Annual Groundwater Monitoring Report

Southwestern Electric Power Company

H. W. Pirkey Power Plant

Landfill CCR Management Unit

Hallsville, Texas

January 2020

Prepared by:
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SOUTHWESTERN ELECTRIC POWER COMPANY℠

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I. Summary

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Pirkey 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 31, 2020.

In general, the following activities were completed:

- Groundwater samples were collected for the wells the landfill groundwater monitoring network in February, May, and August 2019 and analyzed for Appendix III and Appendix IV constituents, as specified in 40 CFR 257.94 or 95 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Assessment Monitoring sampling was initiated on April 3, 2018;
- The unit was in Assessment monitoring at the beginning and end of 2019;
- Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cadmium and cobalt at wells AD-34 on December 26, 2018. Since the Alternate source demonstration was not completed, and assessment of corrective measures was initiated on March 26, 2019. An alternate source for cadmium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on April 22, 2019. As a result, assessment of corrective measure work stopped, and the unit stayed in assessment monitoring;
- Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt and lithium at wells AD-34 on July 11, 2019. An alternate source was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on September 24, 2019;
- An alternate source for the statistically significant increases (SSI) over background that caused this unit to transition to assessment monitoring was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on January 7, 2020. As a result, the unit is returning to detection monitoring;
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared and certified in accordance with 40 CFR 257.93. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009).

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

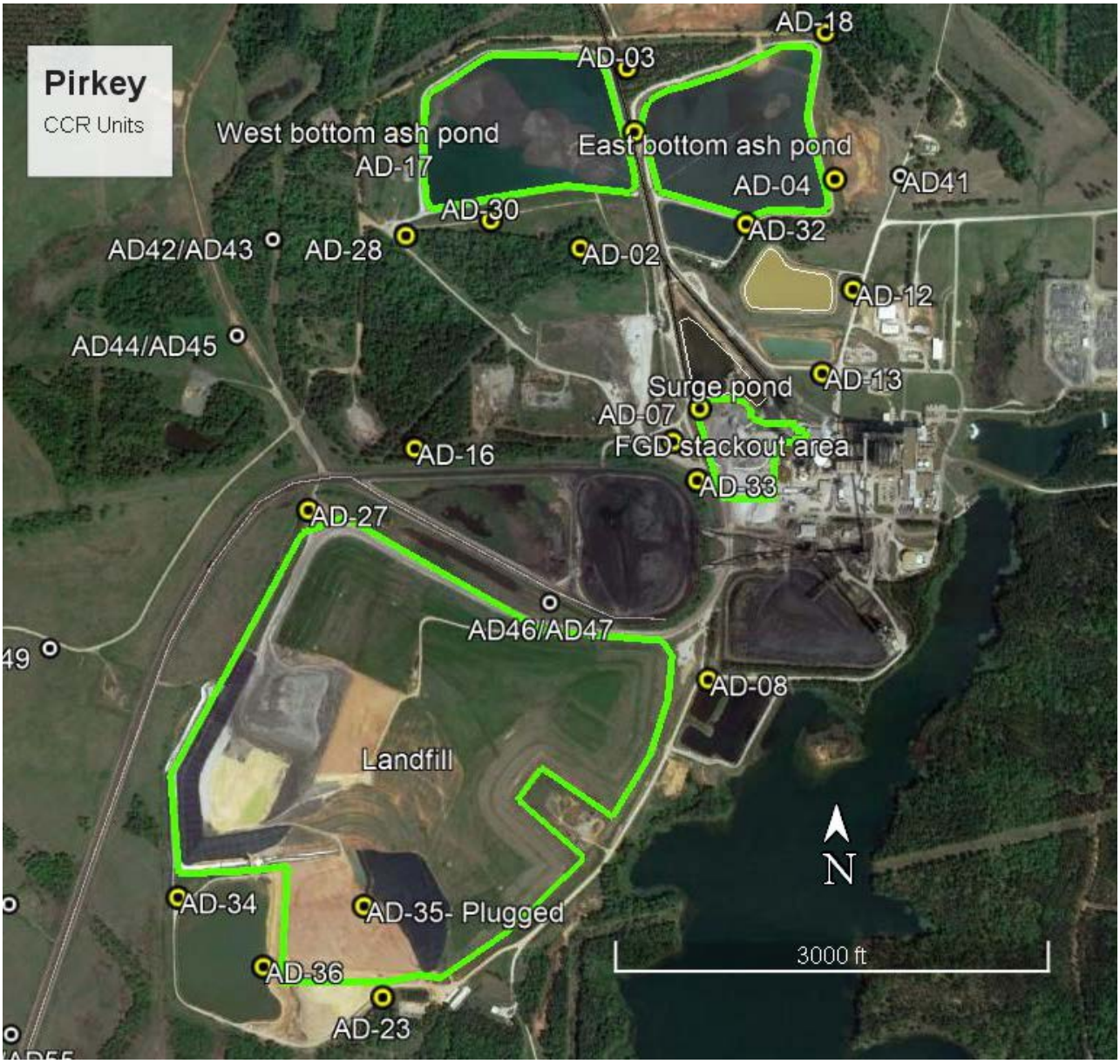
- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;
- 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 is included in Appendix I;
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations (Appendix IV).
- Other information required to be included in the annual report such as alternate source demonstration 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

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers.

Landfill Monitoring Wells	
Up Gradient	Down Gradient
AD-8	AD-23
AD-12	AD-34
AD-16	AD-35 (decommissioned)
AD-27	AD-36 (installed 2019)



III. Monitoring Wells Installed or Decommissioned

There was one monitoring well (AD-36) installed in 2019 to replace AD-35 that was plugged in 2018. The well installation report can be found in Appendix V. The AD-35 was in the footprint of a new cell for the landfill. The network design has been updated, as summarized in the *Groundwater Monitoring System Design and Construction Certification Report*.

Several monitoring wells were installed to better understand spatial variability of constituents across the site, groundwater flow, and groundwater chemistry in mine spoils. Please see a list below.

Soil Boring ID	Monitor Well ID
	AD-37
	AD-38
	AD-39
	AD-40
SB-01A	AD-41
SB-04	AD-42
SB-04	AD-43
SB-05	AD-44
SB-05	AD-45
SB-06	AD-46
SB-06	AD-47
SB-07	AD-48
SB-07	AD-49
SB-08	AD-50
SB-08	AD-52
SB-08	AD-53
SB-09	AD-54
SB-09	AD-55
SB-11	AD-56
SB-11	AD-57

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

Appendix I contains tables showing the groundwater quality. Static water elevation data from each monitoring event also are shown in Appendix I, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

As required by the assessment monitoring rules, 40 CFR 257.95 et seq., one round of sampling was conducted in February from wells AD-8, AD-12, AD-16, AD-23, AD-27, and AD-34 in accordance with 40 CFR 257.95(d)(1). A May sampling event from wells AD-8, AD-12, AD-16, AD-23, AD-27, and AD-34 was conducted in accordance with 40 CFR 257.95(b) including all

Appendix III parameters and those Appendix IV constituents parameters. Wells AD-8, AD-12, AD-16, AD-23, AD-27, AD-34, and AD-36 were sampled in August in accordance with 40 CFR 257.95(d)(1). Detection monitoring will continue in 2020.

V. Statistical Evaluation of 2019 Events

The one statistical analysis report available for this reporting period is included in Appendix II.

Statistically significant levels (SSLs) above the groundwater protection standard were identified for lithium and cobalt at AD-34 as summarized in *Statistical Analysis Summary Landfill Report* on July 11, 2019 in Appendix II.

VI. Alternate Source Demonstration

An alternate source investigation was conducted for the cadmium and cobalt SSLs above the GWPS at AD-34. An alternate source for cadmium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on April 22, 2019. As a result, assessment of corrective measure work stopped, and the unit stayed in assessment monitoring;

Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt and lithium at wells AD-34 on July 11, 2019. An alternate source was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on September 24, 2019.

An alternate source for the statistically significant increases (SSI) over background that caused to unit to transition to assessment monitoring was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on January 7, 2020. As a result, the unit is returning to detection monitoring.

Documentation supporting these findings are found in Appendix III.

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

On April 3, 2018, no alternate source was found for SSIs over background, so the unit transitioned to assessment monitoring. On December 26, 2019, SSLs above GWPS were identified. On March 26, 2019, no alternate sources were identified for the unit, so it transitioned into assessment of corrective measures. On April 22, 2019, an alternate source was identified, so the unit did not continue assessment of corrective measures work and remained in assessment monitoring.

On January 7, 2020, an alternate source was found for the SSIs determined for boron, total dissolved solids (TDS), and sulfate as summarized in *Groundwater Monitoring Statistical Evaluation Report* (1/3/2018), so the unit returned to detection monitoring.

Detection monitoring will continue in 2020.

Regarding defining an alternate monitoring frequency, no modification of the twice-per-year detection monitoring effort is needed.

VIII. Other Information Required

No other information applies at this time.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No problems were encountered this year.

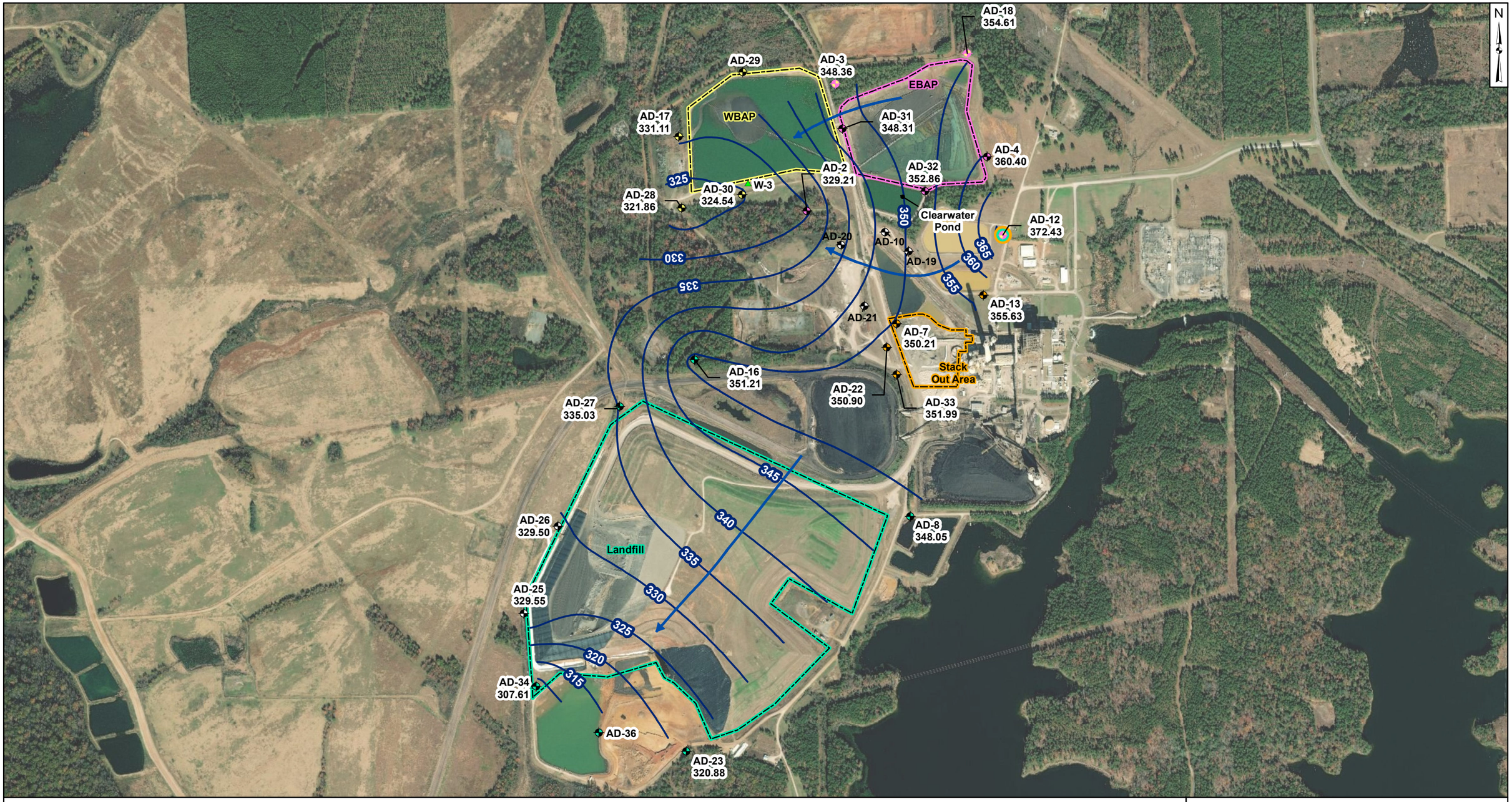
X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Detection monitoring sampling will be conducted;
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any SSIs over background;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the fourth annual groundwater report.

APPENDIX I

Tables follow, showing the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.



Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on February 23-28, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in February 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer
February 2019

AEP Pirkey Power Plant
Hallsville, Texas

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Figure **1**

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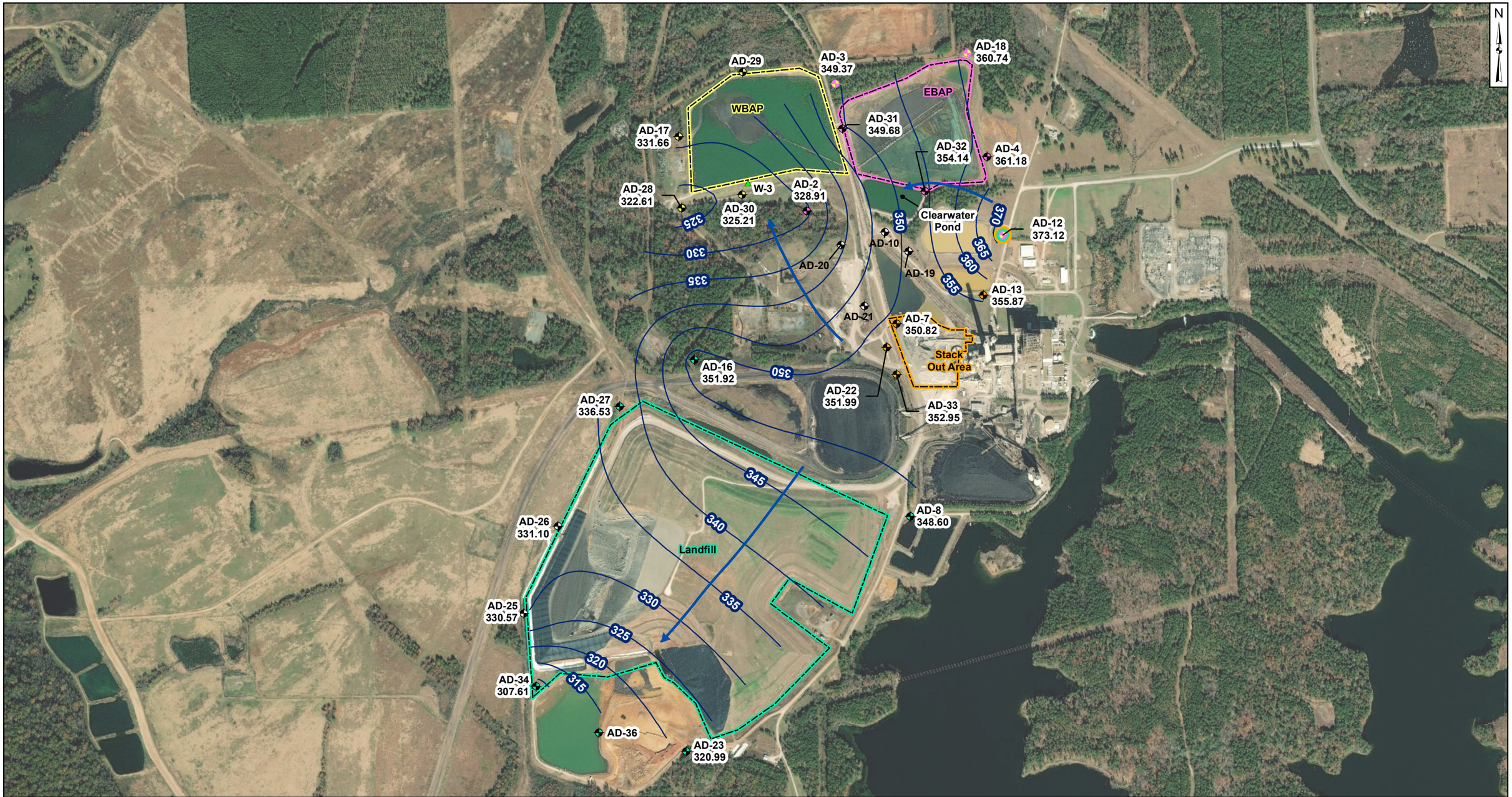

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP
- All CCR Unit Networks
- Piezometer
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 21-23, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in May 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer May 2019

AEP Pirkey Power Plant
Hallsville, Texas

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Figure **2**

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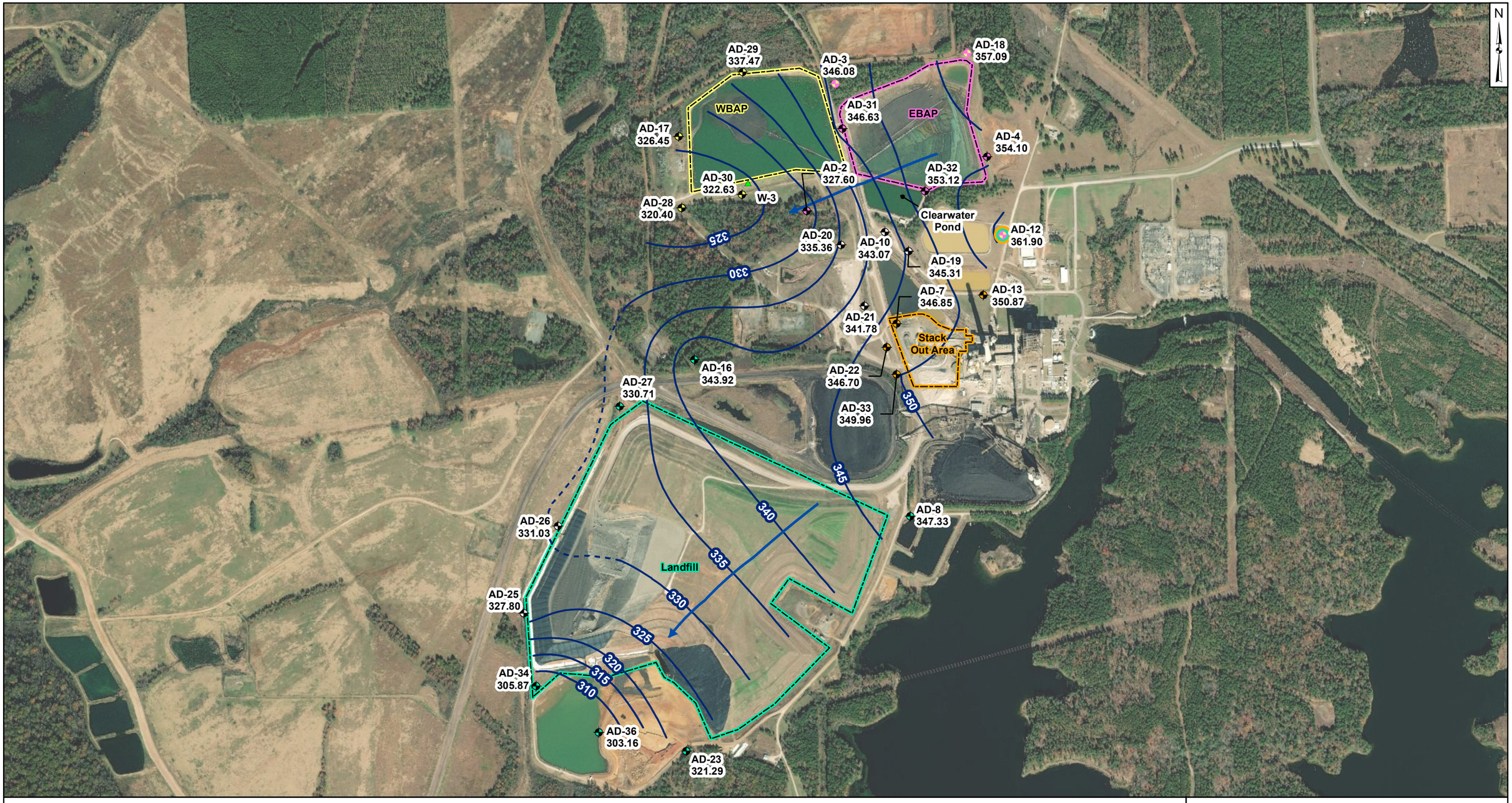

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on August 12-16, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in August 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer August 2019

AEP Pirkey Power Plant
Hallsville, Texas

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Figure **3**

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Table 1: Residence Time Calculation Summary
Pirkey Landfill

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2019-02		2019-05		2019-08	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	AD-8 [1]	4.0	10.4	11.7	6.6	18.5	6.8	17.8
	AD-12 [1]	4.0	34.2	3.6	35.0	3.5	21.4	5.7
	AD-16 [1]	2.0	26.4	2.3	28.3	2.2	22.6	2.7
	AD-23 [2]	2.0	10.8	5.6	10.3	5.9	10.9	5.6
	AD-27 [1]	2.0	19.4	3.1	18.4	3.3	16.7	3.6
	AD-34 [2]	2.0	32.3	1.9	33.6	1.8	28.5	2.1
	AD-36 [2]	2.0	NC	NC	NC	NC	34.4	1.8

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

Table 1 - Groundwater Data Summary: AD-8
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	1.58	109	9	<0.083 U	6.1	432	181
7/13/2016	Background	0.775	20.7	13	2	6.2	280	131
9/8/2016	Background	1.04	50.7	12	2	5.1	285	121
10/12/2016	Background	0.793	20.8	13	2	3.7	276	184
11/15/2016	Background	0.769	17.2	13	3	3.7	296	208
1/11/2017	Background	0.734	18.6	13	3	3.6	280	228
2/28/2017	Background	0.777	18.1	10	2	3.7	250	157
4/11/2017	Background	0.779	17.1	12	3	3.9	284	168
8/23/2017	Detection	0.411	19.4	9	0.587 J	3.9	110	56
3/21/2018	Assessment	1.03	56.1	8	1.1987	5.7	278	140
8/20/2018	Assessment	0.714	14.5	18	5.1991	3.7	300	168
2/28/2019	Assessment	1.05	103	6.83	0.40	5.7	462	175
5/21/2019	Assessment	1.11	85.5	4.48	0.33	5.9	296	127
8/13/2019	Assessment	0.818	27.6	12.7	3.39	4.6	260	128

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: AD-8
Pirkey - Landfill
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
5/10/2016	Background	<0.93 U	<1.05 U	38	1	<0.07 U	1	1.80288 J	0.9155	<0.083 U	1.02541 J	<0.00013 U	0.027	<0.29 U	15	1.19926 J
7/13/2016	Background	<0.93 U	1.16508 J	61	7	0.175996 J	1	20	6.75	2	1.46729 J	0.032	0.211	<0.29 U	<0.99 U	<0.86 U
9/8/2016	Background	<0.93 U	<1.05 U	48	2	<0.07 U	0.835837 J	9	1.658	2	<0.68 U	0.018	0.048	<0.29 U	3.84567 J	<0.86 U
10/12/2016	Background	<0.93 U	1.46586 J	61	6	<0.07 U	0.74214 J	18	6.72	2	2.30733 J	0.032	0.112	<0.29 U	2.51464 J	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	52	6	0.118693 J	0.805286 J	18	6.14	3	2.85553 J	0.03	0.16	<0.29 U	<0.99 U	<0.86 U
1/11/2017	Background	<0.93 U	1.53134 J	60	6	0.108717 J	2	18	6.29	3	2.99592 J	0.032	0.157	<0.29 U	1.4083 J	<0.86 U
2/28/2017	Background	<0.93 U	1.68597 J	52	6	0.13889 J	0.633257 J	18	7.64	2	3.26919 J	0.031	0.153	<0.29 U	1.78549 J	<0.86 U
4/11/2017	Background	<0.93 U	<1.05 U	51	6	0.128137 J	0.887504 J	19	5.56	3	2.44168 J	0.031	0.01068 J	<0.29 U	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	<1.05 U	37.9	2.57	<0.07 U	<0.23 U	9.38	2.499	1.1987	0.95 J	0.01503	0.049	<0.29 U	27.68	<0.86 U
8/20/2018	Assessment	0.02 J	4.05	33.4	4.55	0.18	0.759	15.9	0.145	5.1991	4.46	0.0221	0.105	0.02 J	9.8	0.083
2/28/2019	Assessment	<0.4 U	<0.6 U	46.8	<0.4 U	<0.2 U	<0.8 U	0.8 J	1.066	0.40	<0.4 U	0.002 J	<0.005 U	<8 U	30.8	<2 U
5/21/2019	Assessment	<0.4 U	1 J	42.8	1 J	<0.2 U	<0.8 U	<0.4 U	1.786	0.33	<0.4 U	0.0003 J	0.009 J	<8 U	23.9	<0.1 U
8/13/2019	Assessment	0.03 J	2.13	44.1	4.05	0.16	0.368	12.7	3.77	3.39	1.31	0.0255	0.059	<0.4 U	7.5	<0.1 U

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-12
Pirkey - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.03	0.362	5	<0.083 U	4.4	94	4
7/13/2016	Background	0.03	0.26	6	<0.083 U	3.1	75	4
9/7/2016	Background	0.04	0.343	6	<0.083 U	3.9	63	7
10/12/2016	Background	0.03	0.271	7	< 1 U	3.4	92	8
11/14/2016	Background	0.04	0.331	8	<0.083 U	2.6	80	6
1/11/2017	Background	0.03	0.315	7	<0.083 U	4.8	76	6
2/28/2017	Background	0.04	0.434	5	<0.083 U	3.6	50	4
4/11/2017	Background	0.05	0.299	6	0.2565 J	4.7	72	7
8/23/2017	Detection	0.0495	0.245	6	0.213 J	4.8	52	6
3/21/2018	Assessment	0.01397	0.269	5	<0.083 U	4.2	<2 U	3
8/20/2018	Assessment	0.017	0.338	10	<0.083 U	4.4	94	4
2/27/2019	Assessment	0.03 J	0.4 J	6.08	0.09	5.2	36	3.6
5/21/2019	Assessment	0.020	0.3 J	6.30	0.09	4.1	80	4.0
8/12/2019	Assessment	<0.02 U	0.278	7.24	0.06 J	4.9	90	2.6

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: AD-12
Pirkey - Landfill
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
5/11/2016	Background	<0.93 U	<1.05 U	26	0.219521 J	<0.07 U	0.710981 J	1.58207 J	0.2073	<0.083 U	<0.68 U	<0.00013 U	<0.005 U	<0.29 U	1.73953 J	<0.86 U
7/13/2016	Background	<0.93 U	<1.05 U	23	0.190337 J	<0.07 U	0.68835 J	1.29444 J	2.909	<0.083 U	<0.68 U	0.008	<0.005 U	<0.29 U	<0.99 U	<0.86 U
9/7/2016	Background	<0.93 U	<1.05 U	30	0.232192 J	<0.07 U	0.353544 J	1.66591 J	0.881	<0.083 U	<0.68 U	0.01	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	<0.93 U	<1.05 U	27	0.149553 J	<0.07 U	0.529033 J	1.56632 J	0.257	< 1 U	<0.68 U	0.012	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/14/2016	Background	<0.93 U	<1.05 U	28	0.152375 J	<0.07 U	0.32826 J	1.47282 J	0.767	<0.083 U	<0.68 U	0.013	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/11/2017	Background	<0.93 U	<1.05 U	23	0.126621 J	<0.07 U	0.650158 J	1.09495 J	1.536	<0.083 U	<0.68 U	0.01	<0.005 U	<0.29 U	<0.99 U	<0.86 U
2/28/2017	Background	<0.93 U	<1.05 U	26	0.149219 J	<0.07 U	0.325811 J	1.29984 J	0.416	<0.083 U	<0.68 U	0.009	<0.005 U	<0.29 U	<0.99 U	0.994913 J
4/11/2017	Background	<0.93 U	<1.05 U	24	0.159412 J	<0.07 U	0.416007 J	1.33344 J	0.3895	0.2565 J	<0.68 U	0.008	0.01364 J	<0.29 U	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	<1.05 U	25.82	0.16 J	<0.07 U	1.05	1.49 J	0.784	<0.083 U	<0.68 U	0.00722	<0.005 U	<0.29 U	<0.99 U	<0.86 U
8/20/2018	Assessment	<0.01 U	0.11	27.8	0.159	0.01 J	0.330	1.72	1.128	<0.083 U	0.089	0.0143	<0.005 U	0.04 J	0.1	0.04 J
2/27/2019	Assessment	<0.4 U	<0.6 U	22.5	<0.4 U	<0.2 U	<0.8 U	1.37	0.225	0.09	<0.4 U	0.00688	<0.005 U	<8 U	<0.6 U	<2 U
5/21/2019	Assessment	<0.4 U	<0.6 U	21.7	<0.4 U	<0.2 U	<0.8 U	1.15	0.201	0.09	<0.4 U	0.00576	<0.005 U	<8 U	<0.6 U	<0.1 U
8/12/2019	Assessment	<0.02 U	0.07 J	23.8	0.154	<0.01 U	0.204	1.3	0.237	0.06 J	0.08 J	0.00829	<0.005 U	<0.4 U	0.2 J	<0.1 U

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-16
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	0.02	1.21	8	<0.083 U	3.9	116	16
7/14/2016	Background	0.03	2	9	<0.083 U	3.8	148	45
9/8/2016	Background	0.03	1.83	9	<0.083 U	3.9	133	33
10/13/2016	Background	0.03	1.15	9	<0.083 U	3.9	124	16
11/14/2016	Background	0.03	1.58	9	<0.083 U	4.4	124	23
1/12/2017	Background	0.02	1.76	10	<0.083 U	3.7	112	43
3/1/2017	Background	0.03	1.29	9	<0.083 U	3.2	108	22
4/10/2017	Background	0.02	1.21	11	<0.083 U	3.4	106	24
8/24/2017	Detection	0.03648	0.945	12	<0.083 U	4.3	96	14
3/22/2018	Assessment	0.0171	1.03	14	<0.083 U	4.0	96	13
8/21/2018	Assessment	0.020	1.17	17	<0.083 U	4.0	128	15
2/27/2019	Assessment	0.03 J	0.704	20.3	0.07 J	4.1	76	17.7
5/23/2019	Assessment	0.022	1.06	20.8	0.06 J	4.6	128	26.9
8/15/2019	Assessment	<0.02 U	0.874	20.0	0.06 J	5.1	110	15.4

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: AD-16
Pirkey - Landfill
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
5/10/2016	Background	<0.93 U	1.83497 J	61	0.453643 J	0.0817904 J	1	4.23727 J	1.294	<0.083 U	<0.68 U	0.006	0.01506 J	<0.29 U	2.26113 J	1.3697 J
7/14/2016	Background	<0.93 U	<1.05 U	64	0.565692 J	<0.07 U	1	6	1.438	<0.083 U	<0.68 U	0.036	0.02395 J	1.1177 J	<0.99 U	<0.86 U
9/8/2016	Background	8.00	<1.05 U	70	0.810547 J	0.0926258 J	2	8	1.931	<0.083 U	<0.68 U	0.032	0.00753 J	<0.29 U	<0.99 U	1.75243 J
10/13/2016	Background	<0.93 U	1.52475 J	56	0.250902 J	<0.07 U	1	3.33761 J	1.843	<0.083 U	<0.68 U	0.033	<0.005 U	<0.29 U	1.70284 J	<0.86 U
11/14/2016	Background	<0.93 U	<1.05 U	55	0.38481 J	<0.07 U	0.561291 J	4.34297 J	2.123	<0.083 U	<0.68 U	0.028	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/12/2017	Background	<0.93 U	<1.05 U	58	0.70928 J	<0.07 U	0.406161 J	8	2.629	<0.083 U	<0.68 U	0.031	0.01045 J	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	1.50766 J	76	0.487946 J	<0.07 U	0.558767 J	5	1.417	<0.083 U	<0.68 U	0.021	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	<1.05 U	77	0.435552 J	<0.07 U	0.822329 J	5	0.932	<0.083 U	<0.68 U	0.019	0.00733 J	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	83.66	0.27 J	<0.07 U	1.59	3.6 J	2.11	<0.083 U	<0.68 U	0.02224	0.018 J	<0.29 U	<0.99 U	<0.86 U
8/21/2018	Assessment	0.03 J	0.42	69.0	0.213	0.03	0.211	3.78	1.92	<0.083 U	0.082	0.0347	0.014 J	<0.02 U	0.1	0.051
2/27/2019	Assessment	<0.4 U	7.74	56.2	<0.4 U	<0.2 U	<0.8 U	3.21	0.848	0.07 J	<0.4 U	0.0154	0.011 J	<8 U	<0.6 U	<2 U
5/23/2019	Assessment	<0.4 U	5.80	83.4	<0.4 U	<0.2 U	<0.8 U	3.16	1.957	0.06 J	<0.4 U	0.0227	<0.005 U	<8 U	<0.6 U	<0.1 U
8/15/2019	Assessment	<0.02 U	1.40	80.1	0.203	0.02 J	0.215	2.95	2.108	0.06 J	0.1 J	0.0208	0.024 J	<0.4 U	0.1 J	<0.1 U

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-23
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	0.01	0.535	4	<0.083 U	4.0	72	10
7/13/2016	Background	0.03	0.317	4	<0.083 U	2.7	59	11
9/8/2016	Background	0.02	0.26	5	<0.083 U	3.5	64	12
10/12/2016	Background	0.03	0.321	6	<0.083 U	3.7	68	13
11/15/2016	Background	0.03	0.249	5	<0.083 U	3.5	100	14
1/11/2017	Background	0.02	0.319	6	<0.083 U	3.7	60	13
2/28/2017	Background	0.03	0.217	4	<0.083 U	4.0	48	9
4/11/2017	Background	0.03	0.543	7	0.2688 J	4.2	76	11
8/23/2017	Detection	0.04021	0.276	6	0.198 J	4.1	64	11
12/21/2017	Detection	0.04498	0.469	- -	- -	- -	- -	- -
3/21/2018	Assessment	0.01762	0.227	4	<0.083 U	3.9	72	10
8/20/2018	Assessment	0.017	0.247	9	<0.083 U	3.8	92	11
2/28/2019	Assessment	0.02 J	0.3 J	6.94	0.04 J	5.1	70	7.2
5/23/2019	Assessment	0.017	0.3 J	6.82	0.04 J	4.8	54	9.1
8/13/2019	Assessment	<0.02 U	0.325	7.12	0.03 J	5.0	126	7.4

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: AD-23
Pirkey - Landfill
Appendix IV Constituents

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
5/10/2016	Background	2.89148 J	1.65098 J	48	0.186855 J	0.0739811 J	2	2.29646 J	6.86	<0.083 U	<0.68 U	0.000135818 J	0.01188 J	<0.29 U	1.91991 J	<0.86 U
7/13/2016	Background	3.79558 J	<1.05 U	48	0.192156 J	0.0925427 J	2	2.72879 J	5.69	<0.083 U	<0.68 U	0.006	0.01721 J	1.34973 J	2.00038 J	<0.86 U
9/8/2016	Background	<0.93 U	<1.05 U	53	0.20435 J	<0.07 U	5	2.01019 J	6.68	<0.083 U	2.23756 J	0.006	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	1.29835 J	7	120	0.463688 J	0.13648 J	41	3.91303 J	12.89	<0.083 U	31	1.01	0.095	0.563586 J	2.10924 J	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	50	0.129296 J	<0.07 U	6	1.66943 J	7.54	<0.083 U	3.21271 J	0.006	0.02438 J	0.403857 J	1.34763 J	<0.86 U
1/11/2017	Background	<0.93 U	2.03681 J	73	0.159 J	<0.07 U	15	2.25934 J	8.06	<0.083 U	11	0.009	0.092	<0.29 U	<0.99 U	<0.86 U
2/28/2017	Background	1.65681 J	<1.05 U	41	0.116844 J	<0.07 U	0.295768 J	1.05228 J	5.74	<0.083 U	<0.68 U	0.005	<0.005 U	<0.29 U	1.3076 J	<0.86 U
4/11/2017	Background	<0.93 U	3.9673 J	86	0.318917 J	0.107977 J	22	2.60853 J	10.31	0.2688 J	15	0.01	0.118	0.31517 J	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	<1.05 U	56.1	0.17 J	<0.07 U	5.7	1.09 J	7.55	<0.083 U	3.52 J	0.00709	0.02 J	<0.29 U	<0.99 U	<0.86 U
8/20/2018	Assessment	0.03 J	0.87	53.5	0.147	0.01 J	1.77	0.803	11	<0.083 U	4.79	0.00634	0.025	0.07 J	1.0	0.176
2/28/2019	Assessment	<0.4 U	1 J	46.9	<0.4 U	<0.2 U	4.16	1 J	6.14	0.04 J	3.46	0.00646	0.035	<8 U	1 J	<2 U
5/23/2019	Assessment	<0.4 U	0.7 J	56.4	<0.4 U	<0.2 U	3 J	0.7 J	9.66	0.04 J	8.99	0.00537	0.058 J	<8 U	<0.6 U	0.2 J
8/13/2019	Assessment	<0.02 U	0.67	49.3	0.137	0.01 J	1.25	0.837	7.65	0.03 J	4.65	0.00527	0.039	<0.4 U	0.8	0.1 J

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-27
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.02	4.41	8	0.6176 J	3.9	198	51
7/13/2016	Background	0.03	4.43	8	<0.083 U	2.7	192	54
9/8/2016	Background	0.03	4.17	8	<0.083 U	2.9	196	52
10/12/2016	Background	0.03	4.09	8	<0.083 U	3.0	216	58
11/15/2016	Background	0.03	4.52	8	<0.083 U	3.5	216	92
1/11/2017	Background	0.02	3.74	9	<0.083 U	4.1	180	58
3/1/2017	Background	0.03	4.31	8	<0.083 U	2.8	216	56
4/10/2017	Background	0.03	4.01	9	<0.083 U	3.3	180	54
8/24/2017	Detection	0.0358	3.58	9	0.197 J	3.7	168	52
3/22/2018	Assessment	0.03901	5.58	11	<0.083 U	3.9	192	78
8/21/2018	Assessment	0.024	4.58	10	<0.083 U	3.5	196	65
2/28/2019	Assessment	0.07 J	4.02	11.7	0.20	4.7	42	52.8
5/23/2019	Assessment	0.023	3.89	11.4	0.20	4.4	204	55.2
8/16/2019	Assessment	0.02 J	3.94	10.5	0.18	3.9	198	53.2

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: AD-27
Pirkey - Landfill
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
5/11/2016	Background	1.20808 J	2.15232 J	43	5	0.431235 J	0.87101 J	20	2.031	0.6176 J	<0.68 U	0.066	<0.005 U	<0.29 U	1.10872 J	<0.86 U
7/13/2016	Background	0.956365 J	1.27952 J	45	5	0.434627 J	2	21	2.406	<0.083 U	<0.68 U	0.097	0.02241 J	0.434679 J	<0.99 U	<0.86 U
9/8/2016	Background	<0.93 U	<1.05 U	47	6	0.398469 J	2	20	2.71	<0.083 U	<0.68 U	0.095	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	<0.93 U	2.14429 J	46	5	0.424977 J	2	20	4.43	<0.083 U	<0.68 U	0.096	<0.005 U	<0.29 U	1.35863 J	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	41	5	0.419182 J	2	22	3.69	<0.083 U	<0.68 U	0.095	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/11/2017	Background	<0.93 U	1.56781 J	46	5	0.30207 J	1	18	2.62	<0.083 U	<0.68 U	0.1	0.00659 J	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	<1.05 U	43	5	0.286804 J	2	21	3.48	<0.083 U	<0.68 U	0.1	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	<1.05 U	45	5	0.414787 J	0.954802 J	21	2.58	<0.083 U	<0.68 U	0.104	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	40.53	5.29	0.48 J	3.09	25.63	2.808	<0.083 U	<0.68 U	0.108	0.012 J	<0.29 U	<0.99 U	<0.86 U
8/21/2018	Assessment	0.02 J	1.71	39.5	4.90	0.46	1.14	24.6	2.619	<0.083 U	0.296	0.0921	0.006 J	0.07 J	3.7	0.137
2/28/2019	Assessment	<0.4 U	1 J	39.5	5.32	0.5 J	<0.8 U	18.9	2.95	0.20	<0.4 U	0.0892	<0.005 U	<8 U	2 J	<2 U
5/23/2019	Assessment	<0.4 U	<0.6 U	41.0	5.22	0.3 J	<0.8 U	19.9	3.93	0.20	<0.4 U	0.0885	<0.005 U	<8 U	0.6 J	0.2 J
8/16/2019	Assessment	<0.02 U	0.71	34.1	4.27	0.39	0.313	19.0	4.69	0.18	0.2 J	0.0897	0.012 J	<0.4 U	1.9	0.1 J

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-34
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	0.08	37.8	7	<0.083 U	4.0	1516	974
7/13/2016	Background	0.111	33.2	8	<0.083 U	3.6	1396	837
9/8/2016	Background	0.09	39.5	8	<0.083 U	3.3	1520	870
10/12/2016	Background	0.09	35.8	7	0.6272 J	3.6	1464	1084
11/15/2016	Background	0.1	36.3	7	0.9978 J	3.7	1428	1006
1/11/2017	Background	0.07	39.9	8	<0.083 U	3.2	1378	1334
2/28/2017	Background	0.08	37	6	<0.083 U	3.7	1402	993
4/10/2017	Background	0.09	38.2	8	0.5241 J	3.0	1490	1016
8/23/2017	Detection	0.107	36.2	7	0.619 J	3.7	1128	1231
12/21/2017	Detection	- -	- -	8	0.6669 J	- -	1260	1020
3/21/2018	Assessment	0.171	40.1	6	<0.083 U	3.7	1424	956
8/20/2018	Assessment	0.067	37.0	10	<0.083 U	3.7	1462	1064
2/27/2019	Assessment	0.08 J	39.9	7.64	0.86	2.9	1470	970
5/21/2019	Assessment	0.060	42.0	7.34	0.69	3.3	1154	1080
8/13/2019	Assessment	0.070	39.8	7.46	1.13	3.7	1648	1060

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: AD-34
Pirkey - Landfill
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
5/10/2016	Background	<0.93 U	12	72	3	6	34	301	9.64	<0.083 U	12	0.176	0.105	0.688222 J	<0.99 U	<0.86 U
7/13/2016	Background	<0.93 U	25	177	4	6	81	296	7.75	<0.083 U	39	0.183	0.313	2.11044 J	7	<0.86 U
9/8/2016	Background	<0.93 U	9	31	3	8	12	306	7.91	<0.083 U	1.01746 J	0.158	0.064	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	<0.93 U	10	39	3	5	15	297	10.12	0.6272 J	3.69632 J	0.174	0.036	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	7	23	2	8	6	292	13.21	0.9978 J	<0.68 U	0.154	0.025	<0.29 U	4.50827 J	<0.86 U
1/11/2017	Background	<0.93 U	6	29	2	7	8	284	11.9	<0.083 U	<0.68 U	0.164	0.032	<0.29 U	<0.99 U	<0.86 U
2/28/2017	Background	<0.93 U	7	11	2	6	<0.23 U	294	9.87	<0.083 U	<0.68 U	0.158	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	4.49903 J	23	2	11	7	299	2.407	0.5241 J	<0.68 U	0.167	0.0164 J	<0.29 U	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	6.51	10.6	2.24	11.97	<0.23 U	279	8.85	<0.083 U	<0.68 U	0.156	<0.005 U	<0.29 U	3.24 J	<0.86 U
8/20/2018	Assessment	0.01 J	14.4	7.77	1.77	4.34	0.977	249	10.17	<0.083 U	1.32	0.114	0.005 J	0.03 J	13.0	0.070
2/27/2019	Assessment	<0.4 U	15.9	9.93	2.42	4.57	0.9 J	260	8.56	0.86	1 J	0.153	0.015 J	<8 U	14.8	<2 U
5/21/2019	Assessment	<0.4 U	12.7	10.5	2.25	4.48	0.8 J	272	10.82	0.69	1 J	0.158	<0.005 U	<8 U	4.9	<0.1 U
8/13/2019	Assessment	<0.02 U	11.2	9.28	1.82	4.27	0.758	262	11.11	1.13	1.16	0.180	<0.005 U	<0.4 U	8.1	<0.1 U

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-35
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	0.109	17.4	17	<0.083 U	4.7	162	50
7/13/2016	Background	0.07	5.35	18	<0.083 U	4.6	114	28
9/8/2016	Background	0.04	3.42	14	<0.083 U	4.0	104	21
10/12/2016	Background	0.05	2.43	14	0.3552 J	3.6	116	23
11/15/2016	Background	0.06	2	14	<0.083 U	4.3	142	29
1/11/2017	Background	0.06	10.4	18	<0.083 U	4.7	128	62
2/28/2017	Background	0.123	22.5	19	<0.083 U	3.5	140	84
4/11/2017	Background	0.07	10.8	25	<0.083 U	4.8	160	75
8/23/2017	Detection	0.04134	4.33	16	<0.083 U	4.9	92	35
3/21/2018	Assessment	0.142	24.5	28	<0.083 U	4.6	228	102
8/20/2018	Assessment	0.156	12.5	38	2.9285	4.2	290	149

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: AD-35
Pirkey - Landfill
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
5/10/2016	Background	<0.93 U	11	124	0.327886 J	0.109137 J	21	10	2.465	<0.083 U	7	<0.00013 U	0.061	0.439174 J	<0.99 U	<0.86 U
7/13/2016	Background	<0.93 U	9	185	0.394115 J	<0.07 U	19	6	4.21	<0.083 U	4.37246 J	0.013	0.11	<0.29 U	<0.99 U	<0.86 U
9/8/2016	Background	<0.93 U	1.13012 J	116	0.19327 J	<0.07 U	5	3.44039 J	2.065	<0.083 U	<0.68 U	0.011	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	<0.93 U	4.07365 J	110	0.141123 J	<0.07 U	6	2.98973 J	6.01	0.3552 J	1.53293 J	0.012	0.01021 J	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	12	143	0.304515 J	0.241047 J	30	7	4.83	<0.083 U	7	0.019	0.073	0.583418 J	<0.99 U	<0.86 U
1/11/2017	Background	<0.93 U	2.14698 J	115	0.0923255 J	0.0922067 J	5	4.0586 J	3.65	<0.083 U	<0.68 U	0.01	0.01907 J	<0.29 U	<0.99 U	<0.86 U
2/28/2017	Background	<0.93 U	4.03612 J	94	0.0943688 J	<0.07 U	3	4.75282 J	2.02	<0.083 U	1.23627 J	0.008	0.02305 J	<0.29 U	<0.99 U	<0.86 U
4/11/2017	Background	<0.93 U	1.39833 J	92	0.0696 J	0.329193 J	1	6	2.707	<0.083 U	<0.68 U	0.007	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	5.28	53.17	0.18 J	0.61 J	4.24	11.63	2.013	<0.083 U	0.77 J	0.00401	0.023 J	<0.29 U	1.4 J	<0.86 U
8/20/2018	Assessment	0.02 J	2.90	111	0.702	0.12	0.770	11.9	6.27	2.9285	1.43	0.00876	0.005 J	0.04 J	4.5	0.128

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-36
Pirkey - Landfill
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
8/13/2019	Background	0.065	0.240	9.46	0.05 J	4.71	92	2.2

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: AD-36
Pirkey - Landfill
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
8/13/2019	Background	<0.02 U	0.15	10.8	0.234	<0.01 U	0.203	0.901	1.298	0.05 J	<0.05 U	0.0161	<0.005 U	<0.4 U	0.09 J	<0.1 U

Notes:
µg/L: micrograms 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
pCi/L: picocuries per liter

APPENDIX II

Where applicable, show in this appendix the results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are to be conducted separately for each constituent in each monitoring well.

STATISTICAL ANALYSIS SUMMARY
LANDFILL
H. W. Pirkey Power Plant
Hallsville, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

July 11, 2019

CHA8473

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LIST OF ACRONYMS AND ABBREVIATIONS

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

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Landfill (LF), an existing CCR unit at the H.W. Pirkey Power Plant located in Hallsville, Texas.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, sulfate, and total dissolved solids (TDS) at the LF. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the LF in 2018, in accordance with 40 CFR 257.95. SSLs for cadmium and cobalt were identified at well AD-34. An ASD was successfully completed (Burns & McDonnell, 2019); thus, the unit remained in assessment monitoring.

A semi-annual assessment monitoring event was also completed in February 2019, with the results of the February 2019 event documented in this report. Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The February 2019 monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. SSLs were identified for cobalt and lithium. Thus, either the unit will move to an assessment of corrective measures or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(d)(1). AD-35 was decommissioned in November 2018 and replaced with AD-36, which was installed in April 2019. Thus, only two downgradient wells were sampled for this assessment event. Although antimony, molybdenum, and thallium were not detected at any locations during the March 2018 screening event, samples from the February 2019 semi-annual sampling event were analyzed for all Appendix III and Appendix IV parameters. A summary of data collected during this assessment monitoring event may be found 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.9.6.14 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the LF were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(d)(1) were screened for potential outliers. No outliers were identified.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from

the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for arsenic, beryllium, cadmium, cobalt, fluoride, lead, lithium, mercury, and selenium due to apparent non-normal distributions and for antimony, molybdenum, and thallium due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

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

The following SSLs were identified at the Pirkey LF:

- LCLs for cobalt exceeded the GWPS of 0.026 mg/L at AD-34 (0.272 mg/L).
- LCLs for lithium exceeded the GWPS of 0.110 mg/L at AD-34 (0.145 mg/L).

As a result, the Pirkey LF will either move to an assessment of corrective measures or an alternative source demonstration will be conducted to evaluate if the unit can remain in assessment monitoring

2.2.3 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations. Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for boron, calcium, chloride, and fluoride, whereas interwell tests were used to evaluate potential SSIs for pH, sulfate, and TDS.

Prediction limits for the interwell tests were recalculated using data collected during the February 2019 assessment monitoring event. Five data points (i.e., one sample from five background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised interwell prediction limits were used to evaluate potential SSIs for pH, sulfate, and TDS.

For the intrawell tests, limited data made it possible to add only one data point (i.e., one sample from each compliance well) to each background dataset. Because one sample result is insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The intrawell prediction limits calculated during detection monitoring were used to evaluate potential SSIs for boron, calcium, chloride, and fluoride.

Data collected during the February 2019 assessment monitoring event were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Sulfate concentrations exceeded the interwell UPL of 228 mg/L at AD-34 (970 mg/L).
- TDS concentrations exceeded the interwell UPL of 348 mg/L at AD-34 (1476 mg/L).

While the prediction limits were calculated assuming a one-of-two testing procedure, it was conservatively assumed that an SSI was identified if the initial sample exceeded either the UPL based on previous results. Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Pirkey LF during assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the February 2019 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for cobalt and lithium. Appendix III parameters were also evaluated, with exceedances identified for sulfate and TDS.

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

SECTION 3

REFERENCES

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

Burns & McDonnell Engineering Company, Inc. 2019. Alternative Source Demonstration Evaluation Report. April.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Landfill, H. W. Pirkey Power Plant, Hallsville, Texas. January 3, 2018.

TABLES

Table 1 - Groundwater Data Summary
Pirkey - Landfill

Geosyntec Consultants

Parameter	Unit	AD-8	AD-12	AD-16	AD-23	AD-27	AD-34
		2/28/2019	2/27/2019	2/27/2019	2/28/2019	2/28/2019	2/27/2019
Antimony	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Arsenic	µg/L	2.00 U	2.00 U	7.74	1.00 J	1.00 J	15.9
Barium	µg/L	46.8	22.5	56.2	46.9	39.5	9.93
Beryllium	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	5.32	2.42
Boron	mg/L	1.05	0.0300 J	0.0300 J	0.0200 J	0.0700 J	0.0800 J
Cadmium	µg/L	1.00 U	1.00 U	1.00 U	1.00 U	0.500 J	4.57
Calcium	mg/L	103	0.400 J	0.704	0.300 J	4.02	39.9
Chloride	mg/L	6.83	6.08	20.3	6.94	11.7	7.64
Chromium	µg/L	4.00 U	4.00 U	4.00 U	4.16	4.00 U	0.900 J
Cobalt	µg/L	0.800 J	1.37	3.21	1.00 J	18.9	260
Combined Radium	pCi/L	1.07	0.225	0.848	6.14	2.95	8.56
Fluoride	mg/L	0.400	0.0900	0.0700 J	0.0400 J	0.200	0.860
Lead	µg/L	2.00 U	2.00 U	2.00 U	3.46	2.00 U	1.00 J
Lithium	mg/L	0.00200 J	0.00688	0.0154	0.00646	0.0892	0.153
Mercury	mg/L	0.0000250 U	0.0000250 U	0.0000110 J	0.0000350	0.0000250 U	0.0000150 J
Molybdenum	µg/L	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U
Selenium	µg/L	30.8	4.00 U	4.00 U	1.00 J	2.00 J	14.8
Total Dissolved Solids	mg/L	462	36.0	76.0	70.0	42.0	1470
Sulfate	mg/L	175	3.60	17.7	7.20	52.8	970
Thallium	µg/L	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
pH	SU	5.69	5.17	4.13	5.11	4.67	2.92

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

Table 2: Groundwater Protection Standards
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Constituent Name	MCL	CCR Rule Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.008
Arsenic, Total (mg/L)	0.01		0.0077
Barium, Total (mg/L)	2		0.080
Beryllium, Total (mg/L)	0.004		0.007
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.0051
Cobalt, Total (mg/L)	n/a	0.006	0.026
Combined Radium, Total (pCi/L)	5		7.36
Fluoride, Total (mg/L)	4		5.2
Lead, Total (mg/L)	n/a	0.015	0.0045
Lithium, Total (mg/L)	n/a	0.04	0.11
Mercury, Total (mg/L)	0.002		0.00021
Molybdenum, Total (mg/L)	n/a	0.1	0.0050
Selenium, Total (mg/L)	0.05		0.031
Thallium, Total (mg/L)	0.002		0.002

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

Table 3: Appendix III Data Summary
Pirkey Plant - Landfill

Parameter	Units	Description	AD-23	AD-34
			2/28/2019	2/27/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.030	0.120
		Detection Monitoring Result	0.02	0.08
Calcium	mg/L	Intrawell Background Value (UPL)	0.65	42.5
		Detection Monitoring Result	0.3	39.9
Chloride	mg/L	Intrawell Background Value (UPL)	7.89	9.20
		Detection Monitoring Result	6.94	7.64
Fluoride	mg/L	Intrawell Background Value (UPL)	1.0	1.0
		Detection Monitoring Result	0.04	0.86
pH	SU	Interwell Background Value (UPL)	5.5	
		Interwell Background Value (LPL)	2.5	
		Detection Monitoring Result	5.1	2.9
Sulfate	mg/L	Interwell Background Value (UPL)	228	
		Detection Monitoring Result	7.2	**970**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	348	
		Detection Monitoring Result	70	**1476**

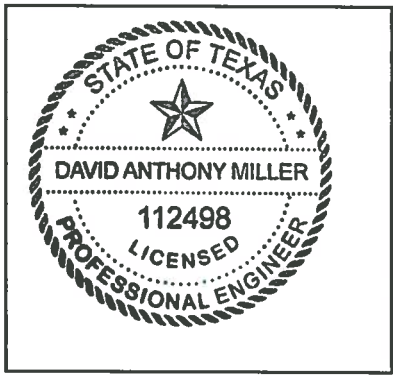
Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Pirkey 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

112498	TEXAS	07.11.19
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING

July 11, 2019

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

Re: Pirkey Landfill
Assessment Monitoring Event – February 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of the groundwater data for the February 2019 sample event for American Electric Power Company's Pirkey 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).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, is listed below. Note that downgradient well AD-35 was originally in the well network but has been abandoned and replaced with a new well. No data are currently available from the new well but will be included in future analyses.

- **Upgradient wells:** AD-8, AD-12, AD-16 and AD-27; and
- **Downgradient wells:** AD-23 and AD-34

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

The CCR program consists of the following constituents:

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

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs. A summary of flagged values follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for pH, sulfate and TDS; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, calcium, chloride and fluoride (Figures C and D, respectively). The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. All values flagged as outliers may be seen on the Outlier Summary report following this letter. No obvious trending patterns were observed in the upgradient wells.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one 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 a false positive result and, therefore, no further action is necessary. No exceedances were noted except for chloride at wells AD-16 and AD-27; and sulfate and TDS at well AD-34. Downgradient well AD-35 had exceedances for the August 2018 event as previously noted in that report for boron, chloride and fluoride. The results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable. Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site which is an indication of natural variability in groundwater unrelated to practices at the site.

No statistically significant increasing or decreasing trends were found for any of the downgradient well/parameter pairs with prediction limit exceedances. Statistically significant increasing trends were noted for chloride in upgradient wells AD-16 and AD-27, which is an indication groundwater concentrations are changing naturally upgradient of the facility.

Evaluation of Appendix IV Parameters

Interwell Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters to determine the Alternate Contaminant Level (ACL) for each constituent (Figure F). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Any flagged values may be seen on the Outlier Summary following this letter.

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure G).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of either the MCL, CCR-rule specified levels or ACL as discussed above (Figure H). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. Two exceedances were noted which included cobalt and lithium in well AD-34. A summary of the confidence interval results follows this letter.

