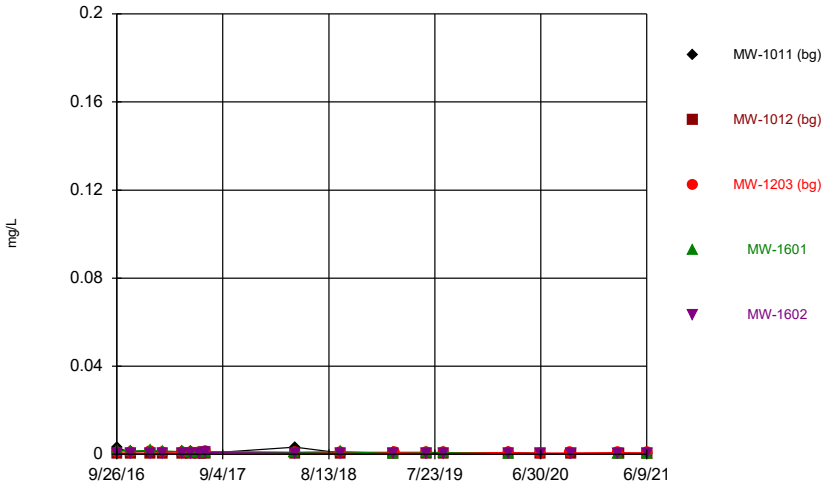
Time Series



Constituent: Chromium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series

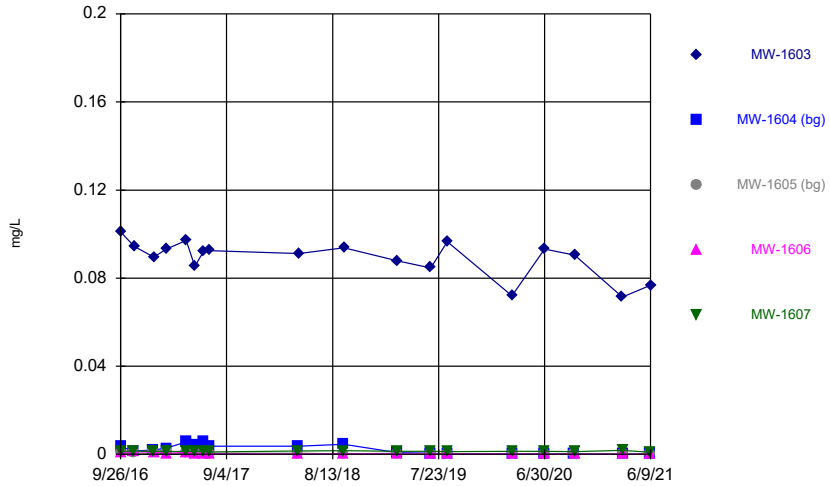


Constituent: Cobalt Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series

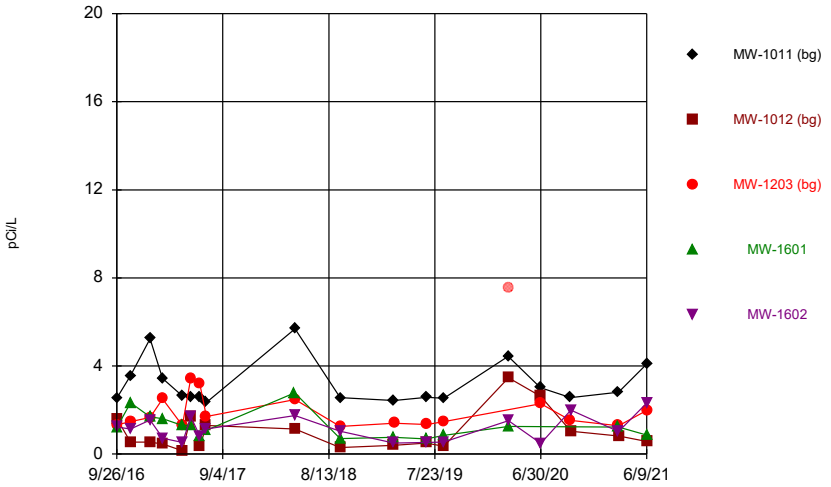


Constituent: Cobalt Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series

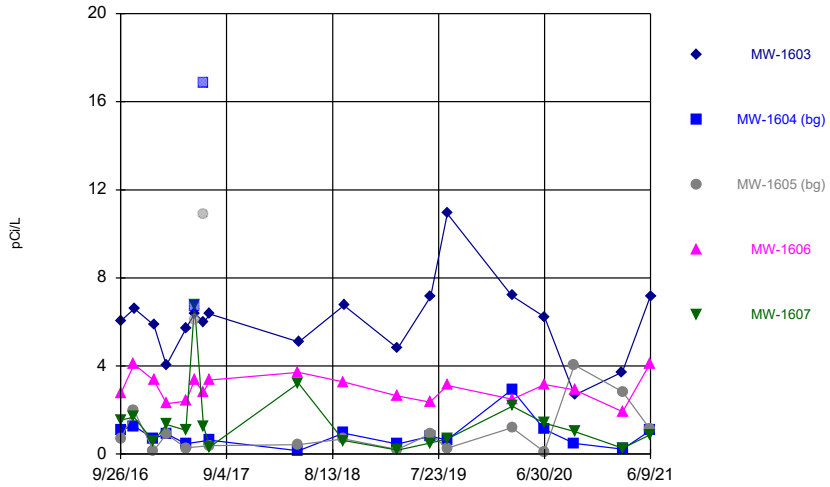


Constituent: Combined Radium 226 + 228 Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series

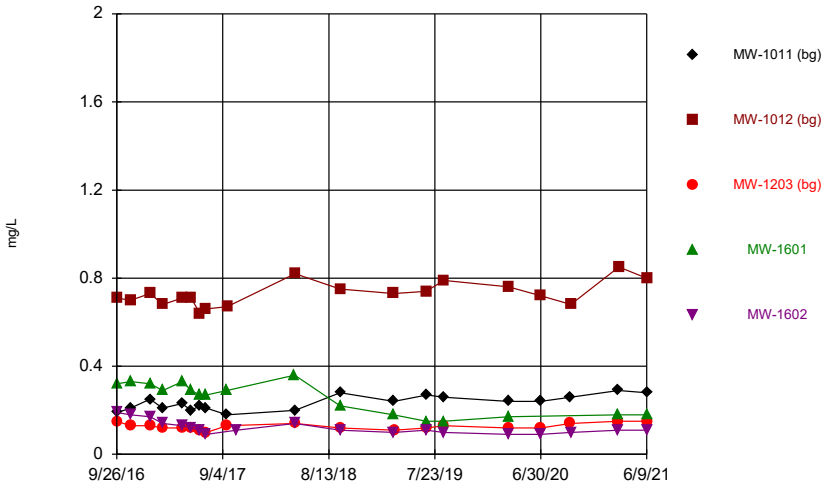


Constituent: Combined Radium 226 + 228 Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Time Series



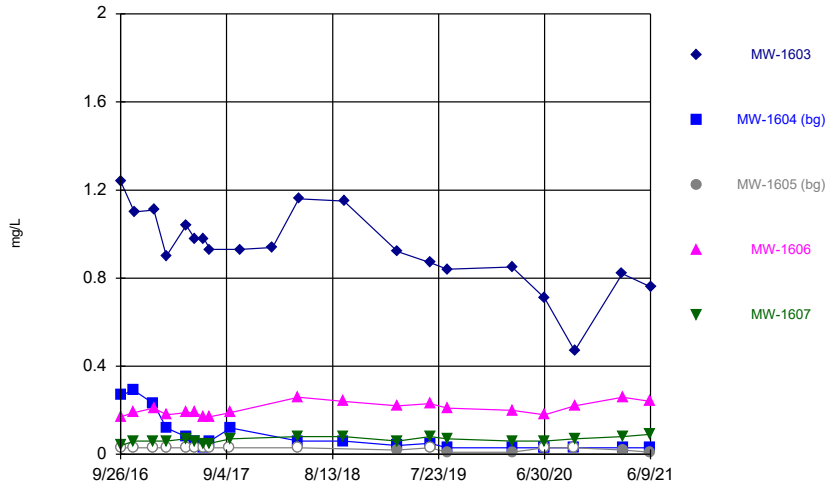
Constituent: Fluoride Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



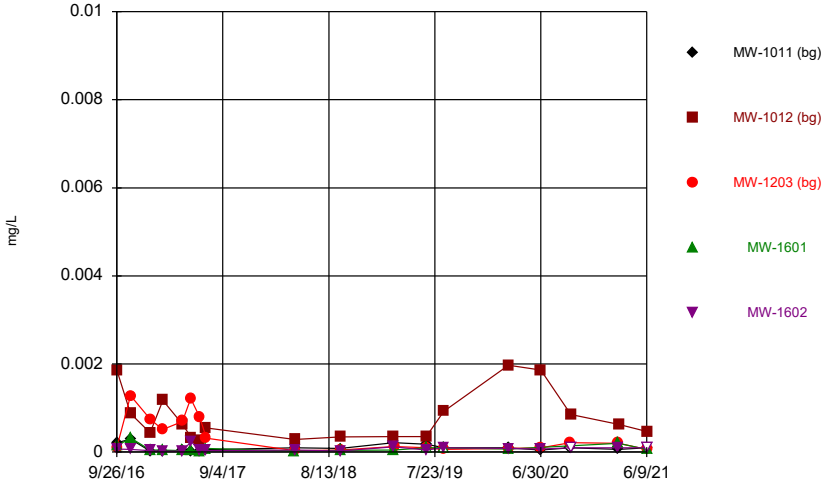
Constituent: Fluoride Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



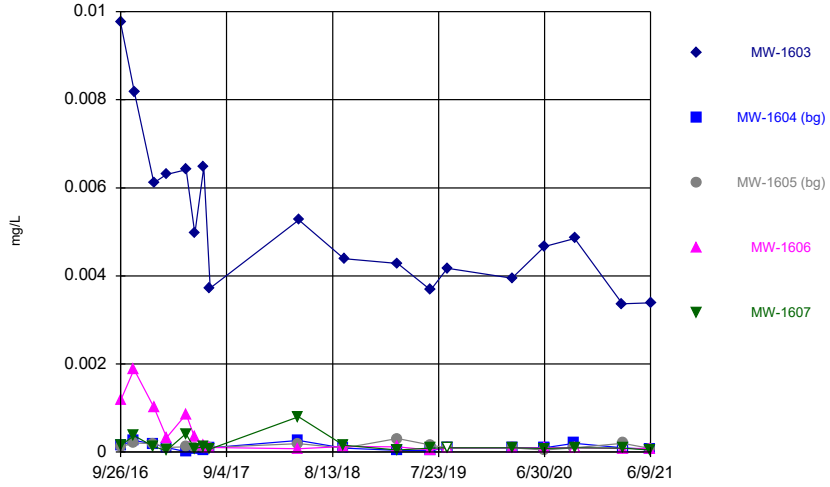
Constituent: Lead Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

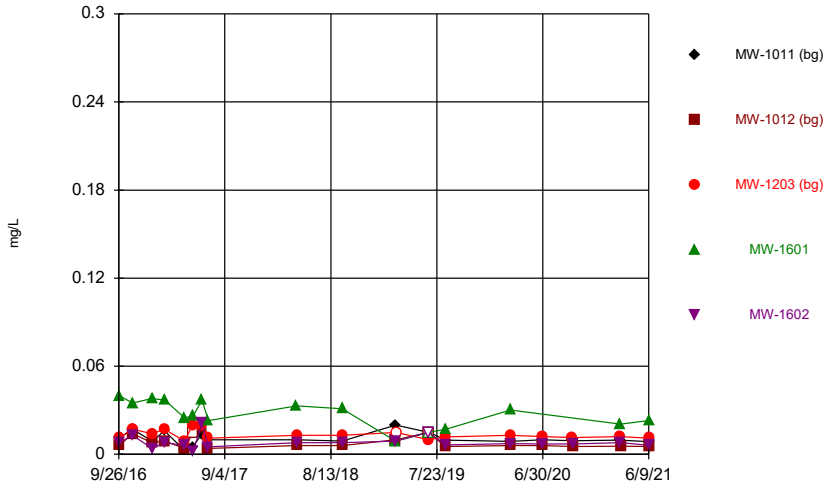


Constituent: Lead Analysis Run 8/31/2021 1:24 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

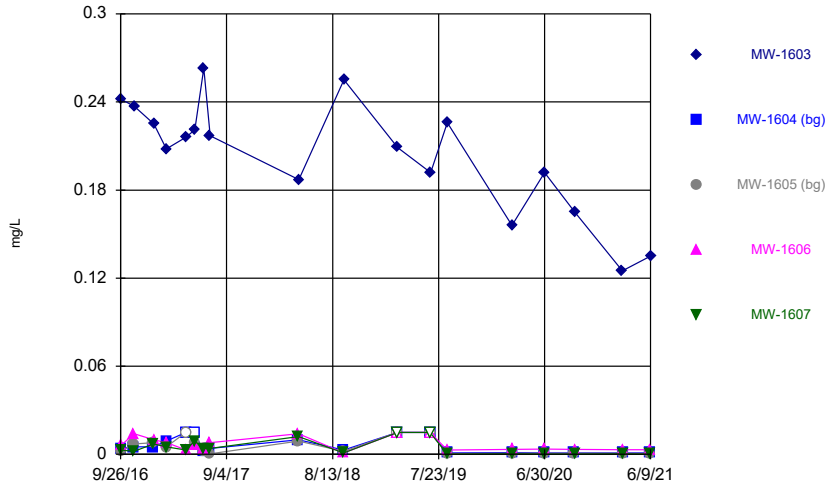
Time Series



Constituent: Lithium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

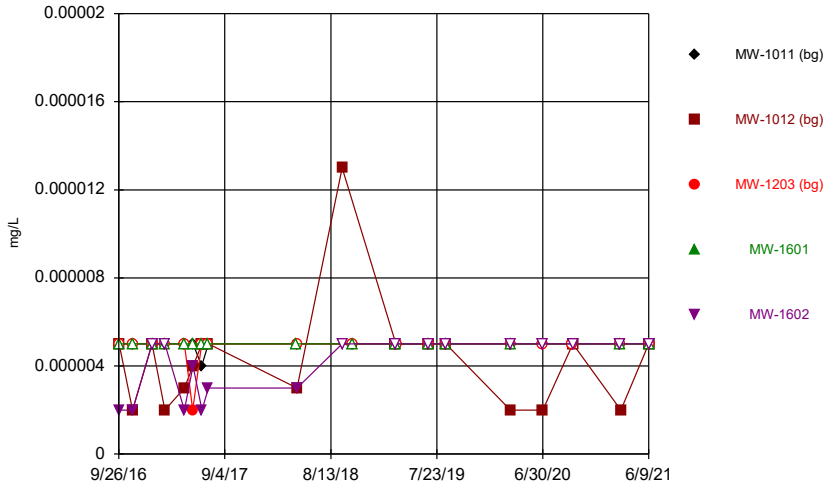
Time Series



Constituent: Lithium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

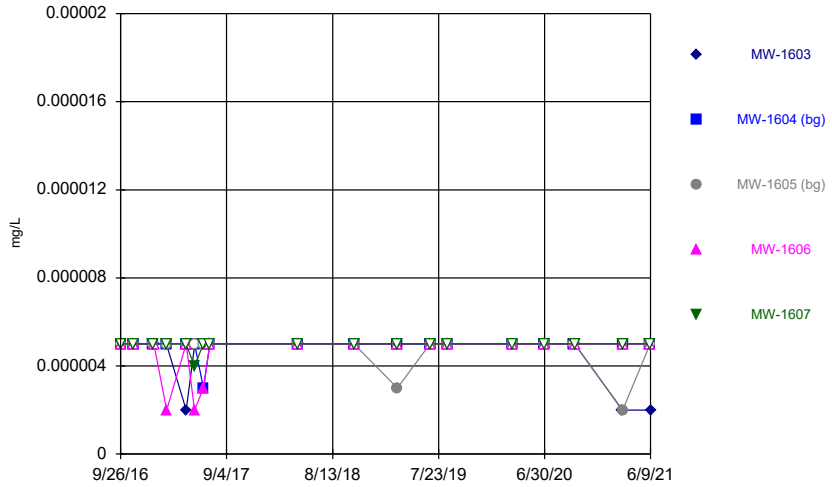
Time Series



Constituent: Mercury Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

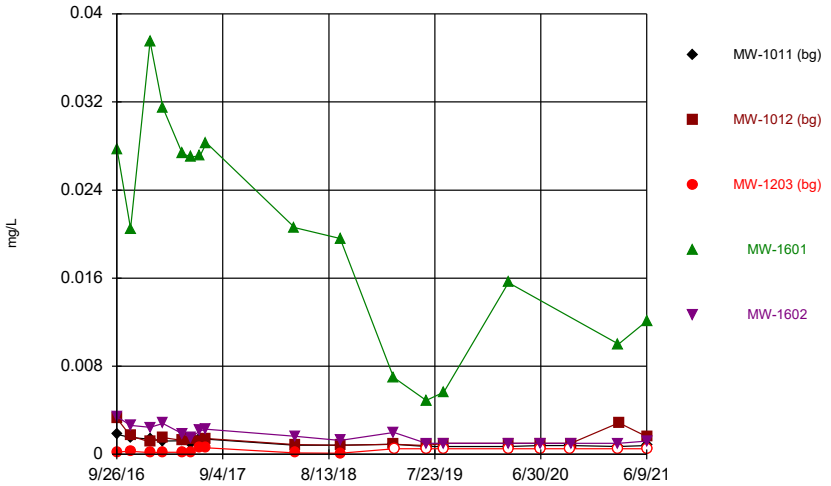
Time Series



Constituent: Mercury Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

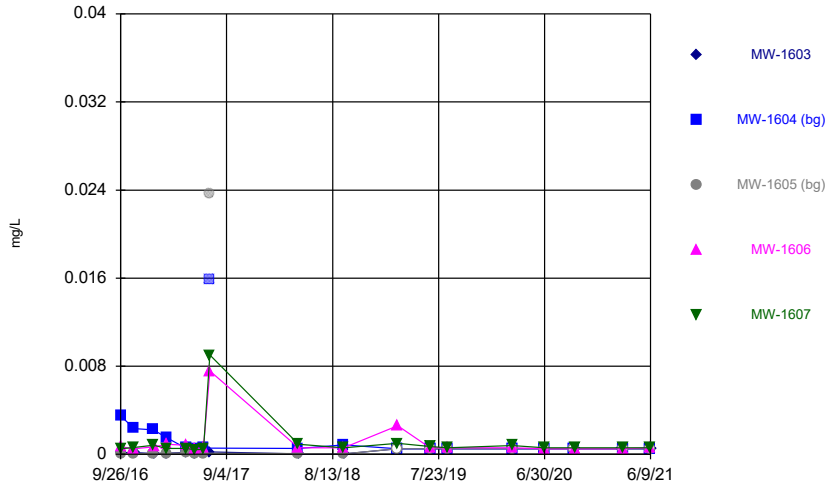
Time Series



Constituent: Molybdenum Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

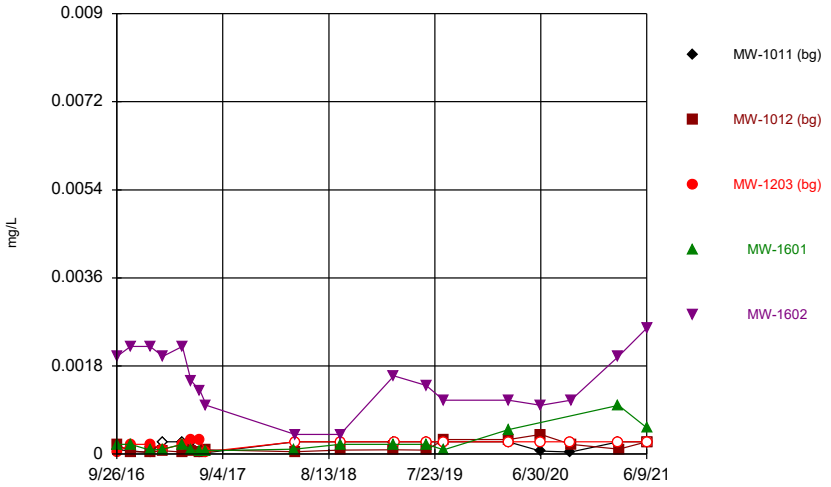
Time Series



Constituent: Molybdenum Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

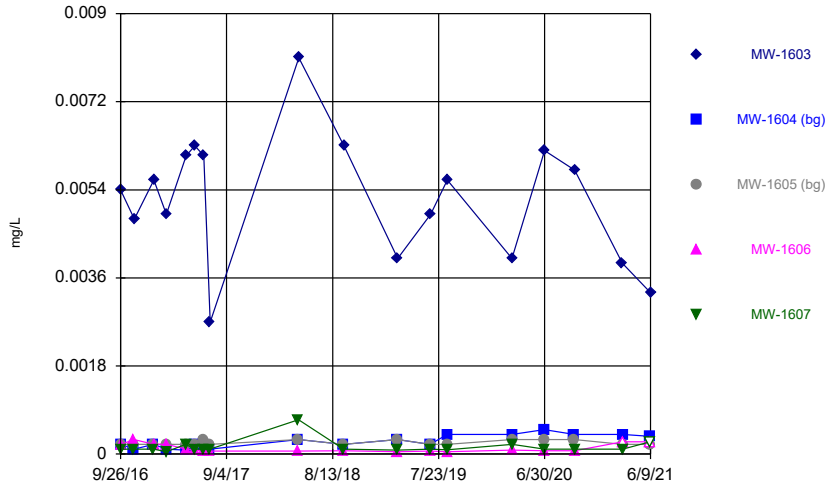
Time Series



Constituent: Selenium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

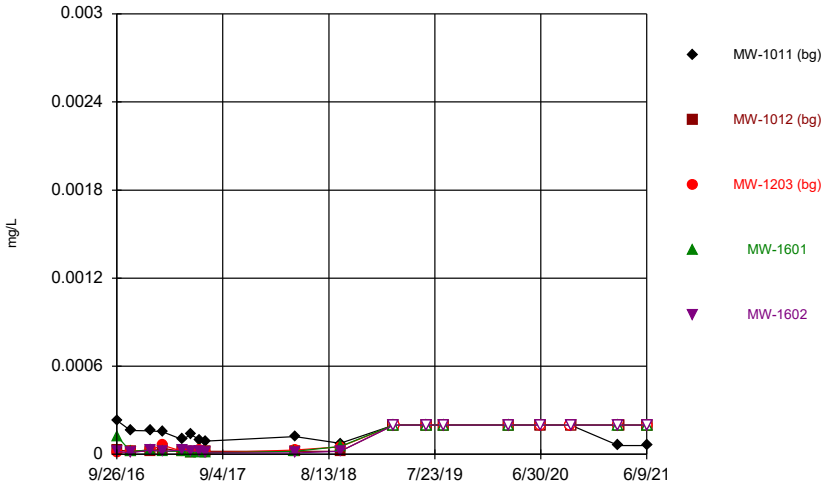
Time Series



Constituent: Selenium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

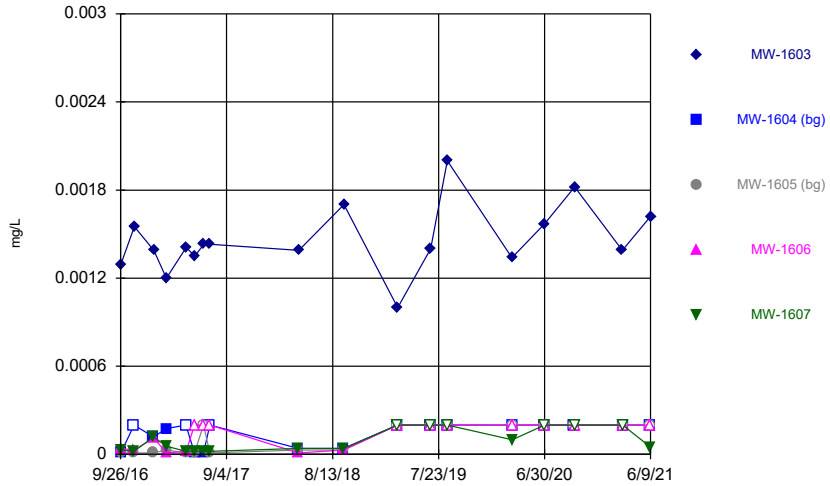
Time Series



Constituent: Thallium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

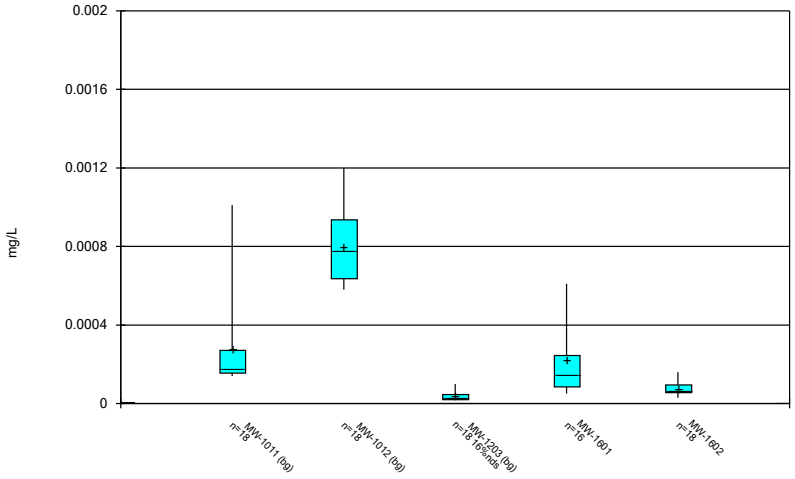
Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Thallium Analysis Run 8/31/2021 1:24 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

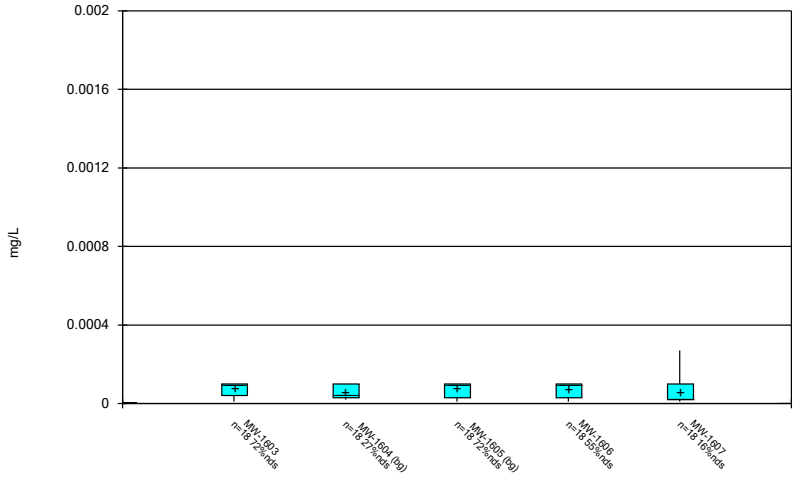


Constituent: Antimony Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

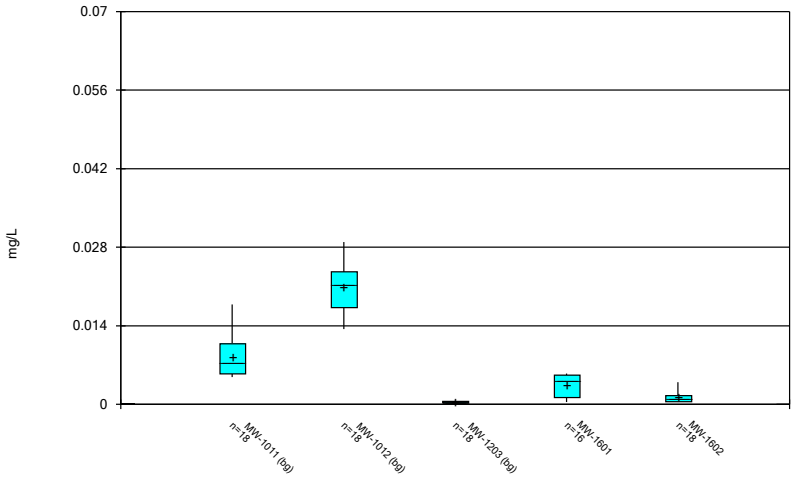


Constituent: Antimony Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

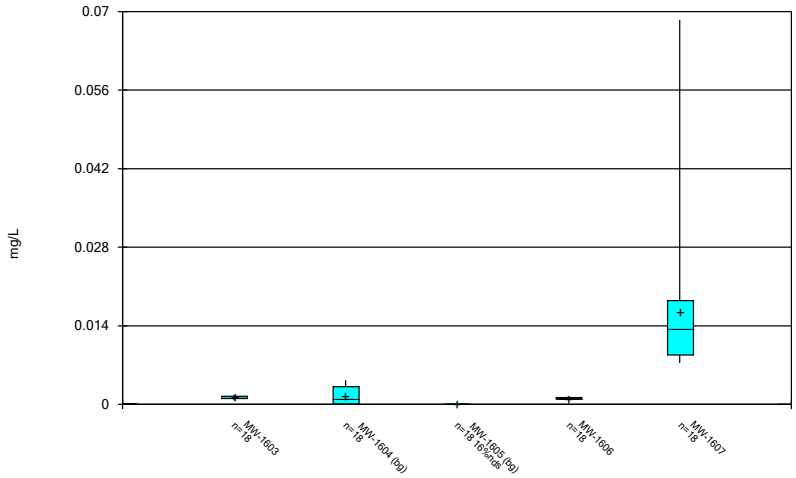


Constituent: Arsenic Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

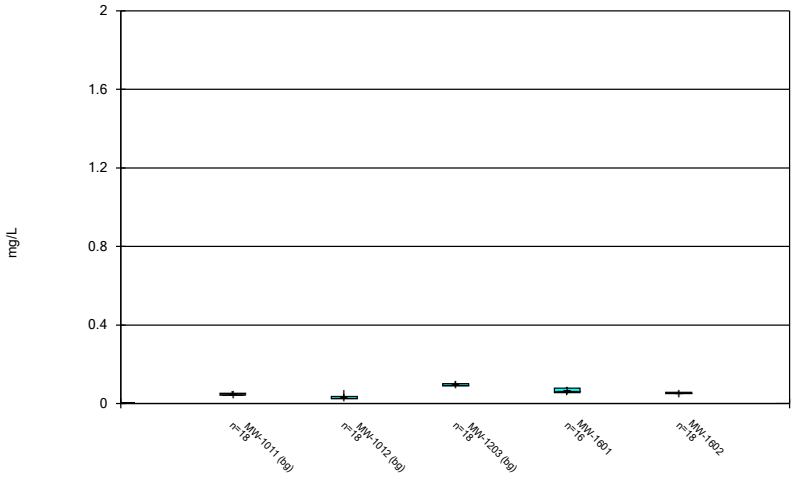
Box & Whiskers Plot



Constituent: Arsenic Analysis Run 8/31/2021 1:42 PM

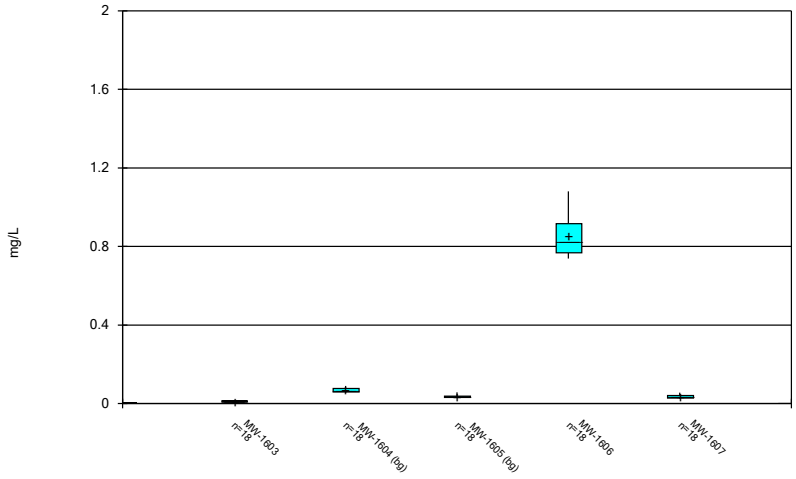
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot



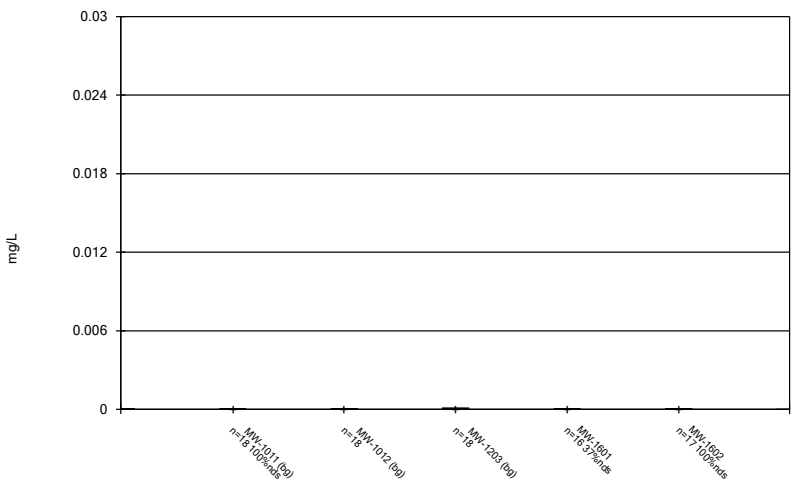
Constituent: Barium Analysis Run 8/31/2021 1:42 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot



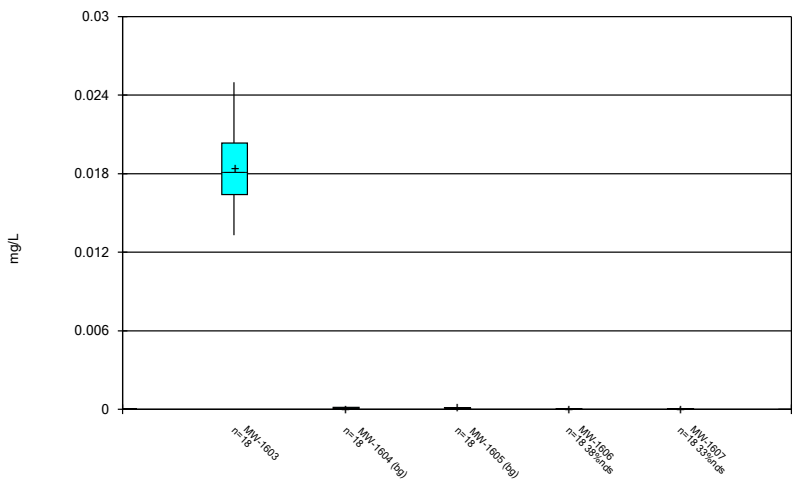
Constituent: Barium Analysis Run 8/31/2021 1:42 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot



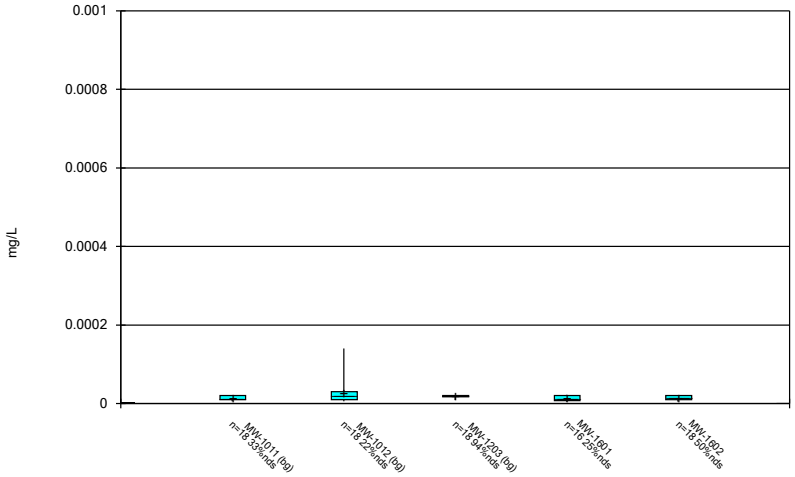
Constituent: Beryllium Analysis Run 8/31/2021 1:42 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot



Constituent: Beryllium Analysis Run 8/31/2021 1:42 PM
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

