Annual Groundwater Monitoring Report

Kentucky Power Company

Mitchell Plant

Landfill

Moundsville, WV

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KENTUCKY POWER℠

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I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for the landfill at Kentucky Power Company's, a wholly owned subsidiary of American Electric Power Company (AEP), Mitchell Power Plant. 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 31st.

In general, the following activities were completed in 2020:

- The unit was in Detection monitoring at the beginning and end of 2020;
- Groundwater samples were collected on October 23, 2019, on May 6, 2020 and on October 21, 2020, and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III parameters were compared to prediction limits (intervals for pH) established from background data established previously;
- The statistical evaluation concluded that there were statistically significant increases (SSIs) over background of one Appendix III parameter at one well (chloride at monitoring well MW-1102F);
- Because SSIs over background of an Appendix III parameter were detected, alternative source demonstration (ASD) studies were conducted resulting in May 2020 and November 2020 ASD reports, as discussed further in Section VI of this report.
- As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event on October 21, 2020, but this data has not yet undergone statistical interpretation.

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

- A map, aerial photograph or a drawing showing the CCR management unit(s), 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 collected as part of detection monitoring or assessment monitoring programs (Attached as Appendix 1);
- Statistical comparison of monitoring data to determine if there have been one or more SSIs over background levels (Attached as Appendix 2, where applicable);

- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as Appendix 3, where applicable);

- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as Appendix 4, 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 5, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or 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 that depicts the PE-certified groundwater monitoring network, the monitoring well locations, and their corresponding identification is provided in Appendix 1.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2020. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mitchell Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

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

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality and detection monitoring. Static water elevation data from each monitoring event also are shown in Appendix 1, along with the groundwater velocities, groundwater flow direction, and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis of the detection monitoring samples collected on October 23, 2019 was completed on February 21, 2020. The evaluation concluded that an SSI of chloride over

background levels was detected in one monitoring well. Statistical analysis of the detection monitoring samples collected on May 6, 2020 was completed on September 3, 2020. The evaluation concluded that an SSI of chloride over background levels was detected in one monitoring well. Memoranda with the results of the statistical evaluations are provided in Appendix 2.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event on October 21, 2020. A statistical evaluation of these results will be completed in 2021.

VI. Alternative Source Demonstrations

Because SSIs over background of an Appendix III parameter were detected at Mitchell Plant's landfill, ASD studies were conducted resulting in May 2020 and November 2020 ASD reports. The reports concluded that the SSIs are not due to a release from the Mitchell Landfill, but were instead attributed to natural variation in groundwater quality. The reports are provided in Appendix 3.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

No transition between monitoring requirements occurred in 2020; the CCR unit remained in detection monitoring over the entire year. A statement to this effect is provided in Appendix 4. The sampling frequency of twice per year will be maintained for the Appendix III parameters (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the semiannual detection monitoring schedule is necessary.

VIII. Other Information Required

The Mitchell landfill has remained in its current status of detection monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2020 and Actions Taken

No significant problems were encountered. Through the use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater were obtained and the schedule was met to support this annual groundwater report preparation. There were, however, dry wells encountered during sampling, but this did not affect the statistical evaluation or monitoring network at the landfill. The minimum requirement of one upgradient and three downgradient wells was still met.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2021 include the following:

- Detection monitoring on a semiannual schedule;
- Statistical evaluation of the detection monitoring results to determine any SSIs (or decreases with respect to pH);
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

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. 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.

Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
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
6/15/2016	Background	0.042	88.3	3.87	0.22	7.4	64.3	395
8/3/2016	Background	0.380	91.0	3.30	0.21	7.4	62.1	425
9/28/2016	Background	0.054	88.6	3.73	0.26	8.7	58.1	466

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
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
6/15/2016	Background	0.21	1.64	159	0.023	0.08	0.6	0.294	0.304	0.22	0.525	0.012	< 0.002 U	3.87	0.2	0.02 J
8/3/2016	Background	0.14	1.46	155	0.033	0.08	0.6	0.244	1.494	0.21	0.673	0.017	< 0.002 U	4.04	0.2	< 0.01 U
9/28/2016	Background	0.18	1.79	142	0.029	0.12	0.8	0.231	1.561	0.26	0.511	0.016	< 0.002 U	3.39	0.3	0.02 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
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
6/15/2016	Background	0.287	6.91	8.41	1.20	8.2	76.4	741
8/3/2016	Background	0.518	5.00	10.3	1.56	8.4	76.4	750
9/28/2016	Background	0.382	6.12	13.3	1.83	8.5	43.5	43
11/16/2016	Background	1.80	19.4	15.2	2.29	8.6	32.2	801
2/14/2017	Background	0.501	2.23	15.4	2.40	8.6	32.0	806
4/12/2017	Background	0.360	4.02	14.4	2.17	8.7	39.2	798
5/24/2017	Background	0.380	1.91	15.1	2.41	8.7	28.6	793
7/25/2017	Background	0.415	1.76	15.8	2.61	8.7	28.7	788
10/11/2017	Detection	0.394	1.87	16.9	2.59	8.7	29.1	784
1/11/2018	Detection	--	1.75	--	--	--	28.8	--
4/10/2018	Detection	0.344	1.75	16.5	2.62	8.5	29.0	790
8/29/2018	Detection	0.371	2.42	16.3	2.45	9.0	29.7	783
5/1/2019	Detection	0.376	1.90	16.9	2.62	10.5	28.7	809
6/12/2019	Detection	0.371	2.03	16.2	2.38	8.8	27.4	822
10/23/2019	Detection	0.389	1.81	17.2	2.70	8.7	28.4	820
5/6/2020	Detection	0.364	2.17	15.1	2.46	8.2	23.9	828
10/21/2020	Detection	0.409	2.42	16.6	2.57	9.1	28.5	845

Notes:
mg/L: milligrams per liter
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- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
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
6/15/2016	Background	0.82	8.11	185	0.031	0.03	1.1	0.650	0.493	1.20	1.22	0.002	0.003 J	31.8	0.5	0.05 J
8/3/2016	Background	1.10	10.8	149	0.023	0.03	1.0	0.363	0.4776	1.56	0.674	0.012	< 0.002 U	32.9	0.5	0.02 J
9/28/2016	Background	0.92	11.1	149	0.01 J	0.02	0.7	0.301	0.565	1.83	0.550	0.009	< 0.002 U	26.2	0.5	0.01 J
11/16/2016	Background	0.67	14.2	125	0.01 J	0.02 J	0.595	0.143	1.808	2.29	0.292	0.026	< 0.002 U	20.6	0.4	< 0.01 U
2/14/2017	Background	0.69	15.3	102	0.01 J	0.02 J	0.512	0.160	1.661	2.40	0.327	0.012	< 0.002 U	34.0	0.4	0.02 J
4/12/2017	Background	0.84	12.4	117	0.02 J	0.02 J	0.824	0.333	0.19	2.17	0.634	0.010	0.002 J	16.7	0.5	< 0.01 U
5/24/2017	Background	0.66	15.7	102	0.01 J	0.01 J	0.526	0.299	0.759	2.41	0.298	< 0.0002 U	< 0.002 U	14.8	0.3	< 0.01 U
7/25/2017	Background	0.62	14.5	91.3	0.01 J	0.01 J	0.377	0.126	0.977	2.61	0.235	0.009	< 0.002 U	18.3	0.3	0.02 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
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
6/15/2016	Background	0.109	4.34	12.4	0.56	8.0	37.2	523
8/3/2016	Background	0.280	5.48	11.9	0.58	8.2	35.9	535
10/3/2016	Background	0.160	5.45	11.8	0.60	8.1	29.5	519
11/15/2016	Background	0.117	4.87	11.7	0.56	8.1	27.4	551
2/14/2017	Background	0.109	5.04	11.3	0.53	8.2	29.9	521
4/12/2017	Background	0.109	4.67	11.3	0.53	8.3	30.6	530
5/24/2017	Background	0.118	5.31	13.7	0.56	8.3	31.8	521
7/26/2017	Background	0.202	5.41	11.4	0.57	8.3	31.5	519
10/10/2017	Detection	0.278	4.79	12.4	0.57	8.4	32.3	526
1/11/2018	Detection	--	4.47	--	--	--	32.1	--
4/10/2018	Detection	0.109	4.40	13.4	0.63	8.2	33.2	539
8/28/2018	Detection	0.247	4.48	14.1	0.64	8.6	33.8	549
5/1/2019	Detection	0.126	4.69	15.2	0.66	9.5	37.6	577
6/12/2019	Detection	0.110	4.36	14.9	0.74	8.2	38.0	574
10/23/2019	Detection	0.114	4.46	16.3	0.68	8.3	38.8	564
1/31/2020	Detection	--	--	16.3	--	8.3	--	--
5/6/2020	Detection	0.129	4.33	16.0	0.69	8.8	33.8	574
7/15/2020	Detection	--	--	16.0	--	8.4	--	--
10/21/2020	Detection	0.147	3.81	17.3	0.76	9.0	39.2	580

Notes:
mg/L: milligrams per liter
SU: standard unit
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J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
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
6/15/2016	Background	0.71	9.37	214	< 0.005 U	0.04	0.4	0.096	0.352	0.56	0.335	0.003	< 0.002 U	28.1	0.3	< 0.01 U
8/3/2016	Background	0.69	8.16	212	< 0.005 U	0.02 J	0.4	0.090	0.881	0.58	0.183	0.006	< 0.002 U	25.8	0.3	0.01 J
10/3/2016	Background	0.64	8.45	194	0.005 J	0.01 J	0.5	0.286	0.972	0.60	0.298	0.002	< 0.002 U	23.9	0.3	< 0.01 U
11/15/2016	Background	0.63	8.49	212	0.005 J	0.008 J	0.435	0.074	1.859	0.56	0.141	0.003	< 0.002 U	22.9	0.3	< 0.01 U
2/14/2017	Background	0.62	8.66	197	0.006 J	0.006 J	0.411	0.049	1.015	0.53	0.131	0.004	< 0.002 U	21.4	0.3	0.02 J
4/12/2017	Background	0.56	7.68	191	0.005 J	0.01 J	0.399	0.079	0.1825	0.53	0.135	0.005	< 0.002 U	19.3	0.3	0.01 J
5/24/2017	Background	0.60	8.76	229	0.01 J	0.02	0.807	0.203	0.3252	0.56	0.335	< 0.0002 U	< 0.002 U	20.0	0.4	0.01 J
7/26/2017	Background	0.54	7.58	205	< 0.004 U	0.01 J	0.323	0.072	0.942	0.57	0.121	0.007	< 0.002 U	34.7	0.3	0.03 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1102R
Mitchell - LF
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
6/15/2016	Background	0.339	3.49	219	2.97	8.2	47.8	1,470
8/3/2016	Background	0.467	4.05	217	2.98	8.3	44.9	1,450
10/3/2016	Background	0.332	5.33	213	2.96	8.3	35.1	1,530

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1102R
Mitchell - LF
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
6/15/2016	Background	2.01	2.64	292	0.02 J	0.35	0.5	0.799	0.71	2.97	0.558	0.015	< 0.002 U	68.7	0.9	0.01 J
8/3/2016	Background	1.71	3.57	356	0.128	0.14	3.0	1.75	1.217	2.98	2.82	0.021	0.007 J	66.0	1.2	0.03 J
10/3/2016	Background	1.73	3.37	441	0.307	0.17	3.9	3.01	2.828	2.96	7.24	0.028	0.007	51.4	1.9	0.03 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1103F
Mitchell - LF
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
6/15/2016	Background	0.355	3.01	243	3.11	8.3	0.5	1,390
8/2/2016	Background	0.402	2.99	247	3.20	8.3	0.3	1,420
10/3/2016	Background	0.321	3.12	242	3.34	8.4	< 0.04 U	1,380
11/16/2016	Background	0.323	2.97	240	2.96	8.4	0.2	1,370
2/15/2017	Background	0.303	2.82	240	3.07	8.5	0.2	1,400
4/11/2017	Background	0.304	2.57	234	3.05	8.6	0.4	1,400
5/23/2017	Background	0.346	2.88	237	3.23	8.5	0.4	1,370
7/26/2017	Background	0.343	2.76	240	3.24	8.5	0.3	1,370
10/11/2017	Detection	0.328	3.09	247	3.17	8.6	0.5	1,390
4/11/2018	Detection	0.286	2.58	239	3.16	8.3	0.5	1,390
8/29/2018	Detection	0.332	2.76	244	3.03	8.6	0.4	1,380
5/2/2019	Detection	0.342	2.95	245	3.13	9.1	0.8	1,360
6/12/2019	Detection	0.329	2.96	233	3.55	8.3	0.9	1,410
10/23/2019	Detection	0.336	3.44	242	3.25	8.5	0.8	1,440
5/6/2020	Detection	0.358	3.48	235	2.96	8.9	0.8	1,420
10/21/2020	Detection	0.332	3.05	237	3.07	8.8	0.8	1,440

Notes:
mg/L: milligrams per liter
SU: standard unit
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J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1103F
Mitchell - LF
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
6/15/2016	Background	0.16	8.03	639	0.029	0.02	1.0	0.351	1.1	3.11	0.674	0.012	< 0.002 U	10.1	0.2	0.01 J
8/2/2016	Background	0.14	7.01	704	0.026	0.01 J	0.9	0.299	0.899	3.20	0.479	0.016	< 0.002 U	2.61	0.2	< 0.01 U
10/3/2016	Background	0.04 J	5.80	558	0.01 J	0.03	0.4	0.180	1.026	3.34	0.313	0.016	< 0.004 U	2.66	0.1 J	0.01 J
11/16/2016	Background	0.10	7.71	723	0.01 J	0.009 J	0.471	0.159	1.57	2.96	0.218	0.015	< 0.002 U	2.57	0.1	< 0.01 U
2/15/2017	Background	0.03 J	7.67	631	0.009 J	0.008 J	0.336	0.147	1.416	3.07	0.213	0.016	< 0.002 U	2.81	0.09 J	0.03 J
4/11/2017	Background	0.07	8.46	618	0.006 J	0.006 J	0.262	0.102	2.183	3.05	0.088	0.015	< 0.002 U	3.19	0.1	< 0.01 U
5/23/2017	Background	0.03 J	7.85	688	0.006 J	0.007 J	0.260	0.149	1.214	3.23	0.194	0.006	< 0.002 U	2.80	0.06 J	< 0.01 U
7/26/2017	Background	0.02 J	6.81	562	< 0.004 U	0.007 J	0.112	0.136	1.798	3.24	0.103	0.015	< 0.002 U	5.46	0.07 J	0.02 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1104R
Mitchell - LF
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
6/21/2016	Background	0.431	39.4	485	1.18	7.87	162	2,390

Notes:
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
SU: standard unit

Table 1 - Groundwater Data Summary: MW-1104R
Mitchell - LF
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
6/21/2016	Background	0.66	4.35	182	0.570	0.18	3.4	4.36	0.153	1.18	9.41	0.014	< 0.09 U	42.3	2.3	0.133

Notes:
µg/L: micrograms per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
mg/L: milligrams per liter

Table 1 - Groundwater Data Summary: MW-1502R
Mitchell - LF
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
6/20/2016	Background	0.268	71.5	33.4	0.18	7.3	155	474
8/9/2016	Background	0.160	95.4	34.0	0.17	7.3	187	547
9/27/2016	Background	0.376	103	39.7	0.1 J	7.4	183	560
11/9/2016	Background	0.214	87.3	25.4	0.1 J	7.4	186	551
2/15/2017	Background	0.069	90.0	167	0.16	7.5	90.1	564
4/12/2017	Background	0.075	72.2	79.5	0.16	7.6	102	507
5/23/2017	Background	0.100	73.9	52.4	0.17	7.6	118	466
7/25/2017	Background	0.158	61.7	18.8	0.20	7.3	88.6	358
10/11/2017	Detection	0.132	91.0	24.5	0.1 J	7.3	159	535
1/11/2018	Detection	--	240	--	--	--	149	--
4/10/2018	Detection	0.051	78.3	196	0.19	7.4	87.6	616
8/29/2018	Detection	0.150	95.7	99.3	0.17	7.7	167	650
5/2/2019	Detection	0.1 J	93.6	245	0.17	8.5	105	702
6/12/2019	Detection	0.127	80.7	155	0.23	7.3	114	661
10/23/2019	Detection	0.194	104	102	0.18	7.2	252	758
1/31/2020	Detection	--	--	--	--	7.4	120	474
5/6/2020	Detection	0.081	64.8	74.6	0.18	7.8	93.0	471
9/1/2020	Detection	--	--	--	--	7.2	--	--
10/21/2020	Detection	0.267	92.5	56.6	0.18	7.7	249	679

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1502R
Mitchell - LF
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
6/20/2016	Background	0.22	0.28	30.6	< 0.005 U	0.005 J	0.3	0.082	0.143	0.18	0.064	0.002	< 0.09 U	3.48	8.2	0.01 J
8/9/2016	Background	0.20	0.26	34.1	< 0.005 U	0.006 J	0.3	0.068	1.029	0.17	0.089	0.010	< 0.002 U	8.71	7.4	< 0.01 U
9/27/2016	Background	0.16	0.27	38.2	< 0.005 U	0.004 J	0.4	0.076	0.429	0.1 J	0.064	0.012	< 0.002 U	8.40	8.8	< 0.01 U
11/9/2016	Background	0.20	0.84	44.2	0.062	0.009 J	1.44	0.507	2.497	0.1 J	0.764	0.006	< 0.002 U	3.19	5.3	0.03 J
2/15/2017	Background	0.13	0.24	27.7	0.006 J	< 0.004 U	1.90	0.069	2.61	0.16	0.061	0.009	< 0.002 U	1.84	4.3	0.03 J
4/12/2017	Background	0.13	0.69	29.2	0.053	0.008 J	1.20	0.426	0.613	0.16	0.630	0.015	0.002 J	1.91	4.8	0.02 J
5/23/2017	Background	0.15	0.53	32.2	0.033	< 0.005 U	0.918	0.238	0.647	0.17	0.364	0.002	< 0.002 U	2.46	4.7	0.01 J
7/25/2017	Background	0.21	0.30	19.0	0.008 J	< 0.005 U	0.196	0.082	0.6323	0.20	0.088	0.009	< 0.002 U	2.47	3.2	0.03 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1: Residence Time Calculation Summary
Mitchell Landfill

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well Pair	Well Diameter (inches)	2020-05		2020-07		2020-10	
			Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	MW1101F/R [1]	2.0	2.4	25	2.4	25	2.4	25
	MW1102F/R [1]	2.0	1.2	49	1.0	59	1.0	64
	MW1103F/R [2]	2.0	1.8	35	1.8	34	1.8	35
	MW1104F/R [2]	2.0	1.2	52	0.7	86	0.6	107
	MW1501F/R [3]	4.0	2.2	55	2.2	54	2.3	54
	MW1502R [3]	4.0	NC	NC	NC	NC	NC	NC
	MW1503F/R [3]	4.0	1.3	96	1.4	89	1.5	84

Notes:
[1] - Sidegradient Well
[2] - Background Well
[3] - Downgradient Well
NC - No calculation can be generated

Legend

- Compliance Sampling Location
- Upgradient Sampling Location
- CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

500 250 0 500
Feet

Site Layout
Landfill - Fish Creek Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1a**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\Landfill-FC\AEP-Mitchell_LF-Fish-Creek_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend

- Compliance Sampling Location
- Upgradient Sampling Location
- CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

500 250 0 500 Feet

Site Layout
Landfill - Rush Run Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1b**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\AEP-Mitchell_LF-Rush-Run_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 22, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek October 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/13

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2019\AEP-Mitchell_Landfill-FC_GW_Oct2019.mxd. ARevezzo. 12/13/2019. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 22, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Rush Run
October 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2019/12/13

Figure **3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-RR\2019\AEP-Mitchell_Landfill-RR_GW_Oct2019.mxd. ARevezzo. 12/13/2019. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 6, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
May 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2020/06/08

Figure **4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2020\AEP-Mitchell_Landfill-FC_GW_May2020.mxd. hduff. 6/8/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 6, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Rush Run
May 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2020/06/09

Figure
5

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-RR\2020\AEP-Mitchell_Landfill-RR_GW_May2020.mxd. hduff. 6/9/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on July 15, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Fish Creek
July 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2020/09/11

Figure **6**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2020\AEP-Mitchell_Landfill-FC_GW_July2020.mxd. ARevezzo. 9/11/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on July 15, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).
- No free water measured at MW-1502R in July 2020.

500 250 0 500
Feet

Potentiometric Surface Map - Rush Run
July 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2020/10/26

Figure **7**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-RR\2020\AEP-Mitchell_Landfill-RR_GW_July2020.mxd. HDuff. 10/26/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 20, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Fish Creek
October 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2020/12/29

Figure **8**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2020\AEP-Mitchell_Landfill-FC_GW_Oct2020.mxd. HDuff. 12/29/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 20, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Rush Run
October 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2021/01/05

Figure **9**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-RR\2020\AEP-Mitchell_Landfill-RR_GW_Oct2020.mxd. ARevezzo. 1/5/2021. Project/Phase/Task.

APPENDIX 2 - Statistical Analyses

The memoranda summarizing the February and September 2020 statistical evaluations follow.

STATISTICAL ANALYSIS SUMMARY-
Background Update Calculations
Landfill – Mitchell Plant
Moundsville, West Virginia

Submitted to

1 Riverside Plaza
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Submitted by

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February 21, 2020

CHA8473

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LIST OF ATTACHMENTS

Attachment A Certification by a Qualified Professional Engineer
Attachment B Statistical Analysis Output

LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Value
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LF	Landfill
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
NELAP	National Environmental Laboratory Accreditation Program
PQL	Practical Quantitation Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
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 lined landfill (LF), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia.

Eight monitoring events were completed prior to June 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. Four semiannual detection monitoring events were conducted between October 2017 and June 2019. Data from these four events, including both initial and verification results, and an additional event completed in January 2018 were evaluated for inclusion in the background dataset. 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 the usability of the data.

The detection monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. The compliance data were reviewed for outliers, which were removed (when appropriate) prior to updating upper prediction limits (UPLs) for each Appendix III parameter to represent background values. Oversight on the use of statistical calculations was provided by Dr. Kirk Cameron of MacStat Consulting, Ltd. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL EVALUATION

2.1 Previous Background Calculations

Eight background monitoring events were completed from September 2016 through June 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. Additional data were collected prior to background monitoring for the CCR Rule at the Mitchell LF, including data collected prior to placement of CCR at the LF. The historical data collected for chloride, fluoride, pH, sulfate, and total dissolved solids (TDS) were also included in the previous background calculation. The data were reviewed for outliers and trends prior to calculating upper prediction limits (UPLs) for each Appendix III parameter. Lower prediction limits (LPLs) were also established for pH. Intrawell prediction limits were selected for all parameters with a one-of-two resampling plan. The statistical analyses to establish background levels were previously documented in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018).

2.2 Data Validation & QA/QC

Since October 2017, four semiannual detection monitoring events have been conducted at the LF. If the initial results for each detection monitoring event identified possible exceedances, verification sampling was completed on an individual well/parameter basis. Thus, a minimum of four samples were collected from each compliance well. A summary of data collected during these detection monitoring events may be found in Table 1. Results for chloride and sulfate samples collected at select wells for an additional event in January 2018, which was also included in the update to background levels, are also provided 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.9.6.23 statistics software. The export was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.3 Statistical Analysis

The data used to conduct the statistical analyses described below are summarized in Table 1. Statistical analyses for the LF were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. The complete statistical analysis results are included in Attachment B.

Time series plots of Appendix III parameters are included in Attachment B and were used to evaluate concentrations over time and to provide an initial screening of suspected outliers and trends. Box plots were also compiled to provide visual representation of variations between wells and within individual wells (Attachment B).