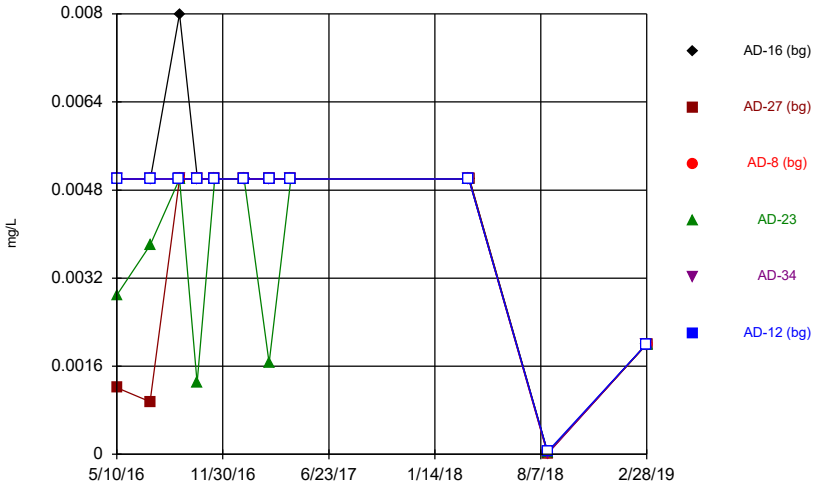
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Pirkey Landfill. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

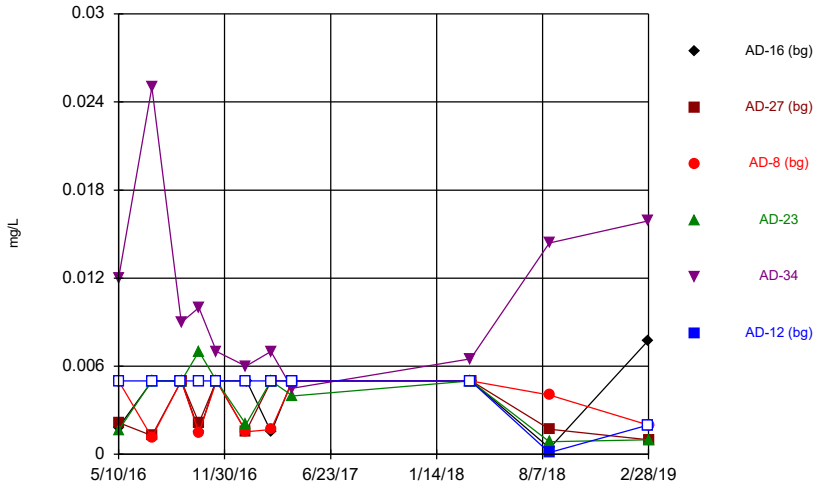
Time Series



Constituent: Antimony, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

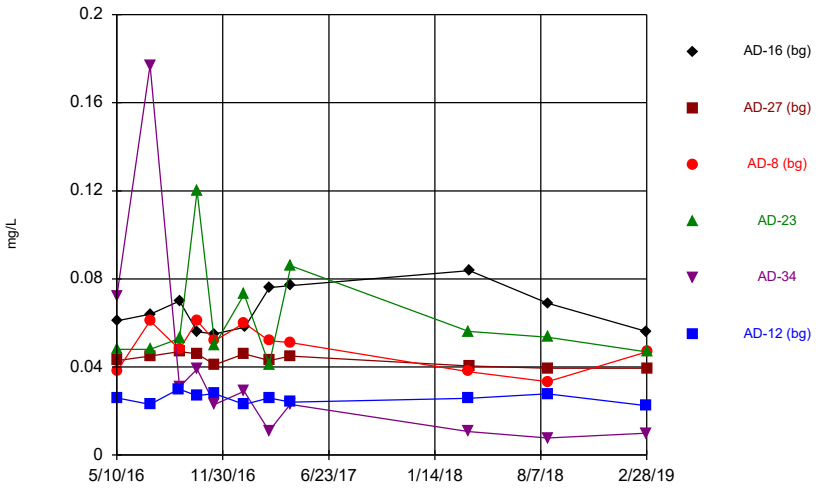
Time Series



Constituent: Arsenic, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

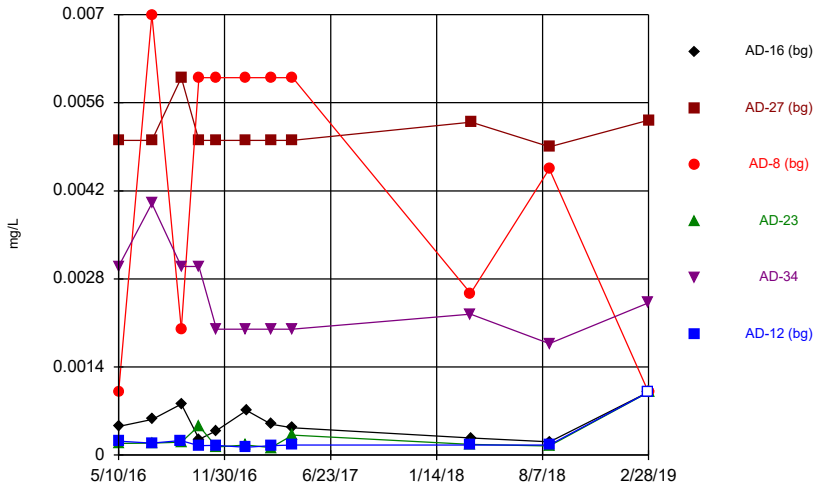
Time Series



Constituent: Barium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

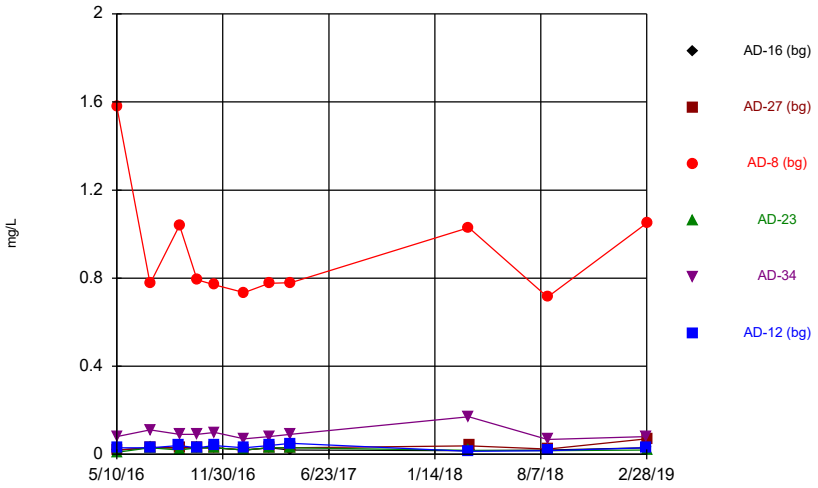
Time Series



Constituent: Beryllium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

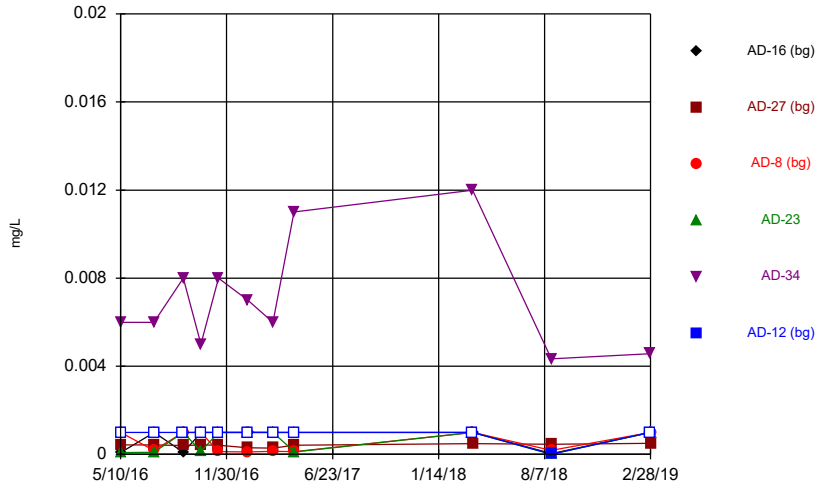
Time Series



Constituent: Boron, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

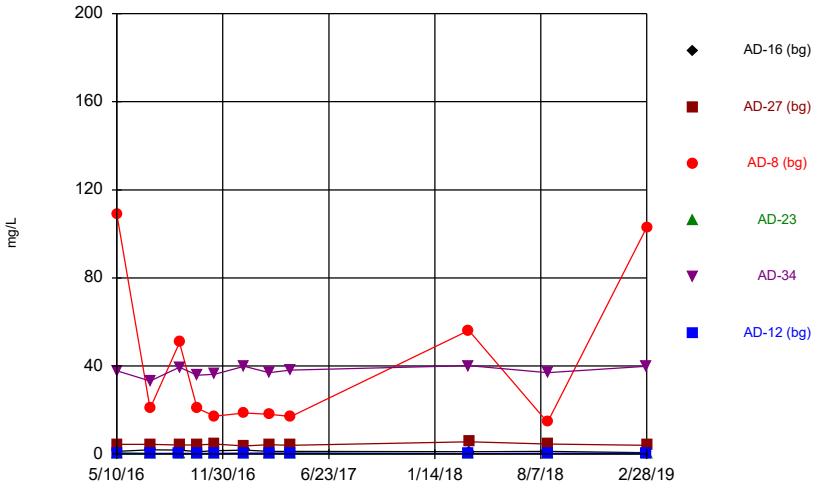
Time Series



Constituent: Cadmium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

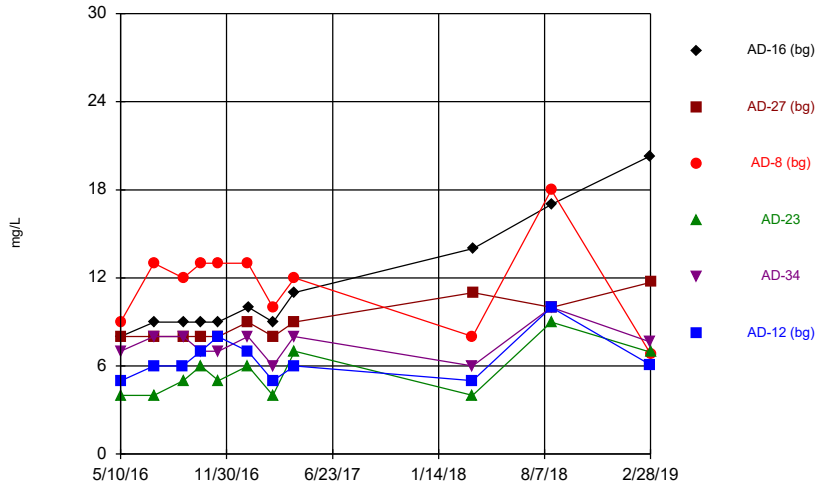
Time Series



Constituent: Calcium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

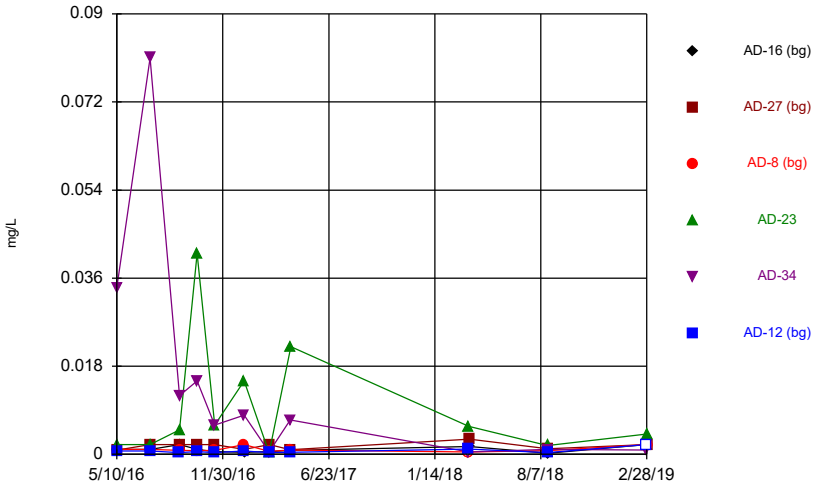
Time Series



Constituent: Chloride, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

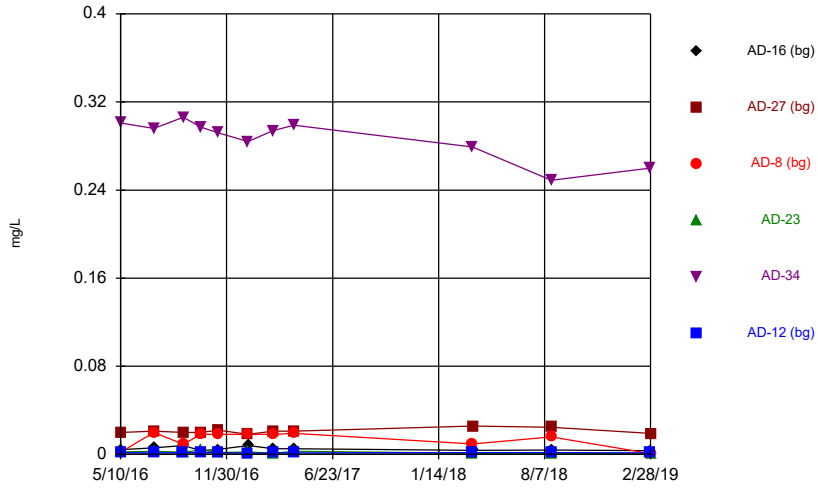
Time Series



Constituent: Chromium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

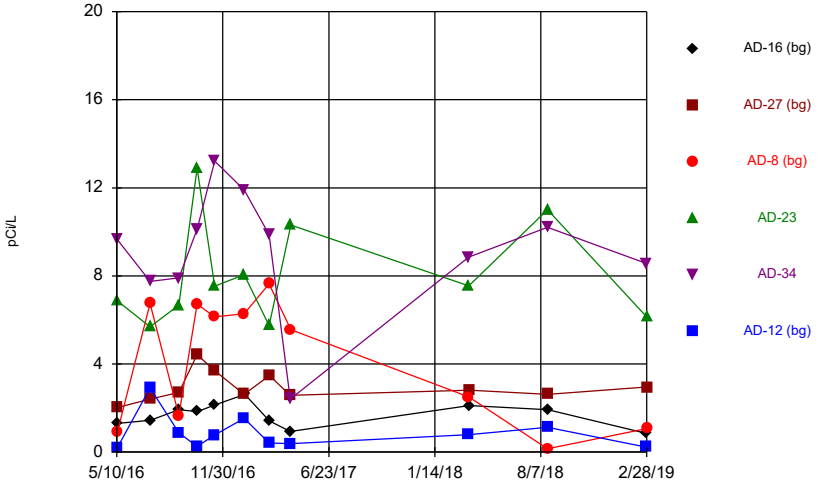
Time Series



Constituent: Cobalt, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

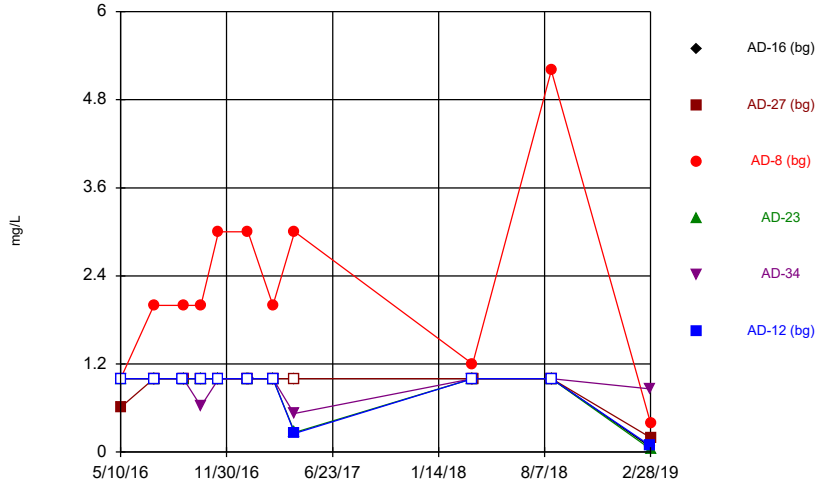
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

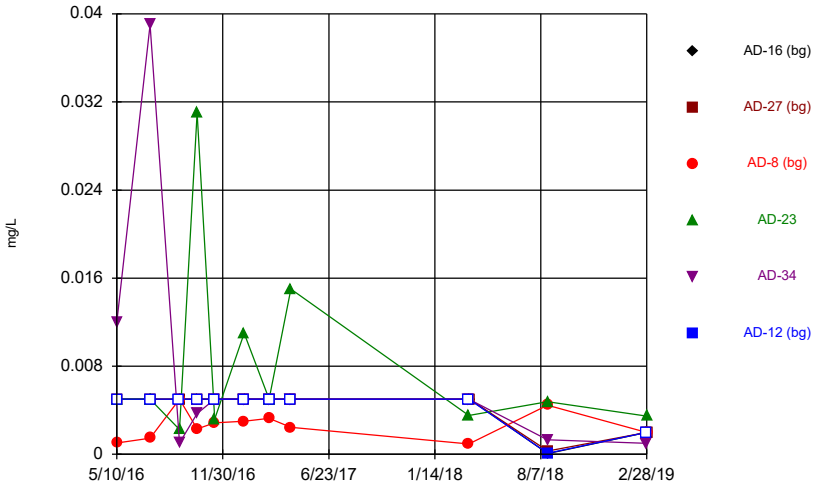
Time Series



Constituent: Fluoride, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

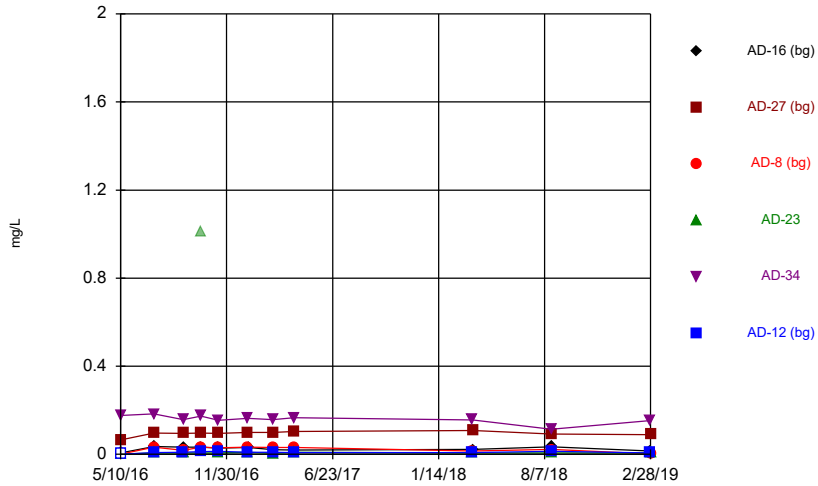
Time Series



Constituent: Lead, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

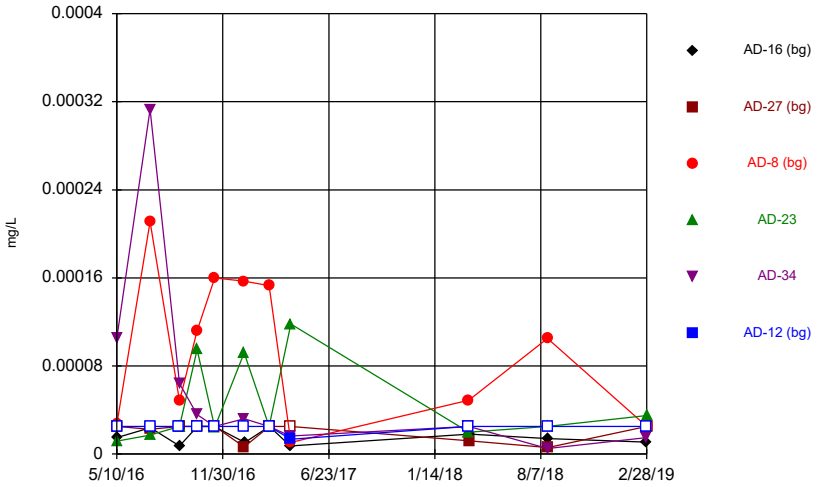
Time Series



Constituent: Lithium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

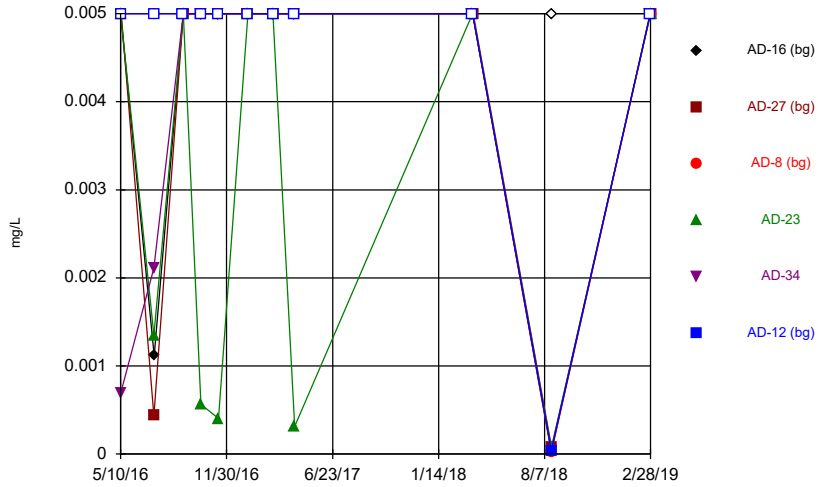
Time Series



Constituent: Mercury, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

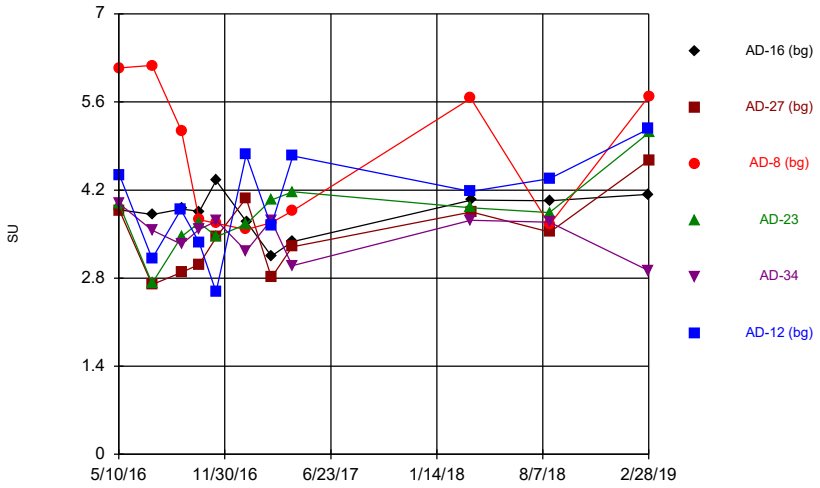
Time Series



Constituent: Molybdenum, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

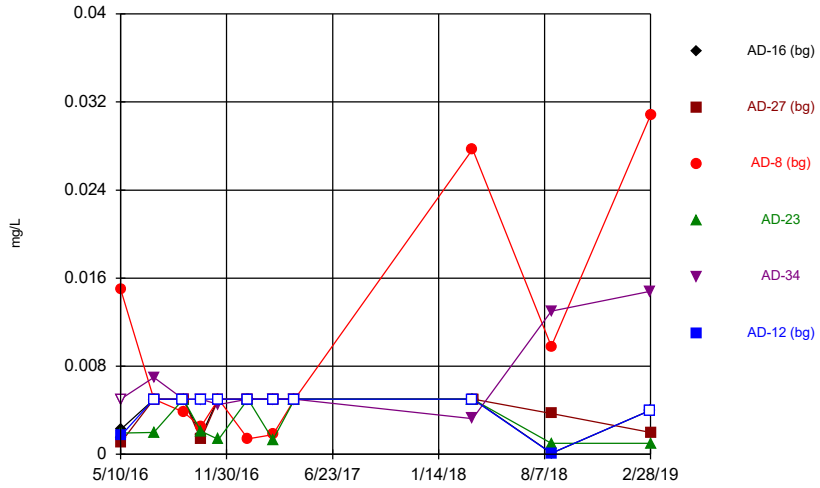
Time Series



Constituent: pH, field Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

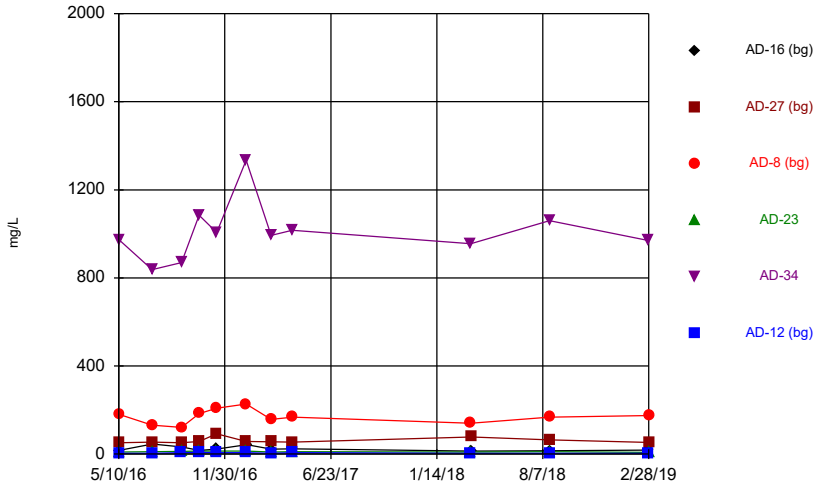
Time Series



Constituent: Selenium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

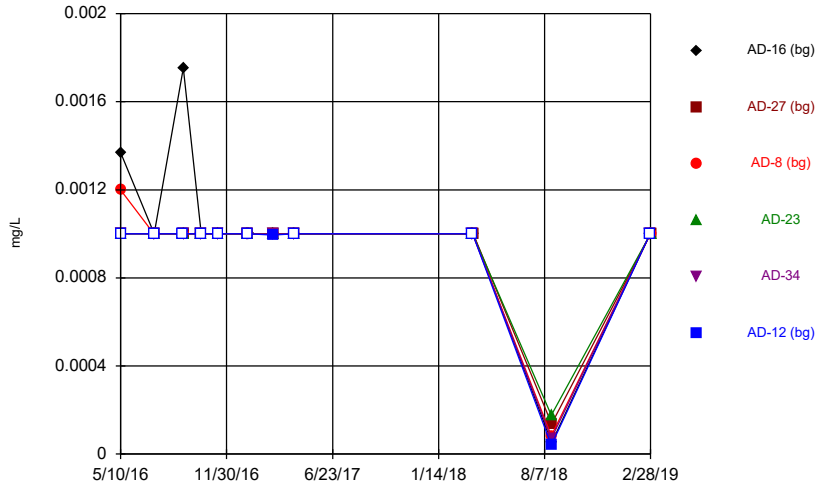
Time Series



Constituent: Sulfate, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

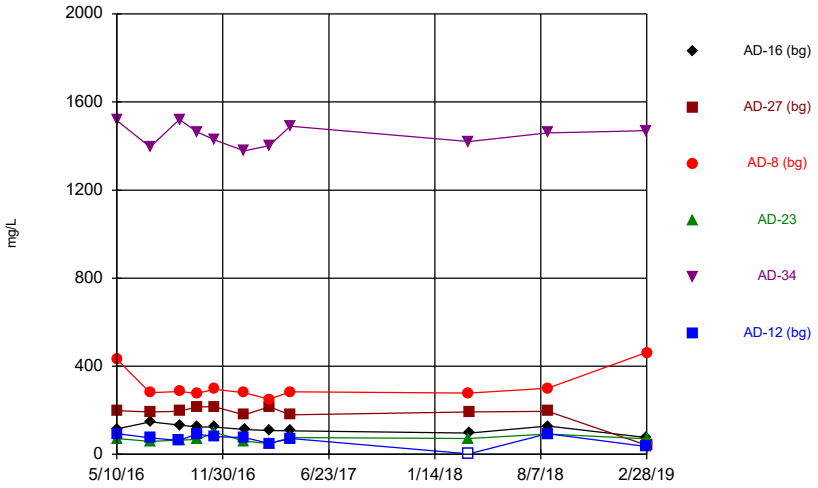
Time Series



Constituent: Thallium, total Analysis Run 7/11/2019 1:49 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Hollow symbols indicate censored values.

Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:49 PM View: Time Series

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Outlier Summary

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/1/2019, 10:17 AM

	AD-23 Lithium, total (mg/L)
10/12/2016	1.01 (o)

Interwell Prediction Limit Summary - Significant Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:46 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	**AD-34**	**228**	**n/a**	**2/27/2019**	**970**	**Yes**	**44**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0009861**	NP (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**AD-34**	**348**	**n/a**	**2/27/2019**	**1470**	**Yes**	**44**	**169.4**	**102.7**	**2.273**	**None**	**No**	**0.002505**	Param 1 of 2

Interwell Prediction Limit Summary - All Results

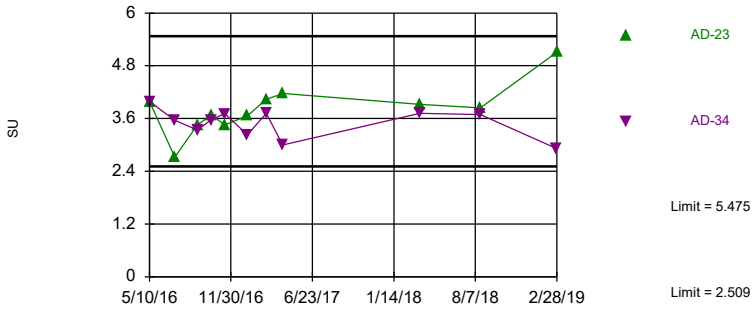
Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:46 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	AD-23	5.475	2.509	2/28/2019	5.11	No	44	3.992	0.8529	0	None	No	0.001253	Param 1 of 2
pH, field (SU)	AD-34	5.475	2.509	2/27/2019	2.92	No	44	3.992	0.8529	0	None	No	0.001253	Param 1 of 2
Sulfate, total (mg/L)	AD-23	228	n/a	2/28/2019	7.2	No	44	n/a	n/a	0	n/a	n/a	0.0009861	NP (normality) 1 of 2
Sulfate, total (mg/L)	**AD-34**	**228**	**n/a**	**2/27/2019**	**970**	**Yes**	**44**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0009861**	NP (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-23	348	n/a	2/28/2019	70	No	44	169.4	102.7	2.273	None	No	0.002505	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**AD-34**	**348**	**n/a**	**2/27/2019**	**1470**	**Yes**	**44**	**169.4**	**102.7**	**2.273**	**None**	**No**	**0.002505**	Param 1 of 2

Within Limits

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=3.992, Std. Dev.=0.8529, n=44. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9258, critical = 0.924. Kappa = 1.739 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001253. Comparing 2 points to limit. Assumes 1 future value.

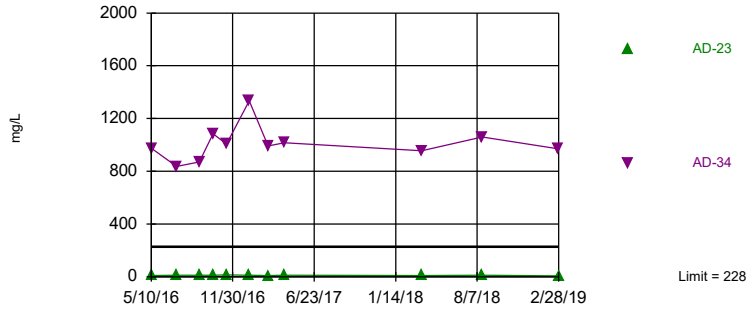
Constituent: pH, field Analysis Run 7/11/2019 1:42 PM View: PL's - Interwell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Exceeds Limit: AD-34

Prediction Limit

Interwell Non-parametric



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 44 background values. Annual per-constituent alpha = 0.005902. Individual comparison alpha = 0.0009861 (1 of 2). Comparing 2 points to limit. Assumes 1 future value.

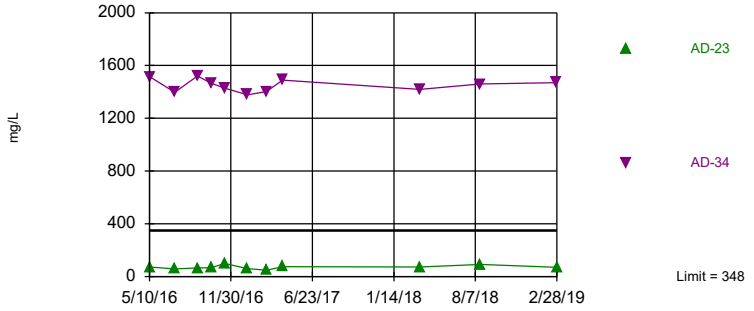
Constituent: Sulfate, total Analysis Run 7/11/2019 1:42 PM View: PL's - Interwell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Exceeds Limit: AD-34

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=169.4, Std. Dev.=102.7, n=44, 2.273% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9299, critical = 0.924. Kappa = 1.739 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.002505. Comparing 2 points to limit. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:42 PM View: PL's - Interwell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Intrawell Prediction Limit Summary - Significant Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:41 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Chloride, total (mg/L)	**AD-16**	**11.43**	**n/a**	**2/27/2019**	**20.3**	**Yes**	**8**	**9.25**	**0.8864**	**0**	**None**	**No**	**0.002505**	**Param Intra 1 of 2**
Chloride, total (mg/L)	**AD-27**	**9**	**n/a**	**2/28/2019**	**11.7**	**Yes**	**8**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.02144**	**NP Intra (normality) 1 of 2**

Intrawell Prediction Limit Summary - All Results

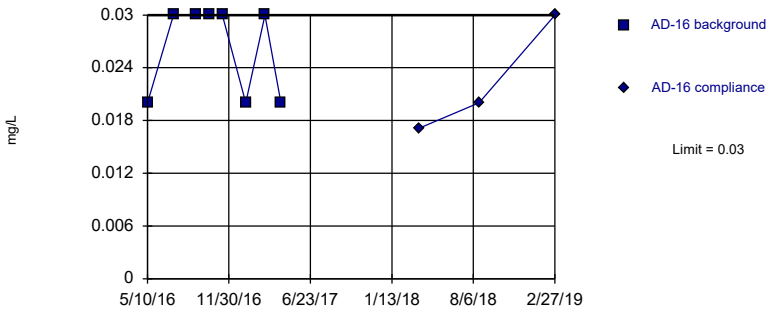
Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:41 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	AD-16	0.03	n/a	2/27/2019	0.03	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Boron, total (mg/L)	AD-27	0.03	n/a	2/28/2019	0.07	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Boron, total (mg/L)	AD-8	1.58	n/a	2/28/2019	1.05	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Boron, total (mg/L)	AD-23	0.03	n/a	2/28/2019	0.02	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Boron, total (mg/L)	AD-34	0.1201	n/a	2/27/2019	0.08	No	8	0.08888	0.01271	0	None	No	0.002505	Param Intra 1 of 2
Boron, total (mg/L)	AD-12	0.05454	n/a	2/27/2019	0.03	No	8	0.03625	0.00744	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-16	2.318	n/a	2/27/2019	0.704	No	8	1.504	0.3311	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-27	4.848	n/a	2/28/2019	4.02	No	8	4.21	0.2595	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-8	109	n/a	2/28/2019	103	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Calcium, total (mg/L)	AD-23	0.6535	n/a	2/28/2019	0.3	No	8	0.3451	0.1255	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-34	42.53	n/a	2/27/2019	39.9	No	8	37.21	2.163	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-12	0.4631	n/a	2/27/2019	0.4	No	8	0.3269	0.05542	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	**AD-16**	**11.43**	**n/a**	**2/27/2019**	**20.3**	**Yes**	**8**	**9.25**	**0.8864**	**0**	**None**	**No**	**0.002505**	**Param Intra 1 of 2**
Chloride, total (mg/L)	**AD-27**	**9**	**n/a**	**2/28/2019**	**11.7**	**Yes**	**8**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.02144**	**NP Intra (normality) 1 of 2**
Chloride, total (mg/L)	AD-8	15.69	n/a	2/28/2019	6.83	No	8	11.88	1.553	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-23	7.893	n/a	2/28/2019	6.94	No	8	5.125	1.126	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-34	9.204	n/a	2/27/2019	7.64	No	8	7.375	0.744	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-12	8.794	n/a	2/27/2019	6.08	No	8	6.25	1.035	0	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	AD-16	1	n/a	2/27/2019	0.07	No	8	n/a	n/a	100	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-27	1	n/a	2/28/2019	0.2	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-8	3.988	n/a	2/28/2019	0.4	No	8	2.25	0.7071	12.5	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	AD-23	1	n/a	2/28/2019	0.04	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-34	1	n/a	2/27/2019	0.86	No	8	n/a	n/a	62.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-12	1	n/a	2/27/2019	0.09	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

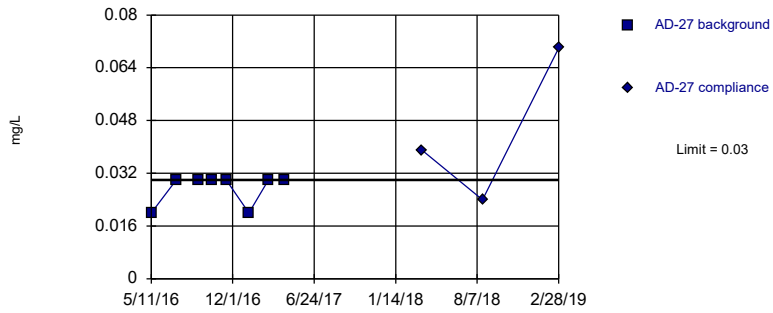
Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

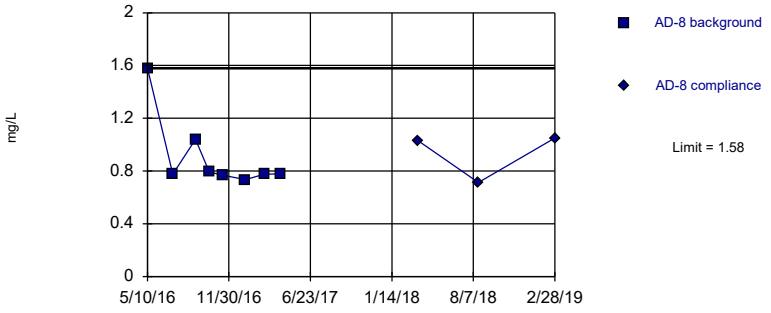
Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

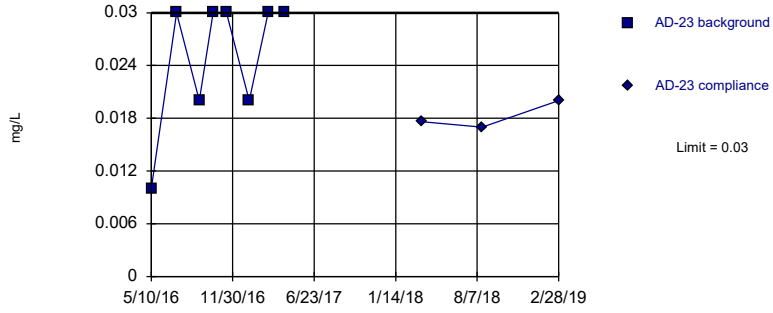
Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



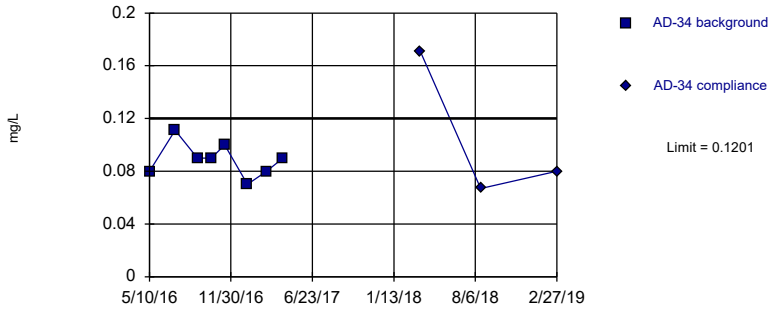
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.08888, Std. Dev.=0.01271, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9562, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

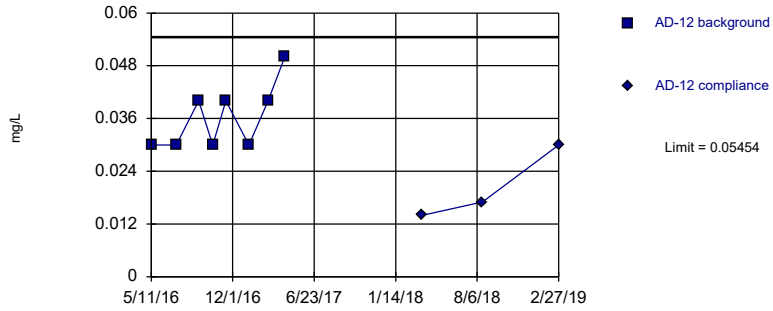
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.03625, Std. Dev.=0.00744, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7968, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Boron, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

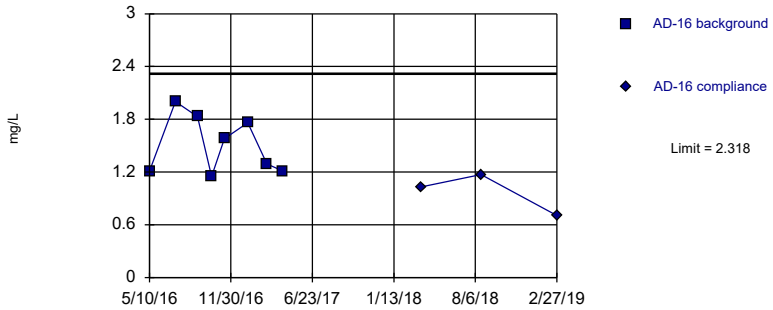
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1.504, Std. Dev.=0.3311, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8818, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

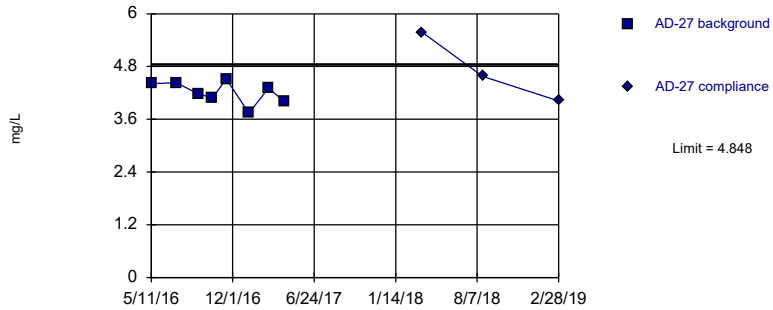
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.21, Std. Dev.=0.2595, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9482, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

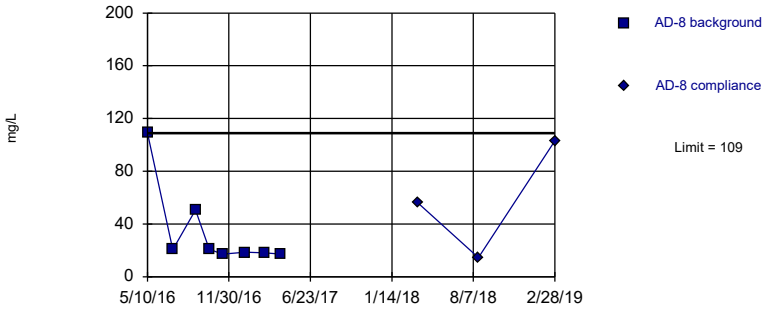
Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

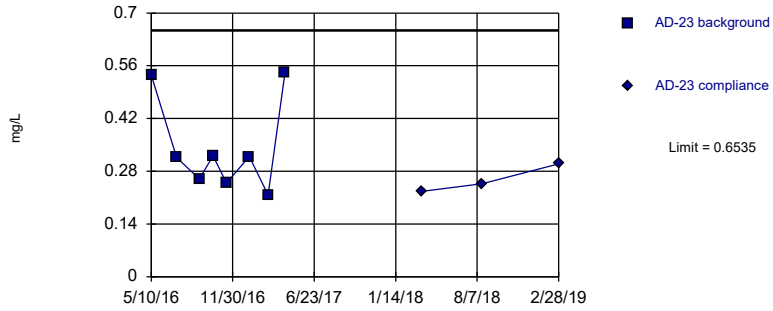
Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.3451, Std. Dev.=0.1255, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.809, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

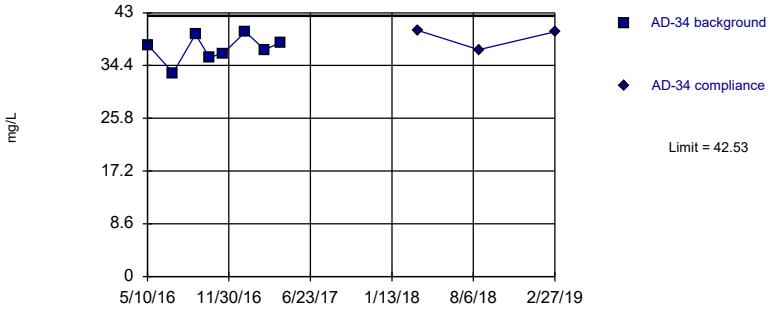
Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=37.21, Std. Dev.=2.163, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9581, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

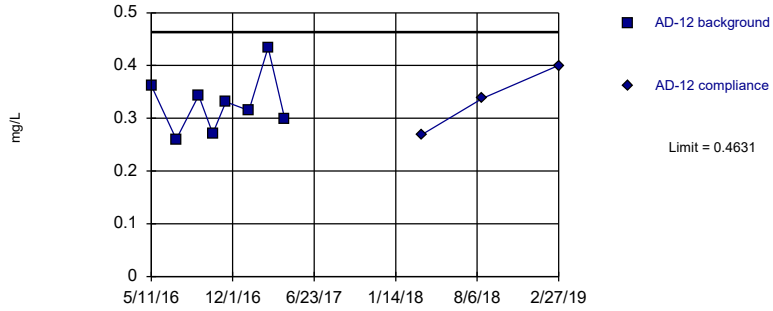
Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



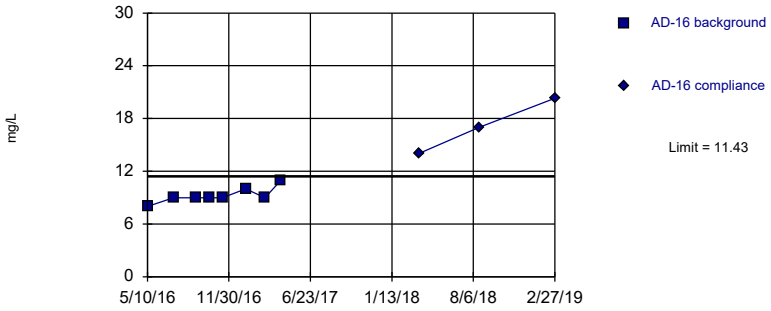
Background Data Summary: Mean=0.3269, Std. Dev.=0.05542, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9467, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=9.25, Std. Dev.=0.8864, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8264, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

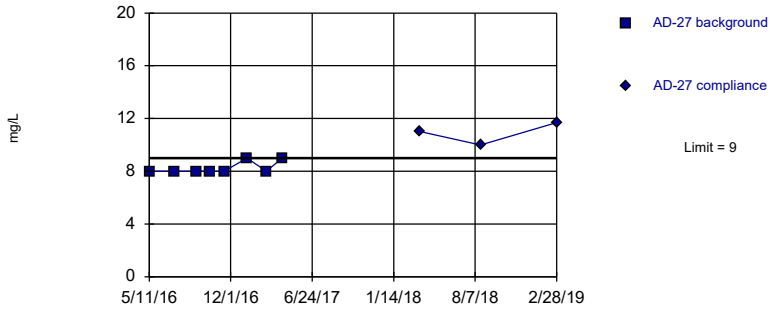
Constituent: Chloride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

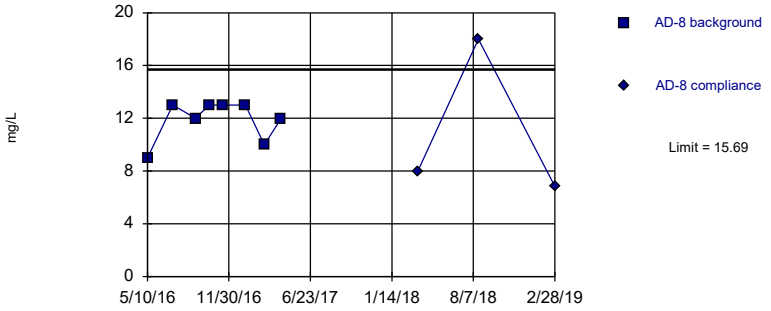
Constituent: Chloride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=11.88, Std. Dev.=1.553, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7682, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

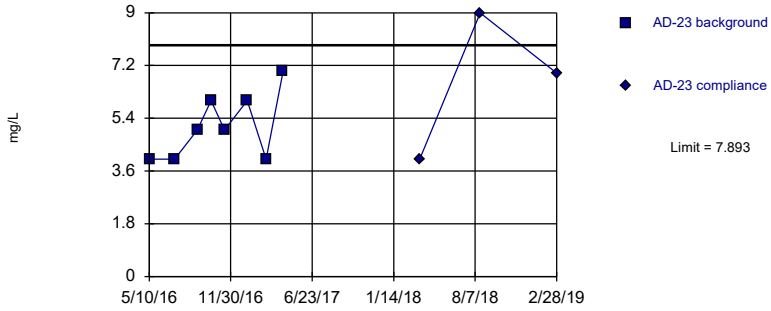
Constituent: Chloride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



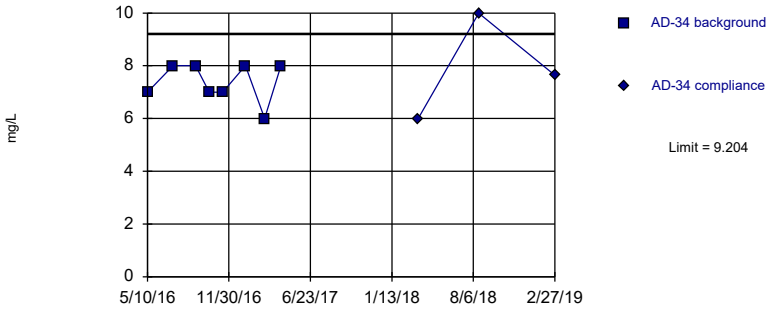
Background Data Summary: Mean=5.125, Std. Dev.=1.126, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8815, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.375, Std. Dev.=0.744, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7968, 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 7/11/2019 1:39 PM View: PL's - Intrawell

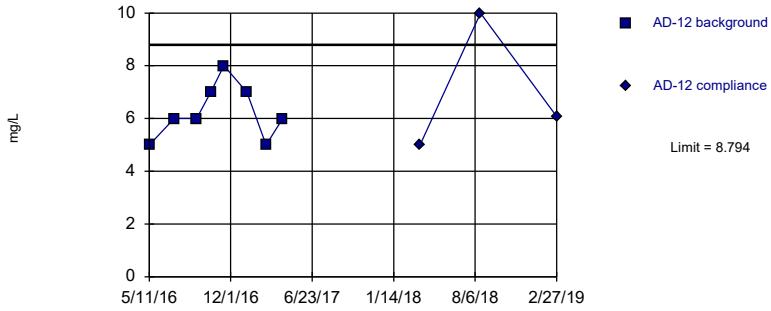
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.25, Std. Dev.=1.035, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9171, 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 7/11/2019 1:39 PM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

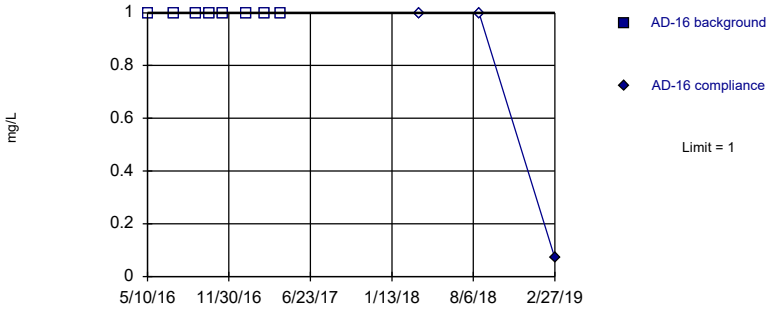
Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

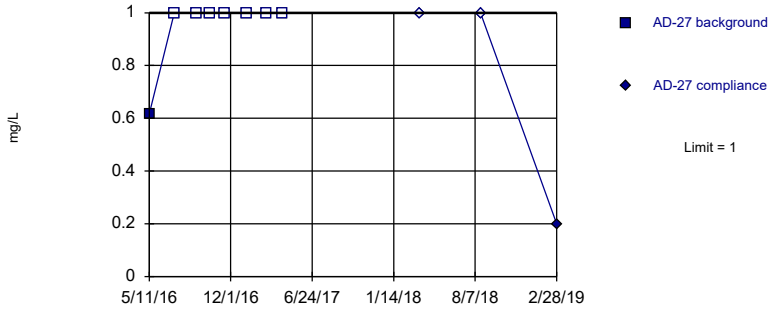
Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell

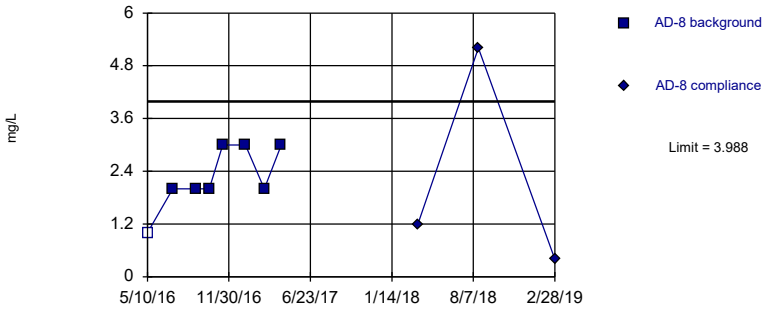
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=2.25, Std. Dev.=0.7071, n=8, 12.5% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8268, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

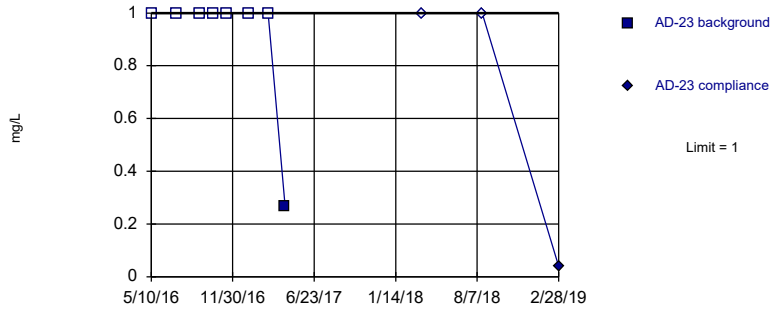
Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

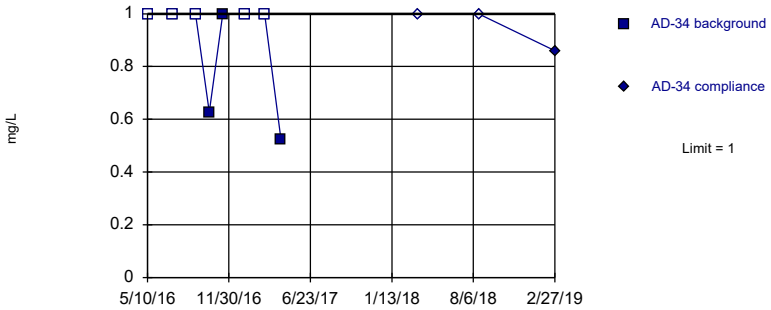
Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 62.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

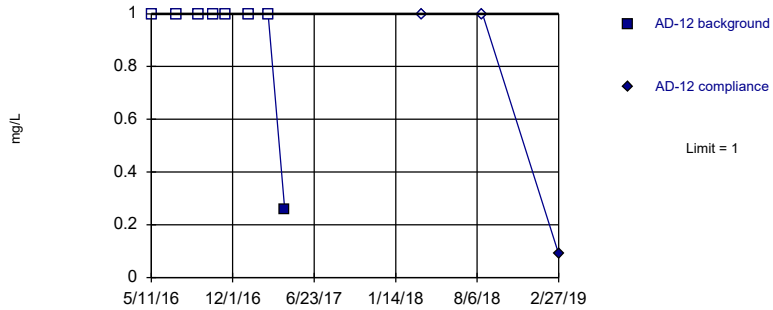
Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:39 PM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

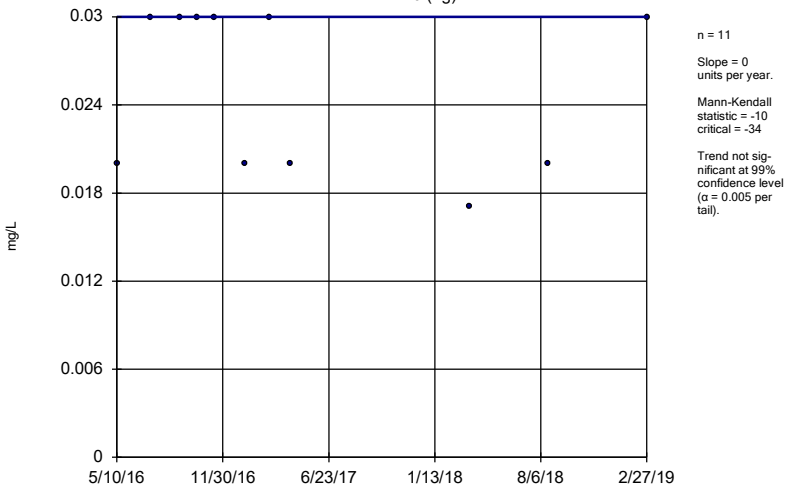
Trend Test Summary Table - All Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:55 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	AD-16 (bg)	0	-10	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-27 (bg)	0.001755	17	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-8 (bg)	-0.02823	-7	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-12 (bg)	0	-4	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**AD-16 (bg)**	**3.702**	**43**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**AD-27 (bg)**	**1.267**	**35**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	AD-8 (bg)	-0.5368	-8	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-12 (bg)	0.03234	10	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-16 (bg)	0	-10	-34	No	11	90.91	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-27 (bg)	0	-1	-34	No	11	81.82	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-8 (bg)	0	8	34	No	11	9.091	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-12 (bg)	0	-15	-34	No	11	81.82	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-16 (bg)	-3.411	-16	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-27 (bg)	3.411	13	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-8 (bg)	5.333	4	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-34	32.31	9	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-12 (bg)	-0.5376	-15	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-16 (bg)	-20.21	-32	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-27 (bg)	-10.77	-15	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-8 (bg)	2.271	4	34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-34	-5.947	-3	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-12 (bg)	-19.73	-20	-34	No	11	9.091	n/a	n/a	0.01	NP

Sen's Slope Estimator

AD-16 (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -10 critical = -34

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

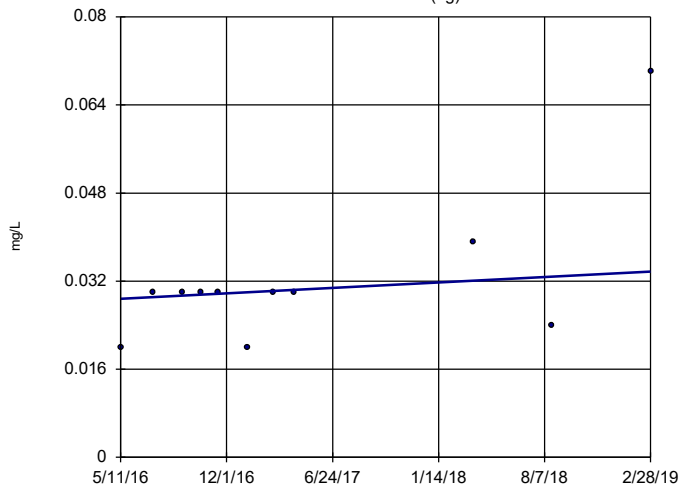
Constituent: Boron, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 11

Slope = 0.001755 units per year.

Mann-Kendall statistic = 17 critical = 34

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

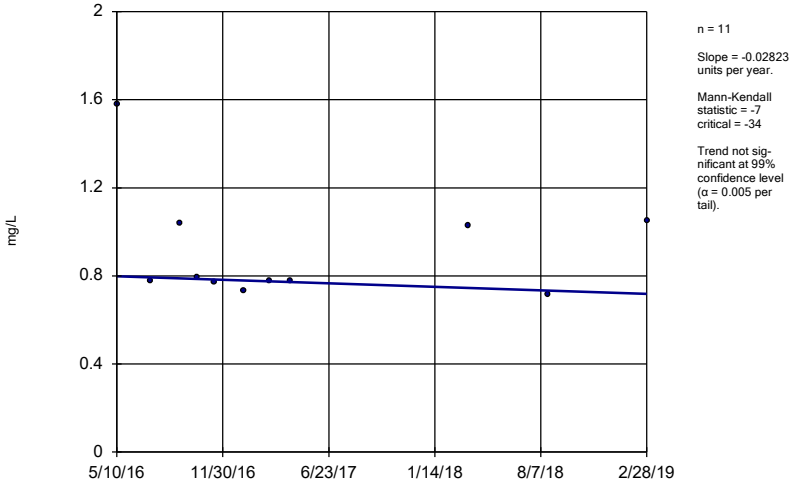
Constituent: Boron, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 11

Slope = -0.02823 units per year.

Mann-Kendall statistic = -7 critical = -34

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

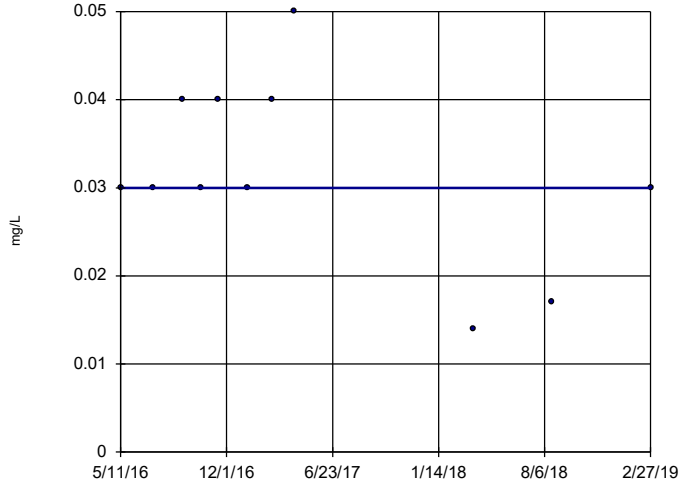
Constituent: Boron, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -4 critical = -34

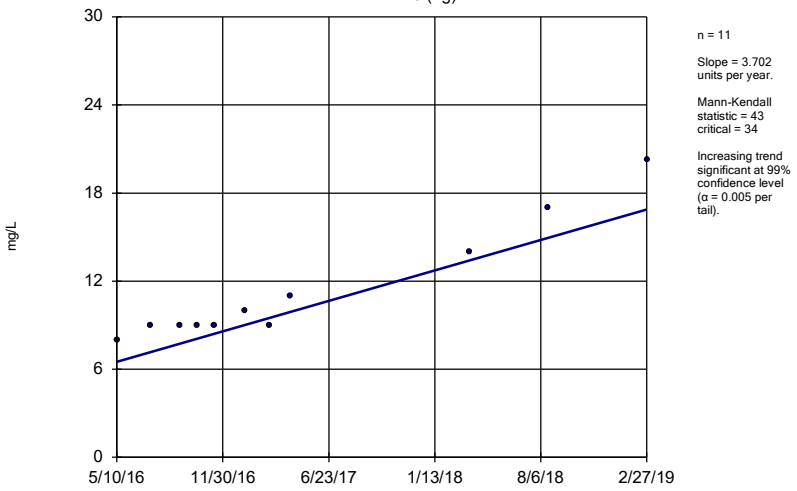
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-16 (bg)



n = 11

Slope = 3.702 units per year.

Mann-Kendall statistic = 43 critical = 34

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

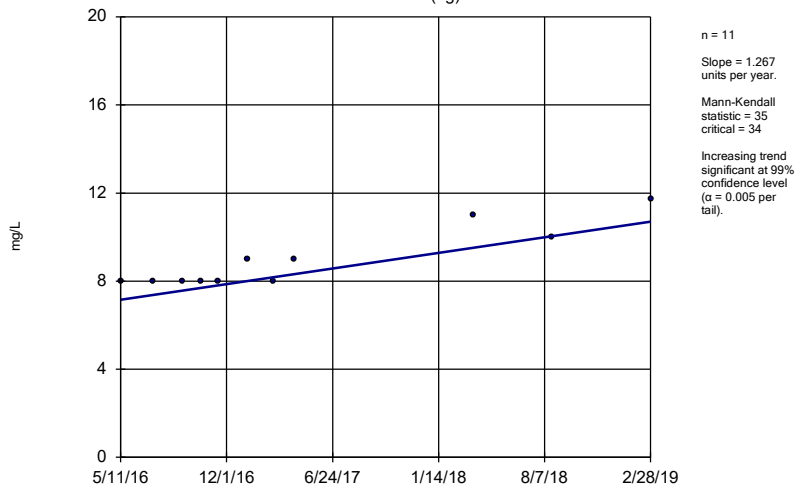
Constituent: Chloride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 11

Slope = 1.267 units per year.

Mann-Kendall statistic = 35 critical = 34

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

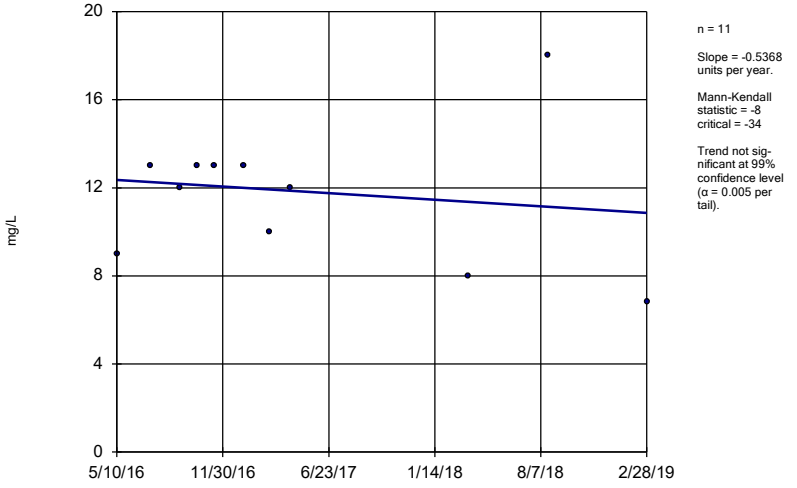
Constituent: Chloride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 11

Slope = -0.5368 units per year.

Mann-Kendall statistic = -8 critical = -34

Trend not sig-nificant at 99% confidence level (α = 0.005 per tail).

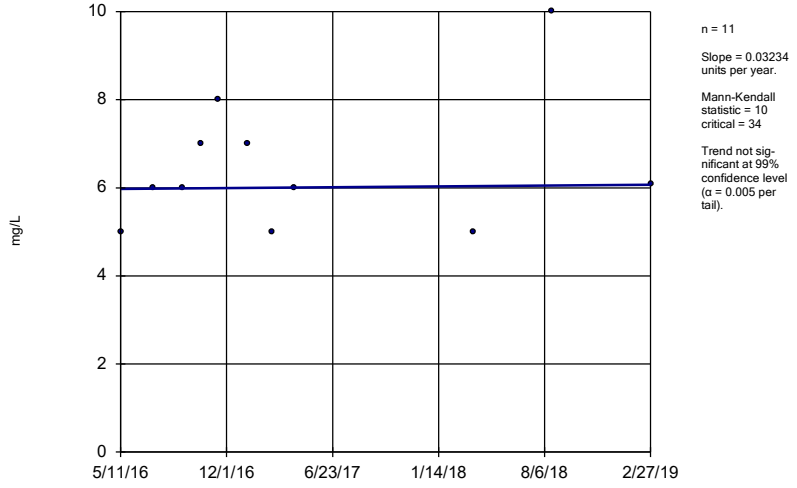
Constituent: Chloride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = 0.03234 units per year.

Mann-Kendall statistic = 10 critical = 34

Trend not sig-nificant at 99% confidence level (α = 0.005 per tail).