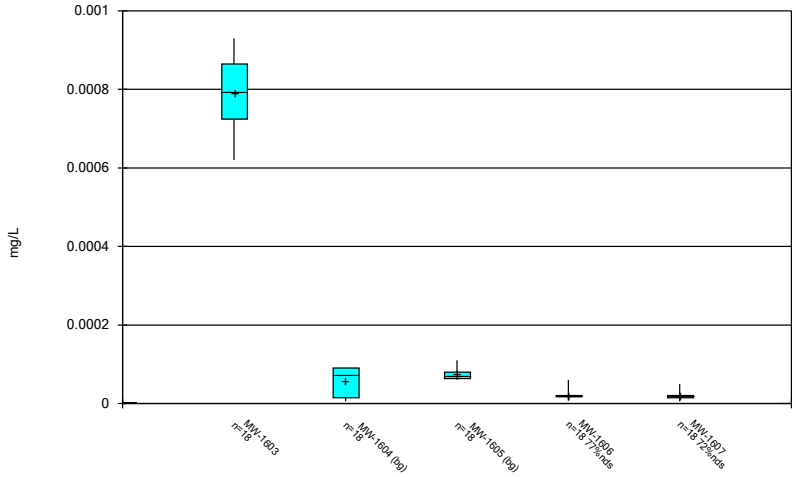


Constituent: Cadmium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

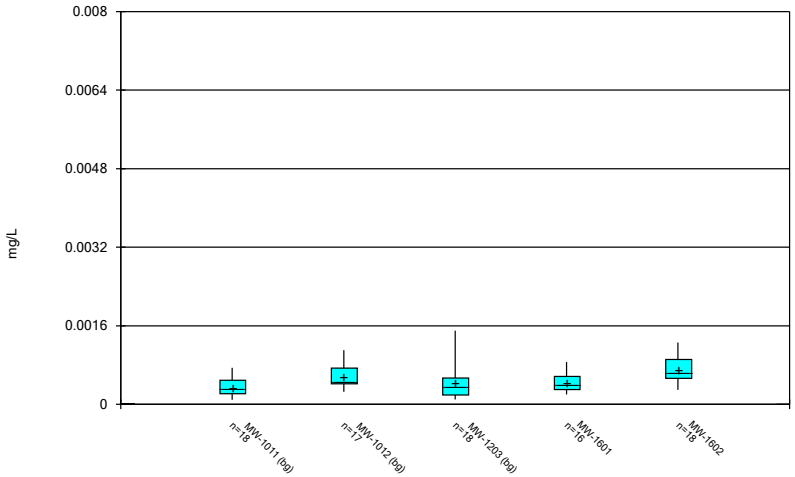


Constituent: Cadmium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

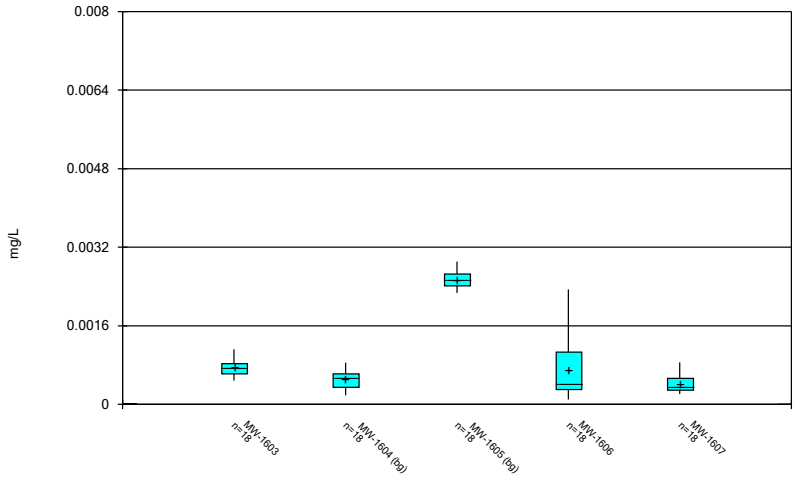


Constituent: Chromium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

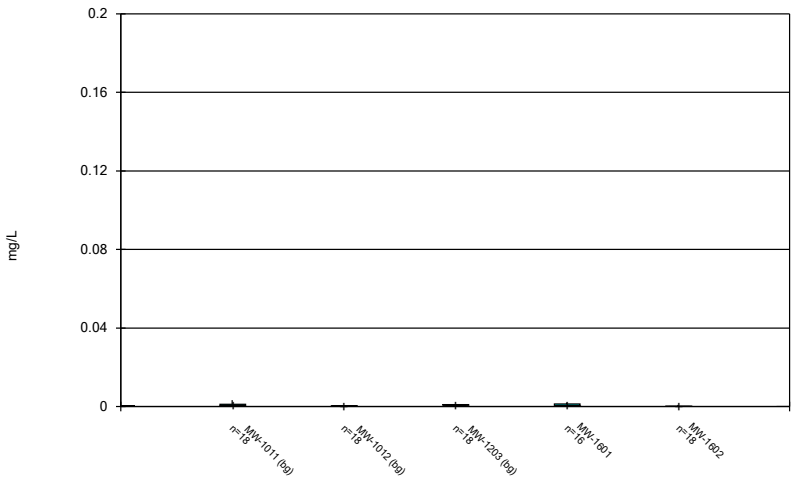


Constituent: Chromium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

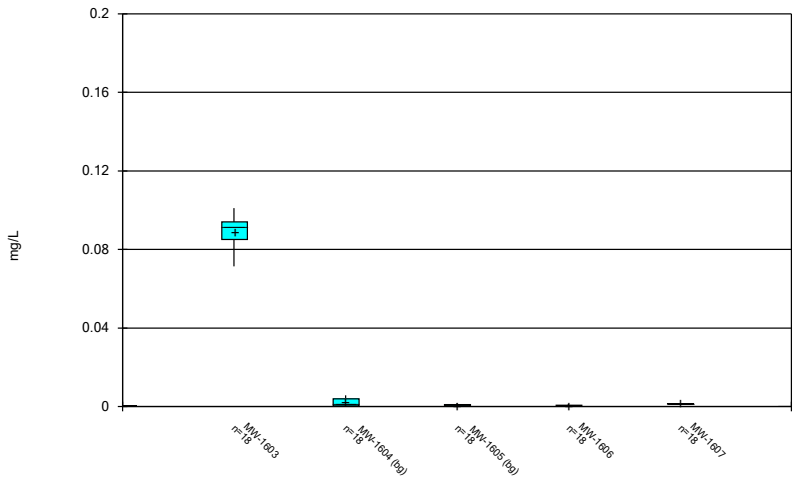


Constituent: Cobalt Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

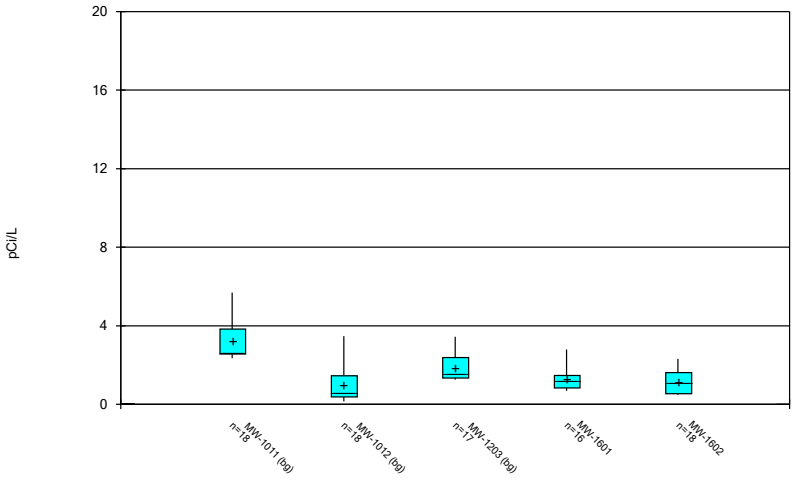


Constituent: Cobalt Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

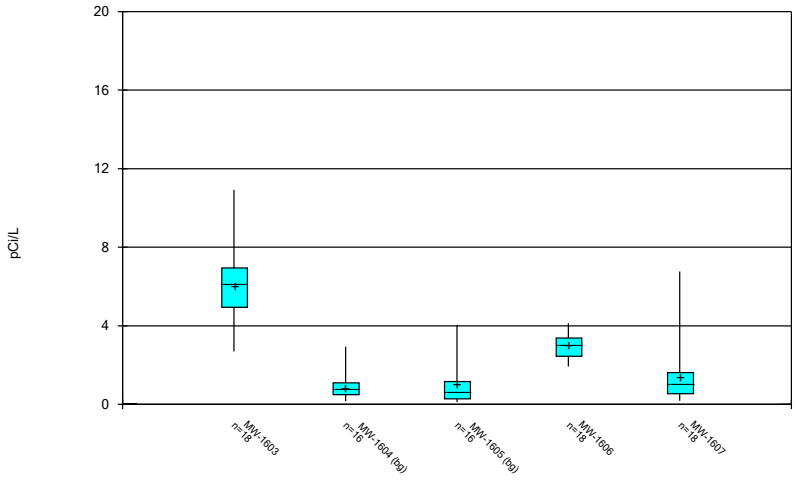


Constituent: Combined Radium 226 + 228 Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

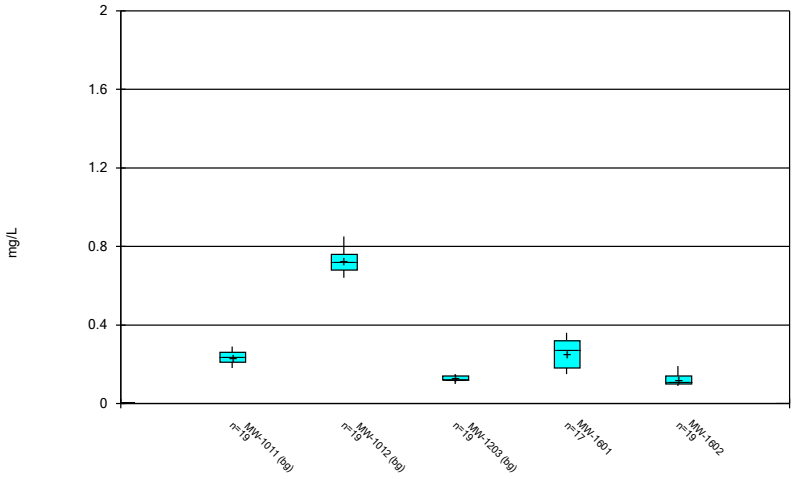


Constituent: Combined Radium 226 + 228 Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

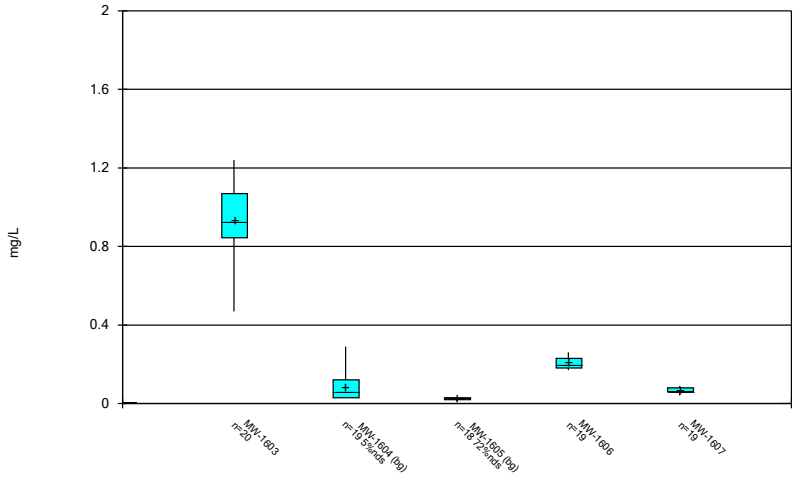


Constituent: Fluoride Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

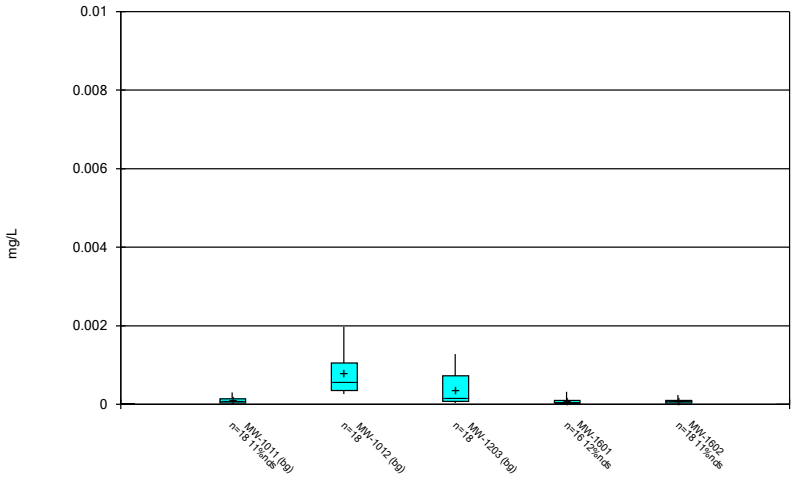


Constituent: Fluoride Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

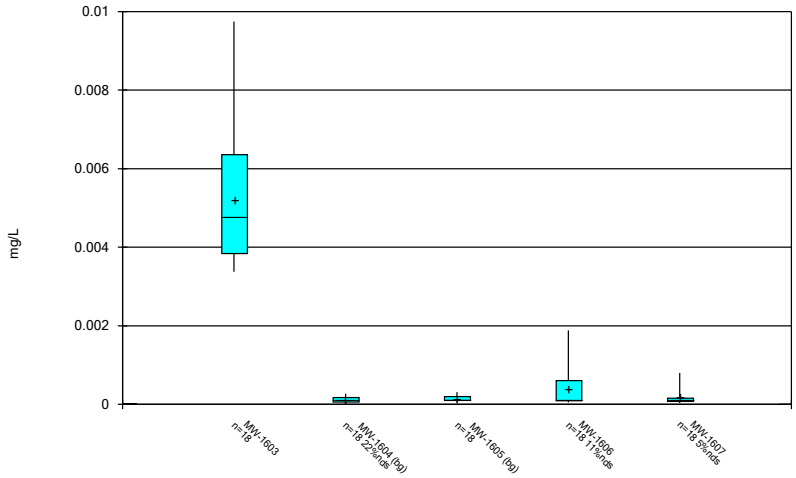


Constituent: Lead Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

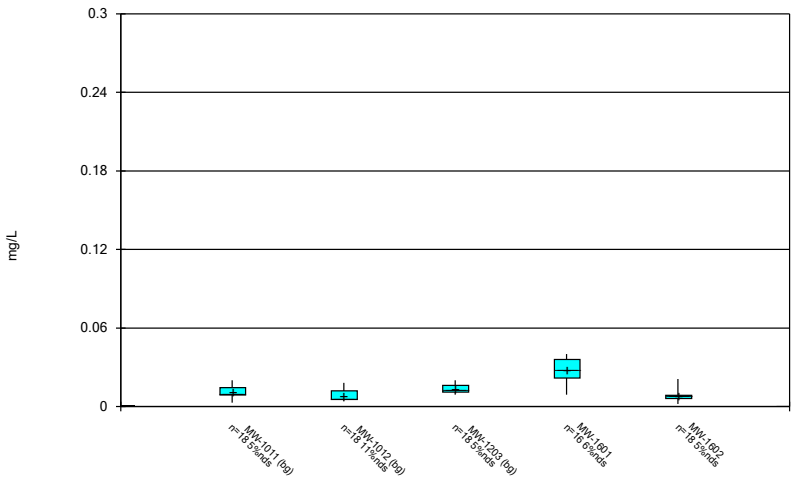
Box & Whiskers Plot



Constituent: Lead Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

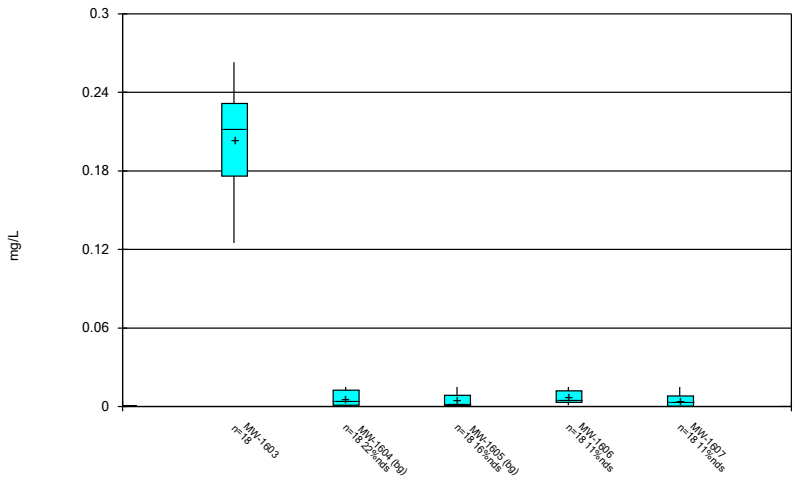


Constituent: Lithium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

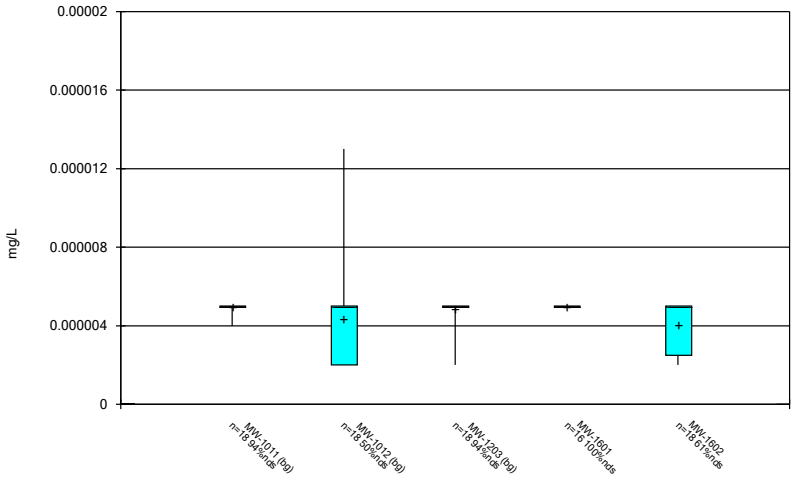


Constituent: Lithium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

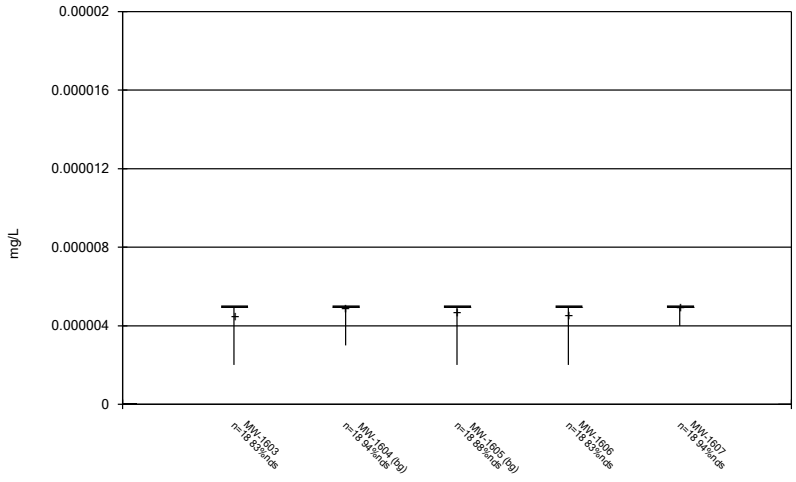


Constituent: Mercury Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

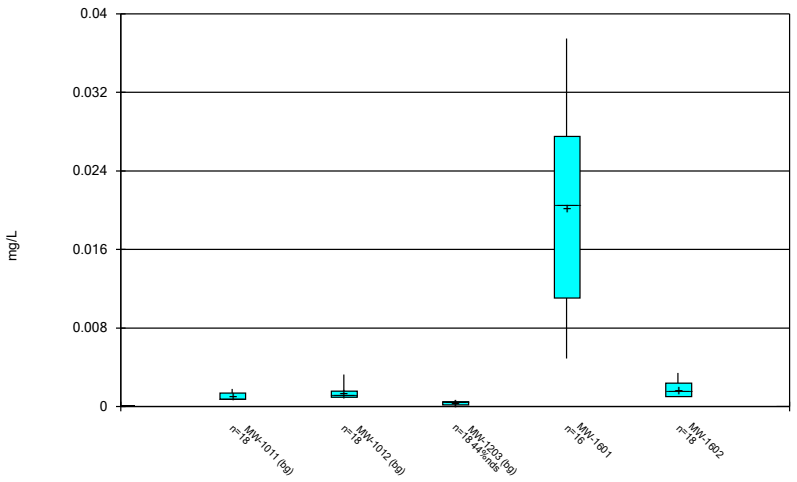
Box & Whiskers Plot



Constituent: Mercury Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

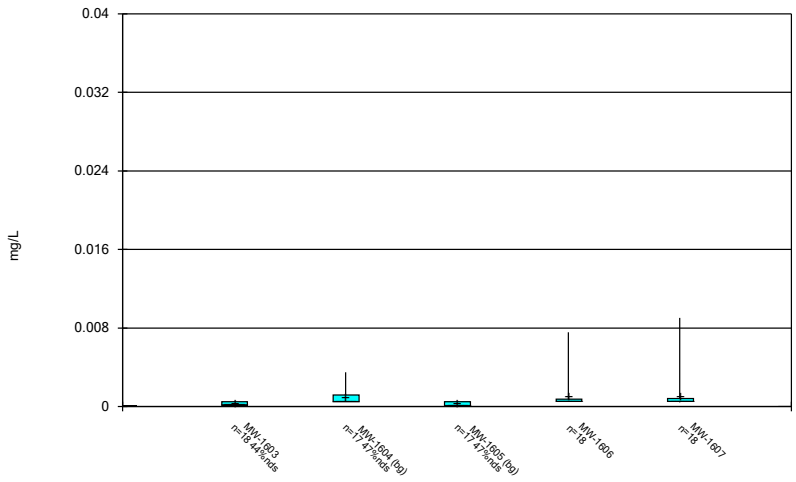


Constituent: Molybdenum Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

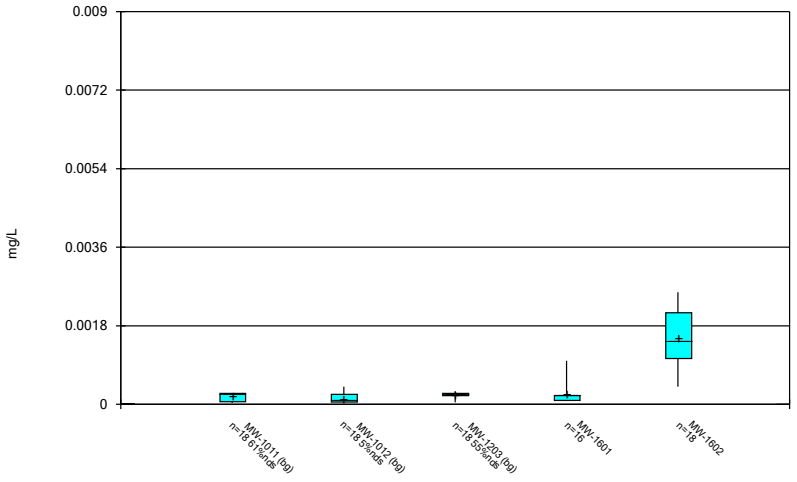


Constituent: Molybdenum Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot

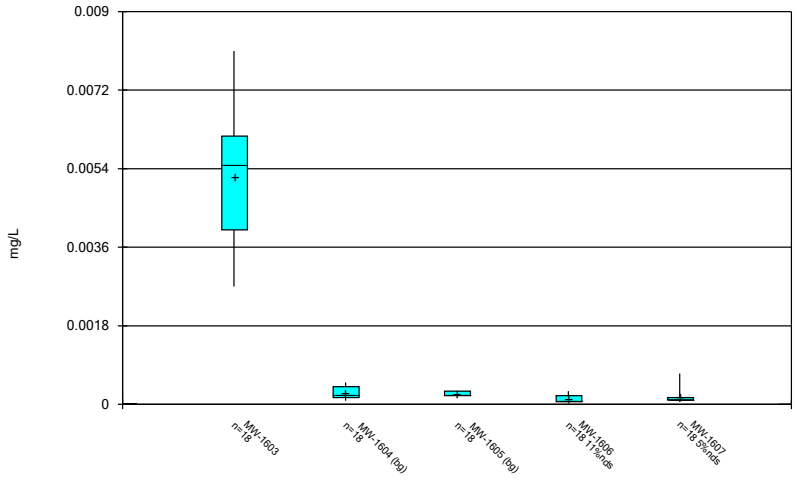


Constituent: Selenium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

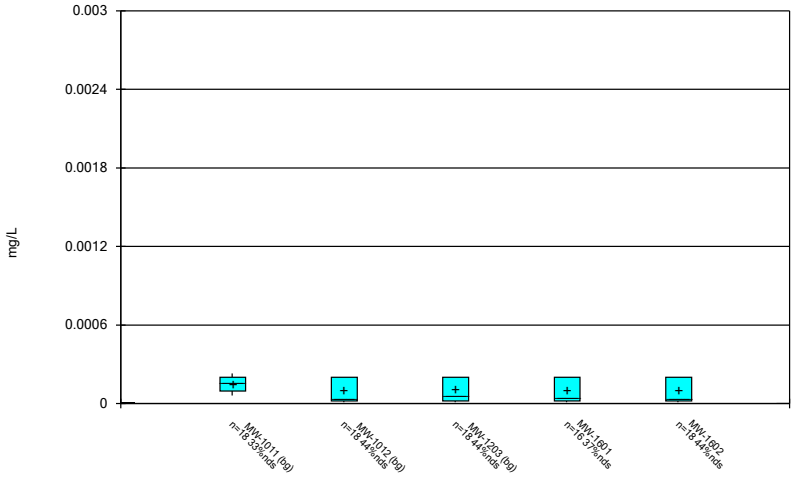
Box & Whiskers Plot



Constituent: Selenium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Box & Whiskers Plot

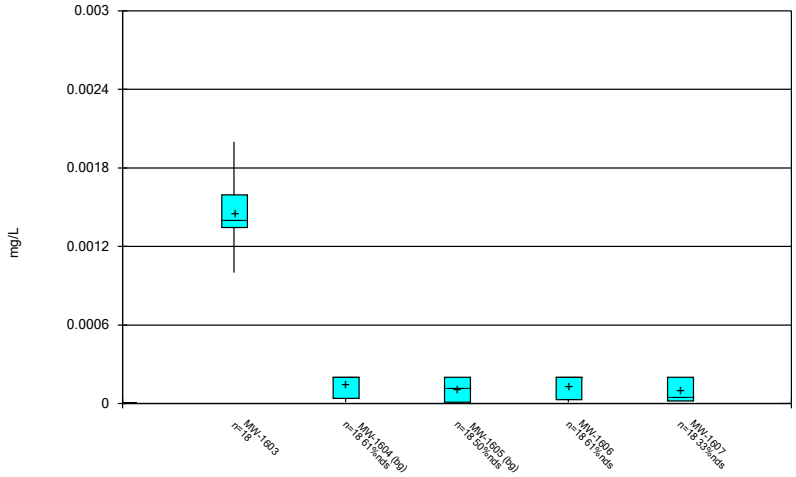


Constituent: Thallium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Thallium Analysis Run 8/31/2021 1:42 PM

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Outlier Summary

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 8/31/2021, 1:44 PM

	MW-1012 Chromium (mg/L)	MW-1203 Combined Radium 226 + 228 (pCi/L)	MW-1604 Combined Radium 226 + 228 (pCi/L)	MW-1605 Combined Radium 226 + 228 (pCi/L)	MW-1604 Molybdenum (mg/L)	MW-1605 Molybdenum (mg/L)
5/23/2017			6.707 (o)	6.077 (o)		
5/24/2017	0.00784 (o)					
6/21/2017			16.848 (o)	10.864 (o)		
7/12/2017					0.0159 (o)	0.0237 (o)
3/17/2020		7.524 (o)				

Upper Tolerance Limit Summary Table

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 1/26/2021, 5:55 PM

Constituent	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	0.0012	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Arsenic (mg/L)	0.0289	n/a	n/a	80	n/a	n/a	2.5	n/a	n/a	0.01652	NP Inter(normality)
Barium (mg/L)	0.1118	n/a	n/a	80	0.2309	0.05269	0	None	sqrt(x)	0.05	Inter
Beryllium (mg/L)	0.0001465	n/a	n/a	80	0.00005513	0.00004654	20	Kaplan-Meier	No	0.05	Inter
Cadmium (mg/L)	0.00014	n/a	n/a	80	n/a	n/a	30	n/a	n/a	0.01652	NP Inter(normality)
Chromium (mg/L)	0.00291	n/a	n/a	79	n/a	n/a	0	n/a	n/a	0.01738	NP Inter(normality)
Cobalt (mg/L)	0.005433	n/a	n/a	80	-7.442	1.135	0	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	4.6	n/a	n/a	75	1.168	0.4951	0	None	sqrt(x)	0.05	Inter
Fluoride (mg/L)	0.82	n/a	n/a	84	n/a	n/a	16.67	n/a	n/a	0.01345	NP Inter(normality)
Lead (mg/L)	0.001584	n/a	n/a	80	-8.741	1.169	6.25	None	ln(x)	0.05	Inter
Lithium (mg/L)	0.01985	n/a	n/a	80	0.009121	0.005467	13.75	None	No	0.05	Inter
Mercury (mg/L)	0.000013	n/a	n/a	80	n/a	n/a	85	n/a	n/a	0.01652	NP Inter(NDs)
Molybdenum (mg/L)	0.00348	n/a	n/a	78	n/a	n/a	23.08	n/a	n/a	0.0183	NP Inter(normality)
Selenium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	21.25	n/a	n/a	0.01652	NP Inter(normality)
Thallium (mg/L)	0.0005	n/a	n/a	80	n/a	n/a	42.5	n/a	n/a	0.01652	NP Inter(normality)

BIG SANDY FAP GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.0012	0.006
Arsenic, Total (mg/L)	0.01		0.029	0.029
Barium, Total (mg/L)	2		0.11	2
Beryllium, Total (mg/L)	0.004		0.00015	0.004
Cadmium, Total (mg/L)	0.005		0.00014	0.005
Chromium, Total (mg/L)	0.1		0.0029	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0054	0.006
Combined Radium, Total (pCi/L)	5		4.6	5
Fluoride, Total (mg/L)	4		0.82	4
Lead, Total (mg/L)	0.015		0.0016	0.015
Lithium, Total (mg/L)	n/a	0.04	0.02	0.04
Mercury, Total (mg/L)	0.002		0.000013	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0035	0.1
Selenium, Total (mg/L)	0.05		0.0005	0.05
Thallium, Total (mg/L)	0.002		0.0005	0.002

**Grey cell indicates Background is higher than MCL or CCR-Rule Specified Level*

**GWPS = Groundwater Protection Standard*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

Confidence Interval - Significant Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 8/31/2021, 2:12 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium (mg/L)	**MW-1603**	**0.02033**	**0.01658**	**0.004**	**Yes**	**18**	**0.01846**	**0.003097**	**0**	**None**	**No**	**0.01**	**Param.**
Cobalt (mg/L)	**MW-1603**	**0.0941**	**0.08454**	**0.006**	**Yes**	**18**	**0.08908**	**0.008284**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium (mg/L)	**MW-1603**	**0.2274**	**0.1805**	**0.04**	**Yes**	**18**	**0.2039**	**0.0388**	**0**	**None**	**No**	**0.01**	**Param.**

Confidence Interval - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 8/31/2021, 2:12 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (mg/L)	MW-1601	0.0002674	0.00009579	0.006	No	16	0.00022	0.0001993	0	None	ln(x)	0.01	Param.
Antimony (mg/L)	MW-1602	0.0000903	0.00005375	0.006	No	18	0.00007389	0.00003256	0	None	sqrt(x)	0.01	Param.
Antimony (mg/L)	MW-1603	0.0001	0.00004	0.006	No	18	0.00007889	0.00003579	72.22	None	No	0.01	NP (NDs)
Antimony (mg/L)	MW-1606	0.0001	0.00003	0.006	No	18	0.00007056	0.00003621	55.56	None	No	0.01	NP (NDs)
Antimony (mg/L)	MW-1607	0.0001	0.00002	0.006	No	18	0.00005889	0.00006703	16.67	None	No	0.01	NP (normality)
Arsenic (mg/L)	MW-1601	0.00524	0.00076	0.029	No	16	0.003374	0.002005	0	None	No	0.01	NP (normality)
Arsenic (mg/L)	MW-1602	0.00141	0.0005951	0.029	No	18	0.001184	0.000973	0	None	ln(x)	0.01	Param.
Arsenic (mg/L)	MW-1603	0.001363	0.001058	0.029	No	18	0.001211	0.0002516	0	None	No	0.01	Param.
Arsenic (mg/L)	MW-1606	0.00112	0.000949	0.029	No	18	0.001037	0.0001453	0	None	sqrt(x)	0.01	Param.
Arsenic (mg/L)	MW-1607	0.0193	0.00871	0.029	No	18	0.01656	0.01398	0	None	No	0.01	NP (normality)
Barium (mg/L)	MW-1601	0.07366	0.05583	2	No	16	0.06474	0.01371	0	None	No	0.01	Param.
Barium (mg/L)	MW-1602	0.05601	0.05185	2	No	18	0.05393	0.003441	0	None	No	0.01	Param.
Barium (mg/L)	MW-1603	0.0129	0.01104	2	No	18	0.01197	0.001536	0	None	No	0.01	Param.
Barium (mg/L)	MW-1606	0.949	0.767	2	No	18	0.8504	0.1027	0	None	No	0.01	NP (normality)
Barium (mg/L)	MW-1607	0.04066	0.03011	2	No	18	0.03539	0.008717	0	None	No	0.01	Param.
Beryllium (mg/L)	MW-1601	0.00005	0.000007	0.004	No	16	0.00002569	0.00002011	37.5	None	No	0.01	NP (normality)
Beryllium (mg/L)	**MW-1603**	**0.02033**	**0.01658**	**0.004**	**Yes**	**18**	**0.01846**	**0.003097**	**0**	**None**	**No**	**0.01**	**Param.**
Beryllium (mg/L)	MW-1606	0.000053	0.00001	0.004	No	18	0.00004078	0.00002704	38.89	None	No	0.01	NP (normality)
Beryllium (mg/L)	MW-1607	0.00005	0.00001	0.004	No	18	0.00003128	0.0000269	33.33	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1601	0.00002	0.000006	0.005	No	16	0.00001325	0.000006598	25	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1602	0.00002	0.000009	0.005	No	18	0.00001439	0.000005922	50	None	No	0.01	NP (normality)
Cadmium (mg/L)	MW-1603	0.0008431	0.000739	0.005	No	18	0.0007911	0.000086	0	None	No	0.01	Param.
Cadmium (mg/L)	MW-1606	0.00006	0.00001	0.005	No	18	0.00002033	0.00001081	77.78	None	No	0.01	NP (NDs)
Cadmium (mg/L)	MW-1607	0.00005	0.000009	0.005	No	18	0.00001889	0.000009418	72.22	None	No	0.01	NP (NDs)
Chromium (mg/L)	MW-1601	0.0005534	0.0003027	0.1	No	16	0.0004441	0.0002148	0	None	x^(1/3)	0.01	Param.
Chromium (mg/L)	MW-1602	0.0008614	0.0005381	0.1	No	18	0.0006998	0.0002672	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1603	0.0008611	0.0006439	0.1	No	18	0.0007525	0.0001795	0	None	No	0.01	Param.
Chromium (mg/L)	MW-1606	0.0009385	0.0003082	0.1	No	18	0.0006909	0.0006242	0	None	sqrt(x)	0.01	Param.
Chromium (mg/L)	MW-1607	0.0004955	0.0003024	0.1	No	18	0.0004083	0.0001737	0	None	sqrt(x)	0.01	Param.
Cobalt (mg/L)	MW-1601	0.001319	0.0006053	0.006	No	16	0.000962	0.0005482	0	None	No	0.01	Param.
Cobalt (mg/L)	MW-1602	0.0001201	0.00002651	0.006	No	18	0.0001357	0.000225	0	None	ln(x)	0.01	Param.
Cobalt (mg/L)	**MW-1603**	**0.0941**	**0.08454**	**0.006**	**Yes**	**18**	**0.08908**	**0.008284**	**0**	**None**	**x^2**	**0.01**	**Param.**
Cobalt (mg/L)	MW-1606	0.0003783	0.0001033	0.006	No	18	0.0003421	0.0003772	0	None	ln(x)	0.01	Param.
Cobalt (mg/L)	MW-1607	0.001461	0.001242	0.006	No	18	0.001351	0.0001815	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1601	1.598	0.9027	5	No	16	1.28	0.5897	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602	1.478	0.8006	5	No	18	1.139	0.5597	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603	7.098	4.982	5	No	18	6.04	1.749	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606	3.377	2.636	5	No	18	3.006	0.6129	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607	1.828	0.5926	5	No	18	1.418	1.53	0	None	x^(1/3)	0.01	Param.
Fluoride (mg/L)	MW-1601	0.2978	0.208	4	No	17	0.2529	0.07166	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1602	0.14	0.1	4	No	19	0.1211	0.03017	0	None	No	0.01	NP (normality)
Fluoride (mg/L)	MW-1603	1.036	0.8345	4	No	20	0.935	0.177	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1606	0.2235	0.1892	4	No	19	0.2063	0.02929	0	None	No	0.01	Param.
Fluoride (mg/L)	MW-1607	0.07317	0.0584	4	No	19	0.06579	0.01261	0	None	No	0.01	Param.
Lead (mg/L)	MW-1601	0.0001141	0.00003968	0.015	No	16	0.00008594	0.00007853	12.5	None	x^(1/3)	0.01	Param.
Lead (mg/L)	MW-1602	0.00009561	0.00004185	0.015	No	18	0.00007306	0.00005195	11.11	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1603	0.006116	0.004173	0.015	No	18	0.005218	0.001722	0	None	sqrt(x)	0.01	Param.
Lead (mg/L)	MW-1606	0.000862	0.00008	0.015	No	18	0.0003789	0.0005146	11.11	None	No	0.01	NP (normality)
Lead (mg/L)	MW-1607	0.0001876	0.0000712	0.015	No	18	0.0001666	0.0001886	5.556	None	ln(x)	0.01	Param.
Lithium (mg/L)	MW-1601	0.03345	0.02154	0.04	No	16	0.02749	0.009147	6.25	None	No	0.01	Param.
Lithium (mg/L)	MW-1602	0.01036	0.00565	0.04	No	18	0.008285	0.004305	5.556	None	sqrt(x)	0.01	Param.
Lithium (mg/L)	**MW-1603**	**0.2274**	**0.1805**	**0.04**	**Yes**	**18**	**0.2039**	**0.0388**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium (mg/L)	MW-1606	0.008853	0.003642	0.04	No	18	0.006865	0.004751	11.11	None	x^(1/3)	0.01	Param.
Lithium (mg/L)	MW-1607	0.006245	0.001009	0.04	No	18	0.004509	0.005078	11.11	None	sqrt(x)	0.01	Param.