2.3.1 Outlier Evaluation

Potential outliers were evaluated using Tukey's outlier test; i.e., data points were considered potential outliers if they met one of the following criteria:

$$x_i < \tilde{x}_{0.25} - 3 \times IQR \quad (1)$$

or

$$x_i > \tilde{x}_{0.75} + 3 \times IQR \quad (2)$$

where:

$x_i =$ individual data point
$\tilde{x}_{0.25} =$ first quartile
$\tilde{x}_{0.75} =$ third quartile
$IQR =$ the interquartile range $= \tilde{x}_{0.75} - \tilde{x}_{0.25}$

Tukey's outlier test and visual inspection indicated three potential outliers, which were removed from the dataset (Attachment B). These outliers include:

- The calcium concentration of 240 mg/L at MW-1502R from January 11, 2018;
- The pH of 10.5 at MW-1101R from May 1, 2019; and
- The pH of 8.5 from MW-1502R from May 2, 2019.

2.3.2 Establishment of Updated Background Dataset

Analysis of variance (ANOVA) was conducted during the initial background screening to assist in identifying if intrawell tests are the most appropriate statistical approach for assessing Appendix III parameters. Intrawell tests compare compliance data from a single well to background data within the same well and are most appropriate when 1) upgradient wells exhibit spatial variation;

2) when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; or 3) when downgradient water quality is not impacted compared to upgradient water quality for the same parameter. Evidence at the LF shows that a minimum of 14 years would be required for water at downgradient monitoring wells to exhibit changes as a result of practices at the site. Since the lined LF has only accepted waste since 2014, the downgradient monitoring wells are representative of background conditions. Periodic updating of background statistical limits is necessary as natural systems continuously change due to physical changes to the environment. For intrawell analyses, data for all wells and constituents are re-evaluated when a minimum of four new data points are available. These four (or more) new data points are used to determine if earlier concentrations are representative of present-day groundwater quality.

Mann-Whitney (Wilcoxon rank-sum) tests were used to compare the medians of historical data (September 2016 - June 2017) to the new compliance samples (October 2017 – June 2019). 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. Statistically significant differences were found for chloride, fluoride, and TDS at MW-1102F. However, the reported concentrations were lower than the upgradient well, thus the records were updated to use the most recent portion of the record for construction of updated prediction limits, as it is assumed the changes in groundwater quality is unrelated to the unit. While the Mann-Whitney test did not note a significant difference between the two medians for chloride at MW-1502R, more recent concentrations are highly variable and appear to be increasing over time. Therefore, the previously calculated upper prediction limit will be used until additional samples are collected to better evaluate influences on the chloride concentration.

2.3.3 Updated Prediction Limits

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.

Intrawell UPLs were updated using all the historical data through June 2019 to represent background values. Intrawell LPLs were also generated for pH. As described in Section 2.3.2, the only exceptions were for chloride, fluoride, and TDS at MW-1102F which deselected historic higher measurements in favor of more conservative limits that better represent present-day groundwater quality conditions, and for chloride at MW-1502R where the original background dataset was used. 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 does not exceed the UPL, a second sample will not be collected. The retesting procedures allowed achieving an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

2.4 Conclusions

Four detection monitoring events were completed in accordance with the CCR Rule. An additional event completed in January 2018 was also included in the new dataset. The laboratory and field data from these events were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. Mann-Whitney tests were completed to evaluate whether data from the detection monitoring events could be added to the existing background dataset. Where appropriate, the background datasets were updated, and UPLs and LPLs were recalculated using intrawell prediction limits with a one-of-two retesting procedure for all Appendix III parameters.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mitchell Plant. January 2017.

Geosyntec Consultants, 2018. Statistical Analysis Summary. Landfill – Mitchell Plant. January 2018.

United States Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.

TABLES

Table 1: Groundwater Data Summary
Mitchell - Landfill

Parameter	Unit	MW-1101R						MW-1102F					
		10/11/2017	1/11/2018	4/10/2018	8/29/2018	5/1/2019	6/12/2019	10/10/2017	1/11/2018	4/10/2018	8/28/2018	5/1/2019	6/12/2019
		2017-D1	*	2018-D1	2018-D2	2019-D1	2019-D1-R1	2017-D1	*	2018-D1	2018-D2	2019-D1	2019-D1-R1
Boron	mg/L	0.394	-	0.344	0.371	0.376	0.371	0.278	-	0.109	0.247	0.126	0.110
Calcium	mg/L	1.87	1.75	1.75	2.42	1.90	2.03	4.79	4.47	4.40	4.48	4.69	4.36
Chloride	mg/L	16.9	-	16.5	16.3	16.9	16.2	12.4	-	13.4	14.1	15.2	14.9
Fluoride	mg/L	2.59	-	2.62	2.45	2.62	2.38	0.570	-	0.630	0.640	0.660	0.740
Total Dissolved Solids	mg/L	784	-	790	783	809	822	526	-	539	549	577	574
Sulfate	mg/L	29.1	28.8	29.0	29.7	28.7	27.4	32.3	32.1	33.2	33.8	37.6	38.0
pH	SU	8.7	-	8.5	9.0	10.5	8.8	8.4	-	8.2	8.6	9.5	8.2

Parameter	Unit	MW-1103F					MW-1502R					
		10/11/2017	4/10/2018	8/29/2018	5/2/2019	6/12/2019	10/11/2017	1/11/2018	4/10/2018	8/29/2018	5/2/2019	6/12/2019
		2017-D1	2018-D1	2018-D2	2019-D1	2019-D1-R1	2017-D1	*	2018-D1	2018-D2	2019-D1	2019-D1-R1
Boron	mg/L	0.328	0.286	0.332	0.342	0.329	0.132	-	0.051	0.150	0.100 J	0.127
Calcium	mg/L	3.09	2.58	2.76	2.95	2.96	91.0	240	78.3	95.7	93.6	80.7
Chloride	mg/L	247	239	244	245	233	24.5	-	196	99.3	245	155
Fluoride	mg/L	3.17	3.16	3.03	3.13	3.55	0.100 J	-	0.190	0.170	0.170	0.230
Total Dissolved Solids	mg/L	1390	1390	1380	1360	1410	535	-	616	650	702	661
Sulfate	mg/L	0.500	0.500	0.400	0.800	0.900	159	149	87.6	167	105	114
pH	SU	8.6	8.3	8.6	9.1	8.3	7.3	-	7.4	7.7	8.5	7.3

Notes:
mg/L: milligrams per liter
SU: standard unit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
--: Not Measured
D1: First semi-annual detection monitoring event of the year
D2: Second semi-annual detection monitoring event of the year
R1: First verification event associated with detection monitoring round
*January 2018 data are not associated with any semiannual detection monitoring events but were included in the background update.

Table 2: Background Level Summary
Mitchell Plant - Landfill

Parameter	Unit	Description	MW-1101R	MW-1102F	MW-1502R
Boron	mg/L	Intrawell Background Value (UPL)	0.525	0.280	0.265
Calcium	mg/L	Intrawell Background Value (UPL)	6.91	5.71	109
Chloride	mg/L	Intrawell Background Value (UPL)	18.1	15.4	191
Fluoride	mg/L	Intrawell Background Value (UPL)	3.14	0.781	0.244
pH	SU	Intrawell Background Value (UPL)	9.1	9.5	7.7
		Intrawell Background Value (LPL)	7.9	7.6	7.1
Sulfate	mg/L	Intrawell Background Value (UPL)	38.4	45.0	213
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	1600	577	744

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

Certification by a Qualified Professional Engineer

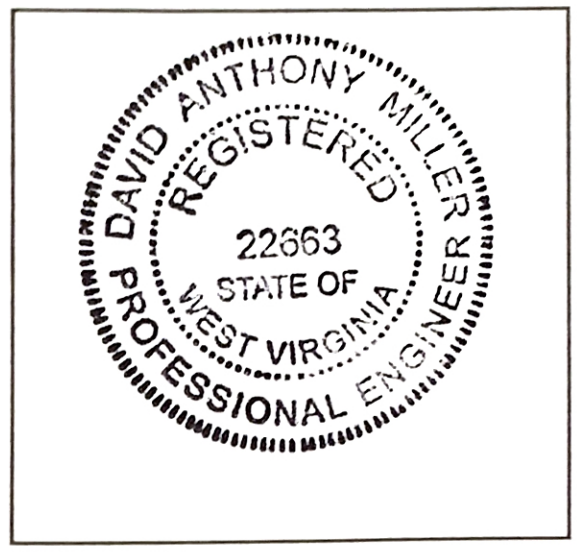
I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



22663	WEST VIRGINIA	02.27.2020
License Number	Licensing State	Date

ATTACHMENT B
Statistical Analysis Output

GROUNDWATER STATS CONSULTING

December 11, 2019

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

RE: Background Update - Mitchell Landfill

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the background update of groundwater data for American Electric Power's Mitchell Landfill. 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).

The Mitchell Landfill is a lined landfill regulated under the CCR program. Sampling for background under the CCR program at all wells began in 2016. The existing data collected prior to 2016 for chloride, fluoride, pH, sulfate and TDS is included in the screened background. Waste placement began in 2014, and based on reported groundwater flow and transport times, as well as downgradient well placement relative to the landfill, a minimum of 14 years would be required for water at downgradient wells to reflect changes should they occur as a result of practices of the site. Therefore, the statistical method is selected during the background screening was based on this information as well as the behavior of groundwater upgradient of the facility.

The monitoring well network, as provided by Geosyntec Consultants, consists of the following: upgradient wells MW_1103F, and MW_1104R; and downgradient wells MW_1101F, MW_1101R, MW_1102F, MW_1102R, MW_1502R and MW_1503F. Note that due to wells being dry at the time of sampling, only upgradient wells MW_1103F and

downgradient wells MW_1101R, MW_1102F, and MW_1502R are included in this analysis and background update.

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting.

The following Appendix III detection monitoring constituents were evaluated: boron, calcium, chloride, fluoride, pH, sulfate, and TDS.

Time series plots for these parameters at all wells are provided for the purpose of evaluating data at these wells (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). The time series plots are used to identify suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

Proposed background data at all wells were evaluated during the background screening conducted in January 2018 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 were provided to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for boron, calcium, chloride, fluoride, pH, 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. 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.

- 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 may be 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.

Summary of Background Screening – Conducted in January 2018

Outlier Evaluation

Time series plots are used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits. A summary of those values was submitted with the screening.

Tukey's outlier test noted a few outliers. Any values identified as outliers are plotted in a lighter font on the time series graph. Note that while the test did not identify an outlier for TDS at well MW-1101R for the reported measurement of 43 mg/L, this value was flagged as an outlier in the database as it does not appear to represent the population based on all other reported measurements at this well. A substitution of the most recent reporting limit was applied when varying detection limits existed in data.

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.

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 that accompanies the trend tests. A statistically significant increasing trend was noted for fluoride in well MW-1101R; however, the concentrations at this well are lower than those observed in the upgradient well and follow a similar pattern. Additionally, statistically significant increasing trends were noted for pH in upgradient well MW_1103F and downgradient well MW_1101R. Generally, when similar patterns in concentrations are observed upgradient of the facility, it is an indication that groundwater is naturally changing over time. All of the observed trends are relatively low in magnitude when compared to average concentrations; therefore, no adjustments were made to the data sets. The trend test results were submitted with the screening.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) is typically used to statistically evaluate differences in average concentrations among multiple 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.

However, the ANOVA could not be performed for the Mitchell Landfill because there is only one upgradient well with greater than 4 reported values. Therefore, all data were further evaluated as described below for the appropriateness of intrawell testing for Appendix III parameters to accommodate the groundwater quality.

Appendix III - Statistical Limits

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. This statistical method removes the element of variation from across wells and eliminates the chance of mistaking natural spatial variation for a release from the facility. Prior to performing intrawell prediction limits, several steps are required to reasonably demonstrate downgradient water quality does not have existing impacts from the practices of the facility.

Exploratory data analysis was used as a general comparison of concentrations in downgradient wells for all Appendix III parameters recommended for intrawell analyses to concentrations reported in the upgradient well. Upper tolerance limits are used in conjunction with confidence intervals to determine whether the estimated averages in downgradient wells are higher than observed levels upgradient of the facility. The upper tolerance limits were constructed to represent the extreme upper range of possible background levels at the site.

In cases where downgradient average concentrations are higher than observed concentrations upgradient for a given constituent, an independent study and hydrogeological investigation would be required to identify local geochemical conditions and expected groundwater quality for the region to justify an intrawell approach. Such an assessment is beyond the scope of services provided by Groundwater Stats Consulting. When there is not an obvious explanation for observed concentration differences in downgradient wells relative to reported concentrations in upgradient wells, interwell prediction limits will initially be selected for the statistical method until further evidence shows that concentrations are due to natural variation rather than a result of the facility.

Parametric tolerance limits were constructed with a target of 99% confidence and 95% coverage using pooled upgradient well data for each of the Appendix III parameters recommended for intrawell analyses. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. As more data are collected, the background population is better represented and the confidence and coverage levels increase.

Confidence intervals were constructed on downgradient wells having at least 4 samples for each of the Appendix III parameters, using the tolerance limits discussed above, to determine intrawell eligibility. When the entire confidence interval is above a background

standard for a given parameter, interwell methods are initially recommended as the statistical method. Therefore, only the parameters with confidence intervals which did not exceed background standards are typically eligible for intrawell prediction limits.

Confidence intervals for the above parameters were found to be within their respective background limit for all Appendix III parameters except calcium and sulfate. However, as discussed previously, the landfill is lined with waste placement beginning in 2014. Evidence shows that a minimum of 14 years would be required for water at downgradient wells to exhibit any changes if they should occur as a result of practices at the site. Because of the limited upgradient well data, implementing an interwell statistical methodology for would likely result in statistical exceedances at downgradient wells due to spatial variation, rather than from practices at the facility. Therefore, intrawell methods are recommended for all Appendix III parameters.

All available data through July 2017 at each well were used to establish intrawell background limits, based on a 1-of-2 resample plan that will be used for future comparisons.

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 will be necessary to accommodate these types of changes In the interwell case, newer data will be included in background when a minimum of 2 new samples are available. In the intrawell case, data for all wells and constituents are 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 some cases, the earlier portion of data are deselected prior to construction of limits in order to provide sensitive limits that will rapidly detect 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.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of an additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered to be a false positive result and, therefore, no further action is necessary.

Background Update Summary – November 2019

Prior to updating background data sets, all Appendix III data through June 2019 were re-evaluated using Tukey's outlier test and visual screening (Figure C). Several outliers were noted and flagged. As mentioned above, flagged data are displayed in a lighter font and as a disconnected symbol on the time series reports, as well as in a lighter font on the accompanying data pages. An updated summary of Tukey's test results and flagged outliers follows this letter.

The Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through July 2017 to the new compliance samples at each well through June 2019 to evaluate whether the groups are significantly different at the 99% confidence level, in which case background data may be updated with compliance data (Figure D). Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future.

Statistically significant differences were found for chloride, fluoride and TDS for well MW_1102F. However, because these reported concentrations are considerably less than those reported in the upgradient well, these records were updated to use the most recent portion of the record with more stable concentrations for construction of updated prediction limits, with the assumption that the groundwater quality is changing unrelated to the facility. While no difference was noted with the Mann Whitney test at 99% confidence for chloride in downgradient well MW_1502R, more recent concentrations are highly variable and appear to be increasing over time. Therefore, this record was not updated at this time and will be re-evaluated during the next background update. A summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report. Additionally, a summary of well/constituent pairs using a truncated portion of their records follows this letter.

Intrawell prediction limits using all historical data through June 2019 (except for special cases discussed above), combined with a 1-of-2 resample plan, were constructed and a summary of the updated limits follows this letter (Figure E). Future compliance observations at each well will be compared to these background limits during each subsequent semi-annual sampling event.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mitchell Landfill. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Date Ranges

Date: 12/11/2019 2:42 PM

Mitchell LF Client: Geosyntec Data: Mitchell Landfill

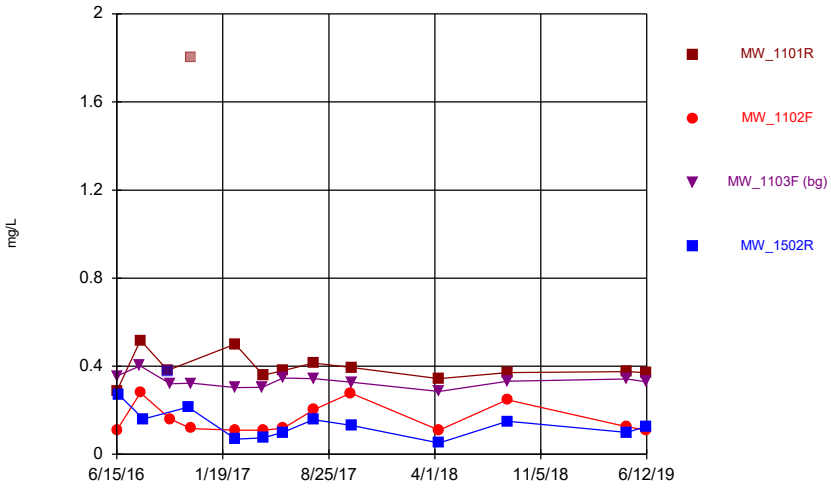
Chloride, total (mg/L)
- MW_1102F background:5/25/2016-6/12/2019
- MW_1502R background:6/20/2016-7/25/2017

Fluoride, total (mg/L)
- MW_1102F background:4/12/2017-6/12/2019

Sulfate, total (mg/L)
- MW_1103F background:8/2/2016-6/12/2019

Total Dissolved Solids [TDS] (mg/L)
- MW_1102F background:6/17/2015-6/12/2019

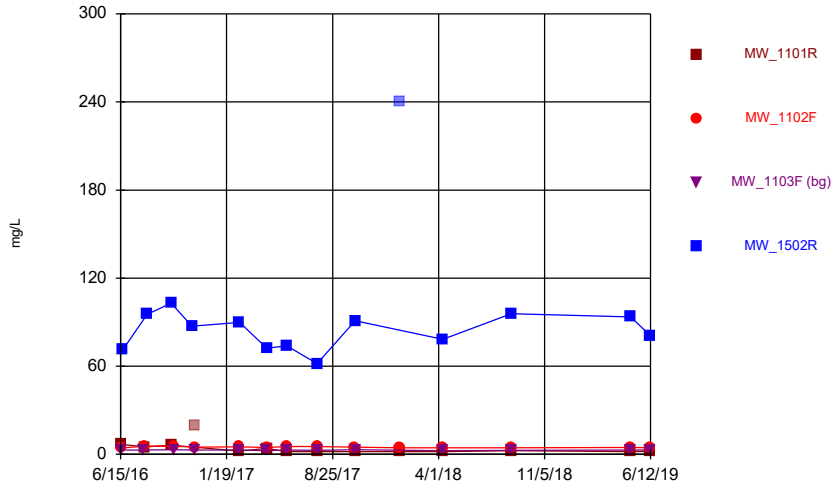
Time Series



Constituent: Boron, total Analysis Run 10/29/2019 12:55 PM View: Time Series
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

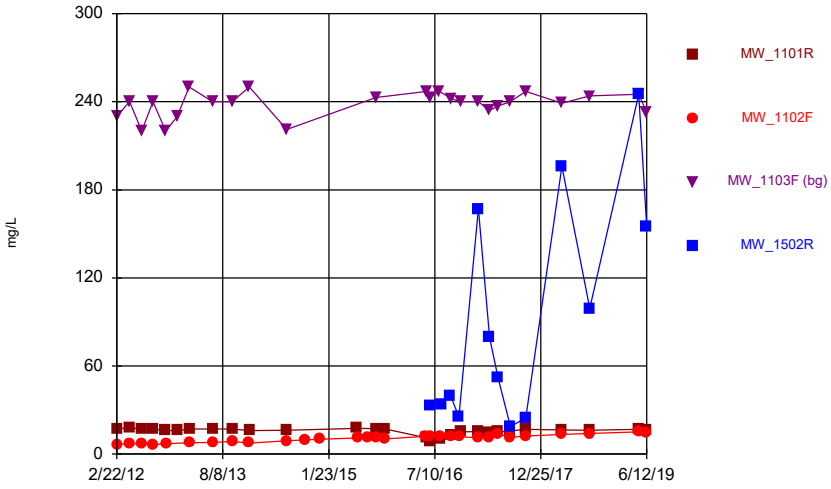
Time Series



Constituent: Calcium, total Analysis Run 10/29/2019 12:55 PM View: Time Series
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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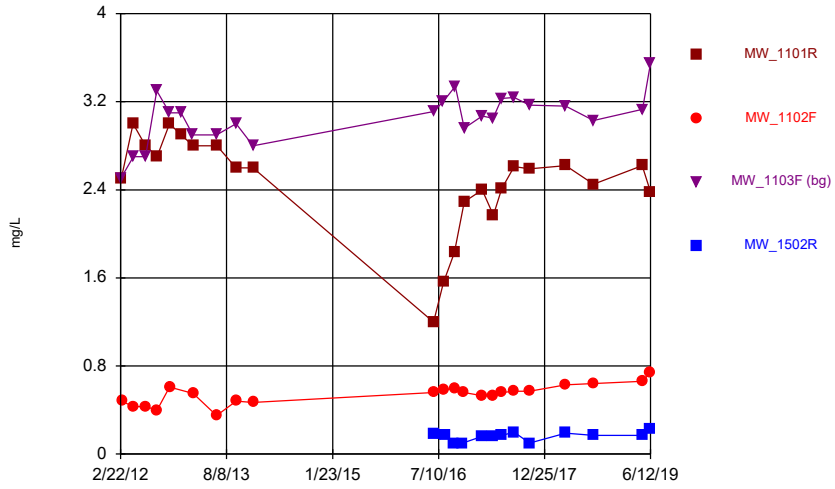
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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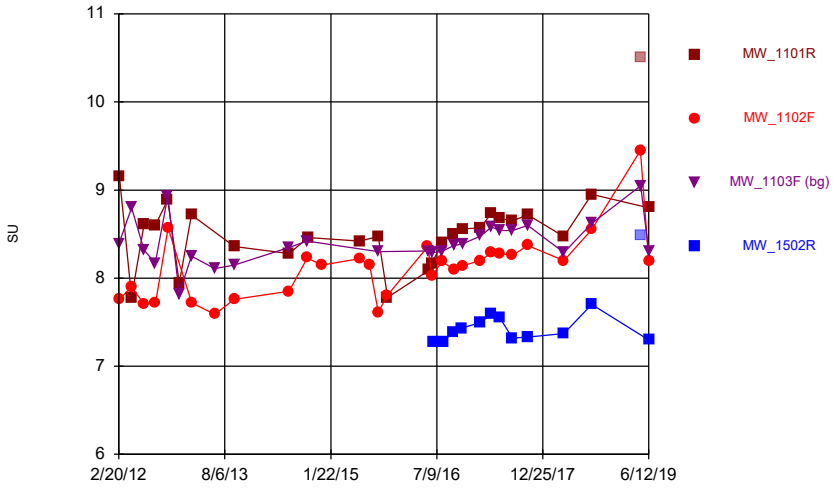
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

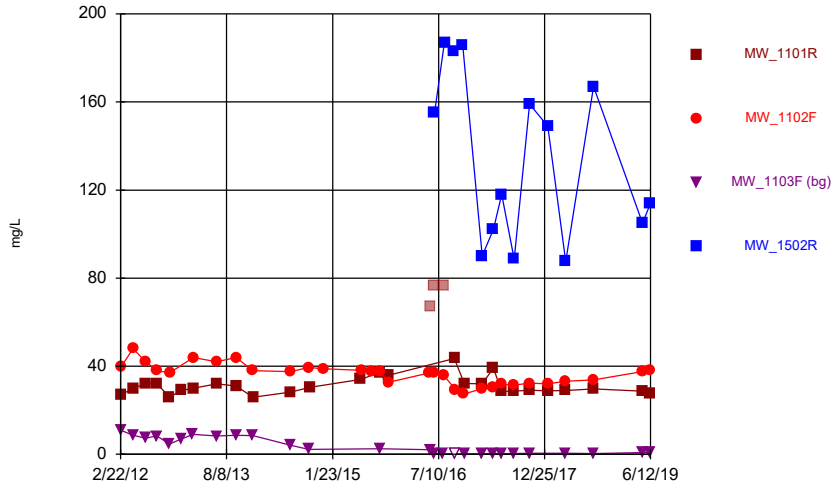
Time Series



Constituent: pH, field Analysis Run 10/29/2019 12:55 PM View: Time Series
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Hollow symbols indicate censored values.