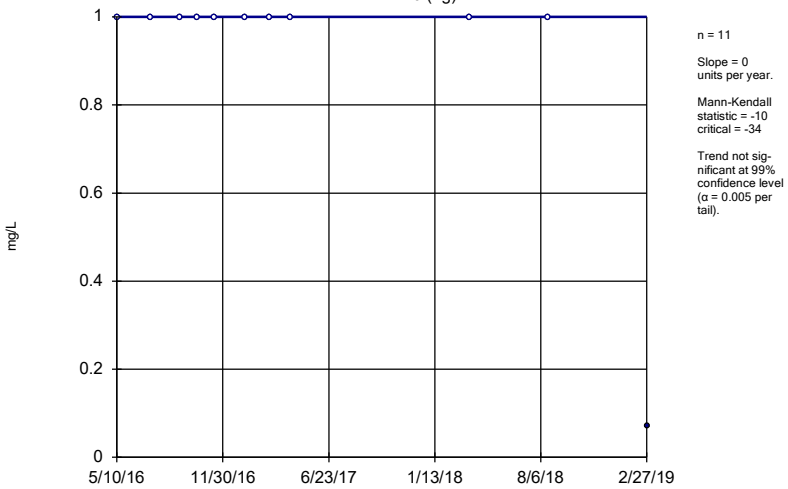
Constituent: Chloride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-16 (bg)



n = 11

Slope = 0
units per year.

Mann-Kendall
statistic = -10
critical = -34

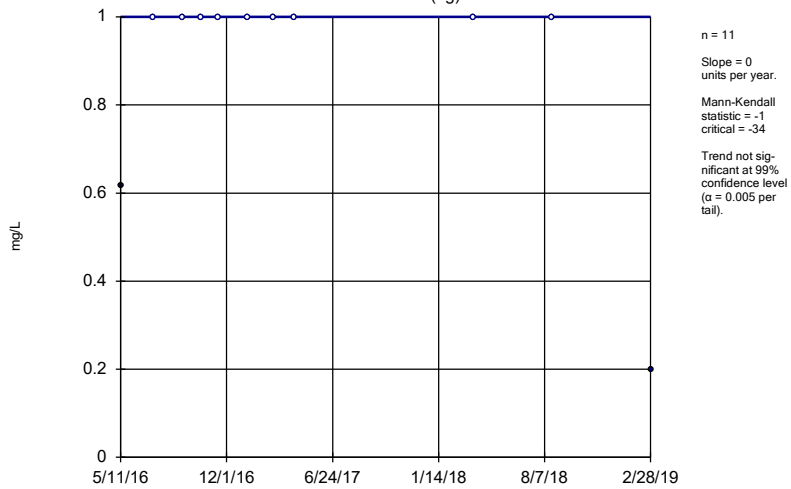
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-27 (bg)



n = 11

Slope = 0
units per year.

Mann-Kendall
statistic = -1
critical = -34

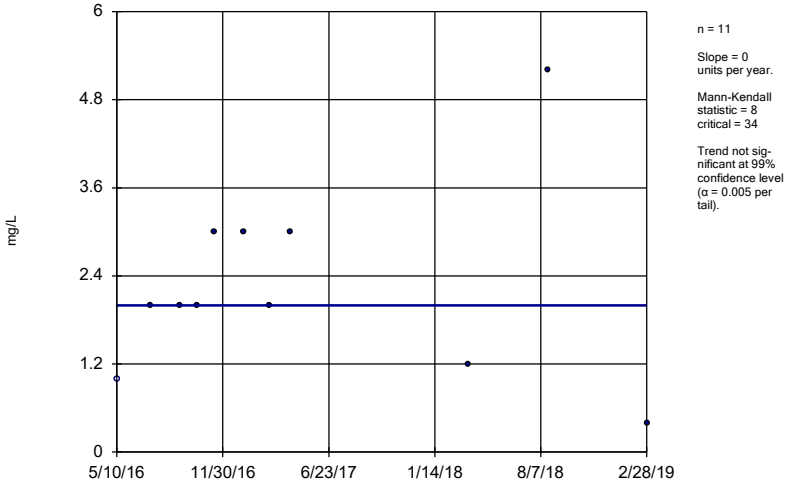
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-8 (bg)



n = 11

Slope = 0
units per year.

Mann-Kendall
statistic = 8
critical = 34

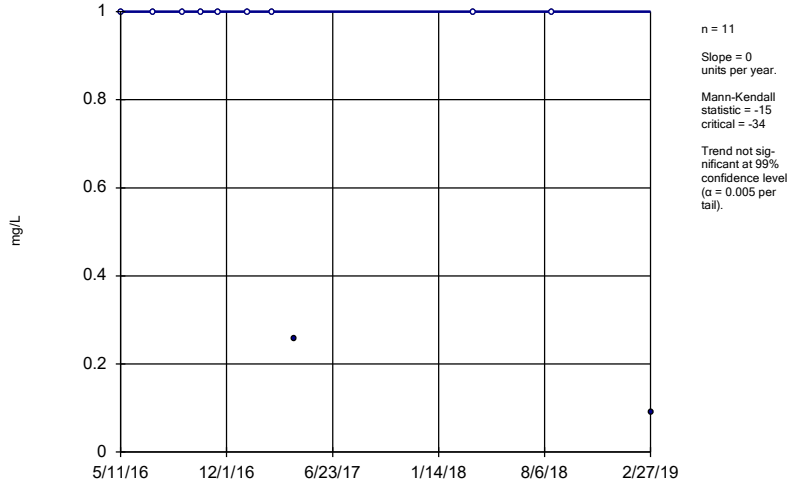
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = 0
units per year.

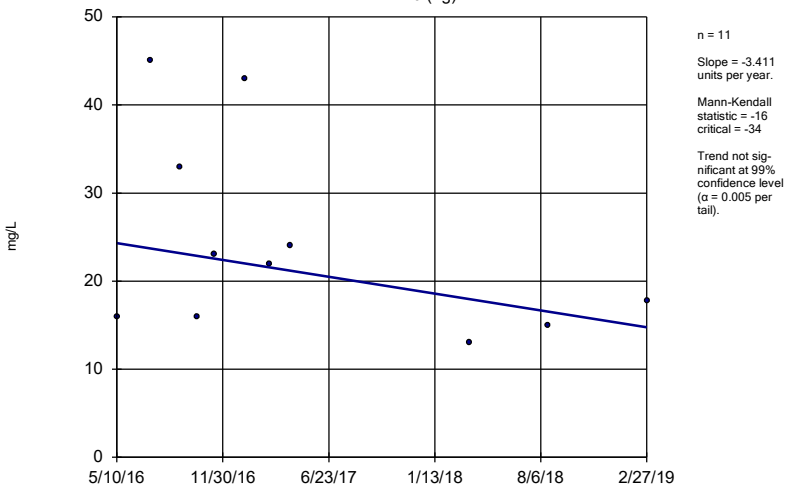
Mann-Kendall
statistic = -15
critical = -34

Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 7/11/2019 1:50 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-16 (bg)



n = 11

Slope = -3.411 units per year.

Mann-Kendall statistic = -16
critical = -34

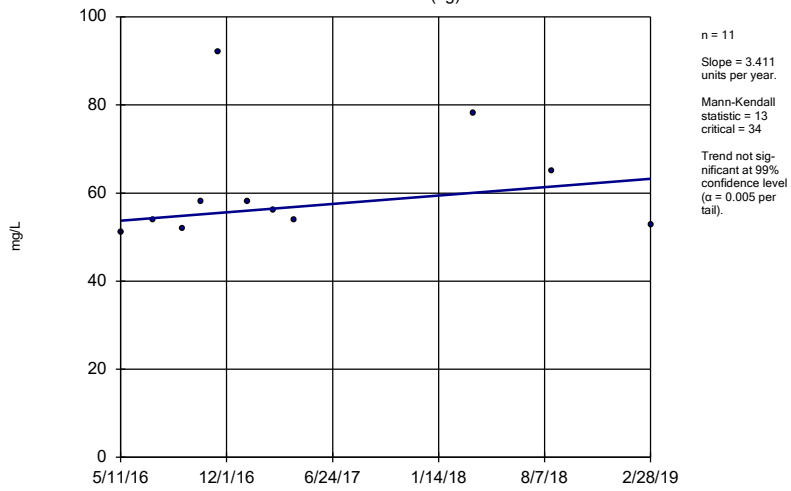
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 11

Slope = 3.411 units per year.

Mann-Kendall statistic = 13
critical = 34

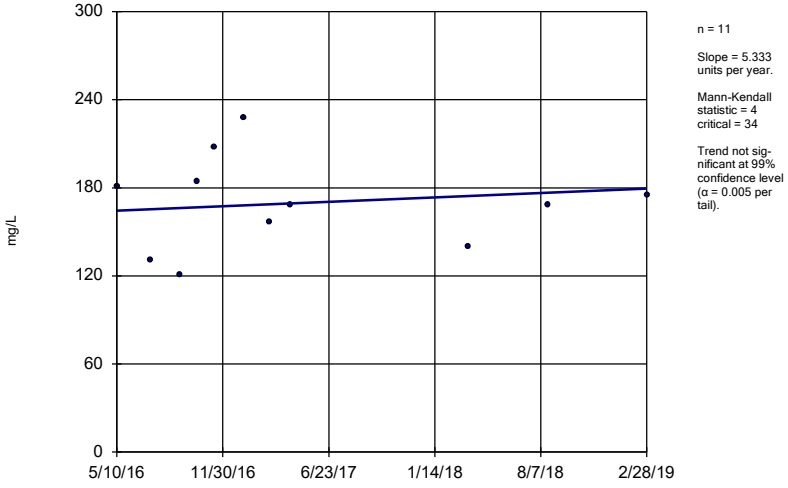
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 11

Slope = 5.333 units per year.

Mann-Kendall statistic = 4
critical = 34

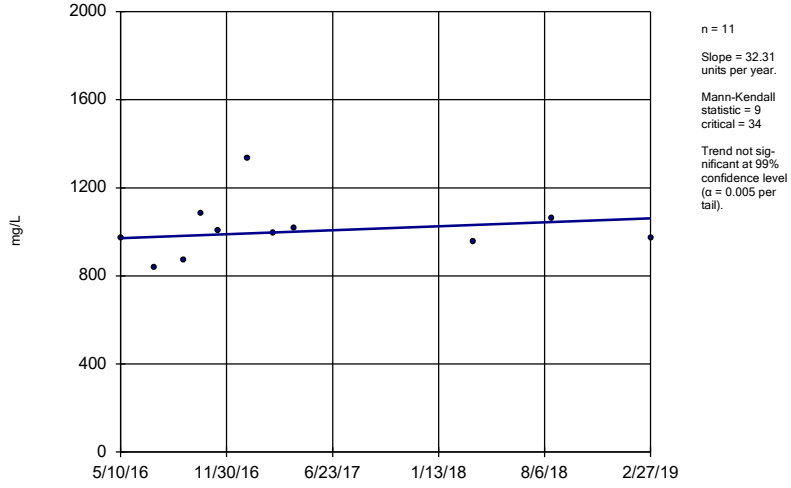
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-34



n = 11

Slope = 32.31 units per year.

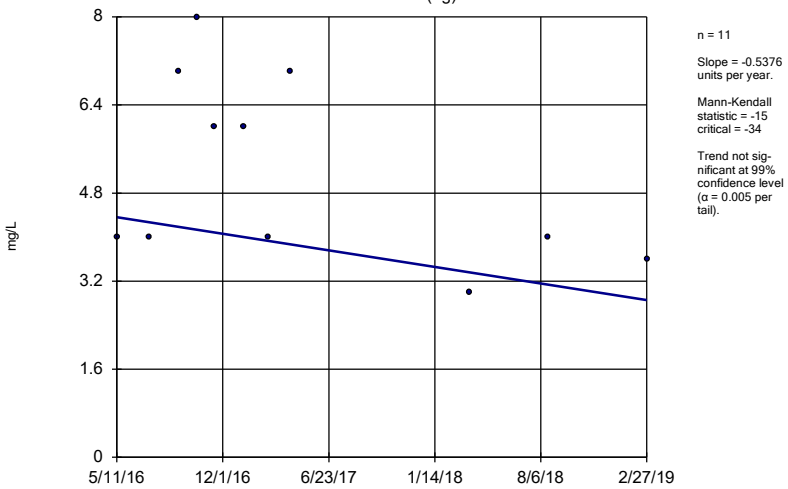
Mann-Kendall statistic = 9
critical = 34

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

Constituent: Sulfate, total Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = -0.5376 units per year.

Mann-Kendall statistic = -15
critical = -34

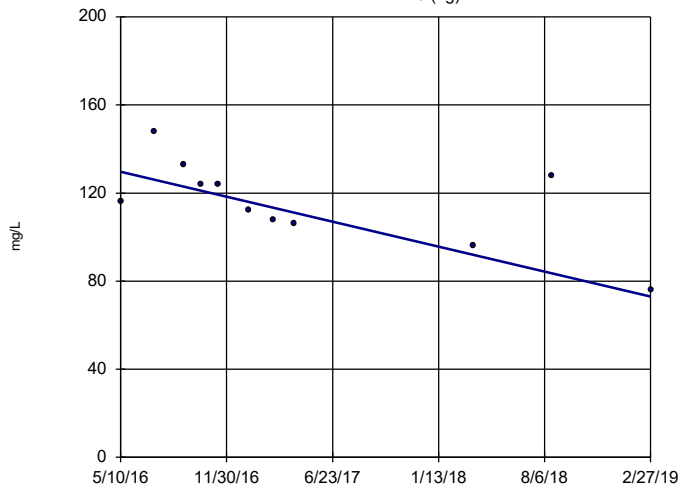
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-16 (bg)



n = 11

Slope = -20.21 units per year.

Mann-Kendall statistic = -32
critical = -34

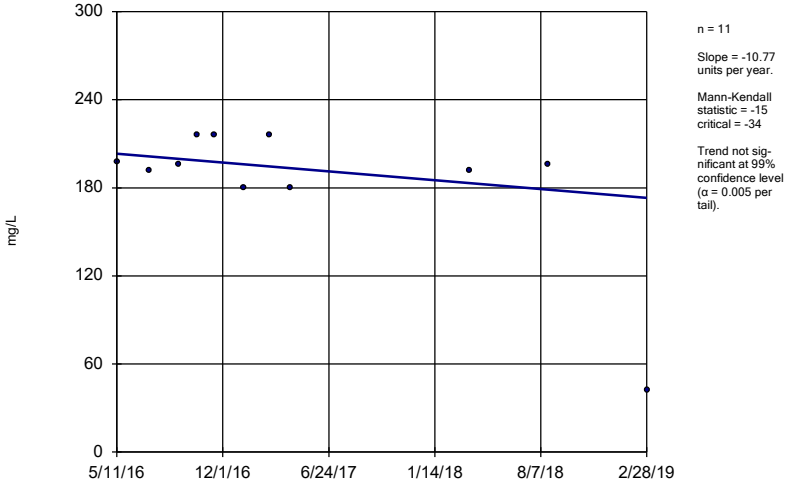
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 11

Slope = -10.77 units per year.

Mann-Kendall statistic = -15
critical = -34

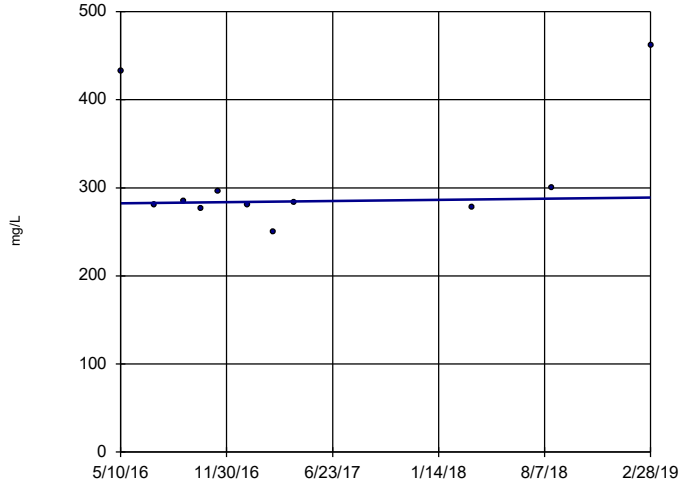
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 11

Slope = 2.271 units per year.

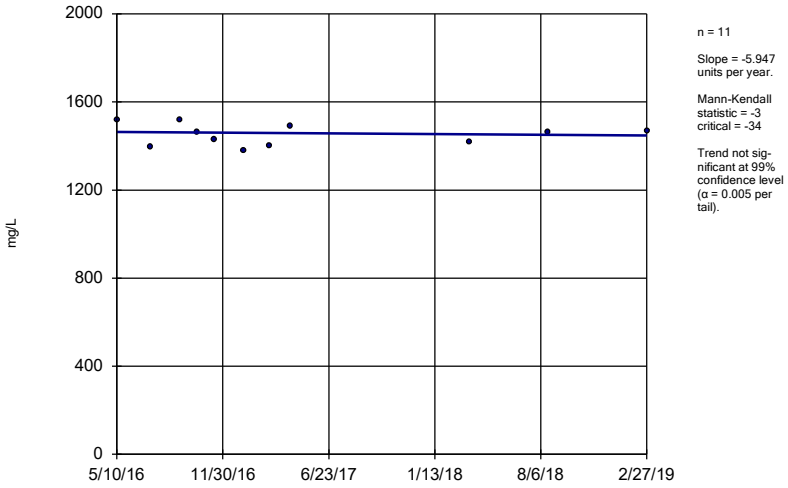
Mann-Kendall statistic = 4
critical = 34

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

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-34



n = 11

Slope = -5.947 units per year.

Mann-Kendall statistic = -3
critical = -34

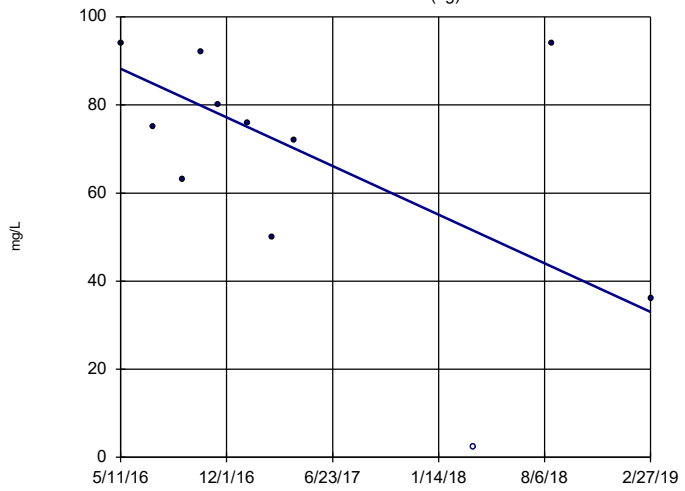
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = -19.73 units per year.

Mann-Kendall statistic = -20
critical = -34

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

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/11/2019 1:51 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Tolerance Limit Summary Table

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/1/2019, 9:49 AM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.008	44	n/a	n/a	86.36	n/a	n/a	0.1047	NP Inter(NDs)
Arsenic, total (mg/L)	n/a	0.00774	44	n/a	n/a	61.36	n/a	n/a	0.1047	NP Inter(normality)
Barium, total (mg/L)	n/a	0.07981	44	0.04604	0.01609	0	None	No	0.05	Inter
Beryllium, total (mg/L)	n/a	0.007	44	n/a	n/a	6.818	n/a	n/a	0.1047	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.001	44	n/a	n/a	52.27	n/a	n/a	0.1047	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.005116	44	-6.886	0.7673	11.36	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.0256	44	n/a	n/a	0	n/a	n/a	0.1047	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	n/a	7.355	44	1.427	0.6124	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	n/a	5.2	44	n/a	n/a	65.91	n/a	n/a	0.1047	NP Inter(normality)
Lead, total (mg/L)	n/a	0.00446	44	n/a	n/a	72.73	n/a	n/a	0.1047	NP Inter(normality)
Lithium, total (mg/L)	n/a	0.108	44	n/a	n/a	4.545	n/a	n/a	0.1047	NP Inter(normality)
Mercury, total (mg/L)	n/a	0.000211	44	n/a	n/a	47.73	n/a	n/a	0.1047	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.005	44	n/a	n/a	88.64	n/a	n/a	0.1047	NP Inter(NDs)
Selenium, total (mg/L)	n/a	0.0308	44	n/a	n/a	61.36	n/a	n/a	0.1047	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.002	44	n/a	n/a	81.82	n/a	n/a	0.1047	NP Inter(NDs)

Confidence Interval Summary Table - Significant Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:58 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Cobalt, total (mg/L)	**AD-34**	**0.3019**	**0.2721**	**0.026**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**AD-34**	**0.1748**	**0.1447**	**0.11**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**

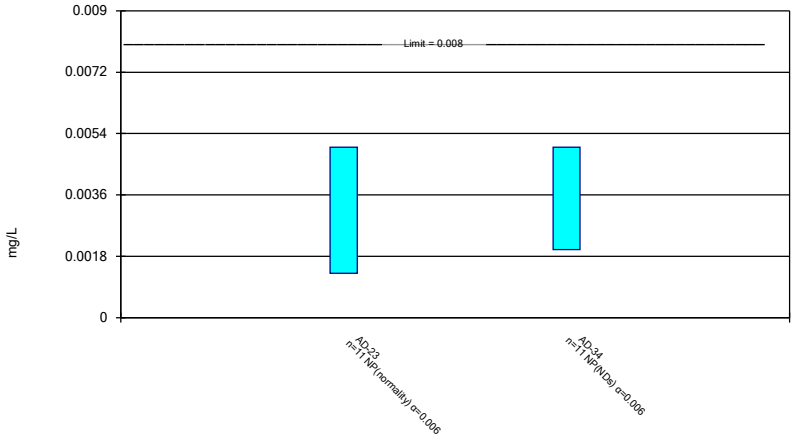
Confidence Interval Summary Table - All Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 7/11/2019, 1:58 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	AD-23	0.005	0.001298	0.008	n/a	No	11	54.55	No	0.006	NP (normality)
Antimony, total (mg/L)	AD-34	0.005	0.002	0.008	n/a	No	11	90.91	No	0.006	NP (NDs)
Arsenic, total (mg/L)	AD-23	0.007638	0.002243	0.01	n/a	No	11	45.45	No	0.01	Param.
Arsenic, total (mg/L)	AD-34	0.01563	0.005694	0.01	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	AD-23	0.086	0.0469	2	n/a	No	11	0	No	0.006	NP (normality)
Barium, total (mg/L)	AD-34	0.06141	0.01018	2	n/a	No	11	0	x^(1/3)	0.01	Param.
Beryllium, total (mg/L)	AD-23	0.0004637	0.0001293	0.007	n/a	No	11	9.091	No	0.006	NP (normality)
Beryllium, total (mg/L)	AD-34	0.003022	0.001947	0.007	n/a	No	11	0	sqrt(x)	0.01	Param.
Cadmium, total (mg/L)	AD-23	0.001	0.000074	0.005	n/a	No	11	54.55	No	0.006	NP (normality)
Cadmium, total (mg/L)	AD-34	0.009173	0.004993	0.005	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	AD-23	0.01641	0.001398	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	AD-34	0.034	0.0005	0.1	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Cobalt, total (mg/L)	AD-23	0.002737	0.00116	0.026	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	**AD-34**	**0.3019**	**0.2721**	**0.026**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Combined Radium 226 + 228 (pCi/L)	AD-23	10.01	6.077	7.36	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-34	11.43	6.828	7.36	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	AD-23	1	0.2688	5.2	n/a	No	11	81.82	No	0.006	NP (NDs)
Fluoride, total (mg/L)	AD-34	1	0.6272	5.2	n/a	No	11	63.64	No	0.006	NP (normality)
Lead, total (mg/L)	AD-23	0.015	0.003213	0.015	n/a	No	11	27.27	No	0.006	NP (Cohens/xfrm)
Lead, total (mg/L)	AD-34	0.012	0.001017	0.015	n/a	No	11	45.45	No	0.006	NP (Cohens/xfrm)
Lithium, total (mg/L)	AD-23	0.008535	0.00387	0.11	n/a	No	10	0	No	0.01	Param.
Lithium, total (mg/L)	**AD-34**	**0.1748**	**0.1447**	**0.11**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Mercury, total (mg/L)	AD-23	0.000095	0.00001721	0.002	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Mercury, total (mg/L)	AD-34	0.000105	0.000015	0.002	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Molybdenum, total (mg/L)	AD-23	0.005	0.0003152	0.1	n/a	No	11	54.55	No	0.006	NP (normality)
Molybdenum, total (mg/L)	AD-34	0.005	0.0006882	0.1	n/a	No	11	72.73	No	0.006	NP (normality)
Selenium, total (mg/L)	AD-23	0.005	0.001	0.05	n/a	No	11	36.36	No	0.006	NP (normality)
Selenium, total (mg/L)	AD-34	0.013	0.004508	0.05	n/a	No	11	54.55	No	0.006	NP (normality)
Thallium, total (mg/L)	AD-23	0.001	0.001	0.002	n/a	No	11	90.91	No	0.006	NP (NDs)
Thallium, total (mg/L)	AD-34	0.001	0.001	0.002	n/a	No	11	90.91	No	0.006	NP (NDs)

Non-Parametric Confidence Interval

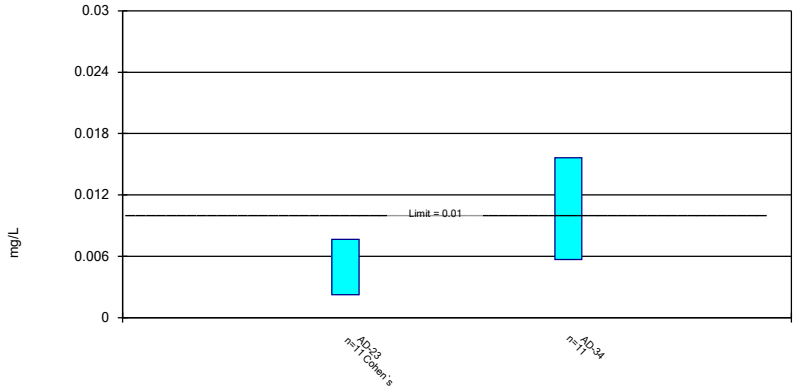
Compliance Limit is not exceeded.



Constituent: Antimony, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Parametric Confidence Interval

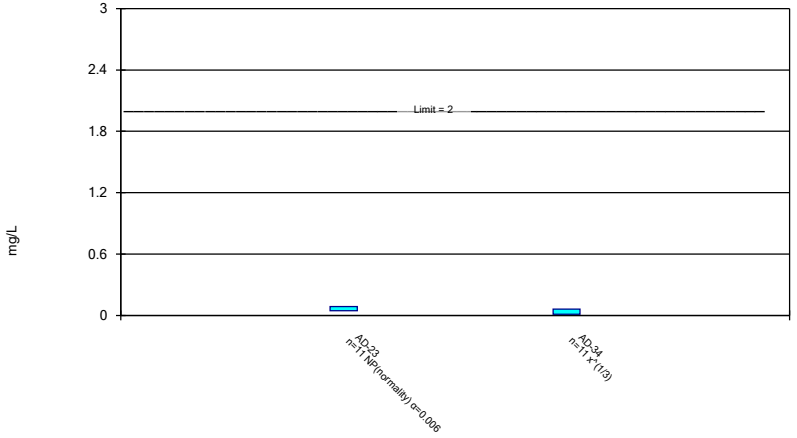
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Parametric and Non-Parametric (NP) Confidence Interval

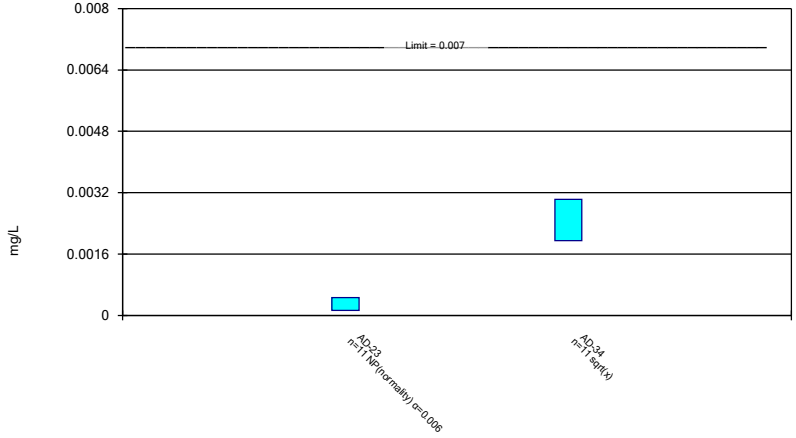
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Barium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Parametric and Non-Parametric (NP) Confidence Interval

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



Constituent: Beryllium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Parametric and Non-Parametric (NP) Confidence Interval

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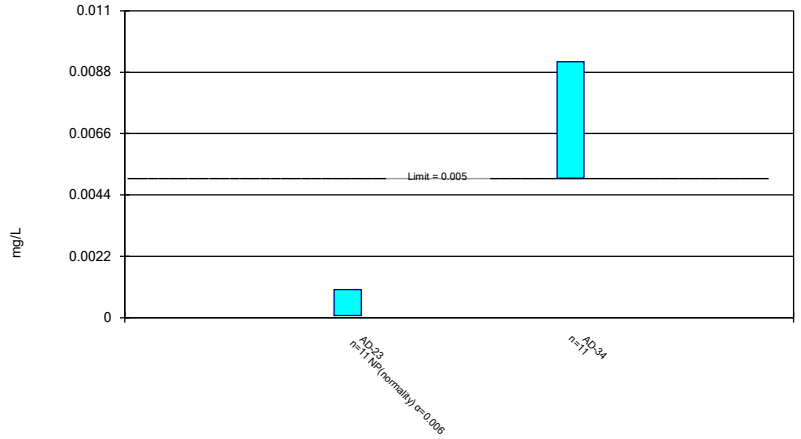
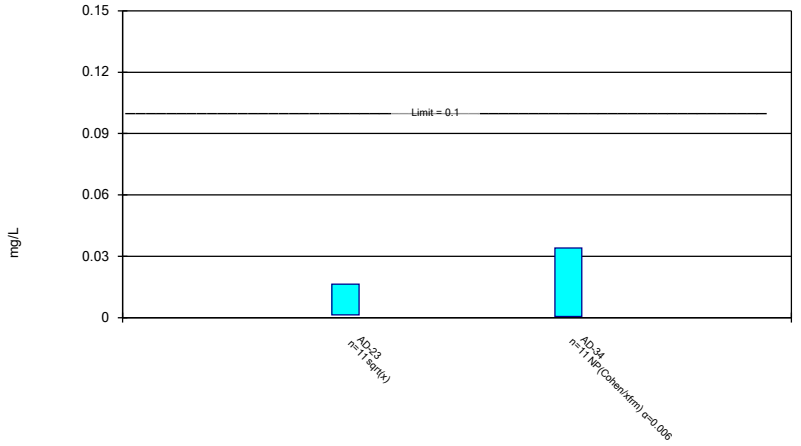


Constituent: Cadmium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

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

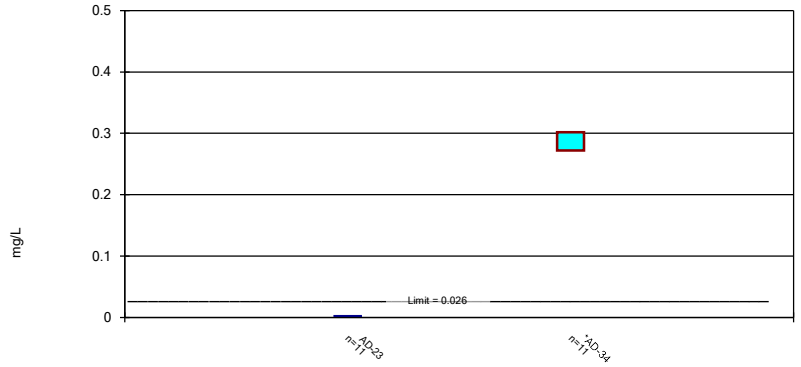


Constituent: Chromium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

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

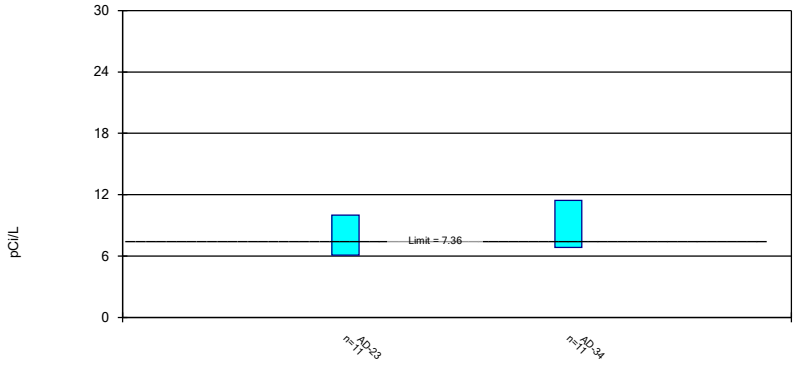


Constituent: Cobalt, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

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

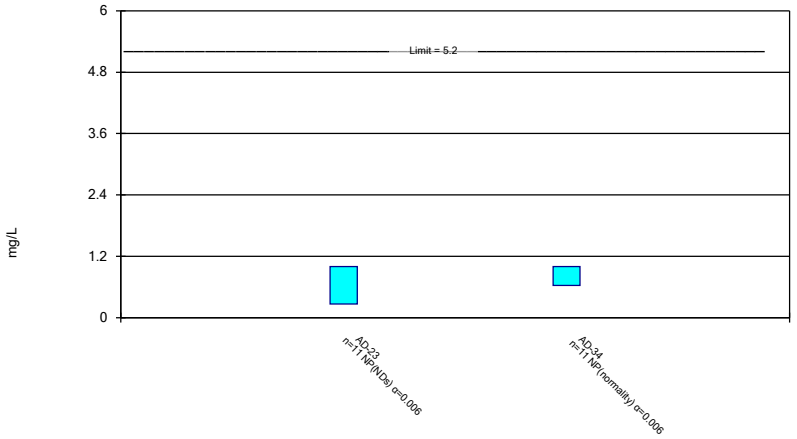


Constituent: Combined Radium 226 + 228 Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals -
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



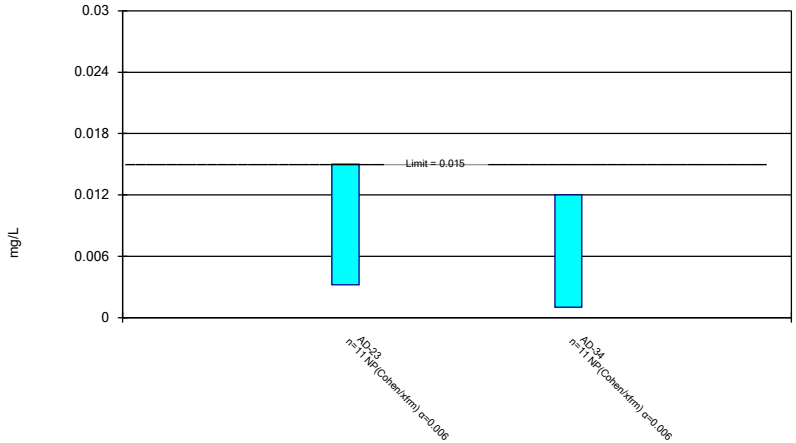
Constituent: Fluoride, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



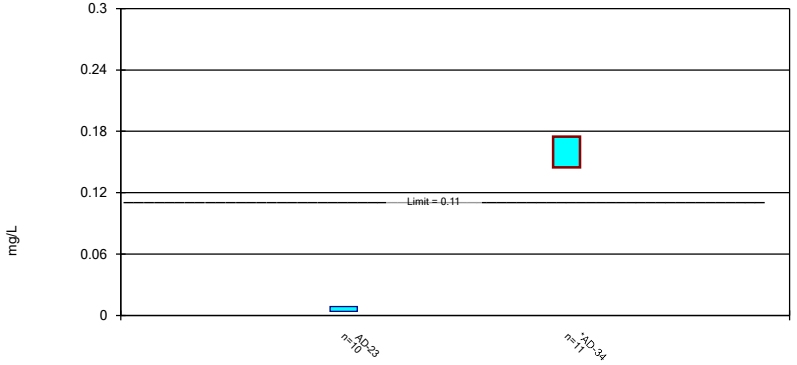
Constituent: Lead, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

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



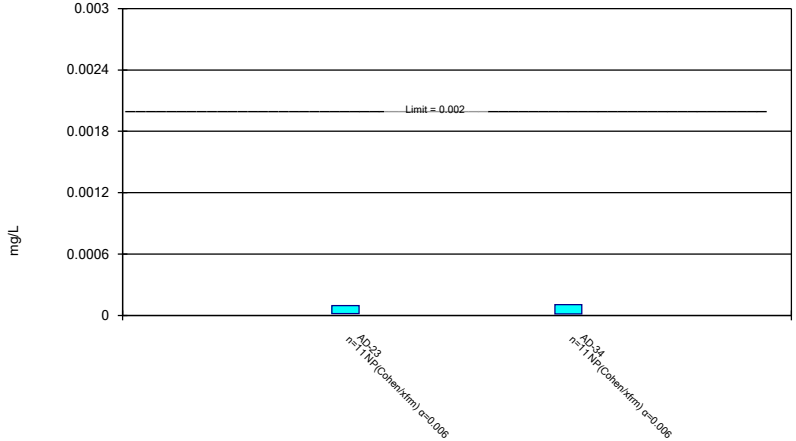
Constituent: Lithium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

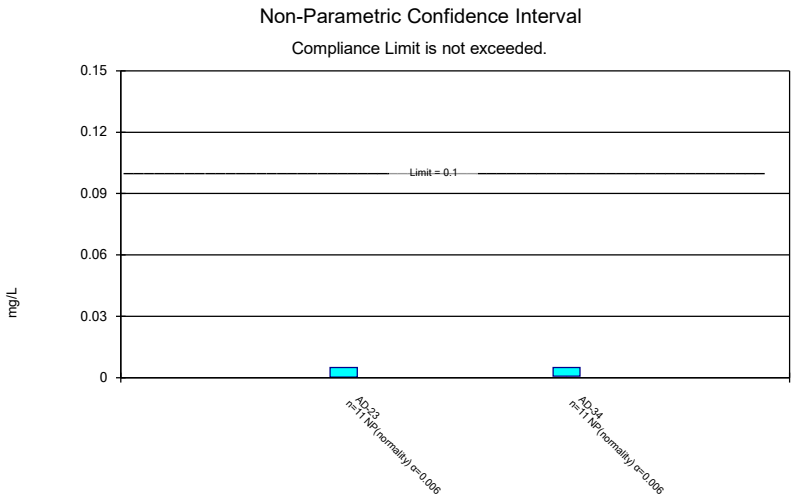
Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



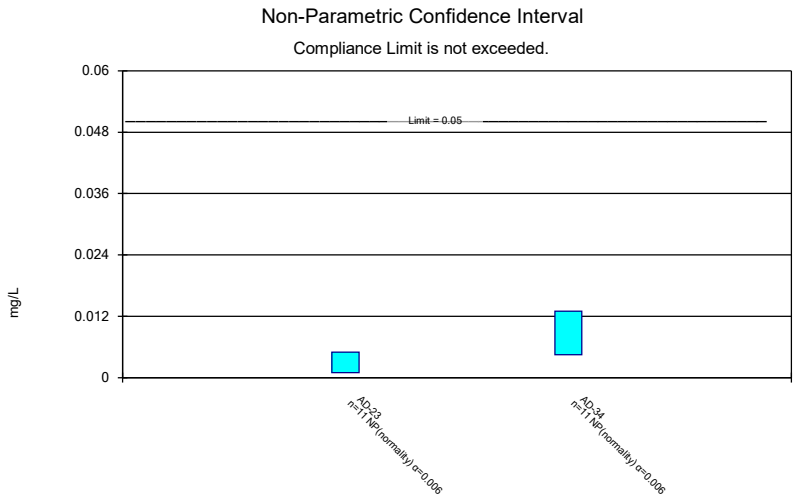
Constituent: Mercury, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV

Pirkey LF Client: Geosyntec Data: Pirkey Landfill



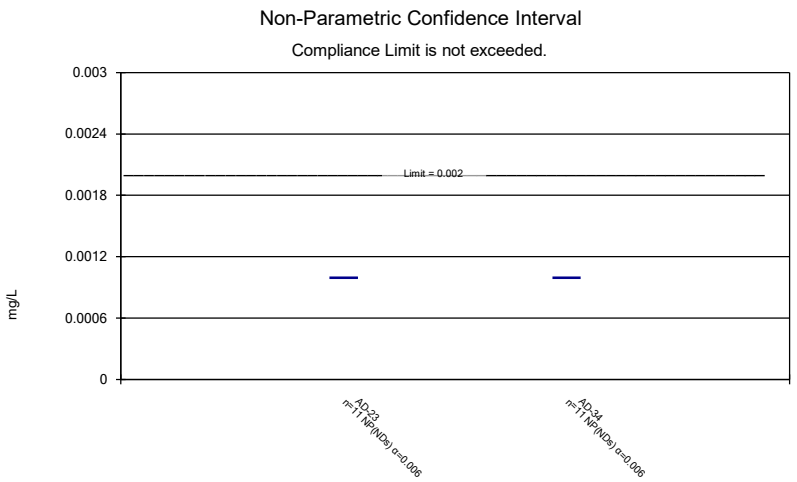
Constituent: Molybdenum, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Selenium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Thallium, total Analysis Run 7/11/2019 1:56 PM View: Confidence Intervals - App IV
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

APPENDIX III

Alternate source demonstrations are included in this appendix. Alternate sources are sources or reasons that explain that statistically significant increases over background or statistically significant levels above the groundwater protection standard are not attributable to the CCR unit.

Alternate Source Demonstration Evaluation Report

American Electric Power

Henry W. Pirkey Power Plant
Landfill CCR Management Unit
Project No. 112112

Revision 1
4/22/2019
(Original Report date 3/26/2019)

Alternate Source Demonstration Evaluation Report

prepared for

American Electric Power
Henry W. Pirkey Power Plant
Landfill CCR Management Unit
Hallsville, Texas

Project No. 112112

Revision 1
4/22/2019
(Original Report date 3/26/2019)

prepared by

Burns & McDonnell Engineering Company, Inc.
St. Louis, Missouri

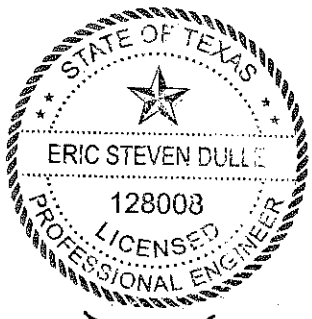
INDEX AND CERTIFICATION

American Electric Power
Alternate Source Demonstration Evaluation Report
Project No. 112112

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Texas, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the American Electric Power or others without specific verification or adaptation by the Engineer.



4-22-19

Eric Dulle, P.E. (Texas 128008)

Date: 4/22/2019

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AEP	American Electric Power
amsl	Above Mean Sea Level
ASD	Alternate Source Demonstration
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	U. S. Environmental Protection Agency
ft	Feet
GWPS	Groundwater Protection Standard
LCL	Lower confidence limit
MCL	Maximum contaminant level
MDL	Method detection limit
mg/L	Milligram per Liter
MS	Matrix spike
MSD	Matrix spike duplicate
SWEPCO	Southwestern Electric Power Company
SSL	Statistically Significant Level
UTL	Upper tolerance limit

1.0 INTRODUCTION

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) has prepared on behalf of AEP this Alternate Source Demonstration (ASD) Evaluation Report (ASD Evaluation Report) for the existing coal combustion residuals (CCR) landfill (Landfill) located at the American Electric Power (AEP) Southwestern Electric Power Company (SWEPCO) Henry W. Pirkey Power Plant (Pirkey Plant or Site) in Hallsville, Texas.

In 2018, two assessment monitoring events were conducted at the Pirkey Plant Landfill in accordance with 40 Code of Federal Regulations (CFR) 257.95. The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the facility (AEP, 2017) and U. S. Environmental Protection Agency's (EPA) Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance (Unified Guidance; EPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or GWPSs established under 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPSs. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). An SSL was identified for cadmium and cobalt at AD-34 at the Landfill (Geosyntec, 2018).

This ASD is produced in conformance with requirements in the "Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments" in 40 CFR 257.95(g)(3)(ii).

1.1 Purpose and Scope of Evaluation

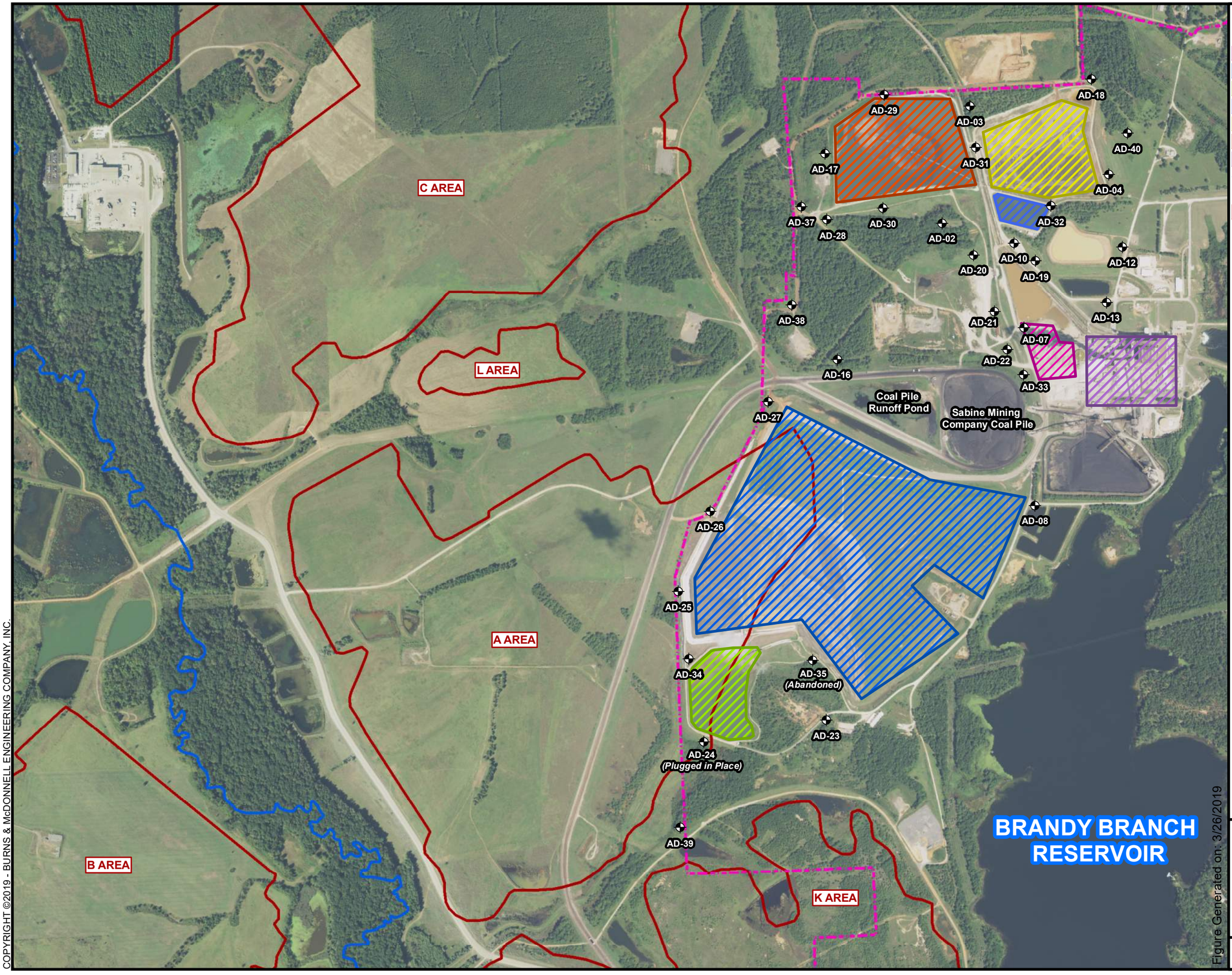
The purpose of this evaluation is to determine if concentrations of certain CCR constituents measured in groundwater samples collected from Site groundwater monitoring wells at SSLs above GWPSs established for the Landfill in accordance with 40 CFR 257.95(h) resulted from a source other than the Landfill or from natural variation in groundwater quality. Specifically, the LCL for cadmium (0.00511 milligram per liter [mg/L]) at AD-34 was above the Landfill GWPS of 0.005 mg/L and the LCL for cobalt (0.277 mg/L) at AD-34 was above the Landfill GWPS of 0.026 mg/L. The scope of the evaluation

included reviews of historical site records, existing groundwater monitoring system well data, and supplemental data collected from December 2018 through March 2019 to support this evaluation.

1.2 Site Setting

As shown on Figure 1-1, the Landfill is bound by an access road followed by Brandy Branch Reservoir to the east, the Stormwater Runoff Pond followed by former lignite mining areas to the south, former lignite mining areas to the west, and a coal pile and coal pile runoff pond to the north. Western portions of the Landfill are underlain by former lignite mining (reclaimed) land. The local surface topography slopes downward to the southwest towards Hatley Creek, located approximately 0.7 miles west of the Landfill. An unnamed tributary of Hatley Creek originates south of the Stormwater Runoff Pond and flows to the southwest towards Hatley Creek.

The Landfill, including closed, active, and under construction areas, occupies approximately 137 acres. The landfill consists of 10 cells identified by their date of construction (1984, 1987, 1993, 1995, 1997, 1999, 2005E, 2005W, 2012 and 2015) and there are three (3) leachate collection outlets along the southern edge of the active cell and the areas under construction. According to the Arcadis 2018 Landfill Lateral Expansion – CCR Location Restriction Evaluation (Arcadis 2018), AEP initiated an evaluation for the lateral expansion of the landfill. The expansion will cover approximately 15 acres and will be located directly southeast of the current landfill.



LEGEND

- AEP CCR WELL
- FGD STACKOUT AREA
- LANDFILL
- STORMWATER RUNOFF POND
- CLEARWATER POND
- EAST BOTTOM ASH POND
- WEST BOTTOM ASH POND
- AEP PIRKEY PLANT
- HATLEY CREEK
- PROPERTY BOUNDARY
- MINE AREAS

NOTES

1) PROPERTY BOUNDARY PROVIDED BY AKRON CONSULTING, LLC.
2) MOST RECENT SAMPLE AND BORING LOCATIONS - 3/20/19.

N

0 625 1,250 2,500 Feet

Figure Generated on: 3/26/2019

FIGURE 1-1
SITE LAYOUT MAP
AEP PIRKEY POWER PLANT
HALLSVILLE, TEXAS

BURNS McDONNELL

2.0 SUPPLEMENTAL DATA COLLECTION

This section of the ASD Evaluation Report describes sampling and analysis conducted during supplemental data collection activities to support the Landfill ASD evaluation at the Site in February and March 2019.

2.1 Overview

Supplemental data collection activities included the collection and analysis of groundwater samples from existing Landfill sentinel wells AD-25 and AD-26 and newly installed sentinel well (SB-10/AD-39) and nature and extent wells located west and southwest of the Landfill (SB-07, SB-08, SB-09, SB-10, and SB-11). In addition, these activities included the collection and analysis of a Landfill leachate sample and surface water sample of the water impounded in the Landfill Stormwater Runoff Pond located southwest of the Landfill. A summary of sample locations is provided in Table 2-1 below and sample locations are shown on Figure 2-1.

Table 2-1: Supplemental Data Collection Summary

Sample Media	Location (Designation)	Purpose/Notes
Landfill Leachate	Landfill	Characterize leachate from Landfill
Surface Water	Landfill Stormwater Runoff Pond	Characterize water quality for runoff collected in Landfill Stormwater Runoff Pond
Groundwater	AD-25 (sentinel well), AD-26 (sentinel well), SB-07 (nature and extent well), SB-08 (nature and extent well), SB-09 (nature and extent well), SB-10 (nature and extent well), SB-11 (nature and extent well), and AD-39 (sentinel well)	Characterize groundwater quality in former lignite mining (reclaimed) areas and areas to the southwest of the Landfill
Soil	SB-6, SB-7, SB-8, SB-9, SB-10 and SB-11	Characterize soil conditions in former lignite mining (reclaimed) areas and background (SB-6)

A summary of the Landfill leachate and stormwater runoff pond results is provided in Appendix A, Table A-1, a summary of groundwater sampling results is provided in Appendix A, Table A-2, and a summary of soil sampling results are summarized in Appendix A, Table A-3. A synoptic round of water level measurements was collected on March 13, 2019 at existing monitoring and sentinel wells and at newly installed nature and extent and sentinel monitoring wells. These measurements are summarized in

Appendix A, Table A-4. Figure 2-2 presents the potentiometric surface map prepared using the March 13, 2019 synoptic round of water level measurements.

LEGEND

- AEP CCR WELL
- LEACHATE SAMPLE
- SOIL BORING
- SURFACE WATER
- HATLEY CREEK
- PROPERTY BOUNDARY
- MINE AREAS

NOTES

1) PROPERTY BOUNDARY PROVIDED BY AKRON CONSULTING, LLC.
2) MOST RECENT SAMPLE AND BORING LOCATIONS - 3/20/19.

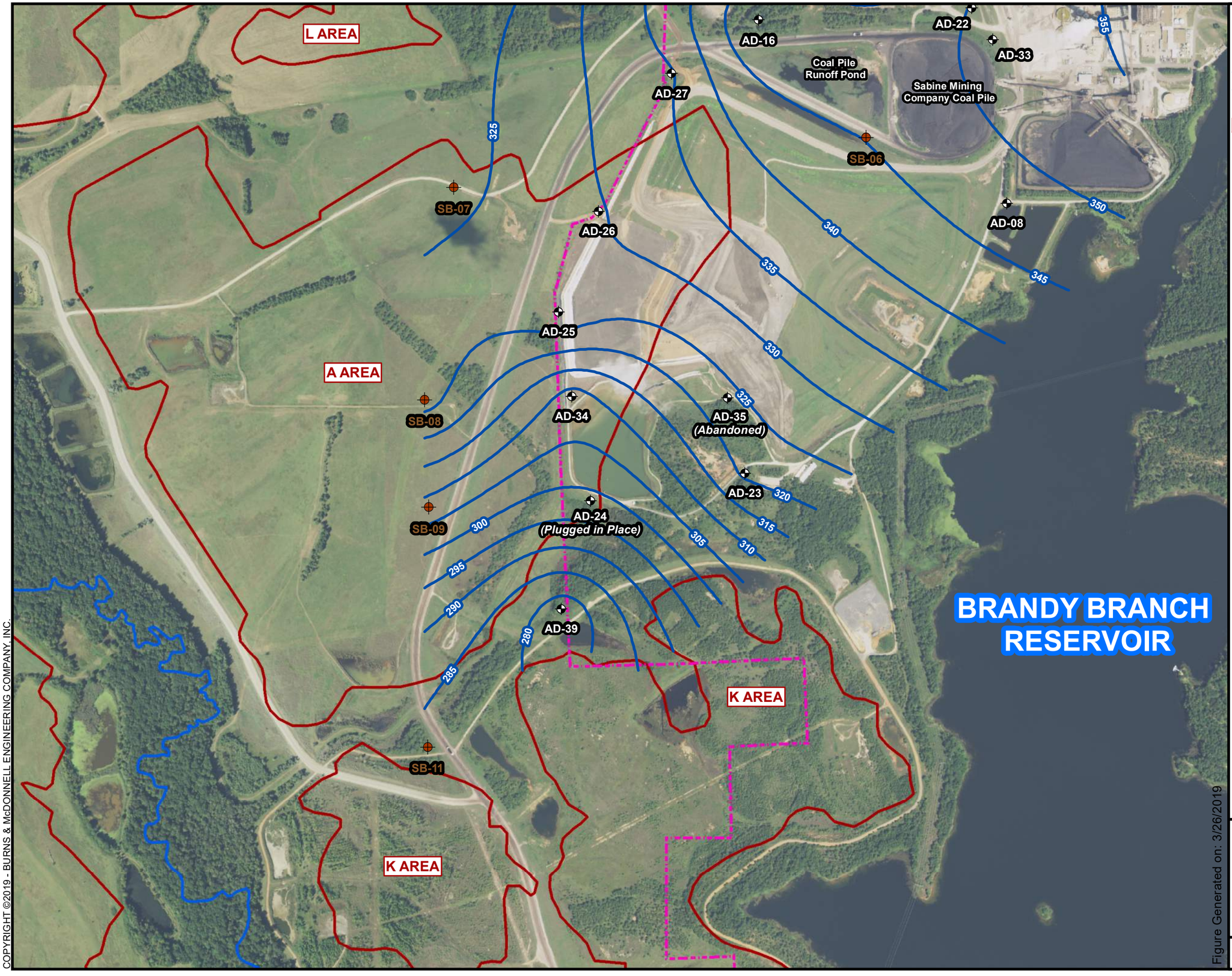
N

0 500 1,000 2,000 Feet

Figure Generated on: 3/26/2019

FIGURE 2-1
SAMPLE LOCATION MAP
AEP PIRKEY POWER PLANT
HALLSVILLE, TEXAS

BURNS McDONNELL



LEGEND

- AEP CCR WELL
- SOIL BORING
- GROUNDWATER CONTOURS 3/12/19
- HATLEY CREEK
- PROPERTY BOUNDARY
- MINE AREAS

NOTES

1) PROPERTY BOUNDARY PROVIDED BY AKRON CONSULTING, LLC.
2) GROUNDWATER CONTOURS PLOTTED AT 5'/CONTOUR.
3) GROUNDWATER CONTOURS DRAFTED BASED ON ELEVATIONS COLLECTED ON 3/12/19

N

0 500 1,000 2,000 Feet

Figure Generated on: 3/26/2019

FIGURE 2-2
POTENTIOMETRIC SURFACE MAP
AEP PIRKEY POWER PLANT
HALLSVILLE, TEXAS

BURNS McDONNELL

3.0 ALTERNATE SOURCE EVALUATION SUMMARY

This section of the ASD Evaluation Report presents lines of evidence that CCR constituents, at concentrations above GWPSs at the Landfill, resulted from sources other than the Landfill.

3.1 Coal Mine Drainage

Water levels at monitoring well AD-34 are consistently above the ground surface and represent artesian conditions. Prior to the installation of AD-34 and landfill cell and stormwater runoff pond expansion in 2015, groundwater from the former lignite (reclaimed) mine discharged to the ground surface in the area of AD-34. Figure 3-1 shows two aerial photographs in the area of AD-34. The December 2009 photo depicts surface flow from the mine drainage with the future location of monitoring well AD-34 located adjacent to the historical surface discharge of mine drainage (AD-34 was installed in December 2015). The August 2018 photo shows the current well location relative to the Landfill Pond Road and the 2015 Cell.

Studies of coal mine draining have identified the presence of cadmium and cobalt in coal mine drainage water. One such study summarizes analytical results for water samples from 128 untreated coal mine drainage discharges (Hyman and Watzlaf, 1997). For samples included in this study, 119 of 128 were analyzed for cadmium and 110 of 128 were analyzed for cobalt. The average of the detected cadmium concentrations was 0.014 mg/L and average of the detected cobalt concentrations 0.794 mg/L. In another EPA study, 15 samples of runoff water from coal mine reclamation areas were analyzed for cadmium and the average of the detected cadmium concentrations was 0.019 mg/L (USEPA, 1982). The runoff water samples for this study were not analyzed for cobalt. A study published in 2008 included analysis of cadmium results for 140 abandoned coal mines in Pennsylvania. For the 99 abandoned bituminous coal sites included in the study the median cadmium concentration was 0.023 mg/L (Cravotta III, 2008). The data from these studies indicates that untreated coal mine drainage similar to conditions at the Landfill affect groundwater conditions. Therefore, impacts from coal mine drainage in the area of AD-34 and coal mine drainage is a source of cadmium and cobalt.

LEGEND

- AEP CCR WELL
- PROPERTY_BOUNDARY
- RUNOFF FROM MINE DRAINAGE

NOTE

1) 2009 AND 2017 AERIAL PHOTO SOURCE: GOOGLE EARTH
2) MONITORING WELL AD-34 WAS INSTALLED ON: DECEMBER 11TH, 2015

N

0 30 60 120 Feet

Figure Generated On: 4/19/2019

FIGURE 3-1
HISTORICAL COAL MINE
DRAINAGE MAP
AEP PIRKEY POWER PLANT
HALLSVILLE, TEXAS

BURNS McDONNELL

3.2 Historical Cadmium Concentrations

Table 3-1 presents historical concentrations of cadmium in samples from sentinel wells AD-25 and AD-26 and Table 3-2 presents historical concentrations of cadmium in samples from monitoring well AD-34.

Table 3-1: Historical Cadmium Concentrations for AD-25 and AD-26

Well Location	Sample Date	Cadmium (mg/L)
AD-25	4/12/2011	0.008
	12/14/2011	0.004
	6/19/2012	0.003
	1/22/2013	0.001
	7/17/2013	0.002
	1/21/2014	0.009
	7/8/2014	0.013
AD-26	4/12/2011	0.004
	12/14/2011	0.005
	6/19/2012	0.003
	1/22/2013	0.005
	7/17/2013	0.004
	1/21/2014	0.003
	7/8/2014	0.012

Notes: mg/L = milligram per liter

Table 3-2: Historical Cadmium Concentrations for AD-34

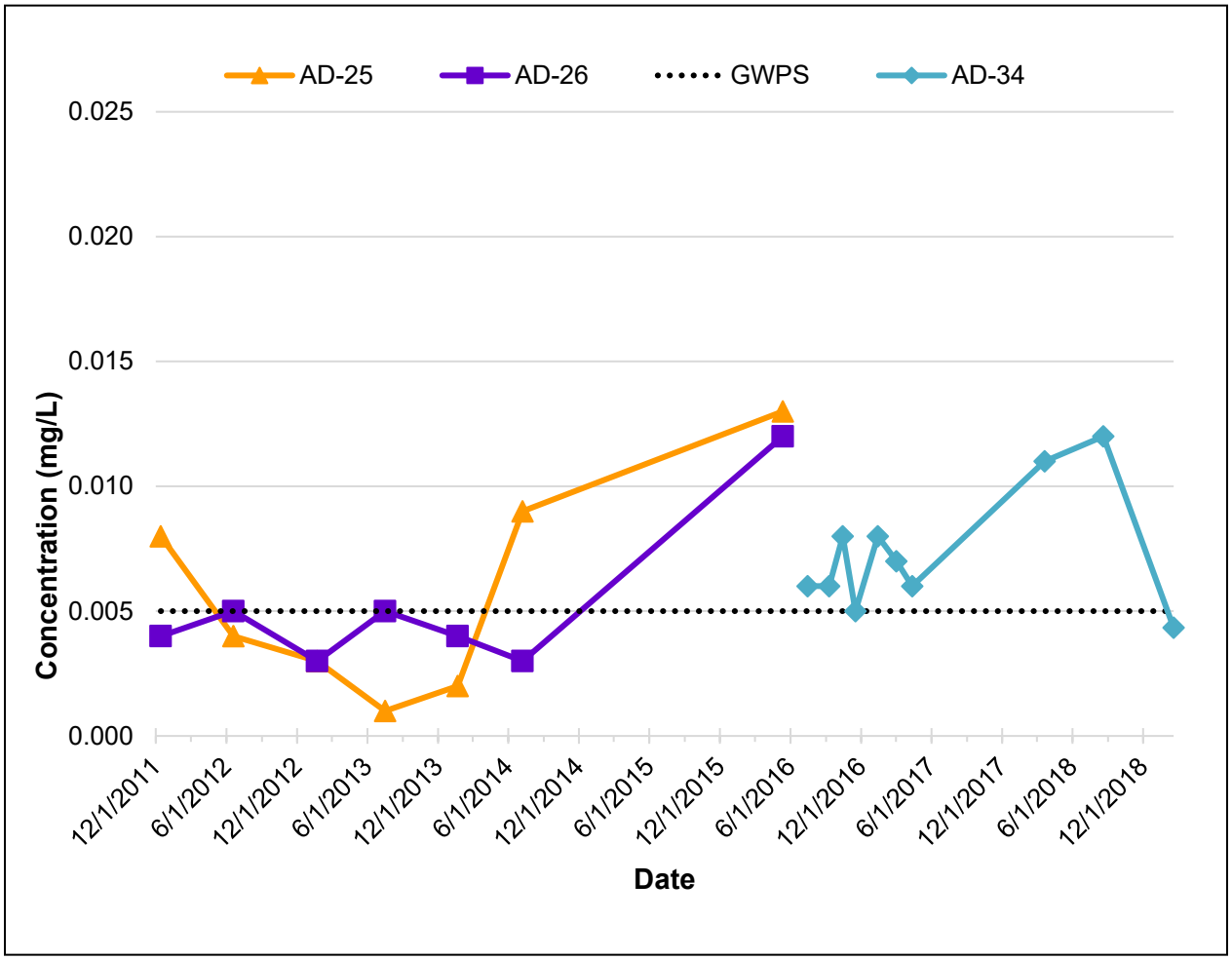
Well Location	Sample Date	Cadmium (mg/L)
AD-34	5/10/2016	0.006
	7/13/2016	0.006
	9/8/2016	0.008
	10/12/2016	0.005
	11/15/2016	0.008
	1/11/2017	0.007
	2/28/2017	0.006
	4/10/2017	0.011
	3/21/2018	0.012
	8/20/2018	0.00434

Notes: mg/L = milligram per liter

Figure 3-2 shows concentrations of cadmium over time in sentinel wells AD-25 and AD-26 along with concentrations of cadmium over time in samples from monitoring well AD-34. A comparison of these historical results indicates that recent cadmium concentrations in samples from AD-34 are within the range of historical cadmium concentrations in samples from sentinel wells located immediately

hydraulically upgradient of AD-34. These cadmium concentrations are also at levels consistent with the average and median concentrations for water affected by former coal mining activities discussed in Section 3.1. It should also be noted that the cadmium concentrations in the sentinel and monitoring wells exhibit natural variability over time. This data indicates former lignite coal mining is a source cadmium at AD-34.