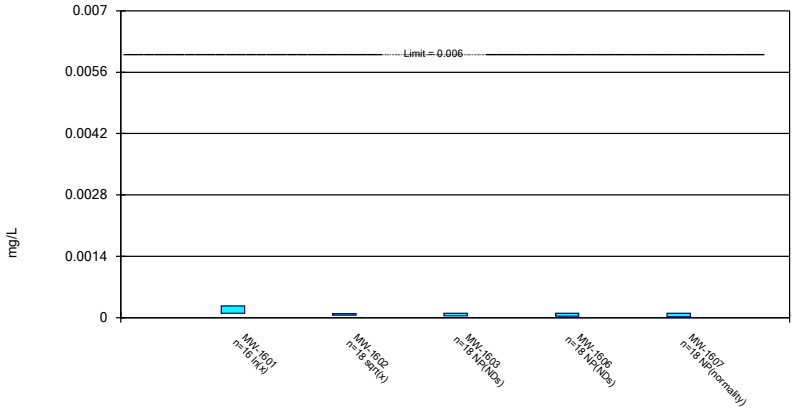
Confidence Interval - All Results

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP Printed 8/31/2021, 2:12 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Mercury (mg/L)	MW-1602	0.000005	0.000003	0.002	No	18	0.000004056	0.000001305	61.11	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1603	0.000005	0.000002	0.002	No	18	0.0000045	0.00000115	83.33	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1606	0.000005	0.000003	0.002	No	18	0.000004556	0.000001042	83.33	None	No	0.01	NP (NDs)
Mercury (mg/L)	MW-1607	0.000005	0.000004	0.002	No	18	0.000004944	2.4e-7	94.44	None	No	0.01	NP (NDs)
Molybdenum (mg/L)	MW-1601	0.02666	0.01363	0.1	No	16	0.02015	0.01002	0	None	No	0.01	Param.
Molybdenum (mg/L)	MW-1602	0.00244	0.001	0.1	No	18	0.001732	0.0007502	0	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1603	0.00025	0.00007	0.1	No	18	0.0001861	0.00008886	44.44	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1606	0.00084	0.00051	0.1	No	18	0.001109	0.00168	0	None	No	0.01	NP (normality)
Molybdenum (mg/L)	MW-1607	0.00083	0.00053	0.1	No	18	0.001107	0.001981	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1601	0.0005	0.00008	0.05	No	16	0.00024	0.0002466	0	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1602	0.001887	0.001121	0.05	No	18	0.001504	0.0006336	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1603	0.006012	0.004433	0.05	No	18	0.005222	0.001305	0	None	No	0.01	Param.
Selenium (mg/L)	MW-1606	0.0002	0.00006	0.05	No	18	0.0001233	0.00008395	11.11	None	No	0.01	NP (normality)
Selenium (mg/L)	MW-1607	0.0002	0.00009	0.05	No	18	0.0001483	0.0001462	5.556	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1601	0.0002	0.00001	0.002	No	16	0.00009481	0.00008838	37.5	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1602	0.0002	0.00002	0.002	No	18	0.00009944	0.0000927	44.44	None	No	0.01	NP (normality)
Thallium (mg/L)	MW-1603	0.001598	0.001322	0.002	No	18	0.00146	0.0002278	0	None	No	0.01	Param.
Thallium (mg/L)	MW-1606	0.0002	0.00003	0.002	No	18	0.0001361	0.00008493	61.11	None	No	0.01	NP (NDs)
Thallium (mg/L)	MW-1607	0.0002	0.00002	0.002	No	18	0.00009633	0.00007998	33.33	None	No	0.01	NP (normality)

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Antimony Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

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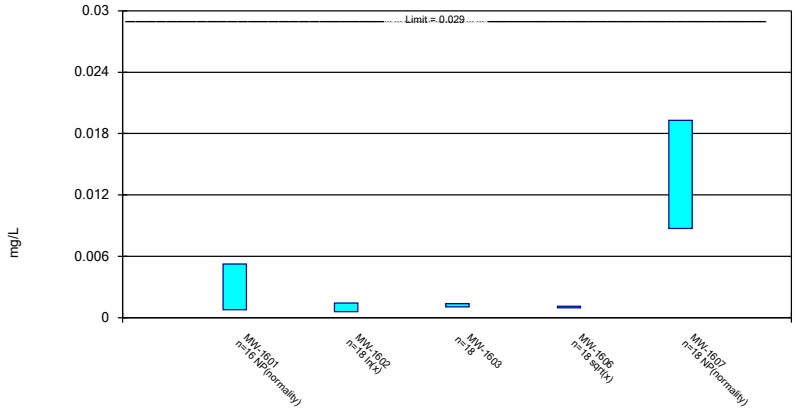
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



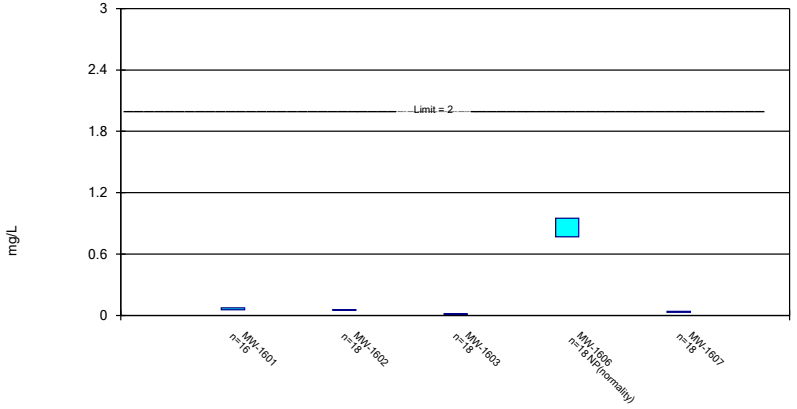
Constituent: Arsenic Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



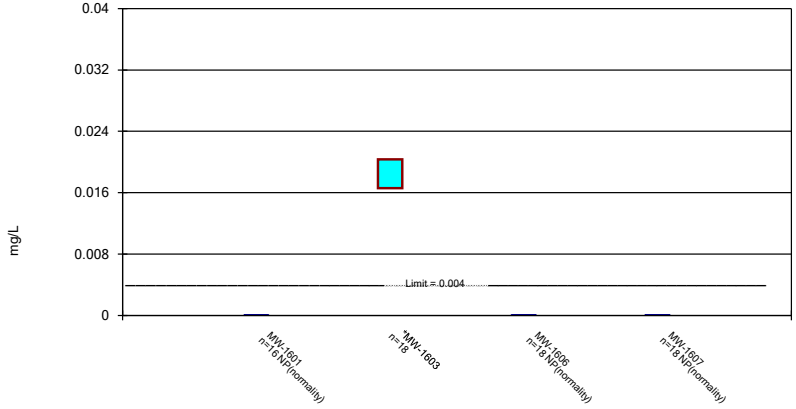
Constituent: Barium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

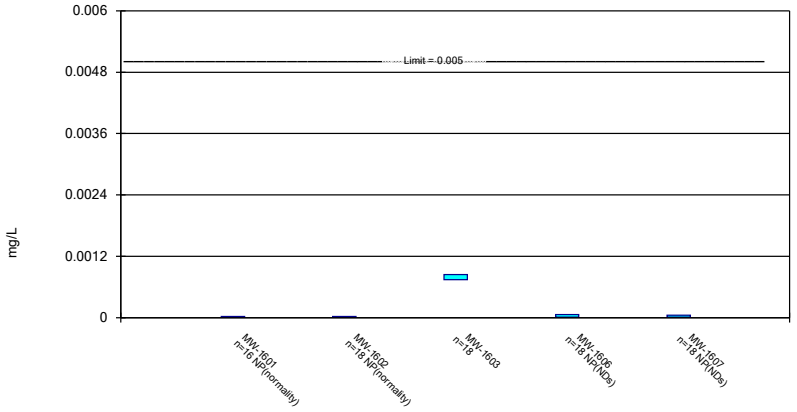


Constituent: Beryllium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals

Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

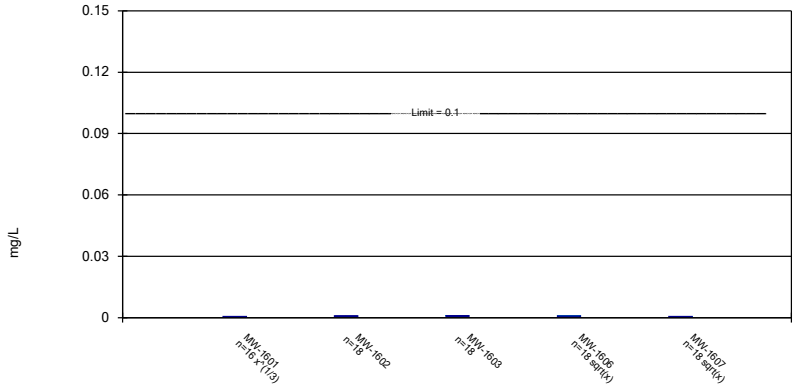


Constituent: Cadmium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

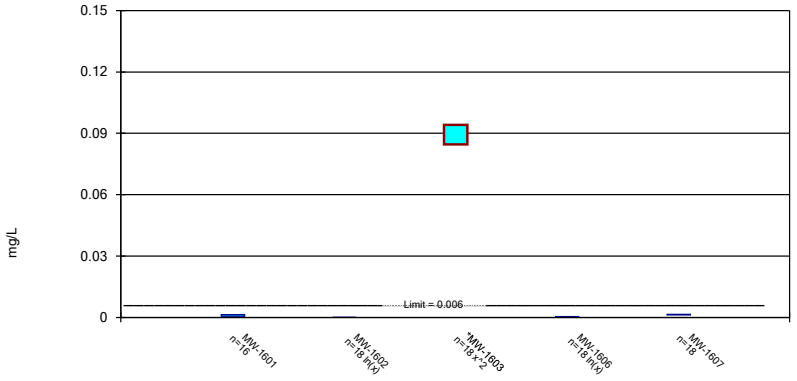


Constituent: Chromium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

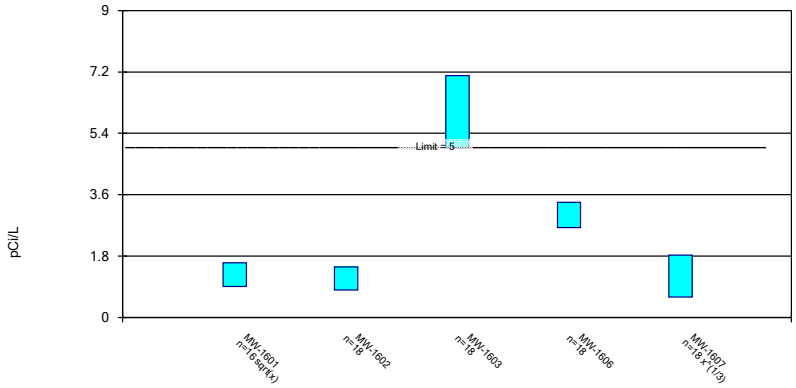


Constituent: Cobalt Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric Confidence Interval

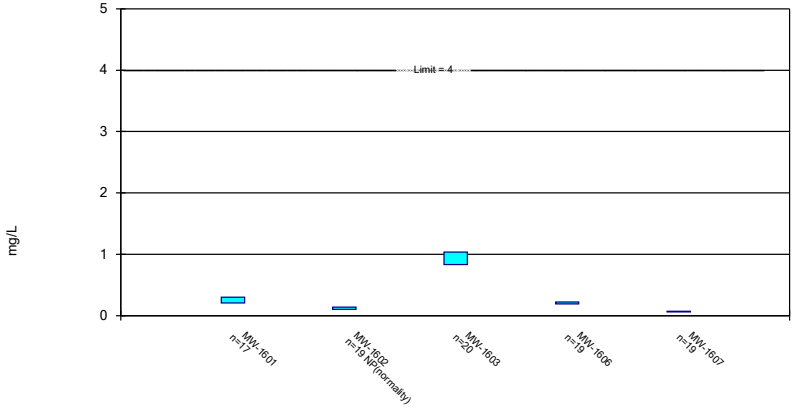
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

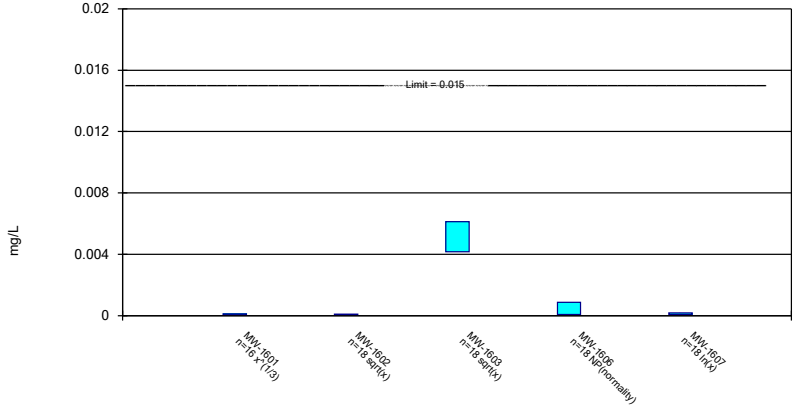


Constituent: Fluoride Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

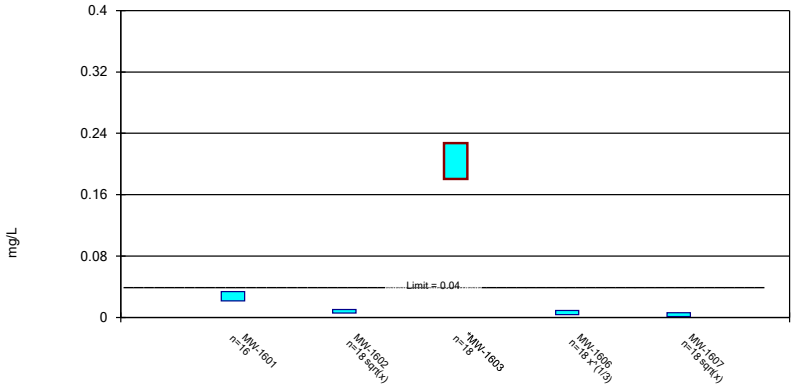


Constituent: Lead Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

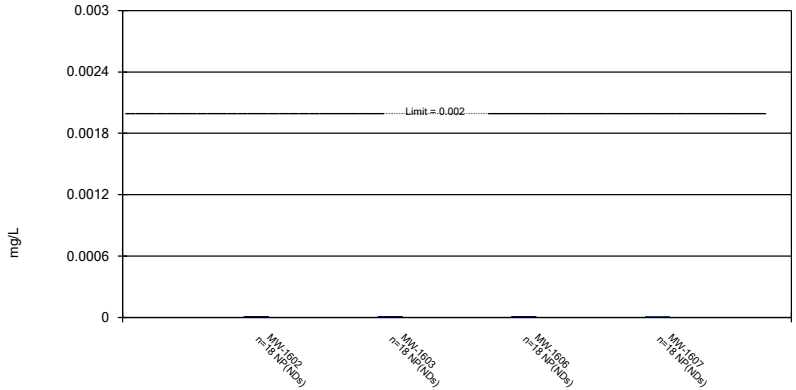


Constituent: Lithium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

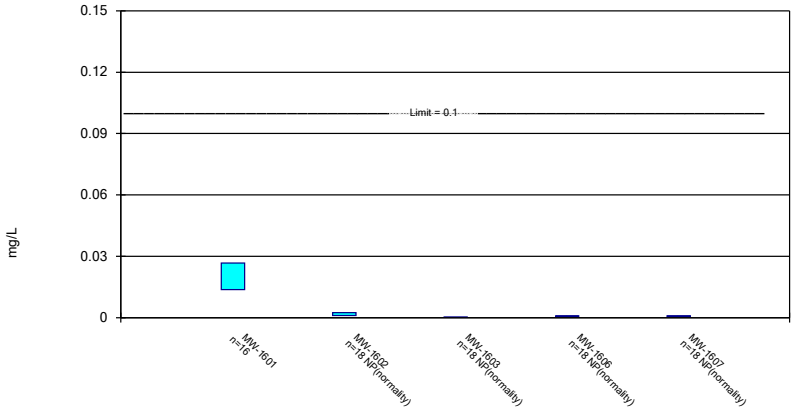
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Mercury Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

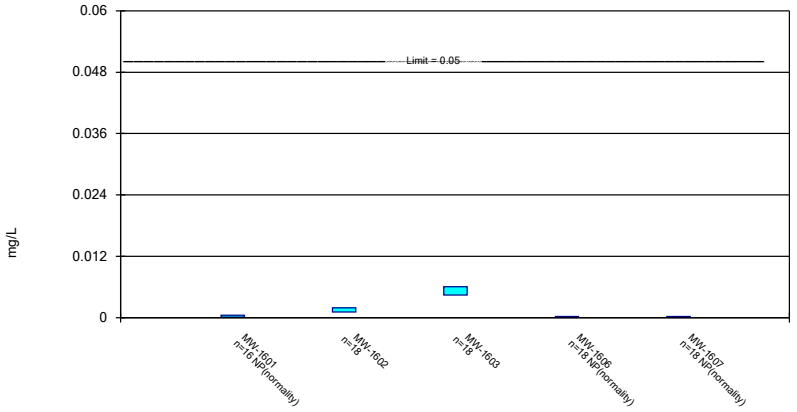


Constituent: Molybdenum Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

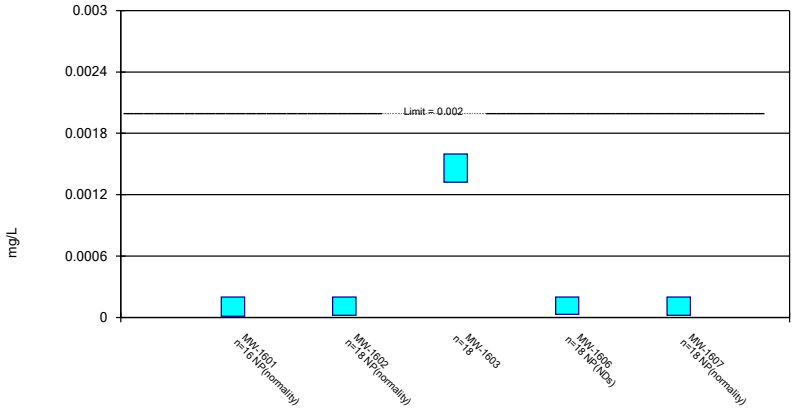


Constituent: Selenium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

Sanitas™ v.9.6.30f Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium Analysis Run 8/31/2021 2:06 PM View: Confidence Intervals
Big Sandy FAP Client: Geosyntec Data: Big Sandy FAP

APPENDIX 4—Alternative Source Demonstration Reports

The April 2021 and November 2021 alternative source demonstration reports concluding that an alternative source for the SSLs corresponding to the October 2020 and the March and June 2021 assessment monitoring sampling events at the CCR unit was identified follows.

Alternative Source Demonstration Addendum Report for the October 2020 Monitoring Data

Big Sandy Fly Ash Pond
Louisa, Kentucky

Prepared for:

American Electric Power

Prepared by:

EHS Support

April 2021

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Acronyms

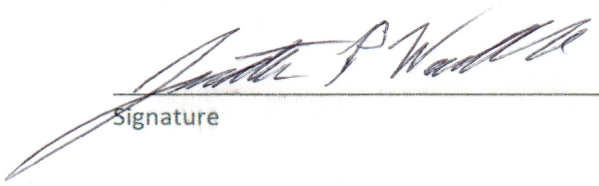
µg/L	micrograms per liter
AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
BSFAP	Big Sandy Fly Ash Pond
CCR	coal combustion residual
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
ft	foot/feet
GWPS	Groundwater Protection Standards
KGS	Kentucky Geological Survey
LCL	lower confidence level
mg/L	milligrams per liter
msl	mean sea level
MDL	method detection limit
ORP	oxidation-reduction potential
pCi/L	picocuries per liter
ppm	parts per million
SSL	statistically significant level
S.U.	standard units (pH)
TDS	total dissolved solids
UCL	upper confidence level
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Certification by Qualified Professional Engineer

I certify that the alternative source demonstration (ASD) conducted and presented within this report is accurate and appropriate for evaluating the groundwater monitoring data for the Big Sandy Fly Ash Pond Coal Combustion Residual (CCR) management area associated with the Big Sandy Power Plant located in Louisa, Kentucky. This ASD meets the requirements of the United States Environmental Protection Agency CCR Rule defined at 40 Code of Federal Regulations 257.95(g)(3)(ii).

Jonathan Patrick Waddell

Printed Name of Licensed Professional Engineer



Signature

#31526	KY	4/28/2021
License Number	Licensing State	Date

1 Introduction

EHS Support LLC ("EHS Support") was retained by American Electric Power (AEP) – Kentucky Power Company in December 2018 to conduct an alternative source demonstration (ASD) investigation for coal combustion residual (CCR) constituents in groundwater near the Big Sandy Fly Ash Pond (BSFAP). The BSFAP is associated with the Big Sandy Power Plant located in Louisa, Kentucky (EHS Support, 2019a). The ASD determined that groundwater in the vicinity of the BSFAP was not being impacted by CCR constituents from the BSFAP. The statistically significant levels (SSLs) of beryllium, cobalt, and lithium concentrations present in excess of the Groundwater Protection Standards (GWPS), which triggered the ASD investigation, were determined to be a result of the oxidation of coal seams that were intersected by the borehole and well screen for well MW-1603.

Since the initial ASD investigation was completed (incorporating data from September 2016 to October 2018), the following ASD investigations have been conducted:

- The second ASD investigation was conducted after the March 2019 groundwater monitoring data indicated continued SSLs of beryllium, cobalt, and lithium exceeding the GWPS at MW-1603 (EHS Support, 2019b).
- The third ASD investigation was conducted following continued detections of beryllium, cobalt, and lithium at SSLs above the GWPS in MW-1603 during the August 2019 sampling event (EHS Support, 2020). In addition, an SSL of radium 226 combined with radium 228 (hereafter radium 226/228) above its GWPS was measured for the first time in MW-1603 during the August 2019 sampling event (EHS Support, 2020).
- The fourth ASD investigation was conducted following continued detections of the four constituents (beryllium, cobalt, lithium, and radium 226/228) at SSLs above the GWPS in MW-1603 In March and June 2020 (EHS Support, 2021).

In October 2020, three constituents (beryllium, cobalt, and lithium) were detected at SSLs above the GWPS in MW-1603, thus requiring the ASD addendum investigation presented in this report. This ASD addendum investigation has been prepared per the requirements of the United States Environmental Protection Agency (USEPA) CCR Rule (40 Code of Federal Regulations [CFR] §257.95). The concentrations of beryllium, cobalt, and lithium in MW-1603 groundwater were determined herein to result from Type IV natural variations in groundwater (ASD types are discussed in **Section 3.1**). This conclusion was reached by examining analytical results for compounds detected at SSLs in the context of the broader list of CCR constituents analyzed at the Site.

1.1 Objectives

The objective of this ASD investigation is to assess groundwater monitoring data collected in compliance with the CCR Rule, as allowed under paragraph 40 CFR §257.95(g)(3)(ii) of the CCR Rule. This part of the CCR Rule allows AEP to determine whether the source(s) for SSLs of beryllium, cobalt, and lithium exceeding the GWPSs, as reported in groundwater monitoring well MW-1603, are associated with the CCR unit; or alternatively if the SSL resulted from an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

1.2 Lines of Evidence

This fifth ASD investigation for the BSFAP has been conducted to further evaluate potential alternate sources or reasons for the continuing detection of SSLs of beryllium, cobalt, and lithium in groundwater samples from monitoring well MW-1603.

A potential alternate source was previously identified in the prior four ASD investigations (EHS Support, 2019a, 2019b, 2020, and 2021), based on the following lines of evidence:

- A lack of exceedances and increasing trends of primary indicators of CCR.
- Constituent concentrations in BSFAP water lower than those of the corresponding constituent observed in groundwater from MW-1603.
- Major ion chemistry was not indicative of mixing between BSFAP water and groundwater.

For the purposes of this ASD addendum investigation, constituents were identified that would serve as a primary indicator for CCR. A primary indicator must meet **both** of the following criteria:

1. Constituent typically has a high concentration in CCR leachate, relative to background, such that it is expected to have an elevated concentration in the event of a release.
2. Constituent is unreactive and has high mobility in groundwater, such that it is expected to be at the leading edge of the plume. Consequently, the constituent will have elevated concentrations relative to background across the entire area of the plume.

As boron and sulfate are primary indicators for CCR (Electric Power Research Institute [EPRI], 2012) and have previously been evaluated, they have been re-evaluated herein as primary indicators for this ASD investigation. In addition, chloride is used as a primary indicator for this ASD. Other potential indicators that were evaluated in this ASD investigation include potassium, sodium, fluoride, molybdenum, and bromide.

2 Project Background

A detailed description of Site location, history, and geology was previously provided in the *Alternative Source Demonstration Report for Beryllium, Cobalt and Lithium, Big Sandy Fly Ash Pond, Louisa, Kentucky* (EHS Support, 2019a). Attached **Figure 1** and **Figure 2** show the Site layout and groundwater monitoring network, respectively.

To support and provide context to this ASD addendum investigation, the following sections describe the groundwater monitoring network and groundwater monitoring.

2.1 Groundwater Monitoring Network Evaluation

On behalf of AEP, Geosyntec Consultants, Inc. ("Geosyntec") conducted an assessment of the groundwater monitoring network in the uppermost aquifer associated with the BSFAP (Geosyntec, 2016). Geosyntec determined that the hydrostratigraphy in the vicinity of the BSFAP is characterized by an interconnected water-bearing system comprised of Pennsylvanian-aged bedrock (of the Breathitt Group, Conemaugh Formation) and Quaternary alluvium. The Conemaugh Formation and Breathitt Group consists of sandstones, siltstones, shale, and coal that may grade laterally and vertically into one another. The overlying Quaternary alluvium deposits include sandy lean clay to silty sand and gravel at the bottom of the Horseford Creek valley and the floodplain of Blaine Creek. Based on these hydrogeologic conditions, Geosyntec defined the interconnected water-bearing system of the fractured bedrock and alluvium as the uppermost aquifer for the BSFAP CCR unit. This determination was based on the presence of groundwater in numerous monitoring wells screened in the water-bearing units (fractured bedrock and alluvium), the recovery of these wells during pumping and development, and a potentiometric surface generally consistent with Site topography and surface water elevations.

To assess the upper water-bearing aquifer (fractured bedrock and alluvium), Geosyntec defined the groundwater detection monitoring network with 10 groundwater monitoring wells (Geosyntec, 2016). Of these, six monitoring wells (MW-1011, MW-1012, MW-1203, MW-1601, MW-1602, and MW-1603) are screened in fractured sandstone and shale layers of the Breathitt formation. The remaining four monitoring wells (MW-1604 through MW-1607) are screened in the alluvium. The location of each groundwater monitoring well within the uppermost aquifer is shown in **Figure 2**.

Three of the monitoring wells (MW-1011, MW-1012, and MW-1203) screened in bedrock were installed on the hillside slopes upgradient of the BSFAP to support background monitoring. Three monitoring wells (MW-1601, MW-1602, and MW-1603) were installed in bedrock located downgradient of the BSFAP and used for compliance monitoring. Two monitoring wells (MW-1604 and MW-1605) were screened in alluvium and are used for background monitoring; while the remaining two monitoring wells (MW-1606 and MW-1607), screened in alluvium and located below the Main Dam, are used for compliance monitoring.

As bedrock monitoring well MW-1603 is the focus of this ASD, the boring log was reviewed (EHS Support, 2019a). The boring log descriptions show alternating sequences of yellowish-brown sandstones and bluish-gray to black shales (beginning at 13 feet below ground surface [ft bgs] and extending to the bottom of the boring at 39.5 ft bgs) that are indicative of the upper portion of the Princess Formation (uppermost formation in the Breathitt Group [Rice and Hiett, 1994]). Within the screened interval (22 to

32 ft bgs), the shale at a depth of 24 to 25 ft bgs was described as "intensely fractured, black, wet, nearly all organic matter; slight coaly texture." This depth (24 to 25 ft bgs) corresponds with the measurements by the Kentucky Geological Survey (KGS) of the elevation of the Princess Number 8 coal, which is present within the Princess Formation of the Breathitt Group (EHS Support, 2019a). Coal or "organic material" was also visually identified during soil boring logging in three other monitoring wells (MW-1608, MW-1609, and MW-1610) in the network (**Table 2-1**) at the same approximate elevation, between 630 and 650 feet, that matches the KGS measurements. No coal was documented in this section in three monitoring wells (MW-1601, MW-1602, and MW-1611). Four monitoring wells (MW-1604, MW-1605, MW-1606, and MW-1607) were installed below this coal layer in the sedimentary sequence.

Table 2-1 Screened Interval of Monitoring Wells

Well/Boring	Surface Elevation (ft msl)	Screened Interval (ft msl)	Coal or "Organics" Description at ~632-650 ft
MW-1601	713.8	646.8-636.8	No coal logged
MW-1602	711.6	632.1-622.1	No coal logged
MW-1603	673.2	651.2-641.2	Yes, at a depth of ~25 ft (Elevation of 648 ft)
MW-1604	553.1	513.1-503.1	---
MW-1605	554.4	538.9-528.9	---
MW-1606	551	513.1-503.1	---
MW-1607	542.2	518.7-508.7	---
MW-1608	716.2	606.6-596.6	Yes, at depths of ~74 ft (Elevation of 642 ft), ~ 75.3 to 76.6 ft (Elevation of 641 to 640 ft), and ~ 83.5 to 84 ft (Elevation of 633 to 632 ft)
MW-1609	~728	---	Yes, at a depth of ~79 ft (Elevation of 649 ft)
MW-1610	~716	---	Yes, at a depth of ~81 ft (Elevation of 635 ft)
MW-1611	~711	606-596	No coal logged

--- = Boring advanced below the coal interval
~ = Approximate
ft = feet
msl = mean sea level

Geosyntec determined that the groundwater monitoring well network described above meets the requirements of 40 CFR §257.91, as it consists of a sufficient number of wells installed at the appropriate locations and depths to yield groundwater samples from the uppermost aquifer, which accurately represents the quality of background groundwater and groundwater passing the waste boundary of the BSFAP.

2.2 Groundwater Monitoring

AEP has conducted groundwater monitoring of the uppermost aquifer to meet the requirements of the CCR Rules. Groundwater monitoring generally included the following activities:

- Collection of groundwater samples and analysis for Appendix III and Appendix IV constituents, as specified in 40 CFR §257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan* (AEP and EHS Support, October 2016).
- Completion of validation tests for groundwater data, including tests for completeness, valid values, transcription errors, and consistent units.
- Establishment of background data for each Appendix III and Appendix IV constituent.
- Initiation of detection monitoring sampling and analysis.
- Evaluation of the groundwater data using a statistical process per 40 CFR §257.93, which was prepared, certified, and posted to AEP's CCR website in April 2017 in AEP's *Statistical Analysis Plan* (Geosyntec, 2017); the statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance"; USEPA, 2009).
- Initiation of assessment monitoring sampling and analysis.
- Completion of statistical data evaluation and determination of GWPS.

Assessment monitoring for the BSFAP has been conducted on a semi-annual basis since April 2018. The groundwater data collected up until and including the October 2020 monitoring events have been used for this ASD addendum investigation. Assessment monitoring data for well MW-1603 in October 2020 is provided in **Table 2-2**.

Table 2-2 MW-1603 October 2020 Groundwater Quality

Analyte	Unit	October 2020 Value
Antimony	µg/L	<0.02
Arsenic	µg/L	1.12
Barium	µg/L	14.6
Beryllium	µg/L	17.5
Boron	mg/L	0.05
Bromide	mg/L	<0.04
Cadmium	µg/L	0.87
Calcium	mg/L	94.5
Chloride	mg/L	4.1
Chromium	µg/L	0.743
Cobalt	µg/L	90.5
Fluoride	mg/L	0.47
Lead	µg/L	4.85
Lithium	mg/L	0.165

Analyte	Unit	October 2020 Value
Mercury	µg/L	<0.002
Molybdenum	µg/L	<0.4
pH	S.U.	4.09
Potassium	mg/L	4.29
Radium 226/228	pCi/L	2.681
Residue, Filterable, TDS	mg/L	1,020
Selenium	µg/L	5.8
Sodium	mg/L	21.1
Sulfate	mg/L	794
Thallium	µg/L	1.82

< = non detect at method detection limit (MDL)
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = constituent not analyzed
pCi/L = picocuries per liter
S.U. = standard units
TDS = total dissolved solids

AEP submitted the October 2020 monitoring data to Groundwater Stats Consulting, LLC for statistical analysis. A GWPS was established for each of the Appendix IV parameters. Confidence intervals, including lower confidence levels (LCLs) and upper confidence levels (UCLs), were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at an SSL above the GWPS. Based on this statistical analysis evaluating the October 2020 data, the following SSLs were identified at the BSFAP in MW-1603 (no other monitoring well had constituents exceeding a GWPS):

- LCL for beryllium exceeded the GWPS of 0.004 milligrams per liter (mg/L) at MW-1603 (0.0167 mg/L).
- LCL for cobalt exceeded the GWPS of 0.006 mg/L at MW-1603 (0.087 mg/L).
- LCL for lithium exceeded the GWPS of 0.04 mg/L at MW-1603 (0.194 mg/L).

3 Alternative Source Demonstration Requirements

3.1 Alternative Source Demonstration

Potential causes that may support an ASD include, but are not limited to, sampling causes (ASD Type I), laboratory causes (ASD Type II), statistical evaluation causes (ASD Type III), and/or natural variation causes (ASD Type IV). This ASD for the BSFAP is focused on assessing whether Type IV natural variations in groundwater could be the cause of the SSLs of beryllium, cobalt, and lithium reported for groundwater collected from monitoring well MW-1603 during the October 2020 sampling.

Historical groundwater monitoring data for MW-1603 is provided in **Table 1**(attached).

3.2 Assessment of Groundwater Monitoring Results

The following constituents will typically provide the information required for a complete ASD:

- Primary indicators (boron and sulfate) are evaluated for potential BSFAP leachate.
- Major ion concentrations (alkalinity, chloride, sulfate, calcium, magnesium, potassium, and sodium) in leachate and groundwater are used to evaluate whether downgradient groundwater chemistry remains representative of background groundwater chemistry. Major ion chemistry can also be used to evaluate natural variability due to seasonal changes or other causes.
- Field turbidity of groundwater is used as an indicator of the presence of suspended solids that may contribute to elevated concentrations of constituents monitored in unfiltered samples under the CCR Rule.
- pH of leachate and groundwater provides information on chemical reactions and potential mobility of constituents in groundwater.
- Dissolved oxygen, oxidation-reduction potential (ORP), iron, and manganese in groundwater are used as indicators of redox conditions. Redox changes can affect the chemical state and solubility of sulfate, in addition to trace elements including arsenic and selenium. For example, under strongly reduced conditions (ORP less than –200 millivolts at pH 7), sulfate can be reduced to form hydrogen sulfide or it can precipitate as iron sulfide, arsenic reduces to the more mobile arsenite species, and selenium reduces to the low-mobility selenite species.

Groundwater monitored at a CCR unit for compliance with the CCR Rule is a compilation of the history of all sources of water comingling at that particular monitoring well. Different sources may contribute to the presence and detection of some of the same constituents, making source identification challenging. The identification and use of water quality “signatures” can be used as a tool for deciphering the similarity between potential sources and the water quality at a specific monitoring point.

4 Alternative Source Demonstration Assessment

As stated within **Section 1.2**, the primary indicators for CCR leachate impacts to groundwater are boron and sulfate. In addition to these two constituents, chloride is also used as a primary indicator for this ASD. Other potential indicators that have been evaluated include potassium, sodium, fluoride, molybdenum, and bromide.

As identified in **Section 1.1**, SSLs of beryllium, cobalt, and lithium have been reported in groundwater samples above the GWPS from monitoring well MW-1603 in October 2020. The water quality signatures for well MW-1603 are discussed in **Section 4.3** and compared to the water quality of the BSFAP.

EPRI (2012) defines three tiers of investigation for evaluation of water quality signatures to determine if elevated concentrations represent a release from a CCR facility:

- Tier I: Trend Analysis and Statistics
- Tier II: Advanced Geochemical Evaluation Methods
- Tier III: Isotopic Analyses

Conversely, these tools can also be used to evaluate whether or not sources other than CCR are contributing to groundwater quality degradation.

The CCR Rule requires statistical analysis under assessment monitoring for the determination of SSLs above the GWPS. Many of the primary and potential indicator constituents listed for CCR (EPRI, 2017) are included in AEP's constituent list for the BSFAP groundwater monitoring programs, including primary constituents boron and sulfate. If there is an SSL without a corresponding increase in a primary indicator constituent (boron and usually sulfate for CCR), then this is a key line of evidence for an ASD.