Time Series



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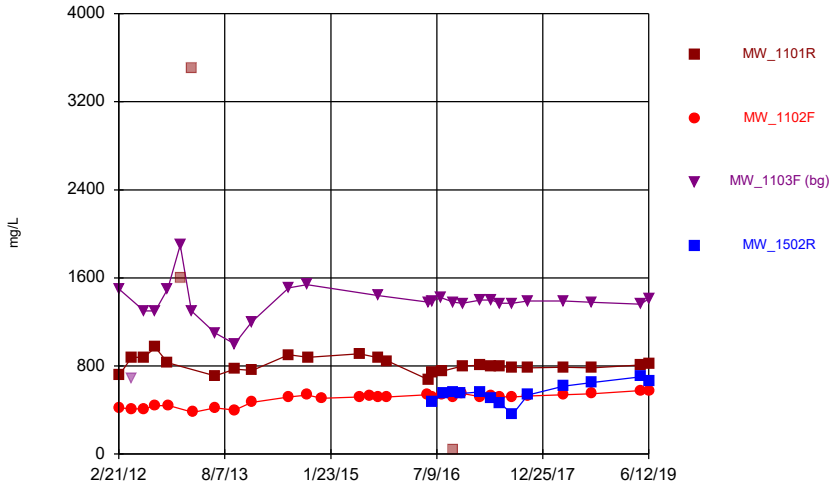
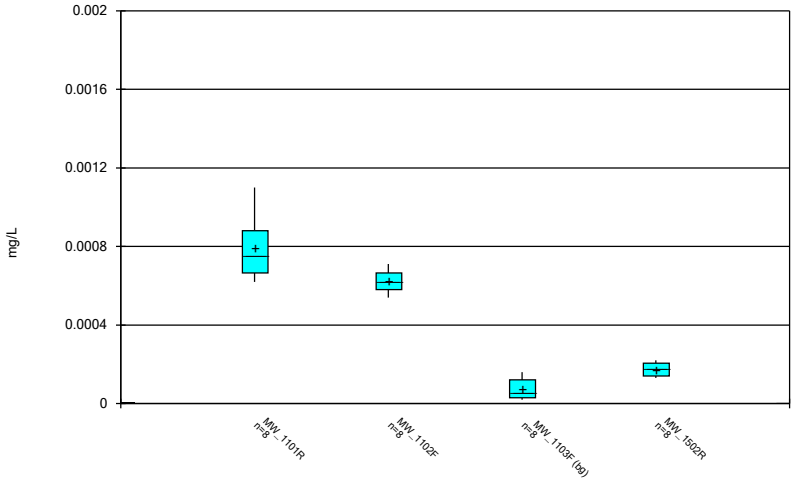
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 10/29/2019 12:55 PM View: Time Series
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot



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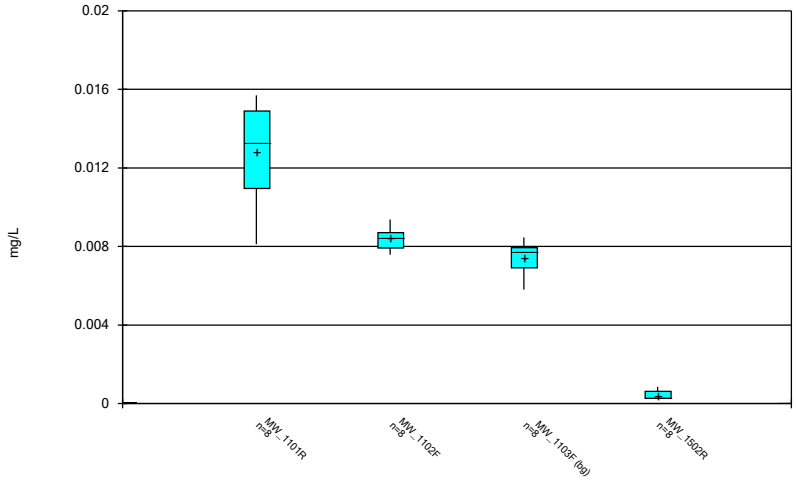
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

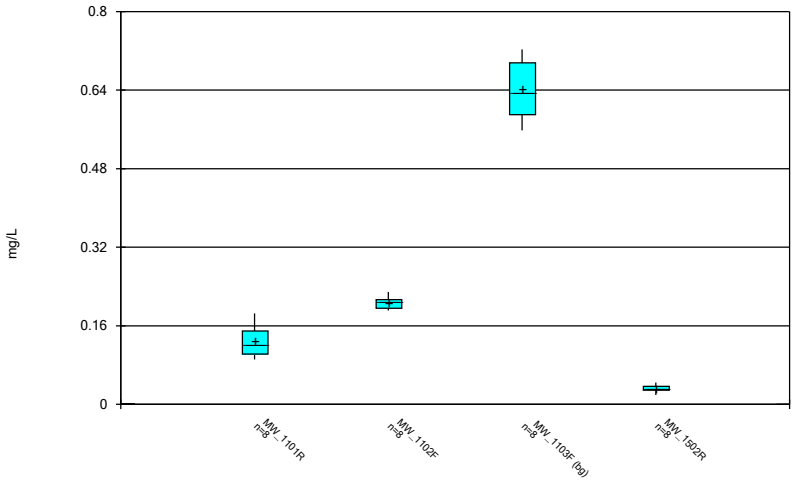
Box & Whiskers Plot



Constituent: Arsenic, Total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

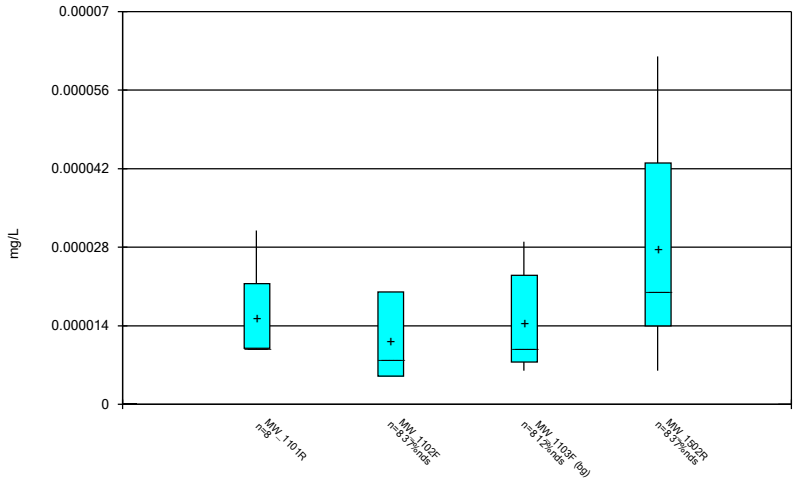
Box & Whiskers Plot



Constituent: Barium, Total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot



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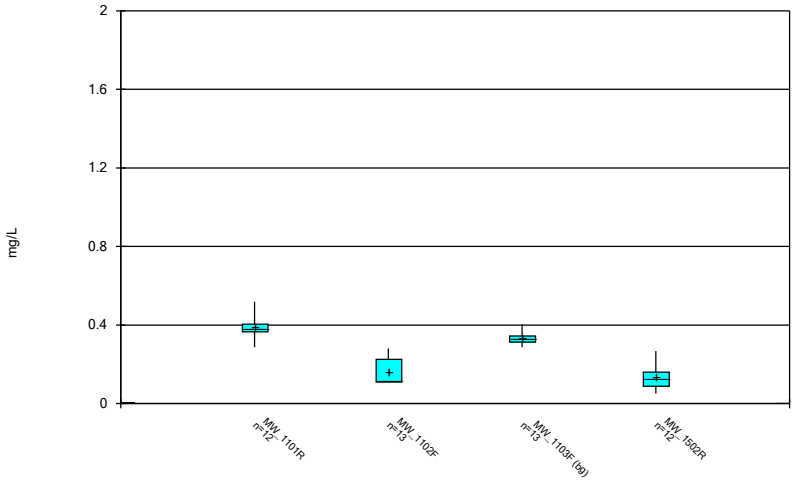
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

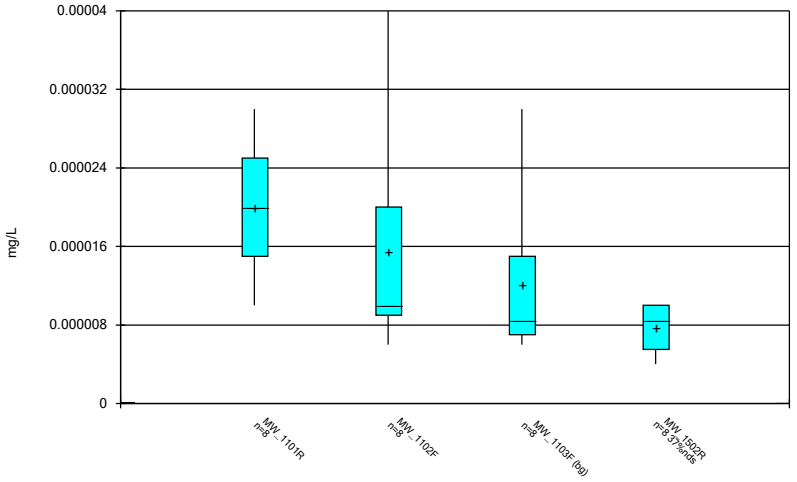
Box & Whiskers Plot



Constituent: Boron, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

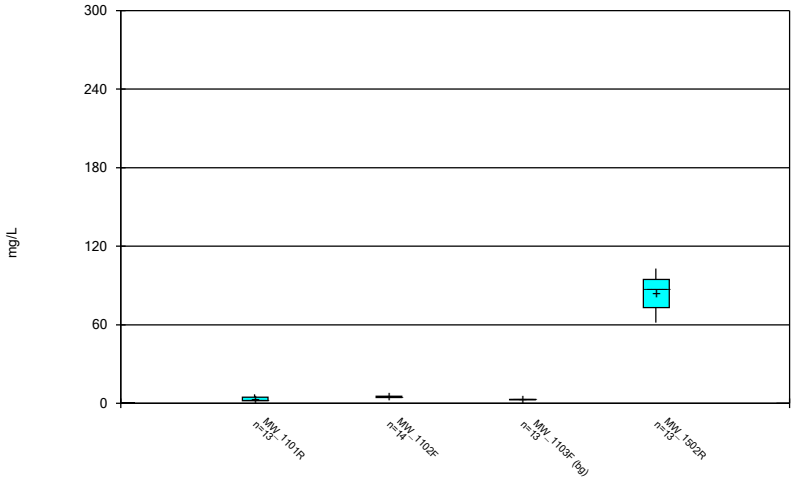
Box & Whiskers Plot



Constituent: Cadmium, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

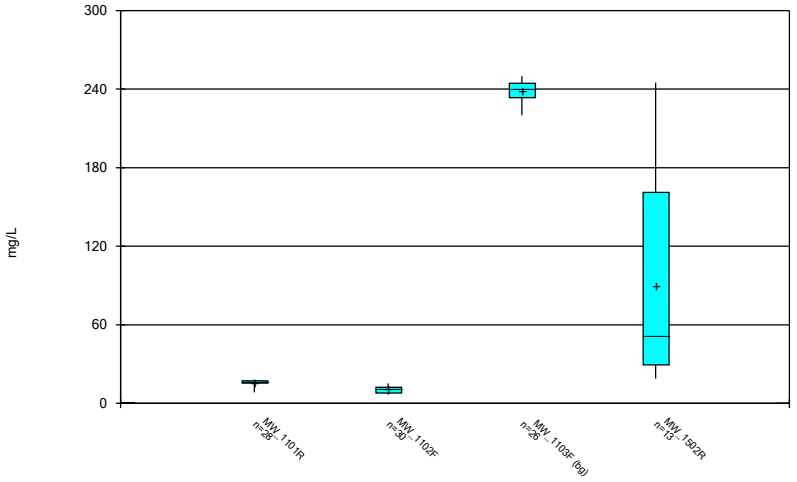
Box & Whiskers Plot



Constituent: Calcium, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

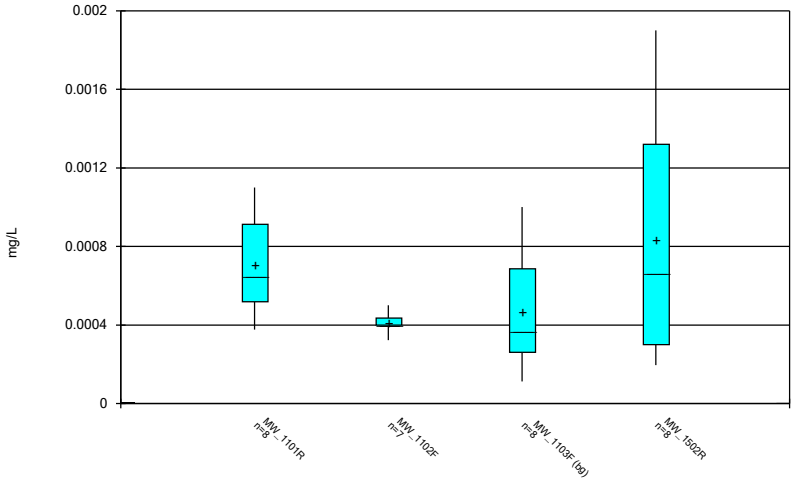
Box & Whiskers Plot



Constituent: Chloride, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

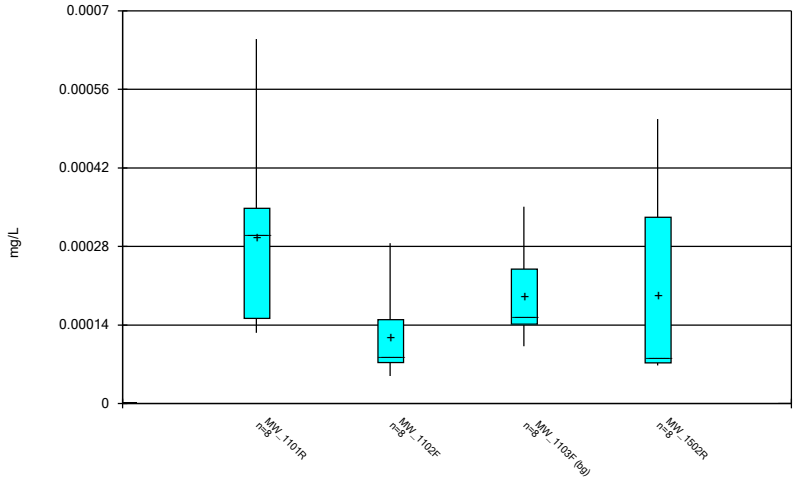
Box & Whiskers Plot



Constituent: Chromium, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

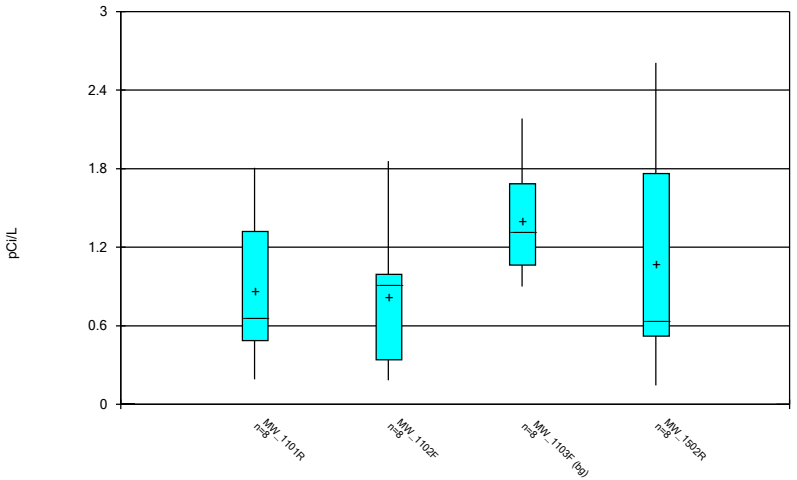
Box & Whiskers Plot



Constituent: Cobalt, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

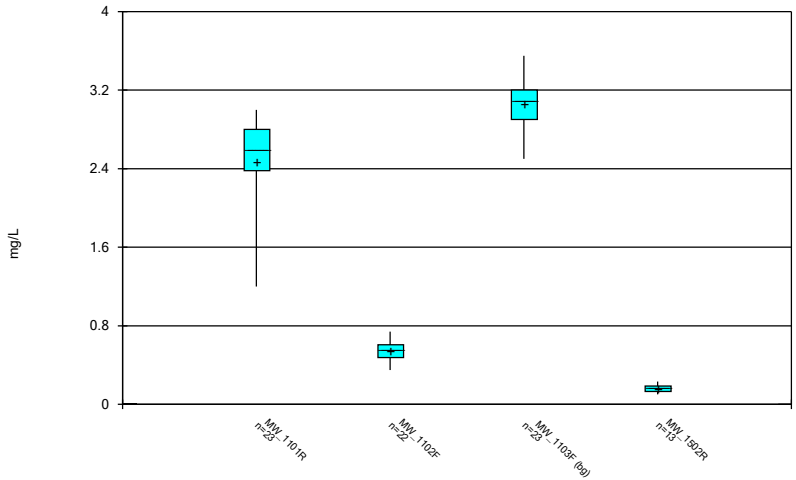
Box & Whiskers Plot



Constituent: Combined Radium Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

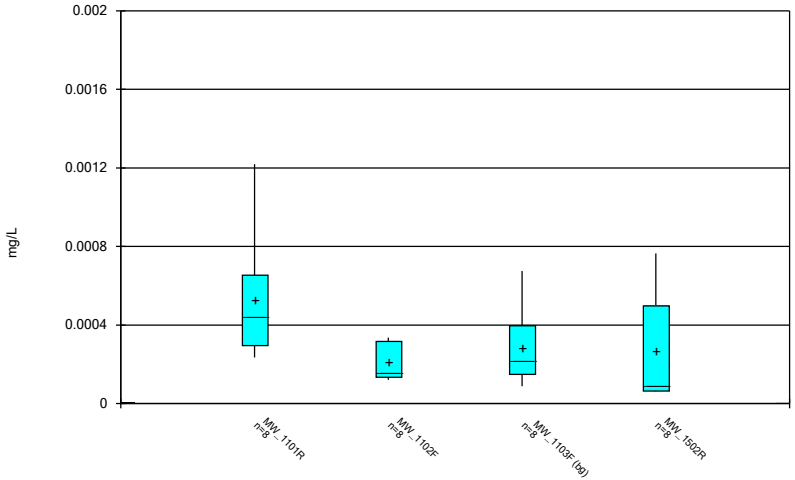
Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot



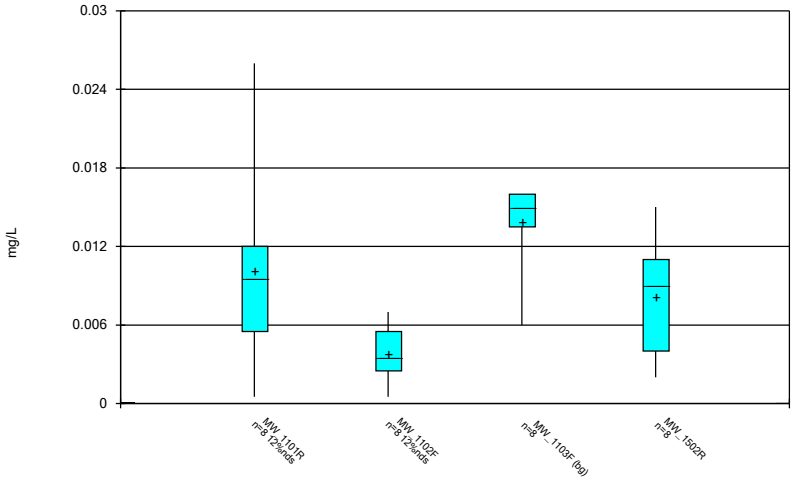
Constituent: Fluoride, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



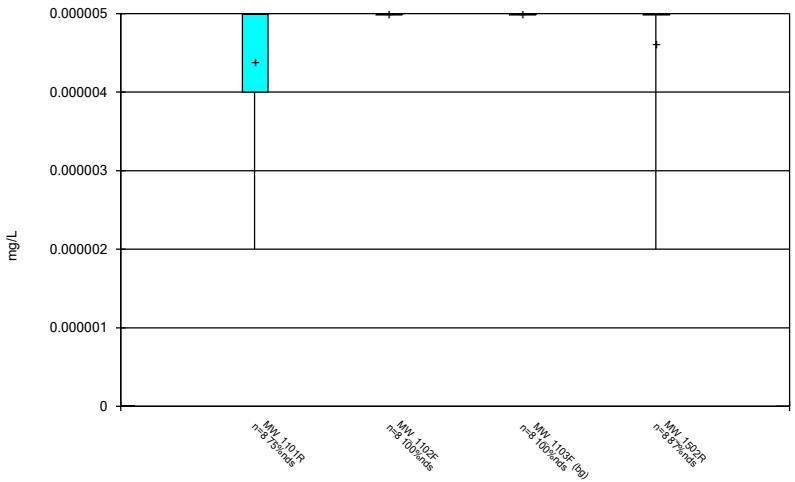
Constituent: Lead, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



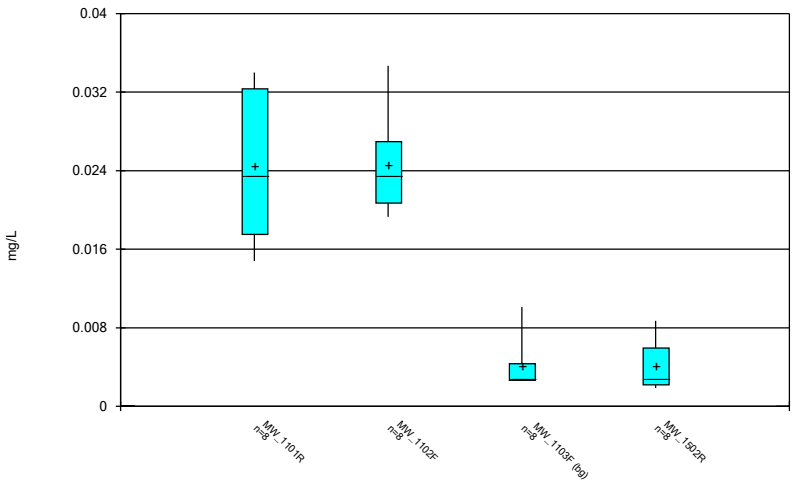
Constituent: Lithium, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