Figure 3-2: Cadmium Concentrations at AD-25, AD-26 and AD-34



3.3 Historical Cobalt Concentrations

Table 3-3 presents historical concentrations of cobalt in samples from monitoring well AD-34. Historical samples from AD-25 and AD-26 were not analyzed for cobalt. A comparison between AD-34 historical and recent results indicate that recent cobalt concentrations are generally consistent over time and have been within a relatively narrow range. The February 2019 concentration of cobalt at sentinel well AD-25, located immediately hydraulically upgradient of AD-34, is approximately two times higher than the average concentration at AD-34 and is slightly lower than the average concentration for coal mine

drainage water discussed in Section 3.1. This data indicates former lignite coal mining is a source of cobalt at AD-34.

Table 3-3: Cobalt Concentrations for AD-25, AD-26, and AD-34

Well Location	Sample Date	Cobalt (mg/L)
AD-25	2/18/2019	0.63
AD-26	2/18/2019	0.19 F
AD-34	5/10/2016	0.301
	7/13/2016	0.296
	9/8/2016	0.306
	10/12/2016	0.297
	11/15/2016	0.292
	1/11/2017	0.284
	2/28/2017	0.294
	4/10/2017	0.299
	3/21/2018	0.279
	8/20/2018	0.249

Notes: mg/L = milligram per liter, F = Matrix Spike (MS) and/or MS Duplicate (MSD) Recovery is outside acceptable limits

3.4 Comparison of Groundwater and Landfill Sample Results

This section presents a comparison of concentrations of leachate from the Landfill and the adjacent stormwater runoff pond to evaluate if they are a potential source of cadmium and cobalt in AD-34. Table 3-4 shows the most recent analytical sampling results for monitoring wells and sentinel wells in the area of the Landfill. This table also notes if the monitoring or sentinel well is considered hydraulically upgradient, downgradient, or cross-gradient of the Landfill and if the monitoring or sentinel well is in a former lignite mining area. As presented in Table 3-4, cadmium and cobalt were detected at very low concentrations in the Landfill leachate and stormwater runoff pond samples. Cadmium concentrations from both potential sources (i.e., Landfill leachate and stormwater runoff pond samples) are an order of magnitude (i.e., ten times) lower than concentrations at AD-34, AD-25, and AD-26 in the former lignite mining area. Cobalt concentrations in the Landfill leachate and stormwater runoff pond samples are three orders of magnitude (i.e., 1,000 times) lower than concentrations at AD-34, AD-25, and AD-26 in the former lignite mining area. Cadmium and cobalt concentrations were highest in samples from nature and extent wells and sentinel wells in former lignite mining area.

Two CCR constituents detected at relatively high levels in the Landfill leachate and stormwater runoff ponds were chloride and molybdenum. Chloride is a conservative (non-reactive) ion and can be used to evaluate the potential influence of leachate on groundwater quality and molybdenum metal transport can

be similar to other metals associated with CCR. The highest concentrations of chloride and molybdenum were detected in the Landfill leachate and stormwater runoff pond samples. Molybdenum was not detected above the laboratory reporting limit in the most recent samples collected from monitoring and sentinel wells and the concentration of molybdenum in the Landfill leachate and stormwater runoff pond water samples was four to five orders of magnitude (i.e., 10,000 to 100,000 times) higher than the detected levels at upgradient and downgradient sentinel wells. Chloride concentrations at nature and extent wells, sentinel wells and monitoring wells ranged from 2.5 mg/L to 38 mg/L, were variable among the well groupings, and were an order of magnitude (i.e., ten times) lower than chloride concentrations in the Landfill leachate and stormwater runoff pond. The comparison of the results demonstrates little correlation between the concentration of key constituents in groundwater and leachate samples indicating that the Landfill and the stormwater runoff pond are not a source of cadmium and cobalt in AD-34.

Additionally, concentrations in downgradient wells AD-23, AD-35, and AD-39 are similar to concentrations in upgradient wells, indicating that the Landfill is not affecting groundwater conditions in these downgradient wells. Also, AD-34 concentrations are more similar to concentrations in nature and extent wells and sentinel wells (also installed within the former lignite mine area), further indicating that former lignite mining area is a source of cadmium and cobalt in AD-34.

The highest concentrations of cobalt in recent groundwater samples from the area of the Landfill were from wells installed within the former lignite mining area and the highest cobalt concentration was detected at AD-25 located immediately upgradient of AD-34. Similarly, the highest concentrations of cadmium were detected in wells installed within the former lignite mining area. Lower cadmium concentrations further to the west of the Landfill may be the result of increased pH in these areas reducing the solubility and mobility of cadmium in groundwater. This pattern of high cadmium and cobalt groundwater concentrations indicate that the former lignite mining area is a source of cadmium and cobalt in AD-34.

Table 3-4: Other Notable Constituents

Sample Location/Type	Former Lignite Mine (Reclaimed) Area	Sample Date	Cadmium (mg/L)	Chloride (mg/L)	Cobalt (mg/L)	Molybdenum (mg/L)
Upgradient Monitoring Wells						
AD-8	No	8/20/2018	0.00018	18	0.0159	0.00002
AD-12	No	8/20/2018	0.00001	10	0.00172	0.00004
AD-27	No	8/21/2018	0.00046	10	0.0246	0.00007
Landfill						
Leachate	--	3/6/2019	0.0003 J	640	0.00043 J	3.7

Sample Location/Type	Former Lignite Mine (Reclaimed) Area	Sample Date	Cadmium (mg/L)	Chloride (mg/L)	Cobalt (mg/L)	Molybdenum (mg/L)
Stormwater Runoff Pond	--	3/6/2019	0.0001 J	110	0.00091 JF	0.52
Downgradient Monitoring Wells						
AD-23	No	8/20/2018	0.00001 J	9	0.000803	0.00007 J
AD-34	Yes	8/20/2018	0.00434	10	0.249	0.00003 J
AD-35	No	8/20/2018	0.00012	38	0.0119	0.00004 J
AD-39	No	3/7/2019	0.005 U	2.5 JB	0.0036 J	0.01 U
Cross-gradient and Downgradient Sentinel and Nature and Extent Wells (former lignite mining area)						
AD-25	Yes	2/18/2019	0.0029	6.2 B	0.63	0.01 U
AD-26	Yes	2/18/2019	0.0035	34	0.19 F	0.01 U
SB-07	Yes	3/6/2019	0.0005 U	18.3	0.0235	0.001 U
SB-08	Yes	2/28/2019	0.0002 J	22 B	0.037	0.01 U
SB-09	Yes	3/6/2019	0.0008	32.7	0.0878	0.001 U
SB-11	No	3/11/2019	0.0005 U	14.5	0.0228	0.001 U

Notes: mg/L = milligram per liter; B = Compound was found in the blank and sample; F = Matrix Spike (MS) and/or MS Duplicate (MSD) Recovery is outside acceptable limits; J = Result is less than the reporting limit but greater than or equal to the Method Detection Limit (MDL) and the concentration is an approximate value; U = Indicates the analyte was analyzed for but not detected above the MDL.

3.5 Soil Sampling Results

Soil sample analytical results are summarized in Appendix A, Table A-3. Concentrations of cobalt were generally an order of magnitude (i.e., ten times) higher than the concentrations of cadmium detected in the soil samples in the area of the Landfill. Groundwater concentrations exhibit a similar pattern with cobalt concentrations and are generally at least an order of magnitude higher than the cadmium concentrations in groundwater. The highest concentrations of both cadmium and cobalt were detected in soil samples collected in former lignite mining area (four of the five soil sampling locations were in former lignite mining (reclaimed) area). The pattern for groundwater concentrations is also similar with the highest cobalt and cadmium concentrations found in the former lignite mining area. This pattern of high cadmium and cobalt groundwater concentrations indicate that the former lignite mining area is a source of cadmium and cobalt in AD-34.

4.0 SUMMARY AND CONCLUSIONS

This section of the ASD Evaluation Report provides a summary of the notable observations and conclusions resulting from a review of the groundwater, leachate, stormwater runoff pond water sample, and soil sample results for the Site. The following observations and conclusions provide multiple lines of evidence that the source of cadmium and cobalt concentration above the GWPS at AD-34 is the former lignite mining area.

- Monitoring well AD-34 is located in reclaimed mine spoils from former lignite mining operations and is in an area where historical coal mine drainage discharged to the ground surface. AD-34 is located hydraulically downgradient of portions of former lignite mining area and portions of the landfill.

- Recent cadmium concentrations in groundwater samples from AD-34 are similar to historical cadmium concentrations in groundwater samples from nature and extent wells in reclaimed mine spoils located immediately hydraulically upgradient of AD-34 (AD-25 and AD-26) and are similar to concentrations found in coal mine drainage impacted water. This data is evidence that former lignite coal mining is a source of cadmium at AD-34.

- The February 2019 concentration of cobalt at sentinel well AD-25 located immediately hydraulically upgradient of AD-34 is approximately two times higher than the average concentration at AD-34 and is slightly lower than the average concentration found in coal mine drainage impacted water. This data is evidence that former lignite coal mining is a source of cobalt at AD-34.

- Cadmium and cobalt were detected at very low concentrations in the Landfill leachate and stormwater runoff pond samples as well as upgradient monitoring wells. Cadmium and cobalt concentrations were highest in samples from monitoring wells, sentinel well, and nature and extent well in former lignite mining (reclaimed) areas. Conversely, the highest concentrations of chloride and molybdenum were detected in the Landfill leachate and stormwater runoff pond samples. The lack of correlation between key constituents in groundwater and leachate samples and lack of correlation among wells is evidence that the Landfill and stormwater runoff pond are not the source of cadmium and cobalt at AD-34.

- The highest concentrations of cadmium and cobalt were consistently detected in wells in the former lignite mining area. This pattern of high cadmium and cobalt groundwater concentrations is evidence that the former lignite mining area is the source of cadmium and cobalt in AD-34.

- The pattern for the highest soil sample concentrations was similar to the groundwater pattern with the highest concentrations of both cadmium and cobalt detected in soil samples from the former lignite mining area (four of the five soil sampling locations were in former lignite mining area). This pattern of high cadmium and cobalt soil concentrations is evidence that the former lignite mining area is a source of cadmium and cobalt at AD-34.

Per EPA's Solid Waste Disposal Facility Criteria Technical Manual, Subpart E (EPA530-R-93-017, November 1993), this ASD has documented that:

- An alternative source exists. The highest concentrations of cadmium and cobalt in groundwater and soil samples were consistently detected in wells in the former lignite mining area. Literature documents coal mine impacted sites have high concentration of cadmium and cobalt. Previous studies of coal mine discharges have identified similar elevated concentrations of cadmium and cobalt.

- Hydraulic connection exists between the alternative source and the groundwater monitoring well(s) with the significant increase. The established Landfill monitoring well network and newly installed shallow sentinel wells in the area of the Landfill are all screened within the same hydrostratigraphic zone of the uppermost aquifer and former lignite mining area and non-mined area are hydraulically connected.

- Constituent(s) are present at the alternative source or along the flow path from the alternative source prior to possible release from the [CCR] unit. The highest concentrations of cadmium and cobalt were consistently detected in wells in the former lignite mining area and as shown on Figure 2-2 former lignite mining areas are located hydraulically upgradient from AD-34.

- The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the [CCR] unit when the fate and transport characteristics of the constituents are considered. The highest concentrations of cadmium and cobalt were consistently detected in wells in the former lignite mining area. Cadmium concentrations in Landfill leachate was an order of magnitude (i.e., ten times) lower than concentrations at AD-34, AD-25, and AD-26 in the former lignite mining area. Cobalt

concentrations in Landfill leachate are three orders of magnitude (i.e. 1,000 times) lower than concentrations at AD-34, AD-25, and AD-26 in the former lignite mining area.

- The concentration observed in groundwater could not have resulted from the [CCR] unit given the waste constituents and concentrations in the [CCR] unit leachate and wastes, and site hydrogeologic conditions. Cadmium concentration in the Landfill leachate was an order of magnitude (i.e., ten times) lower than concentrations detected at AD-34, AD-25, and AD-26 located in the former lignite mining area. Cobalt concentrations in Landfill leachate are three orders of magnitude (i.e. 1,000 times) lower than concentrations at AD-34, AD-25, and AD-26 located in the former lignite mining area.

- The data supporting conclusions regarding the alternative source are historically consistent with hydrogeologic conditions and findings of the monitoring program. As discussed in Sections 3.2 and 3.3 cadmium and cobalt concentrations have shown some natural variability but are generally consistent over time.

As summarized above, there are multiple lines of evidence demonstrating that the source of cadmium and cobalt concentrations in samples from monitoring well AD-34 resulting in an SSL above the GWPS is the former lignite mining spoils located beneath portions of the Landfill and to the west of the Landfill.

5.0 REFERENCES

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APPENDIX A - DATA SUMMARY TABLES

Sample Area:		Landfill	Landfill
Sample ID:		**LANDFILL LEACHATE-1**	**LANDFILL STORMWATER RUNOFF POND-1**
Sample Type:		Water	Water
Screened Interval (ft bgs):		Surface	Surface
Date Sampled:		2/11/2019	2/11/2019
Appendix III			
Boron	mg/L	5000.0 U	1000.0 U
Calcium	mg/L	590.0	290.0
Chloride	mg/L	640.0	110.0
Fluoride	mg/L	0.5 J	0.75 J
pH	-	9.6	8.85
Sulfate	mg/L	2200.0 B	1100.0 B
Total Dissolved Solids	mg/L	5100.0	2000.0
Appendix IV			
Antimony	mg/L	0.0044 B	0.0026 J B
Arsenic	mg/L	0.045	0.0048 J
Barium	mg/L	0.048 J	0.071 J F1
Beryllium	mg/L	0.00011 J	0.004 U
Cadmium	mg/L	0.0003 J	0.00012 J F1
Chromium	mg/L	0.005 U	0.0005 J F1
Cobalt	mg/L	0.00043 J	0.00091 J F1
Fluoride	mg/L	0.5 J	0.75 J
Lead	mg/L	0.00029 J B	0.00014 J B
Lithium	mg/L	0.042	0.014 J
Mercury	mg/L	0.0005	0.0002 U F1
Molybdenum	mg/L	3.7	0.52
Selenium	mg/L	0.13	0.037
Thallium	mg/L	0.002 U	0.002 U
Combined Ra 226/228	pCi/L	0.528 U	0.375 U

NA - Data Not Yet Available from Lab.

B - Compound was found in the blank and sample.

J - Result is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL) and the concentrat

U - Indicates the analyte was analyzed for but not detected.

M1 - Matrix Spike (MS) recovery exceeded Quality Control (QC) limits. Batch accepted based on laboratory control sample (LC

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

F1 - MS and/or MS Duplicate (MSD) Recovery is outside acceptable limits.

* - LCS and/or LCSD is outside acceptable limits.

^ - Instrument related QC outside acceptable limits.

Sample Area:		Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
Sample ID:		**SB-7 / 35-45**	**SB-7 / 60-70**	**SB-8 / 25-35**	**SB-8/55-65**	**SB-8/80-90**	**SB-9 / 20-30**	**SB-9 / 50-60**	**SB-10 / 40-50**
Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Screened Interval (ft bgs):		35-45	60-70	25-35	55-65	80-90	20-30	50-60	40-50
Date Sampled:		3/4/2019	3/4/2019	2/28/2019	3/1/2019	3/1/2019	3/1/2019	2/23/2019	2/23/2019
Appendix III									
Boron	mg/L	0.174	0.186	0.2 J	0.16 J	0.19 J	0.203	0.204	0.23 J
Calcium	mg/L	18.6	37.3	38.0	53.0	71.0	54.7	170.0	5.7
Chloride	mg/L	18.3	18.2	22 B	12 B	30 B ^	32.7	6.8	20.0 B F1
Fluoride	mg/L	0.21	0.29	0.32 J	0.12 J	0.084 J	1.6	0.48	0.23 J
pH	-	5.6	6.1	4.7	5.3	6.3	6.1	4.8	7.5
Sulfate	mg/L	131.0	348.0 M1	350 B	1400 B	300 B	747.0	2580.0	48.0 B
Total Dissolved Solids	mg/L	346.0	614.0	690.0	1000.0	650.0	968.0	3830.0	310.0
Appendix IV									
Antimony	mg/L	0.001 U	0.001 U	0.003 U	0.003 U	0.003 U	0.001 U	0.001	0.003 U
Arsenic	mg/L	0.0037	0.0161	0.0012 J	0.0087	0.005 U	0.0038	0.0232 U M1	0.00099 J
Barium	mg/L	0.109	0.0974	0.087 J	0.028 J	0.048 J	0.258	0.0144	0.067 J
Beryllium	mg/L	0.0005 U	0.0005 U	0.0011 J	0.00078 J	0.00088 J	0.0029	0.005	0.00033 J
Cadmium	mg/L	0.0005 U	0.0005 U	0.00024 J	0.005 U	0.005 U	0.00082	0.0005 U	0.005 U
Chromium	mg/L	0.005 U	0.005 U	0.005 U	0.005	0.005 U	0.005 U	0.01 U D3	0.0033 J
Cobalt	mg/L	0.0235	0.0701	0.037	0.029	0.0049 J	0.0878	0.163	0.0015 J
Fluoride	mg/L	0.21	0.29	0.32 J	0.12 J	0.084 J	1.6	0.48	0.23 J
Lead	mg/L	0.001 U	0.001 U	0.005 U	0.0015 J	0.005 U	0.001 U	0.001 U M1	0.0012 J
Lithium	mg/L	0.103	0.2	0.059	0.17	0.16	0.0684	0.3	0.045
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.001 U	0.001 U	0.01 U	0.01 U	0.01 U	0.001 U	0.001 U	0.0013 J
Selenium	mg/L	0.001 U	0.001 U	0.01 U	0.01 U	0.01 U	0.009	0.0166 U M1	0.01 U
Thallium	mg/L	0.001 U	0.001 U	0.002 U	0.002 U	0.002 U	0.001 U	0.001 M1	0.002 U
Combined Ra 226/228	pCi/L	5.38 ± 1.37	5.22 ± 1.39	NA	NA	NA	10.9 ± 2.14	7.53 ± 1.52	NA

NA - Data Not Yet Available from Lab.

B - Compound was found in the blank and sample.

J - Result is less than the Reporting Limit (RL) but greater than or equal to the Method Detction Limite (MDL) and the concentration is an approximate value.

U - Indicates the analyte was analyzed for but not detected.

M1 - Matrix Spike (MS) recovery exceeded Quality Control (QC) limits. Batch accepted based on laboratory control sample (LCS) recovery.

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

F1 - MS and/or MS Duplicate (MSD) Recovery is outside acceptable limits.

* - LCS and/or LCSD is outside acceptable limits.

^ - Instrument related QC outside acceptable limits.

Sample Area:		Landfill	Landfill	Landfill	Landfill	Landfill
Sample ID:		**SB-11/5-15**	**SB-11/33-43**	**AD-25**	**AD-26**	**AD-39**
Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Screened Interval (ft bgs):		5-15	33-43	MW	MW	MW
Date Sampled:		3/11/2019	3/11/2019	2/18/2019	2/18/2019	2/22/2019
Appendix III						
Boron	mg/L	0.1 U	0.276	0.055 J *	0.12 J	1.1 J
Calcium	mg/L	10.2	17.3	83.0	95.0	44
Chloride	mg/L	14.5	26.1	6.2 B	34.0	2.5 J B
Fluoride	mg/L	0.82	0.2 U	2.8	3.6	0.059 J
pH	-	5.1	6.9	3.51	3.37	5.89
Sulfate	mg/L	159.0	97.4	1500.0 B	1500.0 B	120.0 B
Total Dissolved Solids	mg/L	294.0	314.0	2100.0	2000.0	260.0
Appendix IV						
Antimony	mg/L	0.001 U	0.001 U	0.0011 J B	0.0016 J ^ B	0.0030 U
Arsenic	mg/L	0.001 U	0.001	0.013	0.0037 J	0.0075
Barium	mg/L	0.0914	0.0456	0.0079 J	0.012 J	0.024 J
Beryllium	mg/L	0.0006	0.0005 U	0.0091	0.0084	0.0040 U
Cadmium	mg/L	0.0005 U	0.0005 U	0.0027 J	0.0035 J	0.0050 U
Chromium	mg/L	0.005 U	0.005 U	0.0011 J	0.0022 J	0.0033 J
Cobalt	mg/L	0.0228	0.0023	0.6	0.19 F1	0.0036 J
Fluoride	mg/L	0.82	0.2 U	2.8	3.6	0.059 J
Lead	mg/L	0.001 U	0.001 U	0.00075 J	0.00065 J	0.0050 U
Lithium	mg/L	0.0111	0.0576	0.13	0.16	0.040 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.001 U	0.001 U	0.01 U	0.01 U	0.010 U
Selenium	mg/L	0.001 U	0.001 U	0.00062 J	0.01 U	0.010 U
Thallium	mg/L	0.001 U	0.001 U	0.002 U	0.002 U	0.0020 U
Combined Ra 226/228	pCi/L	8.47 ± 1.64	4.59 ± 1.10	NA	NA	NA

NA - Data Not Yet Available from Lab.

B - Compound was found in the blank and sample.

J - Result is less than the Reporting Limit (RL) but greater than or equal to the Method Detction Limite (MDL) and the concentration is an approximate value.

U - Indicates the analyte was analyzed for but not detected.

M1 - Matrix Spike (MS) recovery exceeded Quality Control (QC) limits. Batch accepted based on laboratory control sample (LCS) recovery.

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

F1 - MS and/or MS Duplicate (MSD) Recovery is outside acceptable limits.

* - LCS and/or LCSD is outside acceptable limits.

^ - Instrument related QC outside acceptable limits.

Sample Area:		Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
Sample ID:		**SB-6 / 6-7**	**SB-6 / 16-17**	**SB-7 / 7-8**	**SB-7 / 22-23**	**SB-8 / 6-7**	**SB-8 / 25-26**	**SB-9 5-6**	**SB-9 20-21**
Sample Type:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sampled Interval (ft bgs):		6-7	16-17	7-8	22-23	6-7	25-26	5-6	20-21
Date Sampled:		2/22/2019	2/22/2019	2/28/2019	2/28/2019	2/27/2019	2/27/2019	3/4/2019	3/4/2019
Isotopic Uranium & Thorium (6020/Alpha Spec)									
Uranium-233/234	pCi/g	0.534	0.355	0.539	0.217	0.604	0.314	NA	NA
Uranium-235/236	pCi/g	0.0459 U	0.0342 U	0.0243 U	-0.00247 U	0.0108 U	0.0380	NA	NA
Uranium-238	pCi/g	0.596	0.325	0.581	0.271	0.564	0.433	NA	NA
Uranium	mg/kg	60.0 U	64.0 U	1.1	0.59 J	0.93	0.71	NA	NA
Thorium-228	pCi/g	0.537	0.839	0.610	0.324	0.584	0.356	NA	NA
Thorium-230	pCi/g	0.477	0.382	0.579	0.357	0.583	0.427	NA	NA
Thorium-232	pCi/g	0.604	0.559	0.464	0.472	0.724	0.382	NA	NA
Thorium	mg/kg	60.0 U	64.0 U	4.4	4.3	4.2	3.7	NA	NA
Appendix IV + Boron									
Antimony	mg/kg	1.2 U	1.3 U	0.40 U	0.42 U	0.38 U	0.40 U		
Arsenic	mg/kg	6.9	6.9	6.9	23	2.7	18		
Barium	mg/kg	51	15 J	66	41	18 J	10 J		
Boron	mg/kg	23 U	25 U	3.4 J	7.1 J	3.7 J	3.4 U		
Beryllium	mg/kg	0.28 J	0.20 J	0.50	0.37 J	0.35 J	0.36 J		
Cadmium	mg/kg	0.067 J	0.094 J	0.095 J	0.12 J	0.085 J	0.12 J		
Chromium	mg/kg	23	21	12	12	4.2	18		
Cobalt	mg/kg	1.5 J	6.4 U	3.1 J	12	5.5 J	2.4 J		
Fluoride	mg/kg	1.1 U	0.95 J	3.1	2.5	0.75 U	0.75 U		
Lead	mg/kg	7.4	4.7	9.3	6.2	9.1	6.1		
Lithium	mg/kg	4.6 J	0.98 J	3.8 J	7.2	2.4 J	2.1 J		
Mercury	mg/kg	0.032 U	0.044 U	0.033 J	0.018 J	0.042	0.017 U		
Molybdenum	mg/kg	0.80 J	0.52 J	0.39 J	0.26 U	0.40 J	0.47 J		
Selenium	mg/kg	1.2 U	0.74 J	0.70 J	0.70 J	0.58 J	0.67 J		
Thallium	mg/kg	2.3 U	2.5 U	0.38 U	0.40 U	0.36 U	0.38 U		
Combined Ra 226/228	pCi/L	NA	NA	NA	NA	NA	NA		

- Analyte Not Requested

NA - Data Not Yet Available from Lab

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U - Indicates the analyte was analyzed for but not detected.

H - Sample was prepped or analyzed beyond the specified holding time.

M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

F1 - MS and/or MSD Recovery is outside acceptable limits.

F2 - MS/MSD RPD exceeds control limits.

* - LCS and/or LCSD is outside acceptable limits.

^ - Instrument related QC outside acceptable limits.

Sample Area:		Landfill	Landfill	Landfill	Landfill
Sample ID:		**SB-10/6.5-7.5**	**SB-10/10-11**	**SB-11 / 8-9**	**SB-11 / 10-11**
Sample Type:		Soil	Soil	Soil	Soil
Sampled Interval (ft bgs):		6.5-7.5	10-11	8-9	10-11
Date Sampled:		2/19/2019	2/19/2019	3/11/2019	3/7/2019
Isotopic Uranium & Thorium (6020/Alpha Spec)					
Uranium-233/234	pCi/g	0.353	0.319		
Uranium-235/236	pCi/g	0.0535	0.0470 U		
Uranium-238	pCi/g	0.240	0.263		
Uranium	mg/kg	0.47	1.0		
Thorium-228	pCi/g	0.848	0.741		
Thorium-230	pCi/g	0.449	0.396		
Thorium-232	pCi/g	0.831	0.612		
Thorium	mg/kg	4.7	11.0		
Appendix IV + Boron					
Antimony	mg/kg	1.1 U	1.2 U	1.1 U M1	1.1 U
Arsenic	mg/kg	23	18	2.0	1.7
Barium	mg/kg	6.4 J	7.6 J	14.5	9.8
Boron	mg/kg	23 U	24 U	11.4 U	11.1 U
Beryllium	mg/kg	0.044 J	0.082 J	0.57 U	0.55 U
Cadmium	mg/kg	0.13 J	0.11 J	0.57 U	0.55 U
Chromium	mg/kg	15	21	10.9	9.0
Cobalt	mg/kg	5.7 U	5.9 U	1.1 U	1.1 U
Fluoride	mg/kg	1.2 U	1.2 U	24.0 U M1	25.4 U
Lead	mg/kg	5.3	5.6	4.8	3.7
Lithium	mg/kg	5.7 U	1.1 J	5.2	2.0
Mercury	mg/kg	0.025 J	0.020 J	0.048 U	0.054 U
Molybdenum	mg/kg	0.77 J	1.1 J	5.7 U	5.5 U
Selenium	mg/kg	1.1 U	1.5	1.1 U	1.1 U
Thallium	mg/kg	2.3 U	2.4 U	1.1 U	1.1 U
Combined Ra 226/228	pCi/L	NA	NA	NA	NA

- Analyte Not Requested

NA - Data Not Yet Available from Lab

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U - Indicates the analyte was analyzed for but not detected.

H - Sample was prepped or analyzed beyond the specified holding time.

M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

F1 - MS and/or MSD Recovery is outside acceptable limits.

F2 - MS/MSD RPD exceeds control limits.

* - LCS and/or LCSD is outside acceptable limits.

^ - Instrument related QC outside acceptable limits.

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ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant
Landfill
Hallsville, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

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September 24, 2019

CHA8462

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FIGURES

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ATTACHMENTS

LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EBAP	East Bottom Ash Pond
EDS	Energy Dispersive Spectroscopic Analyzer
EPRI	Electric Power Research Institute
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LF	Landfill
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
SEM	Scanning Electron Microscopy
SSL	Statistically Significant Level
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
XRD	X-Ray Diffraction

SECTION 1

INTRODUCTION AND SUMMARY

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the Landfill (LF, Figure 1). In February 2019, a semi-annual assessment monitoring event was conducted at the LF in accordance with 40 CFR 257.95(d)(1). The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the facility (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPSs. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). The following SSLs were identified at the Pirkey LF:

- The LCL for cobalt at AD-34 was 0.272 milligrams per liter (mg/L), which exceeded the GWPS of 0.026 mg/L.

- The LCL for lithium at AD-34 was 0.145 mg/L, which exceeded the GWPS of 0.110 mg/L.

No other SSLs were identified (Geosyntec, 2019a).

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations regarding assessment monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration when an SSL is identified (40 CFR 257.95(g)(3)(ii)). An owner or operator may:

> *Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State*

> *Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section….*

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSLs identified for cobalt and lithium at AD-34 should not be attributed to the Pirkey LF.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSL could be attributed. Alternative sources were identified amongst five types, based on methodology provided by EPRI (2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the SSLs identified for cobalt and lithium at AD-34 were based on a Type V cause and not by a release from the Pirkey LF.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule allows the owner or operator 90 days from the determination of an SSL to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSLs identified for cobalt and lithium and the proposed alternative source are described below.

2.1 Proposed Alternative Sources

Initial review of site geochemistry, site historical data, and laboratory quality assurance/quality control (QA/QC) data did not identify ASDs due to a Type I (sampling causes), Type II (laboratory causes), or Type III (statistical causes) issue. As described below, the SSLs were attributed to impacts from a former lignite mining area, which is a Type V issue.

During the previous assessment monitoring event, SSLs for cadmium and cobalt were identified at AD-34 (Geosyntec, 2018). An ASD was generated which identified impacts from a former lignite mining area as the source for the elevated cadmium and cobalt concentrations (Burns and McDonnell, 2019). As shown in Figure 1, AD-34 is the only downgradient well in the LF monitoring network which is set within mine spoil in the former mining area (identified as Area A in the figure). Other nearby monitoring wells in the mine spoil include AD-25 and AD-26; however, neither is in the LF network.

Additionally, the previous ASD noted that the cobalt and cadmium concentrations in the leachate from the LF and from the LF stormwater runoff pond are several orders of magnitude lower than concentrations observed at AD-34. A comparison of the LF leachate and runoff values to the LCLs and the most recent sampling results finds that the LF liquids have significantly lower concentrations of both lithium and cobalt (Table 1), indicating that the LF is not a likely source for these constituents.

The previous ASD found that cadmium and cobalt concentrations at AD-25, AD-26, and AD-34 were comparable to each other but different from other network wells. A Piper diagram was generated to assess whether major ion concentrations are affected by screen placement in the mine spoil area (Figure 2). The Piper diagram shows that AD-34 groundwater appears more similar to AD-25 and AD-26 groundwater based on the distribution of major ions. Groundwater in the mine spoil area is dominated by sulfate and magnesium, whereas wells in the LF network have higher proportions of chloride, sodium, and potassium.

Monitoring wells AD-48, AD-49 and AD-52 through AD-55 were installed in the former mining area in 2019. When these wells are included on a Piper diagram, it is apparent they have chemistry similar to AD-34 (Figure 3). These findings suggest that impacts from the former lignite mine have affected the geochemistry of the groundwater at wells set within its footprint. The effect of the former lignite mining area on cobalt and lithium is described in more detail below.

2.1.1 Cobalt ASD

As described above, an ASD LF previously attributed the observed cobalt exceedance to impacts from the former lignite mining area (Burns and McDonnell, 2019). Additional sampling since completion of the previous ASD provides further evidence that the observed cobalt exceedances at AD-34 are due to impacts from the former mining area and are not related to the LF.

Boring logs from AD-48 through AD-50 and AD-52 through AD-57 (provided in Attachment A) were used to generate a cross-section to illustrate the extent of the fill associated with the former mining activities. Weathering of pyrite, which is present throughout the mine area, is responsible for low pH (3.3 to 6.3) and elevated sulfate (152 to 2,110 mg/L) in the groundwater (Table 2). Acidic pH and elevated sulfate concentrations are known effects of groundwater on mine waste (Johnson, 2003). As shown in Figure 4, cobalt is generally elevated wherever well screens are placed in the mine fill. Cobalt concentrations are below the GWPS in wells that are screened outside the footprint of the former mining area, such as AD-56 and AD-57. AD-48 and AD-53 are the only wells screened in mine spoils which do not have cobalt concentrations above the GWPS. However, AD-48 is set near an upgradient edge of the former mining area, and so is likely to be recharged by unimpacted groundwater. Additionally, it has slightly elevated pH compared to locations with higher cobalt concentrations AD-53 has much higher pH than the other mine spoil wells (6.3 SU in Table 2), which is consistent with low cobalt solubility at circumneutral pH (Izquierdo and Querol, 2012).

Soil was collected at select locations during the installation of monitoring wells AD-46 through AD-57 and analyzed for total cobalt. Additional samples were collected from borings advanced adjacent to existing wells AD-16 and AD-34. Cobalt was detected in all samples, with higher concentrations below 10 ft bgs, which suggests that it is naturally prevalent across the aquifer solid material (Table 3). A groundwater sample was collected from AD-34 and then passed through a 1.5-micron filter. The solid material retained on the filter was submitted for total metals analysis, with cobalt identified in the material at an estimated concentration of 2.2 milligrams per kilogram (mg/kg). This concentration is comparable to concentrations observed in the bulk soil within the footprint of the former mining area, ranging from 2.4 to 12 mg/kg (Figure 5).

Cobalt concentrations in the bulk soil samples are slightly higher in the former mining area, which could be an indicator that the fill material has higher proportions of cobalt-containing minerals (Table 3). Analysis by X-ray diffraction (XRD) identified pyrite and marcasite (both iron sulfides) at AD-34 at concentrations up to 2% by weight (Table 4). Cobalt is known to substitute for iron in crystalline iron minerals such as pyrite and marcasite due to their similar ionic radii (Krupka and Serne, 2002; Hitzman et al., 2019).

These lines of evidence, combined with the low concentrations of cobalt in the LF leachate and stormwater runoff pond, illustrate that the cobalt exceedance at AD-34 is not due to a release from the LF. Instead, the exceedance is due to changes in the groundwater chemistry associated with the former lignite mining area.

2.1.2 Lithium ASD

An SSL for lithium was not previously identified at the LF. As described below, the current exceedances can be attributed to impacts from the former mining area.

Lithium concentrations generally appear to be higher for wells that are located within the footprint of the former mining area (Figure 6). This relationship becomes more apparent when comparing concentrations for wells in the former mining area which are not set within the mine spoil. The observed lithium concentration at AD-50, which is screened in non-mine fill, is more than an order of magnitude lower than the concentrations at AD-52 and AD-53, both of which were installed immediately adjacent to AD-50 and screened within the mine spoil (Figure 7). Lithium concentrations are also below the GWPS at AD-39 (not shown on the cross-section), AD-56, and AD-57, which are set outside the footprint of the former mining area.

An ASD previously generated for lithium exceedances at Pirkey's East Bottom Ash Pond (EBAP) identified natural variation in the aquifer as the source of lithium near that unit. The ASD developed a proposed mechanism for lithium mobility in groundwater which pointed to desorption from clay minerals associated with naturally occurring lignite material as the source of lithium in both up and downgradient wells at the EBAP (Geosyntec, 2019b).

The total metal concentrations in the solid materials separated from the groundwater samples during filtration and the filtered groundwater concentrations were used to calculated partition coefficients values (K_d) for lithium, potassium, and sodium. These constituents were selected as they are all monovalent cations, and so have similar geochemical behavior. Partition coefficients are used to express the tendency of a chemical (e.g. lithium) to become adsorbed onto soil (or sediment). K_d is a ratio of the amount of chemical adsorbed per unit weight of the soil to the concentration of the chemical in solution (i.e., groundwater), as shown in the following equation:

$$K_d = \frac{mg\ adsorbed/kg\ soil}{mg/L\ solution}$$

K_d is characteristic of the soil, so its value varies with soil type. The K_d values for groundwater and particulate collected from AD-34 were compared to literature K_d values reported for organic-rich media such as bogs and peat beds (Table 5) (Sheppard et al., 2009; 2011). The calculated values are generally slightly lower than the literature values. However, the relationship between calculated K_d values for different constituents is consistent with the literature, with potassium being the largest (most sorbable) and sodium the smallest (least sorbable). These results support the proposed mechanism; however, there is less sorbing capacity in soil near AD-34 due to natural variations in the aquifer material.

According to XRD analysis of soil collected adjacent to AD-34, approximately 90% of the soil is composed of quartz, which is an inert mineral. Small fractions (1-2%) of clay minerals (illite, smectite), which have adsorptive capacity were identified in the XRD pattern as well. Suspended solids were separated from groundwater collected from AD-34 and analyzed for chemical

composition and mineralogy by scanning electron microscopy (SEM) using an energy dispersive spectroscopic analyzer (EDS). Clay particles were identified in the backscattered electron micrographs of this sample by morphology (Attachment B). Aluminum was identified in the particles, which provides evidence for clay aluminosilicate minerals in addition to quartz.

The lines of evidence described above show that elevated lithium concentrations at AD-34 are not due to a release from the LF, particularly as the lithium concentration in LF leachate is much lower than in groundwater at wells set within the former mine area. Instead, changes associated with the former mining area appear to be mobilizing lithium which is natural present in the aquifer and likely associated with clay fractions in the soil aquifer material.

2.2 Sampling Requirements

As the ASD presented above supports the position that the identified SSLs are not due to a release from the Pirkey LF, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSLs for cobalt and lithium at AD-34 identified during assessment monitoring in February 2019 were not due to a release from the Pirkey LF. The identified SSLs were, instead, attributed to impacts from a former lignite mining area. Therefore, no further action for cobalt or lithium is warranted, and the LF will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment C.

SECTION 4

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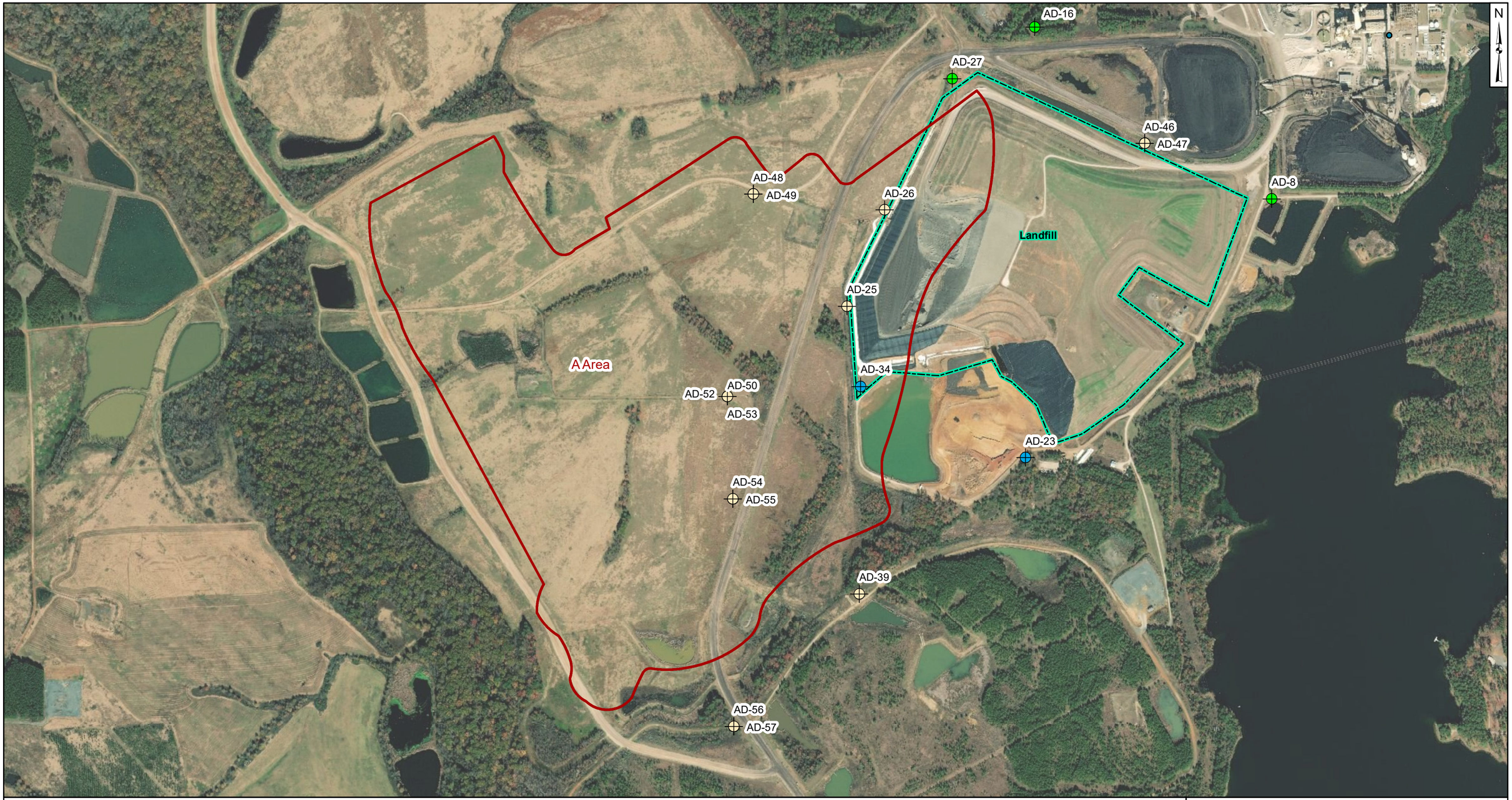
FIGURES



Legend

- A Area
- Upgradient Wells
- Downgradient Wells
- Out of network

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- Area A is a former lignite (reclaimed) mine.

875 437.5 0 875 Feet

Site Layout

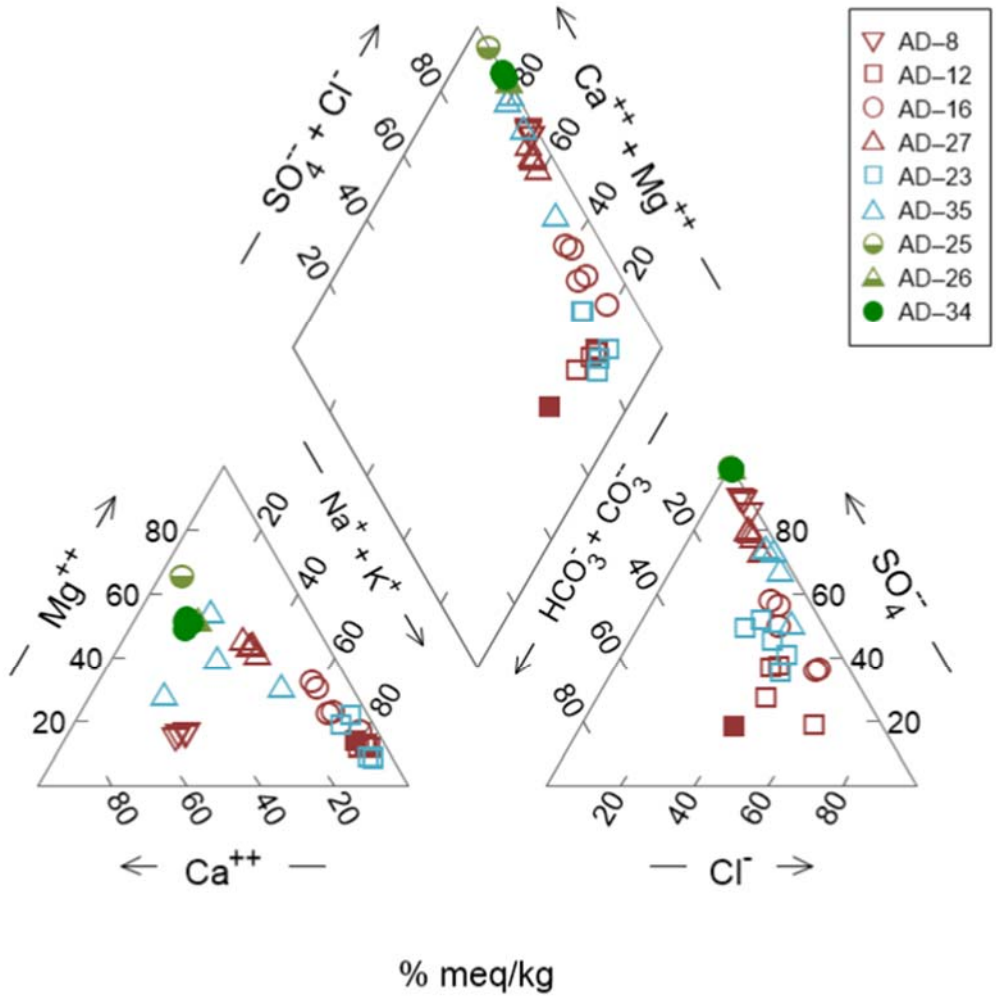
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/09/19

Figure **1**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_Sitelayout_20190919.mxd. hduff. 9/19/2019. Project/Phase/Task.



Notes: All data with complete data sets are shown except for AD-8 2/28/2019 data, which appeared to have an outlier.

Red symbology: Upgradient Locations
Blue symbology: Downgradient Locations
Green symbology: Downgradient locations screened in mine spoils.

Piper Diagram – Select Wells
Pirkey Landfill

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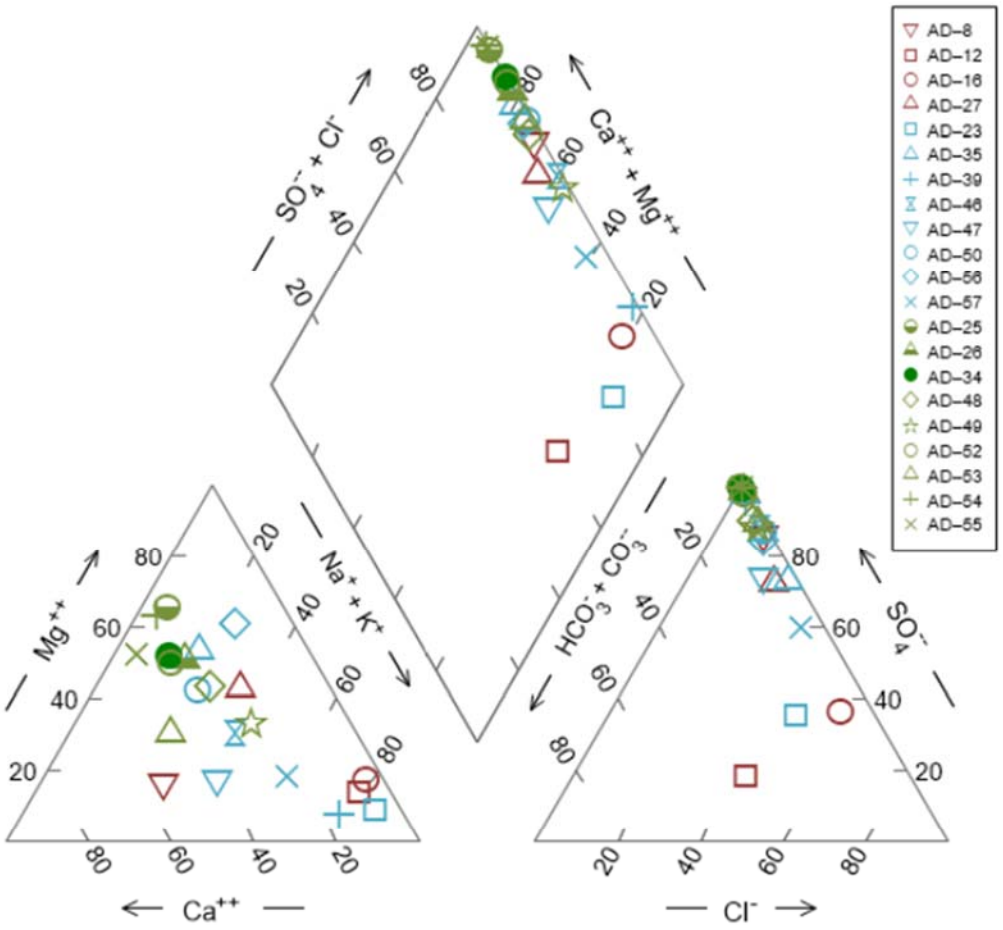
Columbus, Ohio | 19-Sep-2019

Figure 2

internal info: path, date revised, author



Notes: Wells in the LF network use February 2019 data, except AD-8 which used August 2018 due to an apparent outlier. Wells out of the network use August 2019 data.

Red symbology: Upgradient Locations
Blue symbology: Downgradient Locations
Green symbology: Downgradient locations screened in mine fill.

Piper Diagram – Landfill Area Wells
Pirkey Landfill

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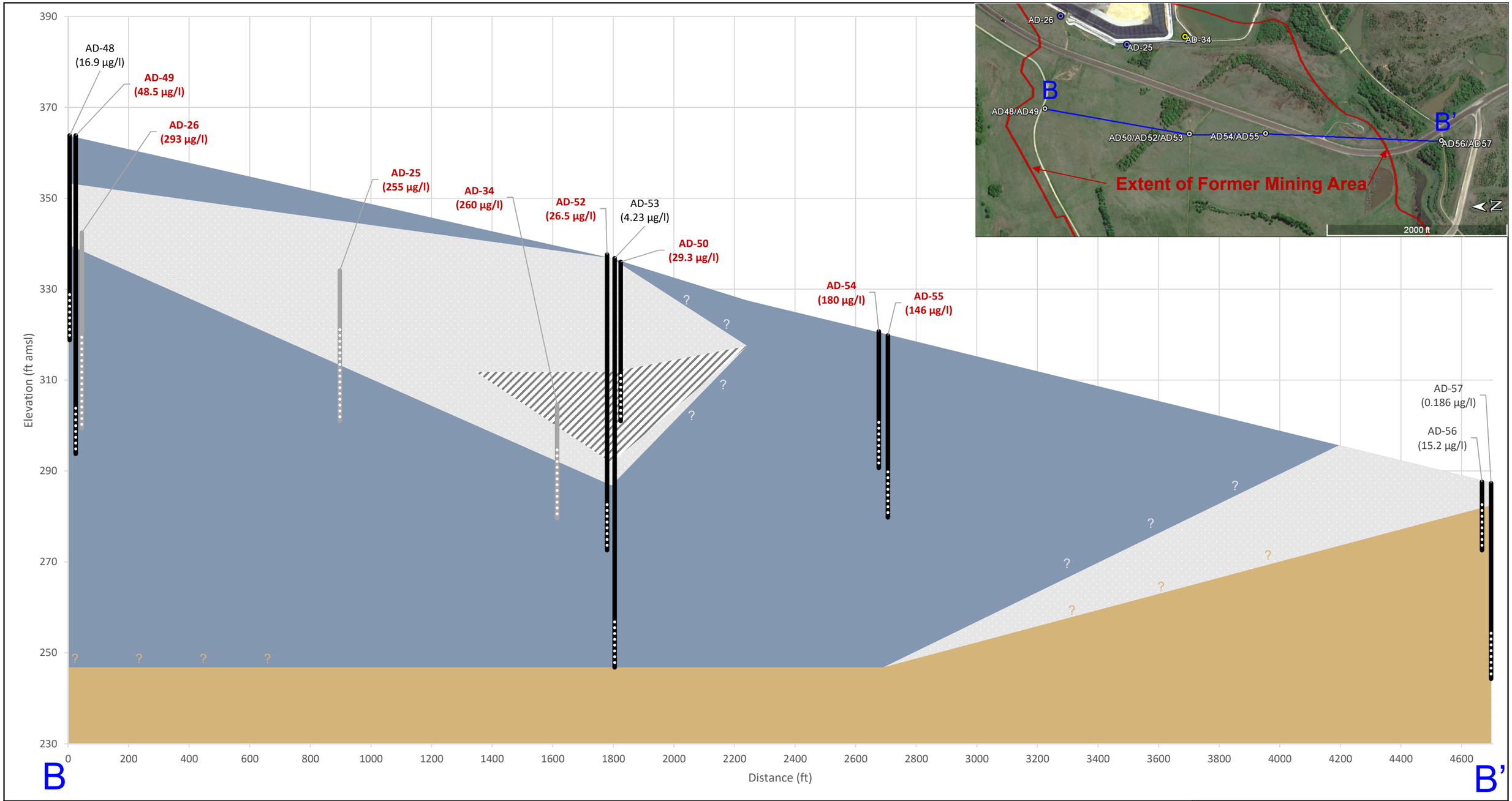
Columbus, Ohio | 19-Sep-2019

Figure 3

internal info: path, date revised, author



Legend

- Mine Spoil (clay, gray, lignite/other inclusions)
- Other Fill (sand to sandy clay, to clayey gravel, gray, some lignite/other inclusions)
- No recovery (assumed same lithology as Other Fill)
- Native sediments (gray sands and clays)
- Monitoring Well (Li Conc.)
- Projected Monitoring Well
- Well Screen
- Inferred Contact

Notes:

Gray wells are projected onto the plane of the cross section, and are generally screened within fill and mine spoil. Lithology for these wells was not used to construct cross section. Positions are approximate.
Cobalt concentrations in micrograms per liter (µg/l)
Groundwater results for all locations collected August 2019, except AD-34 collected February 2019
Bolded locations have concentrations which exceed the groundwater protection standard (GWPS) of 26 µg/L

Landfill Area Cross Section with Cobalt Concentrations
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

CHA8462 | September 2019

Figure 4

\\annarbor-01\data\Projects\AEP\Legal Department - ASD Review\Pirkey\2019-08 ASDs_2nd Round 2018\A-Landfill Area Cross section

Location	AD-48/49	
Depth (ft bgs)	7-8	22
Cobalt (mg/kg)	3.1	12

Location	AD-16	
Depth (ft bgs)	10	19
Cobalt (mg/kg)	0.17	0.44

Location	AD-46/47	
Depth (ft bgs)	6-7	16-17
Cobalt (mg/kg)	1.5	<6.4

Location	AD-50/52/53	
Depth (ft bgs)	6	25
Cobalt (mg/kg)	5.5	2.4

Location	AD-34
Depth (ft bgs)	24
Cobalt (mg/kg)	6.5

Location	AD-56/57	
Depth (ft bgs)	8-9	9-10
Cobalt (mg/kg)	< 1.1	< 1.1

AD-16
AD-27
AD-46
AD-47
AD-8
AD-48
AD-49
AD-26
Landfill
AD-25
AD-34
A Area
AD-50
AD-52
AD-23
AD-54
AD-55
AD-39
AD-56
AD-57

N

Legend

Out of Network
Landfill
Landfill
A Area

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- Cobalt concentrations displayed in milligrams per kilogram (mg/kg).
- ft bgs: feet below ground surface.
- A Area is former lignite (reclaimed) mine.
- Non detectds are shown as less than the reporting limit.

600 300 0 600
Feet

Cobalt Soil Values - Landfill Area
August 2019

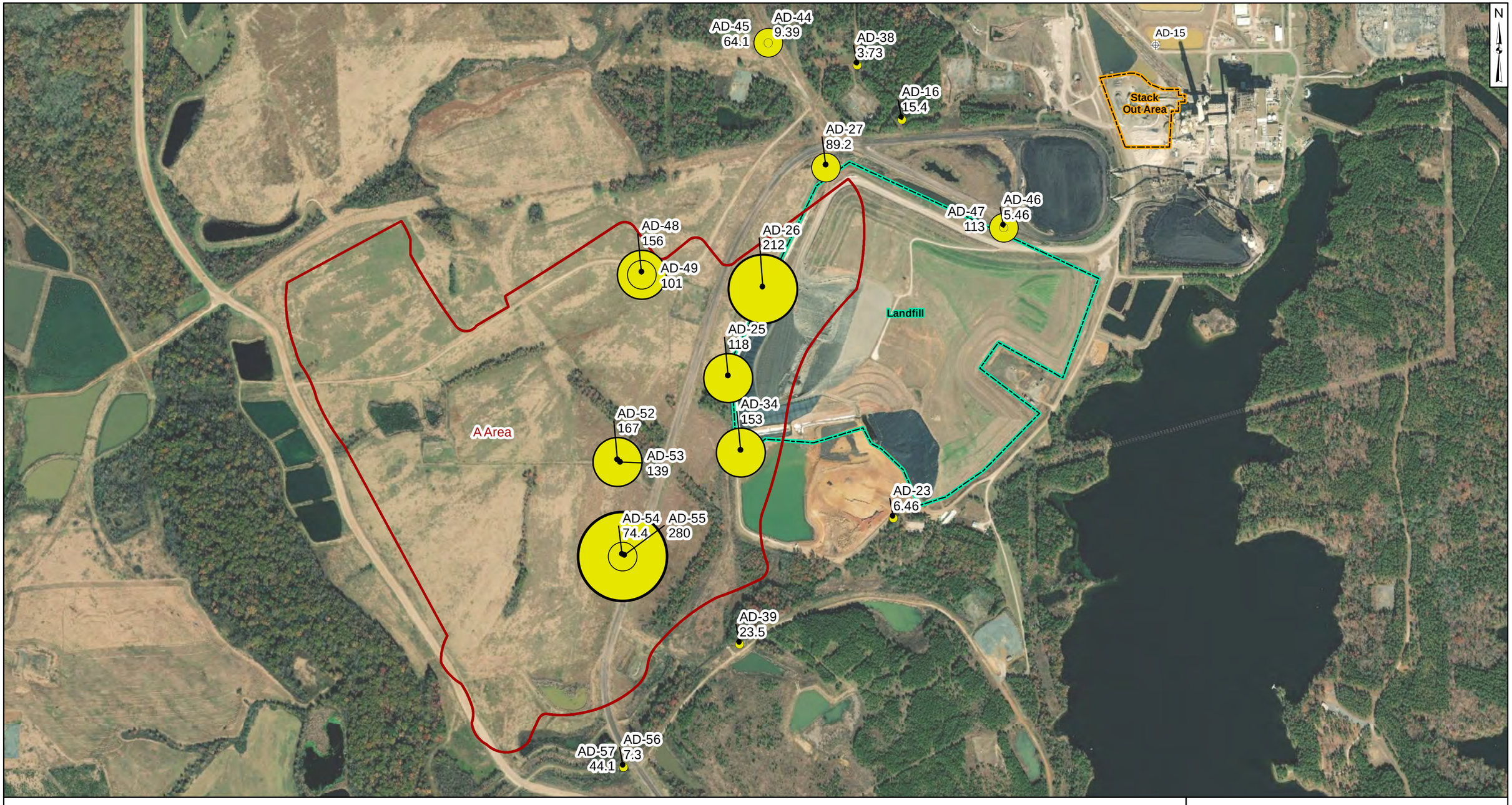
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/09/23

Figure **5**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_PirkeyLF_CoSoil_20190916.mxd. hduff. 9/23/2019. Project/Phase/Task.



Legend

- A Area
- Landfill
- Stack Out Area

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- Location of AD-15 is approximate.
- Circle size is proportional to lithium concentration.
- Lithium concentrations displayed in micrograms per liter (ug/L) and are represented with data from the August 2019 sampling event. Wells AD-16, AD-23, AD-27, and AD-34 are representated with data from the Feburary 2019 sampling event.
- Area A is a former lignite (reclaimed) mine.