4.1 Groundwater Data Analysis

Temporal plots are provided in the following subsections for well MW-1603. Each of the plots uses the following color-coding system:

- Red – indicates a concentration reported above the reporting limit.
- Orange – indicates a concentration reported below the reporting limit but greater than the method detection limit (MDL) (denoted as estimated "J" values).
- Green – indicates a concentration not detected at or above the MDL (denoted as "U"); results were conservatively plotted as the MDL.

The October 19, 2017 data for the BSFAP water is presented for comparison. The BSFAP water signature is plotted as a constant concentration in **Figure 4-1** to **Figure 4-12**. As the BSFAP accepted fly ash before 1970, it is probable that BSFAP water quality has historically varied over time. However, since the BSFAP ceased accepting fly ash before 2016, the water quality is anticipated to be more stable; therefore, the October 19, 2017 data provides a reasonable representation of current BSFAP conditions.

Groundwater quality for well MW-1603 is plotted on the primary y-axis and BSFAP water quality is plotted on the secondary y-axis, due to the differences in concentration between the groundwater quality in the vicinity of MW-1603 and the BSFAP water, as labeled in **Figure 4-1** to **Figure 4-12**

4.1.1 Primary Indicators

Temporal plots for primary indicators boron, sulfate, and chloride reported in groundwater monitoring well MW-1603 are provided in **Figure 4-1** to **Figure 4-3**, respectively.

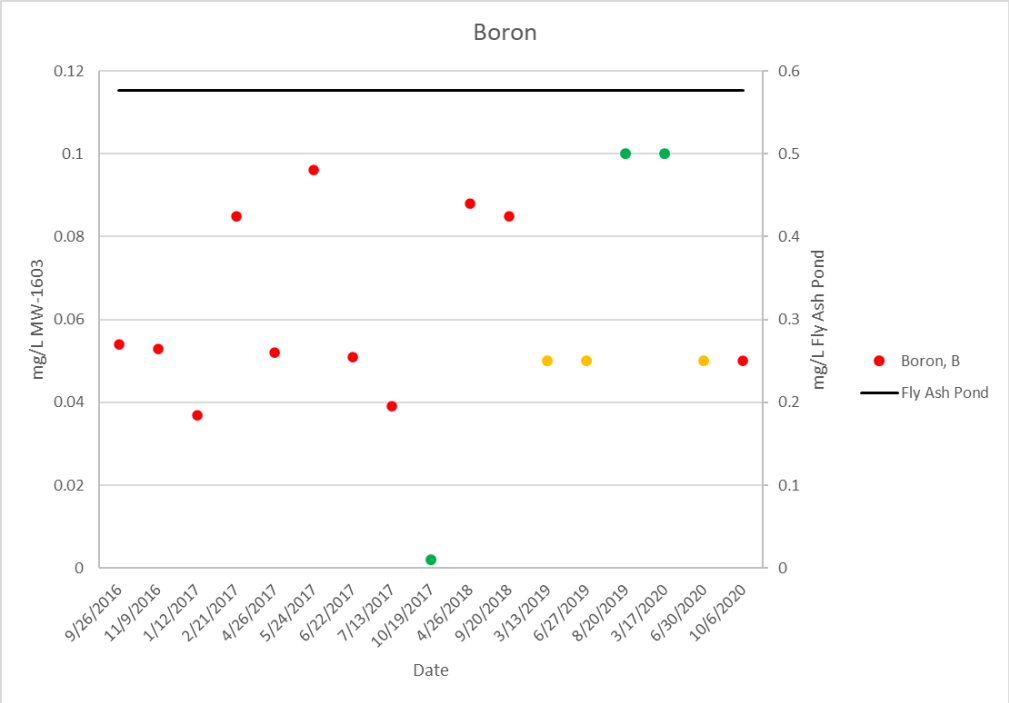


Figure 4-1 MW-1603 Boron Concentrations

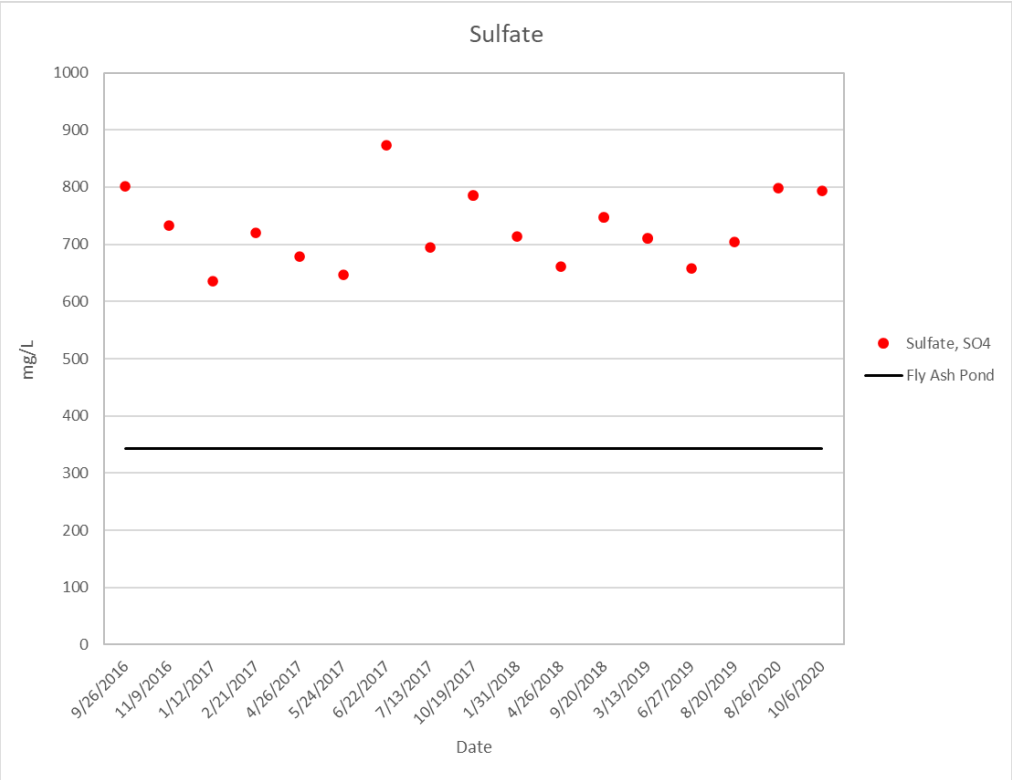


Figure 4-2 MW-1603 Sulfate Concentrations

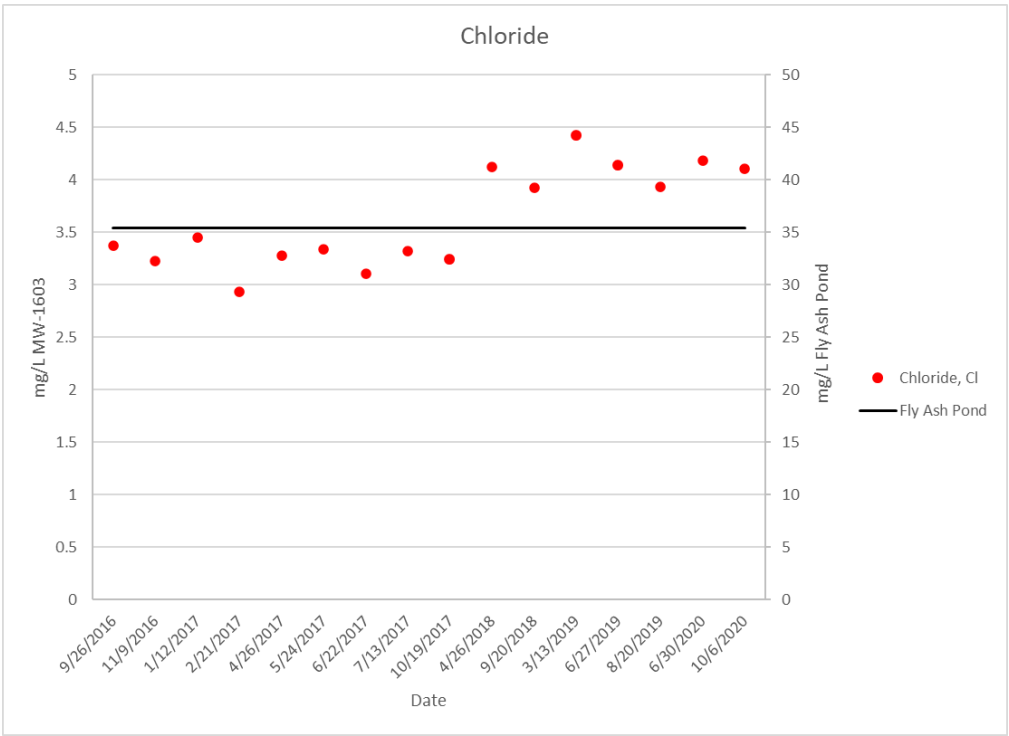


Figure 4-3 MW-1603 Chloride Concentrations

Boron and sulfate concentrations in MW-1603 have remained relatively stable within the same order of magnitude, with minor variability over the monitoring period (September 2016 through October 2020). Chloride concentrations in MW-1603 remained relatively stable between 2.93 and 3.24 mg/L until April 2018, after which a slight increase is observed that has remained stable between 3.92 and 4.42 mg/L. Boron and chloride in water from the BSFAP are present at higher concentrations than in groundwater at MW-1603, whereas sulfate is present at higher concentrations in groundwater at MW-1603 than in water from the BSFAP.

In summary, there were negligible changes in primary indicator concentrations since the last review in January 2021.

4.1.2 Potential Indicators

Temporal plots for potential indicators (bromide, fluoride, molybdenum, potassium, and sodium) reported in groundwater monitoring well MW-1603 are provided in **Figure 4-4** to **Figure 4-8**, respectively.

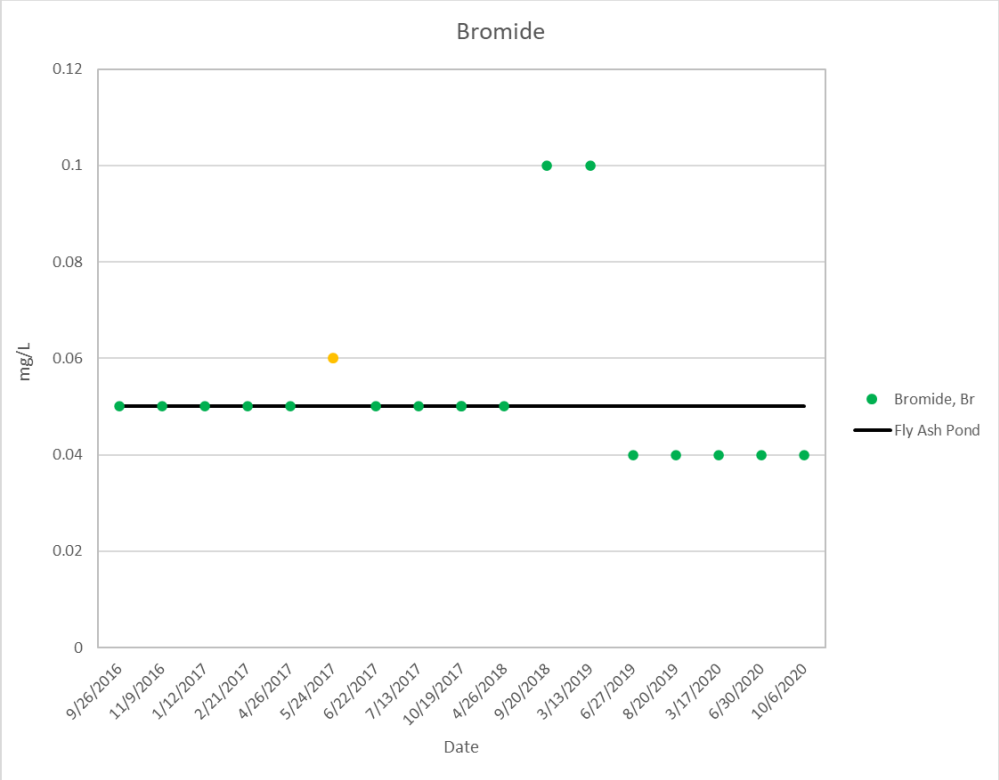


Figure 4-4 MW-1603 Bromide Concentrations[1]

[1] Bromide is below the level of reporting for the BSFAP water, with an MDL of less than 0.05 mg/L for this sample result.

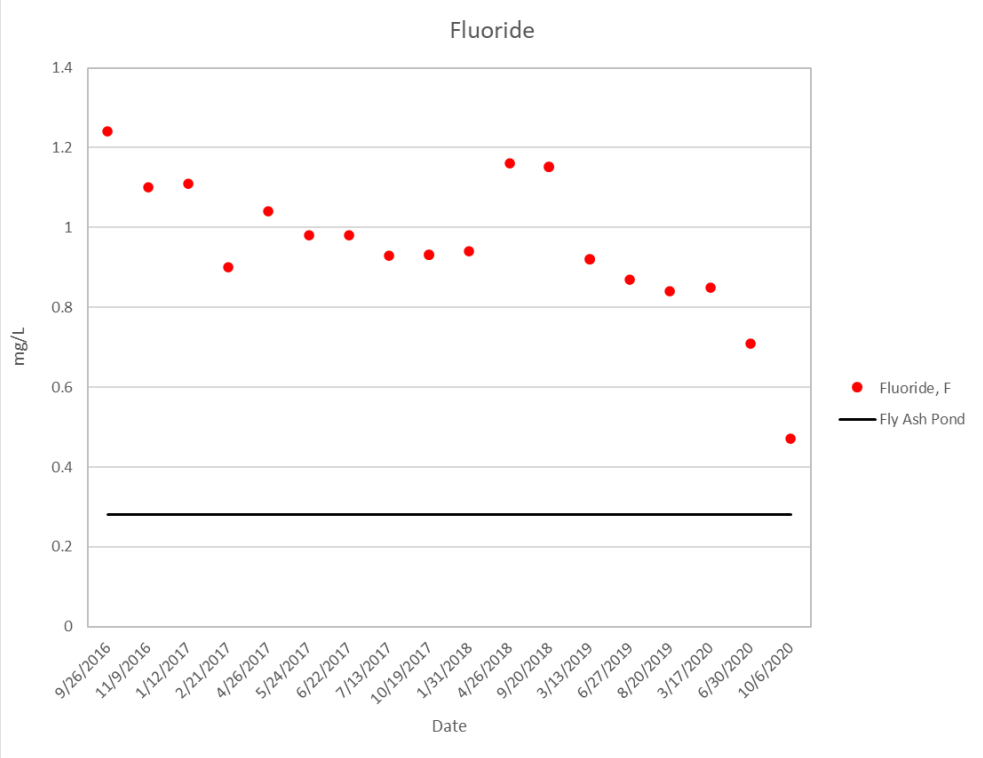


Figure 4-5 MW-1603 Fluoride Concentrations

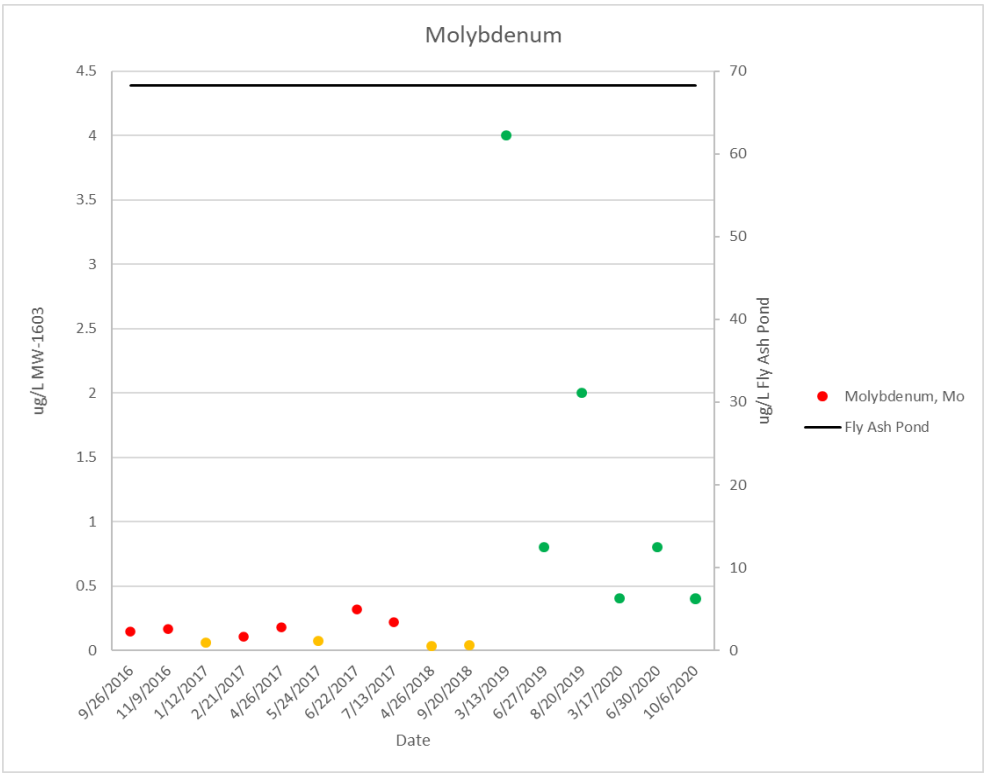


Figure 4-6 MW-1603 Molybdenum Concentrations

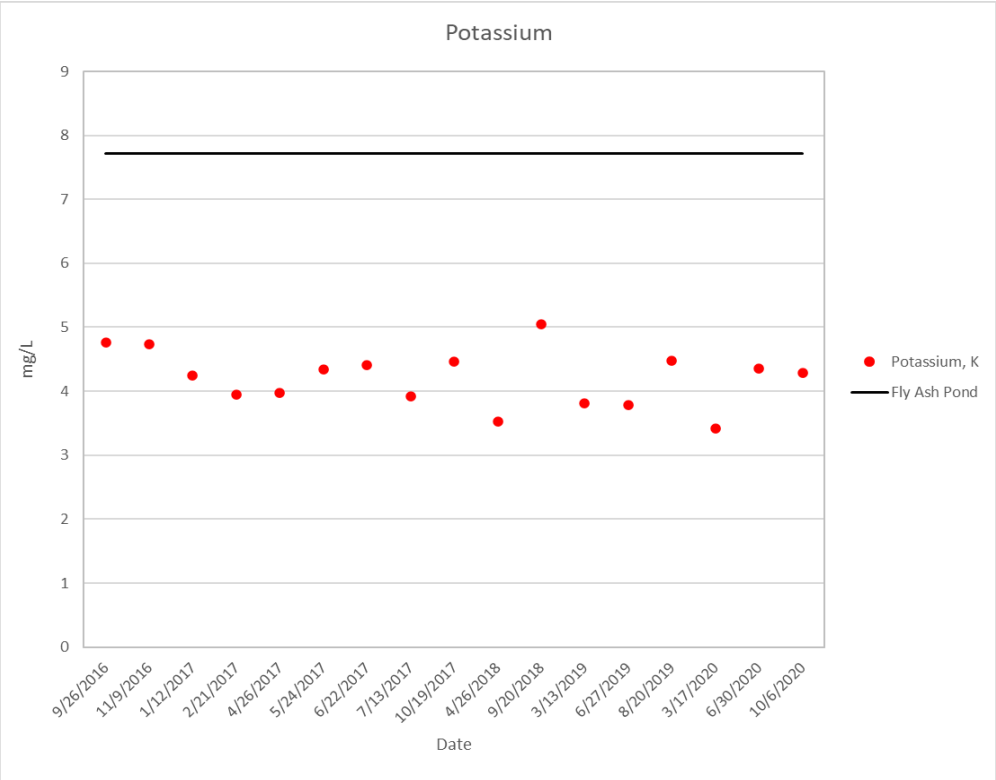


Figure 4-7 MW-1603 Potassium Concentrations

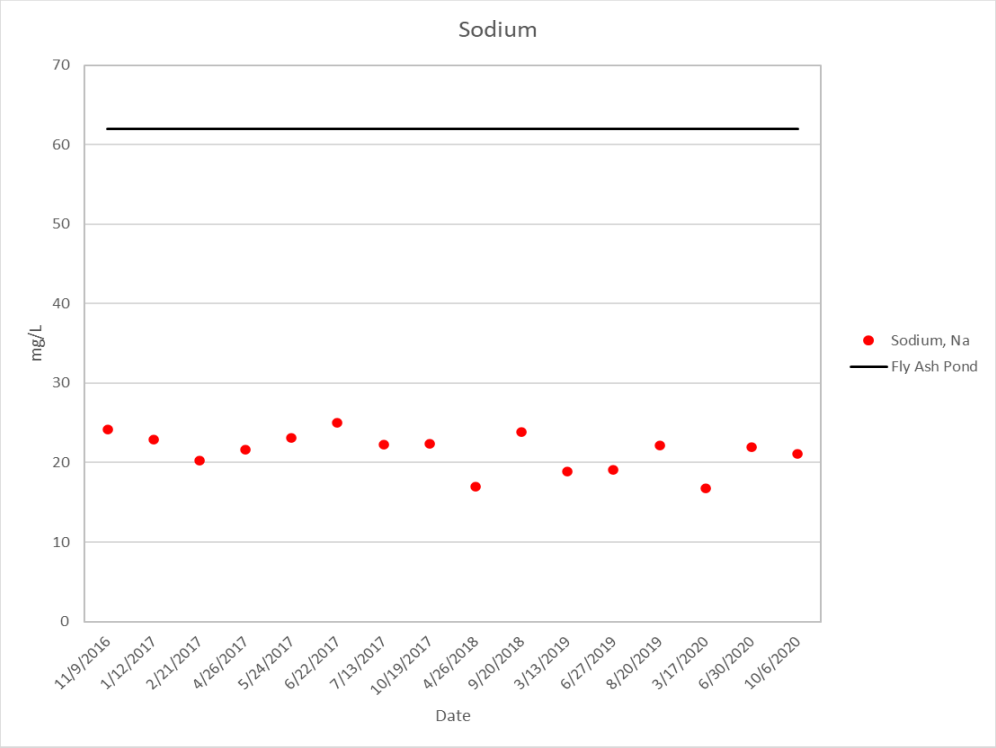


Figure 4-8 MW-1603 Sodium Concentrations

Molybdenum, potassium, and sodium concentrations in groundwater from MW-1603 have consistently been lower than water from the BSFAP. As seen in **Figure 4-6**, molybdenum was last detected above MDL in MW-1603 in September 2018. The recent variation in molybdenum concentrations, as shown in green, is due to variable MDLs achieved via laboratory analysis. Fluoride concentrations in groundwater from MW-1603 have consistently been higher than water from the BSFAP but have been at historical low concentrations for the past two sampling events in 2020, following an overall declining concentration trend with time. Bromide concentrations in groundwater from MW-1603 have been mostly below the MDL. Bromide was detected only once since the initial background monitoring events. When bromide was detected (May 2017) it was 0.06 mg/L, or slightly above the less than 0.05 mg/L reported for BSFAP water in May 2017.

A comparison of the pH of BSFAP water and groundwater from MW-1603 is provided in **Figure 4-9**. The figure illustrates the substantial difference in pH between the pond water and groundwater of approximately three to five standard units. This is using the standard (logarithmic) pH scale which converts to a factor of 1,000 to 100,000 difference in the hydrogen ion concentration between the BSFAP and MW-1603. The pH in MW-1603 is acidic with values generally between 3 and 4 standard pH units, whereas the BSFAP water is alkaline at a pH of approximately 8 standard units.

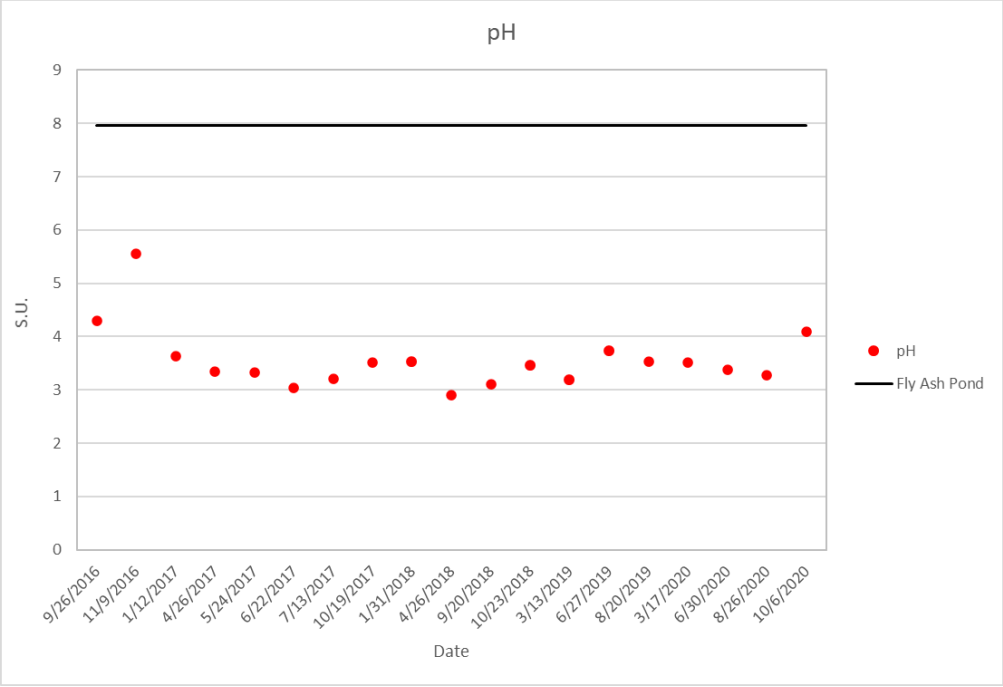


Figure 4-9 MW-1603 pH Values

In summary, there were negligible changes in potential indicator concentrations since the last review in January 2020.

4.1.3 ASD Constituent Trends

Temporal plots for the ASD constituents, beryllium, cobalt, and lithium reported in groundwater monitoring well MW-1603 are provided in **Figure 4-10** to **Figure 4-12**, respectively.

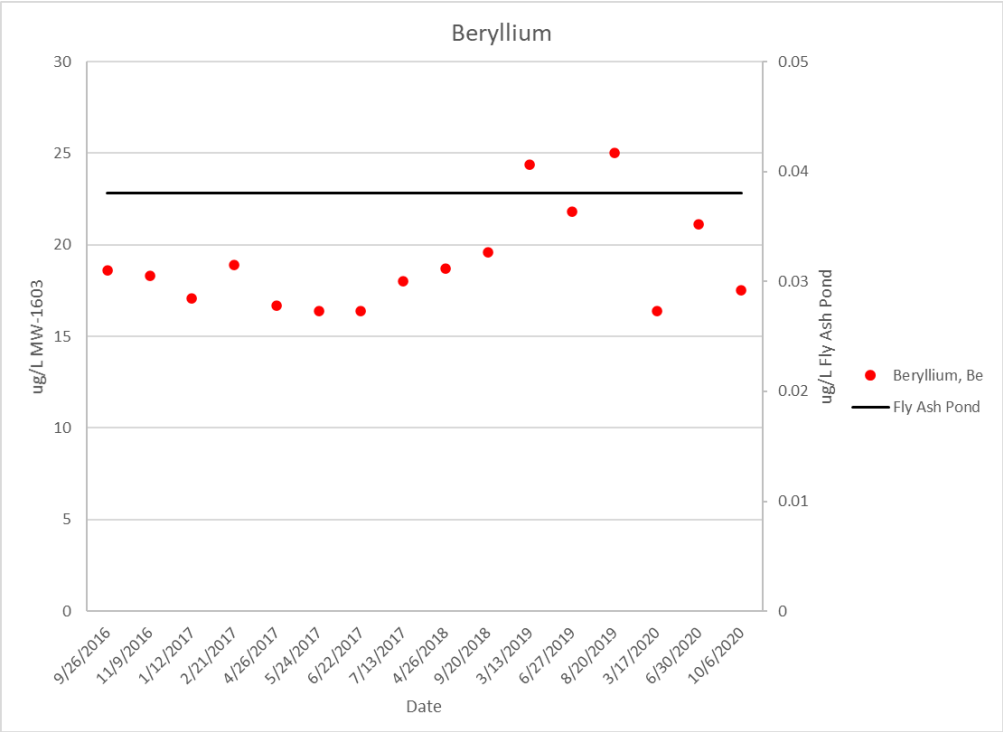


Figure 4-10 MW-1603 Beryllium Concentrations

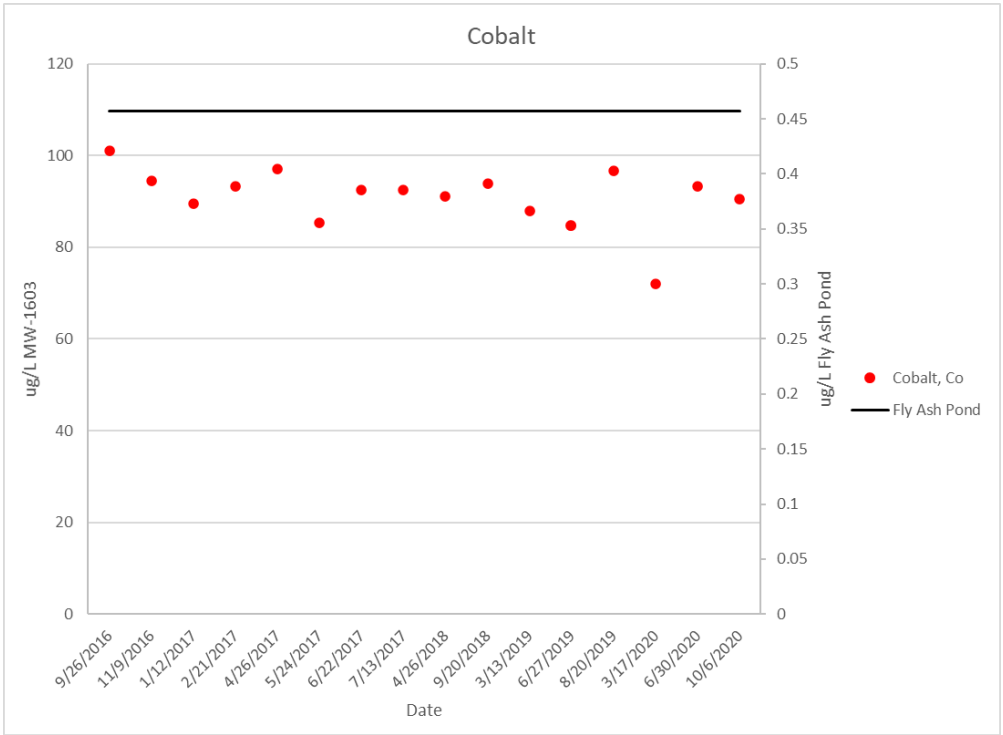


Figure 4-11 MW-1603 Cobalt Concentrations

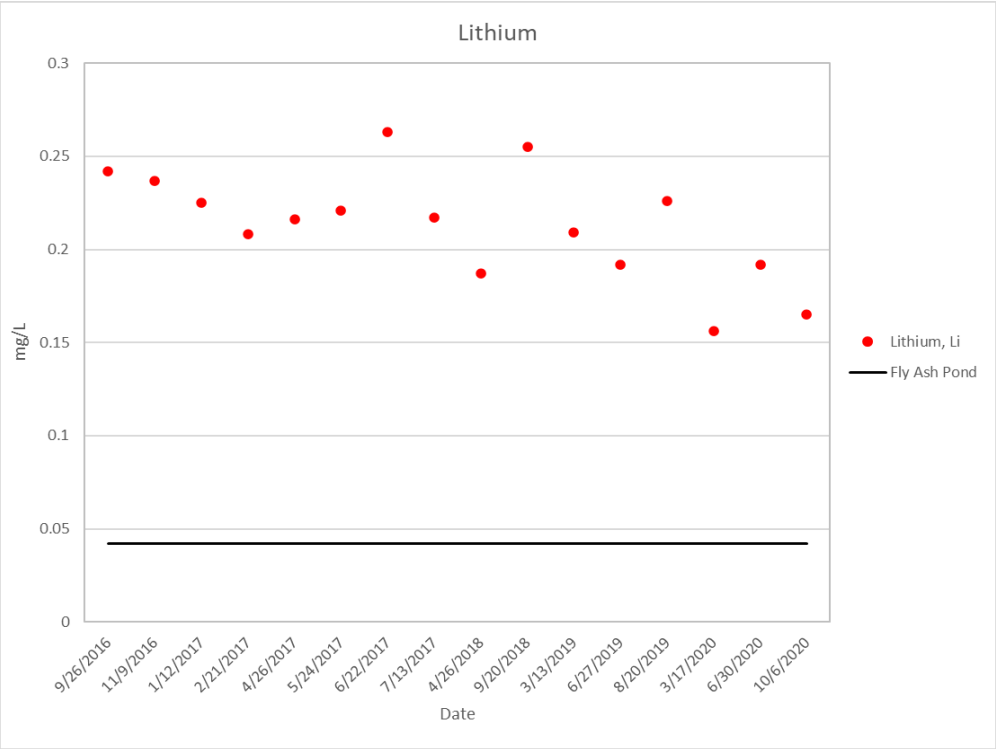


Figure 4-12 MW-1603 Lithium Concentrations

Beryllium, cobalt, and lithium concentrations are higher in groundwater from MW-1603 compared to BSFAP water, indicating that the source of beryllium, cobalt, and lithium is not associated with the BSFAP.

4.1.4 Indicator Analysis Findings

Based on the temporal plots for primary indicators, potential indicators, and ASD constituents, it is considered unlikely that CCR constituents from the BSFAP are influencing the chemistry of surrounding groundwater. This is based on the primary indicator sulfate, potential indicators fluoride and bromide, and the ASD constituent's beryllium, cobalt, and lithium all being present at higher concentrations in surrounding groundwater in comparison to the BSFAP water (EHS Support, 2019a). As the concentrations of these constituents in surrounding groundwater are higher, it is unlikely that there is a concentration gradient extending from the BSFAP into groundwater. It is more likely that an alternate source is contributing to the higher concentrations observed in groundwater.

In summary, based on the analyses presented above, no trends in the MW-1603 groundwater dataset suggest that CCR constituents are migrating from the BSFAP into groundwater.

4.2 Tier I Evaluation - Statistical Evaluation

Statistical evaluations of analytes have been conducted previously (EHS Support, 2019a, 2019b, 2020, and 2021). The evaluations concluded that groundwater in the vicinity of MW-1603 is statistically the

same as that which the United States Geological Survey (USGS) reported for regional background (Ruppert et al., 2000) for arsenic, boron, calcium, chloride, chromium, fluoride, molybdenum, potassium, sodium, and strontium. The box plots from the earlier ASD investigation (EHS Support, 2019a) also show a difference between well MW-1603, BSFAP water, and/or the regional background for pH, alkalinity, barium, cobalt, lead, lithium, magnesium, selenium, and sulfate. No background values were provided by the USGS for beryllium, chromium, lead, lithium, molybdenum, and selenium.

Updated box and whisker plots for constituents reported in MW-1603 groundwater are provided in **Appendix A**. Plots for pH, fluoride, and cobalt exhibit outliers which are calculated to be outside the range of distribution (refer to Figure A-8, Figure A-4, and Figure A-10 of **Appendix A**, respectively).

It is likely that the acidic pH conditions identified at MW-1603, relative to regional background, are driving the observed SSLs. The geochemical conditions within well MW-1603, including a strongly acidic pH, low alkalinity, and high sulfate, are indicative of conditions similar to those observed at acid mine drainage sites. At MW-1603, the geochemical conditions have developed due to the presence of the sulfide-bearing Princess coal seams being intersected by the screened interval of the monitoring well (discussed in EHS Support, 2019a). The combination of the well installation and effects of well sampling have resulted in development of aerobic and water-saturated conditions within the coal seams. These conditions have led to a lowering of the pH through oxidation of sulfides present in the coal which has subsequently enhanced rock dissolution. Enhanced host rock dissolution at MW-1603 is evident from the much higher total dissolved solids (TDS) values at this location in comparison to groundwater samples from the other Site wells, including water from the BSFAP. In addition to an abundance of sulfides, rock and coal samples from the Princess Formation in Kentucky have been shown to contain parts per million (ppm) levels of beryllium, cobalt, and lithium (Hood et al., 2020), thereby, providing a viable source for the observed SSLs.

For context, studies have demonstrated that the pH of groundwater in contact with fly ash is maintained alkaline (pH 7 to 10) for decades due to buffering by reactions with carbonates and amorphous aluminum silicates in the fly ash (Twardowska et al., 2003). The BSFAP water is consistent with this range, with a pH of 7.97. Consequently, the acidic pH of groundwater identified at MW-1603 is compelling evidence that groundwater at this location has not mixed with and is not representative of water from the BSFAP.

4.3 Tier II Evaluation - Geochemical Evaluation

A simple analysis of primary and potential indicator constituents (as performed in **Section 4.1**) may not provide the lines of evidence required for a robust ASD investigation. It is recognized that naturally occurring indicator constituents and upgradient sources may have an additional influence on groundwater quality. Spatially across a Site, groundwater quality may be observed to change due to chemical interactions with the aquifer matrix. EPRI (2012) recommended the use of more sophisticated methods for multiple parameters over multiple locations, such as ion ratios and ternary plots.