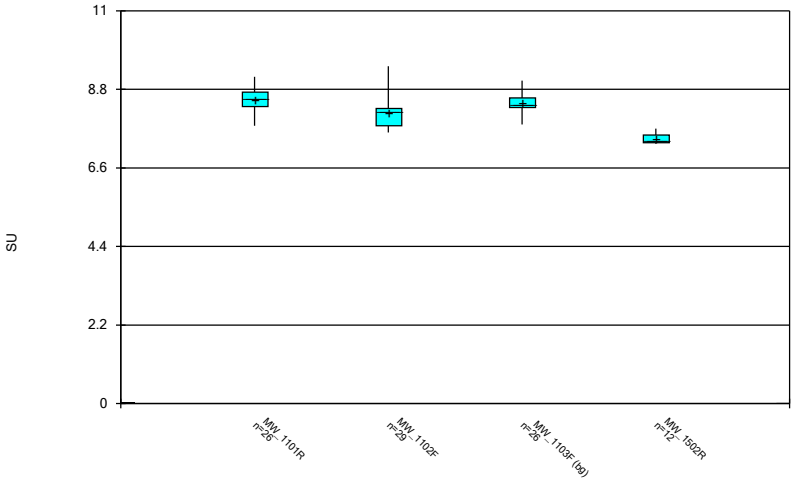
Constituent: Mercury, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



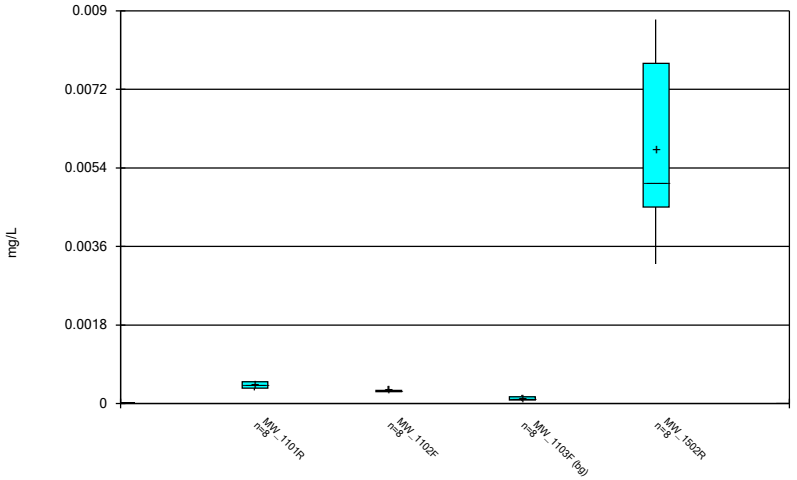
Constituent: Molybdenum, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



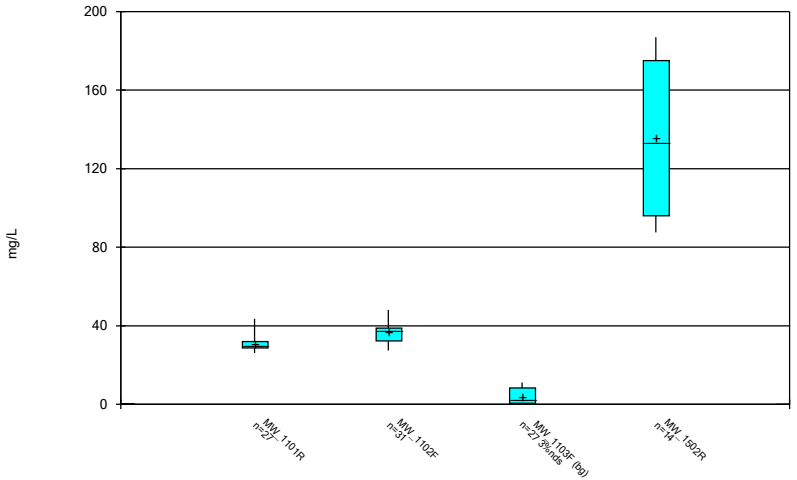
Constituent: pH, field Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



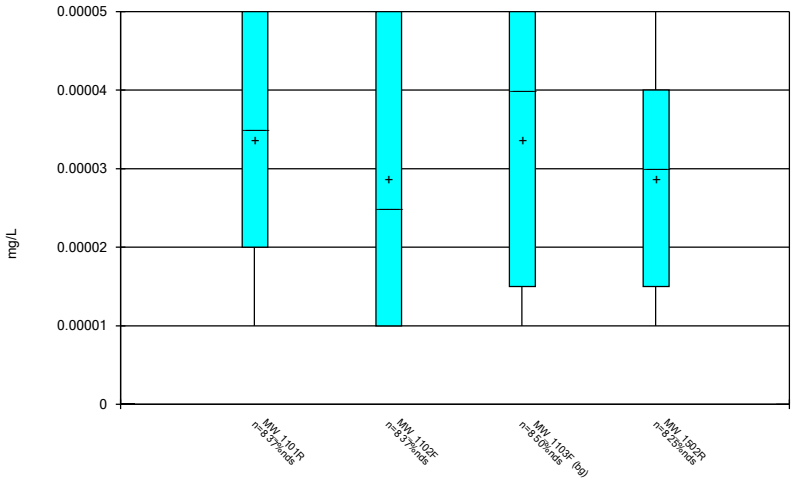
Constituent: Selenium, Total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



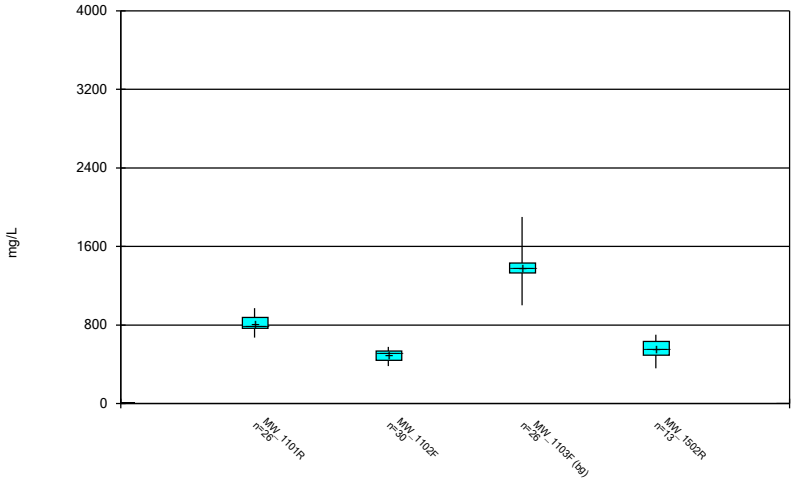
Constituent: Sulfate, total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



Constituent: Thallium, Total Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS] Analysis Run 10/28/2019 5:28 PM View: Time Series - All Wells

Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Outlier Summary

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 10/29/2019, 10:36 AM

	MW_1101R Boron, total (mg/L)	MW_1502R Boron, total (mg/L)	MW_1101R Calcium, total (mg/L)	MW_1502R Calcium, total (mg/L)	MW_1101R pH, field (SU)	MW_1502R pH, field (SU)	MW_1101R Sulfate, total (mg/L)	MW_1101R Total Dissolved Solids [TDS] (mg/L)	MW_1103F Total Dissolved Solids [TDS] (mg/L)
4/26/2012									690 (o)
12/26/2012								1600 (o)	
2/21/2013								3500 (o)	
6/1/2016							67.3 (o)		
6/15/2016							76.4 (o)		
8/3/2016							76.4 (o)		
9/27/2016		0.376 (o)							
9/28/2016								43 (o)	
11/16/2016	1.8 (o)		19.4 (o)						
1/11/2018				240 (o)					
5/1/2019					10.5 (o)				
5/2/2019						8.49 (o)			

Outlier Analysis - Significant Results

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 10/28/2019, 4:34 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Boron, total (mg/L)	**MW_1101R**	**Yes**	**1.8**	**11/16/2016**	**NP**	**13**	**0.4999**	**0.3953**	**ln(x)**	**ShapiroWilk**
Calcium, total (mg/L)	**MW_1502R**	**Yes**	**240**	**1/11/2018**	**NP**	**14**	**95.31**	**43.23**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW_1101R**	**Yes**	**10.5**	**5/1/2019**	**NP**	**27**	**8.565**	**0.5079**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW_1502R**	**Yes**	**8.49**	**5/2/2019**	**NP**	**13**	**7.502**	**0.3247**	**ln(x)**	**ShapiroWilk**
Sulfate, total (mg/L)	**MW_1101R**	**Yes**	**67.3,76.4,76.4**	**6/1/2016,6/15/2016,8/3/2016**	**NP**	**30**	**35.27**	**13.54**	**ln(x)**	**ShapiroWilk**
Total Dissolved Solids [TDS] (mg/L)	**MW_1101R**	**Yes**	**1600,3500,43**	**12/26/2012,2/21/2013,9/28/2016**	**NP**	**29**	**903.9**	**544.8**	**x^(1/3)**	**ShapiroWilk**
Total Dissolved Solids [TDS] (mg/L)	**MW_1103F (bg)**	**Yes**	**690,1900**	**4/26/2012,12/26/2012**	**NP**	**27**	**1359**	**204.6**	**x^2**	**ShapiroWilk**

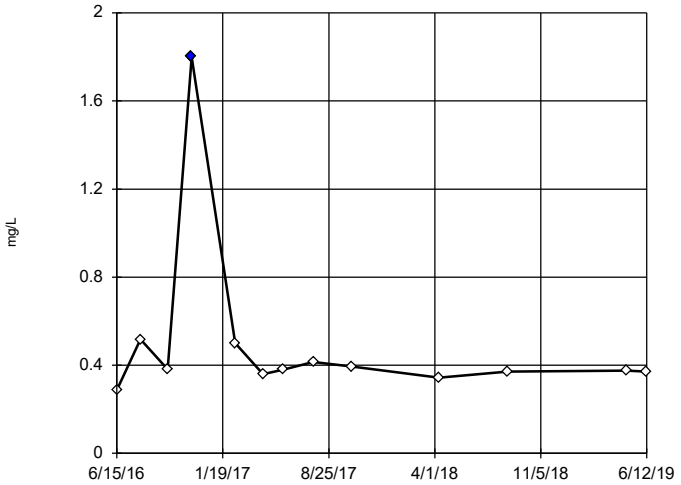
Outlier Analysis - All Results

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 10/28/2019, 4:35 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Boron, total (mg/L)	**MW_1101R**	**Yes**	**1.8**	**11/16/2016**	**NP**	**13**	**0.4999**	**0.3953**	**ln(x)**	**ShapiroWilk**
Boron, total (mg/L)	MW_1102F	No	n/a	n/a	NP	13	0.1595	0.0679	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW_1103F (bg)	No	n/a	n/a	NP	13	0.3318	0.0286	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW_1502R	No	n/a	n/a	NP	13	0.1523	0.08992	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW_1101R	No	n/a	n/a	NP	14	4.219	4.71	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW_1102F	No	n/a	n/a	NP	14	4.84	0.4263	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW_1103F (bg)	No	n/a	n/a	NP	13	2.882	0.1753	x^6	ShapiroWilk
Calcium, total (mg/L)	**MW_1502R**	**Yes**	**240**	**1/11/2018**	**NP**	**14**	**95.31**	**43.23**	**ln(x)**	**ShapiroWilk**
Chloride, total (mg/L)	MW_1101R	No	n/a	n/a	NP	28	15.64	2.29	x^6	ShapiroWilk
Chloride, total (mg/L)	MW_1102F	No	n/a	n/a	NP	30	10.51	2.547	normal	ShapiroWilk
Chloride, total (mg/L)	MW_1103F (bg)	No	n/a	n/a	NP	26	238.5	8.51	x^6	ShapiroWilk
Chloride, total (mg/L)	MW_1502R	No	n/a	n/a	NP	13	90	76.06	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	MW_1101R	No	n/a	n/a	NP	23	2.471	0.4385	x^4	ShapiroWilk
Fluoride, total (mg/L)	MW_1102F	No	n/a	n/a	NP	22	0.5423	0.09201	normal	ShapiroWilk
Fluoride, total (mg/L)	MW_1103F (bg)	No	n/a	n/a	NP	23	3.054	0.2331	x^3	ShapiroWilk
Fluoride, total (mg/L)	MW_1502R	No	n/a	n/a	NP	13	0.1615	0.03976	x^2	ShapiroWilk
pH, field (SU)	**MW_1101R**	**Yes**	**10.5**	**5/1/2019**	**NP**	**27**	**8.565**	**0.5079**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW_1102F	No	n/a	n/a	NP	29	8.116	0.3742	ln(x)	ShapiroWilk
pH, field (SU)	MW_1103F (bg)	No	n/a	n/a	NP	26	8.41	0.2575	ln(x)	ShapiroWilk
pH, field (SU)	**MW_1502R**	**Yes**	**8.49**	**5/2/2019**	**NP**	**13**	**7.502**	**0.3247**	**ln(x)**	**ShapiroWilk**
Sulfate, total (mg/L)	**MW_1101R**	**Yes**	**67.3,76.4,76.4**	**6/1/2016,6/15/2016,8/3/2016**	**NP**	**30**	**35.27**	**13.54**	**ln(x)**	**ShapiroWilk**
Sulfate, total (mg/L)	MW_1102F	No	n/a	n/a	NP	31	36.54	4.74	x^(1/3)	ShapiroWilk
Sulfate, total (mg/L)	MW_1103F (bg)	No	n/a	n/a	NP	27	3.635	3.763	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW_1502R	No	n/a	n/a	NP	14	135.1	38.17	x^(1/3)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	**MW_1101R**	**Yes**	**1600,3500,43**	**12/26/2012,2/21/2013,9/28/2016**	**NP**	**29**	**903.9**	**544.8**	**x^(1/3)**	**ShapiroWilk**
Total Dissolved Solids [TDS] (mg/L)	MW_1102F	No	n/a	n/a	NP	30	498.7	55.58	x^6	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	**MW_1103F (bg)**	**Yes**	**690,1900**	**4/26/2012,12/26/2012**	**NP**	**27**	**1359**	**204.6**	**x^2**	**ShapiroWilk**
Total Dissolved Solids [TDS] (mg/L)	MW_1502R	No	n/a	n/a	NP	13	553.2	92.07	x^2	ShapiroWilk

Tukey's Outlier Screening

MW_1101R



n = 13

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).

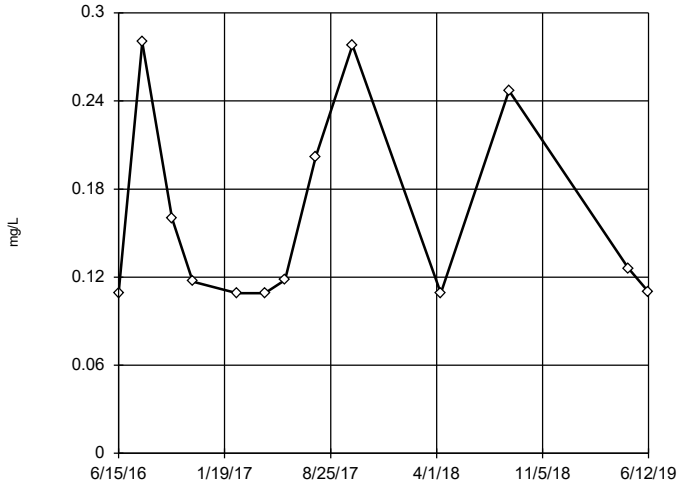
High cutoff = 0.8856, low cutoff = 0.1882, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 13

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

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

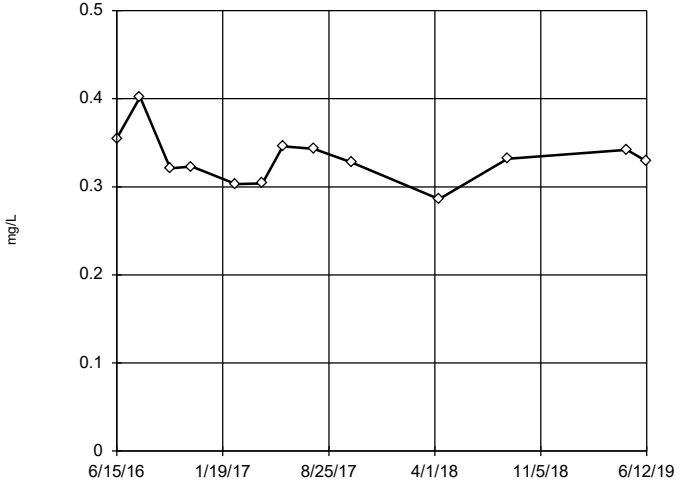
High cutoff = 1.922, low cutoff = 0.01267, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 13

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

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

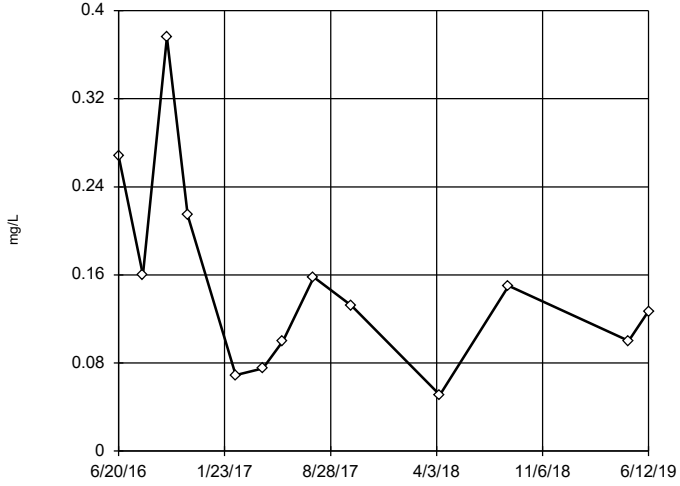
High cutoff = 0.462, low cutoff = 0.2329, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 13

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

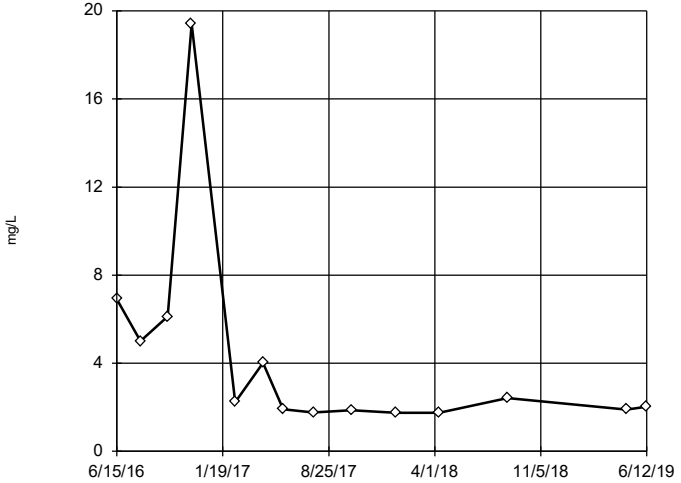
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 1.805, low cutoff = 0.008878, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 14

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

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

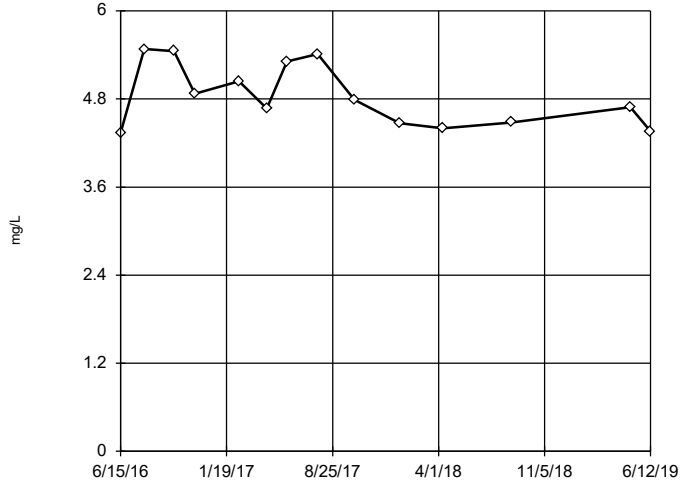
High cutoff = 156.8, low cutoff = 0.06399, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 14

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

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

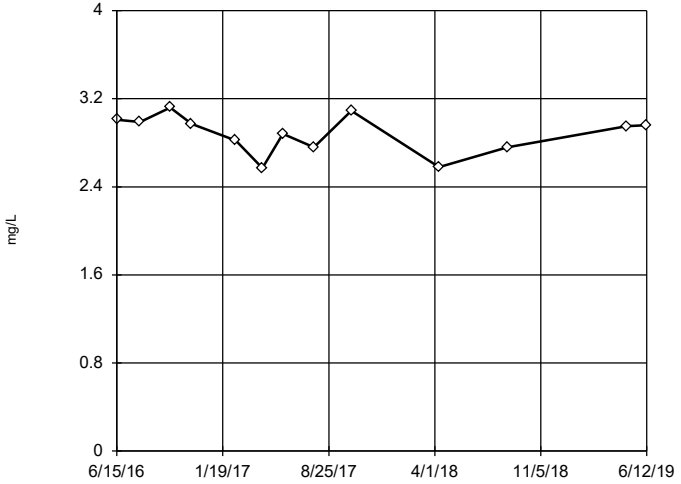
High cutoff = 9.461, low cutoff = 2.512, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 13

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

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

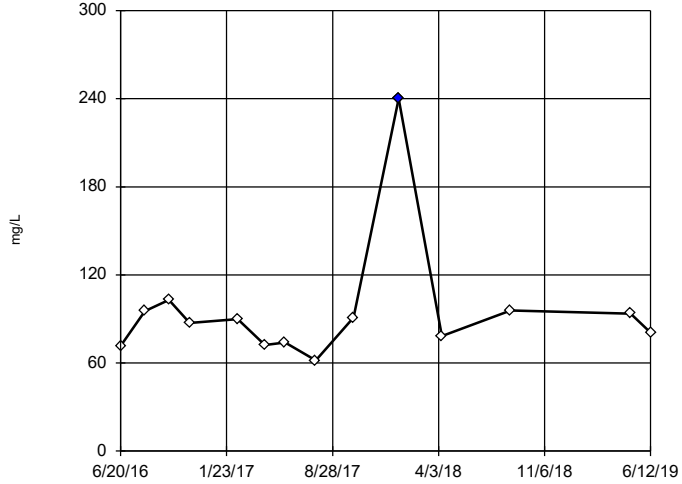
High cutoff = 3.417, low cutoff = -2.736, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 14

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

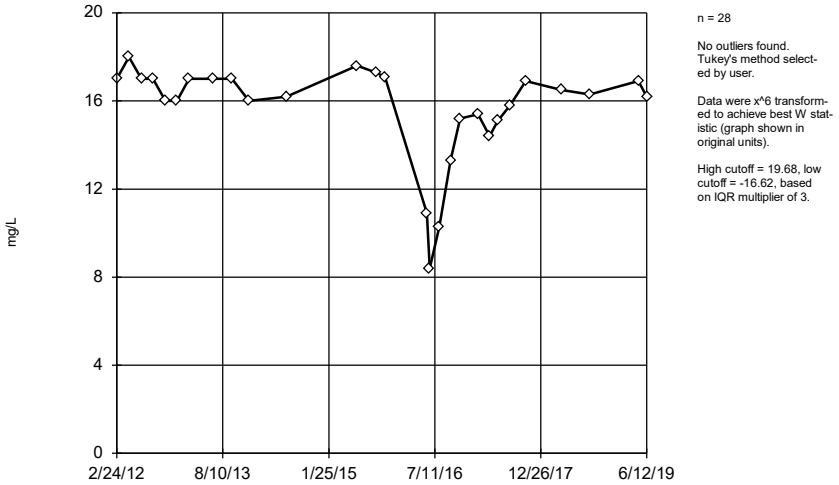
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 213.9, low cutoff = 32.63, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 28