900 450 0 900
Feet

Spatial Distribution of Lithium in Groundwater

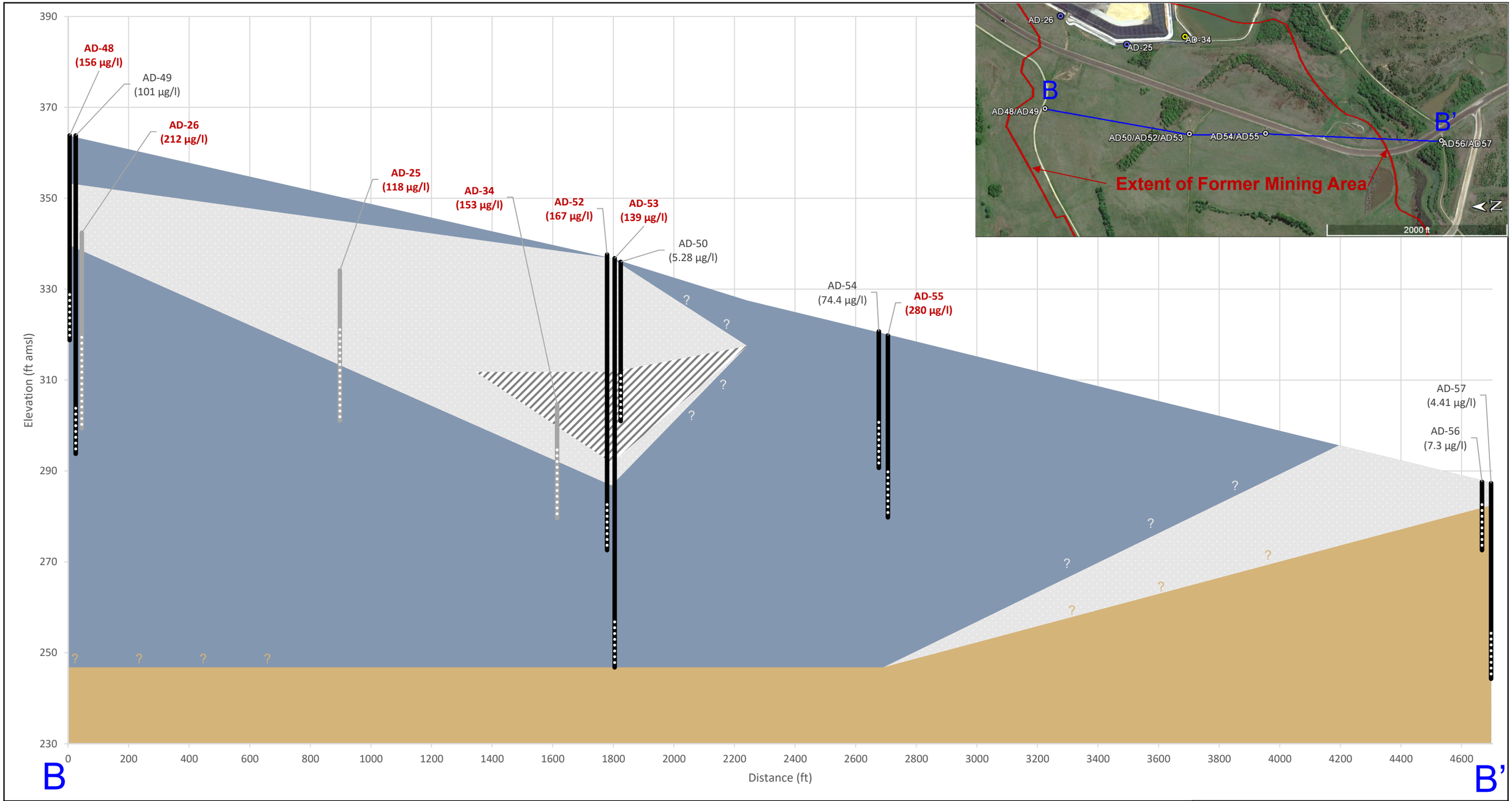
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/09/17

Figure **6**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_PirkeyLF_Li_20190916.mxd. ARevezzo. 9/17/2019. Project/Phase/Task.



Legend

- Mine Spoil (clay, gray, lignite/other inclusions)
- Other Fill (sand to sandy clay, to clayey gravel, gray, some lignite/other inclusions)
- No recovery (assumed same lithology as Other Fill)
- Native sediments (gray sands and clays)
- Monitoring Well (Li Conc.)
- Projected Monitoring Well
- Well Screen
- Inferred Contact

Notes:

Gray wells are projected onto the plane of the cross section, and are generally screened within fill and mine spoil. Lithology for these wells was not used to construct cross section. Positions are approximate.

Lithium concentrations in micrograms per liter (µg/l)

Groundwater results for all locations collected August 2019, except AD-34 collected February 2019

Bolded locations have concentrations which exceed the groundwater protection standard (GWPS) of 110 µg/L

Landfill Area Cross Section with Lithium Concentrations

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

CHA8462 | September 2019

Figure 7

\\annarbor-01\data\Projects\AEP\Legal Department - ASD Review\Pirkey\2019-08 ASDs_2nd Round 2018\A-Landfill Area Cross section

TABLES

Table 1: Leachate and Stormwater Pond Data Comparison
East Bottom Ash Pond - H.W. Pirkey Plant

Geosyntec Consultants, Inc.

Sample	Sample Date	Cobalt Concentration (µg/L)	Lithium Concentration (µg/L)
Leachate	2/11/2019	0.43 J	42
Leachate Stormwater Pond	2/11/2019	0.50 J	14 J
AD-34	LCL	272	145
	2/27/2019	260	153

Notes:

mg/L - milligram per liter

J - Estimated value. Result is less than the reporting limit but greater than or equal to the method detection limit.

LCL - lower confidence limit

Table 2: Groundwater Concentrations
East Bottom Ash Pond - H.W. Pirkey Plant

Geosyntec Consultants, Inc.

Location	Included in Network?	Screened in Mine Fill?	Sample Date	pH (SU)	Cobalt Concentration (µg/L)	Lithium Concentration (µg/L)	Sulfate Concentration (mg/L)
AD-8	Yes	No	2/28/2019	5.7	0.8 J	2.0	175
AD-12	Yes	No	2/27/2019	5.2	1.37	6.88	3.6
AD-16	Yes	No	2/27/2019	4.3	3.21	15.4	17.7
AD-23	Yes	No	2/28/2019	5.1	1.0 J	6.46	7.2
AD-25	No	Yes	8/13/2019	3.6	255	118	775
AD-26	No	Yes	8/16/2019	3.9	293	212	1490
AD-27	Yes	No	2/28/2019	4.7	18.9	89.2	52.8
AD-34	Yes	Yes	2/27/2019	4.7	260	153	970
AD-35	Yes - Abandoned	No	8/20/2018	4.2	11.9	8.76	149
AD-38	No	No	8/15/2019	4.2	5.46	3.73	6.1
AD-39	No	No	8/16/2019	5.4	5.15	23.5	272
AD-44	No	No	8/15/2019	4.5	4.92	9.39	17.4
AD-45	No	No	8/15/2019	5.5	0.331	64.1	16.8
AD-46	No	No	8/15/2019	4.8	13.6	5.46	231
AD-47	No	No	8/15/2019	4.8	4.05	113	37.8
AD-48	No	Yes	8/15/2019	5.6	16.9	156	152
AD-49	No	Yes	8/15/2019	5.5	48.5	101	200
AD-50	No	No	8/16/2019	5.3	29.3	5.28	302
AD-52	No	Yes	8/16/2019	5.6	26.5	167	642
AD-53	No	Yes	8/16/2019	6.3	4.23	139	322
AD-54	No	Yes	8/16/2019	3.7	180	74.4	1290
AD-55	No	Yes	8/16/2019	3.3	146	280	2110
AD-56	No	No	8/16/2019	4.7	15.2	7.3	130
AD-57	No	No	8/16/2019	4.0	0.186	44.1	45.1

Notes:
SU - specific units
µg/L - micrograms per liter
mg/L - milligrams per liter
J - Estimated value. Result is less than the reporting limit but greater than or equal to the method detection limit.

Table 3: Soil Cobalt Data
Landfill - H.W. Pirkey Plant

Location ID	Sample Depth (ft bgs)	Cobalt (mg/kg)
Bulk Soil Samples		
AD-16	10	0.17
	19	0.44
AD-34	6	1.10
	24	6.50
AD-46/47	6	1.5 J
	16	<6.40
AD-48/49	7	3.1 J
	22	12.0
AD-50/52/53	6	5.5 J
	25	2.4 J
AD-56/57	15	< 1.1
	35	<1.1
Solid Material Retained After Filtration		
AD-34	10-25	2.4 J

Notes:
< - Not detected. Result shown as less than the method detection limit.
mg/kg- milligram per kilogram
ft bgs - feet below ground surface
J - Estimated value
Samples shaded gray were not collected from mine fill.
Depths for samples collected after filtration represent the screened interval for the permanent well where the sample was collected.

Table 4: AD-34 X-Ray Diffraction Results *Geosyntec Consultants, Inc.*
Landfill - H. W. Pirkey Plant

Depth	6 ft bgs	24 ft bgs
Quartz	94	91
O Feldspar	2	2
P Feldspar	1	1
Calcite	--	--
Dolomite	--	--
Siderite	1	1
Pyrite/Marcasite	1	2
Illite/Smectite	--	1
Illite	1	1
Kaolinite	--	--
Chlorite	--	--

Notes:
-- : not detected
Results are reported as percentages.

Table 5: Calculated Site-Specific Partition Coefficients
Landfill - H. W. Pirkey Plant

Source	AD-34			Literature Value
Unit	mg/L	mg/kg	L/kg	L/kg
Element	**Aqueous Phase**	**Adsorbed**	**Kd**	**Kd**
Li	0.18	1.1	6	43-370
K	8.1	170	21	42-1200
Na	17	18	1	5.2-82

Notes:
mg/L: milligrams per liter
mg/kg: milligrams per kilogram
L/kg: liters per kilogram
Kd: partition coefficient
Adsorbed values are total metals concentrations reported by USEPA Method 6010B.
Literature values represent maximum and minimum values for the parameter as reported in Sheppard et al, 2009 (Table 4-1, all sites) and Sheppard et al, 2011 (Table 3-3 cultivated peat and wetland peat only).

ATTACHMENT A

Boring Logs

Drilling Log

BURNS McDONNELL	Project Name: AEP Pirkey CSM	Project No.: 111173	Boring/Monitoring Well Number: SB-07
	Coordinates: N 6872868 E 3201272.9	Ground Elevation: 363.80	Page: 1 of 5
	Total Depth (feet): 70 / Hole Size (inches): 6.75"	Driller: J. Smith	
Drilling Rig: Ardco 4x4		Drilling Company: MHC X-Ploration	
Date: 2/28/2019	Logged By: C. Hoglund	Reviewed by:	Approved by:

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
363	1	SILT and very fine grained SAND, dark grayish Brown (10YR 4/2), trace to little clay, wet, low to medium consistency, low to medium plasticity; FILL.		NA	NA	NA	NA	NA	NA	NA	Depth to water while drilling ▽ Depth to water after drilling ▼
362	2	SAND, reddish Yellow (7.5YR 6/6), very fine to fine grained, poorly sorted, with rock fragments (gravel, ironstone, and sandstone), with to some clay, soft to medium consistency, medium to high plasticity; FILL. Mine Reclaim.									
361	3										Log cuttings from 0'-5.0'.
360	4	- with clay below 4.0'									
359	5										
358	6	CLAY, light Brown (7.5YR 6/4), trace silt, trace very fine grained sand, iron staining throughout, some inclusions (sandstone, and gravel), soft to medium; FILL. Mine Reclaim.									
357	7	CLAY, dark Gray (7.5YR 4/1), with very fine grained sand, some to little silt, with to some orange, red, and light gray clay, some inclusions (lignite, coal, ironstone, and gravel), damp, medium to stiff, medium to high plasticity; FILL. Mine Reclaim.		MC	1		NA	2.9/5	NA	NA	Sampled SB-7/7'-8' (1045)
356	8										
355	9	- thin very fine grained sand seam, some to little clay, moist at 8.9'									
354	10										No free water observed
353	11	SAND, Gray (10YR 5/1), very fine grained, poorly graded, little to some silt, damp to wet, silty sand seam at top, low to medium plasticity; SP.									
352	12	SAND, Gray (10YR 5/1), with silt, trace clay, few to trace inclusions (lignite, coal, and sandstone), damp, medium density; SP.		MC	2		NA	4.5/5	NA	NA	
351	13	SAND and GRAVEL, Gray (10YR 5/1), very fine grained sand, poorly sorted, little to some silt, damp, trace to few lignite clasts;									
350											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-07
Page	2 of 5
Date	2/28/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
349	15	SAND and GRAVEL, Gray (10YR 5/1), very fine grained sand, poorly sorted, little to some silt, damp, trace to few lignite clasts; - trace to few white to light gray angular sanstone rock fragments below 14.0'		MC	2		NA	4.5/5	NA	NA	
348	16										
347	17	SAND, dark Gray (10YR 4/1), very fine grained, poorly sorted, with clay, trace muscovite flakes, trace to few lignite clasts, some silt, damp, soft, medium plasticity; SC.		MC	3		NA	4.3/5	NA	NA	
346	18										
345	19	- moist, trace clay below 18.5'									
344	20										
343	21	SAND, dark Gray (10YR 4/1), very fine grained, poorly graded, trace to little clay, trace to little silt, trace lignite-clay clasts, moist, medium to dense, low plasticity; SP-SC.									
342	22	SAND, Gray (10YR 5/1), very fine grained, poorly graded, some silte, few muscovite flakes, moist to wet; SP.		MC	4		NA	2.5/5	NA	NA	Sampled SB-7/22'-23'
341	23	- trace to few inclusions (lignite, coal, ironstone, sandstone, and gravel) below 23.0'									
340	24	CLAY, dark Gray (10YR 4/1) with very fine grained sand, some silt, trace to few inclusions (lignite, coal, sandstone, and gravel), damp, low to medium consistency, low to medium plasticity; FILL. Mine Reclaim.									
339	25			NA	NA	NA	NA	NA	NA	NA	Switch to rock drill bit at 25.0' feet. Begin logging from soil cuttings below 25.0'
338	26	CLAY, Gray (10YR 5/1), some silt, few very fine grained sand, little to some inclusions (coal, lignite, sandstone, ironstone, and gravel), medium consistency, low to medium plasticity; FILL. Mine Reclaim.									
337	27										
336	28										
335											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-07
Page	3 of 5
Date	2/28/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
334	30	CLAY, Gray (10YR 5/1), some silt, few very fine grained sand, little to some inclusions (coal, lignite, sandstone, ironstone, and gravel), medium consistency, low to medium plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
333	31										
332	32										
331	33	CLAY, Gray (10YR 5/1), some silt, trace to little very fine grained sand, few to some inclusions (lignite, coal, sandstone, ironstone and gravel), medium consistency, low to medium plasticity; FILL. Mine Reclaim.									
330	34										
329	35										
328	36										
327	37										
326	38										
325	39										
324	40										
323	41										
322	42										
321	43										
320											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-07
Page	4 of 5
Date	2/28/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
319	45	CLAY, Gray (10YR 5/1), some silt, trace to little very fine grained sand, few to some inclusions (lignite, coal, sandstone, ironstone and gravel), medium consistency, low to medium plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
318	46										
317	47										
316	48										
315	49										
314	50										
313	51										
312	52										
311	53										
310	54										
309	55										
308	56										
307	57										
306	58										
305											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-07
Page	5 of 5
Date	2/28/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
304	60	CLAY, Gray (10YR 5/1), some silt, trace to little very fine grained sand, few to some inclusions (lignite, coal, sandstone, ironstone and gravel), medium consistency, low to medium plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
303	61	- some to with inclusions (ironstone, sandstone, coal, lignite, and red clay) below 59.0'									
302	62										
301	63										
300	64										
299	65	- trace to few red clay clasts below 65.0'									
298	66										
297	67										
296	68										
295	69										
294	70	Boring terminated at 70 feet bgs.									Temporary Piezometer Installed on 2/28/2019
	71										
	72										
	73										

Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-48 (SB-7S)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	300920.8669
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924528.403
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

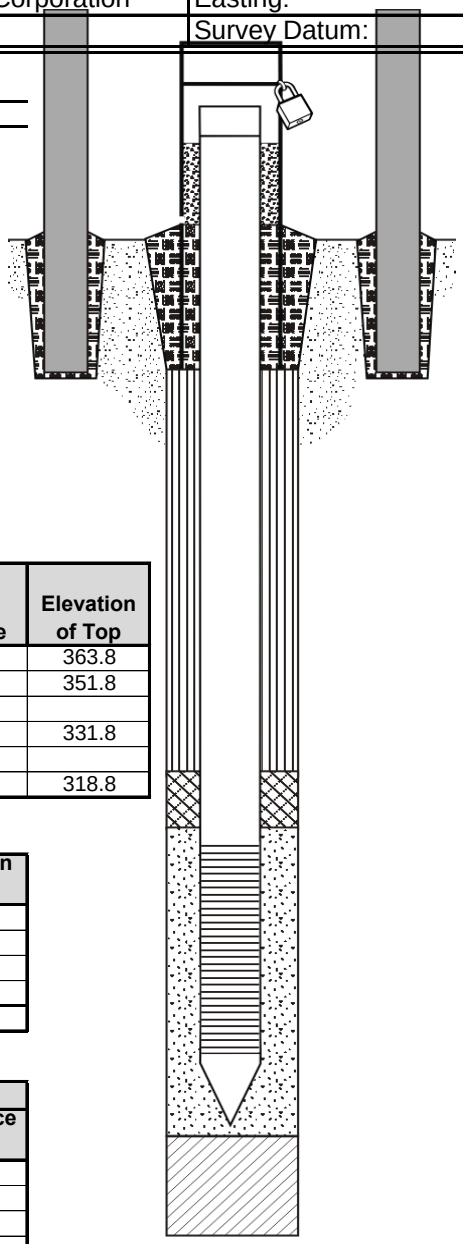
Elevations	
Top of Casing (TOC)	366.4
Ground Surface (GS)	363.8
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	3/3/2019
Installation Complete	3/3/2019
Well Completed	3/3/2019
Development Start	3/6/2019
Development Complete	3/6/2019

Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	12.0	363.8
Bentonite Seal	12	20.0	351.8
Secondary Filter Pack			
Filter Pack	32	13.0	331.8
Backfill	0		
Bottom of Borehole	45		318.8

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	35.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	332.09
Bottom Cap	0.28	322.09
Total Depth from TOC	44.59	

Groundwater Levels		
Date & Time	Depth	Reference Point



Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
Material: steel
Size: 4"
Length: 5'
Pea Gravel (Y/N): N
Weep Hole (Y/N): N
Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
Dimensions: 4' x 4' x 4"
Material: concrete

Annular Seal:
Type & Size: bentonite chips 3/8"
Manufacturer: Cetco
Amount Used: (included with bentonite seal)

Bentonite Seal:
Type & Size: pellets 3/8"
Manufacturer: PDS
Amount Used: 6 bags

Secondary Filter Pack:
Type & Size: --
Manufacturer: --
Amount Used: --

Primary Filter Pack:
Type & Size: sand 16/30
Manufacturer: U.S. Silica Company
Amount Used: 7.5 bags

Well Casing:
Type: PVC
Diameter: 2"
Sch. or Weight: Sch. 40
Manufacturer: Campbell Monoflex
Screen Type: PVC factory slot
Screen Slot Size: 0.010"
Bottom Cap Type: threaded

Centralizers (Y/N): N
Material: --
Number: --
Depth(s): --

Backfill Material:
Type & Size: NA
Manufacturer: --
Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508722

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/3/2019** Drilling End Date: **3/3/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**45**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
32	**45**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**32**	**Bentonite 6 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**45**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**35**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**35**	**45**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

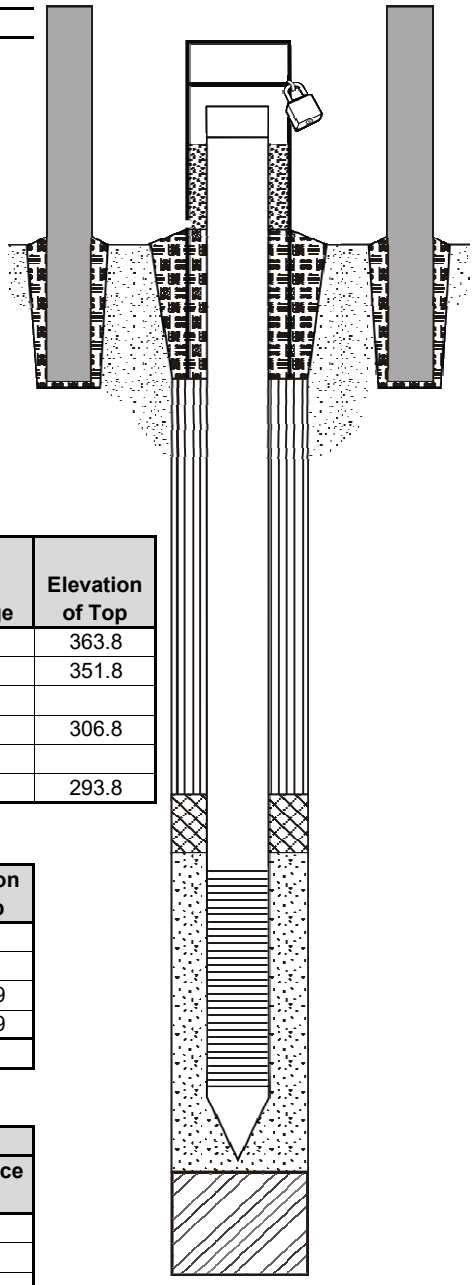
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-49 (SB-7D)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	300924.7371
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924521.039
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	366.5
Ground Surface (GS)	363.8
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	2/28/2019
Installation Complete	2/28/2019
Well Completed	2/28/2019
Development Start	3/4/2019
Development Complete	3/4/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	12.0	363.8
Bentonite Seal	12	45.0	351.8
Secondary Filter Pack			
Filter Pack	57	13.0	306.8
Backfill	0		
Bottom of Borehole	70		293.8

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	60.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	307.19
Bottom Cap	0.28	297.19
Total Depth from TOC	69.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: bentonite chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: chips
- Manufacturer: NA
- Amount Used: 10 bags

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: 5 bags

Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508720

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/28/2019** Drilling End Date: **2/28/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**70**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
57	**70**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**57**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**70**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**60**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**60**	**70**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Drilling Log

BURNS McDONNELL	Project Name: AEP Pirkey CSM	Project No.: 111173	Boring/Monitoring Well Number: SB-08
	Coordinates: N 6871089.8 E 3201042.6	Ground Elevation: 336.80	Page: 1 of 7
	Total Depth (feet): 93 / Hole Size (inches): 6.75"	Driller: J. Smith	
Drilling Rig: Ardco 4x4		Drilling Company: MHC X-Ploration	
Date: 2/24/2019 to 2/26/2019	Logged By: C. Hoglund	Reviewed by:	Approved by:

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
336	1	CLAY, Red (2.5YR 5/6), with silt, some very fine grained sand, little to some lignite and rock fragments, wet, medium to high plasticity, low consitency; FILL.									Depth to water while drilling ▽ / Depth to water after drilling ▼
335	2										
				HA	1		NA	5/5			
334	3										Hand dig from 0.0'-5.0'
333	4	- with very fine grained sand below 4.0'									
332	5										
331	6	CLAY, dark Gray (10YR 4/1) to dark grayish Brown (10YR 4/2), with silt, with very fine sand, damp, medium to stiff, low to medium plasticity; FILL. - with silt to very fine sand lenses - few to little iron staining lenses, few ironstone inclusions									
330	7	- trace to few very fine grained sandstone inclusions, little to some lignite and rock fragments below 7.0'									
				MC	1		NA	4/5	NA	NA	
329	8	- increased very fine grained sand and inclusions below 8.0'									
328	9										
327	10										
326	11	SAND, Gray (10YR 6/1) to dark Gray (10YR 4/1), very fine grained, poorly sorted, trace silt, some light gray thin beds, trace to few black coal lenses and streaks, moist to damp, low to medium density; SP.									No free water observed
325	12	SAND, Gray (10YR 6/1) to dark Gray (10YR 4/1), very fine graded, poorly sorted, trace to little clay, few to some inclusions (sandstone, ironstone, lignite, and rock fragments), trace to few thin sandstone beds, damp to moist, low to medium plasticity; SP.		MC	2		NA	3.2/5	NA	NA	
324	13										
323											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-08
Page	2 of 7
Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
322	15			MC	2		NA	3.2/5	NA	NA	
321	16	SAND, Gray (10YR 6/1) to dark Gray (10YR 4/1), with clay, some silt, few to some inclusions (sandstone, lignite, ironstone, and rock fragments), moist, low to medium density, low to medium plasticity; SC.									
320	17	- with iron staining, massive, below 16.3'		MC	3		NA	2.1/5	NA	NA	
319	18										
318	19										
317	20										
316	21										
315	22										
314	23			MC	4		NA	0.6/5	NA	NA	
313	24										
312	25										
311	26	No Recovery from 25.0'-45.0'.	NR								
310	27			MC	5		NA	0/5	NA	NA	
309	28										
308											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-08
Page	3 of 7
Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
		No Recovery from 25.0'-45.0'.	NR								
307	30			MC	5		NA	0/5	NA	NA	
306	31										
305	32										
304	33			MC	6		NA	0/5	NA	NA	
303	34										
302	35										
301	36										
300	37										
299	38			MC	7		NA	0/5	NA	NA	
298	39										
297	40										
				NA	NA	NA	NA	NA	NA	NA	Switch to rock drill bit. No Recovery.
296	41										
295	42										
294	43										
293											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-08
Page	4 of 7
Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
		No Recovery from 25.0'-45.0'.	NR	NA	NA	NA	NA	NA	NA	NA	
292	45	CLAY, Gray (10YR 6/1 to 5/1), with sand, some to few silt, some inclusions (sandstone, lignite, coal, and gravel), low to medium consistency, medium to high plasticity; CL.									Offset 6.0' north. Resume drilling. Begin logging from soil cuttings below 45.0'.
291	46										
290	47										
289	48										
288	49										
287	50	- increased lignite inclusions below 49.8'									
286	51	CLAY, Gray (10YR 6/1) to dark Gray (10YR 4/1), with sand, some silt, some to with inclusions (lignite, coal, red clay, ironstone, sandstone, and gravel), low to medium consistency, medium to high plasticity; FILL. Mine Reclaim.									
285	52										
284	53										
283	54										
282	55										
281	56										
280	57										
279	58										
278											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-08
Page	5 of 7
Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
277	60	CLAY, Gray (10YR 6/1) to dark Gray (10YR 4/1), with sand, some silt, some to with inclusions (lignite, coal, red clay, ironstone, sandstone, and gravel), low to medium consistency, medium to high plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
276	61										
275	62										
274	63										
273	64										
272	65										
271	66										
270	67										
269	68										
268	69										
267	70										
266	71										
265	72										
264	73										
263											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-08
Page	6 of 7
Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
	74	CLAY, Gray (10YR 6/1) to dark Gray (10YR 4/1), with sand, some silt, some to with inclusions (lignite, coal, red clay, ironstone, sandstone, and gravel), low to medium consistency, medium to high plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
262	75										
261	76										
260	77										
259	78										
258	79										
257	80										
256	81										
255	82										
254	83										
253	84										
252	85										
251	86										
250	87										
249	88										

Drilling Log, continued

BURNS McDONNELL		Boring/Monitoring Well Number	SB-08
	Project Name AEP Pirkey CSM	Page	7 of 7
	Project Number 111173	Date	2/24/2019 to 2/26/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
	89			NA	NA	NA	NA	NA	NA	NA	
247	90	CLAY, light Gray (10YR 7/1), some silt, medium to stiff, low to medium plasticity; CL.									
246	91										
245	92										
244	93	Boring terminated at 93 feet bgs.									Temporary Piezometer Installed on 2/26/2019
	94										
	95										
	96										
	97										
	98										
	99										
	100										
	101										
	102										
	103										

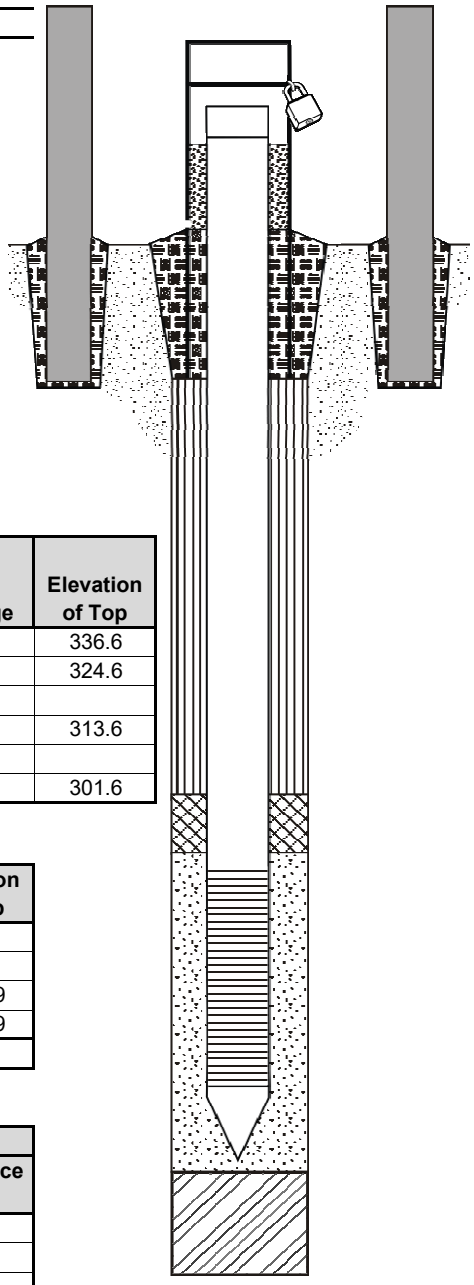
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-50 (SB-8S)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	299140.5817
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924282.637
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	339.0
Ground Surface (GS)	336.6
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	2/27/2019
Installation Complete	2/27/2019
Well Completed	2/27/2019
Development Start	2/28/2019
Development Complete	3/1/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	12.0	336.6
Bentonite Seal	12	11.0	324.6
Secondary Filter Pack			
Filter Pack	23	12.0	313.6
Backfill	0		
Bottom of Borehole	35		301.6

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	25.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	314.69
Bottom Cap	0.28	304.69
Total Depth from TOC	34.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: Chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: Medium Chips
- Manufacturer: NA
- Amount Used: 4 bags

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: 2 bags

Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508724

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**35**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
23	**35**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**23**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**35**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**25**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**25**	**35**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

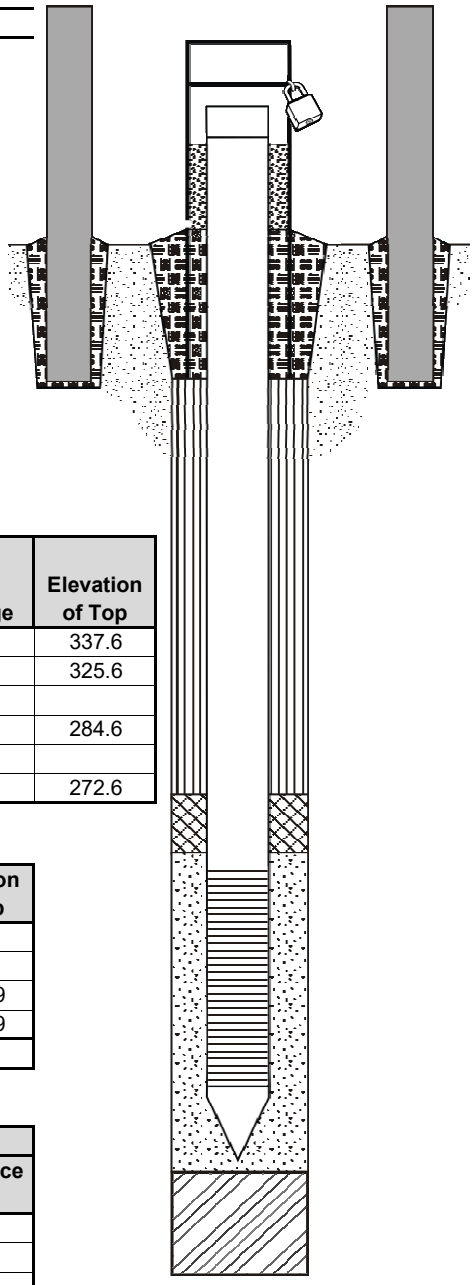
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-52 (SB-8I)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	299148.2762
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924262.209
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	340.7
Ground Surface (GS)	337.6
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	2/27/2019
Installation Complete	2/27/2019
Well Completed	2/27/2019
Development Start	2/28/2019
Development Complete	3/1/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	12.0	337.6
Bentonite Seal	12	41.0	325.6
Secondary Filter Pack			
Filter Pack	53	12.0	284.6
Backfill	0		
Bottom of Borehole	65		272.6

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	55.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	286.39
Bottom Cap	0.28	276.39
Total Depth from TOC	64.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: Chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: Medium Chips
- Manufacturer: NA
- Amount Used: 4 bags

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: NA

Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508729

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 medium (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**65**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
52	**65**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**53**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**65**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**55**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**55**	**65**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

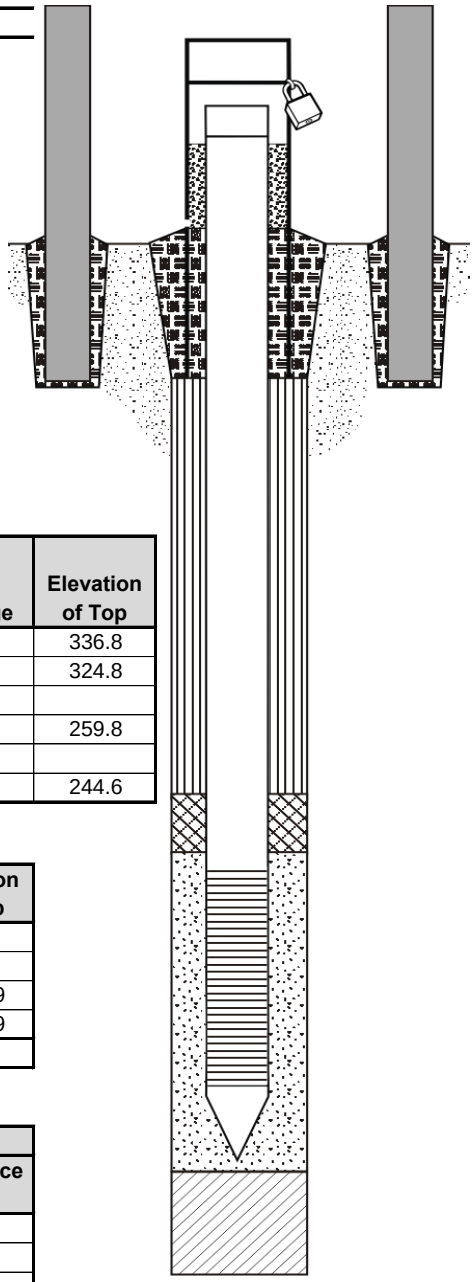
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-53 (SB-8D)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	299148.8657
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924273.815
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	339.4
Ground Surface (GS)	336.8
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	2/24/2019
Installation Complete	2/26/2019
Well Completed	2/26/2019
Development Start	2/28/2019
Development Complete	3/1/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	12.0	336.8
Bentonite Seal	12	65.0	324.8
Secondary Filter Pack			
Filter Pack	77	16.0	259.8
Backfill	0		
Bottom of Borehole	93		244.6

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	80.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	261.39
Bottom Cap	0.28	251.39
Total Depth from TOC	89.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: Chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: Medium Chips
- Manufacturer: NA
- Amount Used: 16 bags

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: 6 bags

Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508777

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/24/2019** Drilling End Date: **2/26/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**93**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
77	**93**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**77**	**Bentonite 15 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**90**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**
90	**93**	**gray clay (old pit base?)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**80**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**80**	**90**

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Drilling Log

BURNS McDONNELL	Project Name: AEP Pirkey CSM	Project No.: 111173	Boring/Monitoring Well Number: SB-09
	Coordinates: N 6870180 E 3201109.5	Ground Elevation: 319.80	Page: 1 of 5
	Total Depth (feet): 60 / Hole Size (inches): 6.75"	Driller: J. Smith	
Drilling Rig: Ardco 4x4		Drilling Company: MHC X-Ploration	
Date: 3/4/2019	Logged By: D. Barker	Reviewed by:	Approved by:

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
319	1	CLAY, Gray (7.5YR 6/1) to light Gray (7.5YR 7/1), with silt and sand, strong Brown (7.5YR 5/6 to 5/8) and Red (2.5YR 4/6 to 4/8), damp, soft, high plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	Log from soil cuttings from 0'-5'.
318	2										
317	3										
316	4										
315	5										
314	6	SILT, with clay, with very fine grained sand, very dark Gray (7.5YR 3/1) to dark Brown (7.5YR 3/2) to strong Brown (7.5YR 5/6), damp, soft, trace plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	Sampled SB-09 5'-6'
		3 Feet of slough (Based on driller's feel).									
313	7										
312	8							0.5/5			
311	9										
310	10	SAND, with silt, with clay, pinkish Gray (7.5YR 7/2) to strong Brown (7/5YR 5/6) to Red (2.5YR 4/6 to 4/8), very fine to fine grained, damp, loose; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	No free water observed
309	11	CLAY, trace silt, trace sand, very dark Gray (7.5YR 3/1) to dark Brown (7.5YR 3/2) to Brown (7.5YR 5/3), damp, soft, high plasticity; FILL. Mine Reclaim									
308	12							0.5/5			
307	13										
306											

Depth to water while drilling

Depth to water after drilling

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-09
Page	2 of 5
Date	3/4/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
305	15	CLAY, trace silt, trace sand, very dark Gray (7.5YR 3/1) to dark Brown (7.5YR 3/2) to Brown (7.5YR 5/3), damp, soft, high plasticity; FILL. Mine Reclaim		NA	NA	NA	NA	NA 0.5/5	NA	NA	
304	16	SAND, with silt, with clay, very dark Gray (7.5YR 3/1) to dark Brown (7.5YR 3/2), very fine grained, damp; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
303	17	1 Foot of slough (Based on driller's feel).									
302	18	SILT and SAND and CLAY, pinkish White (7.5YR 8/2) to dark Red (2.5YR 3/6), very fine to fine grained; FILL. Mine Reclaim.						0.5/5			
301	19										
300	20										
299	21	SILT, with sand, with clay, very dark Gray (7.5YR 3/1) to dark Brown (7.5YR 3/2), very fine to fine grained, damp, soft to hard, medium plasticity; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	Log from soil cuttings below 20.0'. Sampled SB-09 20'-21'
298	22										
297	23										
296	24										
295	25										
294	26	SILT and SAND and CLAY, reddish Yellow (7.5YR 6/6); FILL. Mine Reclaim.									
293	27										
292	28										
291											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-09
Page	3 of 5
Date	3/4/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
290	30	SILT and SAND and CLAY, reddish Yellow (7.5YR 6/6); FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
289	31										
288	32										
287	33										
286	34										
285	35										
284	36										
283	37										
282	38										
281	39										
280	40	SILT and SAND and CLAY, reddish Yellow (7.5YR 6/6), with cemented sand fragments, with lignite fragments; FILL. Mine Reclaim.									
279	41										
278	42										
277	43										
276											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-09
Page	4 of 5
Date	3/4/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
275	45	SILT and SAND and CLAY, reddish Yellow (7.5YR 6/6), with cemented sand fragments, with lignite fragments; FILL. Mine Reclaim.		NA	NA	NA	NA	NA	NA	NA	
274	46										
273	47										
272	48										
271	49										
270	50	SILT and SAND and CLAY, dark Gray (7.5YR 4/1), with cemented sand fragments, with lignite fragments, damp, soft to medium, high plasticity; FILL. Mine Reclaim.									
269	51										
268	52										
267	53										
266	54										
265	55										
264	56										
263	57										
262	58										
261											

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-09
Page	5 of 5
Date	3/4/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
				NA	NA	NA	NA	NA	NA	NA	
260	60	Boring terminated at 60 feet bgs.									Temporary Piezometer Installed on 3/4/2019
	61										
	62										
	63										
	64										
	65										
	66										
	67										
	68										
	69										
	70										
	71										
	72										
	73										

AEP_PIRKEY_SOILBORINGLOGS.GPJ 5/9/19

Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-54 (SB-9S)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	298239.4104
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924320.3597
Driller:	Jason Smith	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

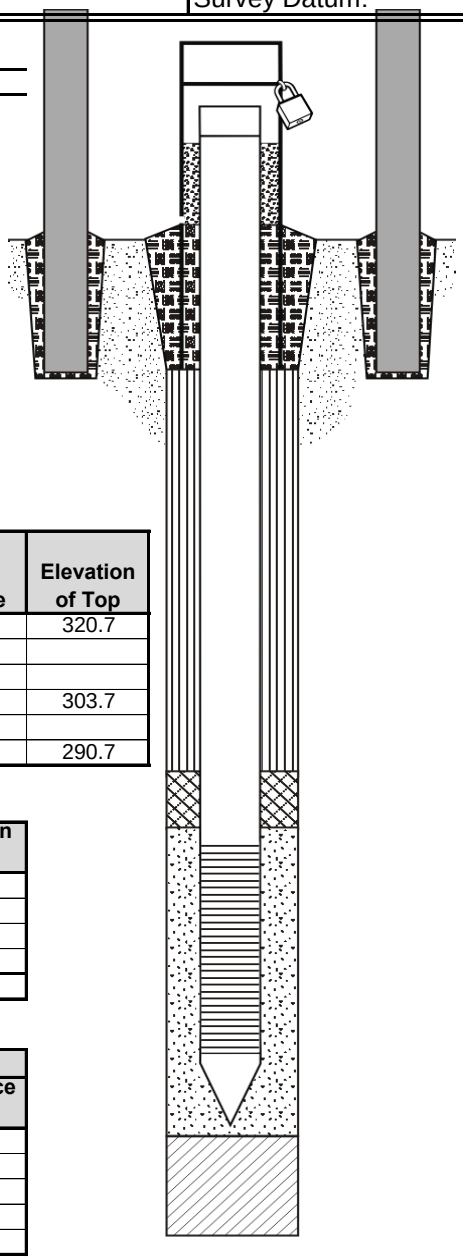
Elevations	
Top of Casing (TOC)	323.7
Ground Surface (GS)	320.7
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	3/5/2019
Installation Complete	3/5/2019
Well Completed	3/18-25/2019
Development Start	3/6/2019
Development Complete	3/6/2019

Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal		17.0	320.7
Bentonite Seal	0		
Secondary Filter Pack			
Filter Pack	17	13.0	303.7
Backfill	0		
Bottom of Borehole	30		290.7

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	30.00	NA
Total Riser Cutoff	7.12	NA
Screen	10.00	300.82
Bottom Cap	0.43	290.82
Total Depth from TOC	33.31	

Groundwater Levels		
Date & Time	Depth	Reference Point



Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
Material: steel
Size: 4"
Length: 5'
Pea Gravel (Y/N): N
Weep Hole (Y/N): N
Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
Dimensions: 4' x 4' x 4"
Material: concrete

Annular Seal:
Type & Size: bentonite chips 3/8"
Manufacturer: Cetco
Amount Used: 1 bag / 50 lbs

Bentonite Seal:
Type & Size: pellets 3/8"
Manufacturer: PDS
Amount Used: 1 bucket / 50 lbs

Secondary Filter Pack:
Type & Size: --
Manufacturer: --
Amount Used: --

Primary Filter Pack:
Type & Size: sand 16/30
Manufacturer: U.S. Silica Company
Amount Used: 7.5 bags / 375 lbs

Well Casing:
Type: PVC
Diameter: 2"
Sch. or Weight: Sch. 40
Manufacturer: Campbell Monoflex
Screen Type: PVC factory slot
Screen Slot Size: 0.010"
Bottom Cap Type: threaded

Centralizers (Y/N): N
Material: --
Number: --
Depth(s): --

Backfill Material:
Type & Size: NA
Manufacturer: --
Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508781

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/5/2019** Drilling End Date: **3/5/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**30**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
17	**30**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**17**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**30**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**20**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**20**	**30**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-55 (SB-9D)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	298238.4991
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924332.0518
Driller:	Jason Smith	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

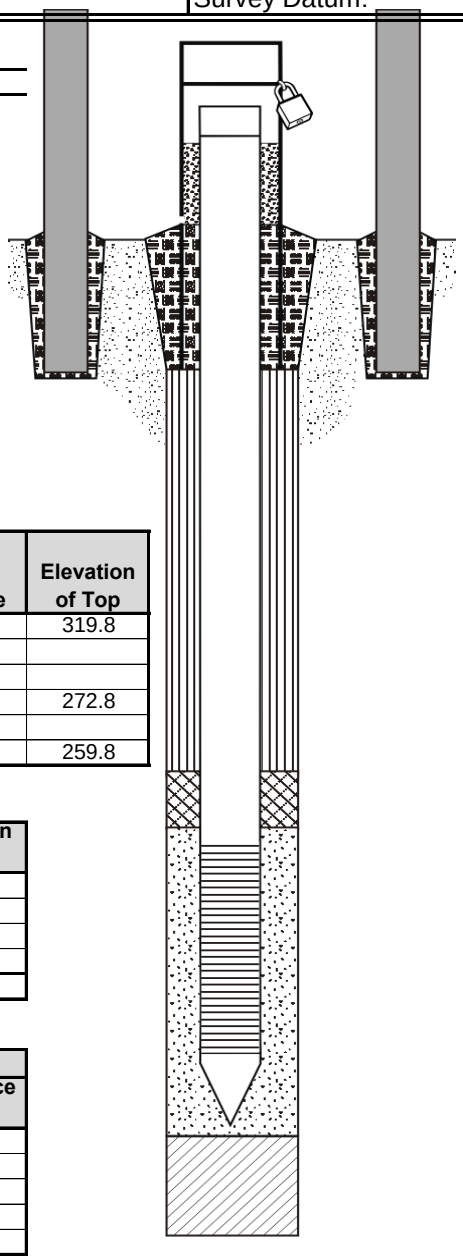
Elevations	
Top of Casing (TOC)	321.9
Ground Surface (GS)	319.8
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	3/4/2019
Installation Complete	3/4/2019
Well Completed	3/18-25/2019
Development Start	3/5/2019
Development Complete	3/5/2019

Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal		47.0	319.8
Bentonite Seal	0		
Secondary Filter Pack			
Filter Pack	47	13.0	272.8
Backfill	0		
Bottom of Borehole	60		259.8

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	60.00	NA
Total Riser Cutoff	7.89	NA
Screen	10.00	269.79
Bottom Cap	0.43	259.79
Total Depth from TOC	62.54	

Groundwater Levels		
Date & Time	Depth	Reference Point



Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
Material: steel
Size: 4"
Length: 5'
Pea Gravel (Y/N): N
Weep Hole (Y/N): N
Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
Dimensions: 4' x 4' x 4"
Material: concrete

Annular Seal:
Type & Size: bentonite chips 3/8"
Manufacturer: Cetco
Amount Used: 8 bags / 400 lbs

Bentonite Seal:
Type & Size: pellets 3/8"
Manufacturer: PDS
Amount Used: 2 buckets / 100 lbs

Secondary Filter Pack:
Type & Size: --
Manufacturer: --
Amount Used: --

Primary Filter Pack:
Type & Size: sand 16/30
Manufacturer: U.S. Silica Company
Amount Used: 5 bags / 250 lbs

Well Casing:
Type: PVC
Diameter: 2"
Sch. or Weight: Sch. 40
Manufacturer: Campbell Monoflex
Screen Type: PVC factory slot
Screen Slot Size: 0.010"
Bottom Cap Type: threaded

Centralizers (Y/N): N
Material: --
Number: --
Depth(s): --

Backfill Material:
Type & Size: NA
Manufacturer: --
Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508779

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/4/2019** Drilling End Date: **3/4/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**60**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
48	**60**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**48**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**60**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**50**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**50**	**60**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Drilling Log

BURNS McDONNELL	Project Name: AEP Pirkey CSM	Project No.: 111173	Boring/Monitoring Well Number: SB-11
	Coordinates:	Ground Elevation:	Page: 1 of 3
	Total Depth (feet): 43 / Hole Size (inches): 6.75"	Driller: J. Smith	
Drilling Rig: Ardco 4x4		Drilling Company: MHC X-Ploration	
Date: 3/7/2019	Logged By: J.Hermanson	Reviewed by:	Approved by:

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
	0	SILT, Brown (7.5YR 4/2), with very fine grained sand, damp, low to medium, low to medium plasticity; FILL.									Depth to water while drilling; Depth to water after drilling
	1–5	clayey GRAVEL, gravel-sand-clay mixture, strong Brown (7.5YR 5/6), coarse grained gravel, fine grained sand, wet, trace to medium plasticity; FILL.		MC	1		NA	4/5	NA	NA	
	5–7	CLAY, dark yellowish Brown (10YR 4/6), some sand, damp to moist, medium plasticity; CL.		MC	2		NA	3/5	NA	NA	
	7–8	SAND, light Gray (7.5YR 7/1), fine grained, trace clay, damp, medium density; SP.									
	8–9	CLAY, light Gray (7.5YR 7/1) with reddish Brown (5YR 5/9) mottling, some sand, damp to moist, trace to medium plasticity; CL.									
	10–11	SAND, pinkish Gray (7.5YR 7/2), fine grained, trace clay, wet, medium density; SP.									Free water observed at approximately 10.0'
	11–12	CLAY, light reddish Gray (2.5YR 7/1), trace sand, damp, medium density, medium plasticity; CL.		MC	3		NA	3/5	NA	NA	
	12–13										

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-11
Page	2 of 3
Date	3/7/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
	15	clayey GRAVEL, gravel-sand-clay mixture, strong Brown (7.5YR 5/6), fine grained gravel, fine grained sand, moist to wet; GC.		MC	3		NA	3/5	NA	NA	
	16	CLAY, light Gray (7.5YR 7/1), trace sand, damp to moist, soft to medium, medium plasticity; CL. - increasing sand and moisture content below 15.6'									
	17	CLAY, light Gray (5YR 7/1), some sand, with sand laminations, damp to moist, medium to stiff, trace to medium plasticity; CL. - increased moisture content below 17.5'		MC	4		NA	4/5	NA	NA	
	18	SAND, Gray (7.5YR 5/1), very fine grained, with clay laminations, trace iron ore laminations, dry, dense; SP.									
	19										
	20										
	21			MC	5		NA	4/5	NA	NA	
	22										
	23										
	24	- iron ore laminations grade out, increased sand content below 24.0'									
	25										
	26										
	27			MC	6		NA	5/10	NA	NA	
	28										

Drilling Log, continued

BURNS McDONNELL

Project Name	AEP Pirkey CSM
Project Number	111173
Boring/Monitoring Well Number	SB-11
Page	3 of 3
Date	3/7/2019

Elevation (MSL)	Depth (feet bgs)	Description	Graphic Log	Sample Type	Sample Number	Blow Count	N Value	Sample Recovery/Length (feet)	Penetrometer (tsf)	PID Reading (ppm)	Remarks
	30	SAND, Gray (7.5YR 5/1), very fine grained, with clay laminations, trace iron ore laminations, dry, dense; SP.		MC	6		NA	5/10	NA	NA	
	31										
	32										
	33										
	34										
	35										
	36										
	37										
	38										
	39			MC	7		NA	8/8	NA	NA	
	40	SAND, dark Gray (7.5YR 4/1), very fine grained, trace clay, moist, medium density; SP.									
	41										
	42	SAND, Gray (7.5YR 5/1), very fine grained, with clay laminations, dry, dense; SP.									
	43	Refusal on obstruction - End of boring at 43 feet bgs.									Abandoned with cement-bentonite grout on 3/7/2019

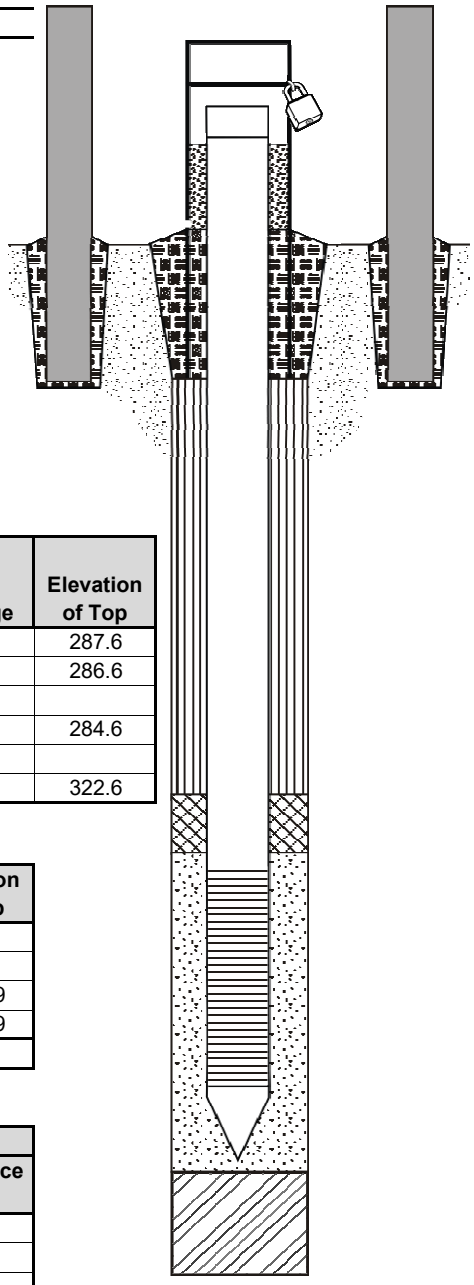
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-56 (SB-11S)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	296233.6811
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924310.063
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	290.0
Ground Surface (GS)	287.6
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	3/8/2019
Installation Complete	3/8/2019
Well Completed	3/8/2019
Development Start	3/10/2019
Development Complete	3/11/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	1.0	287.6
Bentonite Seal	1	2.0	286.6
Secondary Filter Pack			
Filter Pack	3	12.0	284.6
Backfill	0		
Bottom of Borehole	15		322.6

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	5.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	336.39
Bottom Cap	0.28	326.39
Total Depth from TOC	14.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: Chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: Medium Chips
- Manufacturer: NA
- Amount Used: 1 bag

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: 6 bags

Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

STATE OF TEXAS WELL REPORT for Tracking #508718

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-11 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 26' 41" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/8/2019** Drilling End Date: **3/8/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**15**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
3	**15**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Cement**
1	**3**	**Bentonite 5 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**tan and brown sandy, silty clay and occasional gravel**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**15**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

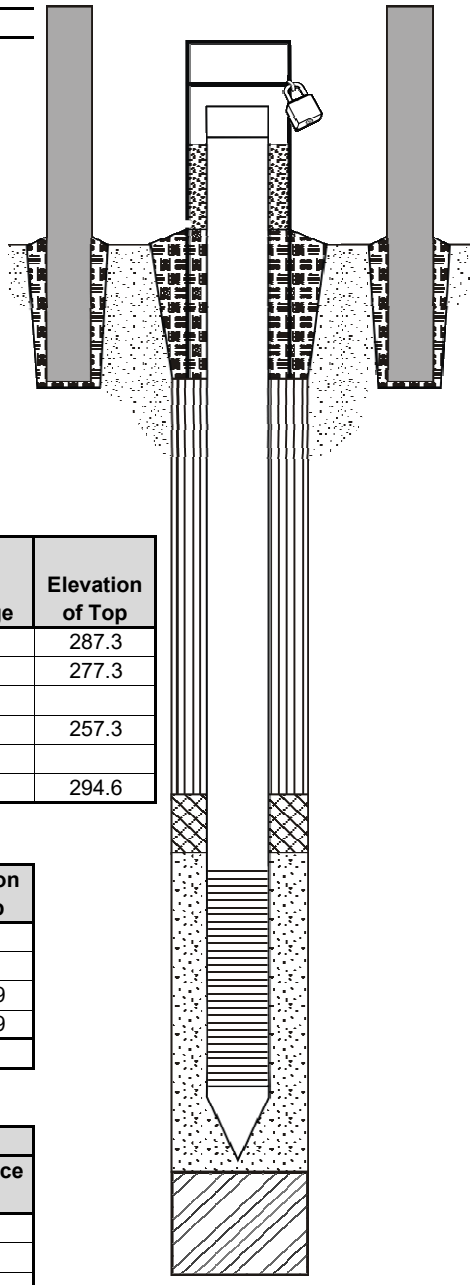
Monitoring Well Construction Diagram

Project Number:	111173	**Well Number:**	**AD-57 (SB-11D)**
Project Name:	AEP-Pirkey	**Property Owner:**	AEP
Geologist:	David Barker	Northing:	296232.0764
Drilling Company:	MHC X-Ploration Corporation	Easting:	2924300.047
Driller:	James K. Collum	Survey Datum:	Texas State Plane North Central (4202)

Drilling Method: Rotary Wash
Borehole Diameter: 6.75-inch

Elevations	
Top of Casing (TOC)	290.0
Ground Surface (GS)	287.3
Reference Point (RP)	ground surface

Dates	
Drilling/Installation Start	3/7/2019
Installation Complete	3/8/2019
Well Completed	3/8/2019
Development Start	3/10/2019
Development Complete	3/11/2019



Annular Material Measurements	Depth to Top from GS	Total Footage	Elevation of Top
Annular Seal	0	10.0	287.3
Bentonite Seal	10	20.0	277.3
Secondary Filter Pack			
Filter Pack	30	13.0	257.3
Backfill	0		
Bottom of Borehole	43		294.6

Casing Materials Measurements	Total Footage	Elevation of Top
Total Riser Installed	33.00	NA
Total Riser Cutoff	0.69	NA
Screen	10.00	308.39
Bottom Cap	0.28	298.39
Total Depth from TOC	42.59	

Groundwater Levels		
Date & Time	Depth	Reference Point

Cap Type: J-plug
Lock Keyed to: AEP monitoring well

Protective Cover:
- Material: steel
- Size: 4"
- Length: 5'
- Pea Gravel (Y/N): N
- Weep Hole (Y/N): N
- Guage Mark (Y/N): Y

Bollards (# and type): 4 - steel

Surface Pad:
- Dimensions: 4' x 4' x 4"
- Material: concrete

Annular Seal:
- Type & Size: Chips
- Manufacturer: NA
- Amount Used: (included with bentonite seal)

Bentonite Seal:
- Type & Size: Medium Chips
- Manufacturer: NA
- Amount Used: 5 bags

Secondary Filter Pack:
- Type & Size: --
- Manufacturer: --
- Amount Used: --

Primary Filter Pack:
- Type & Size: sand 16/30
- Manufacturer: NA
- Amount Used: 5 bags

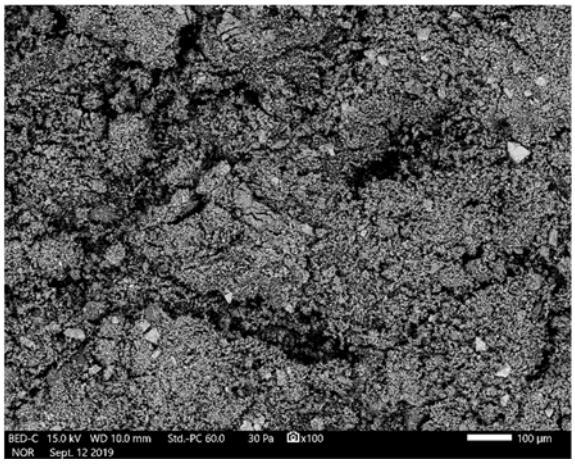
Well Casing:
- Type: PVC
- Diameter: 2"
- Sch. or Weight: Sch. 40
- Manufacturer: Environmental Manufacturing
- Screen Type: PVC factory slot
- Screen Slot Size: 0.010"
- Bottom Cap Type: threaded

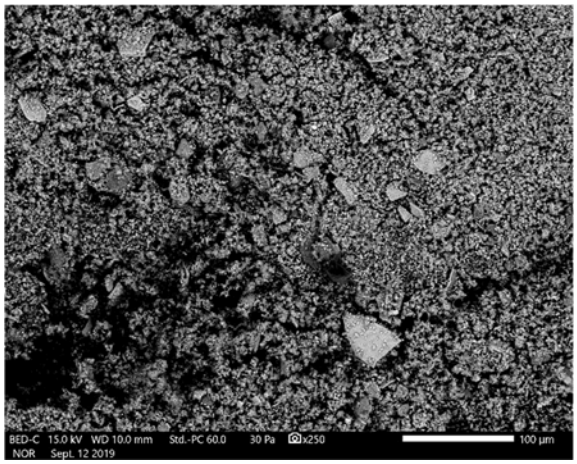
Centralizers (Y/N): N
- Material: --
- Number: --
- Depth(s): --

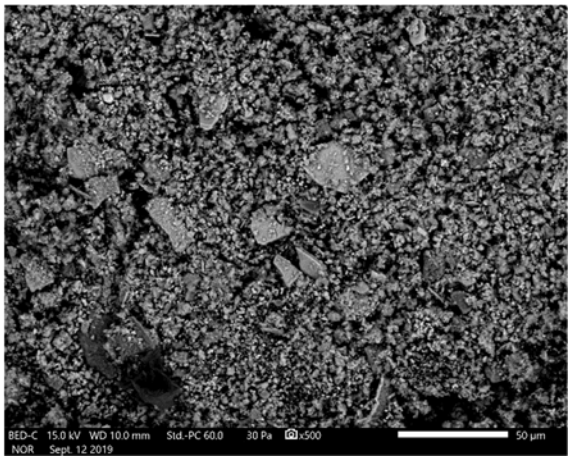
Backfill Material:
- Type & Size: NA
- Manufacturer: --
- Amount Used: --

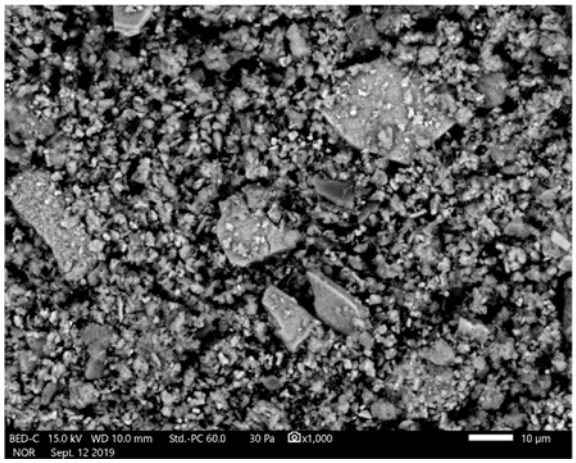
ATTACHMENT B
SEM/EDS Analysis

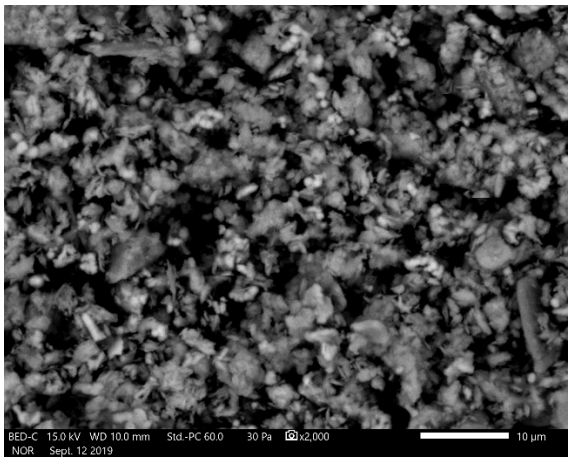
Geosyntec
CTLGroup 150350

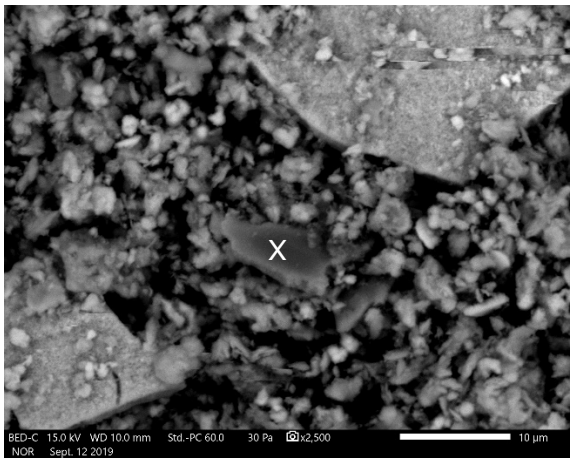


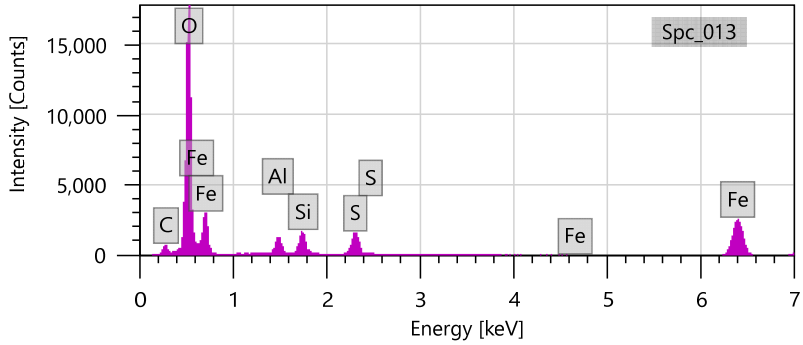












Sample AD-34. BSE spectrum is an area scan for the region shown at 2,000X. Most large blocky particles are quartz or feldspar. X is clay.