4.3.1 Ion Ratios

The development of ion ratios involves first selecting two non-competing, non-sorbing constituents (boron and chloride). The ratios of these constituents are then compared spatially across the Site and a

judgment is made as to whether the hydraulically downgradient groundwater is similar to the background groundwater quality.

The calculation of ion ratios was conducted using median concentrations of the indicator species. The median concentrations of boron, chloride, and sulfate over the monitoring period (September 2016 through October 2020) are provided in **Table 4-1**. These three constituents were selected based on the EPRI (2017) recommended indicator species. Whereas bromide is also a recommended indicator species, it was not included in the assessment as it was non-detect in the BSFAP water, indicating its presence in groundwater was either naturally derived or from an off-site source. The median concentrations for sulfate, boron, and chloride show minimal change since January 2019.

Table 4-1 Median Concentrations of Boron, Chloride, and Sulfate

		Median Concentrations September 2016 to October 2020		
Location	**Location ID**	**Boron (mg/L)**	**Chloride (mg/L)**	**Sulfate (mg/L)**
Source	**Fly Ash Pond**	0.58	35.4	342
Downgradient	**MW-1603**	0.052 ±0.026	3.41 ±0.47	714 ±65

mg/L = milligrams per liter

Ion ratios have been calculated using boron, chloride, and sulfate as recommended in EPRI (2017) and are provided in **Table 4-2**. The ion ratios show little change since the last evaluation in January 2021.

Table 4-2 Ion Ratios

		Median Concentrations September 2016 to October 2020		
Location	**Location ID**	**Boron/Sulfate (x1000)**	**Boron/Chloride**	**Chloride/Sulfate**
Source	**Fly Ash Pond**	1.68	0.002	0.10
Downgradient	**MW-1603**	0.07 ±0.03	0.02 ±0.01	0.005 ±0.001

Based on the previous and current ion ratio analysis, the conclusion that MW-1603 is not impacted by CCR constituents from the BSFAP is unchanged.

4.3.2 Ternary Plots

Ternary plots are used to identify changes in major or minor ion distributions over time. A ternary plot using calcium, chloride, and sulfate measured in the vicinity of MW-1603 is provided in **Figure 4-13**. The close grouping of ratios from all events on the ternary plot shows that the major ion groundwater ratios have not changed during the three-year period of groundwater quality monitoring at well MW-1603 and that the ratios are distinct from the BSFAP.

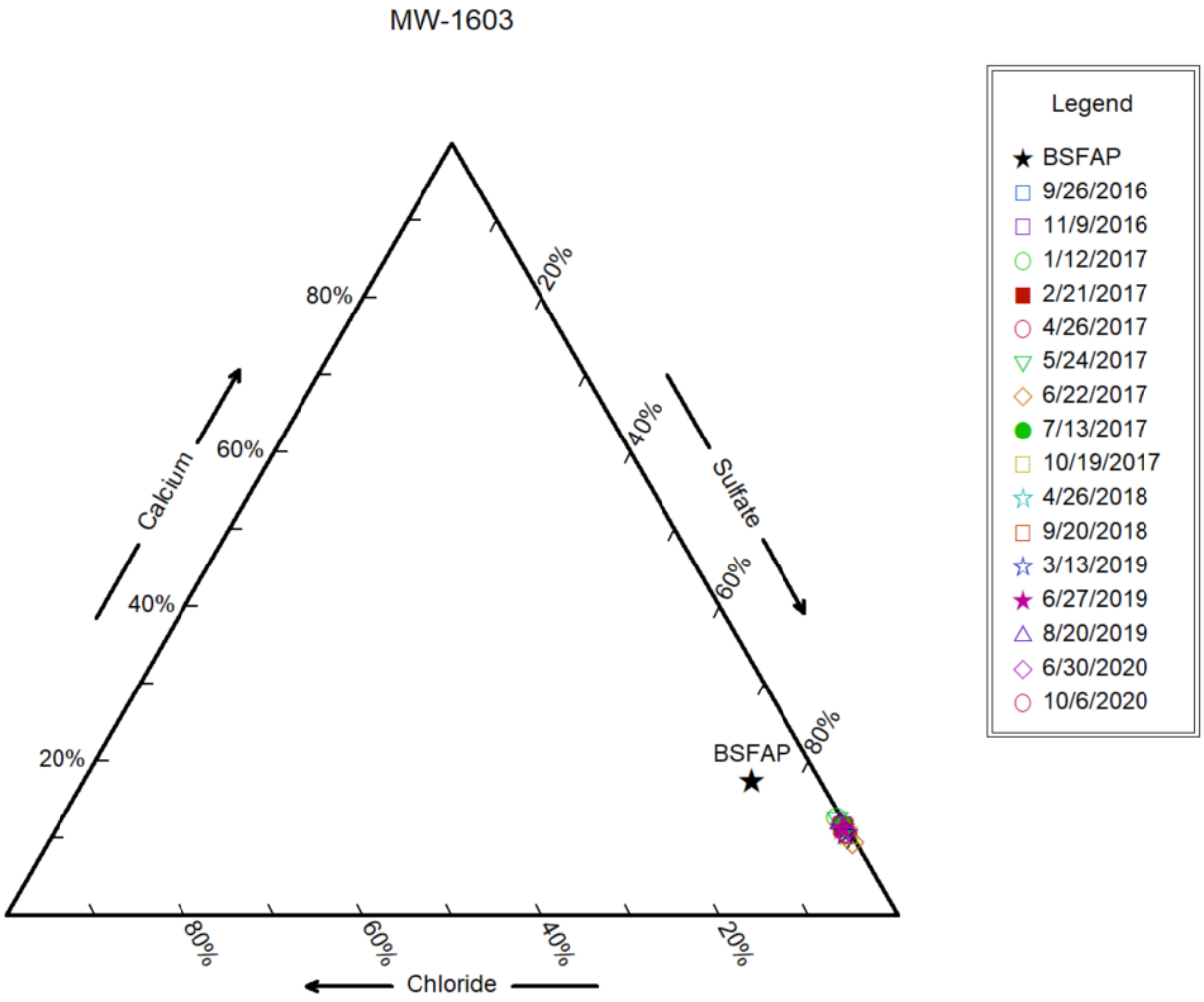


Figure 4-13 Ternary Plot MW-1603

4.3.3 Summary

In summary, based on the previous geochemical evaluation and the updated review presented in this ASD investigation, there is insufficient evidence to support the presence of CCR constituents (beryllium, cobalt, and lithium), as derived from the BSFAP, in groundwater sampled at MW-1603. The ternary plot does not support temporal changes of MW-1603 groundwater quality. The boron, chloride, and sulfate ion ratios remain unchanged since September 2019. Therefore, it is unlikely that beryllium, cobalt, and lithium detected within MW-1603 groundwater are sourced from the BSFAP. It is likely that beryllium, cobalt, and lithium are sourced from the lithologies in which this monitoring well is screened across, which includes the Princess coal seams.

5 Summary and Conclusions

Using the EPRI (2017) guidance for ASD investigations, the conclusions based on the lines of evidence presented and discussed within **Sections 3** and **4** indicate that groundwater in the vicinity of the BSFAP is not being impacted by CCR constituents from the BSFAP. The elevated beryllium, cobalt, and lithium concentrations that triggered the ASD investigation are due to the oxidation of sulfide minerals present in coal seams that have been intersected by well MW-1603, including organic material within the screened interval that is identified as having "a slight coaly texture." This is supported by the visual evidence recorded during the logging of the core from this location (refer to EHS Support, 2019a), the low pH reported in groundwater, and the subsequent mobilization and leaching of trace metals (beryllium, cobalt, and lithium) into groundwater by the elevated acidity.

The elevated pH in the BSFAP water and the corresponding lower concentrations of minor ions in the BSFAP also support the unlikely influence of the BSFAP on groundwater. Therefore, it is concluded that the elevated signatures of beryllium, cobalt, and lithium in MW-1603, as noted in the October 2020 groundwater monitoring data, are related to the dissolution of naturally occurring, coal seam-derived constituents within the shale layers of the Breathitt Group, as supported by the discussion of local and regional geology in **Section 2.1** and EHS Support (2019a).

In conclusion, this ASD addendum for the BSFAP has determined that Type IV natural variations in groundwater resulted in SSLs of beryllium, cobalt, and lithium detected at MW-1603.

6 References

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Twardowska, I., Szczepanska, J. and Stefaniak, S. (2003). Occurrence and mobilization potential of trace elements from disposed coal combustion fly ash. In Chemistry of Trace Elements in Fly Ash (pp. 13-24). Springer, Boston, MA.

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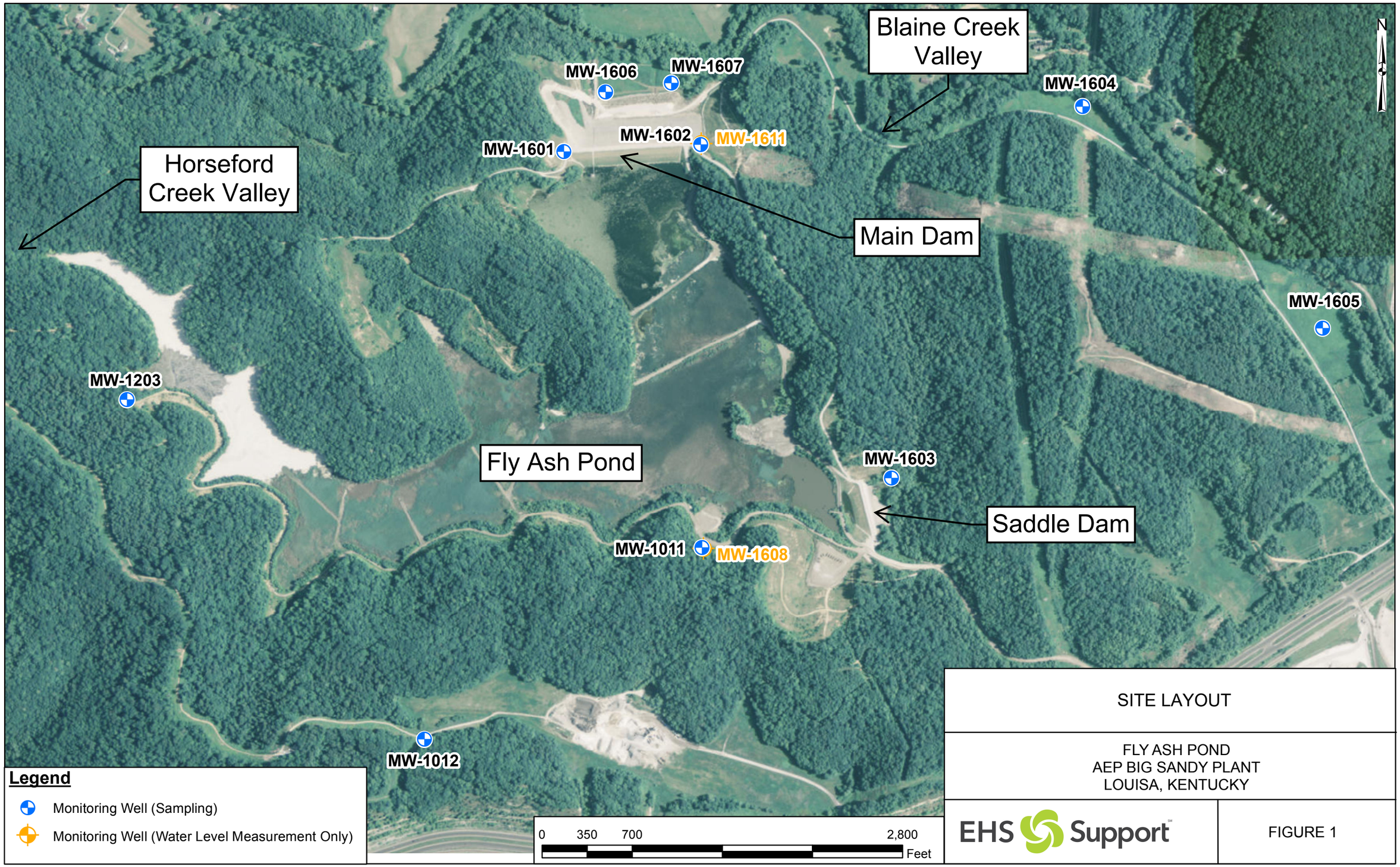
Tables

Table 1
MW-1603 Historical Groundwater Data September 2016 to October 2020
Big Sandy Fly Ash Pond Groundwater Monitoring,
American Electric Power, Kentucky Power Company, Louisa, Kentucky

Analytes	Units	9/26/2016	11/9/2016	1/12/2017	2/21/2017	4/26/2017	5/24/2017	6/22/2017	7/13/2017	10/19/2017	1/31/2018	4/26/2018	9/20/2018	10/23/2018	3/13/2019	6/27/2019	8/20/2019	3/17/2020	6/30/2020	8/26/2020	10/6/2020
Antimony, Sb	µg/L	0.01 J	< 0.01	< 0.01	< 0.01	0.01 J	< 0.01	< 0.01	< 0.01	NA	NA	0.04 J	0.02 J	NA	< 0.2	< 0.04	< 0.1	< 0.02	< 0.04	NA	< 0.02
Arsenic, As	µg/L	1.51	1.19	1.4	1.26	1.3	1.34	1.29	0.89	NA	NA	1.6	1.4	NA	1.26	1.36	1.39	0.83	1.12	NA	1.12
Barium, Ba	µg/L	13.4	15.4	11.4	10.3	12.4	11.5	11.4	11.3	NA	NA	10.5	11.4	NA	12	11	13.6	9.92	12.2	NA	14.6
Beryllium, Be	µg/L	18.6	18.3	17.1	18.9	16.7	16.4	16.4	18	NA	NA	18.7	19.6	NA	24.4	21.8	25	16.4	21.1	NA	17.5
Boron, B	mg/L	0.054	0.053	0.037	0.085	0.052	0.096	0.051	0.039	< 0.002	NA	0.088	0.085	NA	0.05 J	0.05 J	< 0.1	< 0.1	0.05 J	NA	0.05
Bromide	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06 J	< 0.05	< 0.05	< 0.05	NA	< 0.05	< 0.1	NA	< 0.1	< 0.04	< 0.04	< 0.04	< 0.04	NA	< 0.04
Cadmium, Cd	µg/L	0.84	0.93	0.79	0.75	0.87	0.77	0.86	0.8	NA	NA	0.74	0.83	NA	0.78	0.7	0.89	0.64	0.85	NA	0.87
Calcium, Ca	mg/L	105	94.7	92.7	91.9	90.5	93.9	90.6	90.2	91	82.2	83.6	97.5	NA	84.6	83.3	95.8	NA	96.6	NA	94.5
Chloride, Cl	mg/L	3.37	3.22	3.45	2.93	3.28	3.34	3.1	3.32	3.24	NA	4.12	3.92	NA	4.42	4.13	3.93	NA	4.18	NA	4.1
Chromium, Cr	µg/L	1.1	1.12	0.731	0.771	0.829	0.62	0.821	0.485	NA	NA	0.771	0.713	NA	1 J	0.618	0.8	0.56	0.694	NA	0.743
Cobalt, Co	µg/L	101	94.4	89.6	93.2	97.1	85.3	92.4	92.5	NA	NA	91.1	93.8	NA	87.9	84.7	96.6	72	93.2	NA	90.5
Comb. Radium 226/228	pCi/L	6.04	6.6	5.86	4.03	5.72	6.4	6	6.36	NA	NA	5.09	6.75	NA	4.8	7.149	10.92	7.19	6.22	NA	2.681
Fluoride, F	mg/L	1.24	1.1	1.11	0.9	1.04	0.98	0.98	0.93	0.93	0.94	1.16	1.15	NA	0.92	0.87	0.84	0.85	0.71	NA	0.47
Lead, Pb	µg/L	9.75	8.18	6.11	6.3	6.41	4.96	6.47	3.72	NA	NA	5.27	4.39	NA	4.28	3.68	4.17	3.95	4.67	NA	4.85
Lithium, Li	mg/L	0.242	0.237	0.225	0.208	0.216	0.221	0.263	0.217	NA	NA	0.187	0.255	NA	0.209	0.192	0.226	0.156	0.192	NA	0.165
Mercury, Hg	µg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.002 J	< 0.002	< 0.002	< 0.002	NA	NA	< 0.002	NA	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	NA	< 0.002
Molybdenum, Mo	µg/L	0.15	0.17	0.06 J	0.11	0.18	0.07 J	0.32	0.22	NA	NA	0.03 J	0.04 J	NA	< 4	< 0.8	< 2	< 0.4	< 0.8	NA	< 0.4
pH	S.U.	4.29	5.56	3.64	4.51	3.34	3.32	3.04	3.20	3.52	3.52	2.91	3.10	3.46	3.19	3.73	3.54	3.52	3.38	3.27	4.09
Potassium, K	mg/L	4.76	4.73	4.25	3.95	3.98	4.34	4.41	3.92	4.46	NA	3.53	5.05	NA	3.81	3.78	4.48	3.42	4.36	NA	4.29
Residue, Filterable, TDS	mg/L	1,060	1,010	948	1,020	994	936	1,040	1,000	962	915	926	974	NA	896	954	1,010	NA	NA	1,040	1,020
Selenium, Se	µg/L	5.4	4.8	5.6	4.9	6.1	6.3	6.1	2.7	NA	NA	8.1	6.3	NA	4	4.9	5.6	4	6.2	NA	5.8
Sodium, Na	mg/L	NA	24.2	22.9	20.3	21.6	23.1	25	22.3	22.4	NA	17	23.9	NA	18.9	19.1	22.2	16.8	21.9	NA	21.1
Sulfate, SO4	mg/L	801	733	636	720	678	646	873	694	784	714	661	747	NA	709	658	704	NA	NA	798	794
Thallium, Tl	µg/L	1.29	1.55	1.39	1.2	1.41	1.35	1.43	1.43	NA	NA	1.39	1.7	NA	1 J	1.4	2 J	1.34	1.57	NA	1.82

Notes:
< = not detected at or above the method detection limit
µg/L = Micrograms per liter
J = Estimated value. Analyte detected at a level less than the reporting limit but greater than the method detection limit.
mg/L = Milligrams per liter
NA = Not analyzed
pCi/L = Picocuries per liter
S.U. = Standard Units
TDS = Total Dissolved Solids

Figures

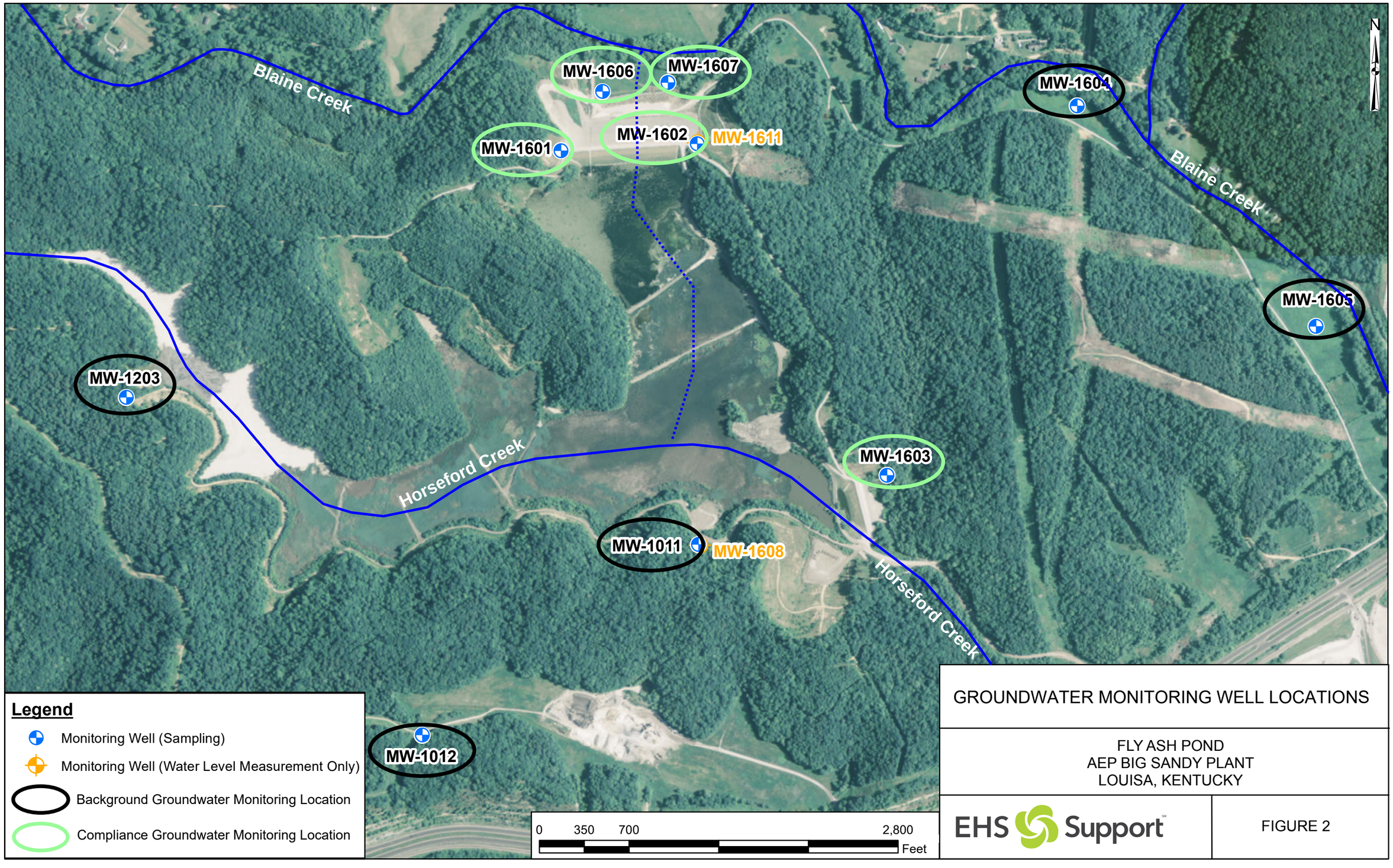


SITE LAYOUT

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

EHS Support℠

FIGURE 1



Legend

- Monitoring Well (Sampling)
- Monitoring Well (Water Level Measurement Only)
- Background Groundwater Monitoring Location
- Compliance Groundwater Monitoring Location