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

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

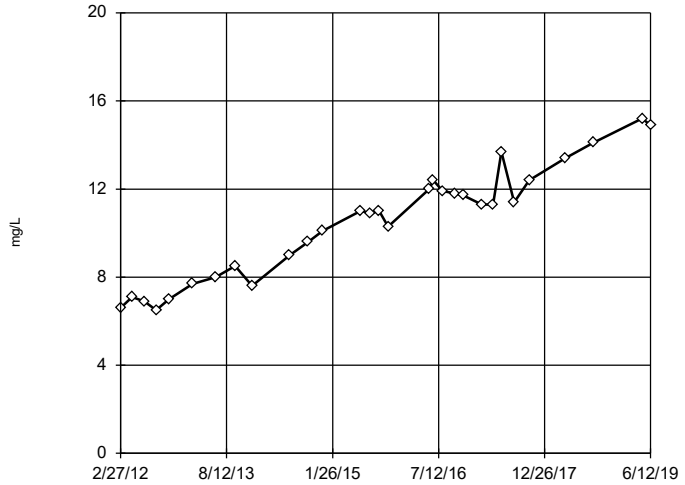
High cutoff = 19.68, low cutoff = -16.62, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 30

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

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

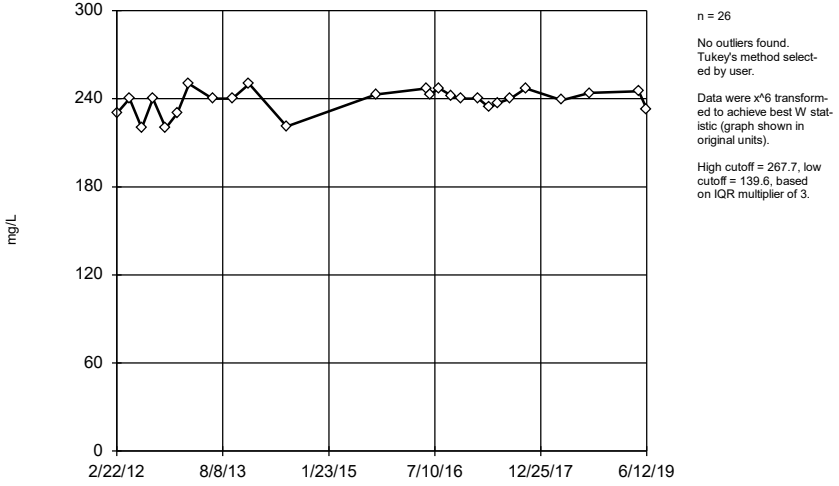
High cutoff = 25.25, low cutoff = -5.2, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 26

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

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

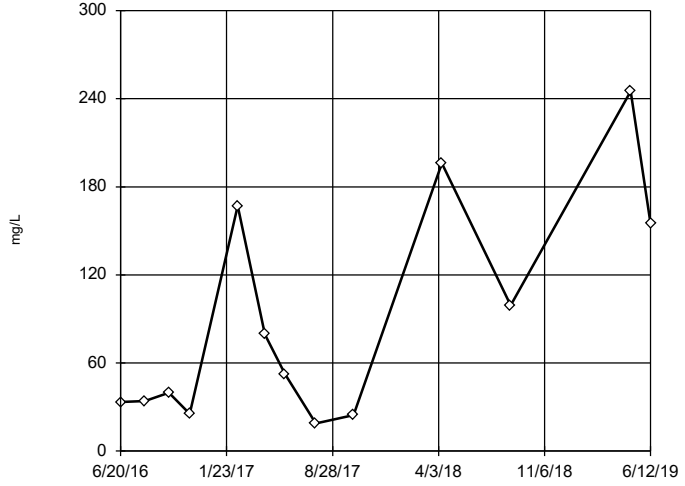
High cutoff = 267.7, low cutoff = 139.6, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 13

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

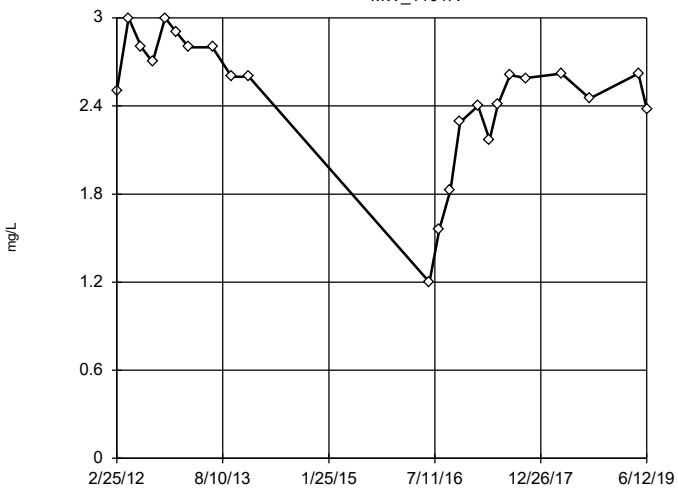
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 27116, low cutoff = 0.1728, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/28/2019 4:24 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 23

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

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

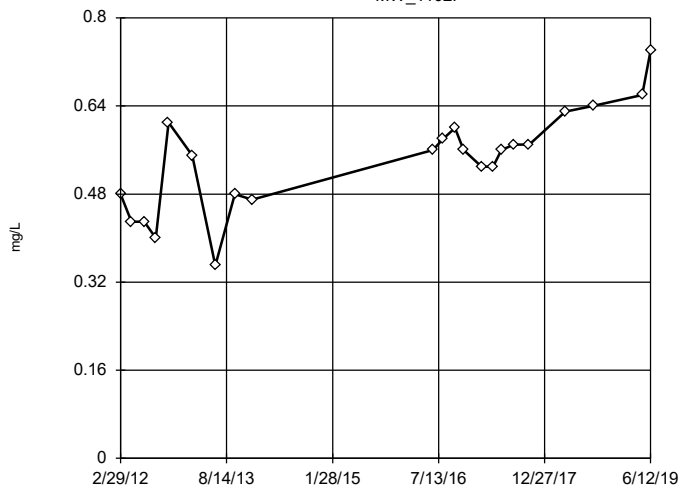
High cutoff = 3.497, low cutoff = -2.736, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 22

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

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

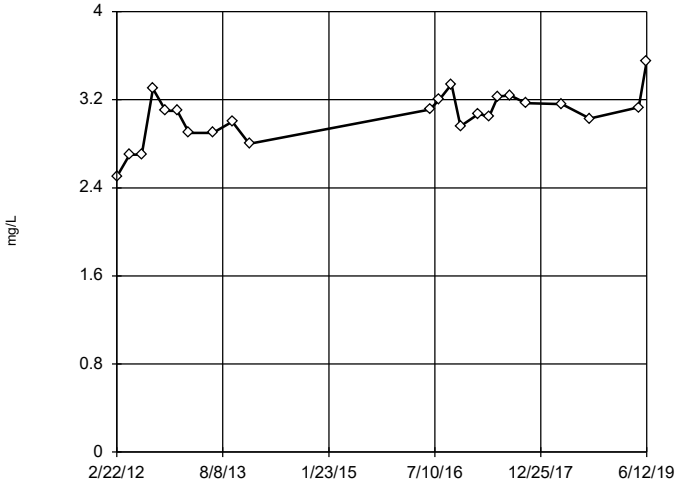
High cutoff = 0.995, low cutoff = 0.085, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 23

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

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

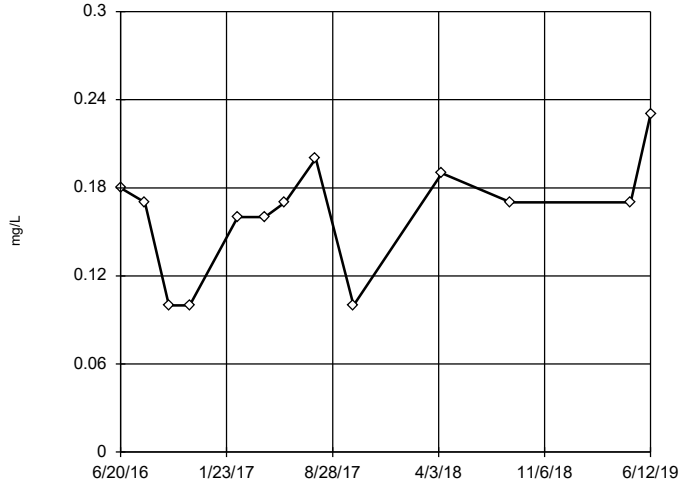
High cutoff = 3.869, low cutoff = -0.9078, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 13

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

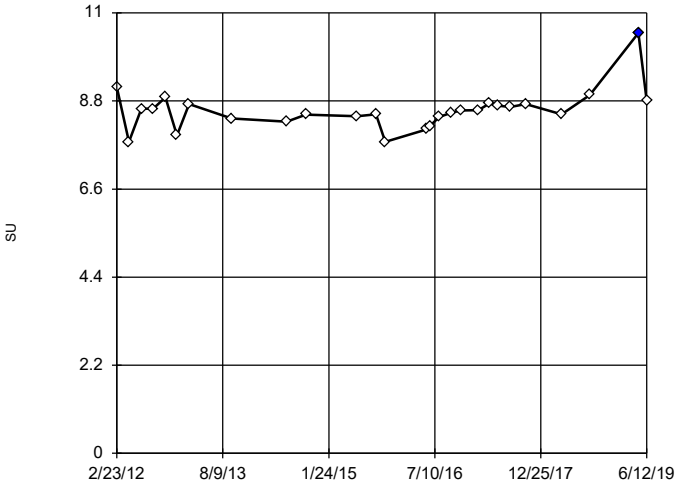
Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2891, low cutoff = -0.1776, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 27

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).

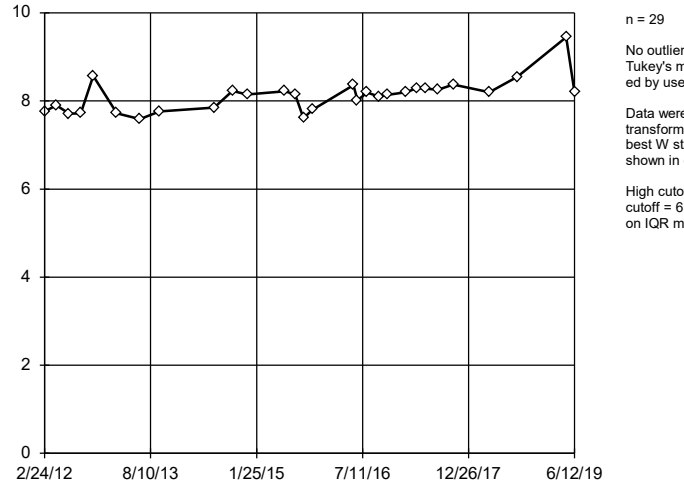
High cutoff = 9.896, low cutoff = 7.367, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 29

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

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

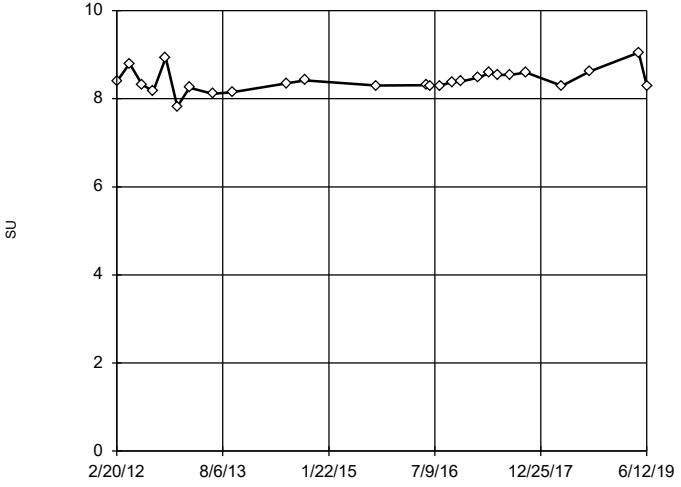
High cutoff = 9.933, low cutoff = 6.477, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 26

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

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

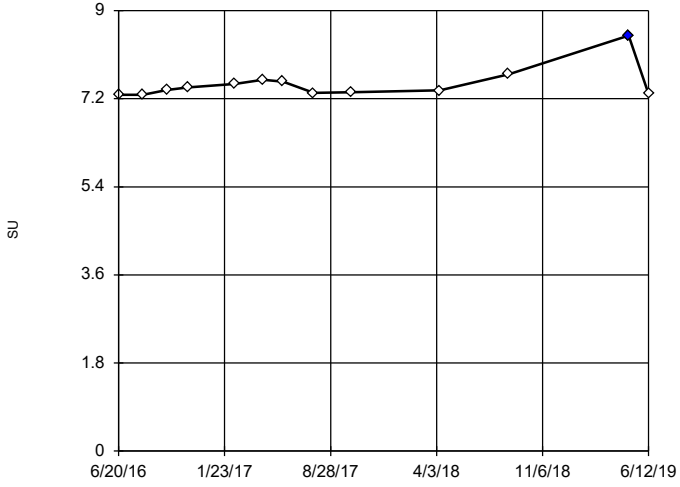
High cutoff = 9.424, low cutoff = 7.53, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 13

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

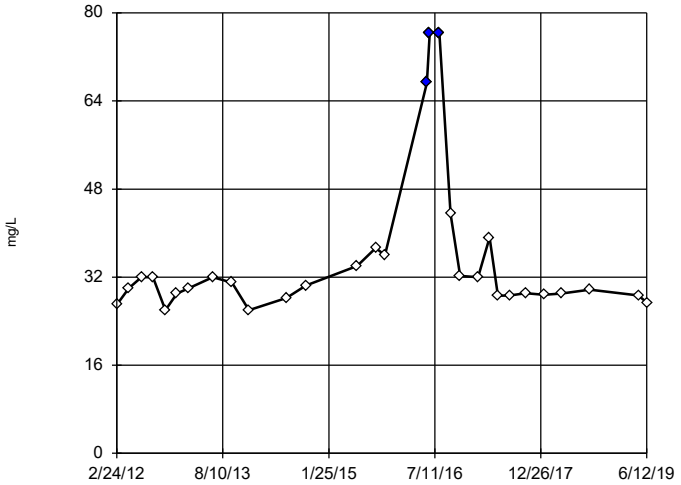
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.407, low cutoff = 6.582, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 30

Outliers are drawn as solid.
Tukey's method selected by user.

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

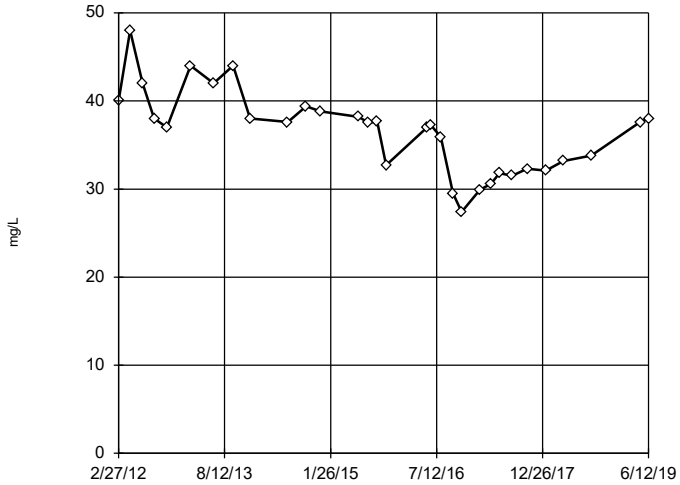
High cutoff = 63.37, low cutoff = 15.84, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 31

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

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

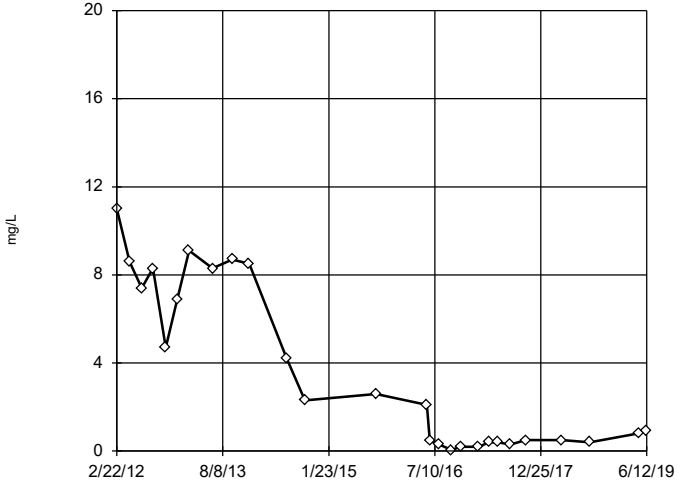
High cutoff = 63.4, low cutoff = 17.22, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 27

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

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

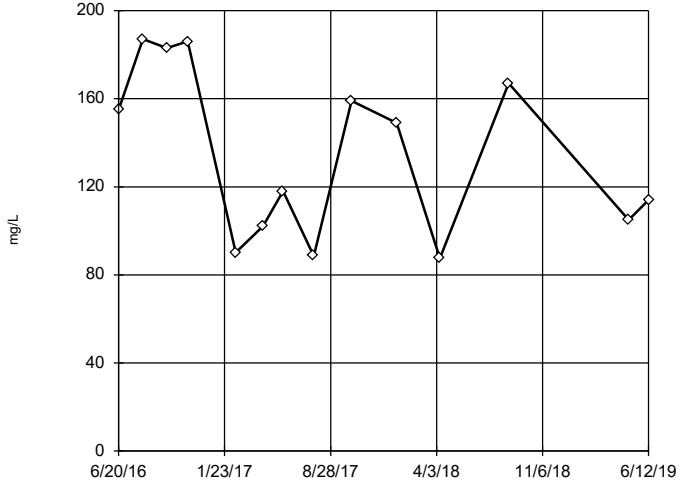
High cutoff = 74154, low cutoff = 0.00004477, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 14

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

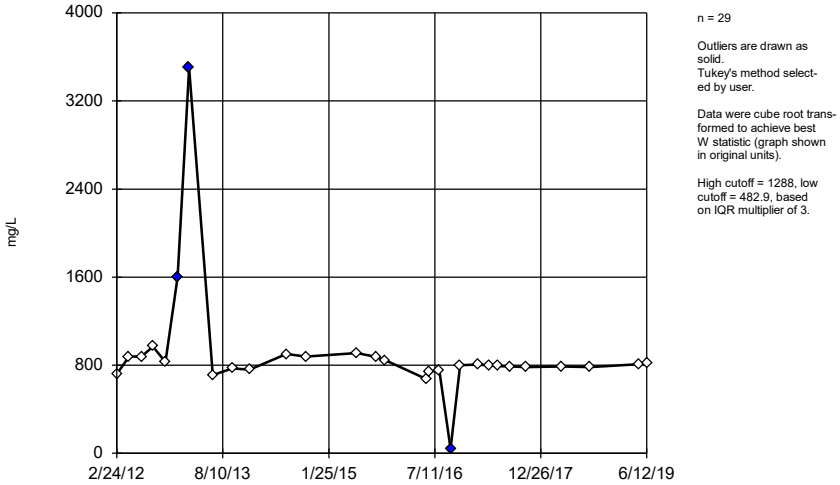
Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 644, low cutoff = 3.612, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Tukey's Outlier Screening

MW_1101R



n = 29

Outliers are drawn as solid.
Tukey's method selected by user.

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

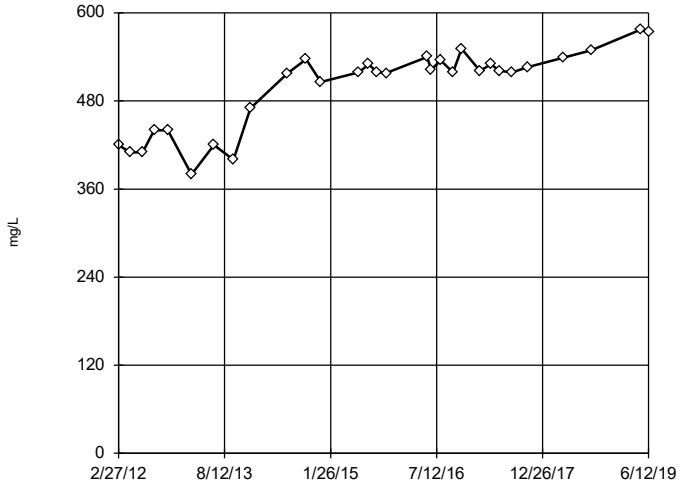
High cutoff = 1288, low cutoff = 482.9, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1102F



n = 30

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

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

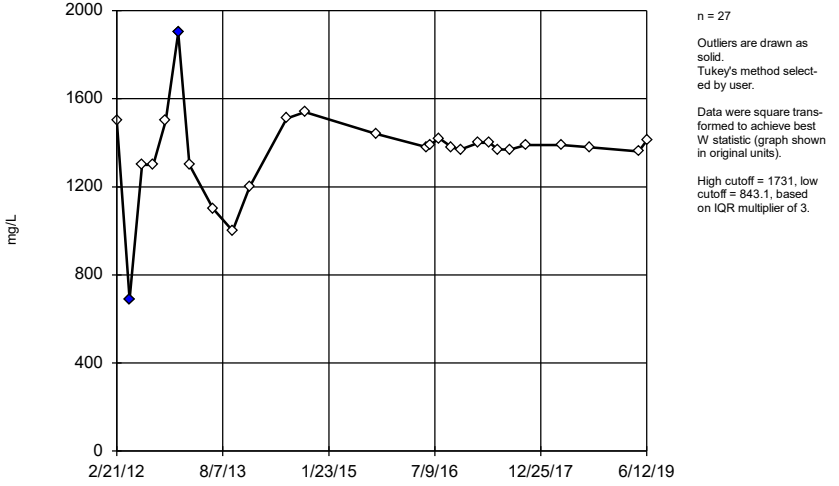
High cutoff = 646.6, low cutoff = -589.9, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1103F (bg)



n = 27

Outliers are drawn as solid.
Tukey's method selected by user.