CTLGROUP
www.CTLGroup.com

ATTACHMENT C
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey FGD LF CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
8217 Shoal Creek Blvd., Suite 200
Austin, TX 78757

Texas Registered Engineering Firm
No. F-1182

79864	Texas	10/3/2019
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant
Landfill
Hallsville, Texas

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, OH 43221

January 7, 2020

CHA8462

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LF	Landfill
MCL	Maximum Contaminant Level
RCRA	Resource Conservation and Recovery Act
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SU	Standard Units
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the Landfill (LF). Eight background monitoring events were conducted at the LF, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Interwell tests were used to calculate background for pH, sulfate, and total dissolved solids (TDS), and intrawell tests were used for boron, calcium, chloride, and fluoride. During the initial detection monitoring event completed in August 2017, statistically significant increases (SSIs) for boron, sulfate, and TDS were observed, and the unit transitioned to assessment monitoring. Semi-annual assessment monitoring events were conducted at the LF between March 2018 and May 2019 in accordance with 40 CFR 257.95.

In 2019, AEP collected additional geologic data in the vicinity of the LF and updated the conceptual site model. Based on this updated interpretation, it has been determined that interwell upper prediction limits (UPLs) are not appropriate for detection monitoring.

United States Environmental Protection Agency (USEPA) regulations (USEPA, 2015) regarding detection monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration (ASD) when an SSI is identified (40 CFR 257.94(e)(2)):

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.*

Pursuant to 40 CFR 257.94(e)(2) of the CCR Rule (40 CFR 257), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents: (1) the change from interwell to intrawell background values for all Appendix III parameters; (2) the alternative source for sulfate and TDS (statistical evaluation cause) in August 2017; (3) exceedances and possible exceedances observed for Appendix III parameters between August 2017 and February 2019; and (iv) the alternative source for boron (natural variation) in August 2017.

SECTION 2

SUMMARY OF GROUNDWATER MONITORING

2.1 Monitoring Network

The groundwater monitoring network for the Pirkey LF currently consists of three upgradient wells (AD-8, AD-16, and AD-27), and three downgradient wells (AD-23, AD-34, and AD-36) (Figure 1). Following the initial detection monitoring event, these wells have been monitored on a semi-annual basis in accordance with 40 CFR 257.95 for Appendix IV parameters. AD-35 was monitored between August 2017 and August 2018 as a downgradient well in the monitoring network before being removed in November 2018 due to landfill expansion activities. Thus, a discussion of AD-35 is not included in this report. AD-35 was replaced by a new downgradient monitoring well, AD-36, which was installed in April 2019 and added to the monitoring network. Eight sampling events are currently being completed at AD-36 to establish background at this well.

2.2 Statistics Completed to Date

2.2.1 Background Established 2018

Between May 2016 and April 2017, sampling was completed at each of the network wells to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. The monitoring well data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis in accordance with the statistical analysis plan developed for the unit (AEP, 2017) and USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The background data were reviewed for outliers, which were removed (when appropriate) prior to calculating UPLs for each Appendix III parameter to represent background values. Interwell tests were selected for pH, sulfate, and TDS, whereas intrawell tests were selected for boron, calcium, chloride, and fluoride (Geosyntec, 2018a).

A 1-of-2 resample plan was established for both interwell and intrawell tests to determine if there were exceedances above background values. 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 confirm whether there had been an exceedance. If the resample confirms the exceedance, an SSI is identified and the unit transitions to assessment monitoring. If the resample falls within the statistical limit, the initial exceedance is considered to be a false positive result and no further action is necessary. In the case of an SSI, an ASD may be prepared in accordance with 40 CFR 257.94(e)(2), which documents that a source other than the unit caused the SSI and permits the unit to remain in detection monitoring.

2.2.2 Initial Detection Monitoring Event

Detection monitoring began in August 2017 after the background monitoring period. The initial detection monitoring event was completed in August and December 2017. This event resulted in SSIs above background for boron at AD-23 and sulfate and TDS at AD-34 (Geosyntec, 2018a).

Table 1 summarizes the analytical results and compares the results with calculated prediction limits. As shown in Table 1:

- Boron concentrations of 0.0402 mg/L (initial sample) and 0.0450 mg/L (verification sample) exceeded the UPL of 0.030 mg/L at AD-23;
- Sulfate concentrations of 1,231 and 1,020 mg/L exceeded the interwell UPL of 207 mg/L at AD-34; and
- TDS values of 1,128 and 1,260 mg/L exceeded the interwell UPL of 335 mg/L at AD-34.

2.2.3 Assessment Monitoring

The unit transitioned to assessment monitoring after SSIs were identified for boron, sulfate, and TDS. An alternative source for these parameters was not identified at that time. Therefore, background limits were established for the Appendix IV parameters using upper tolerance limits (UTLs) constructed with 95% confidence and 95% coverage using pooled upgradient well data in accordance with the facility's statistical analysis plan (AEP, 2017) and the *Unified Guidance* (USEPA, 2009). Next, the groundwater protection standard (GWPS) for each parameter was established as the greater of the background concentration and either the Maximum Contaminant Level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2).

Two assessment monitoring events for Appendix IV parameters were conducted in March 2018 and August 2018 in accordance with 40 CFR 257.95(b) and 40 CFR 257.95(d)(1), respectively. Following the August 2018 assessment monitoring event, statistically significant levels (SSLs) for cadmium and cobalt were identified at well AD-34 (Geosyntec, 2018b). Specifically:

- The lower confidence limit (LCL) for cadmium (0.00511 mg/L) was above the GWPS of 0.00500 mg/L; and
- The LCL for cobalt (0.277 mg/L) was above the GWPS of 0.0260 mg/L.

An ASD concluding that the elevated concentrations could be attributed to lignite mine spoils in the vicinity of AD-34 was completed (Burns & McDonnell, 2019); thus, the LF unit remained in assessment monitoring.

Following an assessment monitoring event in February 2019, which was completed in accordance with 40 CFR 257.95(d)(1), the data were submitted to GSC for statistical analysis. GWPSs were re-established for the Appendix IV parameters in accordance with the statistical analysis plan

developed for the unit. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at an SSL above the GWPS. SSLs for cobalt and lithium were identified at well AD-34 (Geosyntec, 2019a). Specifically:

- The LCL for cobalt at AD-34 was 0.272 mg/L, which exceeded the GWPS of 0.026 mg/L; and,
- The LCL for lithium at AD-34 was 0.145 mg/L, which exceeded the GWPS of 0.110 mg/L.

An ASD was successfully completed which argued that the cobalt and lithium concentrations were related to the mine spoils near AD-34 (Geosyntec, 2019b).

2.3 Need for Updated Statistical Tests

SSLs of cadmium, cobalt, and lithium were identified at AD-34 during assessment monitoring; however, the elevated concentrations were attributed in ASDs to the presence of lignite mine spoils in the vicinity of AD-34. No other SSLs were identified for the Appendix IV parameters.

The presence of the lignite mine spoils also affects the concentrations of detection monitoring parameters at wells located near the spoils. The SSIs for sulfate and TDS identified during the first detection monitoring event were based on observed exceedances of an interwell UPL for these parameters. At the time an alternative source could not be determined for boron, sulfate, and TDS. However, based on updated knowledge of the site geology and geochemistry, as described subsequently in Section 3, the use of intrawell statistics is more appropriate to evaluate possible exceedances of Appendix III parameters.

SECTION 3

REVIEW OF SITE CONDITIONS

3.1 Site Layout

The LF, including closed, active, and areas under construction, occupies approximately 137 acres (Figure 1). The LF is bound by Brandy Branch Reservoir to the east, the Stormwater Runoff Pond (pond south of AD-34 and AD-36) to the south, former lignite mining areas to the west, and a coal pile and coal pile runoff pond to the north. A portion of the west side of the LF is underlain by former lignite mining (reclaimed) land, which is identified as 'A Area' in Figure 1. The local surface topography slopes to the southwest towards Hatley Creek, located approximately 0.7 miles west of the LF. As discussed in Section 2.1, groundwater in the vicinity of the LF is monitored with a network of upgradient and downgradient wells. As shown in Figure 1, AD-34 is the only downgradient well in the LF monitoring network which is set within mine spoil in the former mining area (A Area).

3.2 Site Geochemistry

A geochemical investigation shows that wells screened within the former mining area have a different groundwater composition than wells screened in undisturbed geology. A Piper diagram was generated to assess whether major ion concentrations are affected by screen placement in the mine spoil area (Figure 2). The Piper diagram shows that AD-34 groundwater appears more similar to wells which were screened in the mine spoil area (AD-25, AD-26, AD-48, AD-49, AD-52 through AD-55) than wells that are in the well network. Groundwater in the mine spoil area is dominated by sulfate and magnesium, whereas wells screened in native material have higher proportions of chloride, sodium, and potassium.

Sulfate and TDS are elevated in wells screened within mine spoils in A Area adjacent to the LF, as shown in Figures 3 and 4, respectively. Increased sulfate and TDS concentrations in waters affected by mine spoils are well known (Skousen and Zipper, 2014; Cunningham and Jones, 1990). The effect of mine spoils on the sulfate and TDS concentrations is supported by the lower reported values at AD-50 (illustrated with a smaller radius circle), which is set within the mine spoil footprint but screened in clean fill.

AD-54 and AD-55, which have the highest sulfate and TDS concentrations in the area, are located more than 1,400 feet from the edge of the LF. Groundwater seepage velocities in the area are consistently less than 25 feet per year (AEP, 2019). Impacts from waste placement would take more than fifty years to reach the AD-54/AD-55 cluster, and waste placement did not start at the unit until 1985. Therefore, elevated concentrations of sulfate and TDS within the mine spoil area are unlikely to be related to a release from the unit and instead can be attributed to the effects of the mine spoils on groundwater chemistry.

Additionally, the concentrations of all Appendix III parameters at AD-34 are consistent over time. As shown in Figure 5, the August 2017 and December 2017 values, which were considered SSIs for sulfate and TDS in the initial statistical evaluation, are within the normal range for this monitoring well. This suggests that there are not ongoing impacts that are affecting groundwater chemistry at AD-34, which would be indicative of a release.

Because AD-34 is the only well in the monitoring network that is screened within mine spoils, intrawell statistics are more appropriate for screening Appendix III parameters for SSIs than the interwell approach.

SECTION 4

STATISTICAL REVISION

4.1 Statistical Output from Groundwater Stats Consulting

The presence of mine spoils near AD-34 and their effect on groundwater chemistry was not known when interwell statistics were selected to calculate background concentrations for pH, sulfate, and TDS following the background monitoring period. After AEP updated their conceptual site model in 2019 and became aware of the issue, the need to modify the statistical tests for these parameters became apparent.

Statistical analysis of the LF data was revised in accordance with the January 2017 Statistical Analysis Plan (AEP, 2017). Intrawell prediction limits were calculated for pH, sulfate, and TDS using the background dataset collected prior to initiation of detection monitoring (Table 2). The intrawell background value UPLs for all Appendix III parameters were then used to determine SSIs at the LF downgradient well network for the detection monitoring data collected between August 2017 and February 2019, which are summarized in Table 3. The tests were selected with using a one-of-two retesting procedure.

The revised statistical output for pH, sulfate, and TDS is provided in Attachment A. While all parameters are included, only the tests for pH, sulfate, and TDS were revised.

4.2 Review of August 2017-February 2019 Detection Monitoring Results

Bold values in Table 1 highlight concentrations above the UPL for Appendix III parameters using the current intrawell background values. Exceedances and possible exceedances were noted for boron, chloride, and pH. An exceedance was only confirmed if two consecutive samples were above the UPL based on the selected one-of-two retesting procedure. These exceedances or possible exceedances are discussed below.

4.2.1 August 2017

As discussed in Section 2.2.2, boron concentrations in well AD-23 for the first detection monitoring event exceeded the intrawell UPL of 0.0300 mg/L, resulting in an SSI. The boron concentrations were 0.0402 mg/L for the August 2017 (initial) and 0.0450 mg/L for the December 2017 (verification) sampling events. However, subsequent samples collected from March 2018 through May 2019 were below the UPL, as shown in Figure 6. Additionally, Figure 7 shows that upgradient well AD-8 has consistently higher concentrations of boron than AD-23. Based on a broader understanding of spatial and temporal variations at the LF, it is concluded that the August and December 2017 boron values represent a temporary increase of natural origin and do not suggest a release from the LF. Therefore, natural variation was determined to be the alternative

source for this exceedance. Certification of this ASD by a certified professional engineer is included with this report as Attachment B.

4.2.2 March 2018

A possible exceedance for boron was noted for well AD-34 in March 2018. Boron was detected at 0.171 mg/L, which is above the intrawell UPL of 0.120 mg/L. Verification sampling was not completed at the time because the unit had transitioned to assessment monitoring, but the subsequent semi-annual monitoring result in August 2018 was below the UPL, as shown in Figure 8. This result is now being considered the verification sampling event; thus, no SSI was identified for boron at AD-34 for the March 2018 sampling event. Subsequent samples for boron at AD-34 were also below the intrawell UPL, suggesting that the March 2018 concentration was a natural variation and not a release from the LF.

4.2.3 August 2018

A possible exceedance for chloride was noted for wells AD-23 and AD-34 in August 2018. Chloride was detected at 9 mg/l in well AD-23, which is above the intrawell UPL of 7.89 mg/L, and at 10 mg/L in well AD-34, which is above the intrawell UPL of 9.2 mg/L. Verification sampling was not completed at the time because the unit had transitioned to assessment monitoring, but subsequent semi-annual monitoring results in February 2019 were below intrawell UPLs for both wells, as shown in Figure 9. These results are now being considered the verification sampling events for both wells; thus, no SSIs were identified for chloride at either well for the August 2018 sampling event.

4.2.4 February 2019

A possible exceedance for pH (5.1 standard units [SU]) was identified at well AD-23 in February 2019. Verification sampling was completed in May 2019, and the pH result of 4.8 did not exceed the intrawell UPL for pH of 4.8 at AD-23. Thus, no SSI was identified.

4.3 Return to Detection Monitoring

SSIs for boron, sulfate, and TDS were concluded for the first detection monitoring period in August 2017, and the evaluation of alternative sources was not pursued given the conceptual site model available at the time. However, with the updated statistical tests for sulfate and TDS presented in this report, there is no longer an SSI of sulfate and TDS at AD-34. Further, the initial higher concentrations for boron are now considered to be representative of natural variation rather than an SSI, as described in Section 4.2.1.

The completion of this ASD to address the SSIs initially reported for boron, sulfate, and TDS removes the regulatory need for assessment monitoring of the LF. Therefore, all data collected during the previous assessment monitoring periods may be evaluated as detection monitoring

events. As demonstrated in Section 4, SSIs are not determined for any of the Appendix III parameters monitored for the LF.

SECTION 5

CONCLUSIONS AND RECOMMENDATIONS

Well AD-34 is the only monitoring location within the Pirkey LF monitoring network that is set within a former mining area. The placement of mine spoils within the former mining area has resulted in different groundwater geochemistry at AD-34 compared to the other locations in the LF network. The information presented in this report supports the position that the detection monitoring statistics should be revised to use intrawell tests for all Appendix III parameters. Revised intrawell prediction limits were calculated using a one-of-two resampling procedure. Using the revised UPLs for sulfate and TDS, no exceedances of sulfate or TDS were identified during the August 2017 detection monitoring event.

All sampling events for Appendix III parameters completed since the end of the background monitoring period were evaluated in Section 4 using intrawell background value UPLs. One SSI was identified for boron during the August 2017 detection monitoring event. Section 4.2.1 of this report provides lines of evidence showing that an alternative source (natural variation) is responsible for the boron SSI. No other SSIs were observed in the sampling events completed from August 2017 through February 2019.

This ASD for sulfate and TDS (statistical evaluation cause) and boron (natural variation) was prepared in accordance with 40 CFR 257.94(e)(2). Certification of this ASD is provided in Attachment B. The unit will return to detection monitoring, and a public posting will be made in accordance with 40 CFR 257.95(e).

SECTION 6

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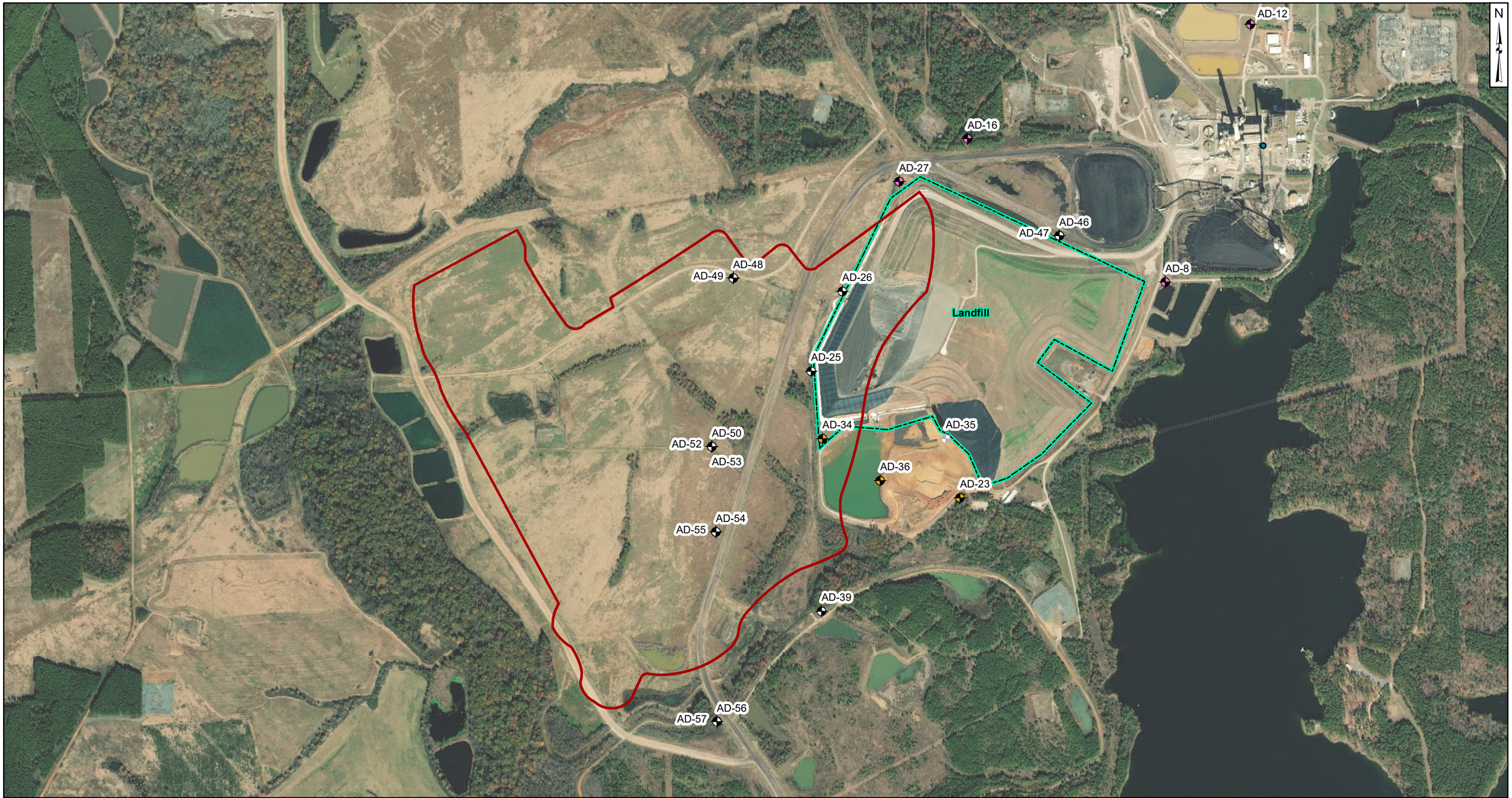
FIGURES



Legend

- Upgradient Well
- Downgradient Well
- Out of Network Well
- Abandoned Well
- A Area
- Landfill

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- A Area is a former lignite (reclaimed) mine.
- AD-35 was abandoned in November 2018 and a new downgradient well, AD-36, was installed in April 2019.
- Aerial imagery provided by DigitalGlobe and dated 12/1/2018.

1,000 500 0 1,000 Feet

Site Layout

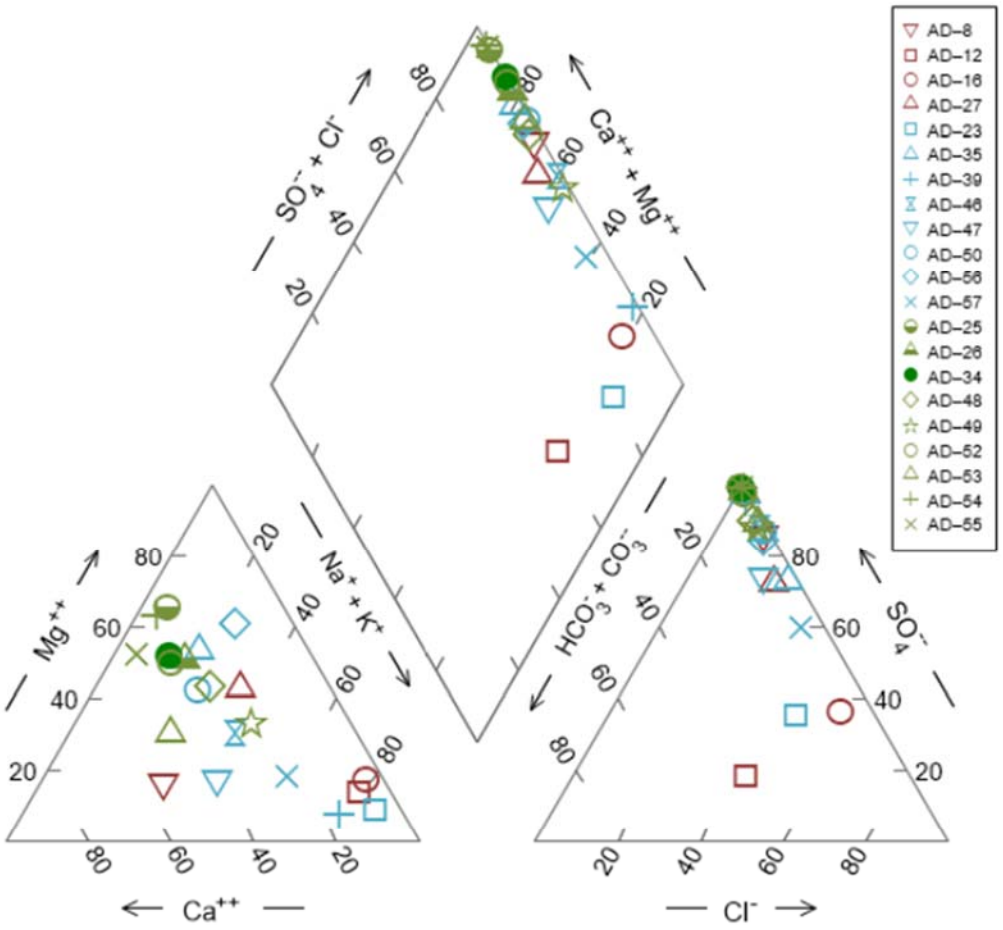
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/06

Figure 1

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_Sitelayout_20191224.mxd. ARevezzo. 1/6/2020. Project/Phase/Task.



Notes: Wells in the LF network use February 2019 data, except AD-8 which used August 2018 data due to an apparent outlier. Wells out of the network use August 2019 data.

Red symbology: Upgradient locations
Blue symbology: Downgradient locations screened in natural geology or clean fill.
Green symbology: Downgradient locations screened in mine fill.

Piper Diagram – Landfill Area Wells
Pirkey Landfill

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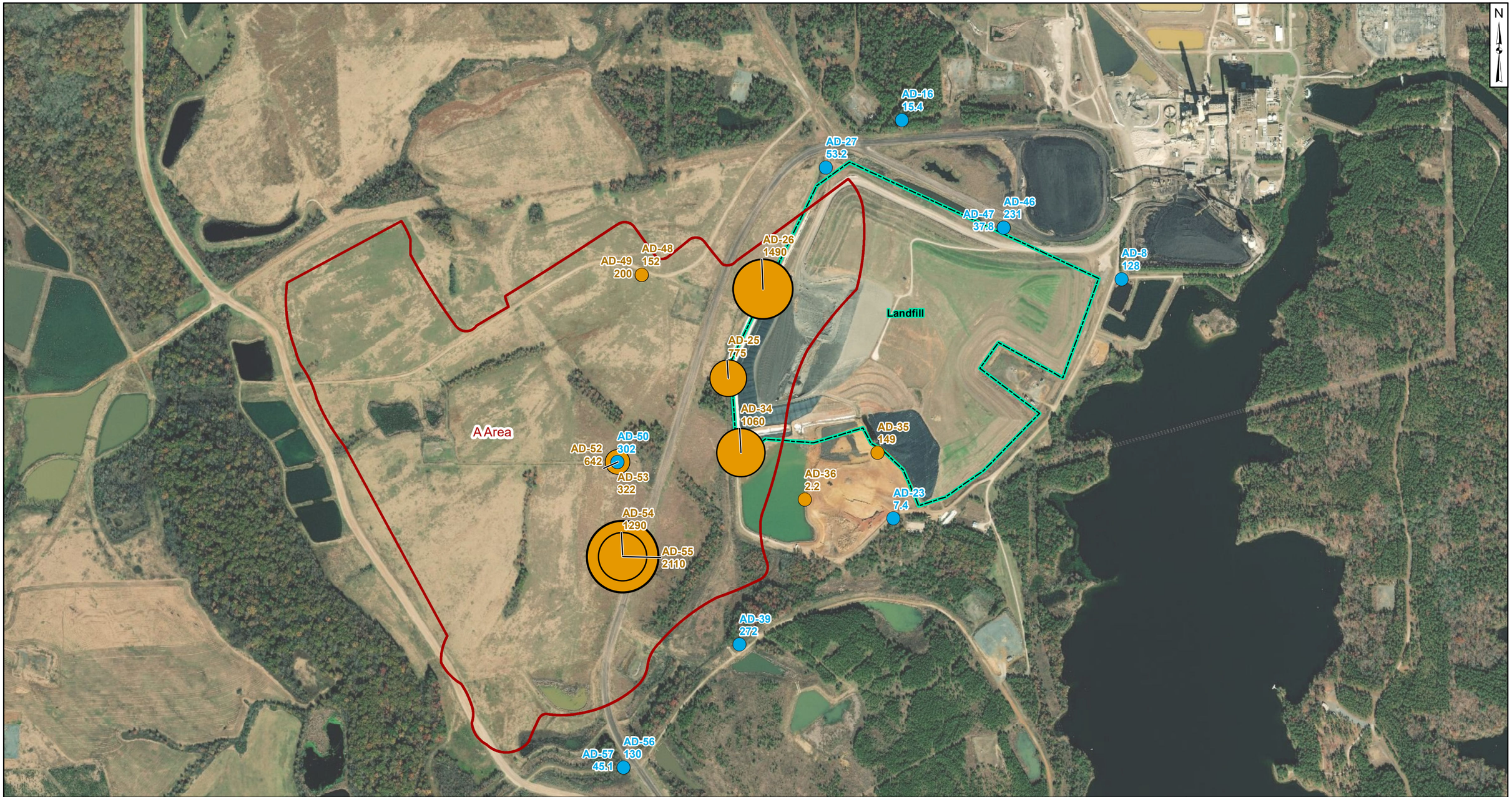
Columbus, Ohio | 19-Sep-2019

Figure 2

internal info: path, date revised, author



Legend

- Wells not screened in mine spoil
- Wells screened in mine spoil
- A Area
- Landfill

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- Size of point symbol corresponds to sulfate concentration.
- Sulfate concentrations displayed in milligrams per liter (mg/L).
- Sulfate concentrations from the August 2019 sampling event are used, as this is the most complete dataset available.
- Sulfate concentrations for monitoring well AD-35 is representated with data from the August 2018 sampling event; AD-25 is represented with data from the February 2019 sampling event.
- A Area is a former lignite (reclaimed) mine.

900 450 0 900
Feet

Landfill Area Sulfate Values

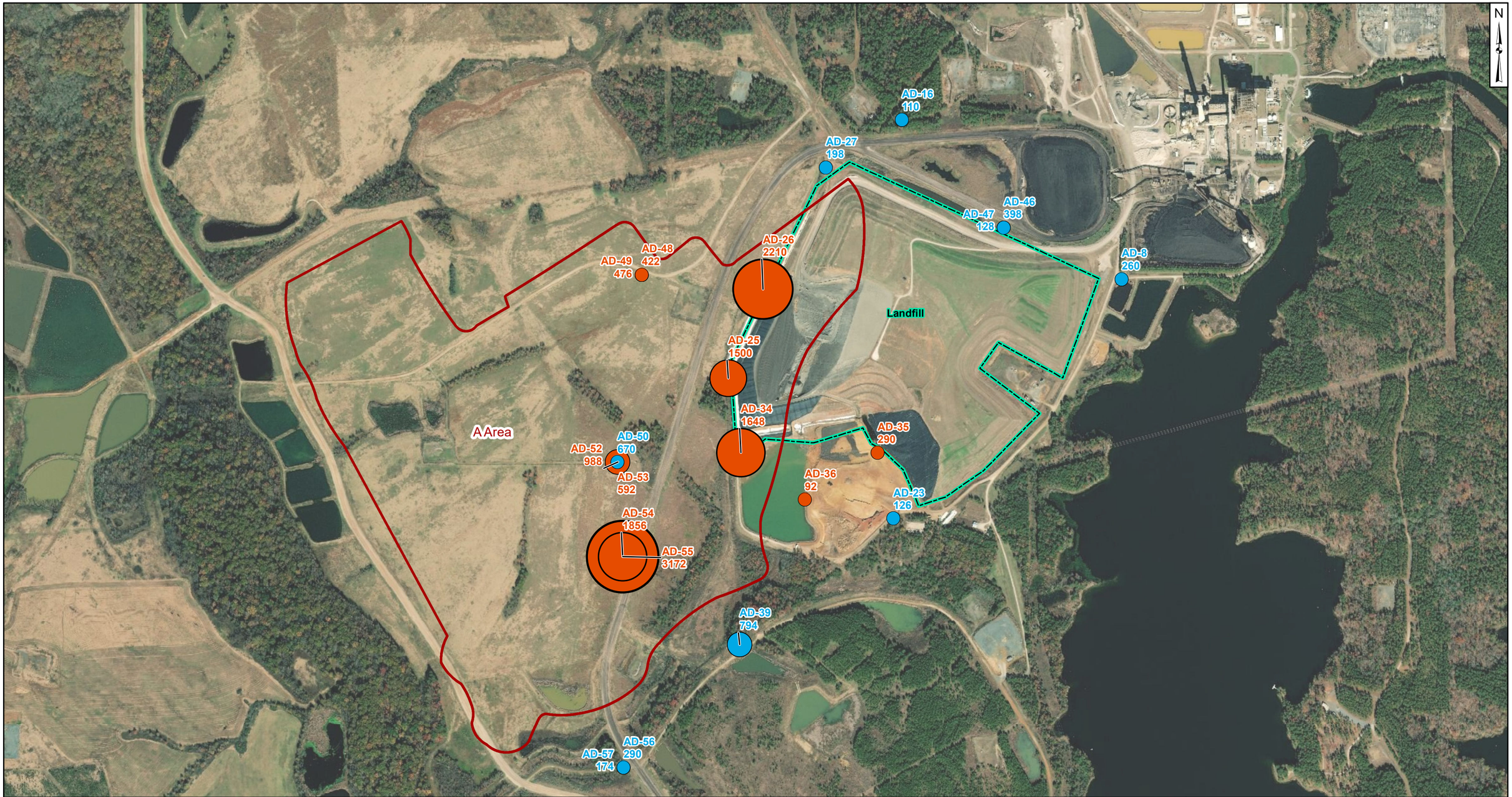
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/06

Figure **3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_PirkeyLF_Sulfate_20191219.mxd. ARevezzo. 1/6/2020.



Legend

- Wells not screened in mine spoil
- Wells screened in mine spoil
- A Area
- Landfill

Notes

- Monitoring well coordinates, site features, and data provided by AEP.
- Size of point symbol corresponds to total dissolved solids (TDS) concentration.
- Total Dissolved Solids (TDS) concentrations displayed in milligrams per liter (mg/L).
- TDS concentrations from the August 2019 sampling event are used, as this is the most complete dataset available.
- TDS concentrations for monitoring well AD-35 is representated with data from the August 2018 sampling event; AD-25 is represented with data from the February 2019 sampling event.
- A Area is a former lignite (reclaimed) mine.

900 450 0 900
Feet

Landfill Area Total Dissolved Soilds Values

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/06

Figure **4**

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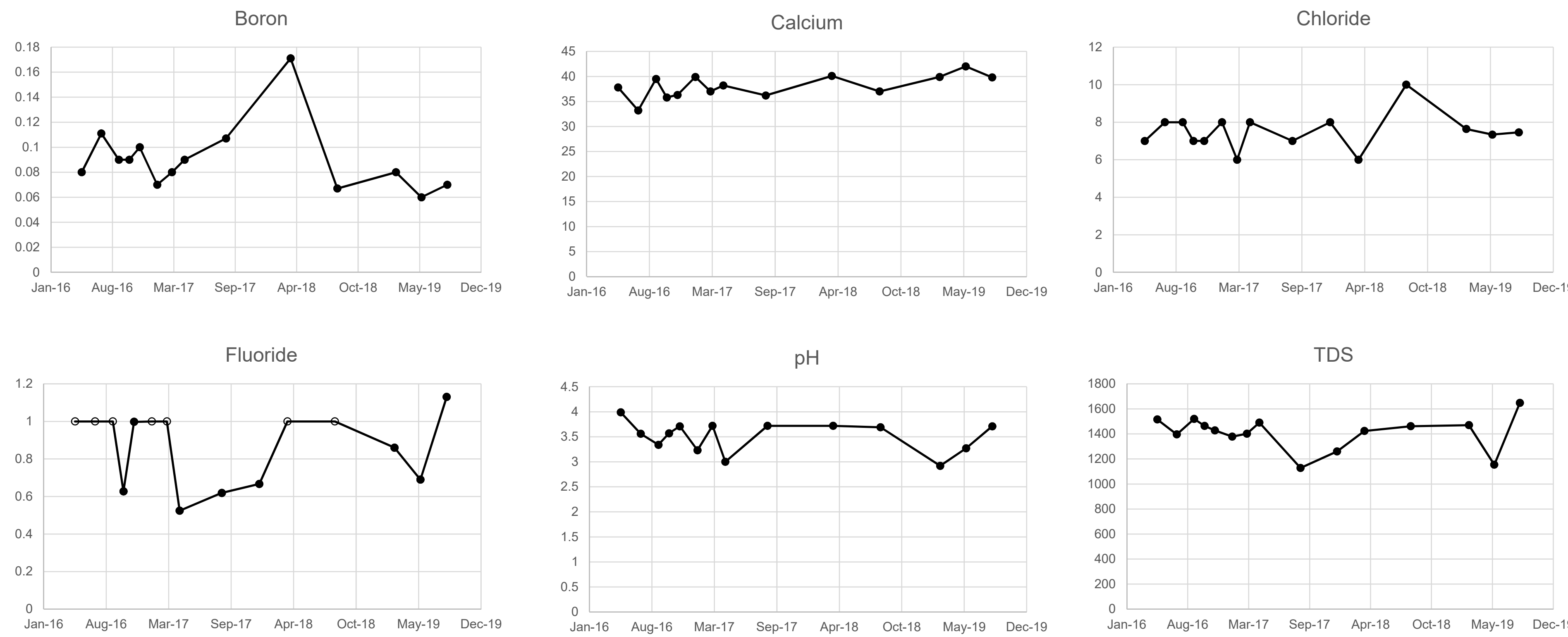
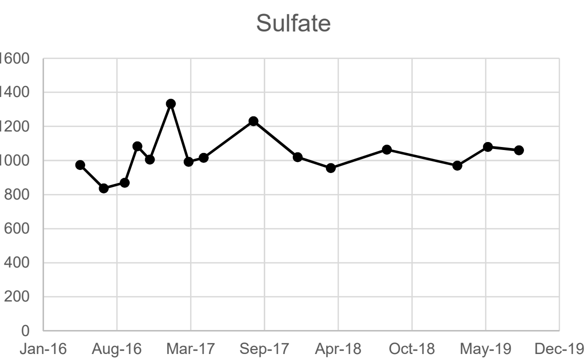




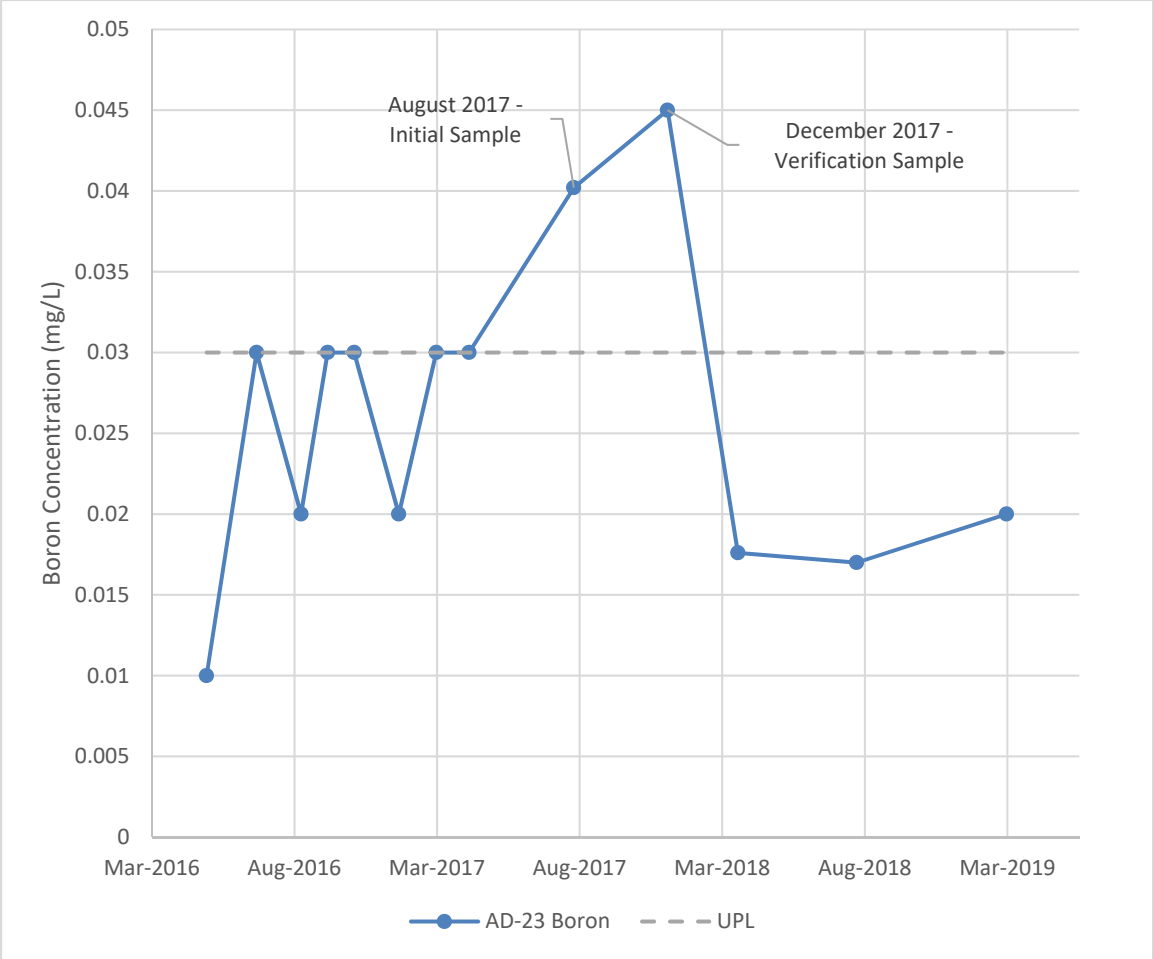
Notes:
- Open circles indicate reporting limit for non-detections
- pH values reported as standard units (SU); all other parameters reported as milligrams per liter (mg/L).

AD-34 Appendix III Time Series Graphs
H.W. Pirkey Power Plant Landfill

Geosyntec consultants

Figure 5

Columbus, OH | 12/20/2019



Notes:
mg/L: milligrams per liter
UPL: Upper prediction limit

AD-23 Boron Time Series Graph
Pirkey Landfill

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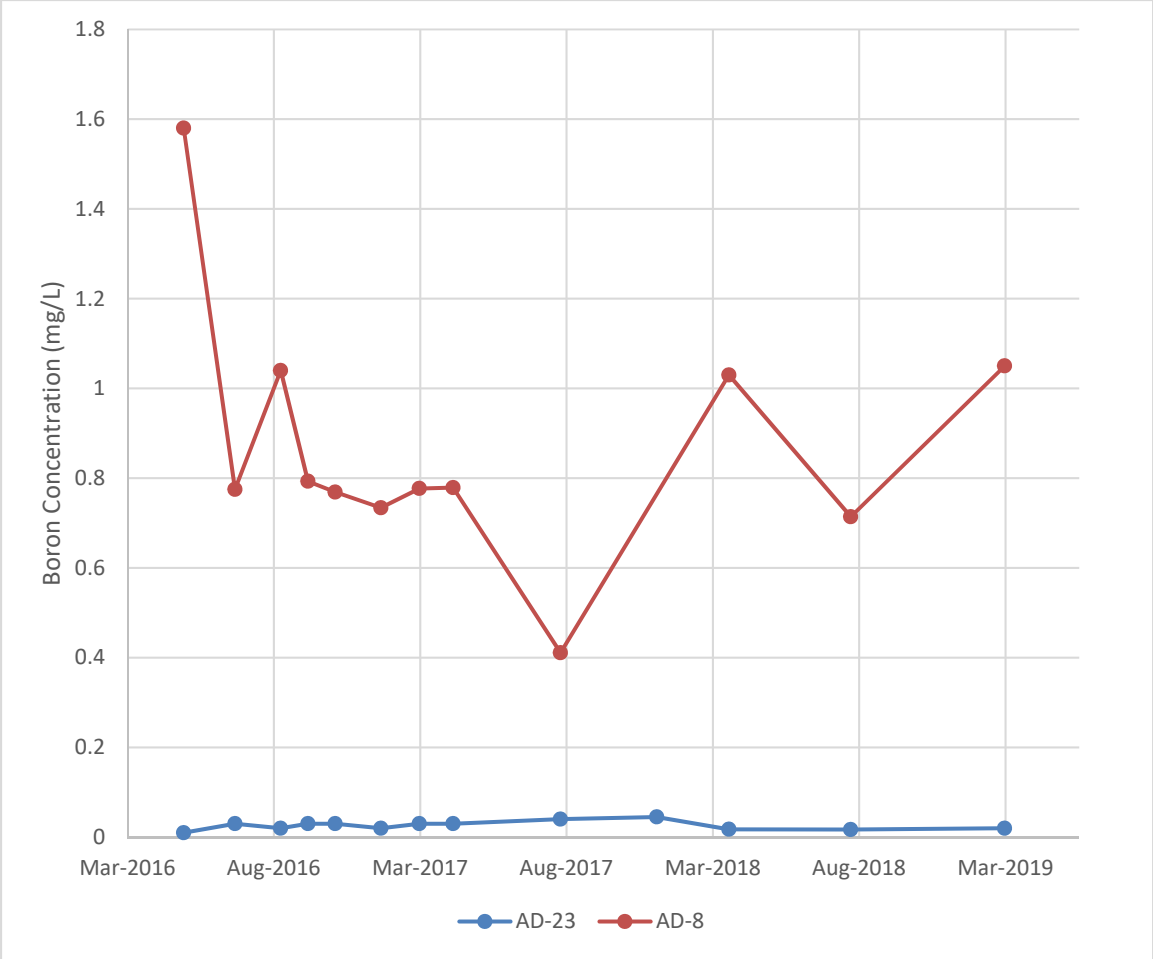
Figure **6**

Columbus, Ohio

12-Dec-2019

internal info: path, date revised, author



Notes:
mg/L: milligrams per liter
AD-8 is an upgradient well in the Pirkey LF monitoring network.

AD-23 and AD-8 Boron Time Series Graphs
Pirkey Landfill

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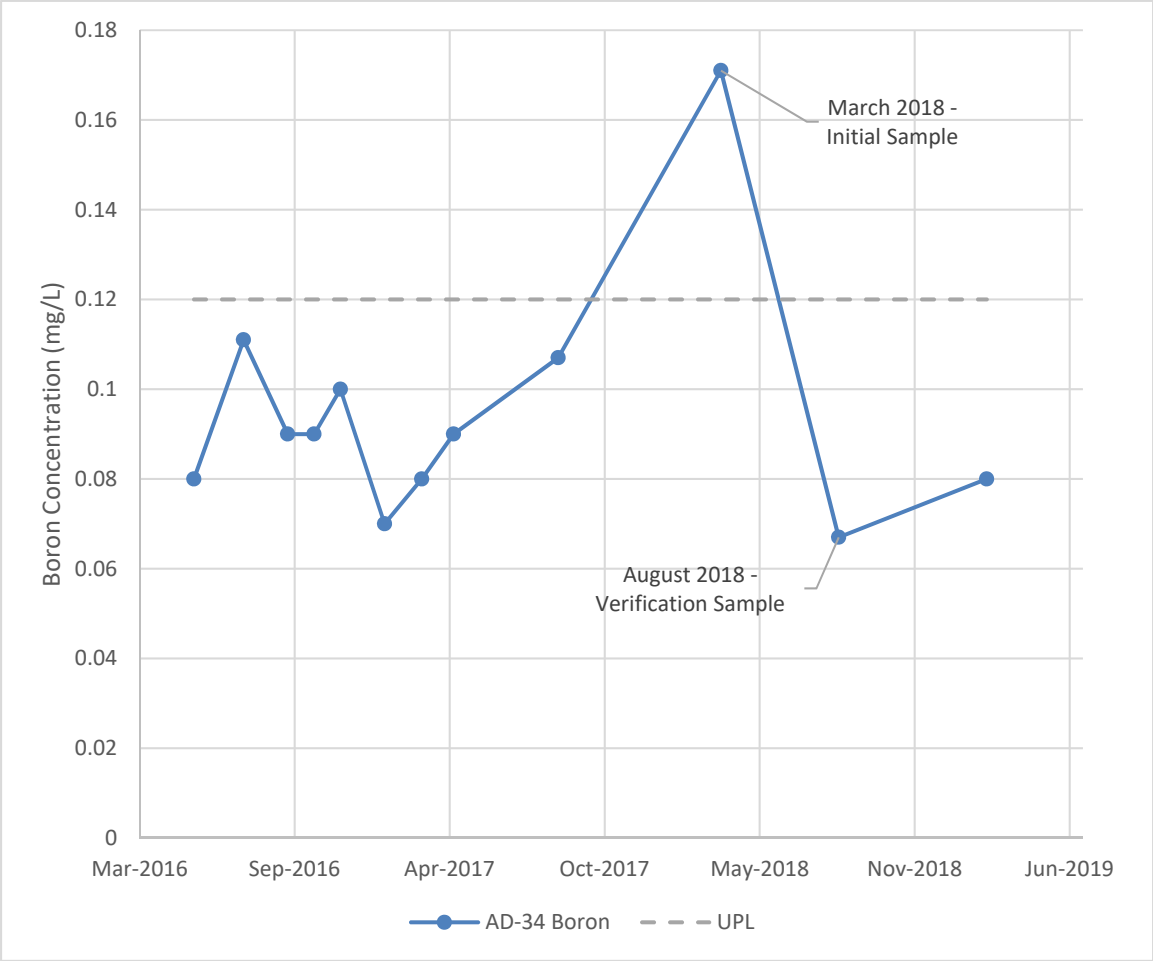
Columbus, Ohio | 12-Dec-2019

Figure **7**

internal info: path, date revised, author



Notes:
mg/L: milligrams per liter
UPL: Upper prediction limit

AD-34 Boron Time Series Graph
Pirkey Landfill

Geosyntec consultants

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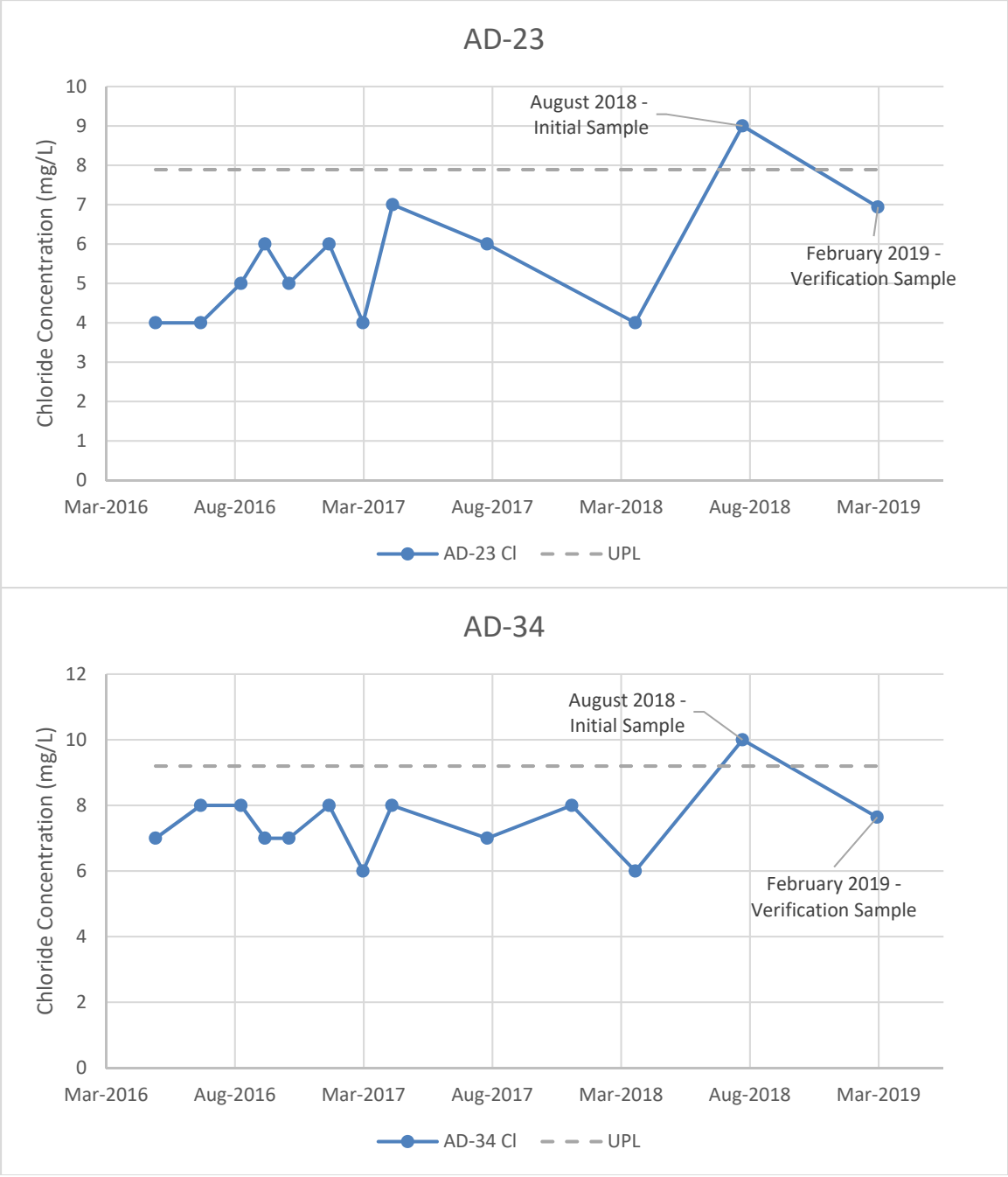
Figure **8**

Columbus, Ohio

12-Dec-2019

internal info: path, date revised, author



Notes:
mg/L: milligrams per liter
UPL: Upper prediction limit

AD-23 and AD-34
Chloride Time Series Graphs
Pirkey Landfill

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 9

Columbus, Ohio | 12-Dec-2019

internal info: path, date revised, author

TABLES

Table 1: Initial Detection Monitoring Data Evaluation
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-23		AD-34		AD-35
			8/23/2017	12/21/2017	8/23/2017	12/21/2017	8/23/2017
Boron	mg/L	Intrawell Background Value (UPL)	0.030		0.120		0.143
		Detection Monitoring Result	**0.0402**	**0.0450**	0.107	--	0.0413
Calcium	mg/L	Intrawell Background Value (UPL)	0.610		42.5		27.7
		Detection Monitoring Result	0.276	0.469	36.2	--	4.33
Chloride	mg/L	Intrawell Background Value (UPL)	7.89		9.2		26.5
		Detection Monitoring Result	6	--	7	8	16
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		1.00		1.00
		Detection Monitoring Result	0.198	--	0.62	0.67	<0.083
pH	SU	Interwell Background Value (UPL)	5.4				
		Interwell Background Value (LPL)	2.5				
		Detection Monitoring Result	4.1	--	3.7	--	4.9
Sulfate	mg/L	Interwell Background Value (UPL)	207				
		Detection Monitoring Result	11.0	--	**1231**	**1020**	35.0
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	335				
		Detection Monitoring Result	64.0	--	**1128**	**1260**	92

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
<: Non-detect value. Parameters which were not detected are shown as less than the MDL.
Background values are shaded gray.
--: Not Sampled
Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the UPL.

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-8							
		5/10/2016	7/13/2016	9/8/2016	10/12/2016	11/15/2016	1/11/2017	2/28/2017	4/11/2017
Antimony	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.005U	0.00117J	0.005U	0.00147J	0.005U	0.00153J	0.00169J	0.005U
Barium	mg/L	0.038	0.061	0.048	0.061	0.052	0.06	0.052	0.051
Beryllium	mg/L	0.001	0.007	0.002	0.006	0.006	0.006	0.006	0.006
Boron	mg/L	1.58	0.775	1.04	0.793	0.769	0.734	0.777	0.779
Cadmium	mg/L	0.001U	0.00018J	0.001U	0.001U	0.00012J	0.00011J	0.00014J	0.00013J
Calcium	mg/L	109	20.7	50.7	20.8	17.2	18.6	18.1	17.1
Chloride	mg/L	9	13	12	13	13	13	10	12
Chromium	mg/L	0.001	0.001	0.00084J	0.00074J	0.00081J	0.002	0.00063J	0.00089J
Cobalt	mg/L	0.0018J	0.02	0.009	0.018	0.018	0.018	0.018	0.019
Combined Radium	pCi/L	0.9155	6.75	1.658	6.72	6.14	6.29	7.64	5.56
Fluoride	mg/L	1U	2	2	2	3	3	2	3
Lead	mg/L	0.00103J	0.00147J	0.005U	0.00231J	0.00286J	0.003J	0.00327J	0.00244J
Lithium	mg/L	0.001U	0.032	0.018	0.032	0.03	0.032	0.031	0.031
Mercury	mg/L	0.00003	0.00021	0.00005	0.00011	0.00016	0.00016	0.00015	0.00001J
Molybdenum	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Selenium	mg/L	0.015	0.005U	0.00385J	0.00251J	0.005U	0.00141J	0.00179J	0.005U
Total Dissolved Solids	mg/L	432	280	285	276	296	280	250	284
Sulfate	mg/L	181	131	121	184	208	228	157	168
Thallium	mg/L	0.0012J	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	6.1	6.2	5.1	3.7	3.7	3.6	3.7	3.9

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-12							
		5/11/2016	7/13/2016	9/7/2016	10/12/2016	11/14/2016	1/11/2017	2/28/2017	4/11/2017
Antimony	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Barium	mg/L	0.026	0.023	0.03	0.027	0.028	0.023	0.026	0.024
Beryllium	mg/L	0.00022J	0.00019J	0.00023J	0.00015J	0.00015J	0.00013J	0.00015J	0.00016J
Boron	mg/L	0.03	0.03	0.04	0.03	0.04	0.03	0.04	0.05
Cadmium	mg/L	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U	0.001U
Calcium	mg/L	0.362	0.26	0.343	0.271	0.331	0.315	0.434	0.299
Chloride	mg/L	5	6	6	7	8	7	5	6
Chromium	mg/L	0.00071J	0.00069J	0.00035J	0.00053J	0.00033J	0.00065J	0.00033J	0.00042J
Cobalt	mg/L	0.00158J	0.00129J	0.00167J	0.00157J	0.00147J	0.00109J	0.0013J	0.00133J
Combined Radium	pCi/L	0.2073	2.909	0.881	0.257	0.767	1.536	0.416	0.3895
Fluoride	mg/L	1U	1U	1U	1U	1U	1U	1U	0.2565J
Lead	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Lithium	mg/L	0.001U	0.008	0.01	0.012	0.013	0.01	0.009	0.008
Mercury	mg/L	0.00002U	0.00002U	0.00002U	0.00002U	0.00002U	0.00002U	0.00002U	0.00001J
Molybdenum	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Selenium	mg/L	0.00174J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Total Dissolved Solids	mg/L	94	75	63	92	80	76	50	72
Sulfate	mg/L	4	4	7	8	6	6	4	7
Thallium	mg/L	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.00099J	0.002U
pH	SU	4.4	3.1	3.9	3.4	2.6	4.8	3.6	4.7

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Parameter	Unit	AD-16							
		5/10/2016	7/14/2016	9/8/2016	10/13/2016	11/14/2016	1/11/2017	3/1/2017	4/10/2017
Antimony	mg/L	0.005U	0.005U	0.008	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.00183J	0.005U	0.005U	0.00152J	0.005U	0.005U	0.00151J	0.005U
Barium	mg/L	0.061	0.064	0.07	0.056	0.055	0.058	0.076	0.077
Beryllium	mg/L	0.00045J	0.00057J	0.00081J	0.00025J	0.00038J	0.00071J	0.00049J	0.00044J
Boron	mg/L	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.02
Cadmium	mg/L	0.00008J	0.001U	0.00009J	0.001U	0.001U	0.001U	0.001U	0.001U
Calcium	mg/L	1.21	2	1.83	1.15	1.58	1.76	1.29	1.21
Chloride	mg/L	8	9	9	9	9	10	9	11
Chromium	mg/L	0.001	0.001	0.002	0.001	0.00056J	0.00041J	0.00056J	0.00082J
Cobalt	mg/L	0.00424J	0.006	0.008	0.00334J	0.00434J	0.008	0.005	0.005
Combined Radium	pCi/L	1.294	1.438	1.931	1.843	2.123	2.629	1.417	0.932
Fluoride	mg/L	1U	1U	1U	1U	1U	1U	1U	1U
Lead	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Lithium	mg/L	0.006	0.036	0.032	0.033	0.028	0.031	0.021	0.019
Mercury	mg/L	0.00002J	0.00002J	0.00001J	0.00002U	0.00002U	0.00001J	0.00002U	0.00001J
Molybdenum	mg/L	0.005U	0.00112J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Selenium	mg/L	0.00226J	0.005U	0.005U	0.0017J	0.005U	0.005U	0.005U	0.005U
Total Dissolved Solids	mg/L	116	148	133	124	124	112	108	106
Sulfate	mg/L	16	45	33	16	23	43	22	24
Thallium	mg/L	0.00137J	0.002U	0.00175J	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	3.9	3.8	3.9	3.9	4.4	3.7	3.2	3.4

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-23							
		5/10/2016	7/13/2016	9/8/2016	10/12/2016	11/15/2016	1/11/2017	2/28/2017	4/11/2017
Antimony	mg/L	0.00289J	0.0038J	0.005U	0.0013J	0.005U	0.005U	0.00166J	0.005U
Arsenic	mg/L	0.00165J	0.005U	0.005U	0.007	0.005U	0.00204J	0.005U	0.00397J
Barium	mg/L	0.048	0.048	0.053	0.12	0.05	0.073	0.041	0.086
Beryllium	mg/L	0.00019J	0.00019J	0.0002J	0.00046J	0.00013J	0.00016J	0.00012J	0.00032J
Boron	mg/L	0.01	0.03	0.02	0.03	0.03	0.02	0.03	0.03
Cadmium	mg/L	0.00007J	0.00009J	0.001U	0.00014J	0.001U	0.001U	0.001U	0.00011J
Calcium	mg/L	0.535	0.317	0.26	0.321	0.249	0.319	0.217	0.543
Chloride	mg/L	4	4	5	6	5	6	4	7
Chromium	mg/L	0.002	0.002	0.005	0.041	0.006	0.015	0.0003J	0.022
Cobalt	mg/L	0.0023J	0.00273J	0.00201J	0.00391J	0.00167J	0.00226J	0.00105J	0.00261J
Combined Radium	pCi/L	6.86	5.69	6.68	12.89	7.54	8.06	5.74	10.31
Fluoride	mg/L	1U	1U	1U	1U	1U	1U	1U	0.2688J
Lead	mg/L	0.005U	0.005U	0.00224J	0.031	0.00321J	0.011	0.005U	0.015
Lithium	mg/L	0.00014J	0.006	0.006	1.01*	0.006	0.009	0.005	0.01
Mercury	mg/L	0.00001J	0.00002J	0.00002U	0.0001	0.00002J	0.00009	0.00002U	0.00012
Molybdenum	mg/L	0.005U	0.00135J	0.005U	0.00056J	0.0004J	0.005U	0.005U	0.00032J
Selenium	mg/L	0.00192J	0.002J	0.005U	0.00211J	0.00135J	0.005U	0.00131J	0.005U
Total Dissolved Solids	mg/L	72	59	64	68	100	60	48	76
Sulfate	mg/L	10	11	12	13	14	13	9	11
Thallium	mg/L	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	4.0	2.7	3.5	3.7	3.5	3.7	4.0	4.2

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled
*: Value was removed from the dataset as an outlier prior to completion of statistical analyses.