GROUNDWATER MONITORING WELL LOCATIONS

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

EHS Support

FIGURE 2

Appendix A Box Plots

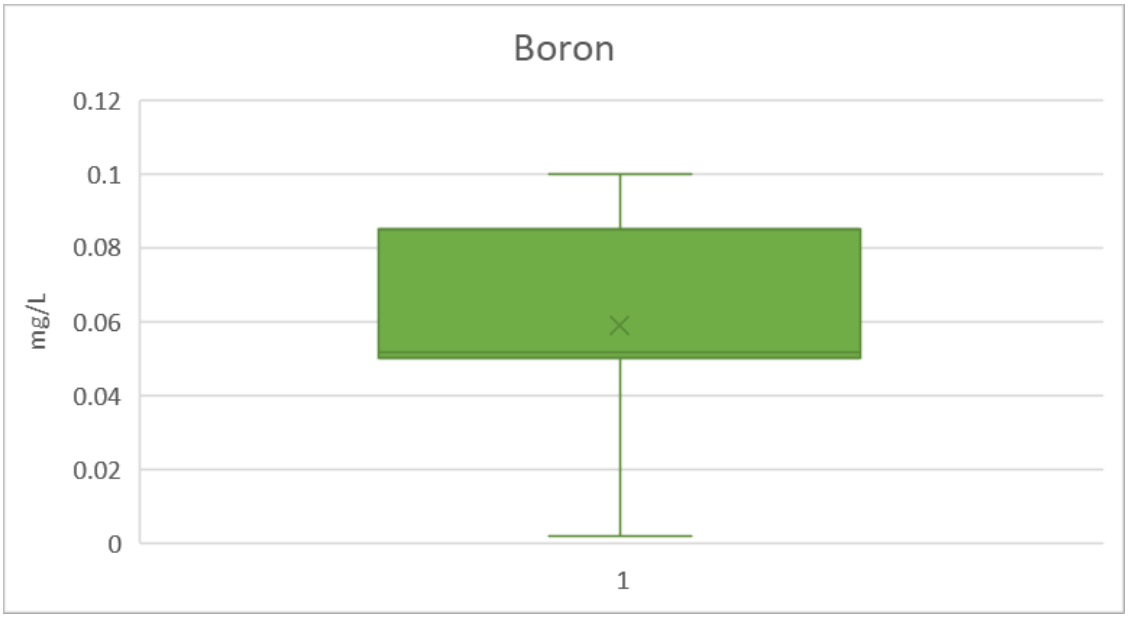


Figure A-1 Boron Box Plot

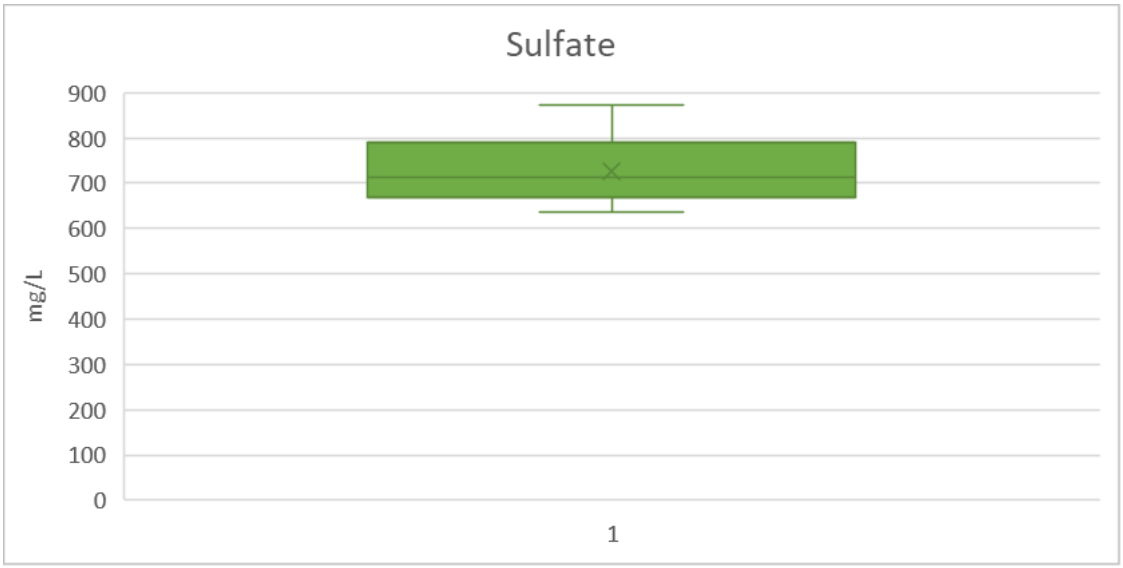


Figure A-2 Sulfate Box Plot

Figure A-3 Chloride Box Plot

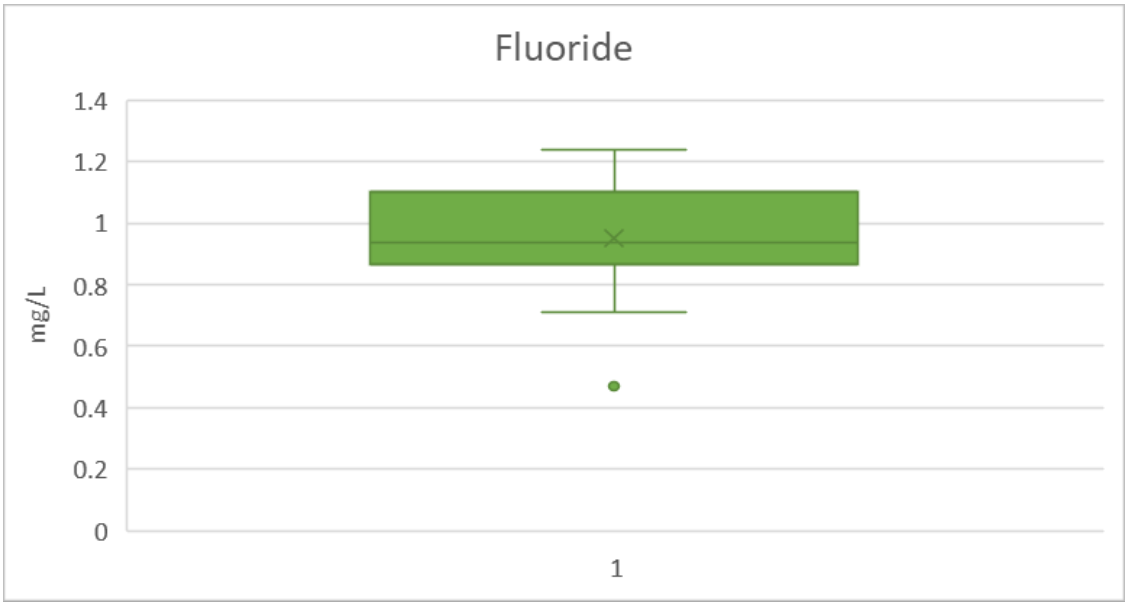


Figure A-4 Fluoride Box Plot

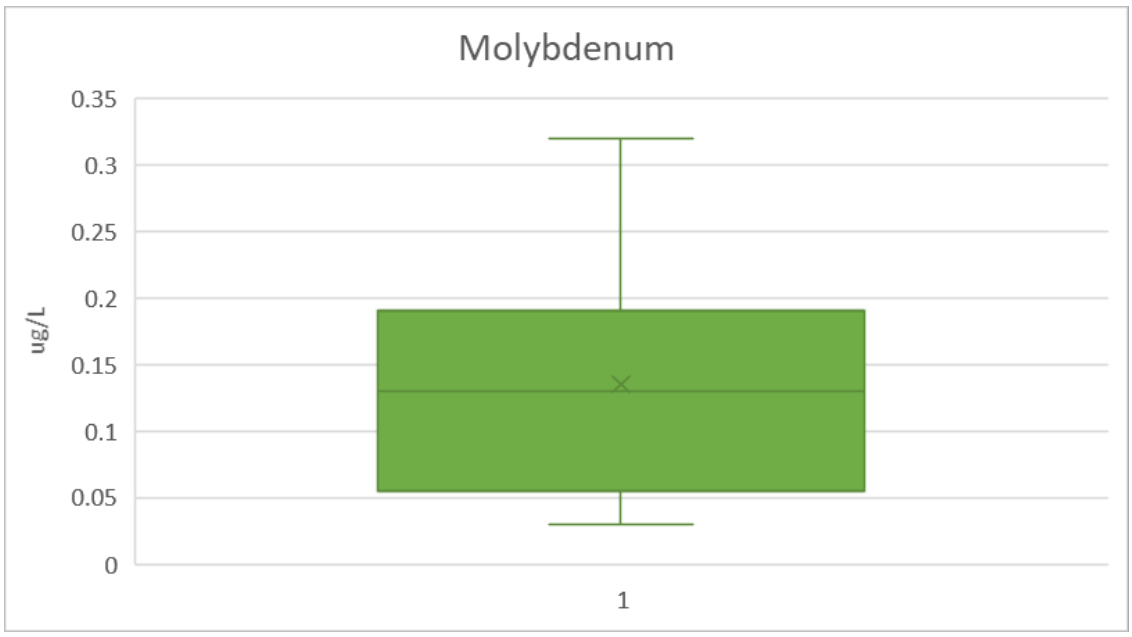


Figure A-5 Molybdenum Box Plot

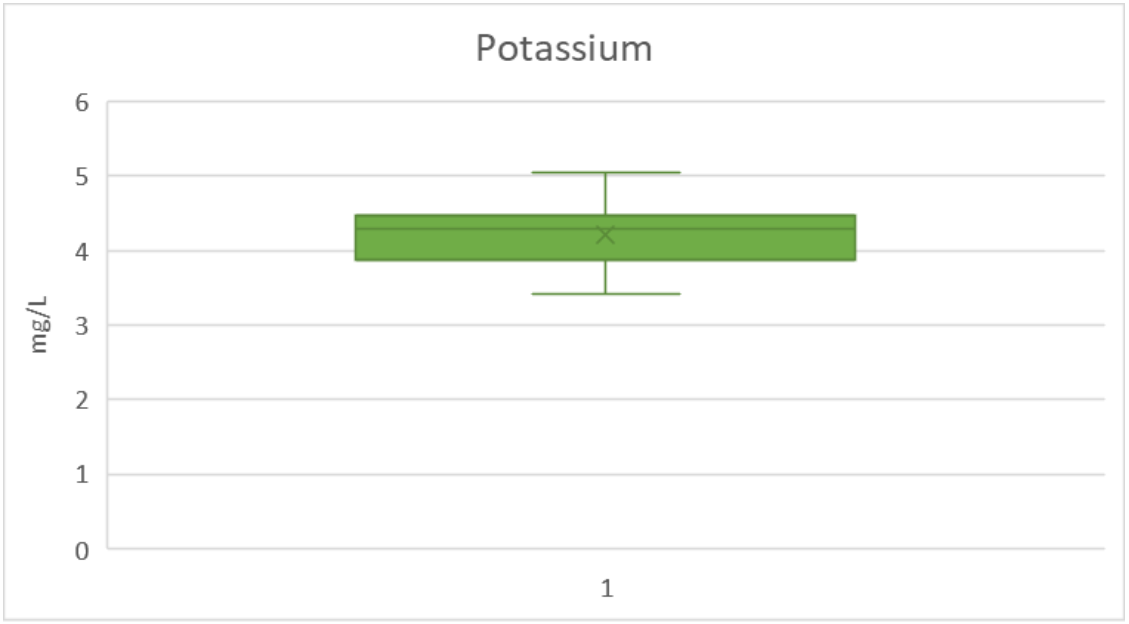


Figure A-6 Potassium Box Plot

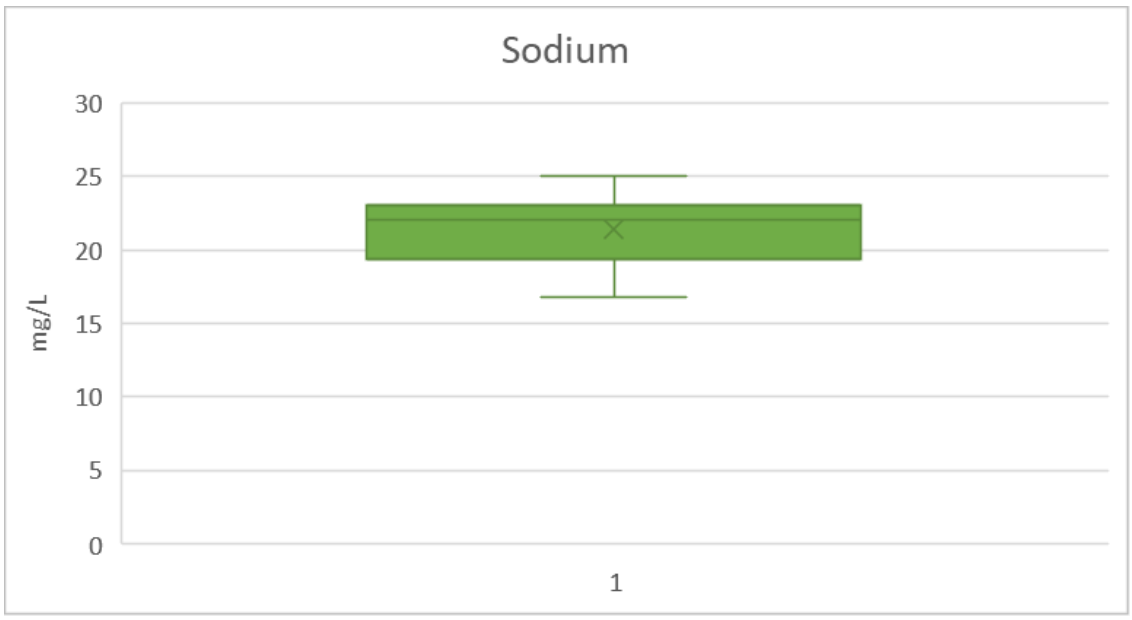


Figure A-7 Sodium Box Plot

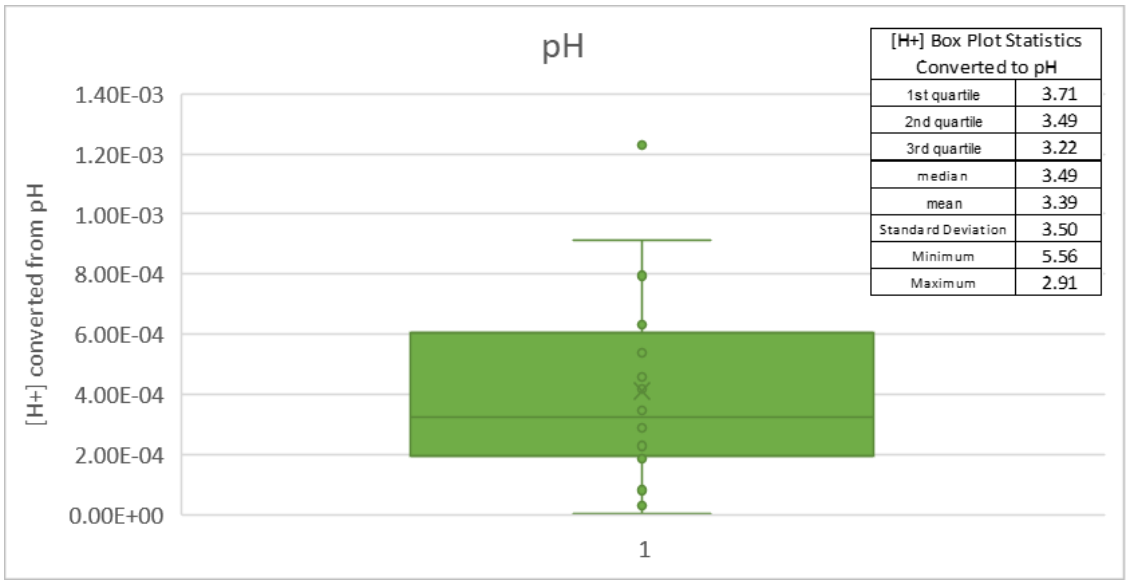


Figure A-8 pH Box Plot

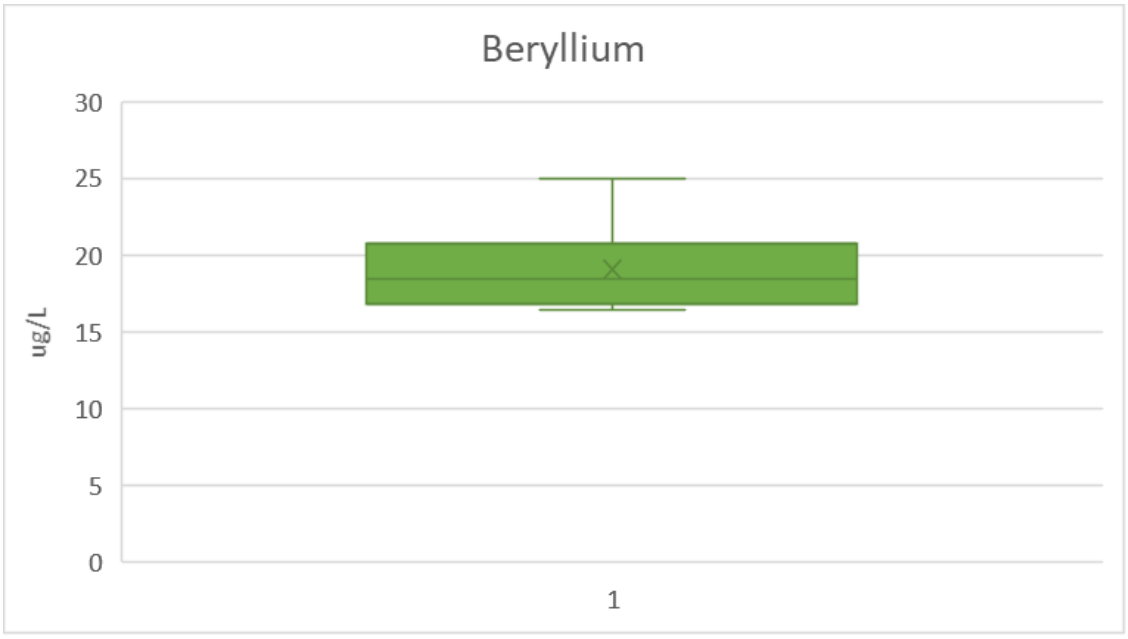


Figure A-9 Beryllium Box Plot

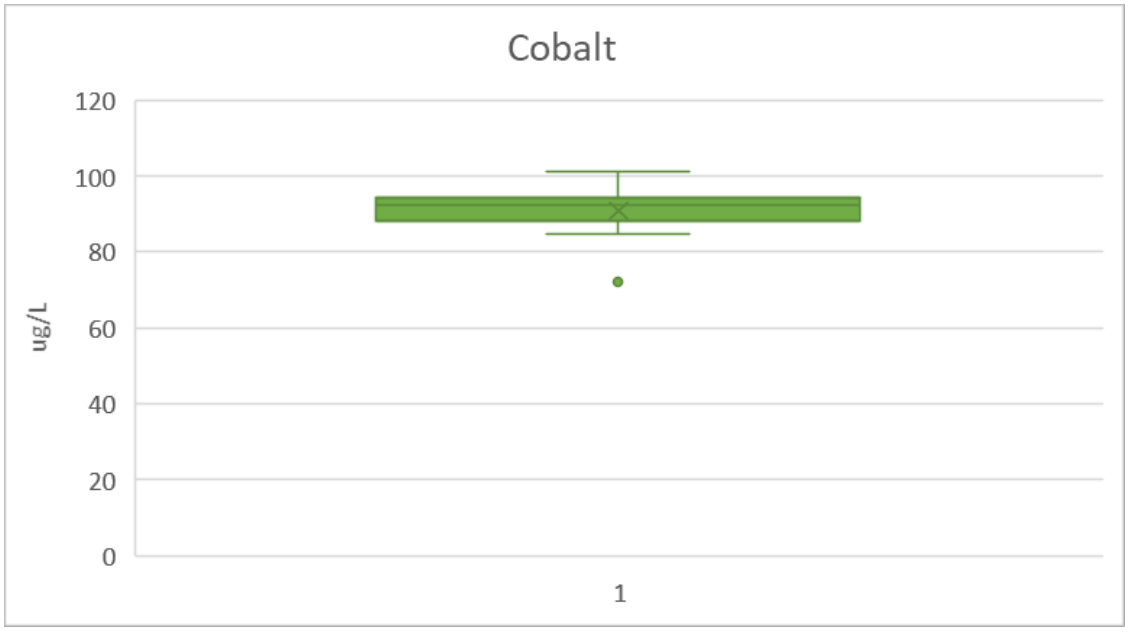


Figure A-10 Cobalt Box Plot

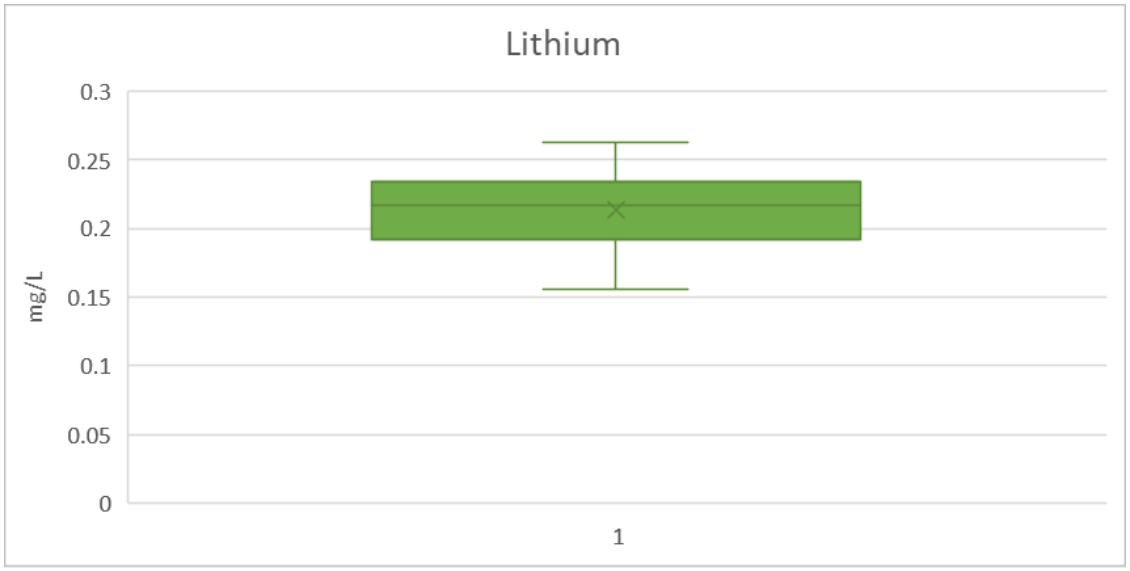


Figure A-11 Lithium Box Plot

Alternative Source Demonstration Addendum Report for the March and June 2021 Monitoring Data

Big Sandy Fly Ash Pond
Louisa, Kentucky

Prepared for:

American Electric Power

Prepared by:

EHS Support

November 2021

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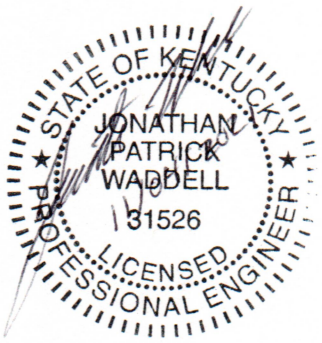
Acronyms

µg/L	micrograms per liter
AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
BSFAP	Big Sandy Fly Ash Pond
CCR	coal combustion residual
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
ft	foot/feet
GWPS	Groundwater Protection Standards
KGS	Kentucky Geological Survey
LCL	lower confidence level
MDL	method detection limit
mg/L	milligrams per liter
msl	mean sea level
ORP	oxidation-reduction potential
pCi/L	picocuries per liter
ppm	parts per million
S.U.	standard units (pH)
SSL	statistically significant level
TDS	total dissolved solids
UCL	upper confidence level
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Certification by Qualified Professional Engineer

I certify that the alternative source demonstration (ASD) conducted and presented within this report is accurate and appropriate for evaluating the groundwater monitoring data for the Big Sandy Fly Ash Pond Coal Combustion Residual (CCR) management area associated with the Big Sandy Power Plant located in Louisa, Kentucky. This ASD meets the requirements of the United States Environmental Protection Agency CCR Rule defined at 40 Code of Federal Regulations 257.95(g)(3)(ii).

Jonathan Patrick Waddell
Printed Name of Licensed Professional Engineer



Signature

31526	KY	11/04/2021
License Number	Licensing State	Date

1 Introduction

EHS Support LLC ("EHS Support") was retained by the American Electric Power (AEP) – Kentucky Power Company in December 2018 to conduct an alternative source demonstration (ASD) investigation for coal combustion residual (CCR) constituents in groundwater near the Big Sandy Fly Ash Pond (BSFAP or "Site"). The BSFAP is associated with the Big Sandy Power Plant located in Louisa, Kentucky (EHS Support, 2019a). The ASD determined that groundwater in the vicinity of the BSFAP was not being impacted by CCR constituents from the BSFAP. The statistically significant levels (SSLs) of beryllium, cobalt, and lithium concentrations present in excess of the Groundwater Protection Standards (GWPS), which triggered the ASD investigation, were determined to be a result of the oxidation of coal seams that were intersected by the borehole and well screen for well MW-1603.

Since the initial ASD investigation was completed (incorporating data from September 2016 to October 2018), the following ASD investigations have been conducted:

- The second ASD investigation was conducted after the March 2019 groundwater monitoring data indicated continued SSLs of beryllium, cobalt, and lithium exceeding the GWPS at MW-1603 (EHS Support, 2019b).
- The third ASD investigation was conducted following continued detections of beryllium, cobalt, and lithium at SSLs above the GWPS in MW-1603 during the August 2019 sampling event (EHS Support, 2020). In addition, an SSL of radium 226 combined with radium 228 (hereafter radium 226/228) was measured above its GWPS for the first time in MW-1603 groundwater during the August 2019 sampling event (EHS Support, 2020).
- The fourth ASD investigation was conducted following continued detections of four constituents (beryllium, cobalt, lithium, and radium 226/228) at SSLs above the GWPS in MW-1603 in March and June 2020 (EHS Support, 2021a).
- The fifth ASD investigation was conducted following continued detections of three constituents (beryllium, cobalt, and lithium) at SSLs above the GWPS in MW-1603 in October 2020 (EHS Support, 2021b).

In March and June 2021, three constituents (beryllium, cobalt, and lithium) were detected at SSLs above the GWPS in MW-1603, thus requiring the ASD addendum investigation presented in this report. This ASD addendum investigation has been prepared per the requirements of the United States Environmental Protection Agency (USEPA) CCR Rule (40 Code of Federal Regulations [CFR] §257.95). The concentrations of beryllium, cobalt, and lithium in MW-1603 groundwater were determined herein to result from Type IV natural variations in groundwater (ASD types are discussed in **Section 3.1**). This conclusion was reached by examining analytical results for compounds detected at SSLs in the context of the broader list of CCR constituents analyzed at the Site.

1.1 Objective

The objective of this ASD investigation is to assess groundwater monitoring data collected in compliance with the CCR Rule, as allowed under paragraph 40 CFR §257.95(g)(3)(ii). This part of the CCR Rule allows AEP to determine whether the source(s) for SSLs of beryllium, cobalt, and lithium exceeding the GWPSs, as reported in groundwater monitoring well MW-1603, are associated with the CCR unit; or alternatively

if the SSL resulted from an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

1.2 Lines of Evidence

This ASD investigation for the BSFAP has been conducted to further evaluate potential alternate sources or reasons for the continued detection of SSLs of beryllium, cobalt, and lithium in groundwater samples from monitoring well MW-1603.

A potential alternate source was previously identified in prior ASD investigations (EHS Support, 2019a, 2019b, 2020, 2021a, and 2021b), based on the following lines of evidence:

- A lack of exceedances and increasing trends of primary indicators of CCR.
- Constituent concentrations in BSFAP water are lower than those of the corresponding constituent observed in groundwater from MW-1603.
- Major ion chemistry was not indicative of mixing between BSFAP water and groundwater.

For the purposes of this ASD addendum investigation, constituents were identified that would serve as a primary indicator for CCR. A primary indicator must meet **both** of the following criteria:

1. The constituent typically has a high concentration in CCR leachate, relative to background, such that it is expected to have an elevated concentration in the event of a release.
2. The constituent is unreactive and has high mobility in groundwater, such that it is expected to be at the leading edge of the plume. Consequently, the constituent will have elevated concentrations relative to background across the entire area of the plume.

As boron and sulfate are primary indicators for CCR (Electric Power Research Institute [EPRI], 2012) and have previously been evaluated, they have been re-evaluated herein as primary indicators for this ASD investigation. In addition, chloride is used as a primary indicator for this ASD. Other potential indicators that were evaluated in this ASD investigation include bromide, fluoride, molybdenum, potassium, and sodium.

2 Project Background

A detailed description of Site location, history, and geology was provided in the *Alternative Source Demonstration Report for Beryllium, Cobalt and Lithium, Big Sandy Fly Ash Pond, Louisa, Kentucky* (EHS Support, 2019a). Attached **Figure 1** and **Figure 2** show the Site layout and groundwater monitoring network, respectively.

To support and provide context to this ASD addendum investigation, **Section 2.1** and **Section 2.2** describe the groundwater monitoring network and groundwater monitoring activities.

2.1 Groundwater Monitoring Network Evaluation

On behalf of AEP, Geosyntec Consultants, Inc. ("Geosyntec") conducted an assessment of the groundwater monitoring network in the uppermost aquifer associated with the BSFAP (Geosyntec, 2016). Geosyntec determined that the hydrostratigraphy in the vicinity of the BSFAP is characterized by an interconnected water-bearing system comprised of Pennsylvanian-aged bedrock (of the Breathitt Group, Conemaugh Formation) and Quaternary alluvium. The Conemaugh Formation and Breathitt Group consist of sandstones, siltstones, shale, and coal that may grade laterally and vertically into one another. The overlying Quaternary alluvium deposits include sandy lean clay to silty sand and gravel at the bottom of the Horseford Creek valley and the floodplain of Blaine Creek. Based on these hydrogeologic conditions, Geosyntec defined the interconnected water-bearing system of the fractured bedrock and alluvium as the uppermost aquifer for the BSFAP CCR unit. This determination was based on the presence of groundwater in numerous monitoring wells screened in the water-bearing unit (fractured bedrock and alluvium), the recovery of these wells during pumping and development, and a potentiometric surface generally consistent with Site topography and surface water elevations.

Geosyntec defined the groundwater detection monitoring network as consisting of ten monitoring wells to assess the upper water-bearing aquifer (fractured bedrock and alluvium) (Geosyntec, 2016). Of these monitoring wells, six locations (MW-1011, MW-1012, MW-1203, MW-1601, MW-1602, and MW-1603) are screened in fractured sandstone and shale layers of the Breathitt formation. The remaining four monitoring wells (MW-1604 through MW-1607) are screened in the alluvium. The location of each groundwater monitoring well within the uppermost aquifer is shown in **Figure 2**.

Three of the monitoring wells (MW-1011, MW-1012, and MW-1203) screened in bedrock were installed on the hillside slopes upgradient of the BSFAP to support background monitoring. Three monitoring wells (MW-1601, MW-1602, and MW-1603) were installed in bedrock located downgradient of the BSFAP and used for compliance monitoring. Two monitoring wells (MW-1604 and MW-1605) side gradient of the BSFAP are screened in alluvium and are used for background monitoring. The remaining two monitoring wells (MW-1606 and MW-1607) are located south of the Main Dam (**Figure 1**). These locations are screened in the alluvium downgradient of the BSFAP and used for compliance monitoring.

As bedrock monitoring well MW-1603 is the focus of this ASD, the boring log was reviewed to assess the lithology that could impact groundwater chemistry (EHS Support, 2019a). The boring log descriptions show alternating sequences of yellowish-brown sandstones and bluish-gray to black shales beginning at 13 feet below ground surface (ft bgs) and extending to the total depth of the boring at 39.5 ft bgs. This lithologic description is indicative of the upper portion of the Princess Formation (uppermost formation

in the Breathitt Group [Rice and Hiett, 1994]). Within the MW-1603 screened interval (22 to 32 ft bgs), the shale at a depth of 24 to 25 ft bgs was described as "intensely fractured, black, wet, nearly all organic matter; slight coaly texture." This depth (24 to 25 ft bgs) corresponds with the measurements by the Kentucky Geological Survey (KGS) of the elevation of the Princess Number 8 coal, which is present within the Princess Formation of the Breathitt Group (EHS Support, 2019a).

Coal or "organic material" was also visually identified on the MW-1608, MW-1609, and MW-1610 boring logs at the same approximate elevation, between 630 and 650 feet, that aligns with the KGS measurements (**Table 2-1**). No coal was documented in this section in three monitoring wells (MW-1601, MW-1602, and MW-1611). Four monitoring wells (MW-1604, MW-1605, MW-1606, and MW-1607) were installed stratigraphically below this coal layer.

Table 2-1 Screened Interval of Monitoring Wells

Well/Boring	Surface Elevation (ft msl)	Screened Interval (ft msl)	Coal or "Organics" Description at ~632-650 ft
MW-1601	713.8	646.8-636.8	No coal logged
MW-1602	711.6	632.1-622.1	No coal logged
MW-1603	673.2	651.2-641.2	Yes, at a depth of ~25 ft (Elevation of 648 ft)
MW-1604	553.1	513.1-503.1	---
MW-1605	554.4	538.9-528.9	---
MW-1606	551	513.1-503.1	---
MW-1607	542.2	518.7-508.7	---
MW-1608	716.2	606.6-596.6	Yes, at depths of ~74 ft (Elevation of 642 ft), ~ 75.3 to 76.6 ft (Elevation of 641 to 640 ft), and ~ 83.5 to 84 ft (Elevation of 633 to 632 ft)
MW-1609	~728	---	Yes, at a depth of ~79 ft (Elevation of 649 ft)
MW-1610	~716	---	Yes, at a depth of ~81 ft (Elevation of 635 ft)
MW-1611	~711	606-596	No coal logged

--- = Boring advanced below the coal interval
~ = Approximate
ft = feet
msl = mean sea level

Geosyntec determined that the groundwater monitoring well network described above meets the requirements of 40 CFR §257.91, as it consists of a sufficient number of wells installed at the appropriate locations and depths to yield groundwater samples from the uppermost aquifer. Thus, the

current groundwater monitoring network accurately represents the quality of background groundwater and groundwater passing the waste boundary of the BSFAP.

2.2 Groundwater Monitoring

AEP has conducted groundwater monitoring of the uppermost aquifer to meet the requirements of the CCR Rules. Groundwater monitoring generally included the following activities:

- Collection of groundwater samples and analysis for Appendix III and Appendix IV constituents, as specified in 40 CFR §257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan* (AEP and EHS Support, 2016).
- Completion of validation tests for groundwater data, including tests for completeness, valid values, transcription errors, and consistent units.
- Establishment of background data for each Appendix III and Appendix IV constituent.
- Initiation of detection monitoring sampling and analysis.
- Evaluation of the groundwater data using a statistical process per 40 CFR §257.93, which was prepared, certified, and posted to AEP's CCR website in April 2017 in AEP's *Statistical Analysis Plan* (Geosyntec, 2017); the statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009).
- Initiation of assessment monitoring sampling and analysis.
- Completion of statistical data evaluation and determination of GWPS.

Assessment monitoring for the BSFAP has been conducted on a semi-annual basis since April 2018. The groundwater data collected through the June 2021 monitoring event have been used for this ASD addendum investigation. Assessment monitoring data for well MW-1603 in March and June 2021 is provided in **Table 2-2**.

Table 2-2 MW-1603 March and June 2021 Groundwater Quality

Analyte	Unit	March 2021 Value	June 2021 Value
Antimony	µg/L	< 0.02	0.04
Arsenic	µg/L	0.84	0.69
Barium	µg/L	10.1	13.1
Beryllium	µg/L	14	13.3
Boron	mg/L	NA	0.036
Bromide	mg/L	0.03	0.03
Cadmium	µg/L	0.62	0.709
Calcium	mg/L	NA	79
Chloride	mg/L	NA	4.16
Chromium	µg/L	0.659	0.51
Cobalt	µg/L	71.4	76.8
Fluoride	mg/L	0.82	0.76

Analyte	Unit	March 2021 Value	June 2021 Value
Lead	µg/L	3.37	3.39
Lithium	mg/L	0.125	0.135
Mercury	µg/L	0.002	0.002
Molybdenum	µg/L	< 0.1	< 0.1
pH	S.U.	3.4	3.64
Potassium	mg/L	3.83	3.6
Radium 226/228	pCi/L	3.73	7.18
Residue, Filterable, TDS	mg/L	NA	880
Selenium	µg/L	3.9	3.3
Sodium	mg/L	18.9	19
Sulfate	mg/L	NA	618
Thallium	µg/L	1.39	1.62

< = non detect at method detection limit (MDL)
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = constituent not analyzed
pCi/L = picocuries per liter
S.U. = standard units
TDS = total dissolved solids

AEP submitted the March and June monitoring data to Groundwater Stats Consulting, LLC for statistical analysis. A GWPS was established for each of the Appendix IV parameters. Confidence intervals, including lower confidence levels (LCLs) and upper confidence levels (UCLs), were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at an SSL above the GWPS. Based on this statistical analysis of the June 2021 data, the following SSLs were identified at the BSFAP in MW-1603 (no other monitoring well had constituents exceeding a GWPS):

- The LCL for beryllium exceeded the GWPS of 0.004 milligrams per liter (mg/L) at MW-1603 (0.01658 mg/L).
- The LCL for cobalt exceeded the GWPS of 0.006 mg/L at MW-1603 (0.08454 mg/L).
- The LCL for lithium exceeded the GWPS of 0.04 mg/L at MW-1603 (0.1805 mg/L).

3 Alternative Source Demonstration Requirements

Potential causes that may support an ASD include, but are not limited to, sampling causes (ASD Type I), laboratory causes (ASD Type II), statistical evaluation causes (ASD Type III), and/or natural variation causes (ASD Type IV).

3.1 Alternative Source Demonstration

This ASD for the BSFAP is focused on assessing whether Type IV natural variations in groundwater could be the cause of the SSLs of beryllium, cobalt, and lithium reported for groundwater collected from monitoring well MW-1603 during the March and June 2021 sampling.

Historical groundwater monitoring data for MW-1603 is provided in **Table 1** (attached).

3.2 Assessment of Groundwater Monitoring Results

The following constituents will typically provide the information required for a complete ASD:

- Primary indicators (boron and sulfate) are evaluated for potential BSFAP leachate.
- Major ion concentrations (alkalinity, chloride, sulfate, calcium, magnesium, potassium, and sodium) in leachate and groundwater are used to evaluate whether downgradient groundwater chemistry remains representative of background groundwater chemistry. Major ion chemistry can also be used to evaluate natural variability due to seasonal changes or other causes.
- Field turbidity of groundwater is used as an indicator of the presence of suspended solids that may contribute to elevated concentrations of constituents monitored in unfiltered samples under the CCR Rule.
- The pH of leachate and groundwater provides information on chemical reactions and potential mobility of constituents in groundwater.
- Dissolved oxygen, oxidation-reduction potential (ORP), iron, and manganese in groundwater are used as indicators of redox conditions. Redox changes can affect the chemical state and solubility of sulfate, in addition to trace elements including arsenic and selenium. For example, under strongly reduced conditions (ORP less than -200 millivolts at pH 7), sulfate can be reduced to form hydrogen sulfide or it can precipitate as iron sulfide, arsenic reduces to more mobile arsenite species, and selenium reduces to the low-mobility selenite species.

Groundwater monitored at a CCR unit for compliance with the CCR Rule is a compilation of the history of all sources of water comingling at that particular monitoring well. Different sources may contribute to the presence and detection of the same constituents, making source identification challenging. The identification and use of water quality “signatures” can be used as a tool for deciphering the similarity between potential sources and the water quality at a specific monitoring point.

4 Alternative Source Demonstration Assessment

As stated within **Section 1.2**, the primary indicators for CCR leachate impacts to groundwater are boron and sulfate. In addition to these two constituents, chloride is also used as a primary indicator for this ASD. Other potential indicators that have been evaluated include potassium, sodium, fluoride, molybdenum, and bromide.

As identified in **Section 1.1**, SSLs of beryllium, cobalt, and lithium have been reported in groundwater samples above the GWPS from monitoring well MW-1603 in March and June 2021. The water quality signatures for well MW-1603 are discussed in **Section 4.3** and compared to the water quality of the BSFAP.

EPRI (2012) defines three tiers of investigation for evaluation of water quality signatures to determine if elevated concentrations represent a release from a CCR facility:

- Tier I: Trend Analysis and Statistics
- Tier II: Advanced Geochemical Evaluation Methods
- Tier III: Isotopic Analyses

Conversely, these tools can also be used to evaluate whether or not sources other than CCR are contributing to groundwater quality degradation.

The CCR Rule requires statistical analysis under assessment monitoring for the determination of SSLs above the GWPS. Many of the primary and potential indicator constituents listed for CCR (EPRI, 2017) are included in AEP's constituent list for the BSFAP groundwater monitoring programs, including primary constituents boron and sulfate. If there is an SSL without a corresponding increase in a primary indicator constituent (boron and usually sulfate for CCR), then this is a key line of evidence for an ASD.

4.1 Groundwater Data Analysis

Temporal plots are provided in **Section 4.1.1** through **Section 4.1.3** for monitoring well MW-1603 (**Figure 4-1** through **Figure 4-12**). Each of the plots uses the following color-coding system:

- Red – indicates a concentration reported above the reporting limit.
- Orange – indicates a concentration reported below the reporting limit but greater than the method detection limit (MDL) (denoted as estimated "J" values).
- Green – indicates a concentration not detected at or above the MDL (denoted as "U"); results were conservatively plotted as the MDL.

The October 19, 2017 data for the BSFAP water is presented for comparison. The BSFAP water signature is plotted as a constant concentration in **Figure 4-1** through **Figure 4-12**. It is probable that BSFAP water quality historically varied over time since the BSFAP accepted fly ash before 1970. However, the BSFAP ceased accepting fly ash in November 2015 and the surface water quality is anticipated to be more stable following this termination of relatively constant fly ash addition. Therefore, the October 19, 2017 data provides a reasonable representation of BSFAP surface water conditions. Shortly after the October 2017 sample collection, BSFAP closure work including contouring of CCR in preparation for geomembrane cover installation began near the surface water collection area and samples were no

longer representative. Geomembrane installation was completed over the entire pond in November 2020 and the BSFAP is now closed.

Groundwater constituents for well MW-1603 are plotted on the primary y-axis and BSFAP water constituents are plotted on the secondary y-axis due to the differences in concentration (**Figure 4-1** through **Figure 4-12**).

4.1.1 Primary Indicators

Temporal plots for primary indicators boron, sulfate, and chloride reported in groundwater monitoring well MW-1603 are provided in **Figure 4-1** to **Figure 4-3**, respectively.

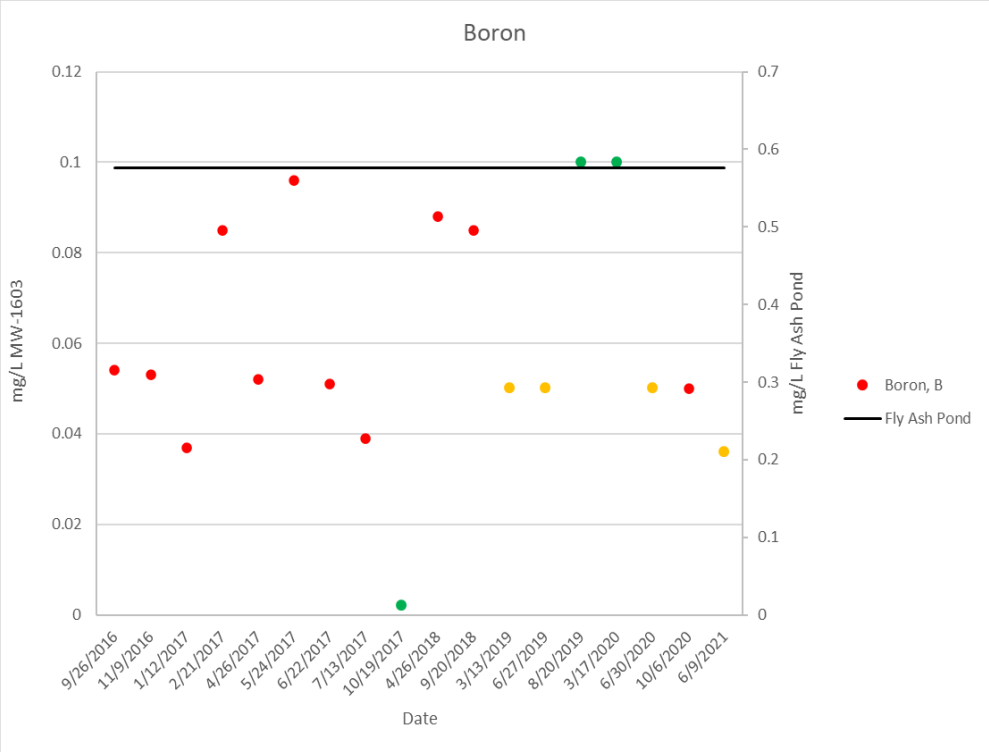


Figure 4-1 MW-1603 Boron Concentrations

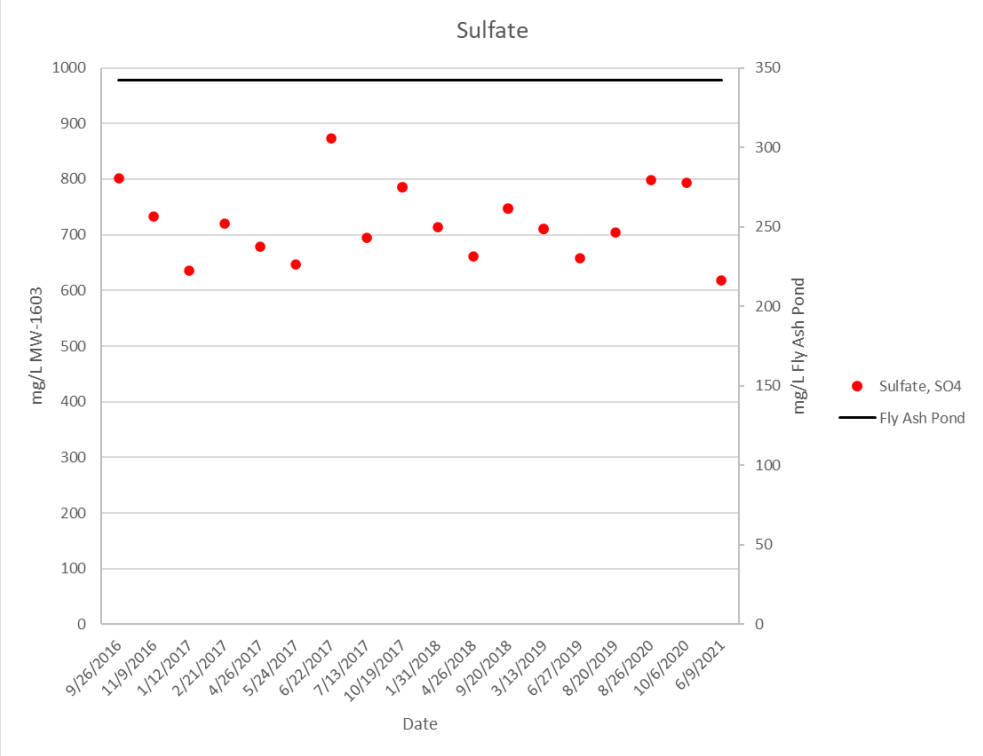


Figure 4-2 MW-1603 Sulfate Concentrations

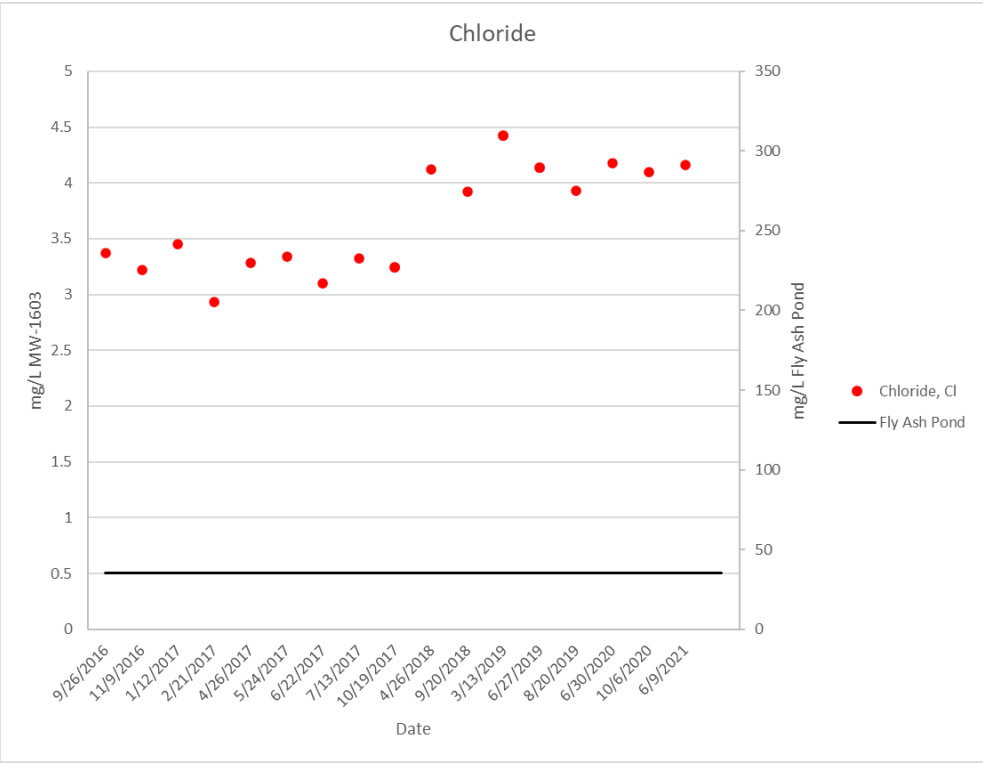


Figure 4-3 MW-1603 Chloride Concentrations

Boron and sulfate concentrations in MW-1603 have remained relatively stable within the same order of magnitude, with minor variability over the monitoring period (September 2016 through June 2021). Chloride concentrations in MW-1603 remained relatively stable until April 2018, after which a slight increase is observed that has remained stable. Given the overall very low chloride concentrations, this slight apparent increase in chloride of approximately 1 mg/L is minimal and most likely reflects a change in sampling or analytical procedure. Boron and chloride in water from the BSFAP are present at higher concentrations than in groundwater at MW-1603, whereas sulfate is present at higher concentrations in groundwater at MW-1603 than in water from the BSFAP.

In summary, there were negligible changes in primary indicator concentrations since the last review in January 2021.

4.1.2 Potential Indicators

Temporal plots for potential indicators (bromide, fluoride, molybdenum, potassium, and sodium) reported in groundwater monitoring well MW-1603 are provided in **Figure 4-4** to **Figure 4-8**, respectively.

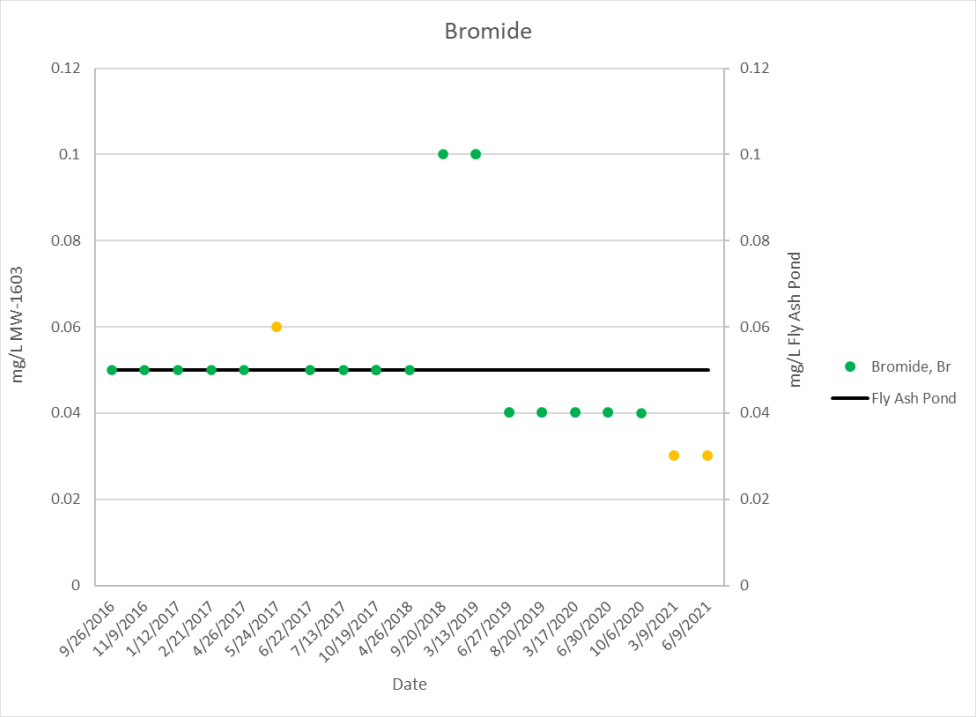


Figure 4-4 MW-1603 Bromide Concentrations[1]

[1] Bromide is below the reporting limit for BSFAP water; therefore, it is plotted at the MDL of 0.05 mg/L.