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

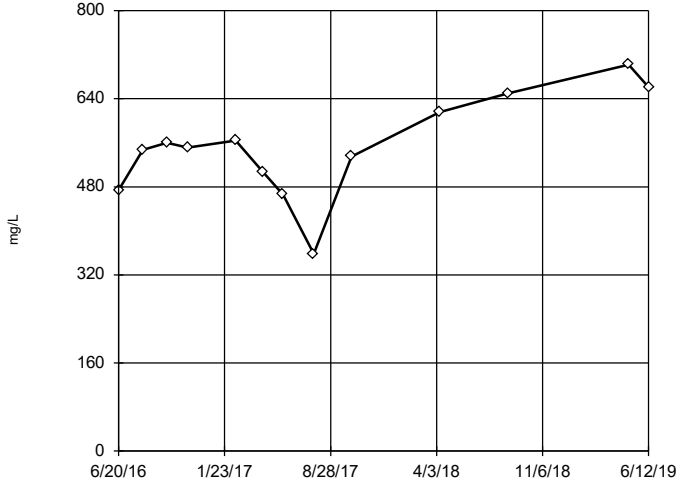
High cutoff = 1731, low cutoff = 843.1, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW_1502R



n = 13

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 = 938.8, low cutoff = -489.4, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/28/2019 4:25 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney - Significant Results

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 10/29/2019, 1:10 PM

Constituent	Well	Calc.	0.01	Sig.	Method
Chloride, total (mg/L)	**MW_1102F**	**3.312**	**Yes**	**Yes**	**Mann-W**
Fluoride, total (mg/L)	**MW_1102F**	**3.023**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	**MW_1102F**	**2.955**	**Yes**	**Yes**	**Mann-W**

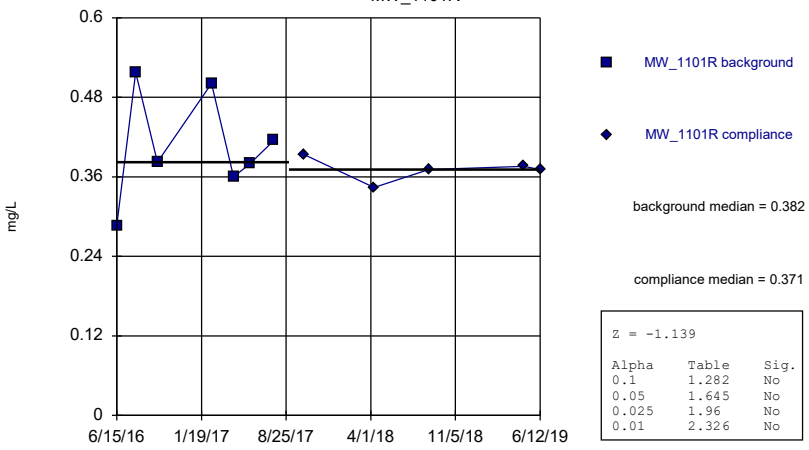
Mann-Whitney - All Results

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 10/29/2019, 1:10 PM

Constituent	Well	Calc.	0.01	Sig.	Method
Boron, total (mg/L)	MW_1101R	-1.139	No	No	Mann-W
Boron, total (mg/L)	MW_1102F	0.4453	No	No	Mann-W
Boron, total (mg/L)	MW_1103F (bg)	-0.6587	No	No	Mann-W
Boron, total (mg/L)	MW_1502R	-1.057	No	No	Mann-W
Calcium, total (mg/L)	MW_1101R	-2.074	No	No	Mann-W
Calcium, total (mg/L)	MW_1102F	-2.13	No	No	Mann-W
Calcium, total (mg/L)	MW_1103F (bg)	-0.4398	No	No	Mann-W
Calcium, total (mg/L)	MW_1502R	0.9515	No	No	Mann-W
Chloride, total (mg/L)	MW_1101R	0.3921	No	No	Mann-W
Chloride, total (mg/L)	**MW_1102F**	**3.312**	**Yes**	**Yes**	**Mann-W**
Chloride, total (mg/L)	MW_1103F (bg)	0.7236	No	No	Mann-W
Chloride, total (mg/L)	MW_1502R	1.537	No	No	Mann-W
Fluoride, total (mg/L)	MW_1101R	-0.2613	No	No	Mann-W
Fluoride, total (mg/L)	**MW_1102F**	**3.023**	**Yes**	**Yes**	**Mann-W**
Fluoride, total (mg/L)	MW_1103F (bg)	1.455	No	No	Mann-W
Fluoride, total (mg/L)	MW_1502R	0.8222	No	No	Mann-W
pH, field (SU)	MW_1101R	1.813	No	No	Mann-W
pH, field (SU)	MW_1102F	2.456	No	No	Mann-W
pH, field (SU)	MW_1103F (bg)	1.205	No	No	Mann-W
pH, field (SU)	MW_1502R	-0.08507	No	No	Mann-W
Sulfate, total (mg/L)	MW_1101R	-1.666	No	No	Mann-W
Sulfate, total (mg/L)	MW_1102F	-1.101	No	No	Mann-W
Sulfate, total (mg/L)	MW_1103F (bg)	-1.157	No	No	Mann-W
Sulfate, total (mg/L)	MW_1502R	-0.5809	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW_1101R	-0.4555	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	**MW_1102F**	**2.955**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	MW_1103F (bg)	0	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW_1502R	2.269	No	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R



background median = 0.382

compliance median = 0.371

Z = -1.139

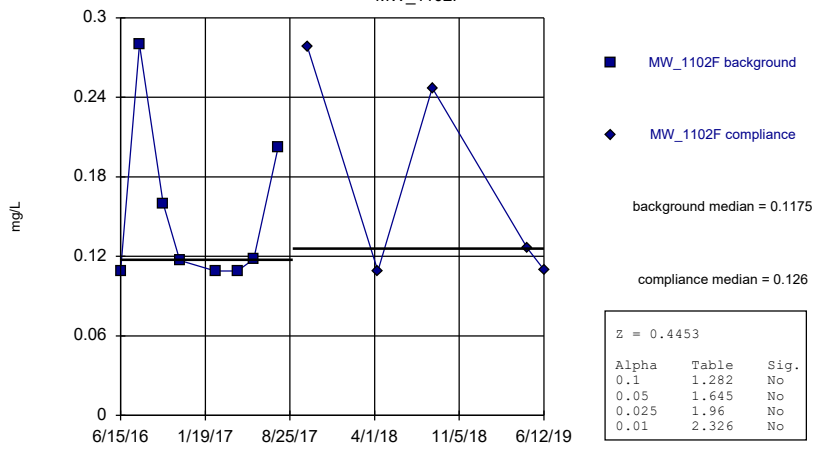
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Boron, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F



background median = 0.1175

compliance median = 0.126

Z = 0.4453

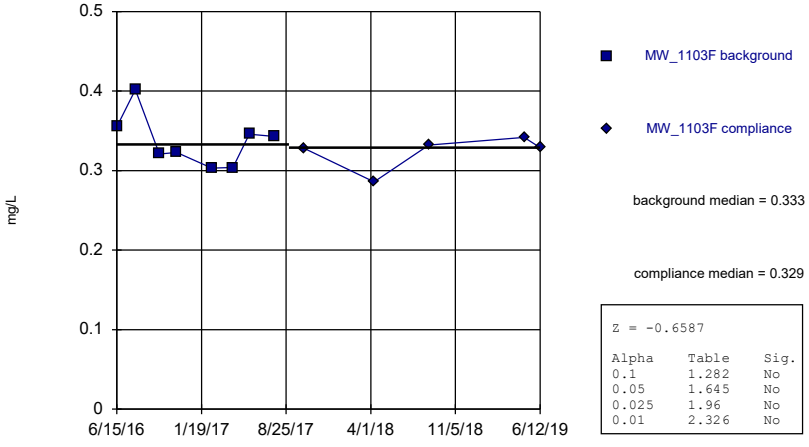
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Boron, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)



background median = 0.333

compliance median = 0.329

Z = -0.6587

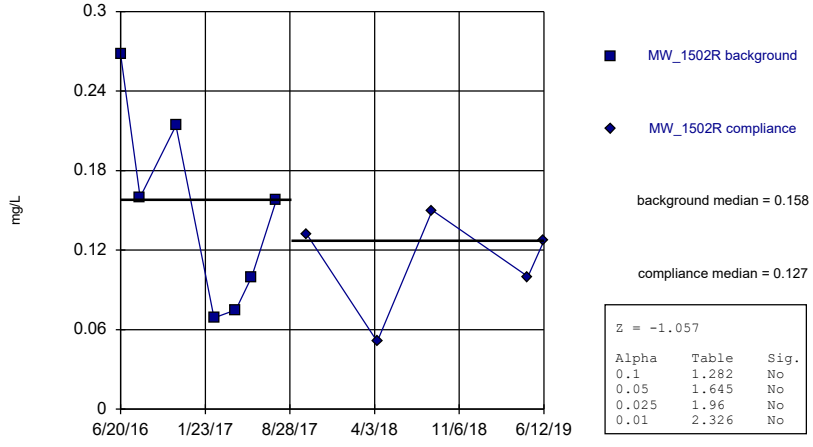
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Boron, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



background median = 0.158

compliance median = 0.127

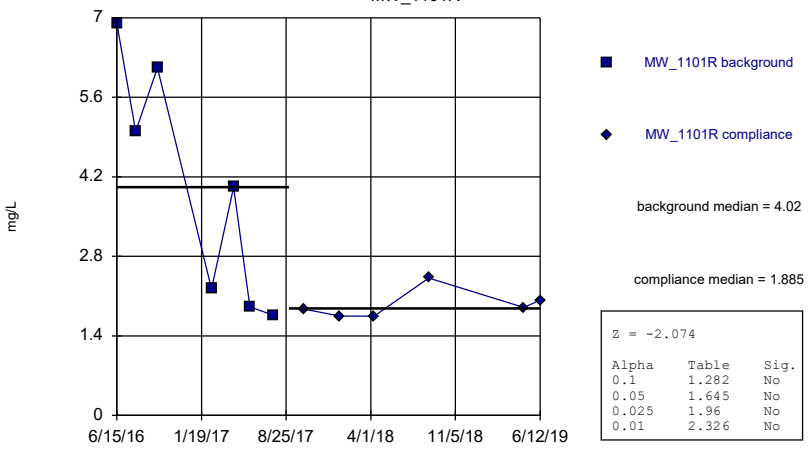
Z = -1.057

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Boron, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R

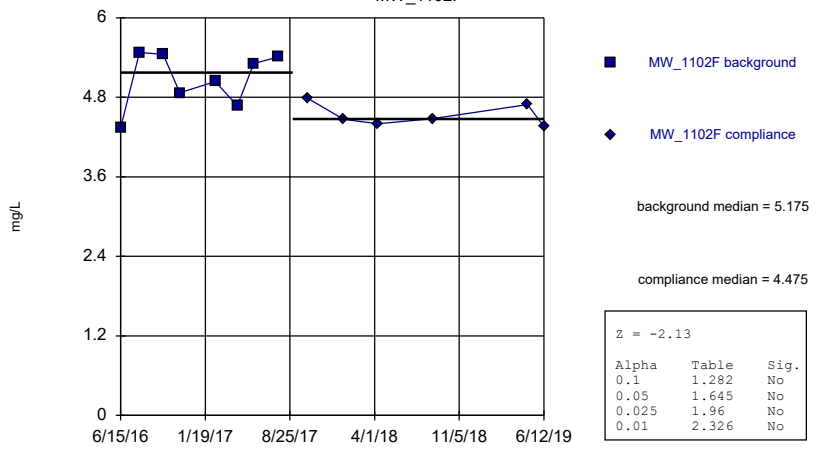


Constituent: Calcium, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F

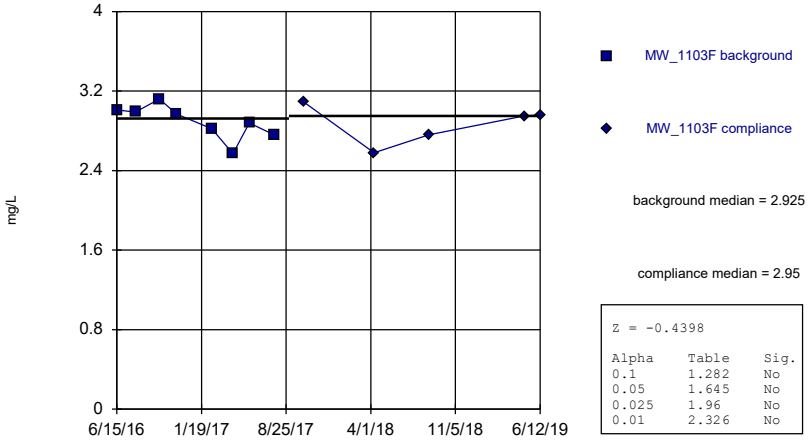


Constituent: Calcium, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)

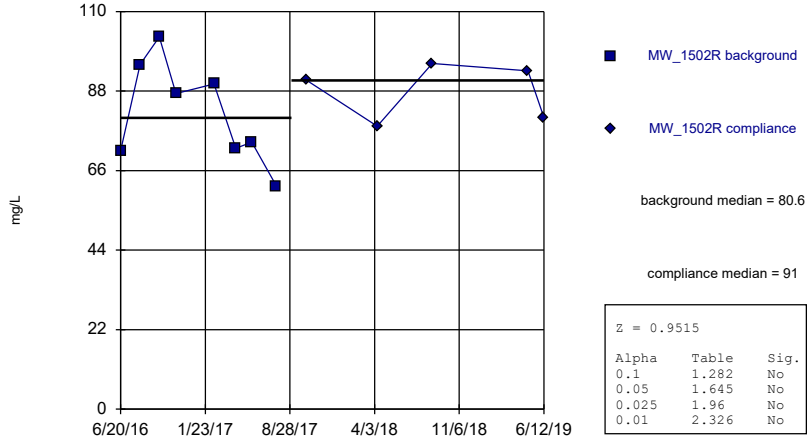


Constituent: Calcium, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

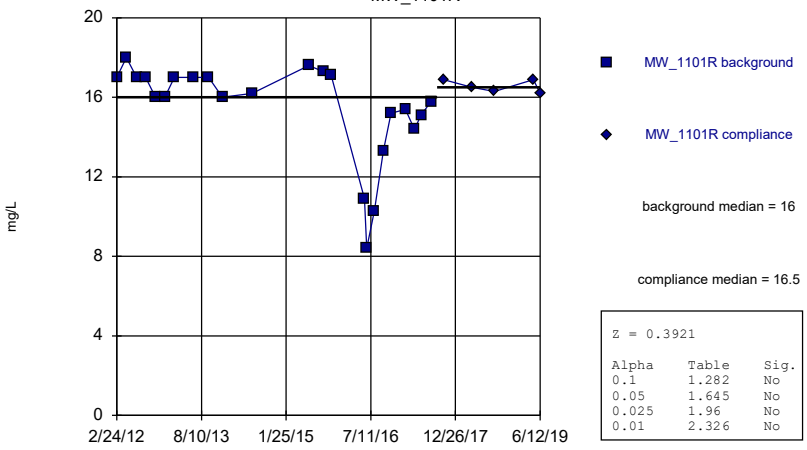
MW_1502R



Constituent: Calcium, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R



Z = 0.3921

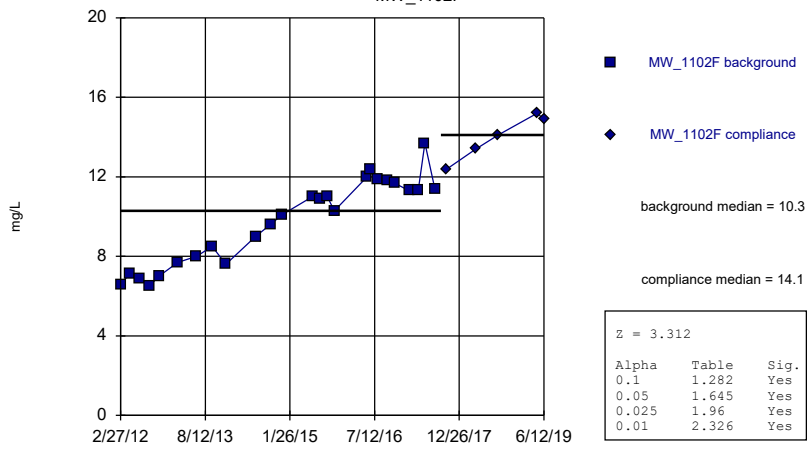
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F



Z = 3.312

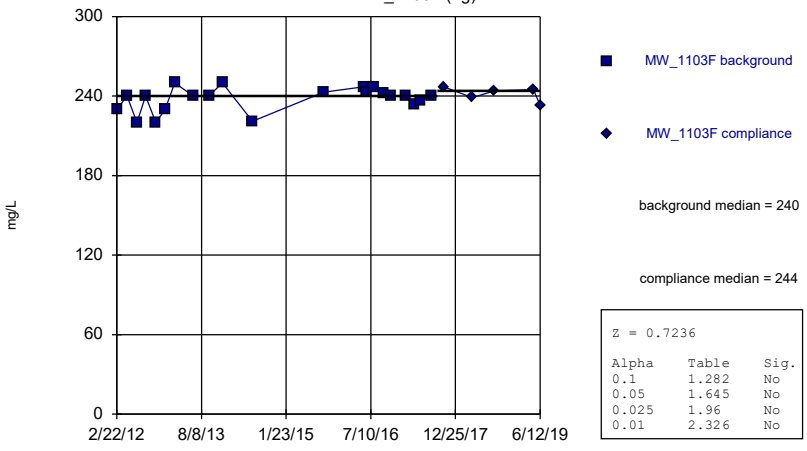
Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	Yes
0.025	1.96	Yes
0.01	2.326	Yes

Constituent: Chloride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)



Z = 0.7236

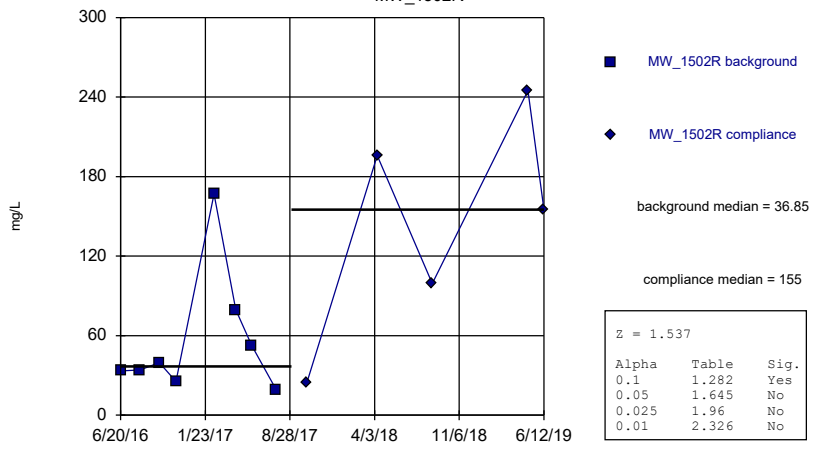
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



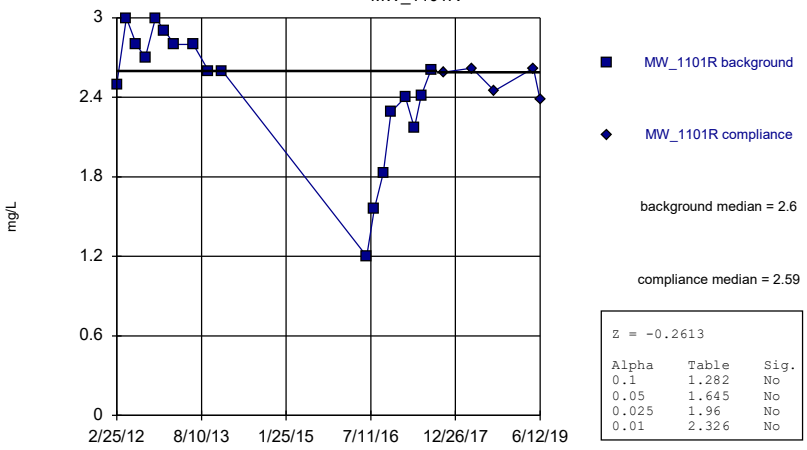
Z = 1.537

Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R



Z = -0.2613

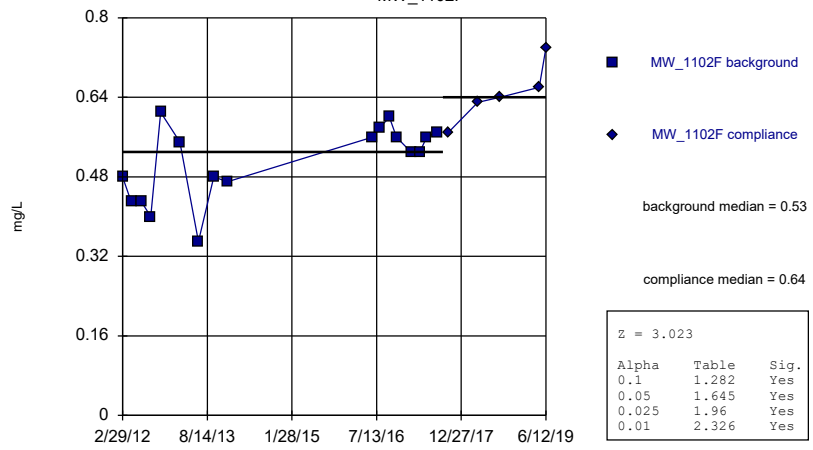
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F



Z = 3.023

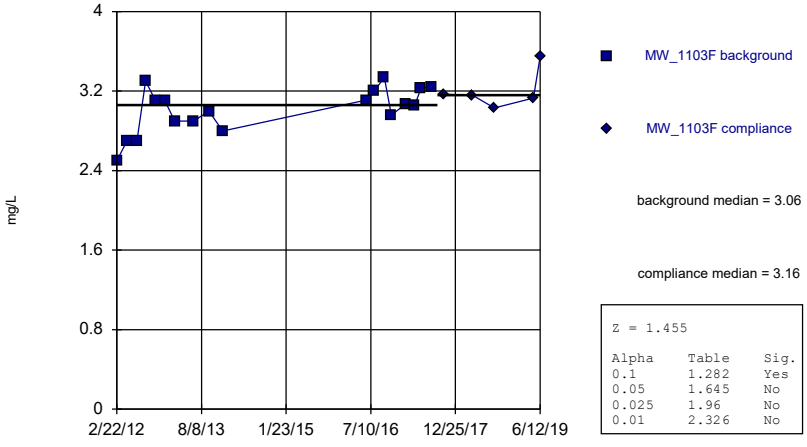
Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	Yes
0.025	1.96	Yes
0.01	2.326	Yes

Constituent: Fluoride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)



Z = 1.455

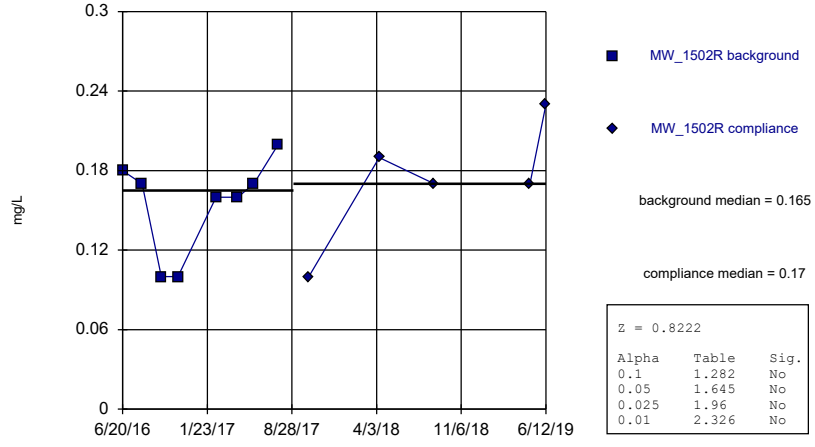
Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



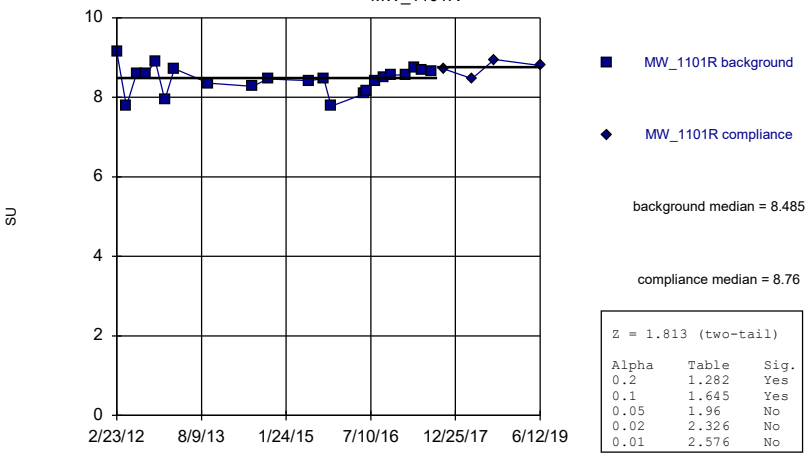
Z = 0.8222

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R



background median = 8.485

compliance median = 8.76

Z = 1.813 (two-tail)