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-27							
		5/11/2016	7/13/2016	9/8/2016	10/12/2016	11/15/2016	1/11/2017	3/1/2017	4/10/2017
Antimony	mg/L	0.00121J	0.00096J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.00215J	0.00128J	0.005U	0.00214J	0.005U	0.00157J	0.005U	0.005U
Barium	mg/L	0.043	0.045	0.047	0.046	0.041	0.046	0.043	0.045
Beryllium	mg/L	0.005	0.005	0.006	0.005	0.005	0.005	0.005	0.005
Boron	mg/L	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03
Cadmium	mg/L	0.00043J	0.00043J	0.0004J	0.00042J	0.00042J	0.0003J	0.00029J	0.00041J
Calcium	mg/L	4.41	4.43	4.17	4.09	4.52	3.74	4.31	4.01
Chloride	mg/L	8	8	8	8	8	9	8	9
Chromium	mg/L	0.00087J	0.002	0.002	0.002	0.002	0.001	0.002	0.00095J
Cobalt	mg/L	0.02	0.021	0.02	0.02	0.022	0.018	0.021	0.021
Combined Radium	pCi/L	2.031	2.406	2.71	4.43	3.69	2.62	3.48	2.58
Fluoride	mg/L	0.6176J	1U	1U	1U	1U	1U	1U	1U
Lead	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Lithium	mg/L	0.066	0.097	0.095	0.096	0.095	0.1	0.1	0.104
Mercury	mg/L	0.00002U	0.00002J	0.00002U	0.00002U	0.00002U	0.00001J	0.00002U	0.00002U
Molybdenum	mg/L	0.005U	0.00043J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Selenium	mg/L	0.00111J	0.005U	0.005U	0.00136J	0.005U	0.005U	0.005U	0.005U
Total Dissolved Solids	mg/L	198	192	196	216	216	180	216	180
Sulfate	mg/L	51	54	52	58	92	58	56	54
Thallium	mg/L	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	3.9	2.7	2.9	3.0	3.5	4.1	2.8	3.3

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-34							
		5/10/2016	7/13/2016	9/8/2016	10/12/2016	11/15/2016	1/11/2017	2/28/2017	4/10/2017
Antimony	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.012	0.025	0.009	0.01	0.007	0.006	0.007	0.0045J
Barium	mg/L	0.072	0.177	0.031	0.039	0.023	0.029	0.011	0.023
Beryllium	mg/L	0.003	0.004	0.003	0.003	0.002	0.002	0.002	0.002
Boron	mg/L	0.08	0.111	0.09	0.09	0.1	0.07	0.08	0.09
Cadmium	mg/L	0.006	0.006	0.008	0.005	0.008	0.007	0.006	0.011
Calcium	mg/L	37.8	33.2	39.5	35.8	36.3	39.9	37	38.2
Chloride	mg/L	7	8	8	7	7	8	6	8
Chromium	mg/L	0.034	0.081	0.012	0.015	0.006	0.008	0.001U	0.007
Cobalt	mg/L	0.301	0.296	0.306	0.297	0.292	0.284	0.294	0.299
Combined Radium	pCi/L	9.64	7.75	7.91	10.12	13.21	11.9	9.87	2.407
Fluoride	mg/L	1U	1U	1U	0.6272J	0.9978J	1U	1U	0.5241J
Lead	mg/L	0.012	0.039	0.00102J	0.0037J	0.005U	0.005U	0.005U	0.005U
Lithium	mg/L	0.176	0.183	0.158	0.174	0.154	0.164	0.158	0.167
Mercury	mg/L	0.0001	0.00031	0.00006	0.00004	0.00002	0.00003	0.00002U	0.00002J
Molybdenum	mg/L	0.00069J	0.00211J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Selenium	mg/L	0.005U	0.007	0.005U	0.005U	0.00451J	0.005U	0.005U	0.005U
Total Dissolved Solids	mg/L	1516	1396	1520	1464	1428	1378	1402	1490
Sulfate	mg/L	974	837	870	1084	1006	1334	993	1016
Thallium	mg/L	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	4.0	3.6	3.3	3.6	3.7	3.2	3.7	3.0

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2 - 2016-2017 Background Groundwater Data
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Unit	AD-35							
		5/10/2016	7/13/2016	9/8/2016	10/12/2016	11/15/2016	1/11/2017	2/28/2017	4/11/2017
Antimony	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Arsenic	mg/L	0.011	0.009	0.00113J	0.00407J	0.012	0.00215J	0.00404J	0.0014J
Barium	mg/L	0.124	0.185	0.116	0.11	0.143	0.115	0.094	0.092
Beryllium	mg/L	0.00033J	0.00039J	0.00019J	0.00014J	0.0003J	0.00009J	0.00009J	0.00007J
Boron	mg/L	0.109	0.07	0.04	0.05	0.06	0.06	0.123	0.07
Cadmium	mg/L	0.00011J	0.001U	0.001U	0.001U	0.00024J	0.00009J	0.001U	0.00033J
Calcium	mg/L	17.4	5.35	3.42	2.43	2	10.4	22.5	10.8
Chloride	mg/L	17	18	14	14	14	18	19	25
Chromium	mg/L	0.021	0.019	0.005	0.006	0.03	0.005	0.003	0.001
Cobalt	mg/L	0.01	0.006	0.00344J	0.00299J	0.007	0.00406J	0.00475J	0.006
Combined Radium	pCi/L	2.465	4.21	2.065	6.01	4.83	3.65	2.02	2.707
Fluoride	mg/L	1U	1U	1U	0.3552J	1U	1U	1U	1U
Lead	mg/L	0.007	0.00437J	0.005U	0.00153J	0.007	0.005U	0.00124J	0.005U
Lithium	mg/L	0.001U	0.013	0.011	0.012	0.019	0.01	0.008	0.007
Mercury	mg/L	0.00006	0.00011	0.00002U	0.00001J	0.00007	0.00002J	0.00002J	0.00002U
Molybdenum	mg/L	0.00044J	0.005U	0.005U	0.005U	0.00058J	0.005U	0.005U	0.005U
Selenium	mg/L	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Total Dissolved Solids	mg/L	162	114	104	116	142	128	140	160
Sulfate	mg/L	50	28	21	23	29	62	84	75
Thallium	mg/L	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U	0.002U
pH	SU	4.7	4.6	4.0	3.6	4.3	4.7	3.5	4.8

Notes:
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Component was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Component was detected in concentrations below the reporting limit
-: Not sampled

Table 3: Detection Monitoring Data Evaluation - Updated Background Prediction Limits
Pirkey Plant - Landfill

Geosyntec Consultants, Inc.

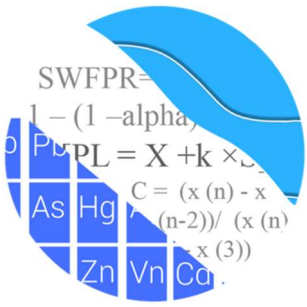
Parameter	Units	Description	AD-23						AD-34				
			8/23/2017	12/21/2017	3/21/2018	8/20/2018	2/28/2019	5/23/2019	8/23/2017	12/21/2017	3/21/2018	8/20/2018	2/28/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.030						0.120				
		Detection Monitoring Result	**0.0402**	**0.0450**	0.0176	0.0170	0.0200	--	0.107	--	**0.171**	0.0670	0.080
Calcium	mg/L	Intrawell Background Value (UPL)	0.654						42.5				
		Detection Monitoring Result	0.276	0.469	0.227	0.247	0.300	--	36.2	--	40.1	37.0	39.9
Chloride	mg/L	Intrawell Background Value (UPL)	7.89						9.2				
		Detection Monitoring Result	6	--	4	**9**	6.94	--	7	8	6	**10**	7.64
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00						1.00				
		Detection Monitoring Result	0.198	--	<0.083	<0.083	0.040	--	0.619	0.67	<0.083	<0.083	0.86
pH	SU	Intrawell Background Value (UPL)	4.8						4.3				
		Intrawell Background Value (LPL)	2.5						2.7				
		Detection Monitoring Result	4.1	--	3.9	3.8	**5.1**	4.8	3.7	--	3.7	3.7	2.9
Sulfate	mg/L	Intrawell Background Value (UPL)	15.8						1388				
		Detection Monitoring Result	11	--	10	11	7.2	--	1231	1020	956	1060	970
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	106						1587				
		Detection Monitoring Result	64.0	--	72.0	92.0	70.0	--	1128	1260	1420	1460	1470

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
<: Non-detect value. Parameters which were not detecteda re shown as less than the method detection limit (MDL).
Background values are shaded gray.
--: Not Sampled
Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the UPL.
Based on a revised understanding of the site, the Appendix III prediction limits were recalculated for intrawell tests using the background dataset.

ATTACHMENT A
Revised Statistical Output

GROUNDWATER STATS CONSULTING

January 8, 2020



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

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of the groundwater data for American Electric Power Company's Pirkey 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).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, is listed below. Note that downgradient well AD-35 was originally in the well network but has been abandoned and replaced with a new well. No data are currently available from the new well but will be included in future analyses.

- **Upgradient wells:** AD-8, AD-12, AD-16 and AD-27; and
- **Downgradient wells:** AD-23 and AD-34

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

The CCR program consists of the following constituents:

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

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (see attached). Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs. A summary of flagged values follows this letter (see attached).

Evaluation of Appendix III Parameters

Intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, calcium, chloride, fluoride, pH, sulfate and TDS. The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one 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 a false positive result and, therefore, no further action is necessary. The summary table of those results follows this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable. Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site which is an

indication of natural variability in groundwater unrelated to practices at the site. When changing concentrations are noted upgradient of the facility, it is an indication that groundwater quality is changing naturally and unrelated to the facility.

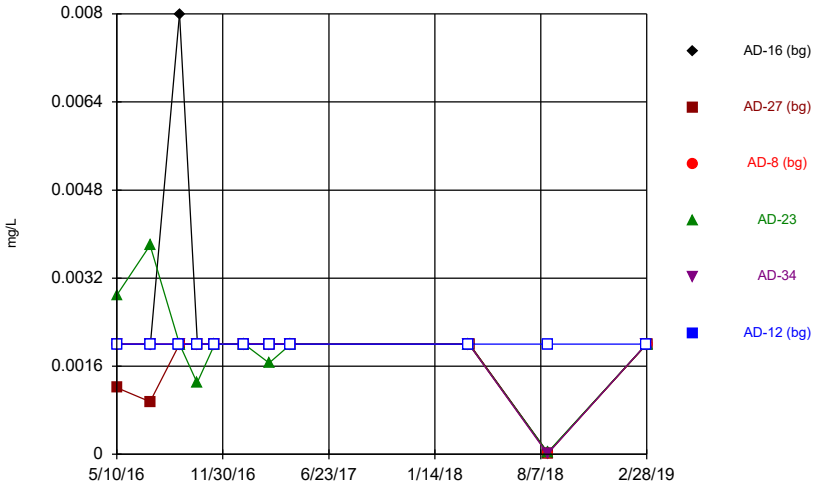
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Pirkey Landfill. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

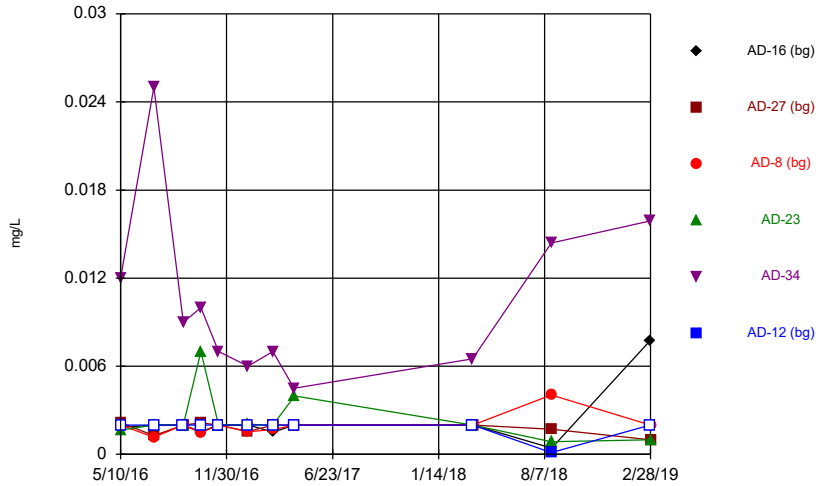
Time Series



Constituent: Antimony, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

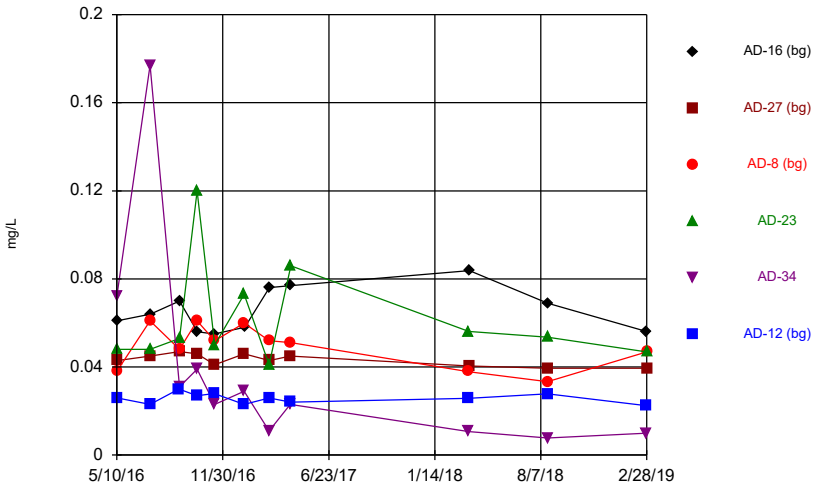
Time Series



Constituent: Arsenic, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

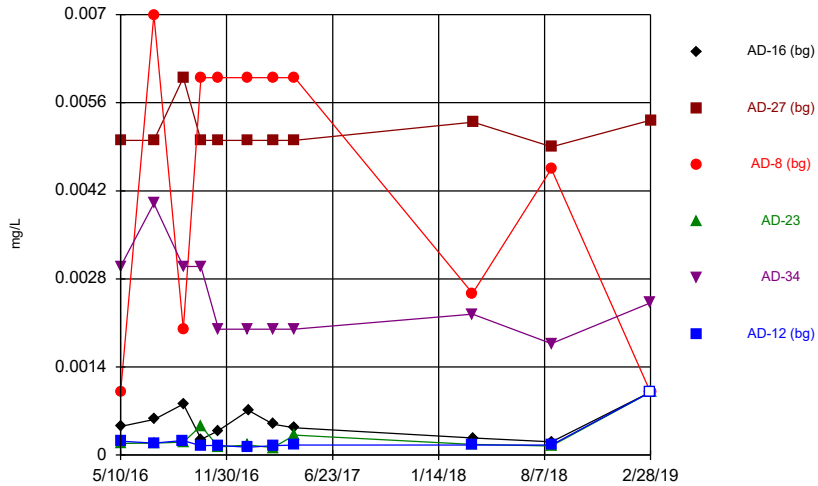
Time Series



Constituent: Barium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

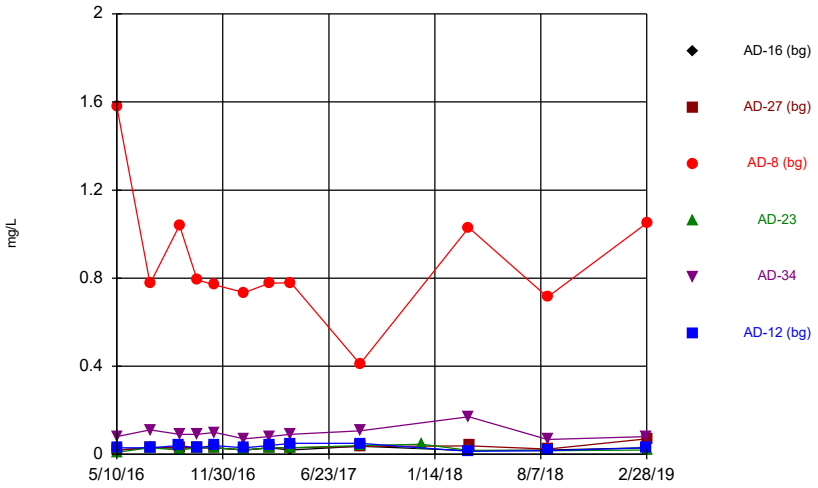
Time Series



Constituent: Beryllium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

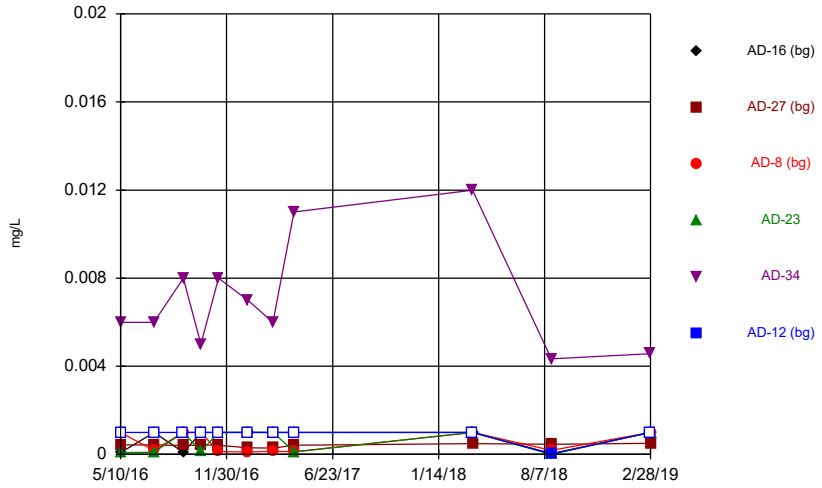
Time Series



Constituent: Boron, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

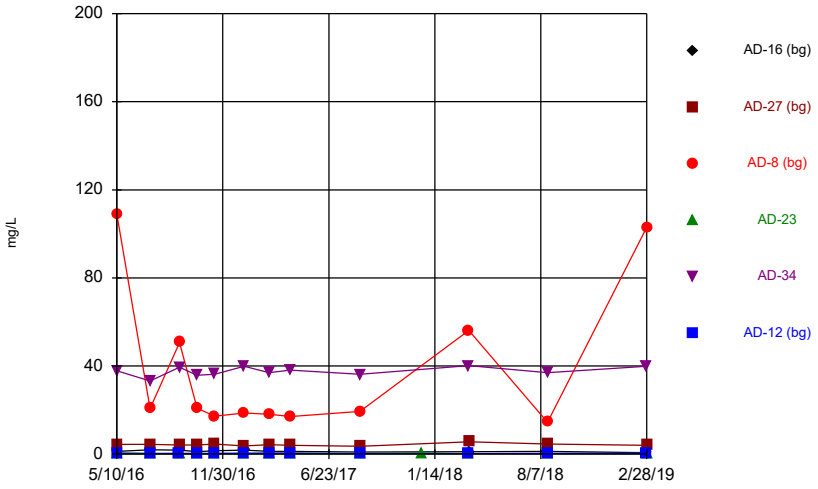
Time Series



Constituent: Cadmium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

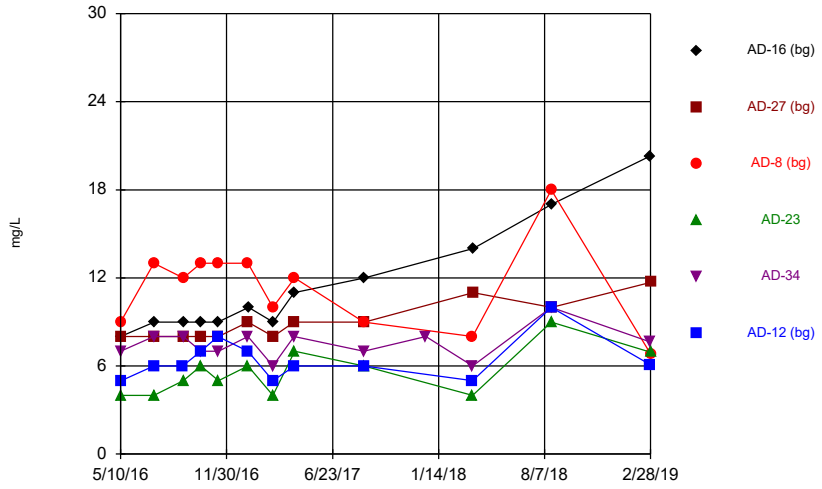
Time Series



Constituent: Calcium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

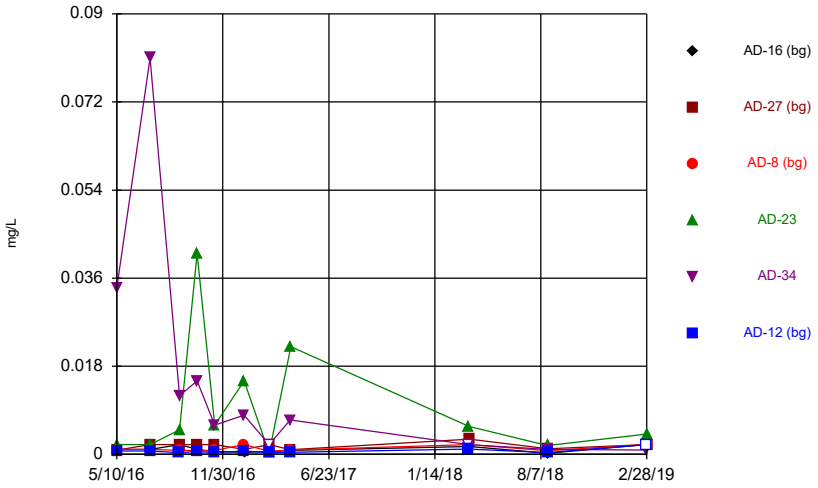
Time Series



Constituent: Chloride, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

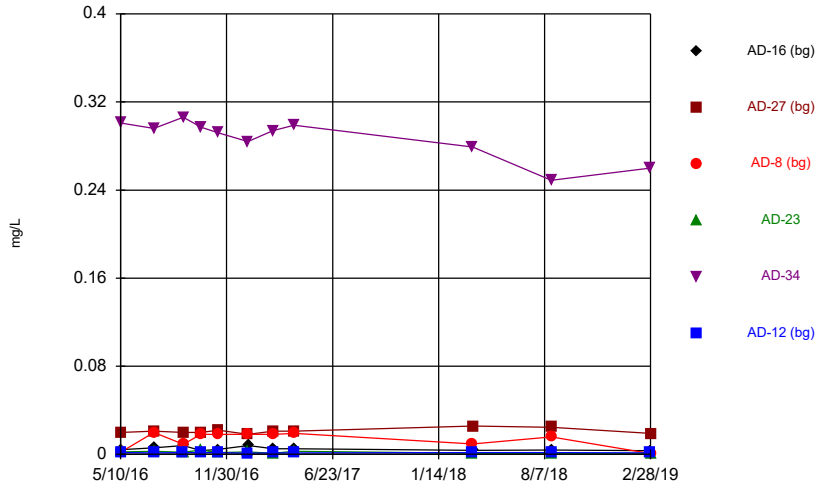
Time Series



Constituent: Chromium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

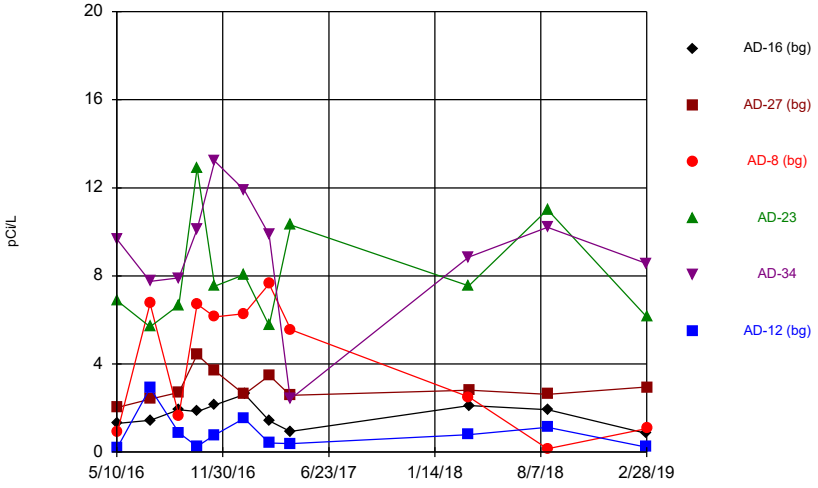
Time Series



Constituent: Cobalt, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

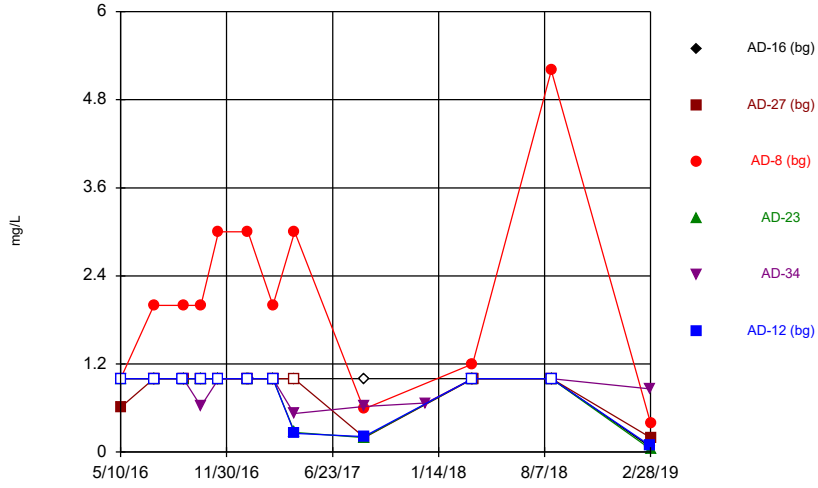
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

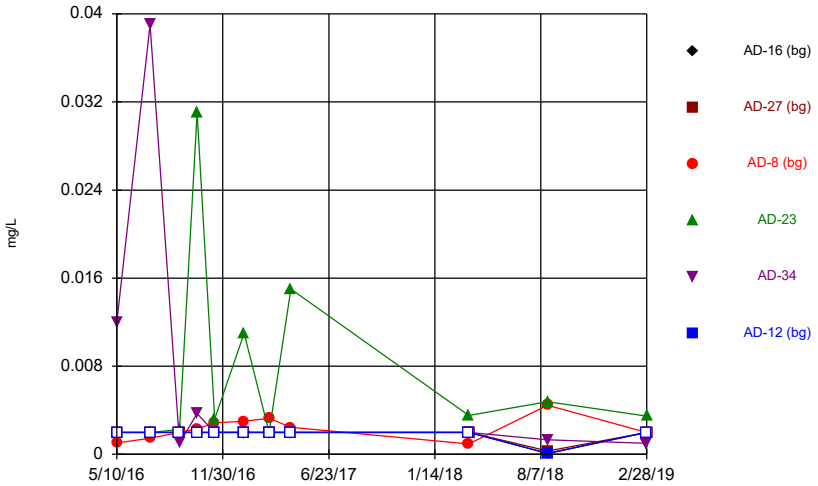
Time Series



Constituent: Fluoride, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

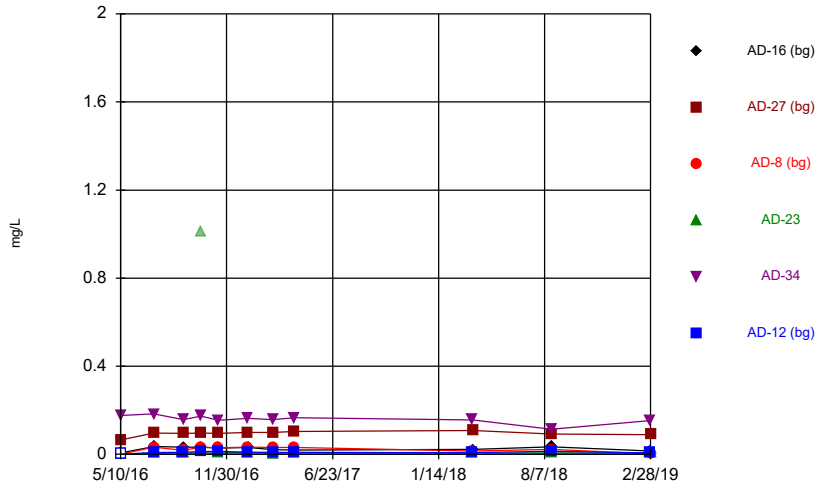
Time Series



Constituent: Lead, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

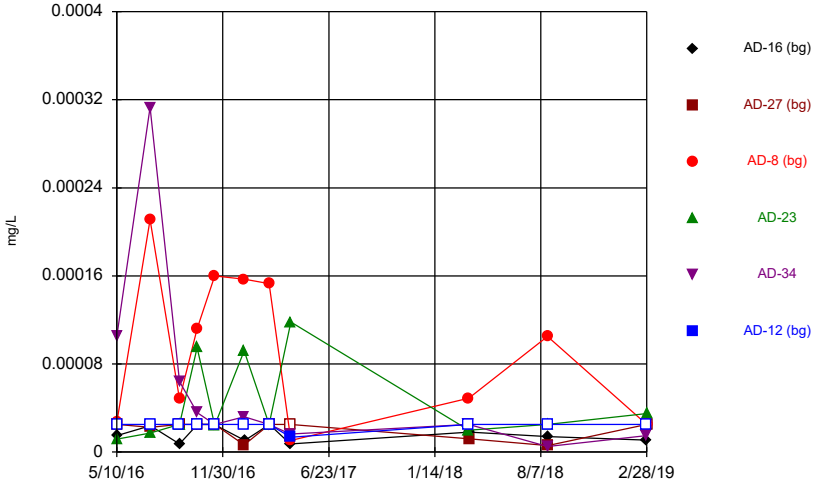
Time Series



Constituent: Lithium, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

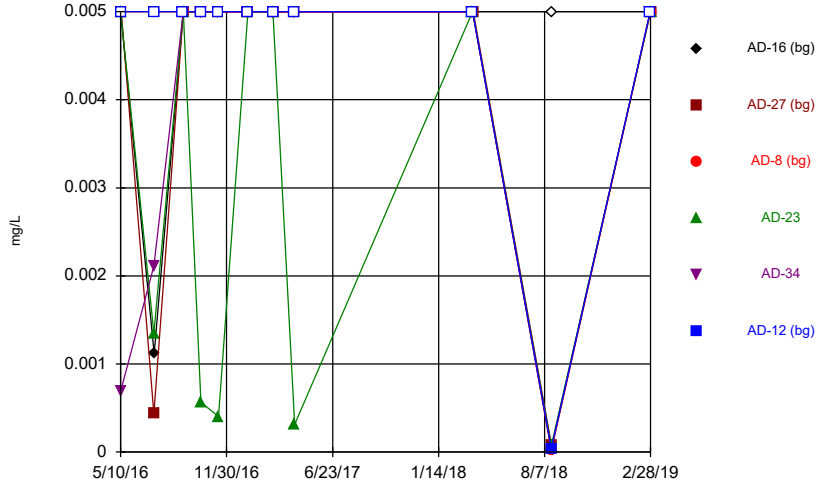
Time Series



Constituent: Mercury, total Analysis Run 9/5/2019 1:36 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

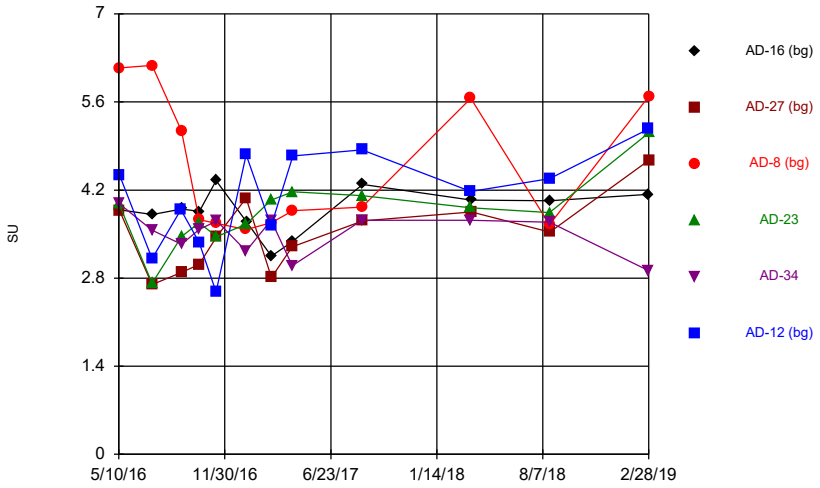
Time Series



Constituent: Molybdenum, total Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

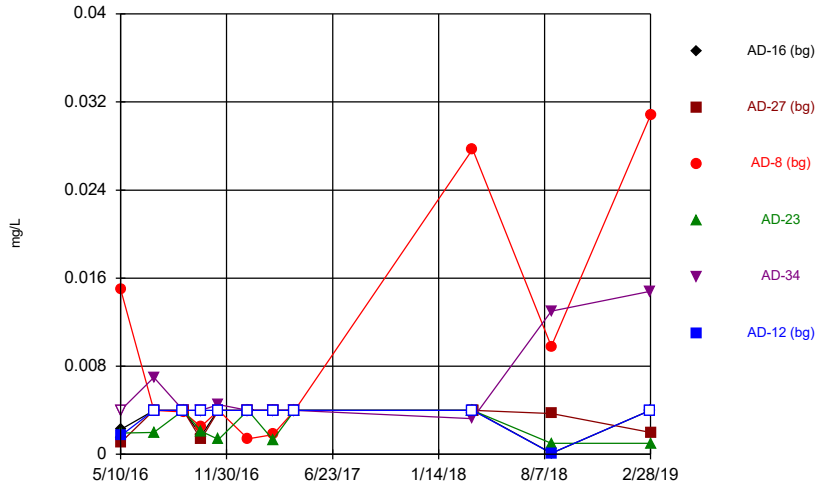
Time Series



Constituent: pH, field Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

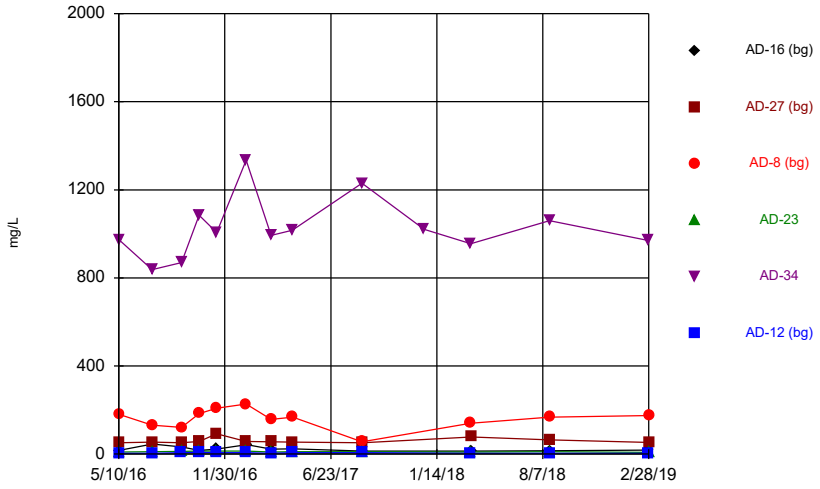
Time Series



Constituent: Selenium, total Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

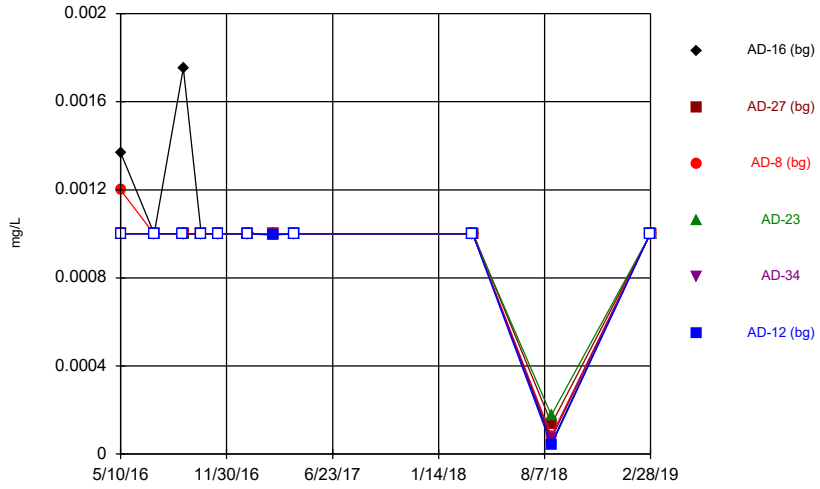
Time Series



Constituent: Sulfate, total Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

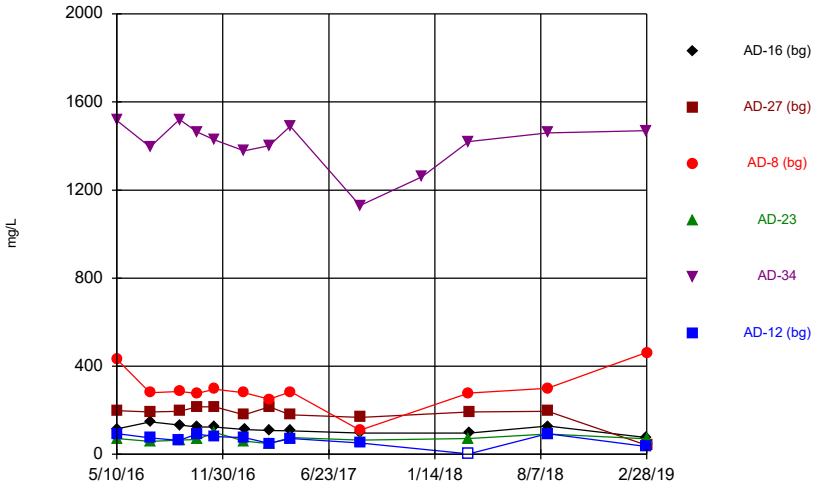
Time Series



Constituent: Thallium, total Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:37 PM View: Time Series
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Outlier Summary

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 9/5/2019, 1:41 PM

	AD-23 Lithium, total (mg/L)
10/12/2016	1.01 (o)

Intrawell Prediction Limit Summary - All Results

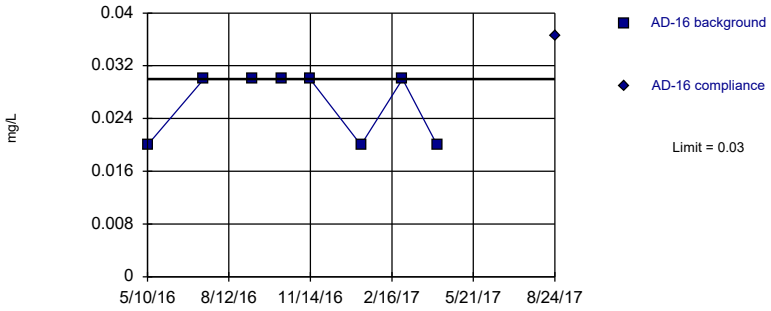
Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 11/26/2019, 8:05 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**AD-16**	**0.03**	**n/a**	**8/24/2017**	**0.0365**	**Yes**	**8**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.02144**	**NP Intra (normality) 1 of 2**
Boron, total (mg/L)	**AD-27**	**0.03**	**n/a**	**8/24/2017**	**0.0358**	**Yes**	**8**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.02144**	**NP Intra (normality) 1 of 2**
Boron, total (mg/L)	AD-8	1.58	n/a	8/23/2017	0.411	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Boron, total (mg/L)	**AD-23**	**0.03**	**n/a**	**8/23/2017**	**0.0402**	**Yes**	**8**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.02144**	**NP Intra (normality) 1 of 2**
Boron, total (mg/L)	AD-34	0.1201	n/a	8/23/2017	0.107	No	8	0.08888	0.01271	0	None	No	0.002505	Param Intra 1 of 2
Boron, total (mg/L)	AD-35	0.1433	n/a	8/23/2017	0.0413	No	8	0.07275	0.02871	0	None	No	0.002505	Param Intra 1 of 2
Boron, total (mg/L)	AD-12	0.05454	n/a	8/23/2017	0.0495	No	8	0.03625	0.00744	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-16	2.318	n/a	8/24/2017	0.945	No	8	1.504	0.3311	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-27	4.848	n/a	8/24/2017	3.58	No	8	4.21	0.2595	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-8	109	n/a	8/23/2017	19.4	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Calcium, total (mg/L)	AD-23	0.6535	n/a	8/23/2017	0.276	No	8	0.3451	0.1255	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-34	42.53	n/a	8/23/2017	36.2	No	8	37.21	2.163	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-35	27.73	n/a	8/23/2017	4.33	No	8	9.288	7.502	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-12	0.4631	n/a	8/23/2017	0.245	No	8	0.3269	0.05542	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	**AD-16**	**11.43**	**n/a**	**8/24/2017**	**12**	**Yes**	**8**	**9.25**	**0.8864**	**0**	**None**	**No**	**0.002505**	**Param Intra 1 of 2**
Chloride, total (mg/L)	AD-27	9	n/a	8/24/2017	9	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Chloride, total (mg/L)	AD-8	15.69	n/a	8/23/2017	9	No	8	11.88	1.553	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-23	7.893	n/a	8/23/2017	6	No	8	5.125	1.126	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-34	9.204	n/a	8/23/2017	7	No	8	7.375	0.744	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-35	26.47	n/a	8/23/2017	16	No	8	17.38	3.701	0	None	No	0.002505	Param Intra 1 of 2
Chloride, total (mg/L)	AD-12	8.794	n/a	8/23/2017	6	No	8	6.25	1.035	0	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	AD-16	1	n/a	8/24/2017	1ND	No	8	n/a	n/a	100	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-27	1	n/a	8/24/2017	0.197	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-8	3.988	n/a	8/23/2017	0.587	No	8	2.25	0.7071	12.5	None	No	0.002505	Param Intra 1 of 2
Fluoride, total (mg/L)	AD-23	1	n/a	8/23/2017	0.198	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-34	1	n/a	8/23/2017	0.619	No	8	n/a	n/a	62.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-35	1	n/a	8/23/2017	1ND	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	AD-12	1	n/a	8/23/2017	0.213	No	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
pH, field (SU)	AD-16	4.644	2.864	8/24/2017	4.29	No	8	3.754	0.3622	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-27	4.51	2.022	8/24/2017	3.71	No	8	3.266	0.506	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-8	7.306	1.689	8/23/2017	3.93	No	8	4.498	1.143	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-23	4.776	2.519	8/23/2017	4.11	No	8	3.648	0.4592	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-34	4.285	2.745	8/23/2017	3.72	No	8	3.515	0.3135	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-35	5.552	3.02	8/23/2017	4.86	No	8	4.286	0.515	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-12	5.764	1.866	8/23/2017	4.84	No	8	3.815	0.7928	0	None	No	0.001253	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-16	55.68	n/a	8/24/2017	14	No	8	27.75	11.36	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-27	92	n/a	8/24/2017	52	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Sulfate, total (mg/L)	AD-8	261.3	n/a	8/23/2017	56	No	8	172.3	36.21	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-23	15.77	n/a	8/23/2017	11	No	8	11.63	1.685	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-34	1388	n/a	8/23/2017	1230	No	8	1014	151.9	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-35	107.6	n/a	8/23/2017	35	No	8	46.5	24.85	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-12	9.636	n/a	8/23/2017	6	No	8	5.75	1.581	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-16	156	n/a	8/24/2017	96	No	8	121.4	14.09	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-27	237	n/a	8/24/2017	168	No	8	199.3	15.34	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-8	432	n/a	8/23/2017	110	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-23	106.3	n/a	8/23/2017	64	No	8	68.38	15.42	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-34	1587	n/a	8/23/2017	1130	No	8	1449	55.98	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-35	185.9	n/a	8/23/2017	92	No	8	133.3	21.43	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-12	110.7	n/a	8/23/2017	52	No	8	75.25	14.41	0	None	No	0.002505	Param Intra 1 of 2

Exceeds Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

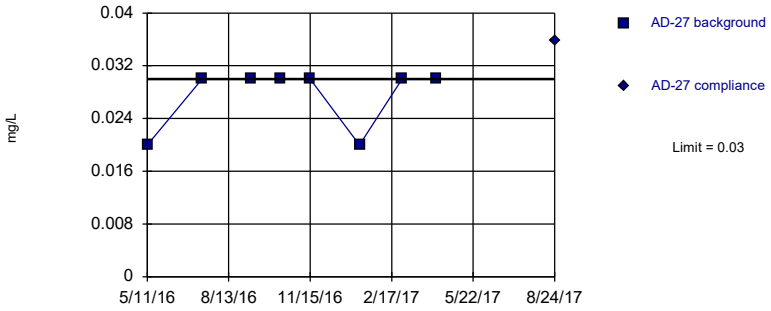
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Exceeds Limit

Prediction Limit

Intrawell Non-parametric



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Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

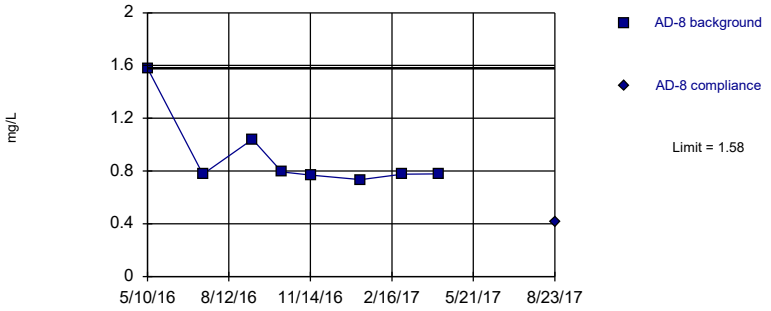
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

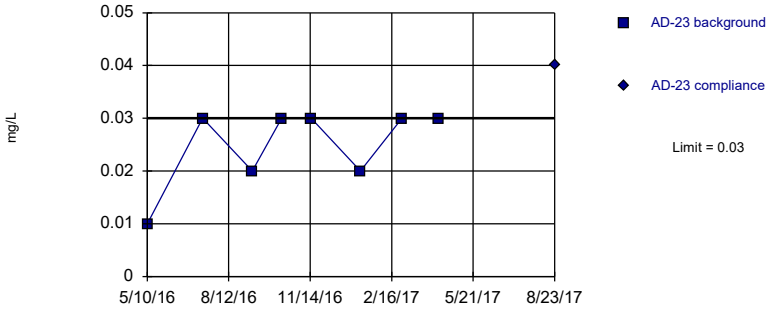
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Exceeds Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

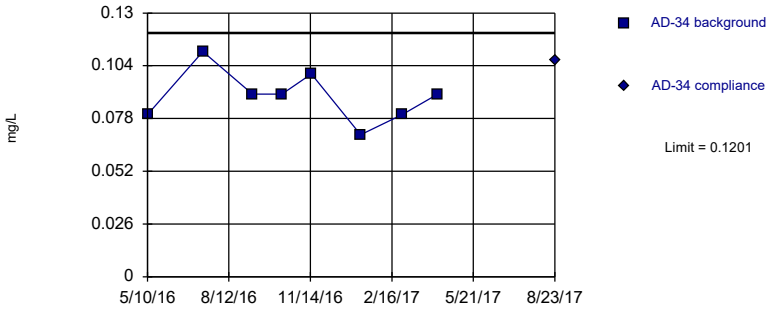
Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.08888, Std. Dev.=0.01271, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9562, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

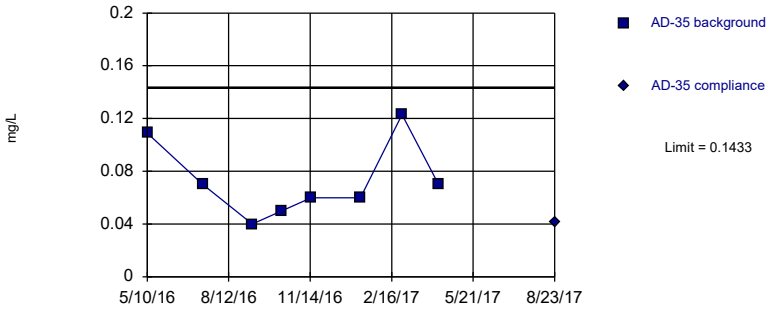
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.07275, Std. Dev.=0.02871, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8787, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

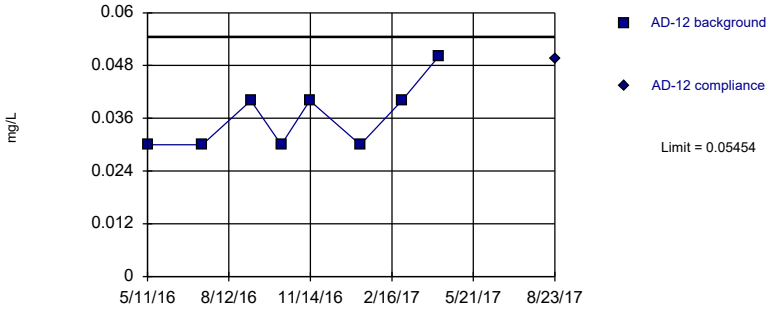
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.03625, Std. Dev.=0.00744, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7968, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Boron, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

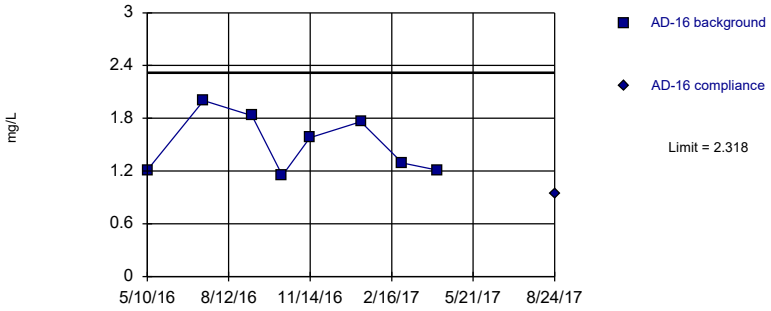
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1.504, Std. Dev.=0.3311, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8818, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

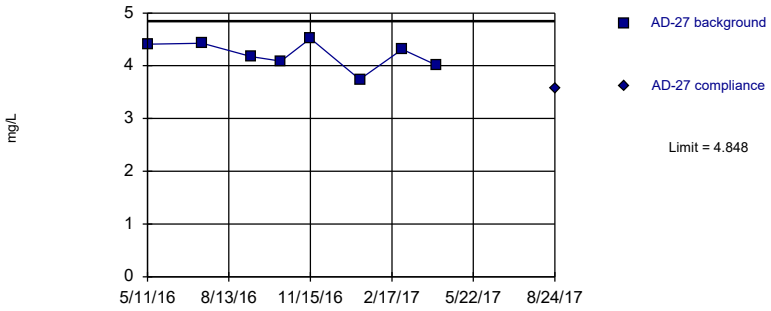
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.21, Std. Dev.=0.2595, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9482, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

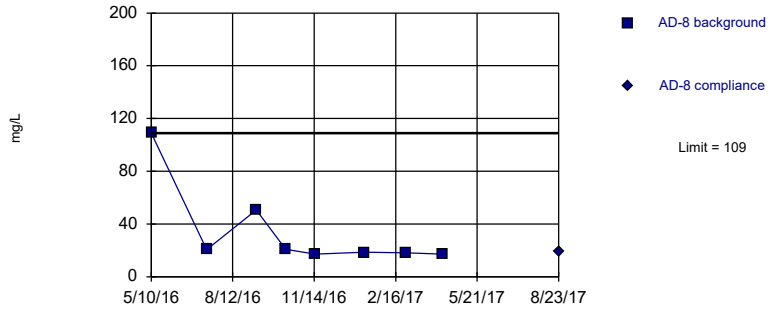
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

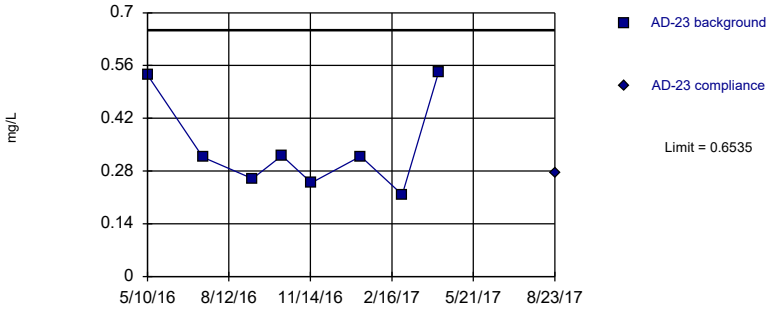
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.3451, Std. Dev.=0.1255, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.809, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

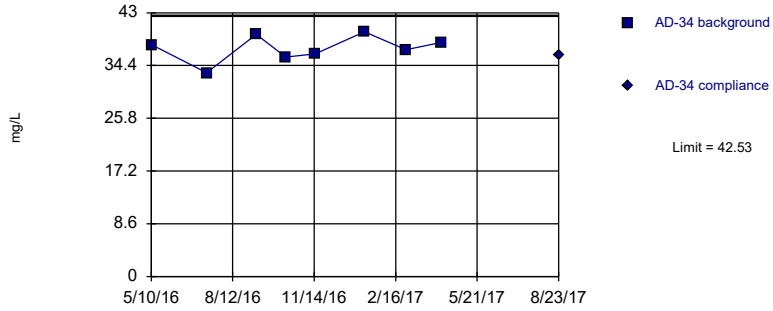
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



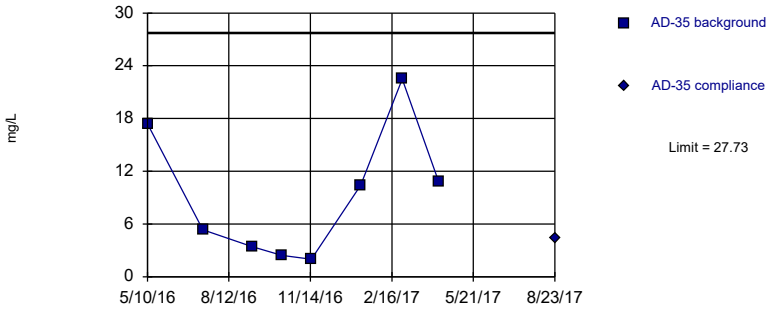
Background Data Summary: Mean=37.21, Std. Dev.=2.163, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9581, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=9.288, Std. Dev.=7.502, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8888, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

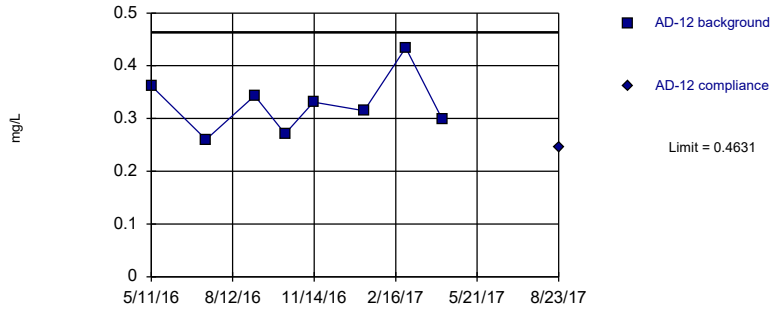
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.3269, Std. Dev.=0.05542, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9467, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

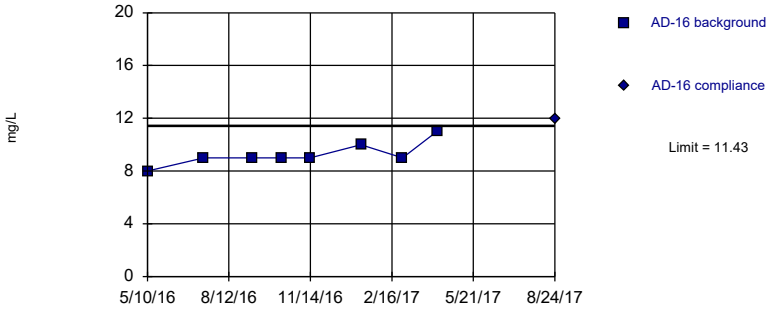
Constituent: Calcium, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=9.25, Std. Dev.=0.8864, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8264, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

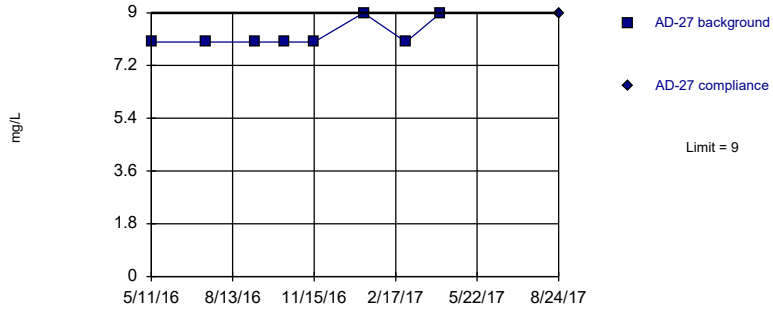
Constituent: Chloride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

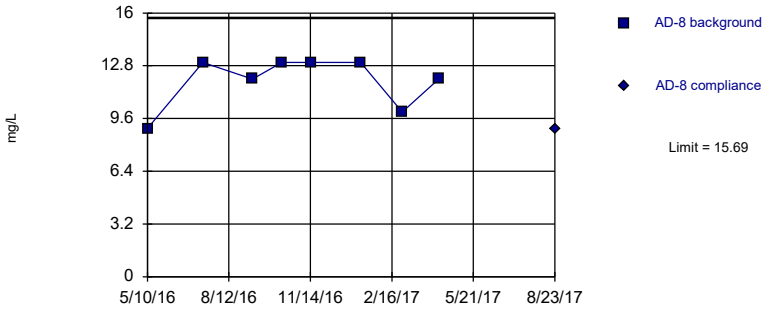
Constituent: Chloride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=11.88, Std. Dev.=1.553, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7682, 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 11/26/2019 8:02 AM View: PL's - Intrawell

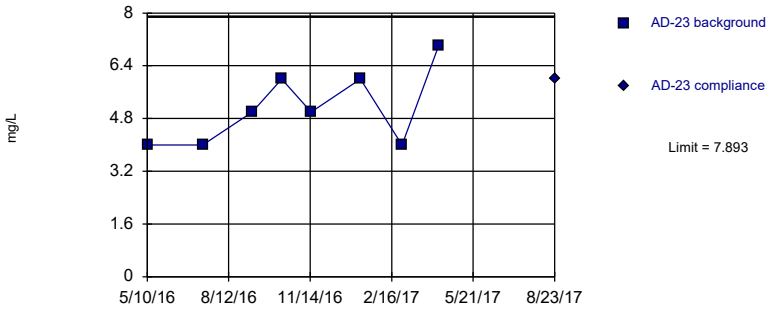
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.125, Std. Dev.=1.126, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8815, 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 11/26/2019 8:02 AM View: PL's - Intrawell

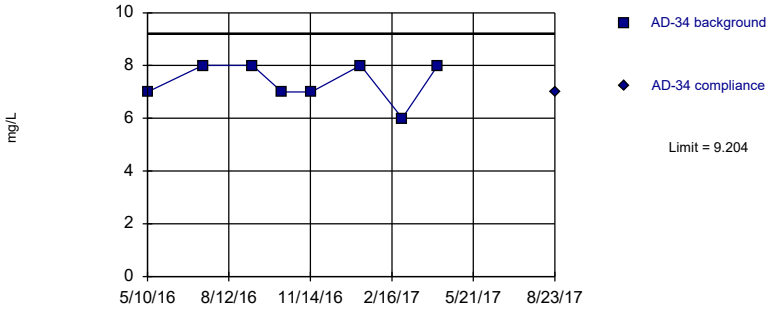
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.375, Std. Dev.=0.744, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7968, 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 11/26/2019 8:02 AM View: PL's - Intrawell

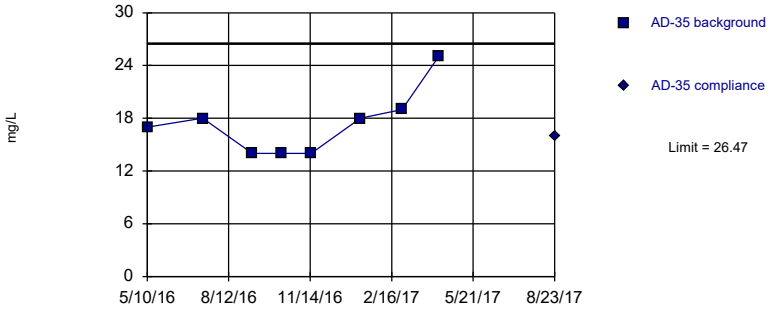
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=17.38, Std. Dev.=3.701, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8434, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

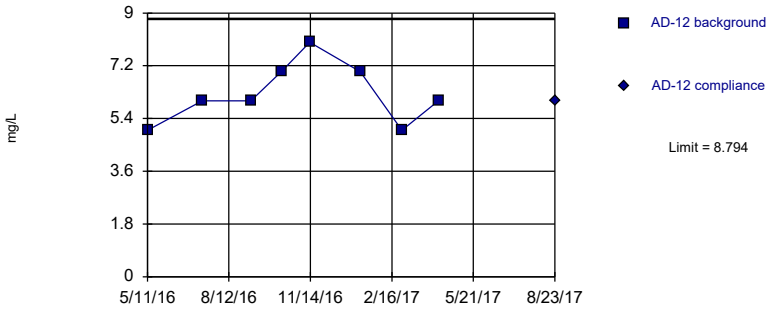
Constituent: Chloride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.25, Std. Dev.=1.035, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9171, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

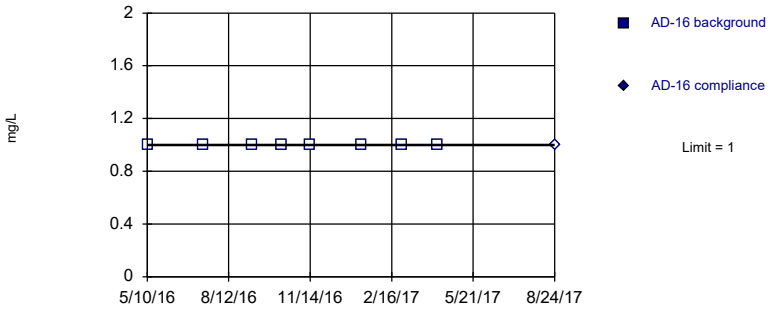
Constituent: Chloride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

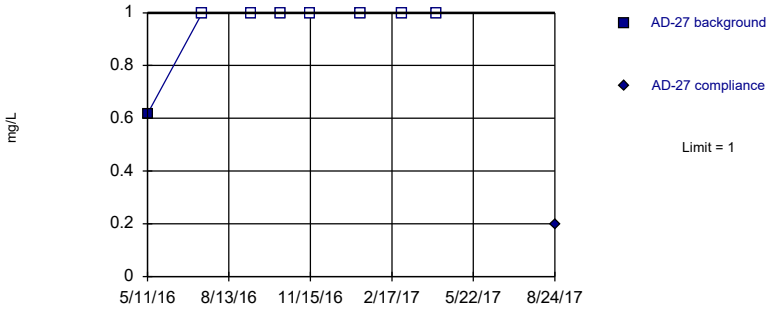
Constituent: Fluoride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