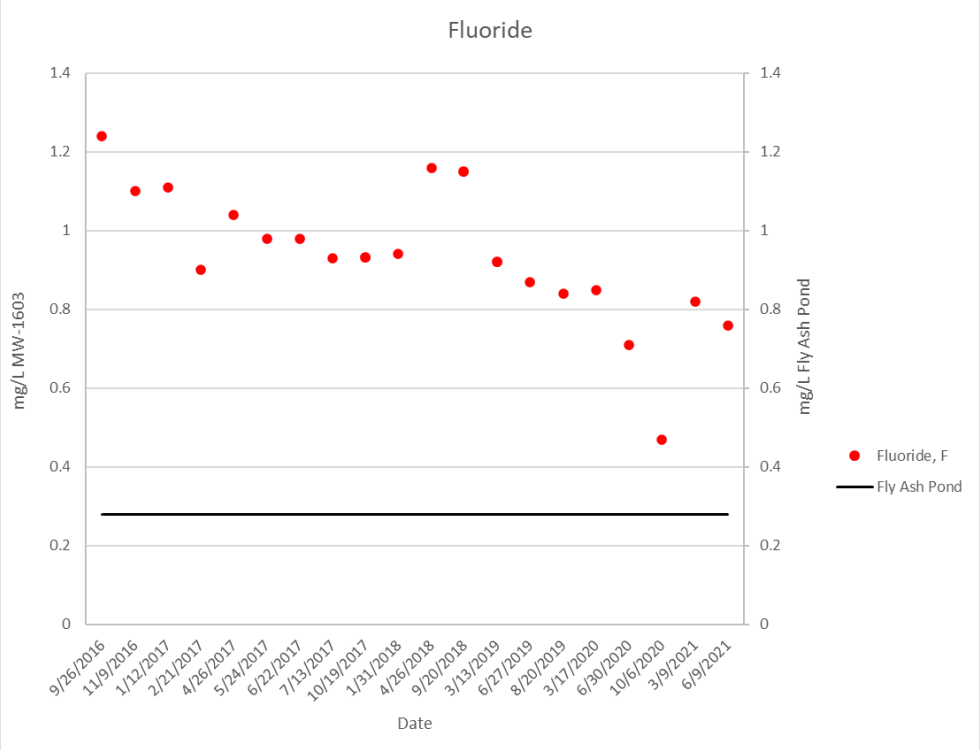


Figure 4-5 MW-1603 Fluoride Concentrations

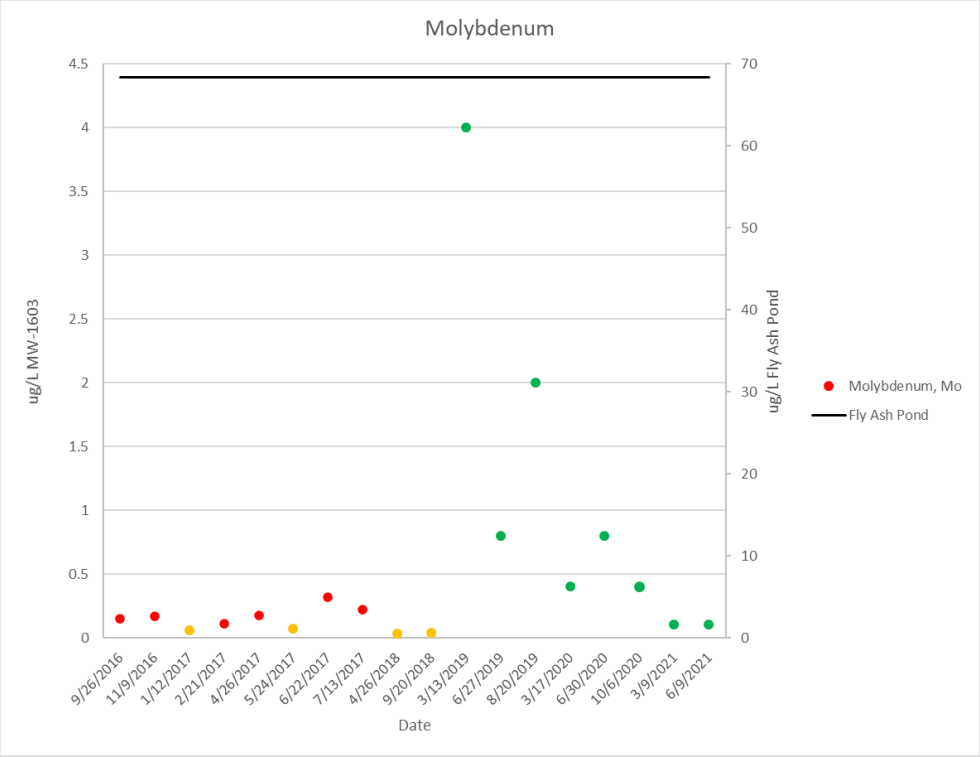


Figure 4-6 MW-1603 Molybdenum Concentrations

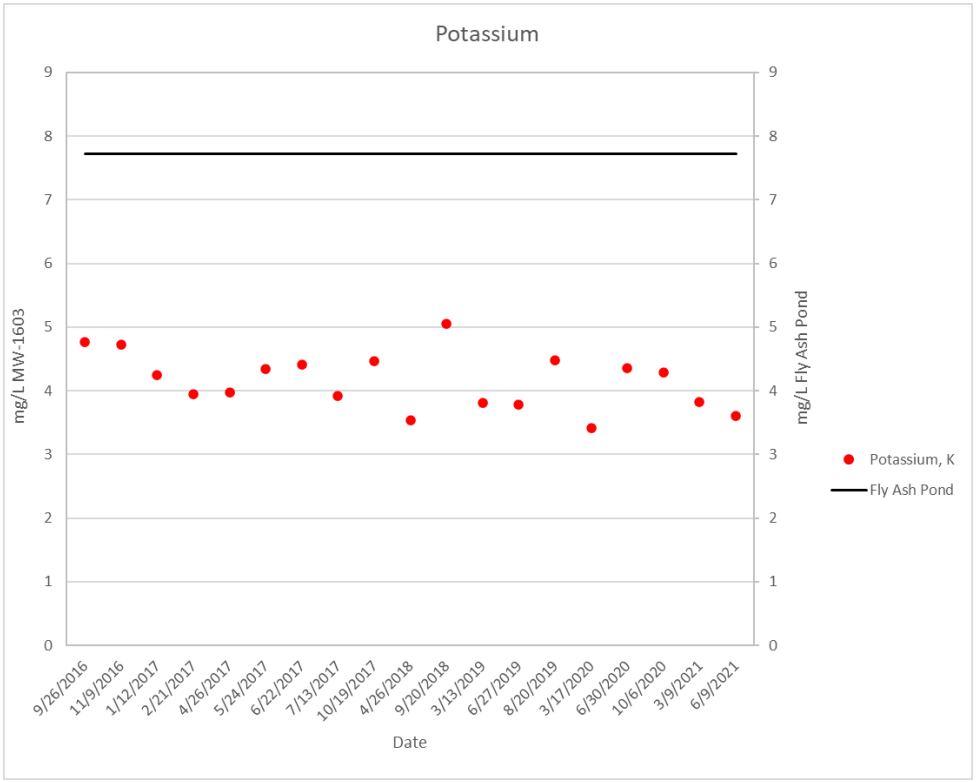


Figure 4-7 MW-1603 Potassium Concentrations

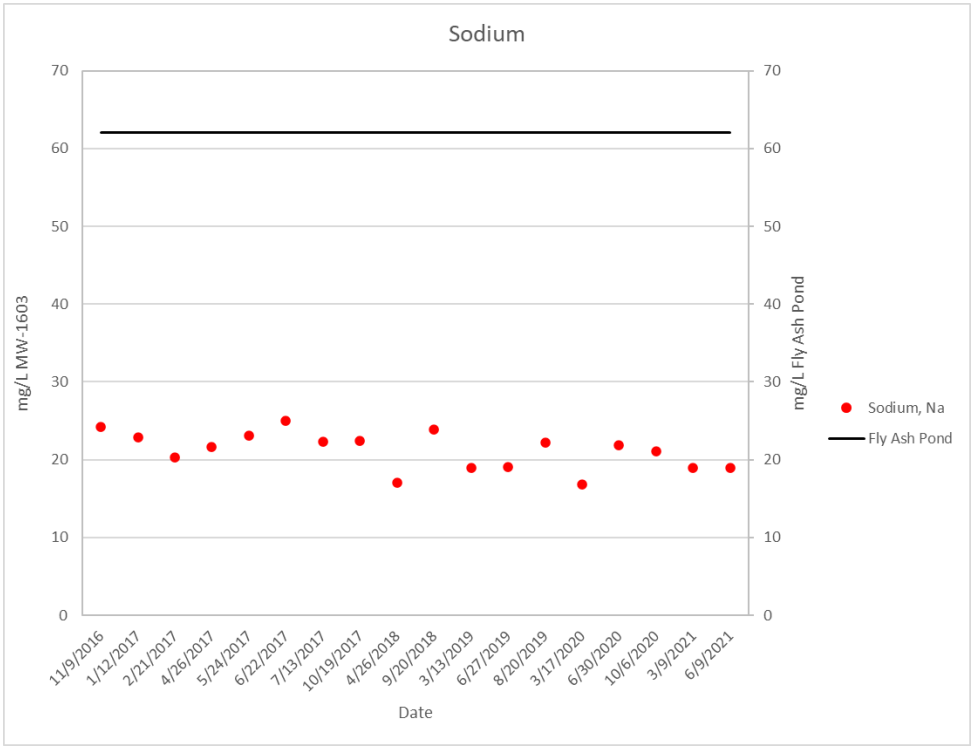


Figure 4-8 MW-1603 Sodium Concentrations

The following summarizes the data presented in **Figure 4-4** through **Figure 4-8**.

- Molybdenum, potassium, and sodium concentrations in groundwater from MW-1603 have consistently been lower than water from the BSFAP (**Figure 4-6**, **Figure 4-7**, **Figure 4-8** respectively).
- Molybdenum was last detected above the MDL in MW-1603 in September 2018 (**Figure 4-6**). The recent variation in molybdenum concentrations, as shown in green, is due to variable MDLs achieved in the laboratory analyses.
- Fluoride concentrations in groundwater from MW-1603 have consistently been higher than water from the BSFAP, but have exhibited an overall declining concentration trend with time (**Figure 4-5**).
- Bromide concentrations in groundwater from MW-1603 have been mostly below the MDL (**Figure 4-4**). Bromide was detected once since the initial background monitoring event. When bromide was detected (May 2017) it was 0.06 mg/L, or slightly above the MDL of 0.05 mg/L reported for BSFAP water in May 2017.

A comparison of the pH of BSFAP water and groundwater from MW-1603 is provided in **Figure 4-9**. The figure illustrates the substantial difference in pH between the BSFAP water and groundwater of approximately three to five standard units. This is using the standard (logarithmic) pH scale which converts to a factor of 1,000 to 100,000 difference in the hydrogen ion concentration. The pH in MW-1603 is acidic with values generally between 3 and 4 standard pH units, whereas the BSFAP water is alkaline at a pH of approximately 8 standard units.

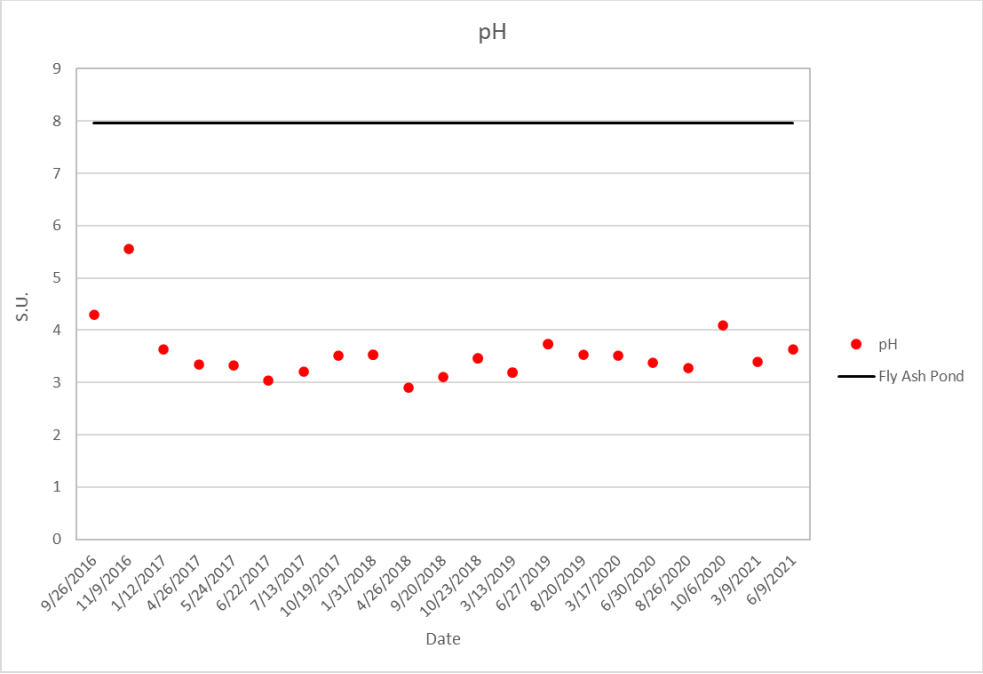


Figure 4-9 MW-1603 pH Values

In summary, there were negligible changes in potential indicator concentrations since the last review in April 2021.

4.1.3 ASD Constituent Trends

Temporal plots for the ASD constituents, beryllium, cobalt, and lithium reported in groundwater monitoring well MW-1603 are provided in **Figure 4-10** to **Figure 4-12**, respectively.

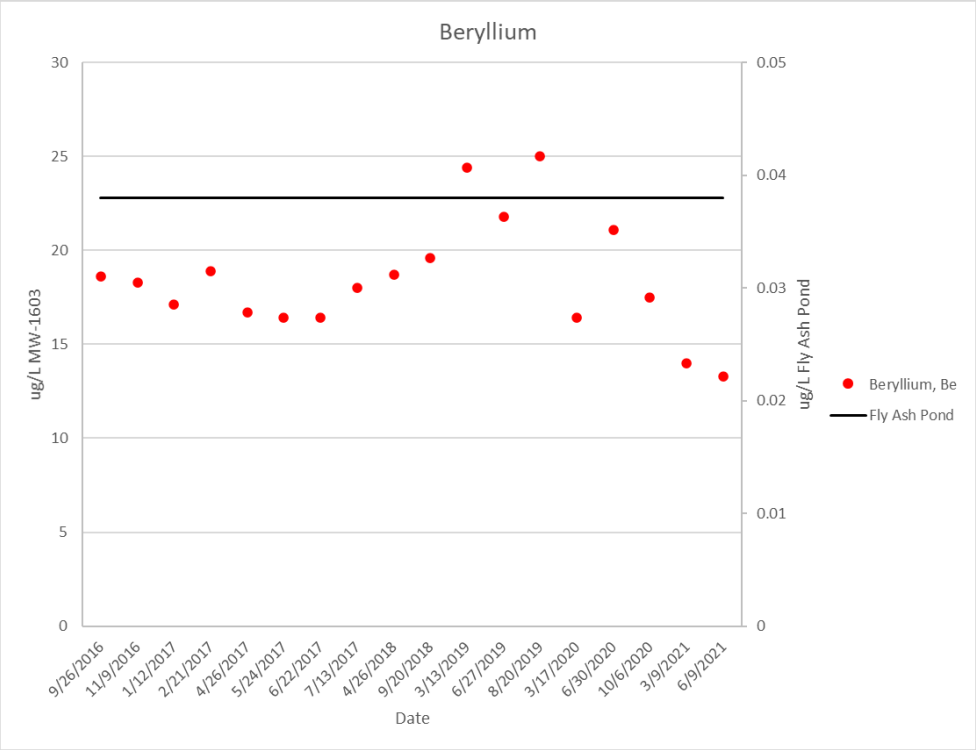


Figure 4-10 MW-1603 Beryllium Concentrations

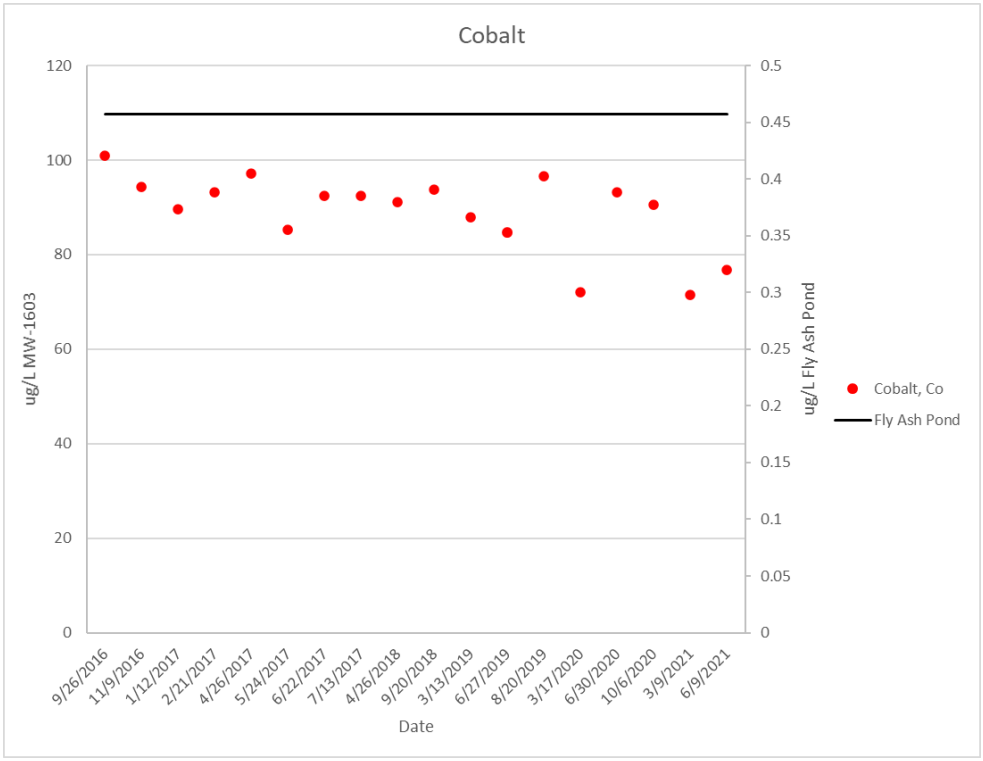


Figure 4-11 MW-1603 Cobalt Concentrations

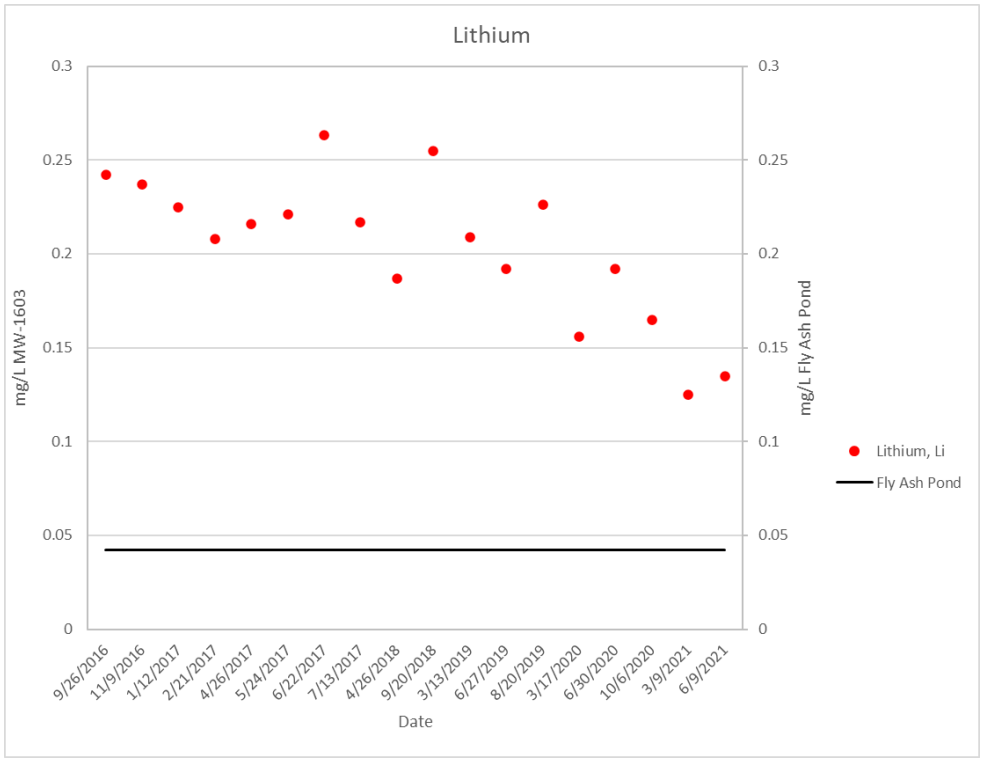


Figure 4-12 MW-1603 Lithium Concentrations

Beryllium, cobalt, and lithium concentrations are higher in groundwater from MW-1603 compared to BSFAP water (note the y-axis scales associated with **Figure 4-10** and **Figure 4-11**). This data indicates that the source of beryllium, cobalt, and lithium in groundwater at MW-1603 is not associated with the BSFAP.

4.1.4 Indicator Analysis Findings

Based on the temporal plots for primary indicators, potential indicators, and ASD constituents, it is considered unlikely that CCR constituents from the BSFAP are influencing the chemistry of surrounding groundwater. This is based on the primary indicator sulfate, potential indicators fluoride and bromide, and the ASD constituent's beryllium, cobalt, and lithium all being present at higher concentrations in surrounding groundwater in comparison to the BSFAP water (EHS Support, 2019a). As the concentrations of these constituents in surrounding groundwater are higher, it is unlikely that there is a concentration gradient extending from the BSFAP into groundwater. A key line of evidence that CCR constituents are not affecting groundwater at MW-1603 is the vastly different pH values between the locations. It is more likely that an alternate source is contributing to the higher concentrations observed in groundwater.

In summary, based on the analyses presented above, no trends in the MW-1603 groundwater dataset suggest that CCR constituents are migrating from the BSFAP into groundwater.

4.2 Tier I Evaluation - Statistical Evaluation

Statistical evaluations of analytes have been conducted previously (EHS Support, 2019a, 2019b, 2020, 2021a, and 2021b). The evaluations concluded that groundwater in the vicinity of MW-1603 is statistically the same as that which the United States Geological Survey (USGS) reported for regional background (Ruppert et al., 2000) for arsenic, boron, calcium, chloride, chromium, fluoride, molybdenum, potassium, sodium, and strontium. The box plots from the earlier ASD investigation (EHS Support, 2019a) also show a difference between monitoring well MW-1603, BSFAP water, and/or the regional background for pH, alkalinity, barium, cobalt, lead, lithium, magnesium, selenium, and sulfate. No background values were provided by the USGS for beryllium, chromium, lead, lithium, molybdenum, and selenium.

Updated box and whisker plots for constituents reported in MW-1603 groundwater are provided in **Appendix A**. Plots for fluoride, pH, and cobalt exhibit outliers which are calculated to be outside the range of distribution (Figure A-4, Figure A-8, and Figure A-10 of **Appendix A**, respectively).

It is likely that the acidic pH conditions identified at MW-1603, relative to regional background, are driving the observed SSLs. The geochemical conditions within well MW-1603, including a strongly acidic pH, low alkalinity, and high sulfate, are indicative of conditions similar to those observed at acid mine drainage sites. At MW-1603, the geochemical conditions have developed due to the presence of the sulfide-bearing Princess coal seams being intersected by the screened interval of the monitoring well (discussed in EHS Support, 2019a). The combination of the well installation and effects of well sampling has resulted in the development of aerobic and water-saturated conditions within the coal seams. These conditions have led to a lowering of the pH through oxidation of sulfides present in the coal which has subsequently enhanced rock dissolution. Enhanced host rock dissolution at MW-1603 is evident from

the much higher total dissolved solids (TDS) values at this location in comparison to groundwater samples from the other Site wells, including water from the BSFAP. In addition to an abundance of sulfides, rock and coal samples from the Princess Formation in Kentucky have been shown to contain parts per million (ppm) levels of beryllium, cobalt, and lithium (Hood et al., 2020), thereby, providing a viable source for the observed SSLs.

For context, studies have demonstrated that the pH of groundwater in contact with fly ash is maintained alkaline (pH 7 to 10) for decades due to buffering by reactions with carbonates and amorphous aluminum silicates in the fly ash (Twardowska et al., 2003). The BSFAP water is consistent with this range, with a pH of 7.97. Consequently, the acidic pH of groundwater identified at MW-1603 is compelling evidence that groundwater at this location has not mixed with and is not representative of water from the BSFAP.

4.3 Tier II Evaluation - Geochemical Evaluation

A simple analysis of primary and potential indicator constituents (as performed in **Section 4.1**) may not provide the lines of evidence required for a robust ASD investigation. It is recognized that naturally occurring indicator constituents and upgradient sources may have an additional influence on groundwater quality. Spatially across a Site, groundwater quality may be observed to change due to chemical interactions with the aquifer matrix. EPRI (2012) recommended the use of more sophisticated methods for multiple parameters over multiple locations, such as ion ratios and ternary plots.

4.3.1 Ion Ratios

The development of ion ratios involves first selecting two non-competing, non-sorbing constituents (boron and chloride). The ratios of these constituents are then compared spatially across the Site and a judgment is made as to whether the hydraulically downgradient groundwater is similar to the background groundwater quality.

The calculation of ion ratios was conducted using median concentrations of the indicator species. The median concentrations of boron, chloride, and sulfate over the monitoring period (September 2016 through June 2021) are provided in **Table 4-1**. These three constituents were selected based on the EPRI (2017) recommended indicator species. Whereas bromide is also a recommended indicator species, it was not included in the assessment as it was non-detect in the BSFAP water, indicating its presence in groundwater was either naturally derived or from an off-site source. The median concentrations for sulfate, boron, and chloride show minimal change since January 2019.

Table 4-1 Median Concentrations of Boron, Chloride, and Sulfate

Location	Location ID	Median Concentrations September 2016 to June 2021		
		Boron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
Source	**Fly Ash Pond**	0.58	35.4	342
Downgradient	**MW-1603**	0.051 ± 0.025	3.45 ± 0.47	711 ± 68

mg/L = milligrams per liter

Ion ratios have been calculated using boron, chloride, and sulfate as recommended in EPRI (2017) and are provided in **Table 4-2**. The ion ratios show little change since the last evaluation in April 2021.

Table 4-2 Ion Ratios

Location	Location ID	Median Concentrations September 2016 to June 2021		
		Boron/Sulfate (x1000)	Boron/Chloride	Chloride/Sulfate
Source	**Fly Ash Pond**	1.68	0.002	0.10
Downgradient	**MW-1603**	0.07 ± 0.03	0.02 ± 0.01	0.005 ± 0.001

Based on the previous and current ion ratio analysis, the conclusion that MW-1603 is not impacted by CCR constituents from the BSFAP is unchanged.

4.3.2 Ternary Plots

Ternary plots are used to identify changes in major or minor ion distributions over time. A ternary plot using calcium, chloride, and sulfate measured in the vicinity of MW-1603 is provided in **Figure 4-13**. The close grouping of ratios from all events on the ternary plot shows that the major ion groundwater ratios have not changed during the five-year period of groundwater quality monitoring at well MW-1603 and that the ratios are distinct from the BSFAP.

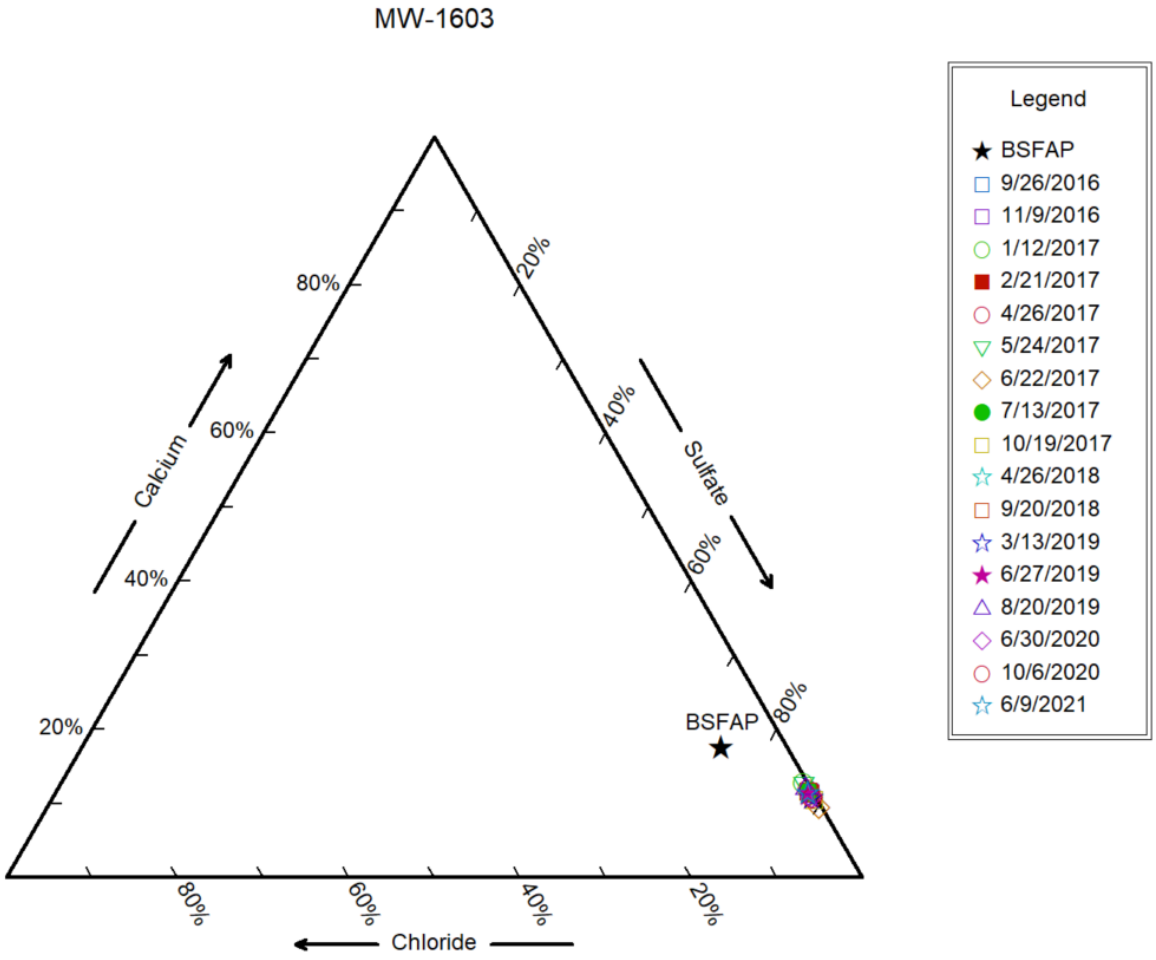


Figure 4-13 Ternary Plot MW-1603

4.3.3 Summary

In summary, based on the previous geochemical evaluation (EHS Support, 2021b) and the updated review presented in this ASD investigation, there is insufficient evidence to support the presence of CCR constituents (beryllium, cobalt, and lithium), derived from the BSFAP, in groundwater sampled at MW-1603. The ternary plot does not support temporal changes of MW-1603 groundwater quality. The boron, chloride, and sulfate ion ratios remain unchanged since September 2019. Therefore, it is unlikely that beryllium, cobalt, and lithium detected within MW-1603 groundwater are sourced from the BSFAP. It is likely that beryllium, cobalt, and lithium are sourced from the lithologies in which MW-1603 is screened across, which includes the Princess coal seam.

5 Summary and Conclusions

Using the EPRI (2017) guidance for ASD investigations, the conclusions based on the lines of evidence presented and discussed within **Sections 3** and **4** indicate that groundwater in the vicinity of the BSFAP is not being impacted by CCR constituents from the BSFAP. The elevated beryllium, cobalt, and lithium concentrations that triggered the ASD investigation are due to the oxidation of sulfide minerals present in coal seams that have been intersected by well MW-1603, including organic material within the screened interval that is identified as having "a slight coaly texture." This is supported by the visual evidence recorded during the logging of the core from this location (refer to EHS Support, 2019a), the low pH reported in groundwater, and the subsequent mobilization and leaching of trace metals (beryllium, cobalt, and lithium) into groundwater by the elevated acidity.

The elevated pH in the BSFAP water and the corresponding lower concentrations of minor ions in the BSFAP also support the unlikely influence of the BSFAP on groundwater. Therefore, it is concluded that the elevated signatures of beryllium, cobalt, and lithium in MW-1603, as noted in the March and June 2021 groundwater monitoring data, are related to the dissolution of naturally occurring, coal seam-derived constituents within the shale layers of the Breathitt Group, as supported by the discussion of local and regional geology in **Section 2.1** and EHS Support (2019a).

In conclusion, this ASD addendum for the BSFAP has determined that Type IV natural variations in groundwater resulted in the SSLs of beryllium, cobalt, and lithium detected at MW-1603.

6 References

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Twardowska, I., Szczepanska, J. and Stefaniak, S. (2003). Occurrence and mobilization potential of trace elements from disposed coal combustion fly ash. In Chemistry of Trace Elements in Fly Ash (pp. 13-24). Springer, Boston, MA.