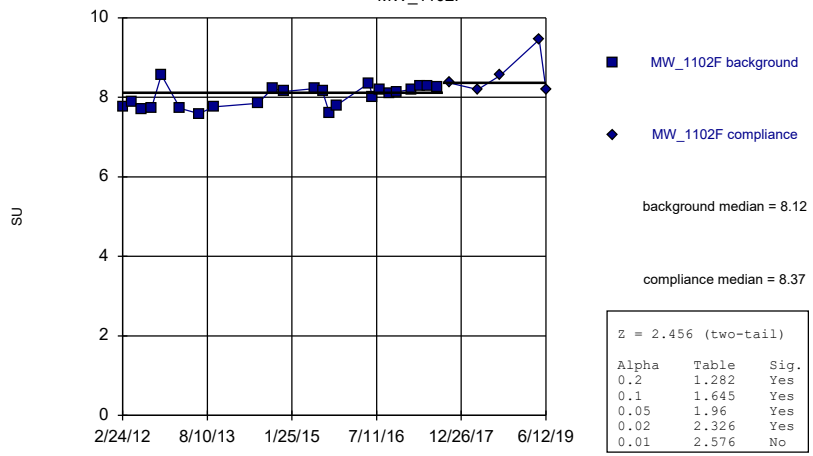
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F



background median = 8.12

compliance median = 8.37

Z = 2.456 (two-tail)

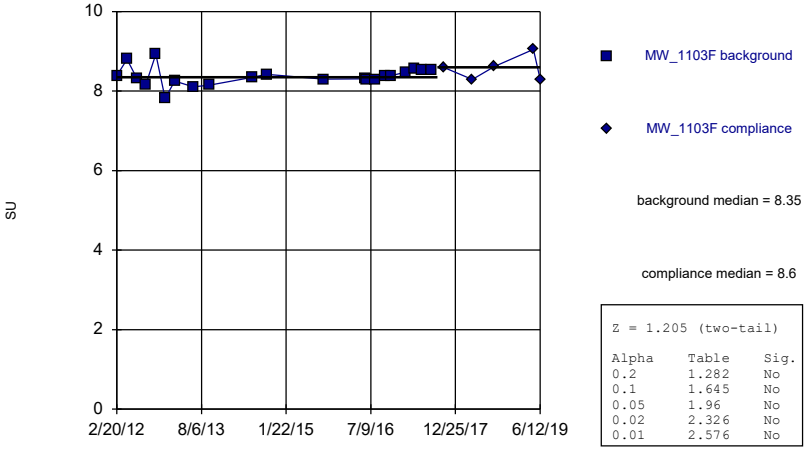
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	Yes
0.02	2.326	Yes
0.01	2.576	No

Constituent: pH, field Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)



background median = 8.35

compliance median = 8.6

Z = 1.205 (two-tail)

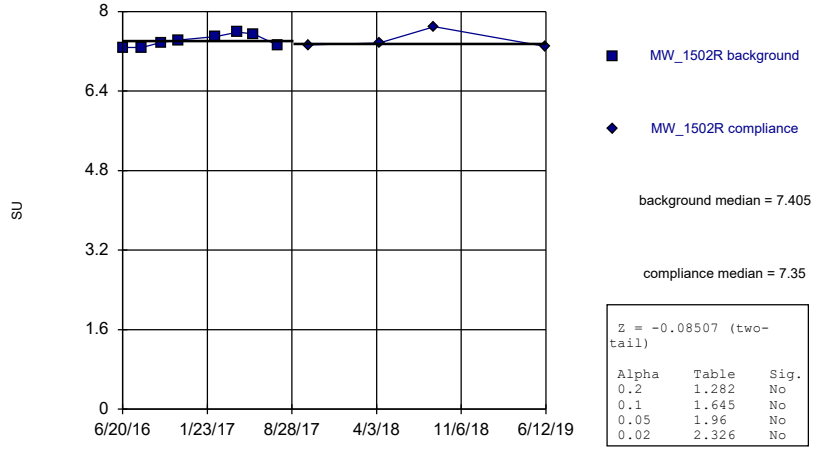
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



background median = 7.405

compliance median = 7.35

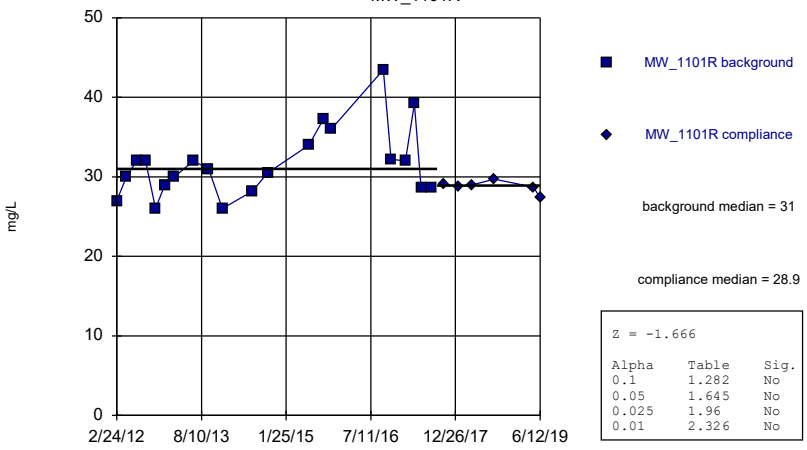
Z = -0.08507 (two-tail)

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

Constituent: pH, field Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R



Z = -1.666

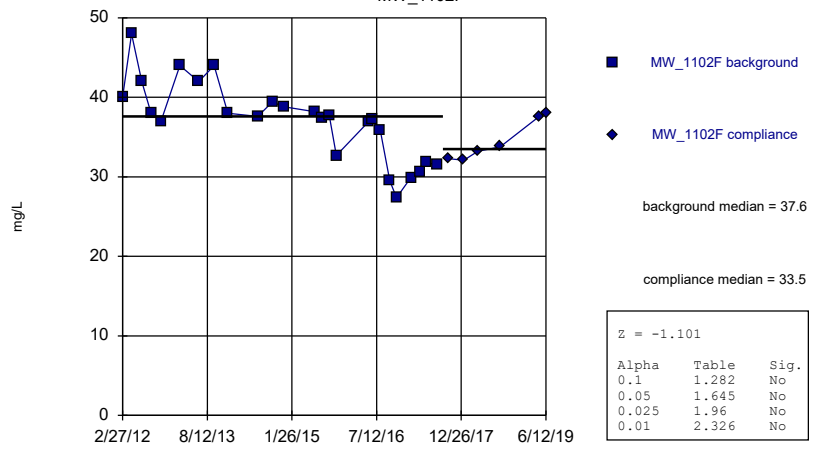
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Sulfate, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F



Z = -1.101

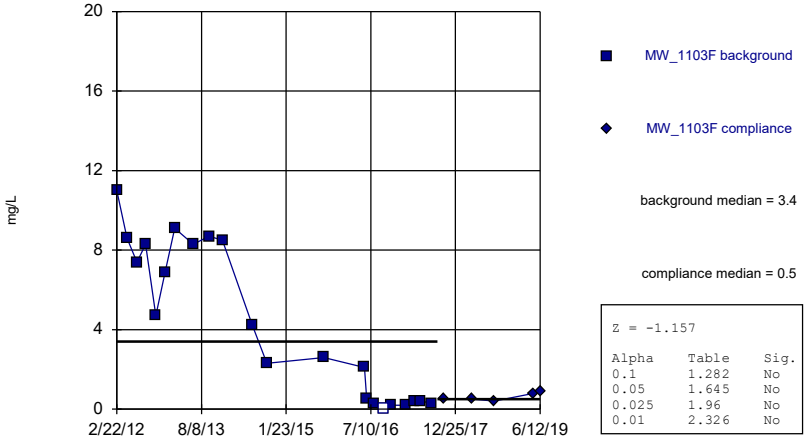
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Sulfate, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)



Z = -1.157

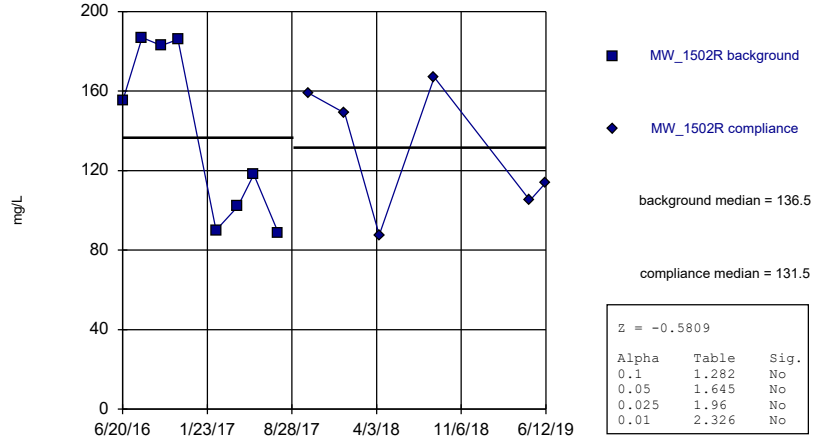
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Sulfate, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



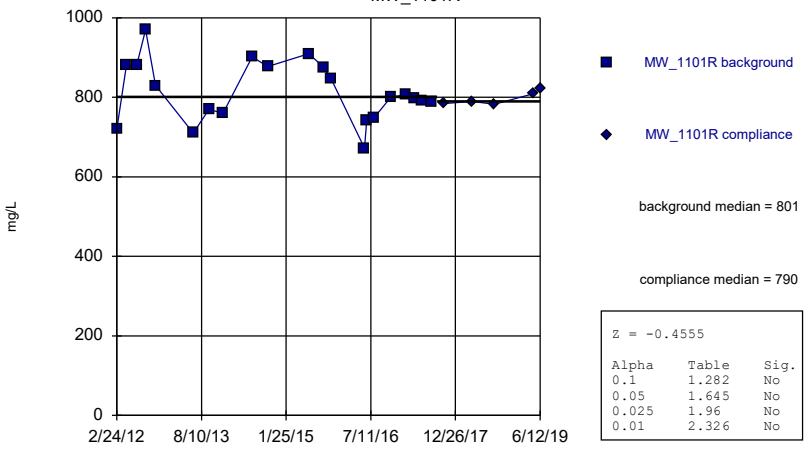
Z = -0.5809

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Sulfate, total Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Mann-Whitney (Wilcoxon Rank Sum)

MW_1101R

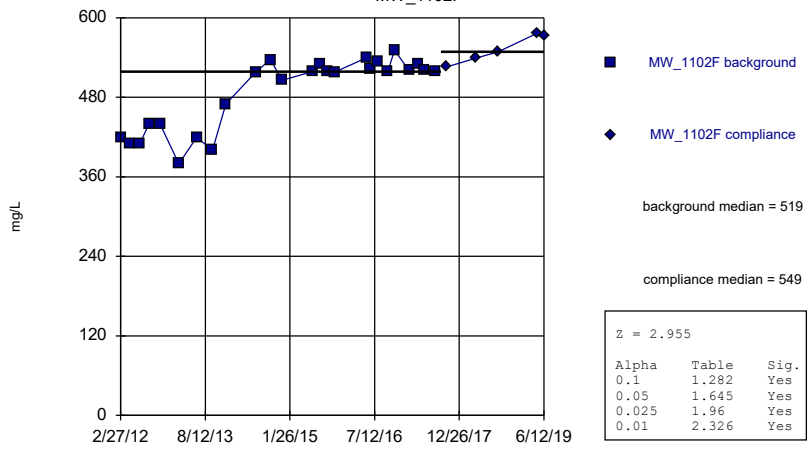


Constituent: Total Dissolved Solids [TDS] Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1102F

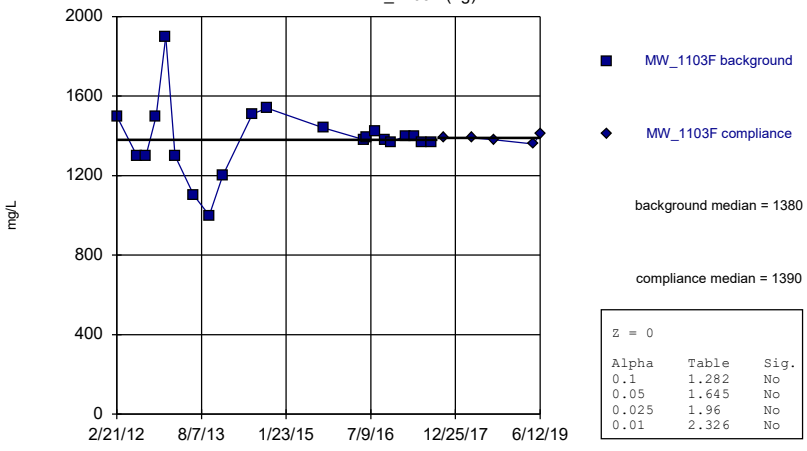


Constituent: Total Dissolved Solids [TDS] Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1103F (bg)

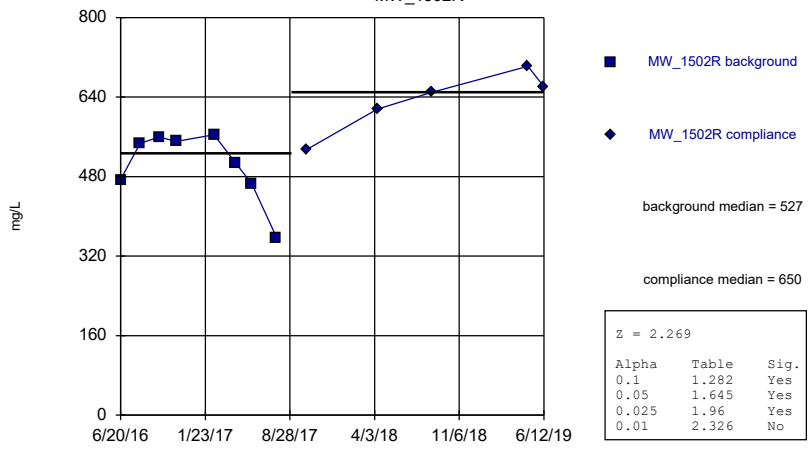


Constituent: Total Dissolved Solids [TDS] Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23d Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW_1502R



Constituent: Total Dissolved Solids [TDS] Analysis Run 10/29/2019 1:07 PM View: Mann Whitney
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

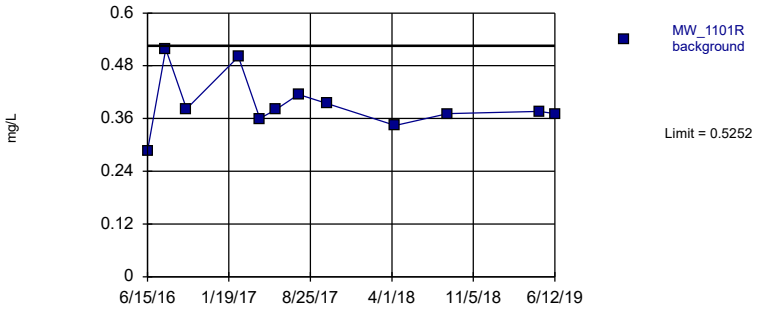
Intrawell Prediction Limit Summary

Mitchell LF Client: Geosyntec Data: Mitchell Landfill Printed 12/11/2019, 2:45 PM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW_1101R	0.5252	n/a	12	0.3916	0.06326	0	None	No	0.002505	Param Intra 1 of 2
Boron, total (mg/L)	MW_1102F	0.28	n/a	13	n/a	n/a	0	n/a	n/a	0.009692	NP Intra (normality) 1 of 2
Boron, total (mg/L)	MW_1103F	0.3912	n/a	13	0.3318	0.0286	0	None	No	0.002505	Param Intra 1 of 2
Boron, total (mg/L)	MW_1502R	0.2654	n/a	12	0.1337	0.06239	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	MW_1101R	6.91	n/a	13	n/a	n/a	0	n/a	n/a	0.009692	NP Intra (normality) 1 of 2
Calcium, total (mg/L)	MW_1102F	5.71	n/a	14	4.84	0.4263	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	MW_1103F	3.245	n/a	13	2.882	0.1753	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	MW_1502R	109.3	n/a	13	84.18	12.09	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	MW_1101R	18.1	n/a	28	1086131	472396	0	None	x^5	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	MW_1102F	15.41	n/a	14	12.68	1.338	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	MW_1103F	253.5	n/a	26	56970	3994	0	None	x^2	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	MW_1502R	190.8	n/a	8	7.046	2.754	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	MW_1101R	3.137	n/a	23	6.289	1.914	0	None	x^2	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	MW_1102F	0.7806	n/a	8	0.6125	0.0684	0	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	MW_1103F	3.487	n/a	23	3.054	0.2331	0	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	MW_1502R	0.2441	n/a	13	0.1615	0.03976	0	None	No	0.002505	Param Intra 1 of 2
pH, field (SU)	MW_1101R	9.104	7.877	26	8.491	0.3359	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	MW_1102F	9.45	7.59	29	n/a	n/a	0	n/a	n/a	0.004345	NP Intra (normality) 1 of 2
pH, field (SU)	MW_1103F	8.881	7.94	26	8.41	0.2575	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	MW_1502R	7.709	7.13	12	7.419	0.137	0	None	No	0.001253	Param Intra 1 of 2
Sulfate, total (mg/L)	MW_1101R	38.42	n/a	27	3.137	0.1302	0	None	x^(1/3)	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	MW_1102F	45.04	n/a	31	36.54	4.74	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	MW_1103F	0.9261	n/a	12	0.4125	0.2432	8.333	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	MW_1502R	213	n/a	14	135.1	38.17	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1101R	1600	n/a	27	n/a	n/a	0	n/a	n/a	0.002502	NP Intra (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1102F	577	n/a	18	n/a	n/a	0	n/a	n/a	0.005373	NP Intra (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1103F	1900	n/a	26	n/a	n/a	0	n/a	n/a	0.002667	NP Intra (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1502R	744.3	n/a	13	553.2	92.07	0	None	No	0.002505	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, MW_1101R



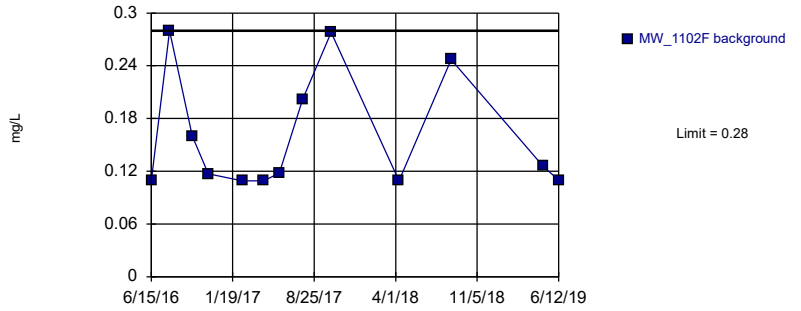
Background Data Summary: Mean=0.3916, Std. Dev.=0.06326, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8759, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW_1102F



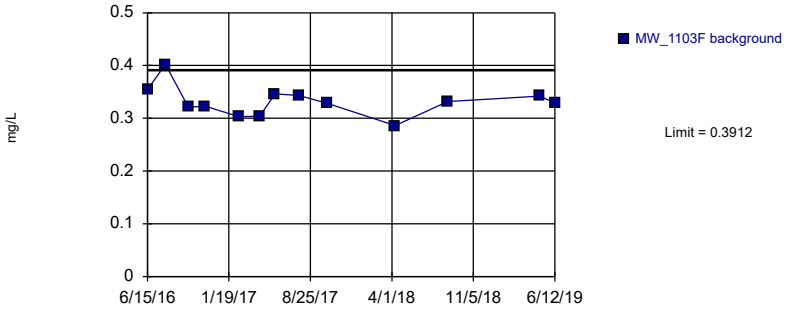
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 13 background values. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

Constituent: Boron, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1103F (bg)



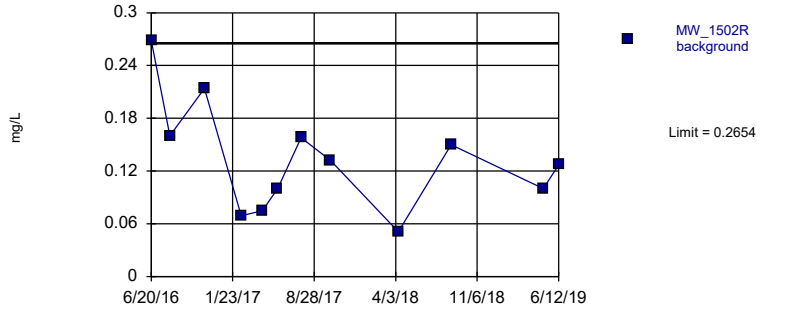
Background Data Summary: Mean=0.3318, Std. Dev.=0.0286, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9321, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1502R

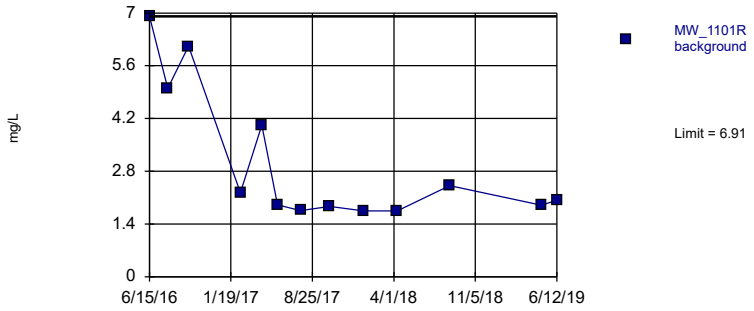


Background Data Summary: Mean=0.1337, Std. Dev.=0.06239, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9428, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Non-parametric, MW_1101R



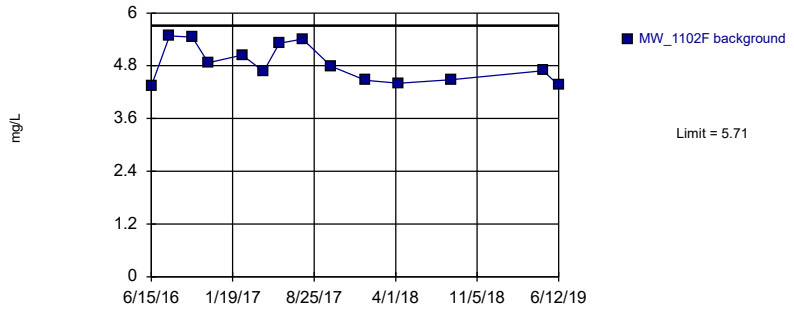
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 13 background values. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1102F



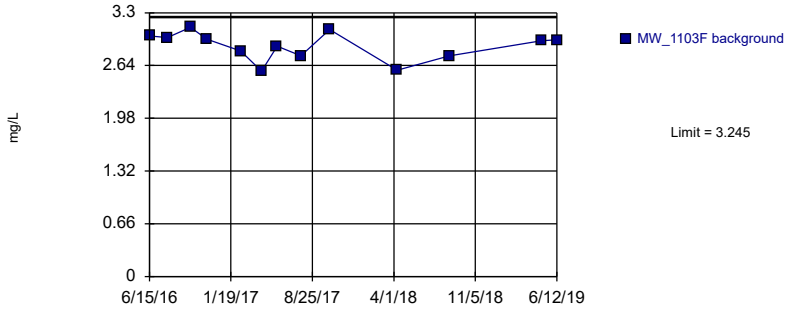
Background Data Summary: Mean=4.84, Std. Dev.=0.4263, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8855, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1103F (bg)