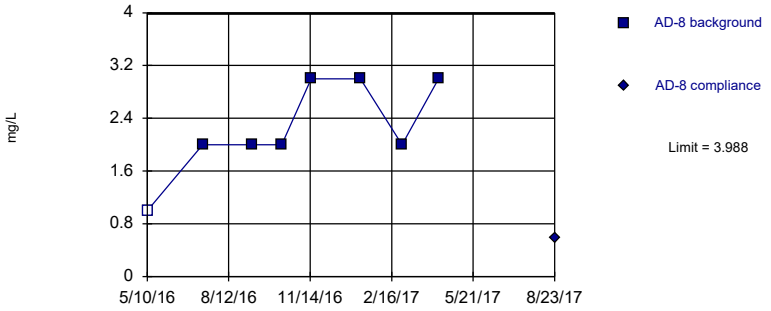
Constituent: Fluoride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=2.25, Std. Dev.=0.7071, n=8, 12.5% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8268, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

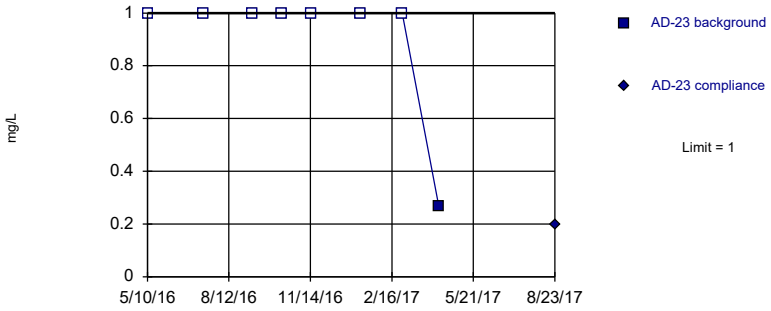
Constituent: Fluoride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

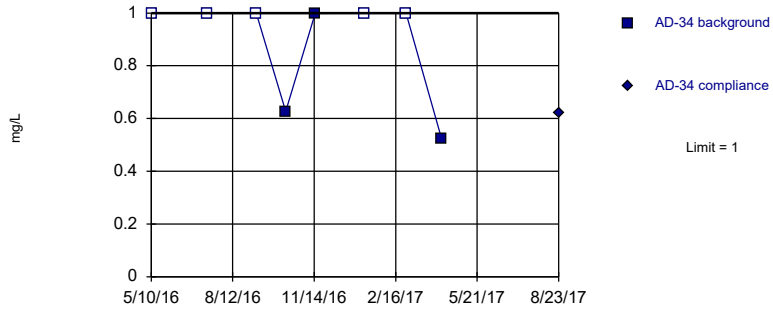
Constituent: Fluoride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 62.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

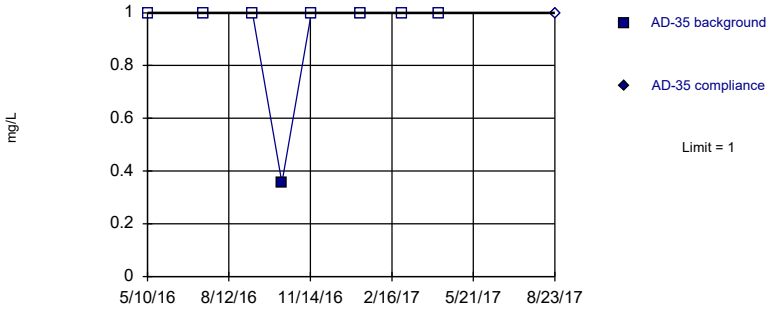
Constituent: Fluoride, total Analysis Run 11/26/2019 8:02 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

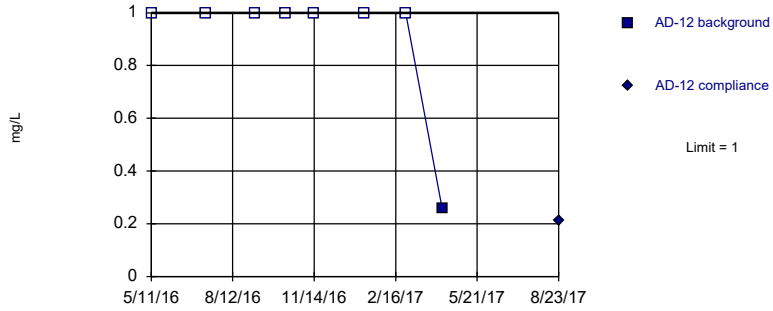
Constituent: Fluoride, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Non-parametric



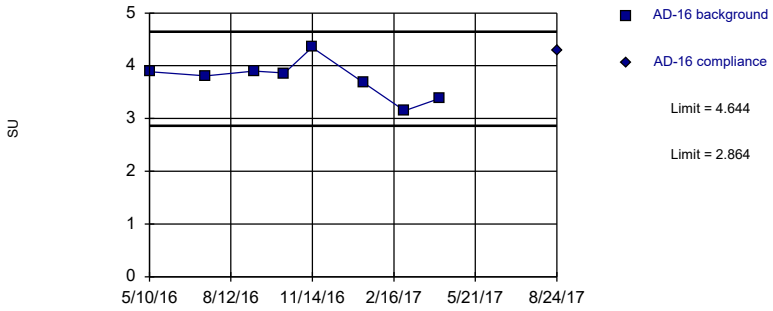
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Fluoride, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.754, Std. Dev.=0.3622, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9388, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

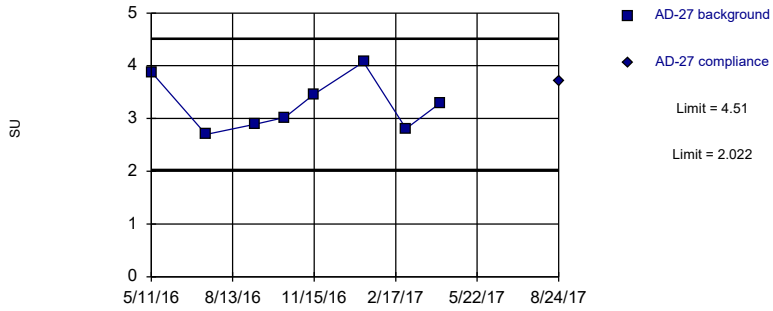
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.266, Std. Dev.=0.506, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.918, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

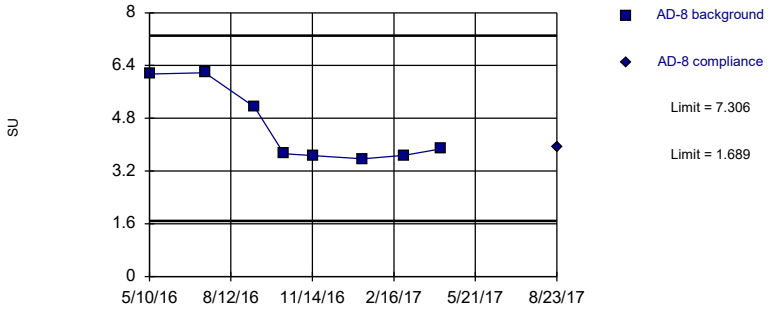
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.498, Std. Dev.=1.143, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7532, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

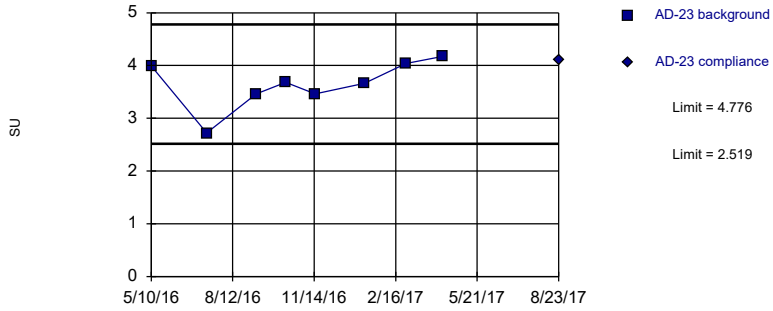
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.648, Std. Dev.=0.4592, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.903, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

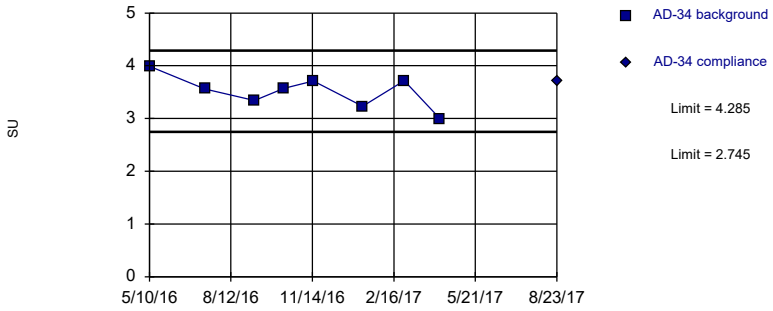
Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.515, Std. Dev.=0.3135, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9758, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

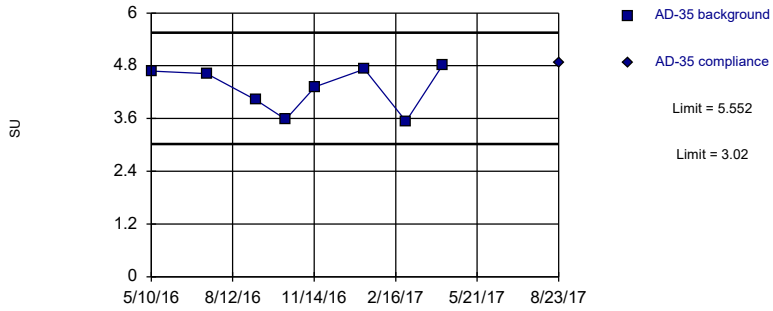
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.286, Std. Dev.=0.515, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8567, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

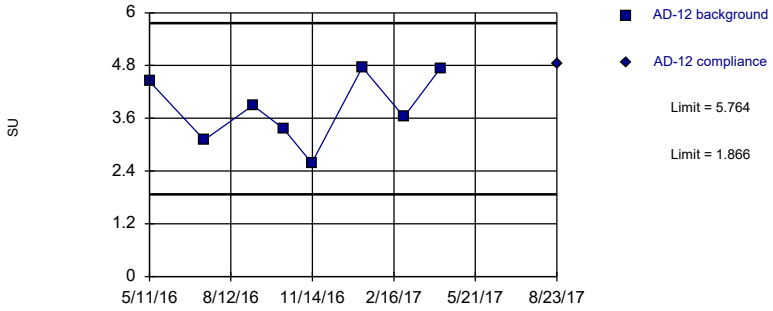
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.815, Std. Dev.=0.7928, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9424, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

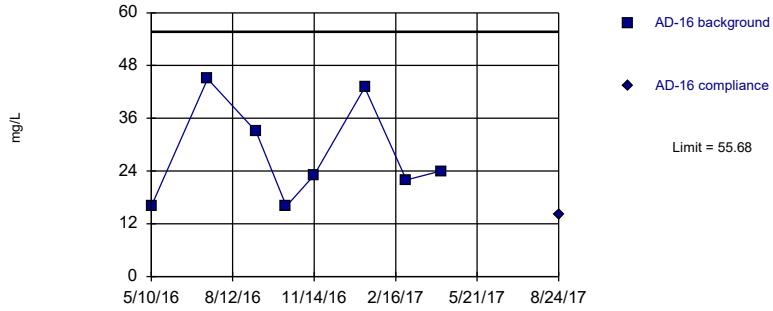
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=27.75, Std. Dev.=11.36, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8719, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

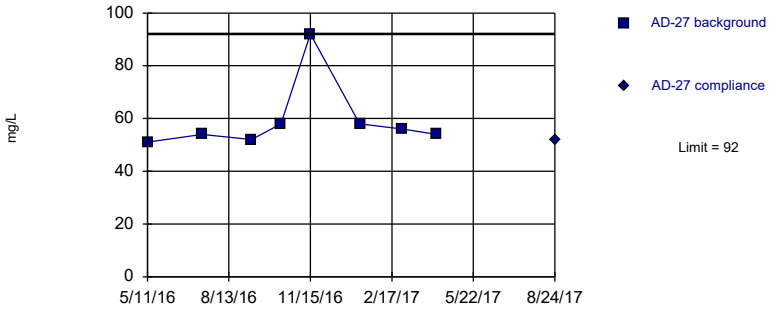
Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

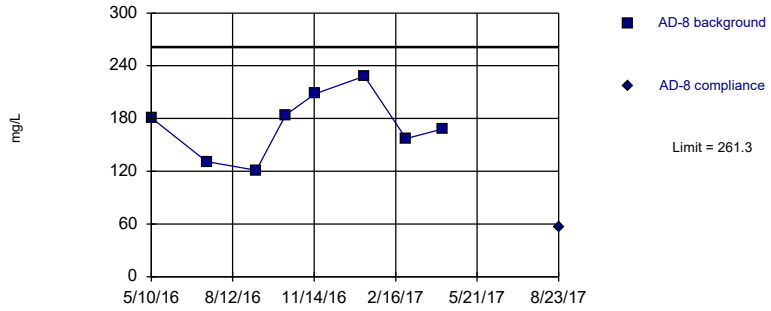
Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=172.3, Std. Dev.=36.21, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.974, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

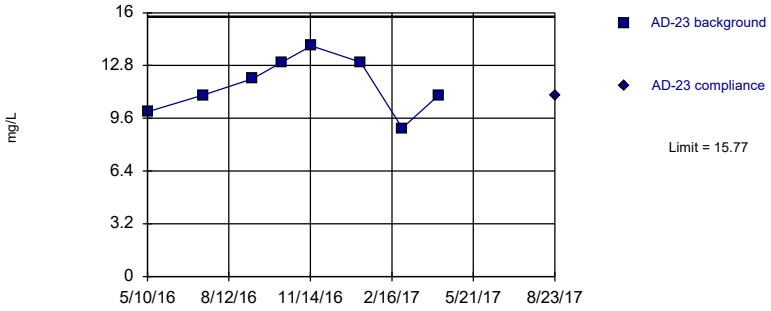
Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=11.63, Std. Dev.=1.685, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9652, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

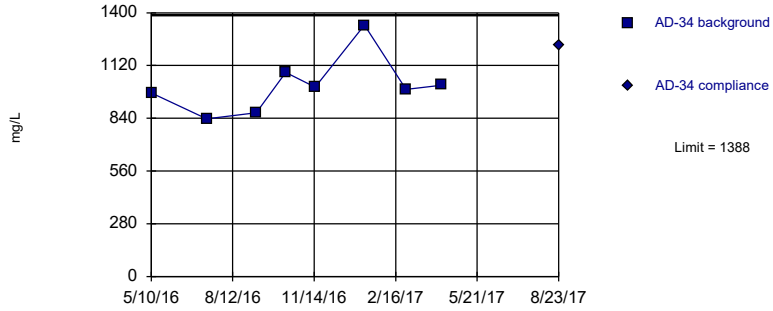
Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



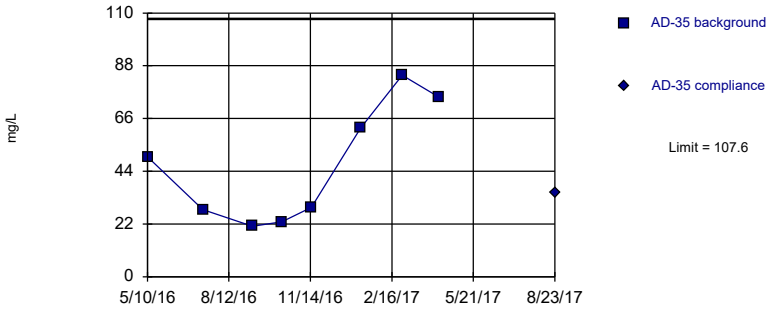
Background Data Summary: Mean=1014, Std. Dev.=151.9, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8781, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=46.5, Std. Dev.=24.85, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8804, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

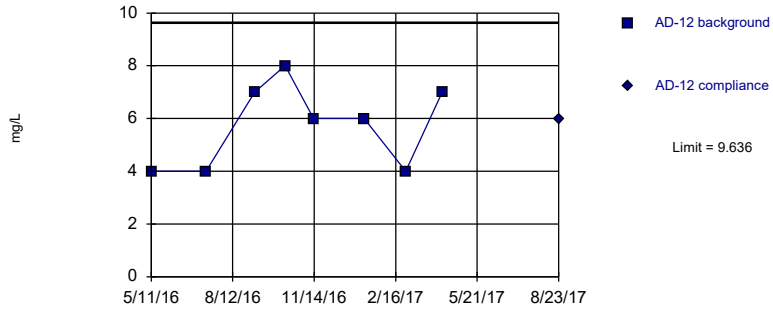
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.75, Std. Dev.=1.581, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.866, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

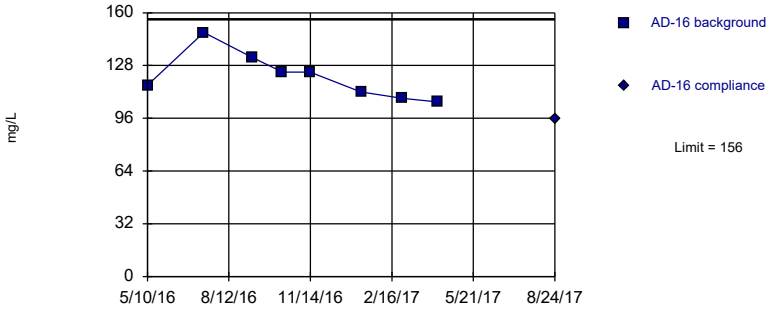
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=121.4, Std. Dev.=14.09, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9257, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

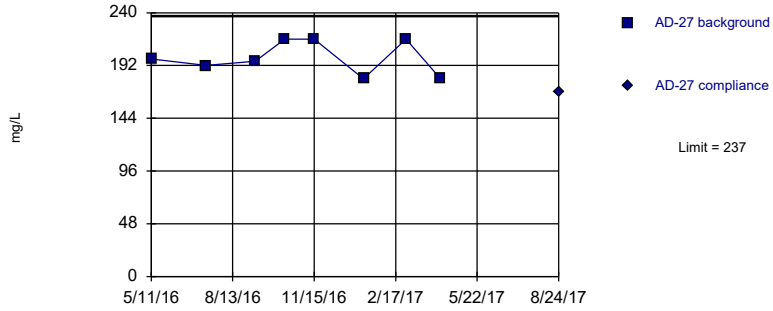
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=199.3, Std. Dev.=15.34, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8523, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

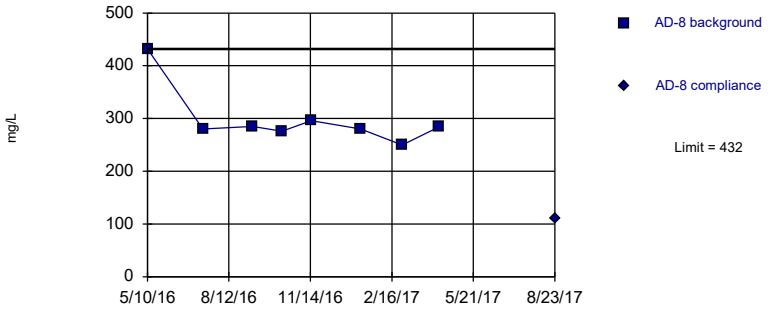
Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Non-parametric



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 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

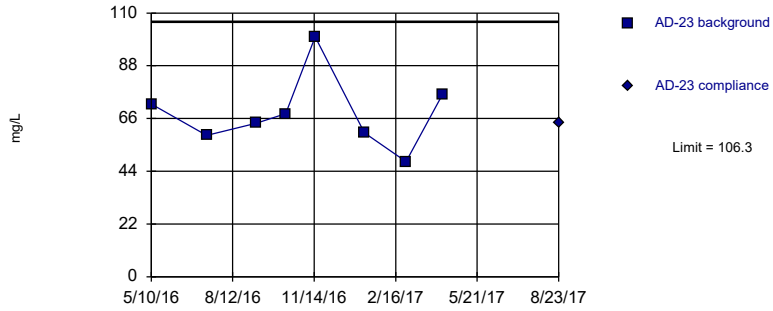
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=68.38, Std. Dev.=15.42, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9219, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

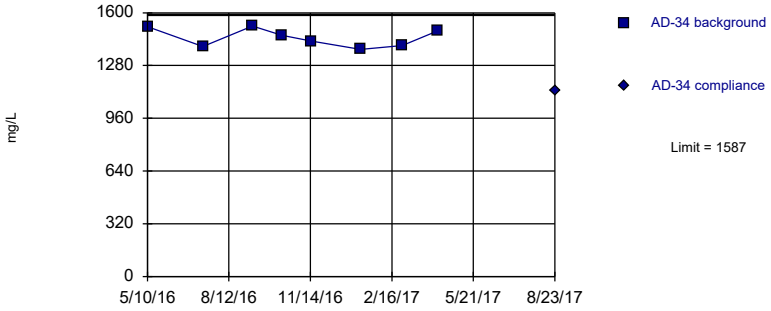
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1449, Std. Dev.=55.98, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9097, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

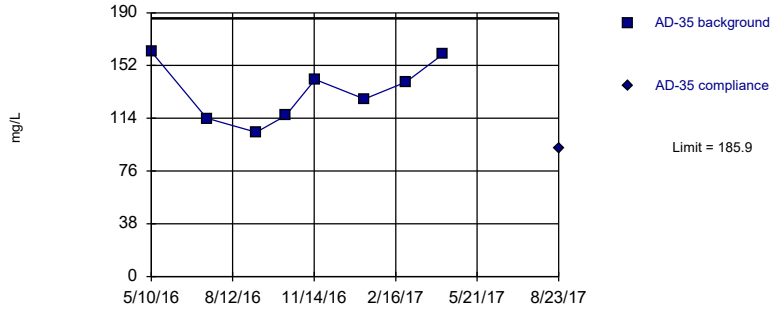
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=133.3, Std. Dev.=21.43, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.936, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

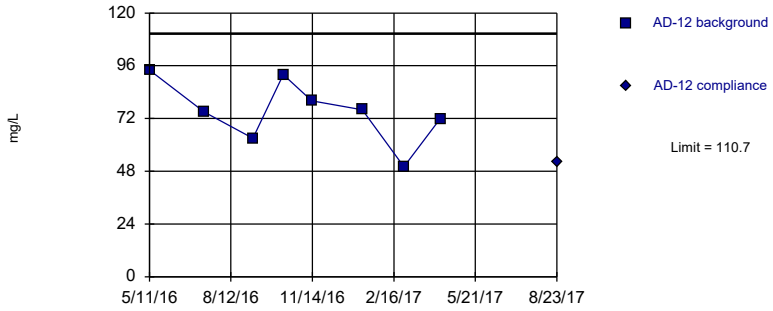
Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=75.25, Std. Dev.=14.41, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9549, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/26/2019 8:03 AM View: PL's - Intrawell

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Trend Test Summary Table - Signfiicant Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 9/5/2019, 1:43 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Chloride, total (mg/L)	**AD-16 (bg)**	**3.476**	**54**	**38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**AD-27 (bg)**	**1.144**	**44**	**38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**AD-16 (bg)**	**-20.86**	**-40**	**-38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**

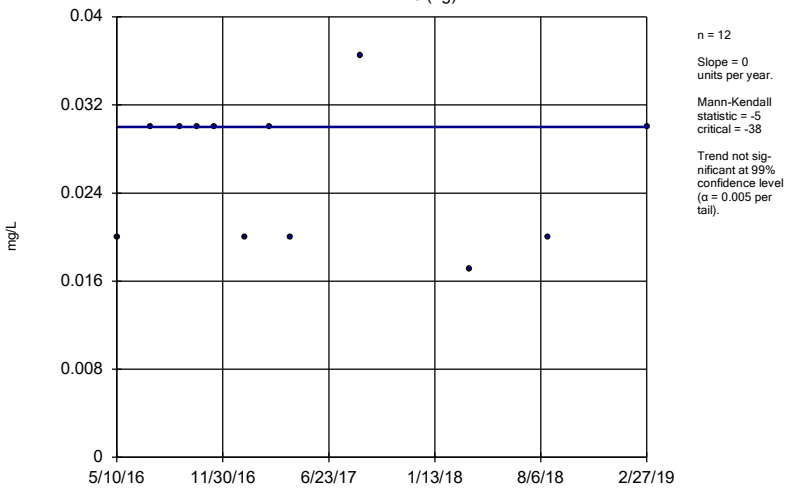
Trend Test Summary Table - All Results

Pirkey LF Client: Geosyntec Data: Pirkey Landfill Printed 9/5/2019, 1:43 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	AD-16 (bg)	0	-5	-38	No	12	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-27 (bg)	0.005714	26	38	No	12	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-8 (bg)	-0.03662	-12	-38	No	12	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-12 (bg)	0	-1	-38	No	12	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**AD-16 (bg)**	**3.476**	**54**	**38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**AD-27 (bg)**	**1.144**	**44**	**38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	AD-8 (bg)	-1.386	-16	-38	No	12	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-12 (bg)	0.01522	10	38	No	12	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-16 (bg)	0	-11	-38	No	12	91.67	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-27 (bg)	0	-6	-38	No	12	75	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-8 (bg)	0	1	38	No	12	8.333	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-12 (bg)	0	-22	-38	No	12	75	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-16 (bg)	-3.711	-23	-38	No	12	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-27 (bg)	1.909	11	38	No	12	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-8 (bg)	-1.069	-1	-38	No	12	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-34	31.48	14	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	AD-12 (bg)	-0.565	-18	-38	No	12	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**AD-16 (bg)**	**-20.86**	**-40**	**-38**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	AD-27 (bg)	-16.41	-22	-38	No	12	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-8 (bg)	-0.5925	-1	-38	No	12	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-34	-23.3	-12	-43	No	13	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	AD-12 (bg)	-20.7	-27	-38	No	12	8.333	n/a	n/a	0.01	NP

Sen's Slope Estimator

AD-16 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = -5 critical = -38

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

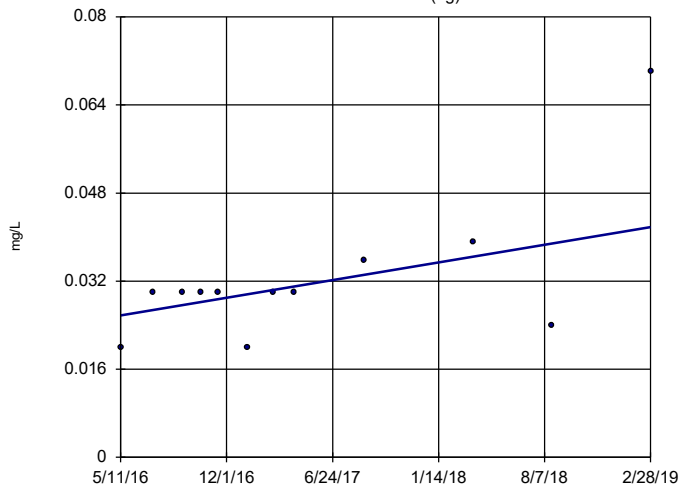
Constituent: Boron, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 12

Slope = 0.005714 units per year.

Mann-Kendall statistic = 26 critical = 38

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

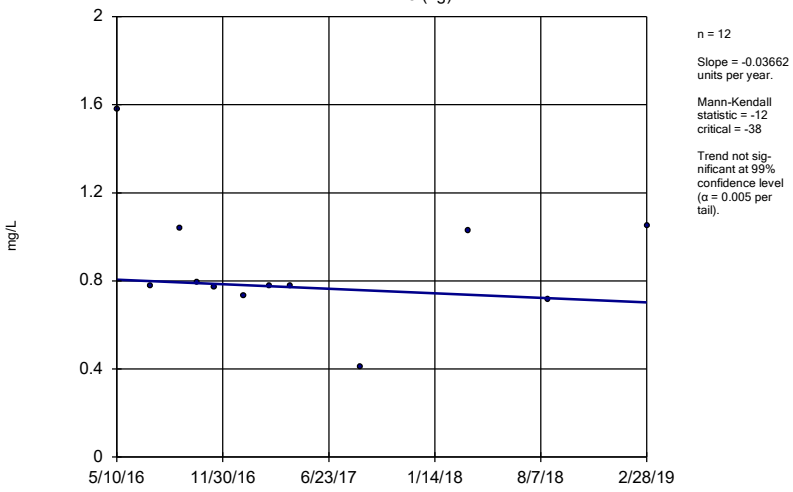
Constituent: Boron, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 12

Slope = -0.03662 units per year.

Mann-Kendall statistic = -12 critical = -38

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

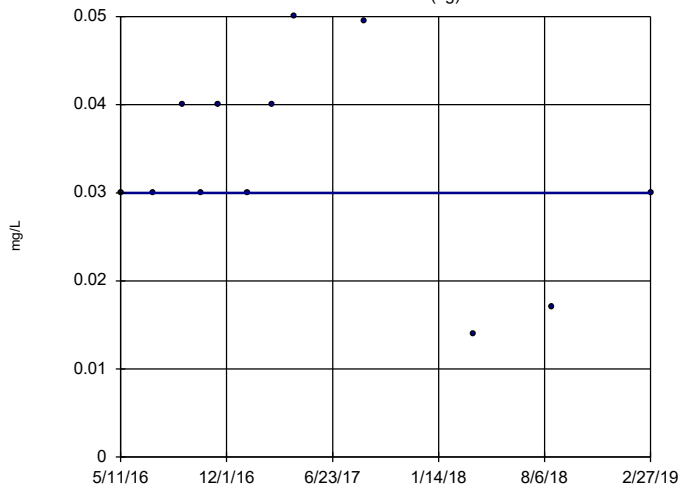
Constituent: Boron, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = -1 critical = -38

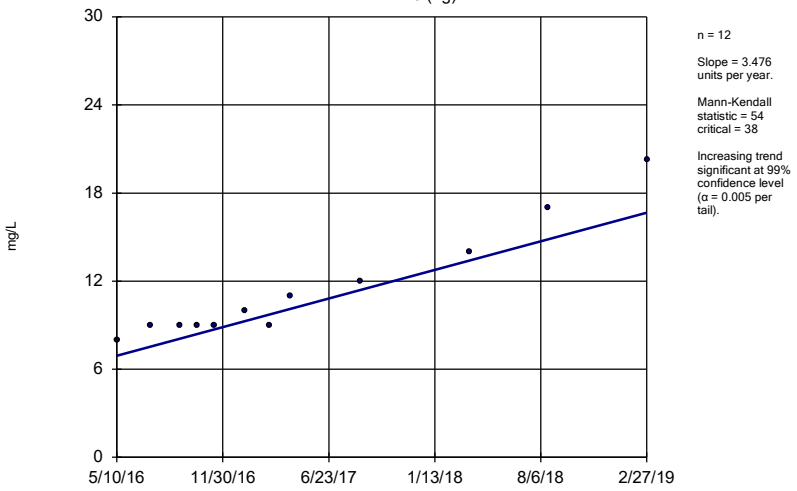
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-16 (bg)



n = 12

Slope = 3.476 units per year.

Mann-Kendall statistic = 54 critical = 38

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

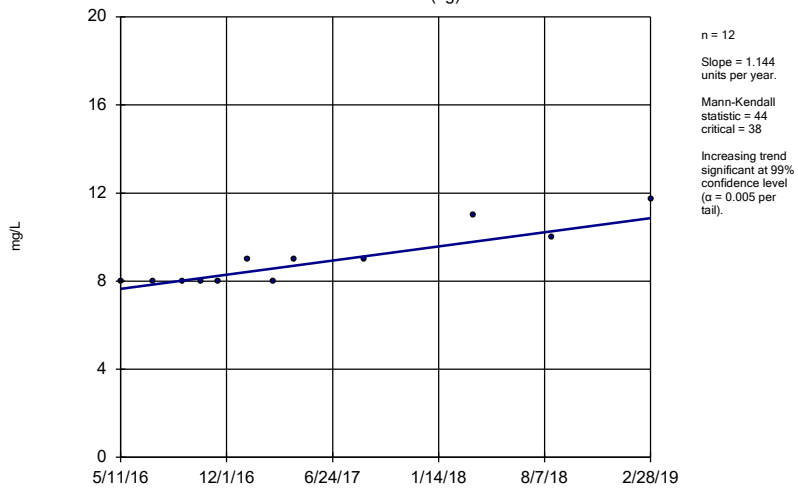
Constituent: Chloride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 12

Slope = 1.144 units per year.

Mann-Kendall statistic = 44 critical = 38

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

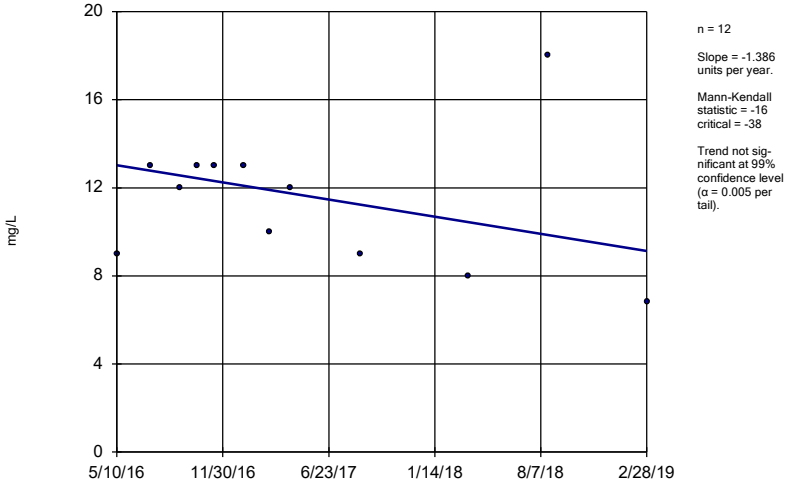
Constituent: Chloride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 12

Slope = -1.386 units per year.

Mann-Kendall statistic = -16 critical = -38

Trend not sig-nificant at 99% confidence level (α = 0.005 per tail).

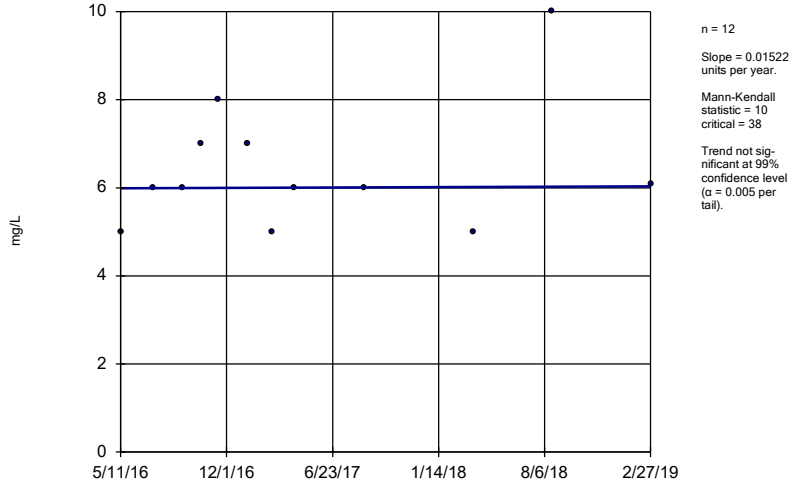
Constituent: Chloride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 12

Slope = 0.01522 units per year.

Mann-Kendall statistic = 10 critical = 38

Trend not sig-nificant at 99% confidence level (α = 0.005 per tail).

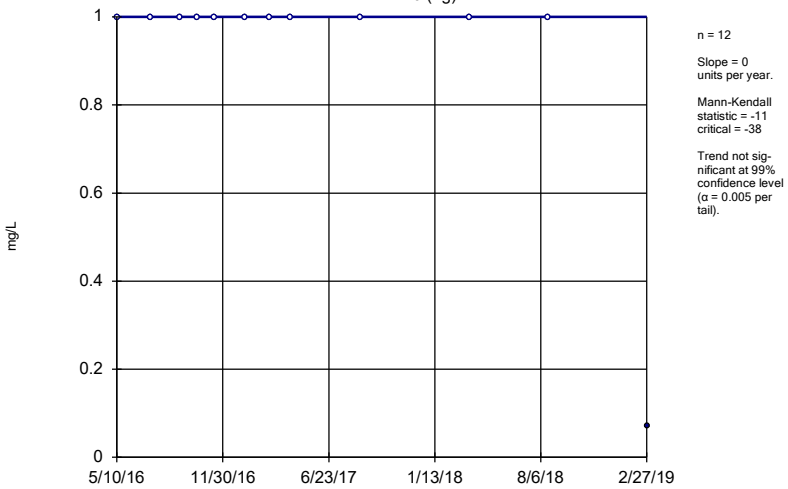
Constituent: Chloride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-16 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = -11
critical = -38

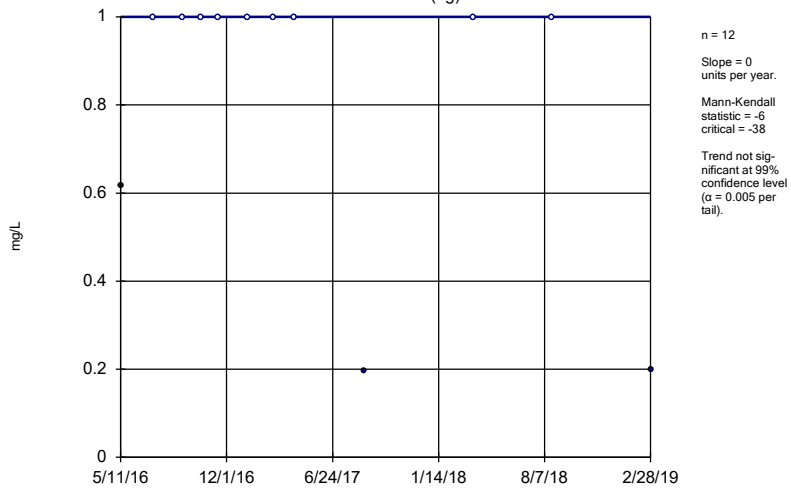
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-27 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = -6
critical = -38

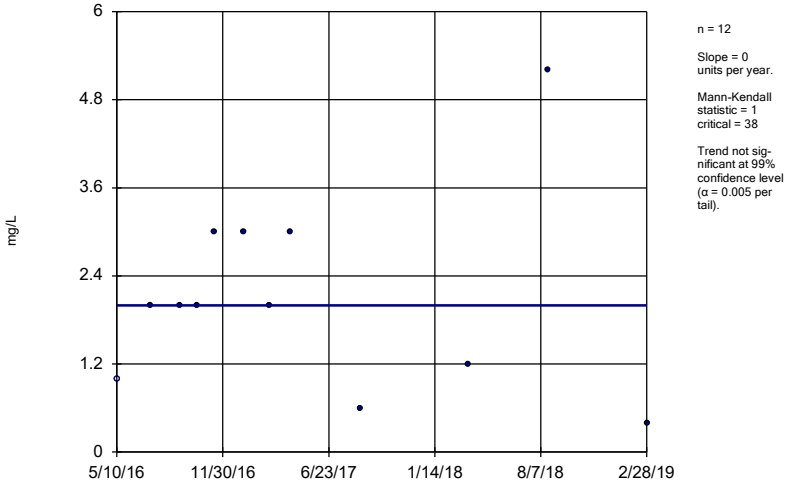
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-8 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 1
critical = 38

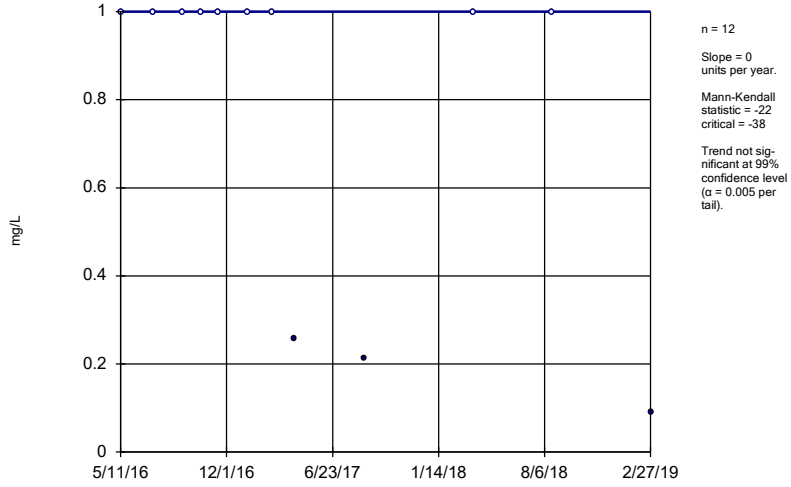
Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 12

Slope = 0
units per year.

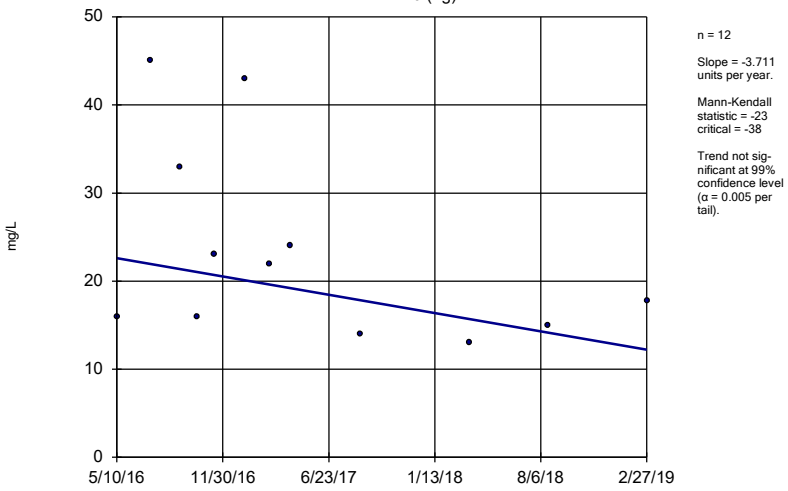
Mann-Kendall
statistic = -22
critical = -38

Trend not sig-
nificant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Fluoride, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-16 (bg)



n = 12

Slope = -3.711 units per year.

Mann-Kendall statistic = -23
critical = -38

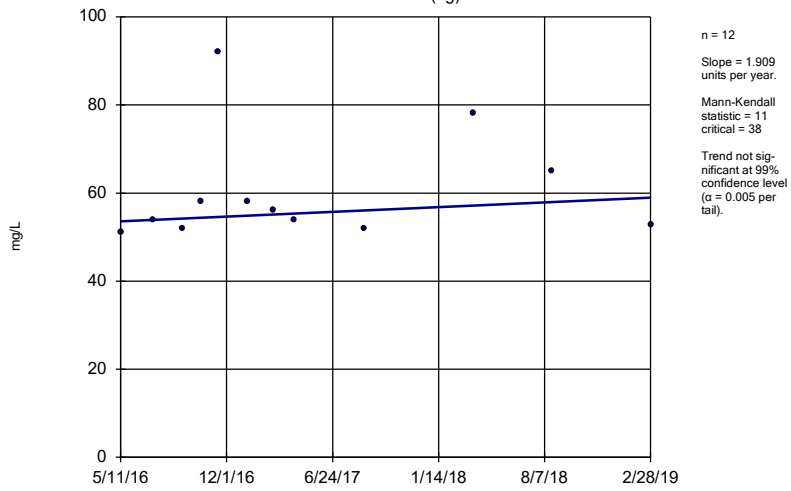
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 12

Slope = 1.909 units per year.

Mann-Kendall statistic = 11
critical = 38

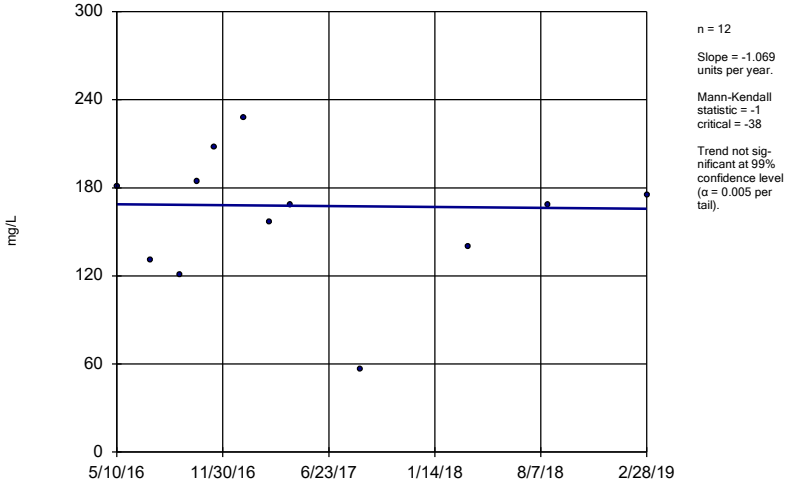
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 12

Slope = -1.069 units per year.

Mann-Kendall statistic = -1
critical = -38

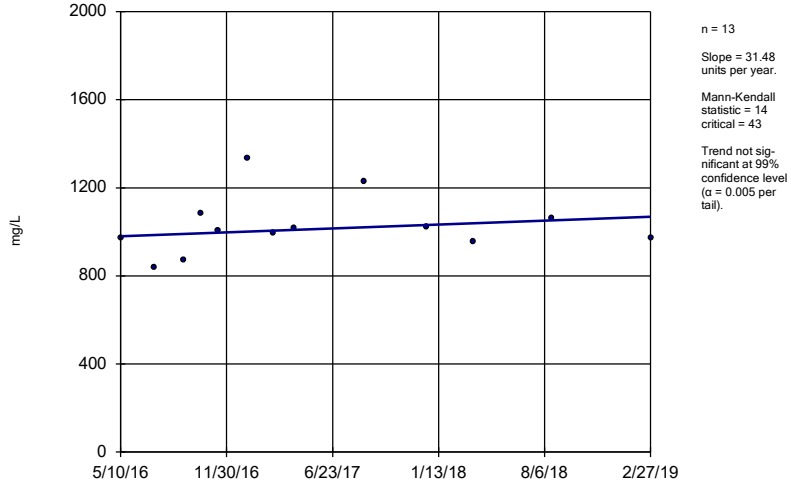
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-34



n = 13

Slope = 31.48 units per year.

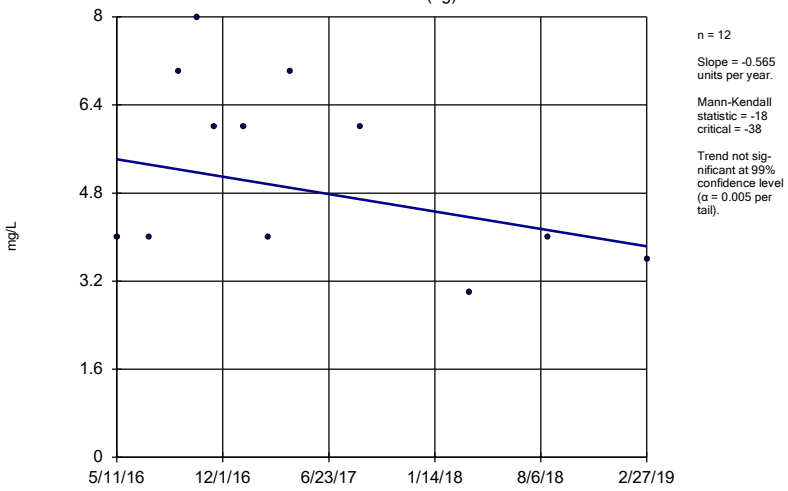
Mann-Kendall statistic = 14
critical = 43

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

Constituent: Sulfate, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-12 (bg)



n = 12

Slope = -0.565 units per year.

Mann-Kendall statistic = -18
critical = -38

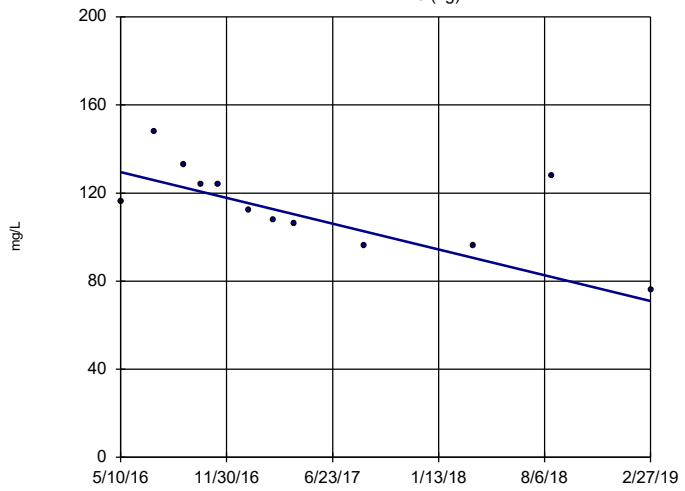
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-16 (bg)



n = 12

Slope = -20.86 units per year.

Mann-Kendall statistic = -40
critical = -38

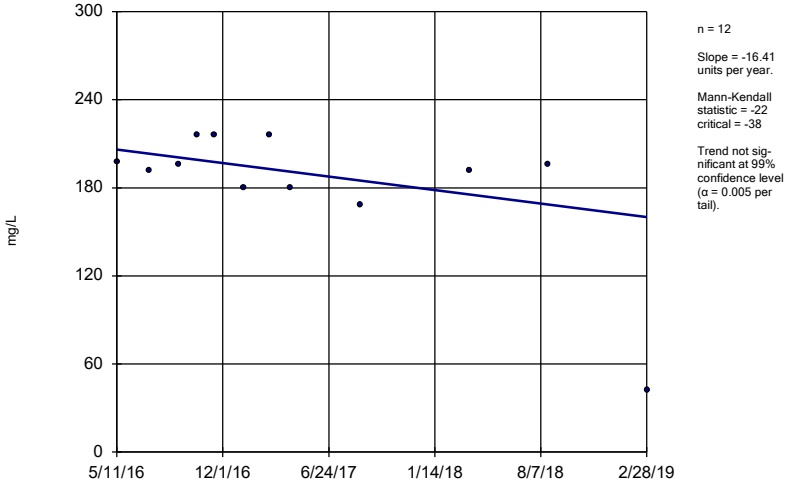
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-27 (bg)



n = 12

Slope = -16.41 units per year.

Mann-Kendall statistic = -22
critical = -38

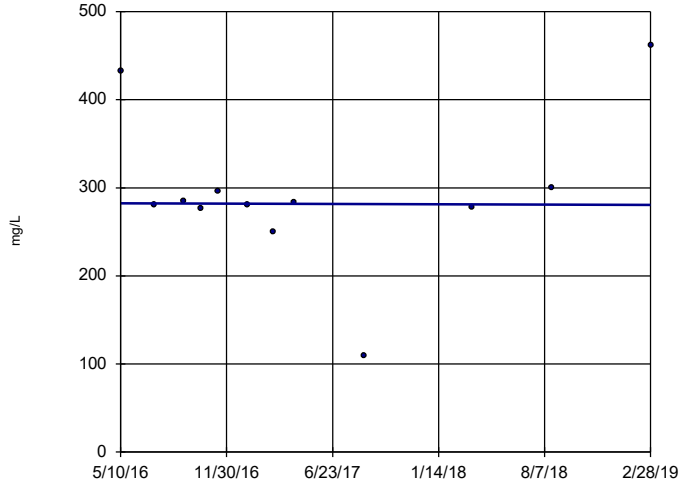
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-8 (bg)



n = 12

Slope = -0.5925 units per year.

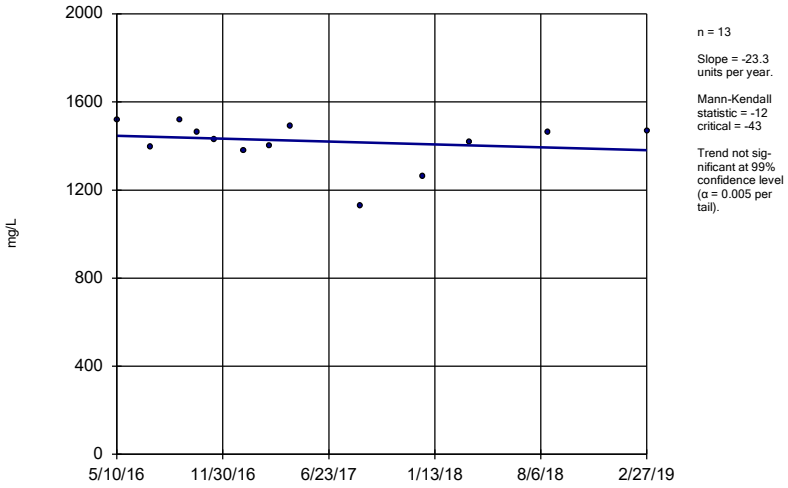
Mann-Kendall statistic = -1
critical = -38

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

Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:42 PM View: Trend Tests
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sen's Slope Estimator

AD-34



n = 13

Slope = -23.3 units per year.

Mann-Kendall statistic = -12 critical = -43

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

Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:42 PM View: Trend Tests

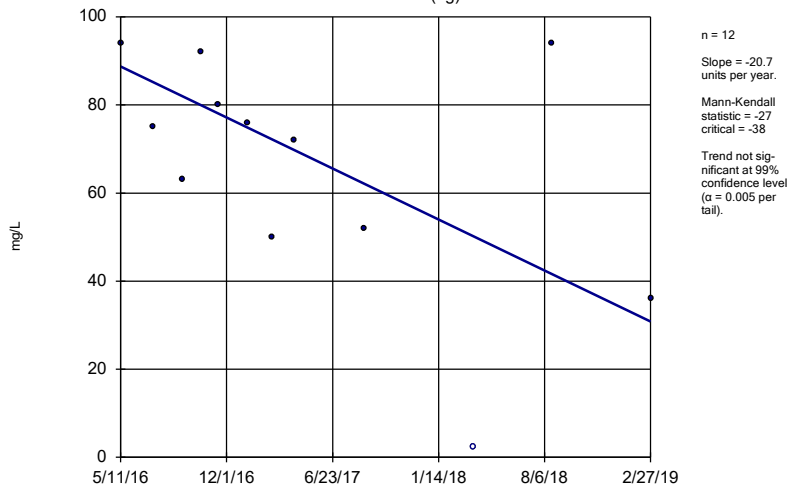
Pirkey LF Client: Geosyntec Data: Pirkey Landfill

Sanitas™ v.9.6.21g Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 12

Slope = -20.7 units per year.

Mann-Kendall statistic = -27 critical = -38

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

Constituent: Total Dissolved Solids [TDS] Analysis Run 9/5/2019 1:42 PM View: Trend Tests

Pirkey LF Client: Geosyntec Data: Pirkey Landfill

ATTACHMENT B
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey LF CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Point Blvd., Suite 103
Tallahassee, FL 32308

Texas Registered Engineering Firm
No. F-1182

79864	Texas	1/7/2020
License Number	Licensing State	Date

APPENDIX IV

Notices of groundwater monitoring program transitions are included in this appendix.

APPENDIX V

Reports documenting monitoring well plugging and abandonment or well installation are included in the appendix.

STATE OF TEXAS WELL REPORT for Tracking #511623

Owner:	**American Electric Power Company**	Owner Well #:	**AD-36**
Address:	**502 N. Allen Street Shreveport, LA 71101**	Grid #:	**35-37-4**
		Latitude:	**32° 27' 05.39" N**
Well Location:	**2400 Farm Road Hallsville, TX 75650**	Longitude:	**094° 29' 50.99" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **4/24/2019** Drilling End Date: **4/24/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**15**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**4**	**15**	**Sand**	**20/40**

Annular Seal Data: **No Data**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **C & S Lease Service**

1873 FM 1252 E
Kilgore, TX 75663

Driller Name: **Buford E. Collier** License Number: **50089**

Apprentice Name: **David Diduch** Apprentice Number: **60297**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**9**	**Sandy clay with gravel, mainly fill**
9	**11**	**Clayey sand, mainly Iron ore**
11	**14**	**Sandy clay**
14	**15**	**clayey sand with iron ore**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**15**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506035

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB10**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.08" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 58.82" W**
Well County:	**Harrison**	Elevation:	**No Data**
			****Plugged Within 48 Hours****

****This well has been plugged**** **Plugging Report Tracking #185184**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/19/2019** Drilling End Date: **2/20/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**60**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**31**	**38**	**Bentonite 3 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Description (number of sacks & material)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Plug Information:	**SAND**	**50**	**60**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**clay brown**
1	**5**	**silty sand**
5	**9.5**	**clay**
9.5	**11**	**sand**
11	**32**	**clay**
32	**39**	**sand and clay**
39	**55**	**sand**
55	**60**	**fine sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**40**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**40**	**50**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS PLUGGING REPORT for Tracking #185184

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB10**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.08" N**
		Longitude:	**094° 29' 58.82" W**
	LOCATED ON OWNERS PROPERTY	Elevation:	**No Data**
Well County:	**Harrison**		

Well Type: **Monitor**

Drilling Information

Company: **Plains Environmental Services** Date Drilled: **2/20/2019**

Driller: **Jesse Kalvig** License Number: **5025**

Well Report Tracking #506035

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**60**

Plugging Information

Date Plugged: **2/21/2019** Plugger: **Jesse Kalvig**

Plug Method: **Pour in 3/8 bentonite chips when standing water in well is less than 100 feet depth, cement top 2 feet**

Casing Left in Well:

DIa (in.)	*Top (ft.)*	*Bottom (ft.)*
2	**15**	**50**

Plug(s) Placed in Well:

Top (ft.)	*Bottom (ft.)*	*Description (number of sacks & material)*
1	**40**	**Bentonite 10 Bags/Sacks**

Certification Data: The driller certified that the driller plugged this well (or the well was plugged under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the reports(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

STATE OF TEXAS WELL REPORT for Tracking #506039

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD37**
Address:	**2400 FM 3251** **HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251** **HALLSVILLE, TX 75650**	Latitude:	**32° 27' 56.32" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 41.78" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/22/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**17**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**10**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**8.5**	**CLAYS WITH SOME SAND**
8.5	**10.5**	**SAND**
10.5	**13**	**CLAY SOME SAND**
13	**15**	**SAND WITH SOME CLAYS**
15	**17**	**CLAYS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**12**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**12**	**17**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506038

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD38**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 46.12" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 43.34" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/21/2019** Drilling End Date: **2/21/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**18**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**11**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**CLAY RED**
5	**7**	**CLAY GRAY/RED**
7	**11.5**	**SAND/CLAY**
11.5	**17.5**	**SAND SOME CLAYS**
17.5	**18**	**CLAY SLITS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**13**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**13**	**18**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506037

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD39**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.05" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 58.84" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/20/2019** Drilling End Date: **2/20/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**12**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**5**	**Bentonite 3 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**CLAY**
1	**5**	**CLAY/SAND**
5	**9.5**	**CLAY**
9.5	**12**	**SAND/CLAY**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**7**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**7**	**12**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508688

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**AD-40 (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 28' 03" N**
		Longitude:	**094° 29' 00.5" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/10/2019** Drilling End Date: **3/10/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**40**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
27	**40**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**13**	**Cement**
13	**27**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**6**	**tan and brown sandy, silty clay**
6	**15**	**red and tan sand**
15	**28**	**red and grey clay**
28	**40**	**red and grey sand with occasional clay intervals**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**30**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**30**	**40**

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STATE OF TEXAS WELL REPORT for Tracking #508686

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB(MW)-01A**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 28' 03" N**
		Longitude:	**094° 29' 00.5" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/9/2019** Drilling End Date: **3/10/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**100**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
86	**100**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**86**	**Bentonite 17 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**6**	**tan and brown sandy, silty clay**
6	**15**	**red and tan sand**
15	**28**	**red and grey clay**
28	**85**	**red and grey sand with occasional clay intervals**
85	**88**	**grey clay**
88	**100**	**grey sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**90**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**90**	**100**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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P.O. Box 12157
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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508703

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-4 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 55" N**
		Longitude:	**094° 29' 50" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/22/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**22**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
8	**22**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**3**	**Cement**
3	**8**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**7**	**tan and brown sandy, silty clay**
7	**22**	**red and grey sand w/occ. lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**12**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**12**	**22**

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Texas Department of Licensing and Regulation
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Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508695

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-4 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 55" N**
		Longitude:	**094° 29' 50" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/20/2019** Drilling End Date: **2/22/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**80**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
56	**80**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**8**	**Cement**
8	**56**	**Bentonite 9 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**7**	**tan and brown sandy, silty clay**
7	**36**	**red and grey sand w/occ. lignite layers**
36	**41**	**red and tan clay**
41	**69**	**red and grey sand with occasional clay iand lignite layers**
69	**80**	**grey sandy clay with lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**59**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**59**	**69**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508712

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-5 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 48" N**
		Longitude:	**094° 29' 53" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/24/2019** Drilling End Date: **2/24/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**25**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
12	**25**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**8**	**Cement**
8	**12**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**tan and brown sandy, silty clay**
5	**18**	**red and grey sand w/occ. clay layers**
18	**20**	**gray clay**
20	**25**	**brown sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**15**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**15**	**25**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508708

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-5 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 48" N**
		Longitude:	**094° 29' 53" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/23/2019** Drilling End Date: **2/23/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**70**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
45	**70**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**45**	**Bentonite 9 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**tan and brown sandy, silty clay**
5	**18**	**red and grey sand w/occ. clay layers**
18	**20**	**gray clay**
20	**28**	**brown sand**
28	**41**	**brown and grey silty clay**
41	**70**	**grey sand with occasional lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**50**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**50**	**60**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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P.O. Box 12157
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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506040

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB6S**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 30.34" N**
		Longitude:	**094° 29' 27.76" W**
	LOCAATED ON OWNERS PROPERTY	Elevation:	**No Data**
Well County:	**Harrison**		

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/23/2019** Drilling End Date: **2/23/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**18**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**11**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAYS**
10	**18**	**SANDS AND CLAYS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**13**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**13**	**18**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506041

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB6D**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 30.28" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 27.75" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/23/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**65**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**53**	**Bentonite 19 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAYS**
10	**24**	**SANDS AND CLAYS**
24	**29**	**CLAYS**
29	**42.5**	**SANDS AND CLAYS**
42.5	**48.5**	**SANDS WITH SOME CLAY**
48.5	**56**	**CLAYS WITH SOME SAND**
56	**65**	**SILY SANDS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**55**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**55**	**65**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508722

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/3/2019** Drilling End Date: **3/3/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**45**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
32	**45**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**32**	**Bentonite 6 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**45**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**35**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**35**	**45**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508720

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/28/2019** Drilling End Date: **2/28/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**70**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
57	**70**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**57**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**70**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**60**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**60**	**70**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508724

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**35**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
23	**35**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**23**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**35**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**25**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**25**	**35**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508729

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 medium (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**65**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
52	**65**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**53**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**65**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**55**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**55**	**65**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508777

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/24/2019** Drilling End Date: **2/26/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**93**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
77	**93**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**77**	**Bentonite 15 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**90**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**
90	**93**	**gray clay (old pit base?)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**80**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**80**	**90**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508781

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/5/2019** Drilling End Date: **3/5/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**30**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
17	**30**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**17**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**30**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**20**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**20**	**30**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508779

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/4/2019** Drilling End Date: **3/4/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**60**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
48	**60**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**48**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**60**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**50**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**50**	**60**

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STATE OF TEXAS WELL REPORT for Tracking #508718

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-11 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 26' 41" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/8/2019** Drilling End Date: **3/8/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**15**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
3	**15**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Cement**
1	**3**	**Bentonite 5 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**tan and brown sandy, silty clay and occasional gravel**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**15**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508717

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-11 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 26' 41" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/7/2019** Drilling End Date: **3/8/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**43**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
30	**43**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**30**	**Bentonite 5 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**tan and brown sandy, silty clay and occasional gravel**
18	**43**	**red and grey sand w/occ. clay layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**33**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**33**	**43**

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