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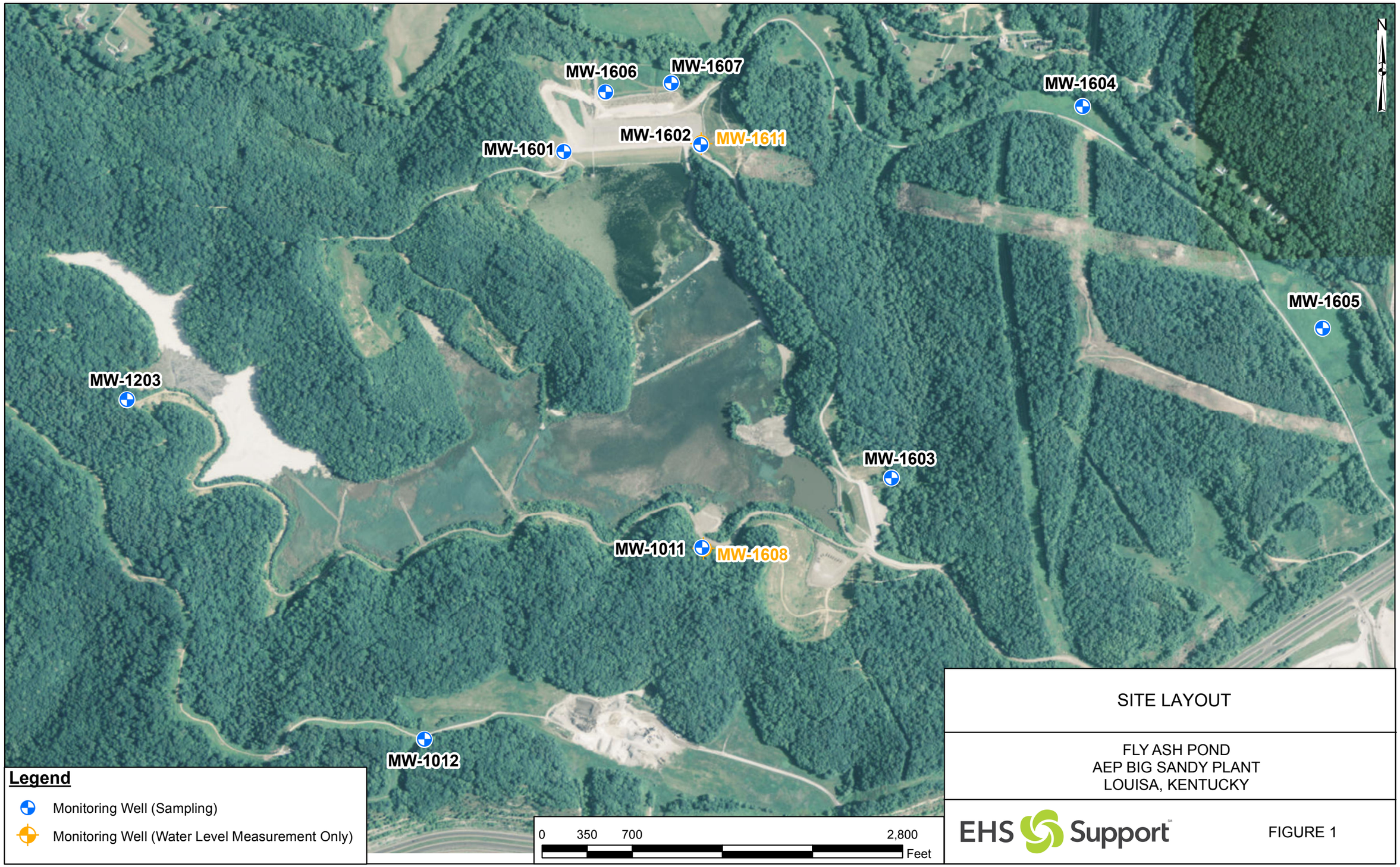
Tables

Table 1
MW-1603 Historical Groundwater Data September 2016 to June 2021
Big Sandy Fly Ash Pond Groundwater Monitoring,
American Electric Power, Kentucky Power Company,
Louisa, Kentucky

Analytes	Units	9/26/2016	11/9/2016	1/12/2017	2/21/2017	4/26/2017	5/24/2017	6/22/2017	7/13/2017	10/19/2017	1/31/2018	4/26/2018	9/20/2018	10/23/2018	3/13/2019	6/27/2019	8/20/2019	3/17/2020	6/30/2020	8/26/2020	10/6/2020	3/9/2021	6/9/2021
Antimony, Sb	µg/L	0.01 J	< 0.01	< 0.01	< 0.01	0.01 J	< 0.01	< 0.01	< 0.01	NA	NA	0.04 J	0.02 J	NA	< 0.2	< 0.04	< 0.1	< 0.02	< 0.04	NA	< 0.02	< 0.02	0.04 J
Arsenic, As	µg/L	1.51	1.19	1.4	1.26	1.3	1.34	1.29	0.89	NA	NA	1.6	1.4	NA	1.26	1.36	1.39	0.83	1.12	NA	1.12	0.84	0.69
Barium, Ba	µg/L	13.4	15.4	11.4	10.3	12.4	11.5	11.4	11.3	NA	NA	10.5	11.4	NA	12	11	13.6	9.92	12.2	NA	14.6	10.1	13.1
Beryllium, Be	µg/L	18.6	18.3	17.1	18.9	16.7	16.4	16.4	18	NA	NA	18.7	19.6	NA	24.4	21.8	25	16.4	21.1	NA	17.5	14	13.3
Boron, B	mg/L	0.054	0.053	0.037	0.085	0.052	0.096	0.051	0.039	< 0.002	NA	0.088	0.085	NA	0.05 J	0.05 J	< 0.1	< 0.1	0.05 J	NA	0.05	NA	0.036 J
Bromide	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06 J	< 0.05	< 0.05	< 0.05	NA	< 0.05	< 0.1	NA	< 0.1	< 0.04	< 0.04	< 0.04	< 0.04	NA	< 0.04	0.03 J	0.03 J
Cadmium, Cd	µg/L	0.84	0.93	0.79	0.75	0.87	0.77	0.86	0.8	NA	NA	0.74	0.83	NA	0.78	0.7	0.89	0.64	0.85	NA	0.87	0.62	0.709
Calcium, Ca	mg/L	105	94.7	92.7	91.9	90.5	93.9	90.6	90.2	91	82.2	83.6	97.5	NA	84.6	83.3	95.8	NA	96.6	NA	94.5	NA	79
Chloride, Cl	mg/L	3.37	3.22	3.45	2.93	3.28	3.34	3.1	3.32	3.24	NA	4.12	3.92	NA	4.42	4.13	3.93	NA	4.18	NA	4.1	NA	4.16
Chromium, Cr	µg/L	1.1	1.12	0.731	0.771	0.829	0.62	0.821	0.485	NA	NA	0.771	0.713	NA	1 J	0.618	0.8	0.56	0.694	NA	0.743	0.659	0.51
Cobalt, Co	µg/L	101	94.4	89.6	93.2	97.1	85.3	92.4	92.5	NA	NA	91.1	93.8	NA	87.9	84.7	96.6	72	93.2	NA	90.5	71.4	76.8
Comb. Radium 226/228	pCi/L	6.04	6.6	5.86	4.03	5.72	6.4	6	6.36	NA	NA	5.09	6.75	NA	4.8	7.149	10.92	7.19	6.22	NA	2.681	3.73	7.18
Fluoride, F	mg/L	1.24	1.1	1.11	0.9	1.04	0.98	0.98	0.93	0.93	0.94	1.16	1.15	NA	0.92	0.87	0.84	0.85	0.71	NA	0.47	0.82	0.76
Lead, Pb	µg/L	9.75	8.18	6.11	6.3	6.41	4.96	6.47	3.72	NA	NA	5.27	4.39	NA	4.28	3.68	4.17	3.95	4.67	NA	4.85	3.37	3.39
Lithium, Li	mg/L	0.242	0.237	0.225	0.208	0.216	0.221	0.263	0.217	NA	NA	0.187	0.255	NA	0.209	0.192	0.226	0.156	0.192	NA	0.165	0.125	0.135
Mercury, Hg	µg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.002 J	< 0.002	< 0.002	< 0.002	NA	NA	< 0.002	NA	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	NA	< 0.002	0.002 J	0.002 J
Molybdenum, Mo	µg/L	0.15	0.17	0.06 J	0.11	0.18	0.07 J	0.32	0.22	NA	NA	0.03 J	0.04 J	NA	< 4	< 0.8	< 2	< 0.4	< 0.8	NA	< 0.4	< 0.1	< 0.1
pH	S.U.	4.29	5.56	3.64	4.51	3.34	3.32	3.04	3.20	3.52	3.52	2.91	3.10	3.46	3.19	3.73	3.54	3.52	3.38	3.27	4.09	3.4	3.64
Potassium, K	mg/L	4.76	4.73	4.25	3.95	3.98	4.34	4.41	3.92	4.46	NA	3.53	5.05	NA	3.81	3.78	4.48	3.42	4.36	NA	4.29	3.83	3.6
Residue, Filterable, TDS	mg/L	1,060	1,010	948	1,020	994	936	1,040	1,000	962	915	926	974	NA	896	954	1,010	NA	NA	1,040	1,020	NA	880
Selenium, Se	µg/L	5.4	4.8	5.6	4.9	6.1	6.3	6.1	2.7	NA	NA	8.1	6.3	NA	4	4.9	5.6	4	6.2	NA	5.8	3.9	3.3
Sodium, Na	mg/L	NA	24.2	22.9	20.3	21.6	23.1	25	22.3	22.4	NA	17	23.9	NA	18.9	19.1	22.2	16.8	21.9	NA	21.1	18.9	19
Sulfate, SO4	mg/L	801	733	636	720	678	646	873	694	784	714	661	747	NA	709	658	704	NA	NA	798	794	NA	618
Thallium, Tl	µg/L	1.29	1.55	1.39	1.2	1.41	1.35	1.43	1.43	NA	NA	1.39	1.7	NA	1 J	1.4	2 J	1.34	1.57	NA	1.82	1.39	1.62

Notes:
< = not detected at or above the method detection limit
µg/L = Micrograms per liter
J = Estimated value. Analyte detected at a level less than the reporting limit but greater than the method detection limit.
mg/L = Milligrams per liter
NA = Not analyzed
pCi/L = Picocuries per liter
S.U. = Standard Units
TDS = Total Dissolved Solids

Figures

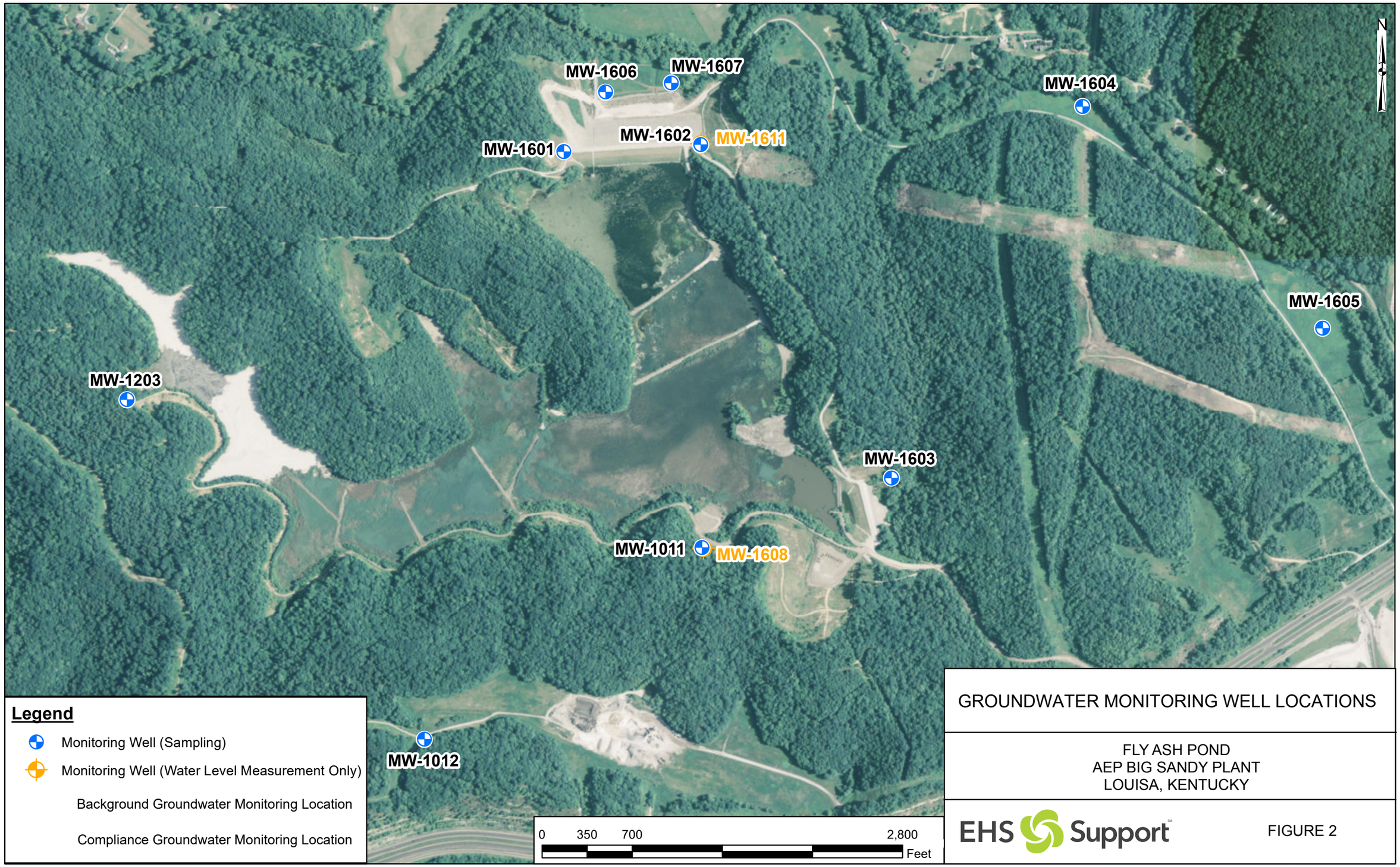


SITE LAYOUT

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

EHS Support

FIGURE 1



GROUNDWATER MONITORING WELL LOCATIONS

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

EHS Support℠

FIGURE 2

Appendix A Box Plots

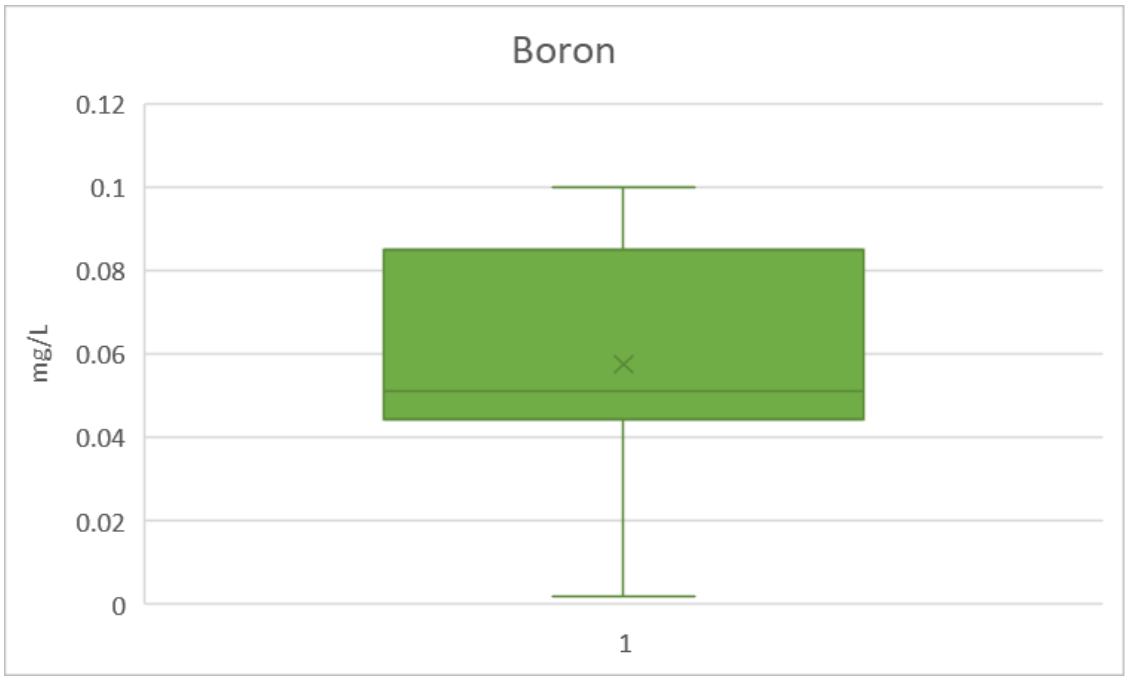


Figure A-1 Boron Box Plot

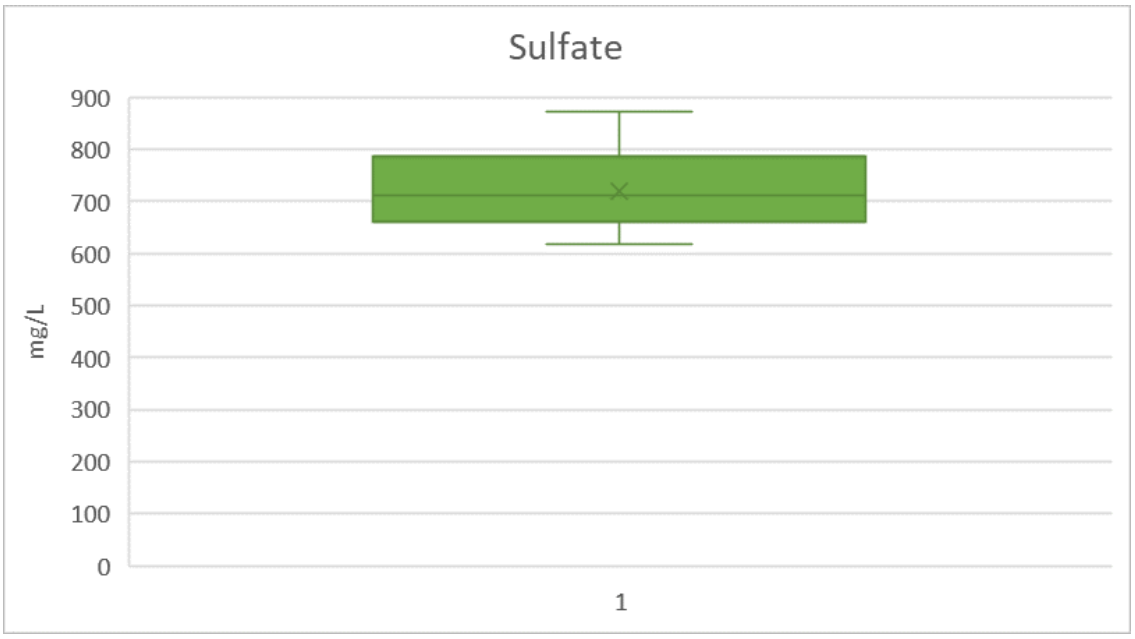


Figure A-2 Sulfate Box Plot

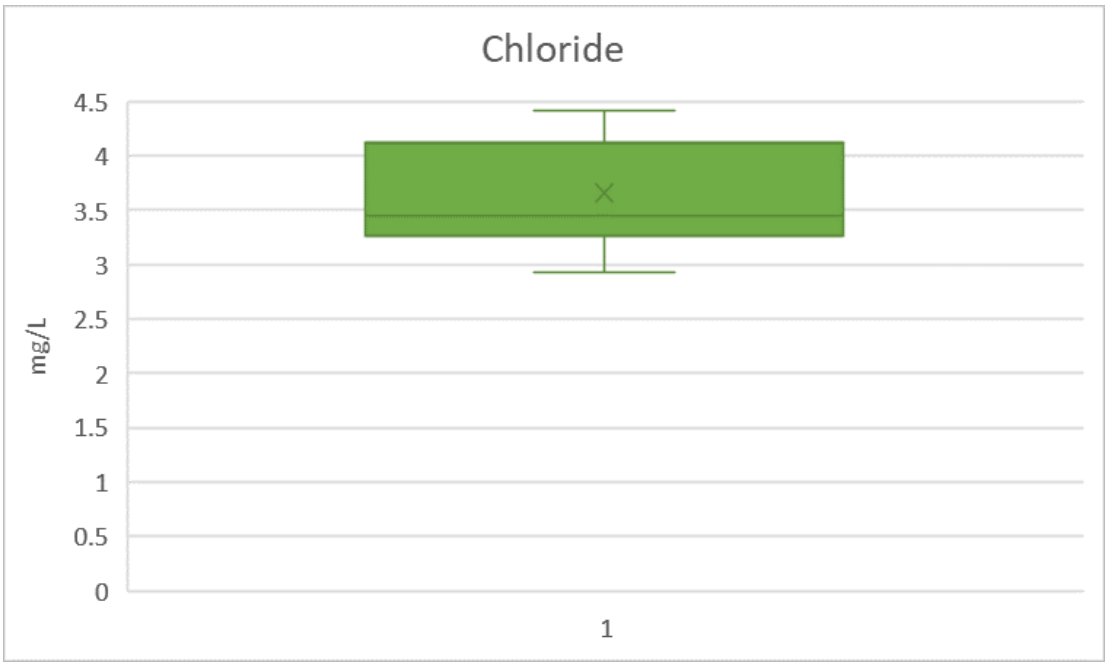


Figure A-3 Chloride Box Plot

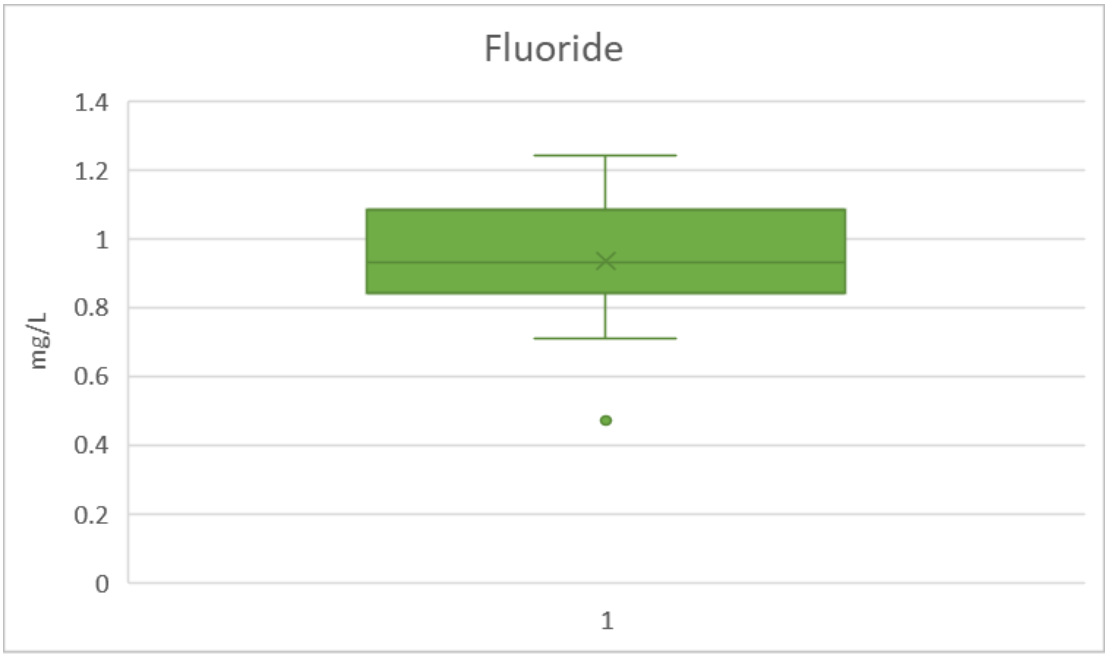


Figure A-4 Fluoride Box Plot

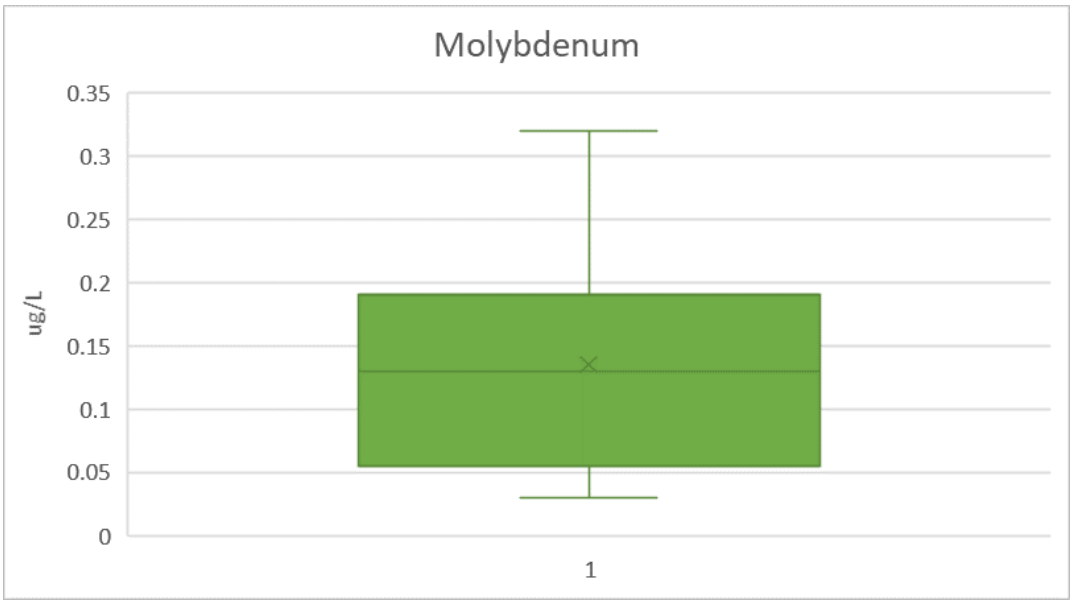


Figure A-5 Molybdenum Box Plot

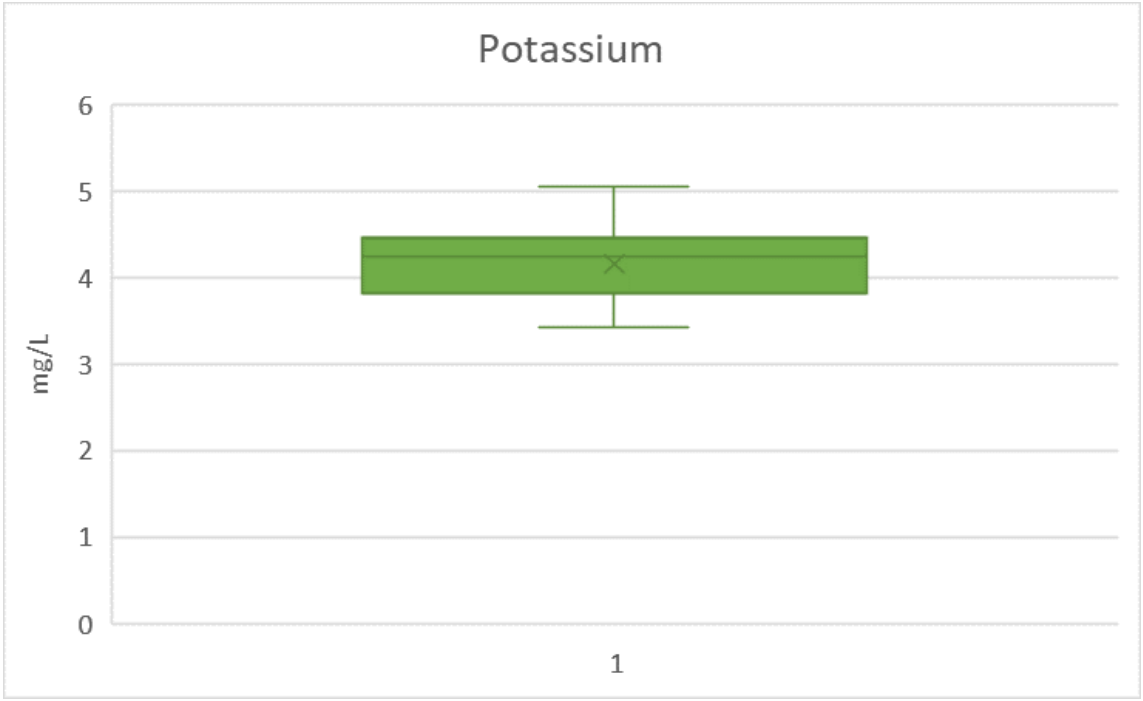


Figure A-6 Potassium Box Plot

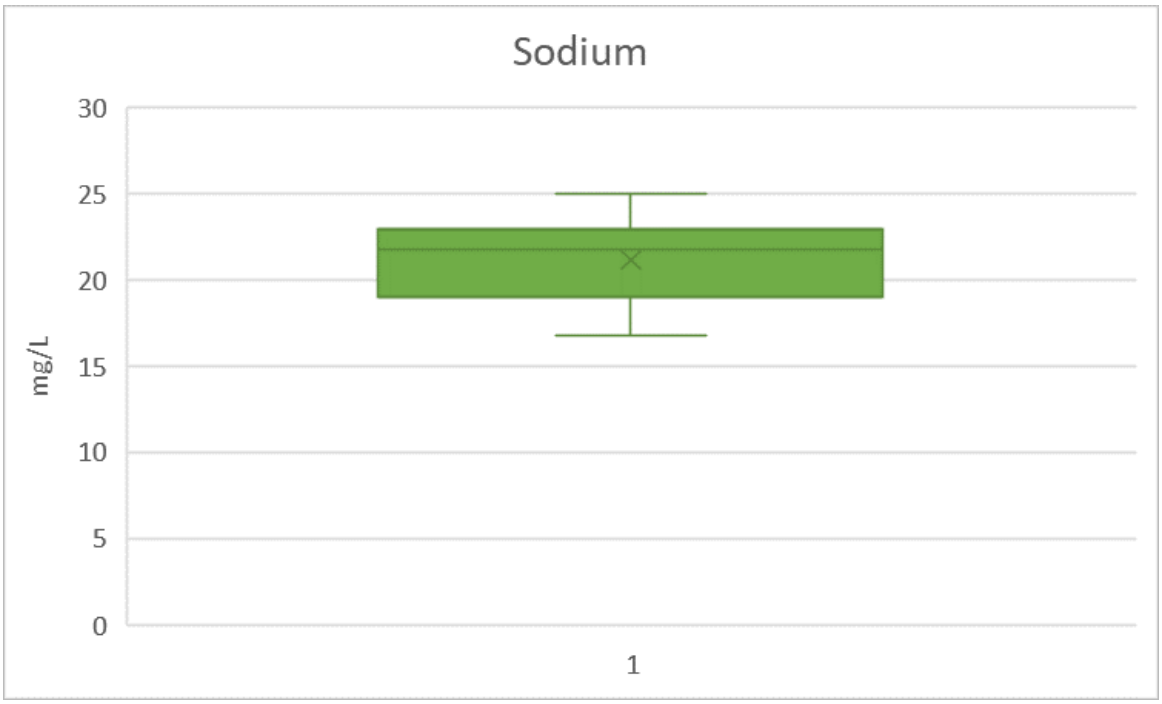


Figure A-7 Sodium Box Plot

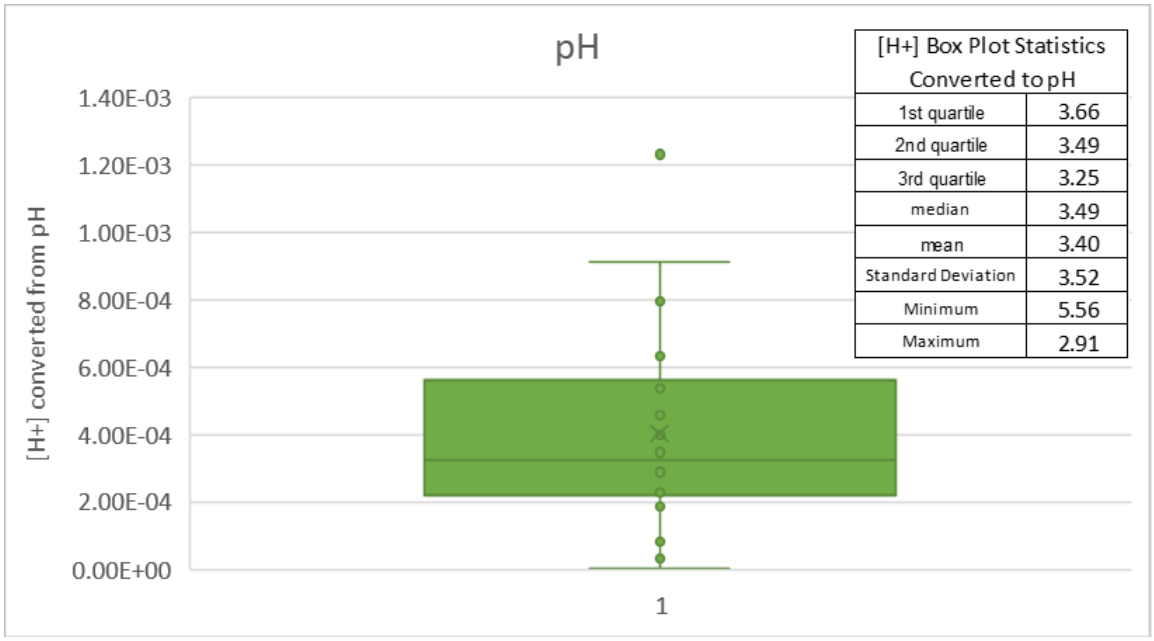


Figure A-8 pH Box Plot

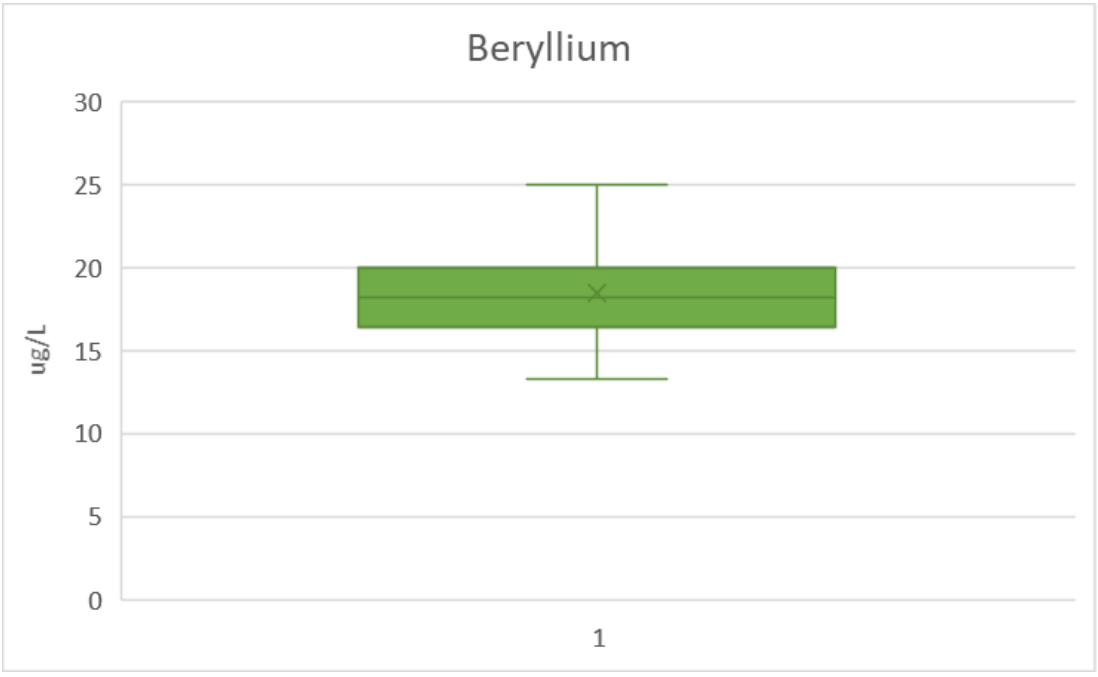


Figure A-9 Beryllium Box Plot

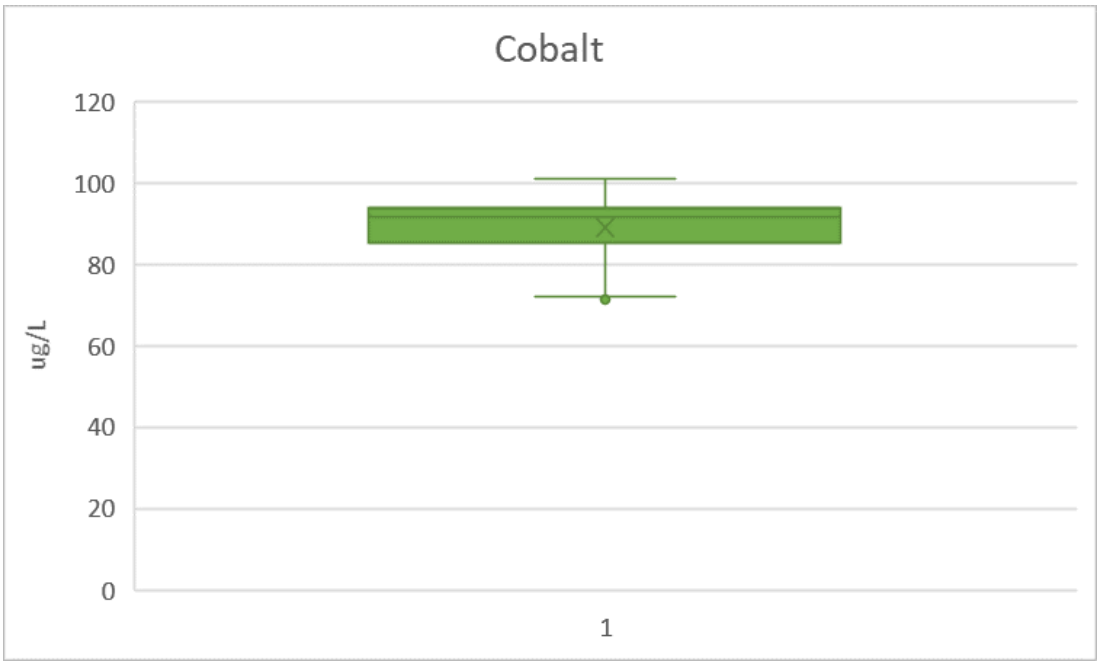


Figure A-10 Cobalt Box Plot

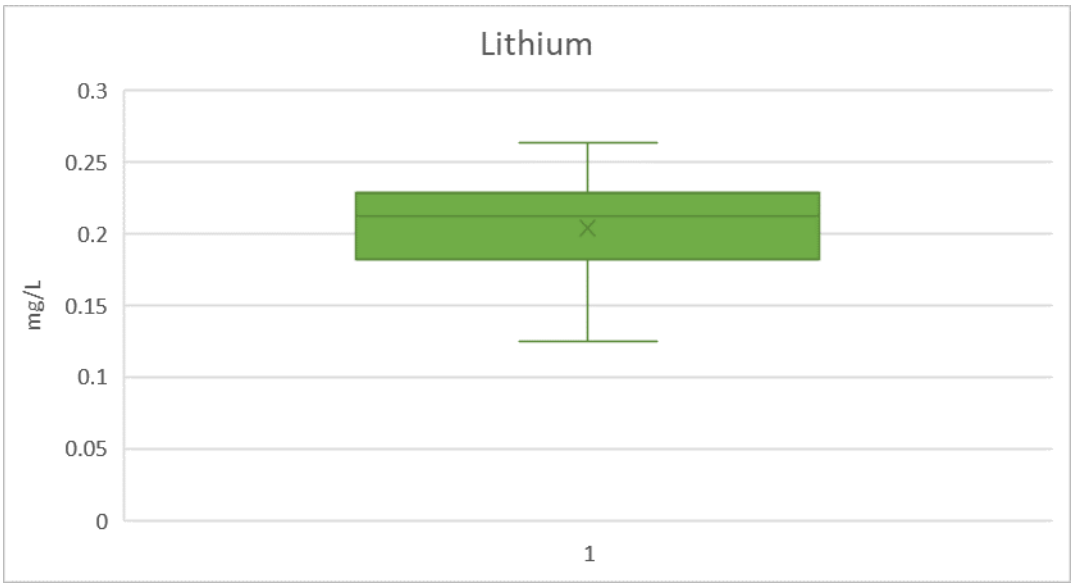


Figure A-11 Lithium Box Plot

APPENDIX 5 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2021; the CCR unit remained in assessment monitoring. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 6 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2021. Well installation/decommissioning logs are not applicable at this time.