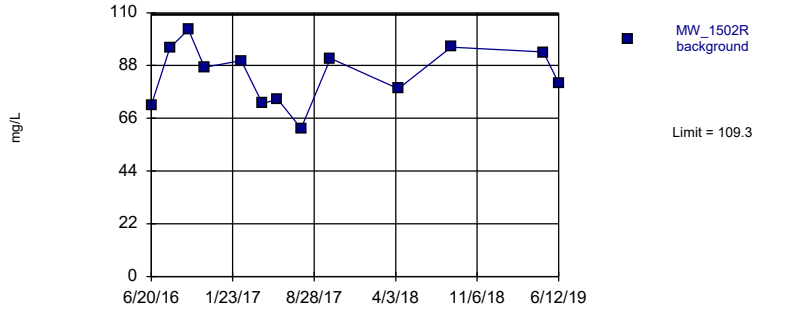
Background Data Summary: Mean=2.882, Std. Dev.=0.1753, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9275, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1502R

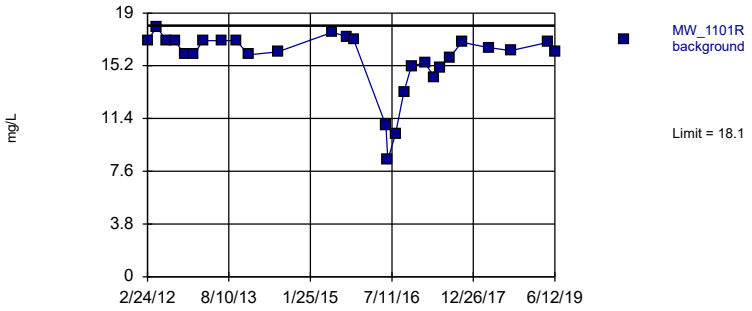


Background Data Summary: Mean=84.18, Std. Dev.=12.09, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9602, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1101R



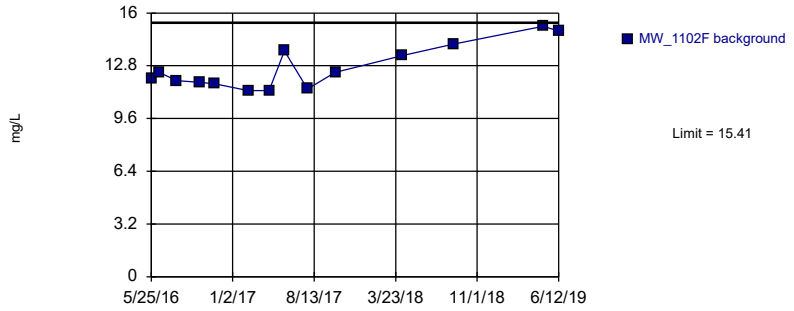
Background Data Summary (based on x^5 transformation): Mean=1086131, Std. Dev.=472396, n=28. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9175, critical = 0.896. Kappa = 1.814 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1102F



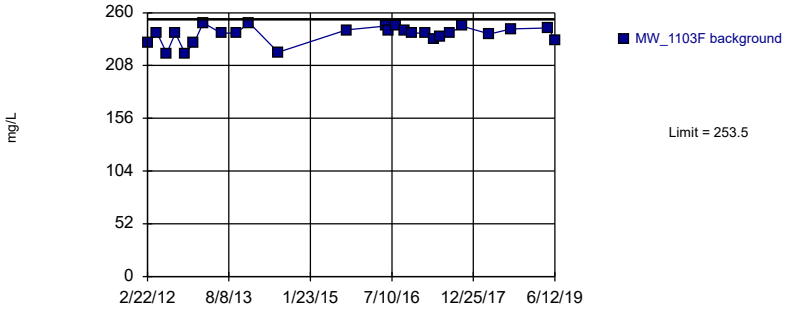
Background Data Summary: Mean=12.68, Std. Dev.=1.338, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8748, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1103F (bg)



Background Data Summary (based on square transformation): Mean=56970, Std. Dev.=3994, n=26. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8949, critical = 0.891. Kappa = 1.827 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

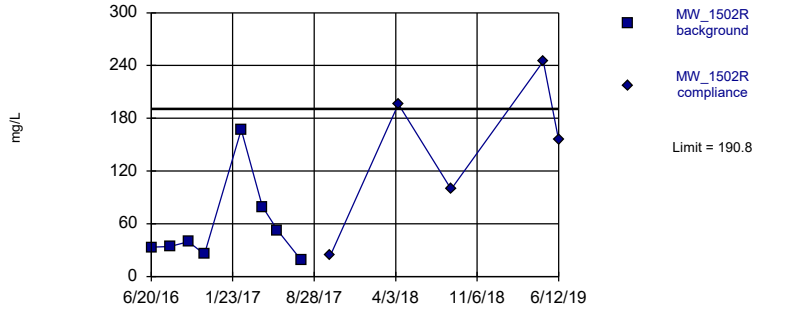
Constituent: Chloride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric

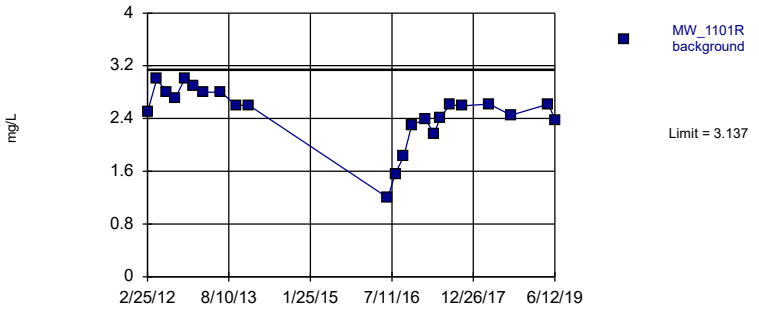


Background Data Summary (based on square root transformation): Mean=7.046, Std. Dev.=2.754, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8468, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1101R



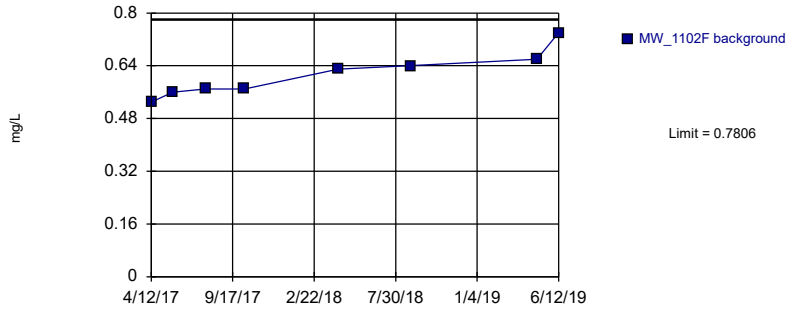
Background Data Summary (based on square transformation): Mean=6.289, Std. Dev.=1.914, n=23. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.92, critical = 0.881. Kappa = 1.857 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1102F



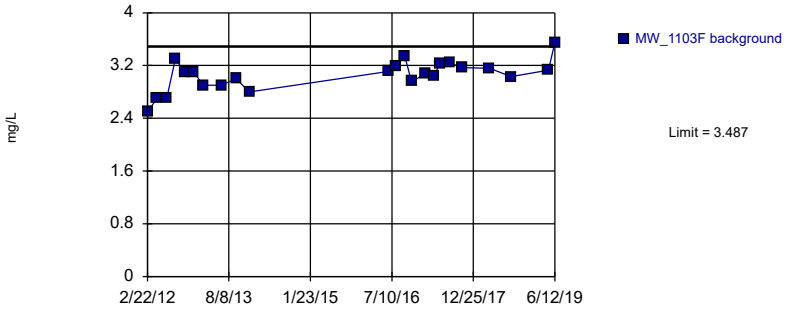
Background Data Summary: Mean=0.6125, Std. Dev.=0.0684, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9276, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1103F (bg)



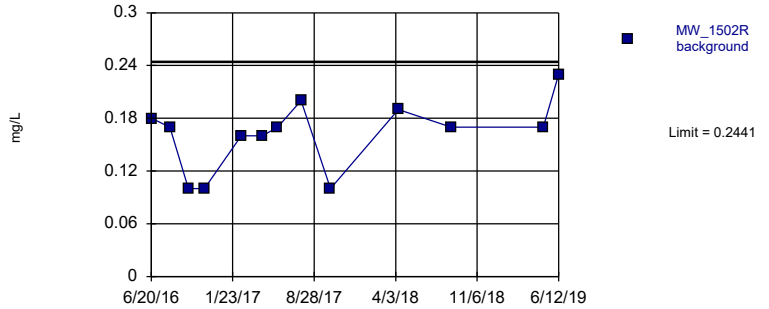
Background Data Summary: Mean=3.054, Std. Dev.=0.2331, n=23. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.974, critical = 0.881. Kappa = 1.857 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1502R

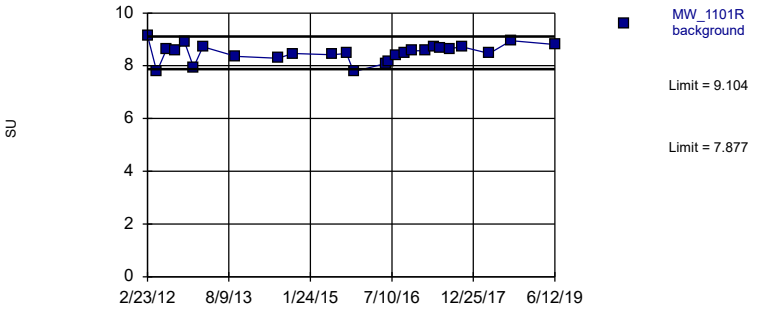


Background Data Summary: Mean=0.1615, Std. Dev.=0.03976, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8791, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1101R



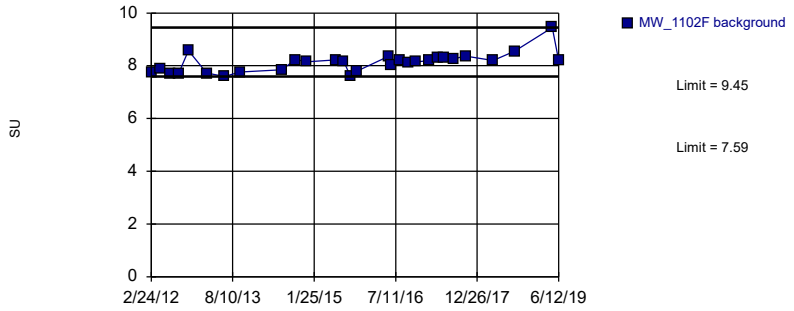
Background Data Summary: Mean=8.491, Std. Dev.=0.3359, n=26. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9587, critical = 0.891. Kappa = 1.827 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW_1102F



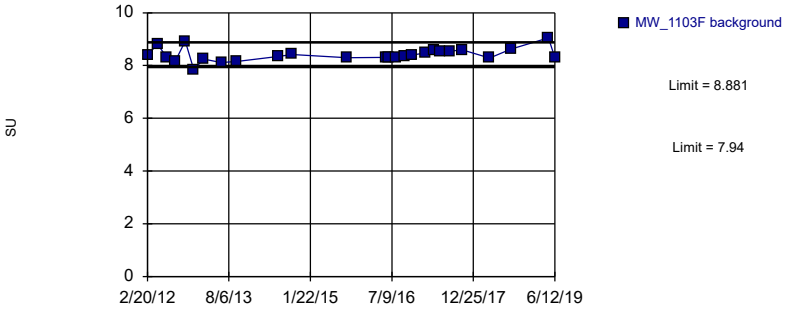
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 29 background values. Well-constituent pair annual alpha = 0.00868. Individual comparison alpha = 0.004345 (1 of 2). Assumes 1 future value.

Constituent: pH, field Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1103F (bg)



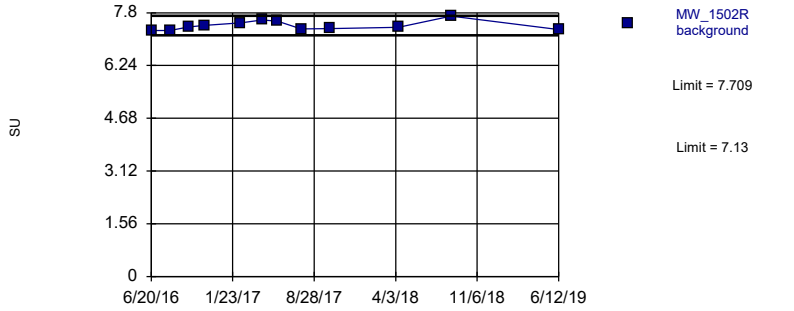
Background Data Summary: Mean=8.41, Std. Dev.=0.2575, n=26. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9446, critical = 0.891. Kappa = 1.827 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1502R

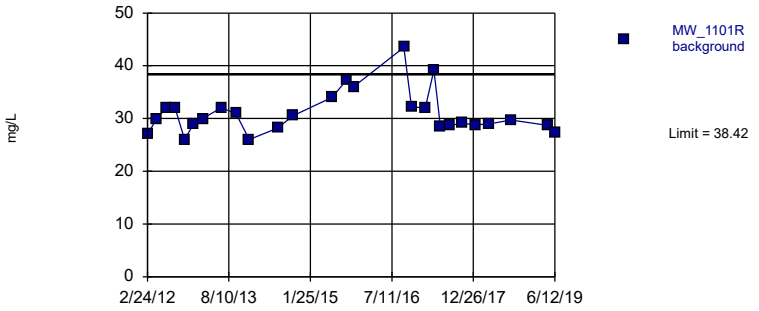


Background Data Summary: Mean=7.419, Std. Dev.=0.137, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8945, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1101R

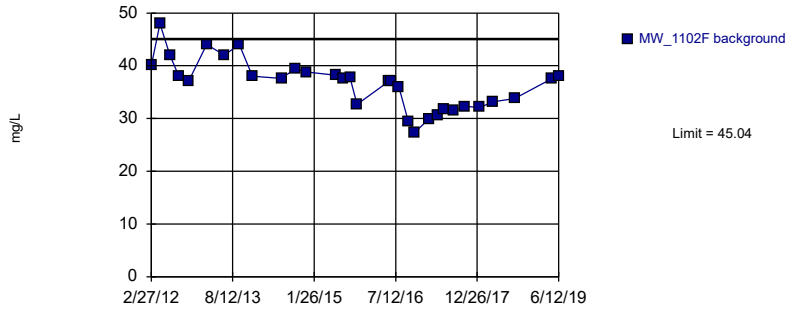


Background Data Summary (based on cube root transformation): Mean=3.137, Std. Dev.=0.1302, n=27. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8947, critical = 0.894. Kappa = 1.82 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1102F



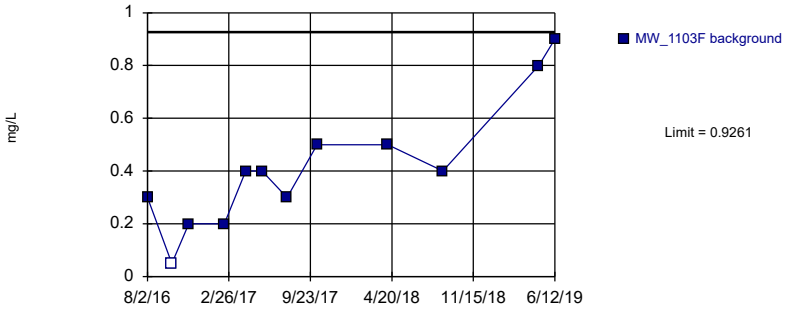
Background Data Summary: Mean=36.54, Std. Dev.=4.74, n=31. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9676, critical = 0.902. Kappa = 1.794 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, MW_1103F (bg)

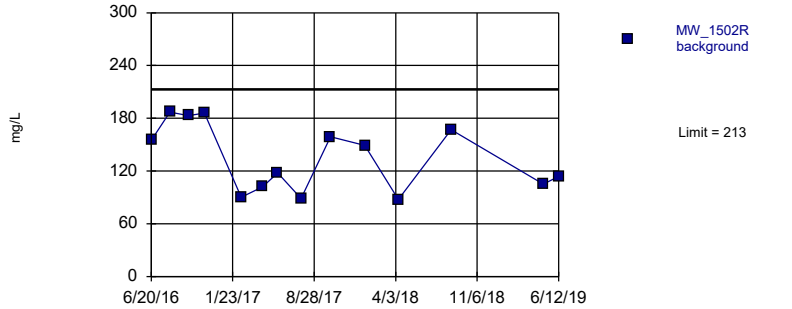


Background Data Summary: Mean=0.4125, Std. Dev.=0.2432, n=12, 8.333% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9261, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Parametric, MW_1502R

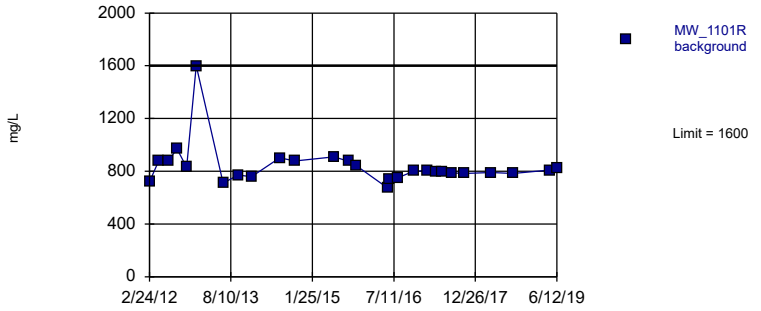


Background Data Summary: Mean=135.1, Std. Dev.=38.17, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8855, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Prediction Limit

Intrawell Non-parametric, MW_1101R



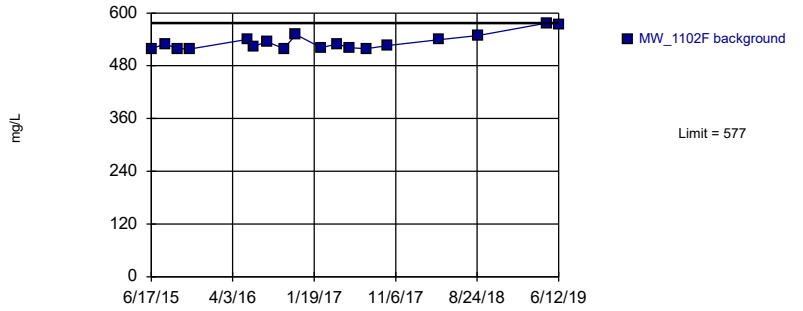
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 27 background values. Well-constituent pair annual alpha = 0.004998. Individual comparison alpha = 0.002502 (1 of 2). Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW_1102F



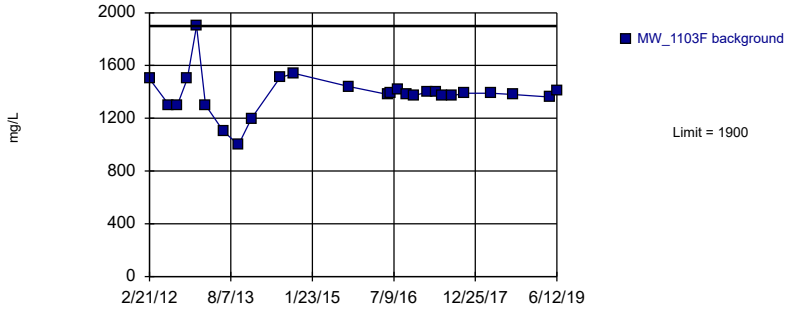
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 18 background values. Well-constituent pair annual alpha = 0.01072. Individual comparison alpha = 0.005373 (1 of 2). Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW_1103F (bg)



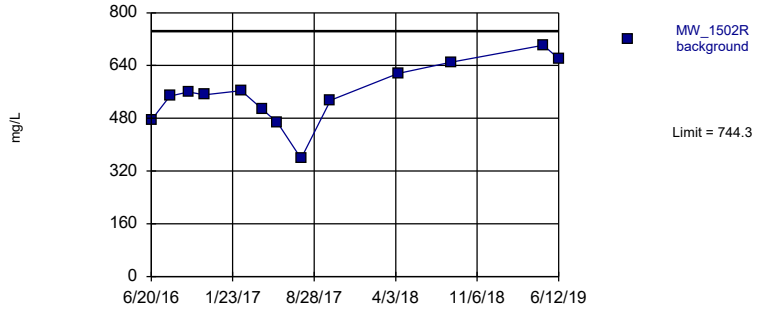
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 26 background values. Well-constituent pair annual alpha = 0.005327. Individual comparison alpha = 0.002667 (1 of 2). Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW_1502R



Background Data Summary: Mean=553.2, Std. Dev.=92.07, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.97, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/11/2019 2:43 PM View: PLs - Intrawell
Mitchell LF Client: Geosyntec Data: Mitchell Landfill

Geosyntec consultants

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Memorandum

Date:	September 3, 2020
To:	David Miller (AEP)
Copies to:	Bill Smith (AEP)
From:	Allison Kreinberg (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill (LF)

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 Subpart D, "CCR rule"), the first semi-annual detection monitoring event at the Mitchell Landfill (LF), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia was completed on May 6, 2020. Based on the results, verification sampling was completed on July 15, 2020 and September 1, 2020.

Background values for the LF were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated February 21, 2020.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 15.4 mg/L in both the initial (16.0 mg/L) and second (16.0 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.

In response to the exceedance noted above, the Mitchell LF CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride at MW-1102F will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell LF will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Mitchell Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1101R	MW-1102F	MW-1102F	MW-1502R	MW-1502R
			5/6/2020	5/6/2020	7/15/2020	5/6/2020	9/1/2020
Boron	mg/L	Intrawell Background Value (UPL)	0.525	0.280		0.265	
		Analytical Result	0.364	0.129	--	0.081	--
Calcium	mg/L	Intrawell Background Value (UPL)	6.91	5.71		109	
		Analytical Result	2.17	4.33	--	64.8	--
Chloride	mg/L	Intrawell Background Value (UPL)	18.1	15.4		191	
		Analytical Result	15.1	**16.0**	**16.0**	74.6	--
Fluoride	mg/L	Intrawell Background Value (UPL)	3.14	0.781		0.244	
		Analytical Result	2.46	0.69	--	0.18	--
pH	SU	Intrawell Background Value (UPL)	9.1	9.5		7.7	
		Intrawell Background Value (LPL)	7.9	7.6		7.1	
		Analytical Result	8.2	8.8	**--**	**7.8**	7.2
Sulfate	mg/L	Intrawell Background Value (UPL)	38.4	45.0		213	
		Analytical Result	23.9	33.8	--	93.0	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	1600	577		744	
		Analytical Result	828	574	--	471	--

Notes

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

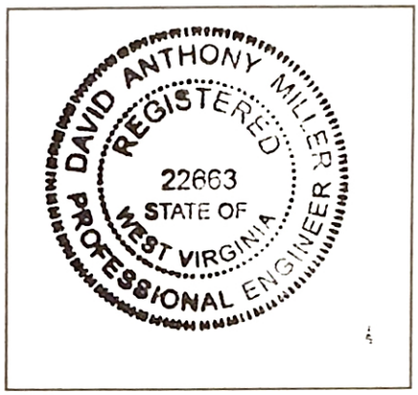
--: Not sampled

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the February 21, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell LF 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

22663	WEST VIRGINIA	09.04.2020
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The May 2020 and November 2020 ASD reports follow.

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2020; the CCR unit remained in detection monitoring over the entire year. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2020. Well installation/decommissioning logs are not applicable at this time.

APPENDIX 6 - Record of Changes

Record of Changes		
Revision Number	Date	Revision Description
0	01/31/2021	Initial Report
1	05/05/2021	Made changes to Section I – Overview. Added a statement on what monitoring mode (detection or assessment) the CCR unit was in at the beginning and end of the reporting year; and added a statement identifying all constituents and monitoring wells with any statistically significant increases (SSIs) over background in the case of a CCR unit in detection monitoring or statistically significant levels (SSLs) over groundwater protection standards (GWPSs) in the case of a CCR unit in assessment monitoring.